BRITISH STANDARD

BS 7121-2:2003

Code of practice for safe use of cranes —

Part 2: Inspection, testing and examination

ICS 53.020.20

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee MHE/3, Cranes and derricks, to Subcommittee MHE/3/11, Crane safety and testing, upon which the following bodies were represented:

Association of Lorry Loaders Manufacturers and Importers

CEA — The Construction Equipment Association

Construction Confederation

Construction Health and Safety Group

Construction Plant-Hire Association

Electricity Association

Health and Safety Executive

Institution of Occupational Safety and Health

Institution of Structural Engineers

Low Power Radio Association

Safety Assessment Federation Ltd.

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Contents

Foreword

This part of BS 7121 has been prepared by Subcommittee MHE/3/11. It supersedes BS 7121-2:1991, which is withdrawn. It is intended to be used in conjunction with other parts of BS 7121 to ensure, so far as is reasonably practicable, that lifting operations are carried out safely.

The Lifting Operations and Lifting Equipment Regulations (LOLER) [1] and the Provision and Use of Work Equipment Regulations (PUWER) [2] came into force on the 5th December 1998. Details of the Regulations, an Approved Code of Practice plus HSE guidance can be found in the HSE books *Safe use of lifting equipment* [3] and *Safe use of work equipment* [4].

BS 7121-1 provides general recommendations for crane types not covered in an additional part of BS 7121. This part covers in-service inspection, thorough examination and, where appropriate, testing for the safe use of all types of crane. Subsequent parts deal with the specific crane types as follows:

— *Part 3: Mobile cranes*;
— *Part 4: Lorry loaders*;
— *Part 5: Tower cranes*;
— *Part 6: Derrick cranes*;
— *Part 7: Overhead/under-hung travelling and goliath cranes*;
— *Part 8: High pedestal and portal jib dockside cranes*;
— *Part 9: Container handling cranes*;
— *Part 10: Rail mounted cranes*;
— *Part 11: Offshore cranes*;
— *Part 12: Recovery vehicles and equipment*;
— *Part 13: Hydraulic gantry lifting systems*;
— *Part 14: Side boom pipe layers*.

When all parts of BS 7121 have been published, CP 3010 will be withdrawn and BS 5744 will be revised to cover manually operated and light cranes only.

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 [5]. This standard was drawn up with the participation of HSE representatives and will be referred to in relevant HSE publications.

The photographs in this British Standard have been reproduced by kind permission of Bridon Ropes International and Japan Crane Association.

The BS 7121 series has been accepted as representing the consensus of practical experience for safety on cranes.

As a code of practice, this British Standard 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.

It has been assumed in the drafting of this British Standard that the execution of its provisions is entrusted to appropriately qualified and competent people.

I 22 April 2003

Attention is drawn to the following statutory regulations:

The Lifting Operations and Lifting Equipment Regulations (LOLER) [1];

The Provision and Use of Work Equipment Regulations (PUWER) [2];

The Health and Safety at Work etc. Act 1974 [5];

The Supply of Machinery (Safety) Regulations [6];

The Merchant Shipping Act [7];

The Road Vehicles (Construction and Use) (amendment) Regulations [8].

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 does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i to iv, pages 1 to 61 and a back cover.

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Introduction

The need to thoroughly examine equipment dates back to the introduction of steam power into factories. There were a large number of steam boiler explosions and it was found that a legal requirement to have the boilers regularly examined by a competent person dramatically reduced the number of these accidents. The premises had to be closed down whilst examination of the boiler was carried out and this normally only occurred during the Easter holidays. Because Easter was a moveable feast, the maximum time set for the intervals between thorough examinations was 14 months to accommodate the holiday period.

It was then recognized that there were also a large number of accidents on cranes and other types of lifting machines and so a similar requirement was introduced with a similar time scale, and again the number of accidents was dramatically reduced. The most noteworthy of the old regulations being the Construction (Lifting Operations) Regulations 1961 which have now been revoked. It was not until the introduction of the Lifting Operations and Lifting Equipment Regulations (LOLER) [1] in December 1998 that it was acknowledged that the time constraints in factories no longer applied and a more logical period could be set as the maximum time between thorough examinations. As an alternative to time periods between thorough examinations LOLER permits the use of an examination scheme.

1 Scope

This part of BS 7121 gives recommendations for the pre-use checks, in-service inspection, thorough examination and testing of cranes, including associated equipment, and the means by which tests are to be carried out.

Although this part is not applicable to the testing of new cranes, it does give guidance on safety matters to be observed during these tests within the UK.

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.

BS 1757*, Specification for power-driven mobile cranes.*

BS 449-2*, Specification for the use of structural steel in buildings — Part 2: Metric units.*

BS 5950-1*, Structural use of steelwork in building — Part 1: Code of practice for design — Rolled and welded sections.*

BS 6968*, Guide for use and maintenance of non-calibrated round steel lifting chain and chain slings.*

BS EN 473:2000*, Non-destructive testing — Qualification and certification of NDT personnel — General principles.*

BS EN 45004:1995*, General criteria for the operation of various types of bodies performing inspection.*

ISO 3056*, Non-calibrated round steel link lifting chain and chain slings — Use and maintenance.*

ISO 4301 (all parts)*, Cranes — Classification.*

3 Terms and definitions

For the purposes of this part of BS 7121, the following terms and definitions apply.

3.1
thorough examination
examination by a competent person in such depth and detail as the competent person considers necessary to enable them to determine whether the equipment being examined is safe to continue in use

NOTE The thorough examination is not part of the maintenance regime for the equipment but provides owners with information which could be used to determine the effectiveness of the regime.

3.2
competent person
person who has such practical and theoretical knowledge and experience of the lifting equipment to be thoroughly examined which enables them to detect defects or weaknesses and to assess their importance in relation to the safety and continued use of the lifting equipment

NOTE The competent person may be a member of the organization's staff. See **5.2**.

3.3
competent engineer
person who has such theoretical knowledge of the design of the lifting equipment as enables them to assess the design of the item in order to establish appropriate criteria for a thorough examination

3.4
inspection body
employer of the competent person(s) who provide examination and testing services

3.4.1
type A inspection body
inspection body providing "third-party" services in accordance with BS EN 45004:1995, Annex A

3.4.2
type B inspection body
inspection body which forms a separate and identifiable part of an organization involved in the design, manufacture, supply, installation, use or maintenance of the items it inspects and has been established to supply inspection services to its parent organization criteria in accordance with BS EN 45004:1995, Annex B

3.4.3
type C inspection body
inspection body which is involved in the design, manufacture, supply, installation, use or maintenance of the items it inspects or of similar competitive items and may supply inspection services to other parties not being its parent organization in accordance with BS EN 45004:1995, Annex C

3.5 testing

3.5.1
functional testing
operation of each motion of the appliance without a load applied in order to determine whether the equipment performs as the manufacturer intended

3.5.2
performance testing
operation of each motion of the appliance with the rated load applied in order to determine whether the equipment performs to the manufacturer's specification

3.5.3
overload testing
<static> operation of the appliance with a load exceeding the rated load applied but without operating the full range of motions of the appliance in order to determine whether the appliance is stable, structurally sound and fit for the use for which it was designed

3.5.4
overload testing
<dynamic> operation of each motion of the appliance with a load that exceeds the rated load applied in order to determine whether the appliance is stable, structurally sound and fit for the use for which it was designed

3.5.5
non-destructive testing
NDT
testing carried out on the structure of the appliance to establish the presence, location and extent of any defects that can affect the integrity of that structure

NOTE The techniques employed for non-destructive testing are such that they do not damage or alter the material under test. NDT is also known as non-destructive examination (NDE).

3.6
user
person or organization that has control of both the lifting operation and the crane operator, and has a responsibility to ensure that cranes and other equipment are properly maintained and thoroughly examined by a competent person

3.7
rated capacity indicator/limiter
RCI/L
device that warns and prevents the crane from being overloaded as described in the Supply of Machinery (Safety) Regulations [6] Schedule 3 EHSR **4.2.1.4**

NOTE This was previously known as an "automatic safe load indicator" and "overload protection".

3.8
crane operator
person who is operating the crane for the purpose of positioning loads or for erection of the crane

3.9
load radius indicator
device fitted to a crane that shows the radius at which the crane is operating and its corresponding rated capacity

3.10
radius
horizontal distance between the point at which the centre of rotation of the crane meets the ground and the vertical centreline passing through the load lifting attachment

NOTE In the case of a non-slewing crane, the horizontal distance from the centreline of a load lifting attachment to the centreline of the nearest axle, bogie or track, measured at ground level, may be assumed to be the radius for the purpose of this definition.

3.11
rated capacity
maximum load that can be safely handled by a crane at a specified position and under specified conditions

NOTE The rated capacity was formerly known as "safe working load".

3.12 service conditions

3.12.1
in-service
condition where the crane is handling loads less than the rated capacities within permissible wind speeds and other conditions as specified by the manufacturer

3.12.2
out-of service
condition where the crane is either not required for use or is out of use, without a load on the load lifting attachment and in conditions as specified by the manufacturer

NOTE These conditions may include a higher wind speed than that permitted for the in-service conditions.

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3.13
lifting
movement of loads or persons necessitating, at a given moment, a change of level

3.14
lifting accessory
lifting equipment for attaching loads to machinery for lifting purposes

4 General

Regular pre-use checking, in-service inspection, thorough examination and testing of cranes is essential if cranes are to function safely and reliably. Each of these activities differ from the others in frequency and content as follows.

— Pre-use checks are visual checks which should be carried out by the crane operator at the start of each shift to ensure that the crane has not suffered any damage or failure, and is safe to go to work.

— In-service inspections should be carried out by the crane operator, generally at weekly intervals, and cover items that are additional to the pre-use check.

— Thorough examinations should be carried out by a competent person (see **5.2**) 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.

— Testing is part of thorough examination and the extent and nature of any testing should be specified by the competent person carrying out the examination.

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

5.1 Pre-use checks and in-service inspections

Pre-use checks and in-service inspections should be carried out by a person who is competent. This competence should be achieved through a training and assessment scheme consisting of the following.

— Initial training and assessment of competence.

— Periodic reassessment of that competence.

Crane operators may perform pre-use checks and in-service inspections provided that they meet these criteria. The crane user should ensure that the crane is taken out of use for the period of time required to carry out the checks and inspections. 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 by inadvertent operation of the crane.

5.2 Thorough examinations

Thorough examinations should be carried out by a competent person taking account of any instructions. If the instructions are not available, a competent engineer should make an assessment of the design of the crane to establish limiting criteria.

NOTE 1 Attention is drawn to the relevant requirements of LOLER [1], PUWER [2] and The Supply of Machinery (Safety) Regulations [6] regarding examination of cranes.

NOTE 2 Attention is drawn to the Health and Safety at Work etc. Act [4] which requires that the instructions are available to the crane user.

It is essential that the competent person is sufficiently independent and impartial to allow objective decisions to be made. This does not mean that competent persons have to be employed from an external company or inspection body, which could be of type A, B or C. If employers and others within their own organizations have the necessary competence then they may carry out the examination. However, if they do, they should also have the genuine authority and independence to ensure that thorough examinations are properly carried out and that the necessary recommendations arising from them are made without fear or favour.

6 Periodic pre-use checks and in-service inspections

6.1 General

The appointed person should ensure that the appropriate pre-use checks and in-service inspections are carried out and that there is a system in place to rectify any defects disclosed by the checks and inspections.

6.2 Daily pre-use checks

At the beginning of each shift or working day that the crane is in use, the following pre-use checks, as appropriate for the type of crane, should be carried out.

a) Pre-use checks required by the instructions for the crane.

b) Check that all ropes are correctly positioned on their sheaves and drums have not been displaced.

c) Visually check that no electrical equipment is exposed to contamination by oil, grease, water or dirt.

d) Visually check, by inspecting relevant levels and/or components, that no loss of fluids, for example lubricating oil and coolant, is apparent.

e) Check the operation of all limit switches or cut-outs and the dead man's handle or lever, exercising caution whilst making checks in case of malfunction.

f) Check the hydraulic system including hoses and oil level.

g) Check that the RCI/L is set for its correct duty and that the manufacturer's daily test is carried out.

h) Check that the load radius scale is appropriate to the jib configuration fitted if the equipment is separate from that in item g).

i) By varying the load lifting attachment radius without load, check the correct movement of the equipment in items g) and h).

j) Check that the correct air pressure is maintained in any pneumatic control system, for example brakes.

k) Check that lights, windscreen wiper(s) and washers operate efficiently.

l) Visually check the security of wheels and the condition of tyres on wheel mounted cranes.

m) Check that all crane controls function correctly without a load applied.

n) Check that all audible warning devices operate satisfactorily.

o) In the interests of safety and fire prevention, check that the work areas on the crane are in a tidy condition and free from tins of oil, rags, tools or materials other than those for which storage provision is made, that access and egress from the cab is adequate and that the appropriate fire-fighting equipment is available.

p) Check that there are no obstructions in the path of travel of the crane or that adequate precautions are in place to prevent collisions.

6.3 Weekly in-service inspections

Once a week, when the crane is in use, in addition to the checks in **6.2** the following pre-use inspections, as appropriate for the type of crane, should be carried out.

a) Inspection required by the instructions for the crane.

b) Inspect the automatic RCI/L in accordance with the operating instructions. This should comprise a physical check of the RCI components at least, paying particular attention to cables, connectors and mountings.

c) Visually inspect all wire ropes for broken wires, flattening, basket distortion or other signs of damage, excessive wear and surface corrosion.

d) Inspect all rope terminations, swivels, pins and retaining devices and inspect all sheaves for damage, worn bushes or seizure.

e) Inspect the structure for damage, for example missing and bent bracings on bridges and strut jibs, bulges, indentations and unusual rubbing marks on telescopic jibs, cracked welds and loose bolts and other fasteners.

f) Inspect hook(s) and other load lifting attachments, safety catch(es) and swivel(s) for damage, free movement or wear. Inspect the hook shank thread and securing nut for undue movement, which may indicate wear or corrosion.

g) Verify the correct operation and adjustment of controllers.

h) Inspect the hydraulic system including rams and hoses for damage.

i) Inspect hydraulic rams for creep rate.

j) Verify the functional effectiveness of brakes and clutches. This should be by confirmation with the crane operator at least.

k) On wheel mounted cranes check the tyre pressure and inspect the tyres for damage and wear on walls and tread. Also inspect wheel nuts for correct tightness.

l) On rail mounted cranes inspect rails, end stops and ties if fitted.

m) Verify the presence and condition of all guards.

n) Inspect the slew lock if fitted.

o) Inspect the steering, travel brakes (both foot and parking), lights, indicators, horn, windscreen wipers and washers.

p) Enter the results in the record of inspection.

6.4 Record of inspection

After every inspection a record should be prepared by the crane user and kept by the crane owner.

The record of inspection should include at least the following information.

a) Date and location of inspection.

b) Name of person carrying out the inspection.

c) Type of equipment inspected.

d) Results of inspections carried out in **6.3**.

7 Thorough examinations

7.1 General

The implementation of LOLER and the proposed Regulations under The Merchant Shipping Act 1995 [7] provides the opportunity for either a “specified period” or an “examination scheme” approach to thorough examination. If the examination scheme approach is to be used, the user or owner should produce the scheme in consultation with the manufacturer or another competent engineer.

When considered necessary by the competent person the thorough examination should be supplemented by the following actions.

a) Overload testing.

b) Methods of NDT that determine the condition of any part of the crane without causing any detrimental change to the material.

c) The opening up of concealed or encased parts by a skilled person to the extent required by the competent person.

The competent person might require testing to be carried out. This could involve the use of specialists in particular types of testing such as NDT or load testing. The competent person should specify precisely what is required, to ensure that such work is effectively managed and that the results of the work are assessed accurately in relation to their significance for the crane.

7.2 Responsibilities of the crane user

7.2.1 *General*

The crane user should ensure that the crane is taken out of use for the period of time required by the competent person to carry out the thorough examination. The user should also ensure that a safe system of work is in place to prevent the competent person from being exposed to danger by inadvertent operation of the crane.

Where the crane is hired from a third-party, the user should ensure that the thorough examinations are undertaken at the required intervals. The user might come to an arrangement with the owner whereby the owner carries out the thorough examinations but the user should ensure they are carried out.

7.2.2 *Provision of facilities and services*

The crane user should ensure that facilities or services which are required by the competent person to carry out the thorough examination are provided. These could include the following.

— Appropriate area, cordoned off to prevent access by persons not directly involved in the examination.

— Operator for the crane.

— Person(s) to remove covers or open up parts of the crane.

— Preparation of parts or areas of the crane for NDT.

7.2.3 *Provision of information*

Information regarding for example rated capacities, alterations, maintenance repairs, renewals, operators' instructions, should be made available to the competent person if these are necessary to carry out the thorough examination.

NOTE Attention is drawn to the Supply of Machinery (Safety) Regulations [6] which require that cranes and other equipment acquired after 1st January 1995 are CE marked and supplied with a Declaration of Conformity together with the supporting technical documentation.

A "Report of thorough examination after installation" should be supplied, where appropriate, and retained.

7.3 Responsibilities of the competent person

Where the competent person identifies defects which need to be rectified within a specified timescale, they should submit a report promptly to allow the employer to take the necessary action within the required period.

If, whilst carrying out a thorough examination, a competent person sees that a lifting accessory or equipment is not safe for any reason, in addition to defects caused by deterioration, this should also be notified to the user and owner of the lifting accessory or equipment.

7.4 Rectification of defects

Where the competent person identifies defects affecting the continued safe use of the crane, or specifies a timed replacement of components etc., the crane user should ensure that these defects are rectified.

NOTE Normally the owner of the crane is responsible for carrying out the work but the user is responsible for ensuring that the crane is not used until the defects are rectified.

7.5 Specified period of thorough examination

7.5.1 *Six monthly thorough examination*

Cranes used to lift persons, and lifting accessories should undergo a thorough examination by a competent person at least once every 6 months unless the competent person specifies a shorter interval.

7.5.2 *Twelve monthly thorough examination*

Cranes which are not used to lift persons should be subject to a thorough examination by a competent person at least once every 12 months. After carrying out the thorough examination the competent person should specify when the next thorough examination is to be carried out, which may be less than but not more than 12 months.

7.6 Examination scheme

7.6.1 *General*

An examination scheme should include a written schedule of the steps required to periodically assess the condition of items included in the examination, for example condition monitoring. The scheme is intended to ensure that the equipment remains safe to use and includes information on the required frequency of examinations.

Before thoroughly examining items included in the examination, subject to an examination scheme, the competent person should take into account the age, loading, environmental and duty cycle history of the equipment, and any examination intervals which have traditionally been accepted as appropriate for that or similar equipment (see **7.5**). Equipment that does not have a complete record of past usage should be subject to periodic thorough examination in accordance with **7.5**.

The competent person should prepare an examination scheme which might require the co-operation of the equipment manufacturer and owner.

NOTE For example the manufacturer might provide limiting criteria based on the equipment design; number of load cycles, load spectrum, critical parts, and exceptional circumstances (such as shock loading).

7.6.2 *Details of an examination scheme*

An examination scheme should contain at least the following information.

1) The name and address of the owner.

2) The name, qualifications and address of the person drawing up the scheme and certifying that it is suitable and sufficient. If the competent person is not working on their own account, the name of their employing organization and their position in that organization.

3) The make, model and unique identification number of the crane.

4) Any information references used in drawing up the scheme. This might include the instructions, or specific information from the designer on the design life of the structure and mechanisms.

5) Details of any data logging system fitted, including a listing of the parameters monitored and the means by which data retrieval, monitoring and storage is achieved.

6) Details of the environment in which the crane may be used during the period covered by the scheme.

7) Identification of those parts of the crane requiring thorough examination and the probable methods of deterioration, for example wear and corrosion.

8) Frequency of thorough examination for those identified parts which might include time, loading or duty cycle limits and vary for different parts of the equipment.

9) Method of thorough examination of those identified parts requiring thorough examination which might include the degree of dismantling required, any preparation to be carried out by the user prior to the examination, NDT techniques, timed replacement etc.

10) An indication of the resources required to carry out the inspection. This might include qualified personnel, workshop facilities, specialist NDT and metallurgical facilities etc.

11) Any changes to equipment condition, operational or environmental parameters that would require a review of the scheme by the competent person. These might include damage to the structure, change of use from general use to heavy duty work, or moving from an inland location to a marine environment.

12) The date of drawing up the scheme and the date at which any routine review is required.

The examination scheme should also determine whether all mechanisms function correctly and are free from defect and whether the crane is safe for further use.

If it is not possible to comply with any of the requirements of the examination scheme, the crane should be subjected to a specified period examination (see **7.5**).

7.7 Thorough examination prior to load testing

7.7.1 Prior to load testing the competent person should determine by thorough examination with the crane in motion and at rest whether it is:

a) free from any defect that would preclude it from safely handling the test load;

b) in the correct configuration and condition according to the instructions;

c) equipped with sufficient falls of wire rope for the load under consideration.

7.7.2 The amount of ballast present and its disposition should be checked to determine whether it is in accordance with the crane instructions.

NOTE During the processes of erection and dismantling, ballast can be mislaid or lost.

7.7.3 The weight of all ballast should be on record and, where not marked on the ballast, the weight should be confirmed.

7.7.4 Where loose ballast such as brick, gravel, punchings, pig iron, billets or similar material is used, it should be contained, e.g. by the use of a steel box.

7.7.5 All safety switches, for example over hoist, lowering limit, derricking limit, trolley limit, should be checked for correct operation.

7.7.6 Lifting accessories should be thoroughly examined before the test and the competent person should determine whether the slinging arrangements are safe.

7.8 Thorough examination after load testing

After load testing, a thorough examination (see **7.1**) should be undertaken by a competent person to determine whether the crane has withstood testing without signs of structural damage that could affect the safety of the crane, such as:

a) cracking;

b) permanent deformation;

c) paint flaking;

d) loosening of or damage to structural connections.

8 Pre-use checks and in-service inspections for cranes and other equipment not in use for an extended period of time

In cases where a crane is not used for an extended period of time the user should ensure that the competent person specifies a special programme of pre-use checks, in-service inspections and thorough examination before it is used. The extent and thoroughness of this programme depends not only on the length of the period that the crane was out of use but also on the location of the crane during this period. Cranes standing under cover or inside a workshop might require very little extra inspection. Cranes that have been out of use in the open and therefore exposed to the weather and atmospheric pollution, etc. might require an extensive appraisal to ensure fitness for work. The programme of pre-use checks and in-service inspections should contain the following checks.

a) Any checks that are recommended in the instructions for the crane.

b) Checking all ropes for signs of corrosion/degradation and damage and ensuring that where applicable there is thorough lubrication.

c) Checking all control linkage for evidence of seizure or partial seizure and ensuring that there is correct lubrication.

d) Checking for correct functioning of all the safety devices.

e) Checking hoses, seals or other components for evidence of deterioration.

f) Checking for corrosion on the structure, access, control linkages etc.

g) Checking for structural integrity, for example cracks, dents, missing components.

h) Testing of every motion for several minutes without load, each motion individually at first then by combination of two or more motions simultaneously as appropriate, and then repeating the test with a load.

9 Testing as part of thorough examination

9.1 General

Thorough examination of a crane includes testing. This can take many forms including functional testing, performance testing, non-destructive testing (NDT) and overload testing.

The competent person should decide when a test is necessary and determine the most appropriate method of carrying it out.

It is important therefore that the competent person takes account of the instructions and other relevant information provided by the manufacturer or other appropriate specialist.

9.2 Functional testing

Functional testing should be carried out without a load applied.

The object of functional testing is to determine whether the equipment performs as the manufacturer intended. This should include the operation of all controls (including any remote controls) to determine whether the equipment operates correctly and smoothly, and is free from wear and other damage.

Functional testing should be carried out on all functions of the crane, including brakes and safety devices where it might be necessary to include the lifting of a suitable load once these devices have been tested without a load applied.

9.3 Performance testing

Performance testing should be carried out after functional testing and with the rated load applied.

The object of performance testing is to determine whether the equipment performs to the manufacturer's specification. This should include the operation of all controls (including any remote controls) to determine whether the equipment operates correctly and smoothly at the rated speeds, and is free from wear and other damage.

Performance testing should be carried out on all functions of the crane including brakes and safety devices.

9.4 Load testing

Before and after any load testing the equipment should be thoroughly examined. See **7.7** and **7.8**. The objective of load testing is to determine whether the equipment is stable, structurally sound and fit for the use for which it was designed. The test programme drawn up by the competent person should include every load-bearing part. The competent person should determine whether the original or if appropriate the previous test certificate is satisfactory, and subsequent testing should be based on this with any necessary modifications to suit the requirements of the particular item of equipment.

To prevent undue repetition the test programme should be conducted so that each load-bearing part is given one overload, for example to test a wire rope hoist mechanism and brakes it is only necessary to subject the mechanism to the overload on maximum line pull.

NOTE The competent person might wish to consult the manufacturer or other design authority to ensure that the selected test programme is adequate.

During testing with overloads all operations should be carried out with extreme care and every permissible crane motion carried out singly at the lowest possible speed.

Overloads should be kept as close to the ground as possible, generally between 100 mm and 200 mm. It is preferred that overloads are not raised above 200 mm to allow them to pass over obstructions. Where such limitations exist the competent person should consider an alternative test to prove the crane in the restricted area. When no alternative test is possible and the competent person is not satisfied that all of the crane duties have been adequately tested, use of the crane should be restricted to the tested duties and both the certificate of test and report of thorough examination endorsed accordingly.

To ensure that the load is applied at the correct position any dimensions should be checked using separate measuring equipment; the crane instrumentation should not be used for this purpose. All measuring equipment should be accurate to ±1 % of the measured value unless specified otherwise and be undamaged and properly maintained.

The weight of the lifting accessories should be included as part of the test load.

During the test the performance of the crane should be monitored by the competent person.

9.5 Cranes and other equipment which have been altered or repaired

In the event of any alteration or repair that could affect the stability of the crane, stability testing should be carried out in accordance with the original crane specification.

In the event of any alteration or repair which affects the strength of the crane, overload testing should be carried out to ensure that all parts affected by the repair are subjected to the test loads in accordance with the original crane specification.

NOTE It might be necessary to confirm with the manufacturer or other design authority the loads to be applied following such alterations or repairs.

9.6 Overload testing as part of periodic checks and inspections

After lifting equipment has been overload tested at the time of initial supply or installation, the competent person might specify overload testing to prove the continued integrity of the equipment taking into account its age, usage, condition and operating environment. The instructions and other relevant information provided by the manufacturer or other appropriate specialist should be followed prior to the application of overloads to the equipment.

9.7 Overload testing following major repair or modification

Equipment should be thoroughly examined and tested after every major repair or modification. Any testing should be carried out in accordance with written instructions from the manufacturer or other appropriate design authority.

9.8 Testing of rated capacity indicator/limiter (RCI/L)

9.8.1 *General*

At least every 12 months the calibration of any RCI/L device should be verified by the suspension of calibrated weights.

Thorough examinations should include confirmation that the calibration of the RCI/L has been checked by the suspension of weights on the crane. A calibration check should also be carried out when any major repair or modification has been carried out on the RCI/L. At each successive calibration, a different configuration of the crane should be chosen so that eventually all configurations are systematically covered.

9.8.2 *Rated capacity indicator/limiter (RCI/L) calibration check*

The following warnings should be given by the RCI/L within the specified tolerance.

a) *Warning of approach to rated capacity*

The RCI/L should give a clear and continuous warning of approach to the rated capacity. The warning should commence at not less than 90 % of the rated capacity and not more than 97.5 %. The approach to rated capacity warning should continue to function until the percentage of load falls to below the value at which the warning was initiated.

b) *Warning of overload*

The RCI/L should give a clear and continuous warning of overload. The warning should commence at not less than 102.5 % of the rated capacity and not more than 110 %. The overload warning should continue to function until the percentage of the load to the rated capacity falls to below the value at which the warning was initiated.

Guidance on how to calibrate an RCI/L is given in BS 7262. During the calibration check of the RCI/L it is essential that the crane is not loaded beyond 110 % of its rated capacity. The radius/angle 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.

I 22 April 2003

9.9 Test site conditions

9.9.1 Careful consideration should be given to the condition of the site where the tests are to be conducted. The recommendations provided in the operating instructions for the crane relate to operations within the rated capacity and more stringent requirements apply when loads are being applied for the purpose of testing.

9.9.2 The ground should be well consolidated and capable of withstanding the loads applied to it. There should be no hidden dangers such as cable ducts, drains, pipes, back-filled areas, cellars or other subterranean weaknesses. Cranes should not be tested in the vicinity of overhead power lines (see BS 7121-1:1989, **9.3.2**).

9.9.3 The ground should be level as specified in the instructions.

9.9.4 The site should be of sufficient area and have unrestricted overhead clearance to allow the unobstructed movement of the crane and load throughout its test movement, for example slewing, derricking and travelling.

9.9.5 It is preferable that tests are not conducted over high risk areas, for example a public highway, railway, occupied buildings or in the flight path of airports (see BS 7121-1:1989, **9.3.3**). If due to the requirements of usage this is unavoidable, arrangements should be made with the appropriate authorities.

9.9.6 Load testing is designed to prove a crane, however the crane might not withstand the loading. All personnel not essential to the test should be kept away from the area. The test area should be roped off and notices posted prohibiting unauthorized entry. The site should be clear of plant and property which could inhibit the test.

9.10 Weather conditions

NOTE See BS 7121-1:1989, **12.6** for further guidance regarding weather conditions.

9.10.1 *General*

For cranes operating in situations where they are likely to be affected by the weather, careful attention should be given to this aspect. Certain weather conditions such as electric storms, strong wind, heavy rains, ice, snow or excessive sea state can impose loads on a crane or adversely affect the safety of crane operations.

For this reason test sites should not be located in areas which are known to be exposed to extreme weather conditions. The limitations on wind speed for testing of the crane can be lower than the limitations for normal operation and in cases of doubt advice should be sought from a design authority or competent engineer.

It is essential that tests are not undertaken when the crane or load cannot easily be seen because of limitations on visibility (including inadequate lighting) or when heavily coated with ice or snow.

A test load should not be applied to a crane by pulling against an anchor point instead of using test weights. Pulling against anchor points can introduce side loading to the crane and the test load cannot be hoisted and applied to all parts of the gear train.

9.10.2 *Wind speeds*

The crane should not be operated in wind speeds (or in the case of water-borne craft, sea states/significant vessel movement) that are in excess of those specified in the operating instructions for the crane. During overload testing the limiting wind speed is reduced so advice should be sought from a design authority before overload testing is carried out.

NOTE 1 Gusting wind conditions can have an additional adverse effect on the safe handling of the load and the safety of the crane.

NOTE 2 Information regarding the Beaufort scale of wind force is given in Annex B.

NOTE 3 Information regarding sea state codes is given in Annex C.

9.11 Test weights

The following test weights should be used.

a) Weights of proven accuracy to within ±1.0 %.

b) Weights proven on a weighbridge, the weighbridge having been calibrated within the last 12 months.

c) Weights suspended from a calibrated weighing device, the weighing device having been calibrated within the last 12 months.

NOTE It is important that the weighing device is capable of weighing the test load to within ±1.0 %.

9.12 Non-destructive testing (NDT) techniques

During thorough examination of a crane the competent person might consider it appropriate to apply NDT techniques to assess the integrity of components. These techniques can assist in the detection of any material cracks or defects that might grow in service and ultimately lead to failure.

BS EN 473 contains guidance on qualification and certification of NDT personnel and, unless the operator is working to a detailed written procedure, they should be qualified to Level Two in accordance with BS EN 473:2000.

The three most common types of NDT used are as follows.

— *Magnetic particle examination*

In this technique a magnetic field is induced in the area under examination whilst the surface is flooded with ferrous particles suspended in a liquid. Any cracks or defects cause a discontinuity in the magnetic field which in turn causes the ferrous particles to cluster over the defect, indicating its presence by a dark line. This technique is only suitable for magnetic materials (most structural steels and some stainless steels) and only detects surface defects and large defects just below the material surface.

NOTE 1 Further guidance is given in BS EN ISO 9934, PD 6513 and BS EN 10228-1.

— *Dye penetrant*

In this technique the surface of the material is flooded with a liquid dye which penetrates into any surface cracks or defects. After a specified period the dye is cleaned off and the surface sprayed with an absorbent "developer" which draws the dye from any defects indicating the presence of the defect. The technique is often employed on non-ferrous materials such as aluminium alloys, but can only locate surface defects.

NOTE 2 Further guidance is given in BS EN 571-1 and BS EN 10228-2.

— *Ultrasonic examination*

In this technique pulses of high frequency sound waves are transmitted from the surface of the material into its interior. Any defects or discontinuities cause the sound waves to be reflected back to the surface where they can be detected and, by measuring the time delay from the time of transmission, an estimate of the defect's depth below the surface can be made. The technique can be used for a wide range of materials and detects both surface and subsurface defects. However, it requires both a skilled operator and specialist equipment and would normally be carried out by a specialist firm.

NOTE 3 Further guidance is given in BS EN 583-3.

9.13 Reports of thorough examinations and certificates of test

After every thorough examination (including when a crane is tested) a report should be prepared. Information regarding the contents of the report is given in Annex A.

On completion of every load test a certificate should be issued.

NOTE 1 Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. An example of a test certificate is given in Annex D.

NOTE 2 Additional details might be required for specific crane types.

The competent person should ensure that the information provided in the report of thorough examination and certificate of test is the same as the rated capacities given on the duty charts for the crane and the settings on the RCI/L.

NOTE 3 The rated capacities established by the competent person and referred to in the current report of thorough examination and certificate could make it necessary to alter the charts on the crane and re-calibrate the RCI/L.

All certificates of test should be endorsed with the information necessary to ensure there is no ambiguity as to crane rigging at the time of test. This applies to all possible variables, for example jib length, rope reeving, track width, short or long crawlers, counterweight, blocked, free on wheels, jib locking pins.

Where for any reason the competent person considers it necessary to restrict the use of a crane (for example site limitations prevent the testing of the full range of duties of the crane) then the restrictions should be noted on the report of thorough examination and certificate of test and the use of the crane subject to these restrictions. A notice of these restrictions should be posted in the cab of the crane. Where for any reason the competent person deems it necessary to change the rated capacities, the markings and tables of rated capacities on the crane should be amended to reflect these restrictions and recorded on the test certificate. The RCI/L should be set to perform in accordance with the new rated capacities.

10 Data logging

Data logging is available for some types of lifting equipment and this can provide a valuable aid to the competent person. There are several suppliers of software packages available for introducing data logging and condition monitoring. These address the various levels of complexity at which condition monitoring is undertaken. Systems range from simple storage of results and the generation of "trends" from those records, to the most sophisticated which can process data and generate reports and warnings to assist the competent person with the decision making.

The following are some examples of the information that data loggers can record:

— time, date and duration of lift;
— configuration;
— details of average and maximum load;
— radius, angle and boom length;
— number of lifts carried out;
— rated capacity exceeded and percentage;
— the number of times that manufacturer's set limits are exceeded;
— reeving changes;
— operating mode;
— road travel or on-site working;
— distances travelled;
— start and stop times in real time;
— operator identification;
— over speeding;
— harsh braking;
— idling time.

11 Additional recommendations for cranes for lifting persons and suspended baskets

11.1 General

Cranes and other equipment that are used to lift persons and the personnel carrier should either be thoroughly examined at least every 6 months or in accordance with a written scheme of thorough examination.

11.2 The crane

11.2.1 Check that the crane has an RCI/L with an appropriate duty for personnel lifting (i.e. half the rated capacity for lifting other loads).

11.2.2 Check that the crane is equipped with a motion control system that brings motion to rest automatically when the controls are released.

11.2.3 Check that the crane is equipped with an appropriate anemometer or other device to monitor in-service wind speeds.

NOTE This is intended to ensure that personnel carriers are not used in wind speeds in excess of 7 m/s.

11.2.4 Check that any crane equipped with a winch has power lowering. Cranes with free-fall ability should not be used to lower and raise persons unless the free-fall facility has been locked out.

11.2.5 Check that load bearing hydraulic cylinders are fitted with load hold valves (over-centre valves) to stop movement in case of hose rupture or pipe fracture. Cranes only equipped with simple check or hose rupture valves should not be used for the lifting of persons.

11.2.6 Carry out a functional check to determine whether the crane control system is able to provide a smooth transition of the carrier. The control should be such that the carrier can proceed gently and the working speed should not exceed 0.5 m/s on all motions.

11.2.7 Check that means are provided so that if the power supply or control system fails, the carrier can be positioned to enable access/egress without risk.

11.2.8 Measure the wire rope used for hoisting and lowering the carrier. The wire rope should have a diameter of at least 8 mm.

11.3 The carrier

11.3.1 Visually check that storage accommodation for equipment, including any emergency egress equipment (for example safety harness, lanyard), is provided in the carrier.

11.3.2 Visually check that the carrier is marked with the number of persons that can be carried and the maximum load that can be carried.

11.3.3 Check that any doors in the carrier do not open outwards and can be securely fastened.

11.3.4 Visually check that the carrier has handrails to provide security for persons, mounted in positions that do not trap hands.

11.3.5 Visually check that the carrier sides prevent persons or materials falling from the carrier.

11.3.6 Visually check that any attachment points for safety devices such as harnesses are secure and undamaged.

11.3.7 Visually check any safety devices such as harnesses and lanyards for integrity and completeness.

11.3.8 Visually examine the structure of the carrier. It should be free from damage, corrosion, cracks and other imperfections.

11.3.9 Visually check any mechanism provided to ensure that the floor of the carrier remains horizontal. It should be free from damage, leaks, corrosion and wear.

11.3.10 Visually check the carrier for a unique identification mark and record this on the report of thorough examination.

11.3.11 On the report of thorough examination state that the crane and carrier have been thoroughly examined for the purpose of lifting persons.

11.4 Bosun's chair

11.4.1 Visually examine both primary and secondary suspension points. They should be free from damage, corrosion, cracks and other imperfections.

11.4.2 Visually examine the seat structure for damage, security and contamination.

11.4.3 Visually examine the seat belt(s) for damage, contamination, security of their fixings and check them for correct operation.

11.5 Harnesses

11.5.1 Visually examine the harness for signs of cuts, abrasion, damaged stitching or contamination.

11.5.2 Check the harness for correct operation of all buckles, adjusters, fasteners etc.

11.5.3 Visually examine both primary and secondary suspension points. They should be free from damage, corrosion, cracks and other imperfections.

11.5.4 Check the age of the harness to determine whether it is within the age range recommended by the manufacturer.

11.6 Pre-use checks

11.6.1 *The crane*

In addition to the daily pre-use checks given in **6.2** the following recommendations apply to cranes for use with lifting persons and suspended baskets.

a) Hoist ropes should be free of kinks and other obvious defects.

b) A means should be provided to prevent the carrier attachment from becoming detached from the hook.

c) Multiple part lines should not be twisted around each other.

d) There should be no slack in the wire ropes.

e) All ropes should be properly seated on drums and on sheaves.

11.6.2 *The carrier*

The carrier, suspension system, attachment points and any carrier motion controls should be checked before use by the appointed person/crane supervisor. The checks are to identify conditions that have been specifically indicated by the carrier manufacturer, or competent person, as potentially creating a hazardous operating condition. An example of a personnel carrier pre-use check form is given in Annex E. The checks should cover at least those items listed in Annex E, and the form should be signed by the appointed person/crane supervisor. Any conditions found to be unsatisfactory should be corrected prior to lifting personnel.

12 Assessment of wire rope condition and discard criteria

12.1 General

The continued safe use of wire ropes depends on regular assessment of the condition of the ropes and the equipment with which they are used. Figure 1 shows some points to be considered as part of the assessment of the wire rope condition.

Some cranes operate in conditions where the wire ropes and equipment are particularly liable to damage, e.g. corrosive atmosphere, abrasive particles. In such circumstances, assessment of the condition of the rope and the equipment should be carefully carried out and the rope removed from service when the damage affects its safe operation.

Records should be kept of the examination and replacement of wire ropes. These should consist of the reports of thorough examination for the crane and certificates of test for the wire ropes at time of supply. An example of a certificate of test for wire ropes is given in Annex F.

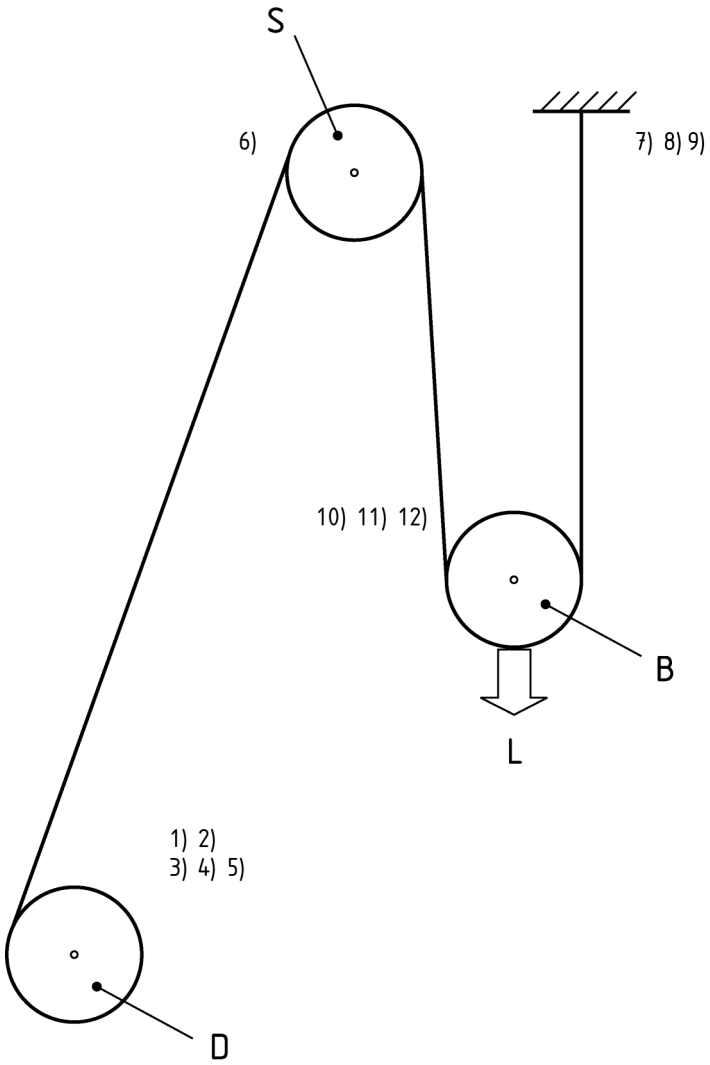
When carrying out inspections and examinations to assess the fitness of the wire rope for further service, both general deterioration and localized deterioration or damage should be considered. Therefore the whole length of the rope should be examined, paying particular attention to the rope adjacent to the terminations, lengths that have been running or stationary over drums, sheaves and deflection pulleys and any other areas likely to sustain damage.

The competent person should assess the severity of each of the individual discard criteria given in **12.2**, **12.3**, **12.4** and **12.5** on the wire rope being examined and establish if any of these occur in combination. A combination of two or more criteria should be viewed more seriously than a criterion occurring on its own. Guidance on how to assess the cumulative effect is given in **12.6**.

If the competent person has any doubts about the safe operation of the wire rope it should be discarded.

NOTE 1 Detailed guidance on the examination and discard of crane wire ropes is given in ISO 4309.

NOTE 2 Detailed advice on the off loading, storage, uncoiling, handling, installation, termination, running and maintenance of wire ropes can be found in BS 7121-1:1989, Clause **15**.



Key

B Block
D Drum
L Load
S Sheave
1 Examine termination of wire rope at drum
2 Examine for defective coiling, which causes deformations (flattened portions), and wear, which can be severe at cross-over positions
3 Examine for wire breaks
4 Examine for corrosion
5 Look for deformations caused by snatch loading
6 Examine portion that winds over sheave for wire breaks and wear
7 Points of attachment: check for wire breaks and corrosion; similarly, check section of wire rope that lies on or adjacent to compensating pulleys
8 Look for deformation
9 Check wire rope diameter
10 Examine carefully the length of wire rope that runs through the block, particularly the length that lies on the pulley when the crane is in a loaded condition
11 Examine for wire breaks or surface wear
12 Examine for corrosion

Figure 1 — Some points to be considered during the assessment of the wire rope

12.2 Broken wires

12.2.1 *Randomly distributed broken wires*

The total number of visible wire breaks should not exceed 10 % in any length of wire rope of eight rope diameters.

Breaks that occur on the crown of the rope are typical of deterioration by abrasive wear and bend fatigue. See Figure 2. Breaks that occur in the valley area between the strands are typical of deterioration of the core by wear, fatigue or corrosion. See Figure 3.

In the case of rotation-resistant (multi-strand) ropes, there is a probability that the majority of broken wires occur internally and are "non-visible" fractures.

If the broken wires are localized or all in one strand, the rope should be discarded before the number of broken wires reaches 10 % in any length of wire rope of eight rope diameters.

12.2.2 *Localized broken wires in the vicinity of terminations*

The wire rope should be discarded when there are three or more visible broken wires in the immediate vicinity of terminations. Detachable terminations such as a wedge and socket should be examined for broken wires within and under the terminations.

If the wire rope is shortened so that the broken wires are removed, it may be considered for re-termination and reuse. Broken wires at or adjacent to the termination, even if low in number, are indicative of high stresses at this point and can be caused by incorrect fitting of the termination. The causes of the broken wires should be investigated before the rope is re-terminated.

12.2.3 *Wire ropes operating in plastics sheaves*

When any wire rope operates either solely or partly in plastics sheaves or metal sheaves having plastics lining, wire breaks can occur internally in large numbers before there is any visible evidence of broken wires or substantial wear on the periphery of the rope.

Attention should be paid to any localized area that exhibits a dryness or denaturing of the lubrication.

The rope or crane manufacturer's advice should be sought regarding discard criteria but the discard criteria should be no less stringent than those applicable to multi-strand ropes working over metal sheaves. A general guide would be to reduce the specified number of randomly distributed broken wires for ropes operating in metal sheaves by 50 %, particularly where the rope operates on a single layer on the drum.

12.3 Wear

Wear of wire ropes can be either general or localized and results from contact of the wire rope with sheaves, drums or other hard surfaces or from rope to rope pressure. Wear can be uniform along or around the rope or only occur along one side of the rope. See Figure 4 and Figure 5.

When working over metal sheaves, six-strand and eight-strand rope should be discarded when the rope diameter at any point is reduced to 90 % of the nominal diameter.

In the case of rotation-resistant ropes, internal wear or damage is frequently more critical than external wear and can also be accompanied by an accumulation of internal debris. If the rope diameter falls to 97 % of the nominal diameter or rises to 105 % of the nominal diameter, a more detailed examination should be carried out to ascertain the significance of this change, and discard might be necessary. The rope should be discarded when the diameter has reduced to 90 % of the nominal diameter.

If wear is not even, the cause should be ascertained and corrective action taken.

12.4 Corrosion and chemical attack

Corrosion and chemical attack of wire ropes can be external or internal and general or localized and are significant when the surface of the wires is severely roughened or pitted, or when the wires are slack within the strands due to wastage. If any of these phenomena is present, either locally or generally, the rope should be discarded.

Slight rusting of the surface is not normally detrimental but can be an indication that the rope is in need of lubrication. See Figure 6 and Figure 7.

Internal corrosion and chemical attack are not always easy to detect and are therefore particularly dangerous. Indications are an unusual increase or decrease in rope diameter, lack of gap between the strands, dryness and deterioration of the lubricant, discoloration in the valleys between the strands and increase in stiffness on bending. See Figure 8. If a rope shows any of these signs it should be carefully examined and, if necessary, discarded. Where discard is not necessary it should be re-dressed (see BS 7121-1:1989, **15.7.2**).

12.5 Localized damage or distortion

Other forms of damage or distortion that can affect the safe working of wire ropes are as follows.

a) *Waviness*

Waviness is a deformation in which the longitudinal axis of the wire rope takes the shape of a helix. While not necessarily resulting in any immediate loss of strength, the deformation can transmit a pulsation which after prolonged working gives rise to wear and wire breaks. The wire rope should be discarded in the case of waviness that affects the operation of the equipment. See Figure 9.

b) *Basket distortion (or birdcage)*

Basket distortion occurs in wire ropes when the outer layer of strands has been dislocated or when the outer layer becomes longer than the inner layer of strands. Such a condition can occur as a result of abrupt (snatch) loading of the rope from a slack condition, incorrect installation or incorrect termination. If basket distortion is present the wire rope should be discarded. See Figure 10.

c) *Strand or core protrusion*

Strand or core protrusion is frequently associated with basket distortion and the wire rope should be discarded immediately. See Figure 11, Figure 12 and Figure 13.

d) *Wire extrusion*

In this condition certain wires or groups of wires rise up on the opposite side of the rope to the sheave groove, in the form of loops. This feature usually results from shock loading. If the condition is severe (three wires or more) the wire rope should be discarded. See Figure 14.

e) *Local increase in diameter of rope*

A local increase in the diameter of the wire rope can occur and could affect a relatively long length of the wire rope. The condition usually relates to corrosion (see **12.4**) or to swelling of a fibre core owing to moisture. If the condition is severe the wire rope should be discarded. See Figure 15.

f) *Local decrease in diameter of rope*

A local decrease in the diameter of the wire rope is frequently associated with fracture of the core. Positions close to terminations should be carefully examined for such deformations. If the condition is severe the wire rope should be discarded. See Figure 16.

g) *Bends and kinks*

A bend is an angular deformation of the wire rope. A kink is a deformation created by a loop in the rope that has been tightened without allowing for rotation about its axis. Unbalance of lay length occurs, which causes excessive wear, and in severe cases the rope is so distorted that it only has a small proportion of its strength remaining. If the bend or kink is severe the wire rope should be discarded immediately. See Figure 17, Figure 18 and Figure 19.

h) *Flattened portions*

If the wire rope on a drum is spooled with insufficient tension, the layer above can induce a flattened portion in the lower layer. See Figure 20 and Figure 21.

i) *Damage due to heat or electric arcing*

The wire rope should be discarded if there is evidence that it has been affected by electric arcing in any way or substantially affected by heat. Indicators are dryness or loss of lubrication, bluing of the wire surfaces, fusion of wire surfaces and the presence of weld splatters.

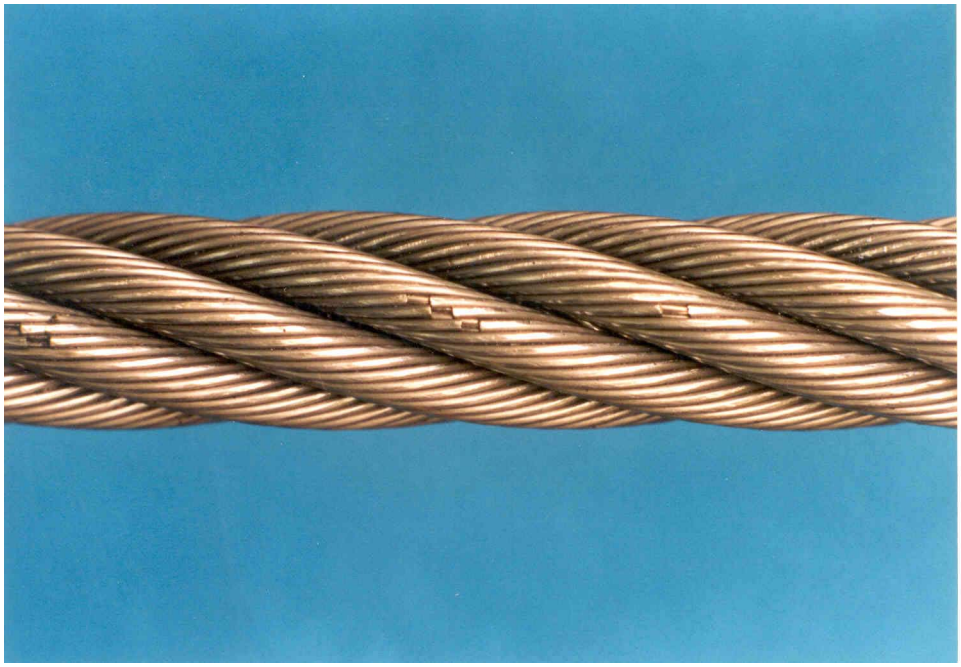


Figure 2 — Broken wires on the "crowns" of the strands of the rope

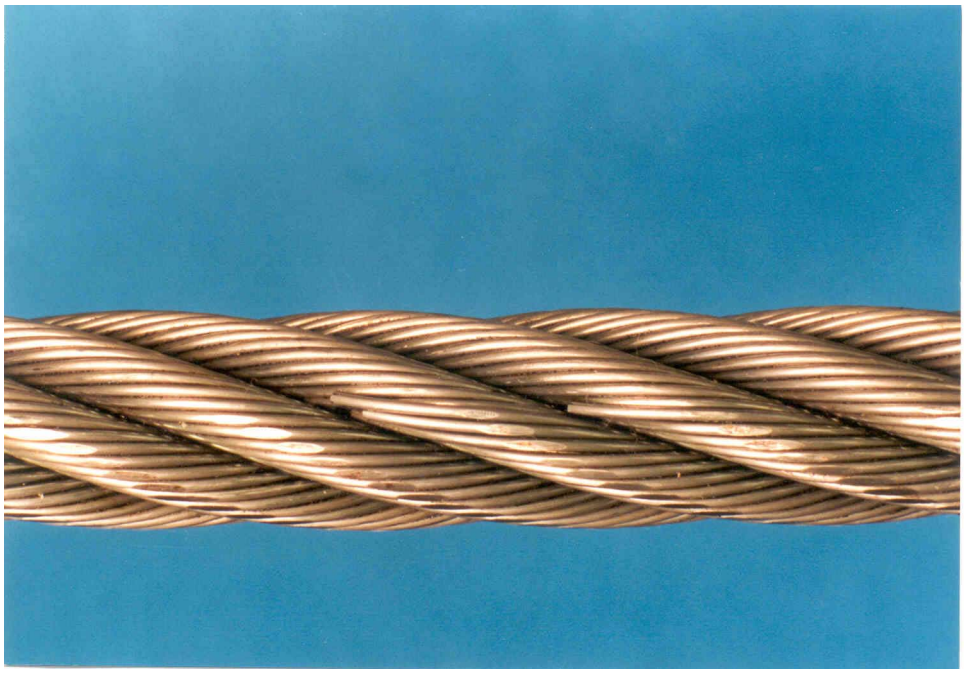


Figure 3 — Broken wires in the "valleys" (sometimes called gussets or interstices) between the outer strands of the rope

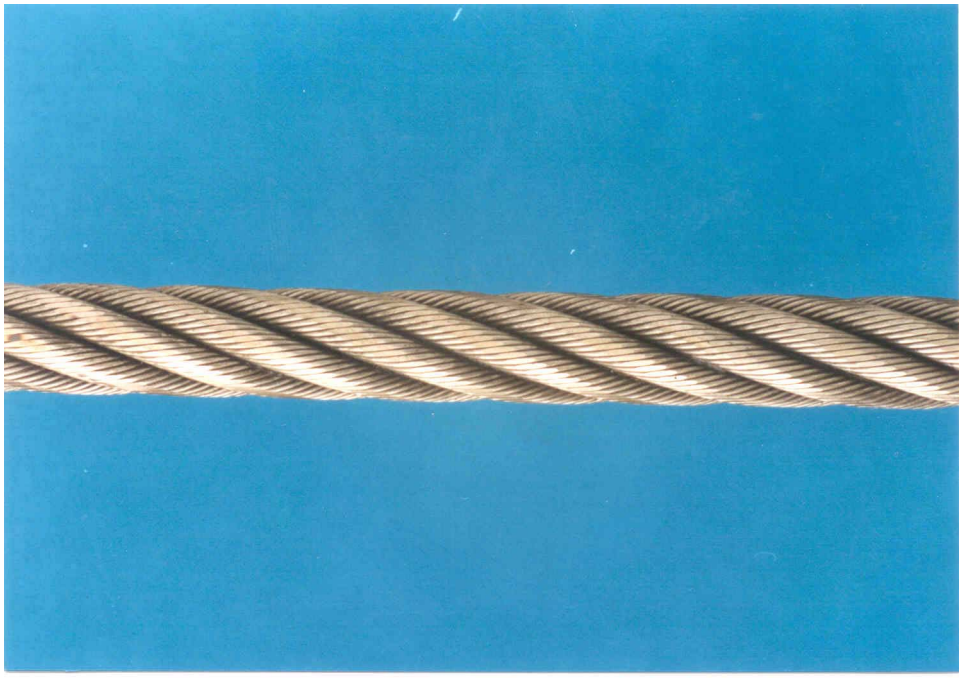


Figure 4 — External wear

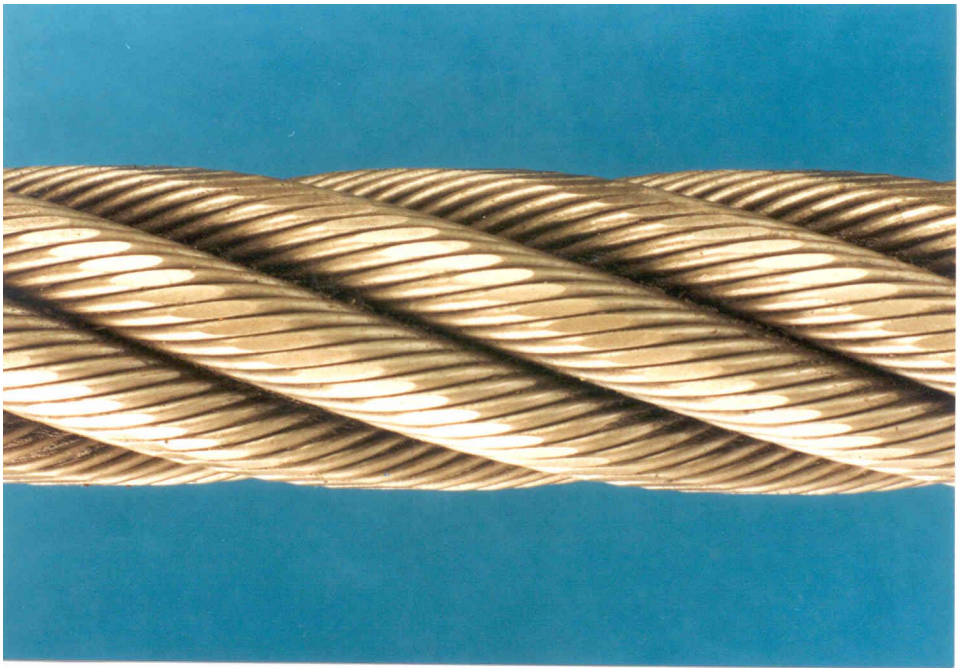


Figure 5 — Enlargement of Figure 4

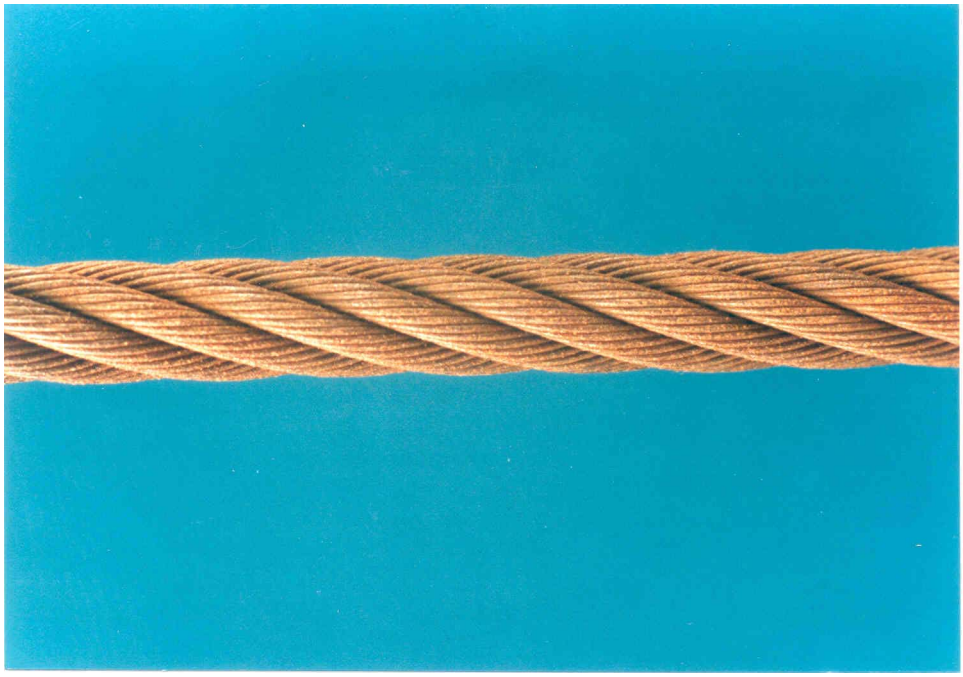


Figure 6 — External corrosion

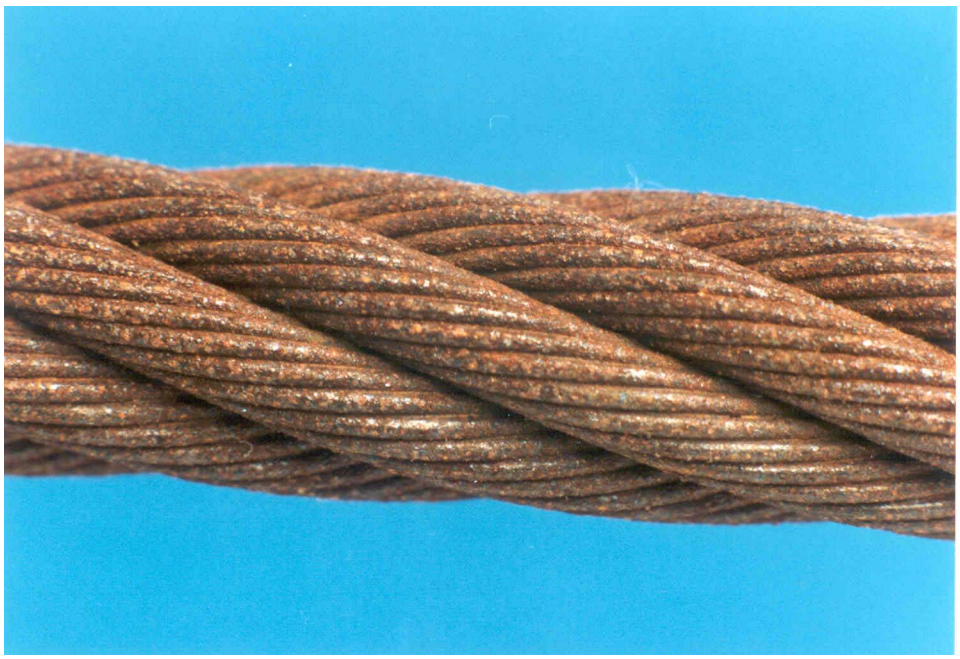


Figure 7 — Enlargement of Figure 6

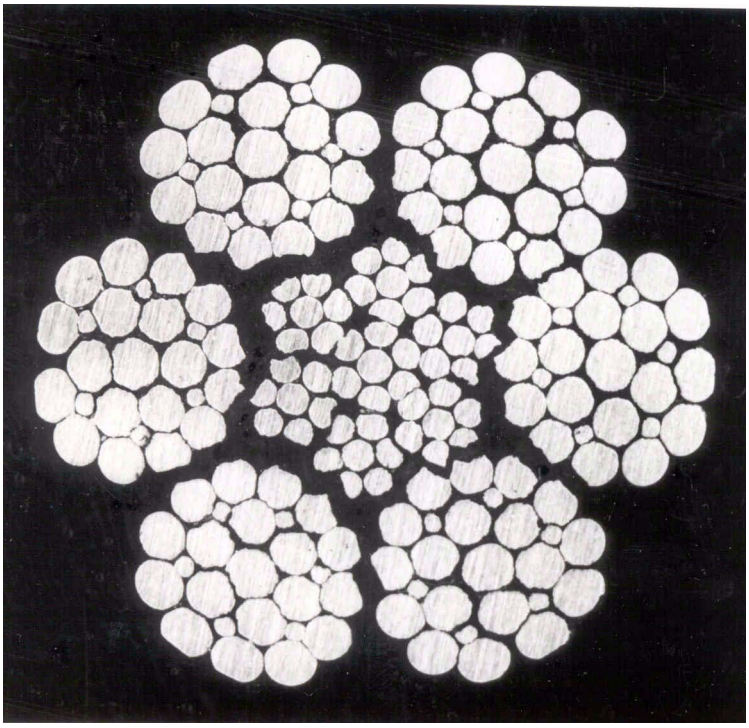


Figure 8 — Internal corrosion

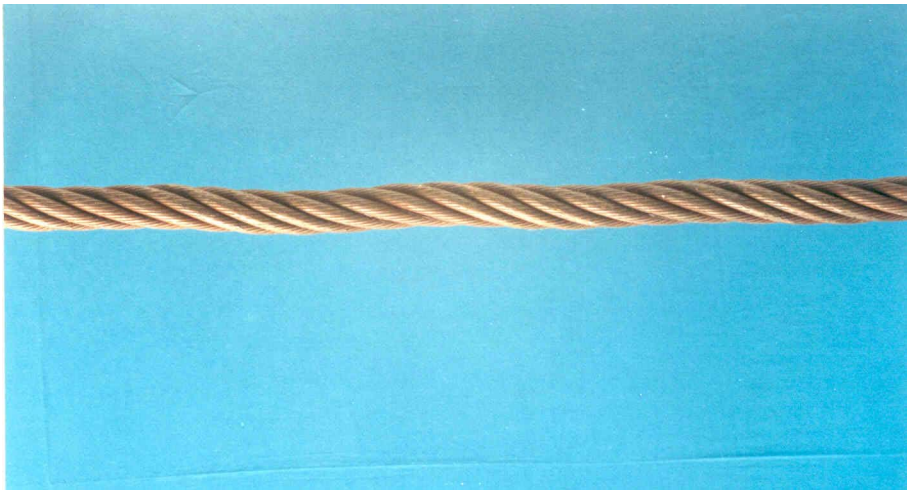


Figure 9 — Waviness

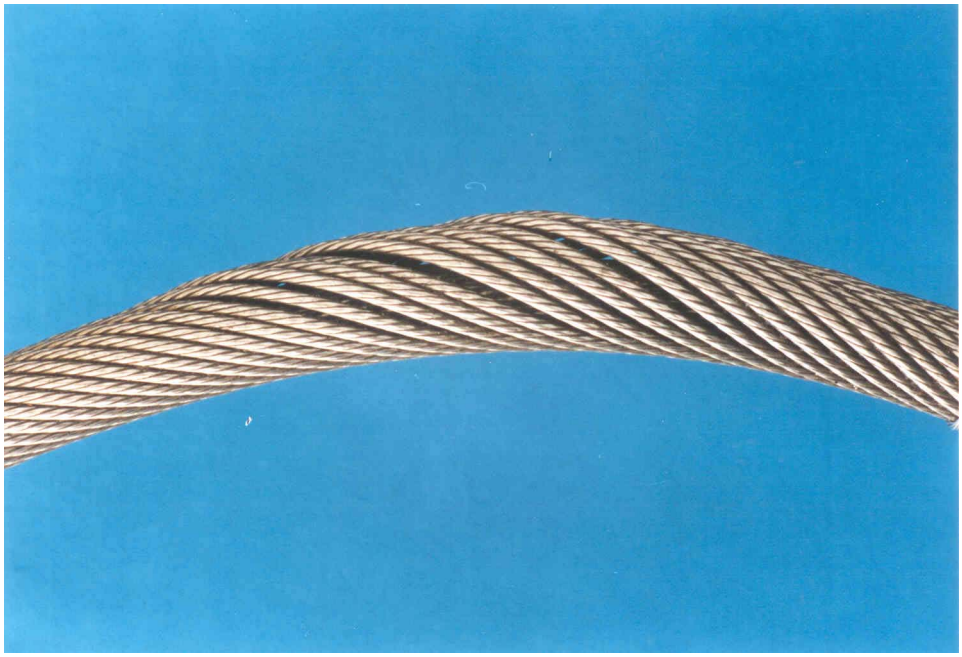


Figure 10 — Basket deformation

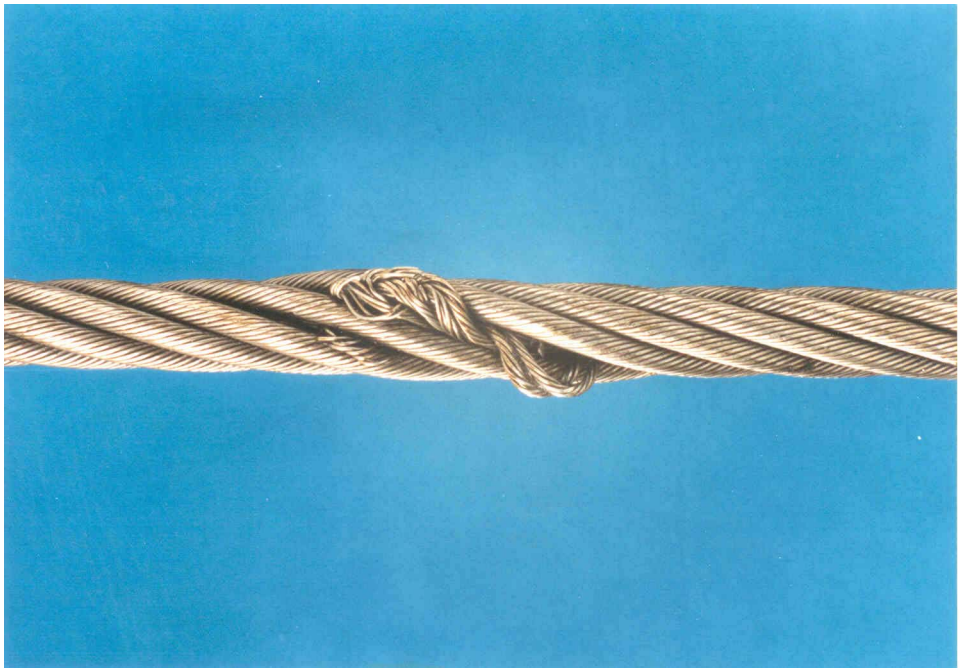


Figure 11 — Strand protrusion

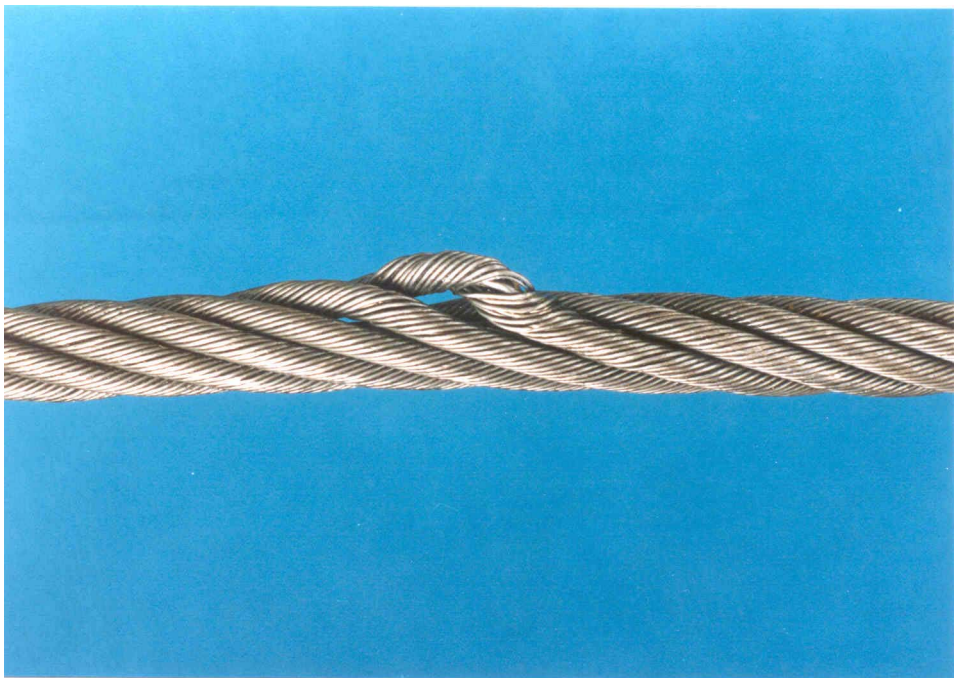


Figure 12 — Strand protrusion

Figure 13 — Core protrusion

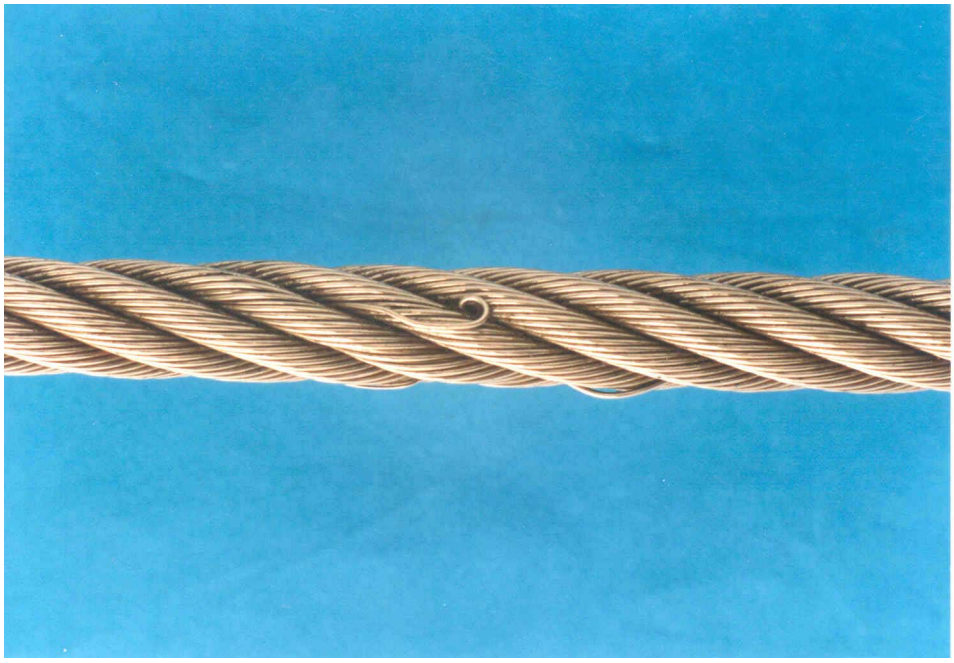


Figure 14 — Wire protrusion

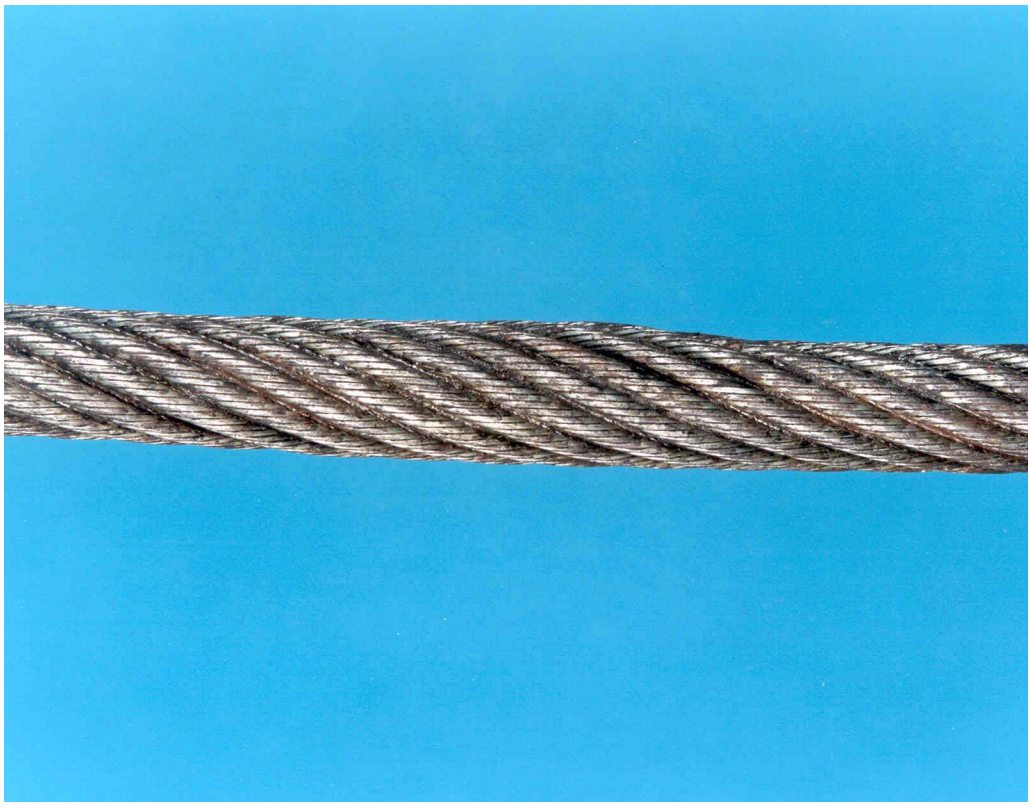


Figure 15 — Local increase in rope diameter due to core protrusion

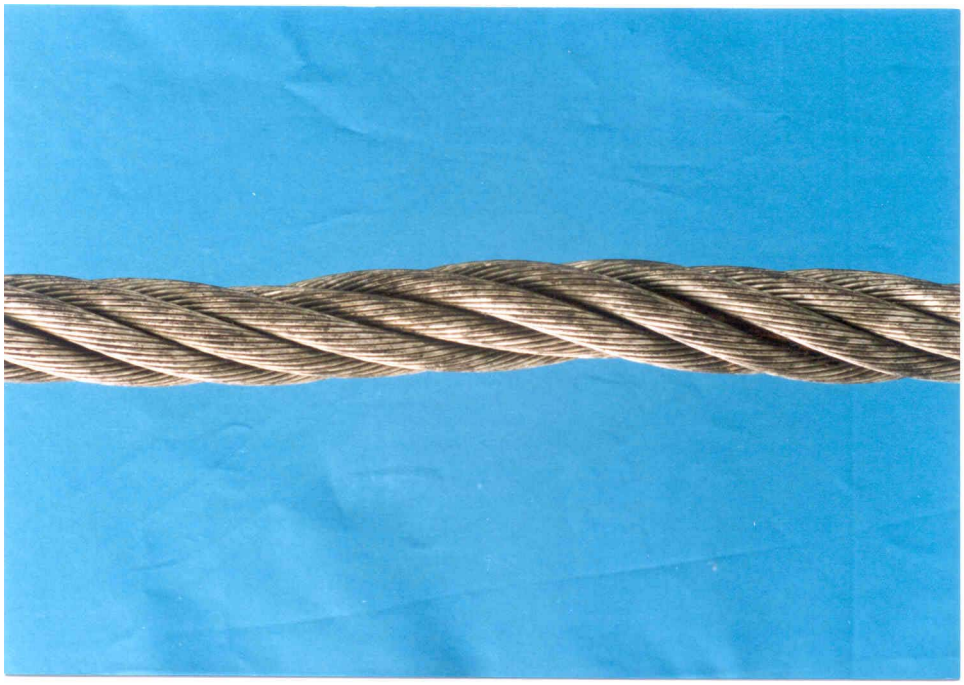


Figure 16 — Local reduction of rope diameter

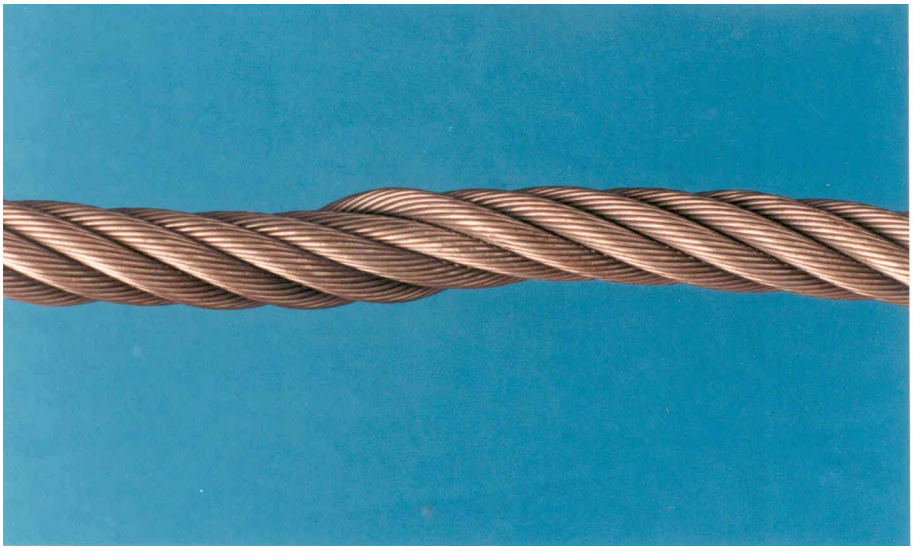


Figure 17 — Kink

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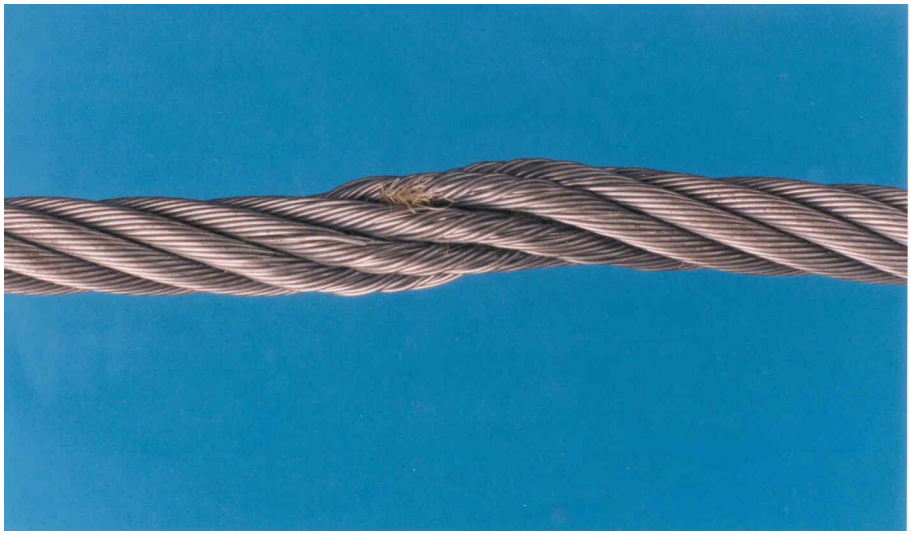

Figure 18 — Kink

Figure 19 — Kink

Figure 20 — Flattened portion

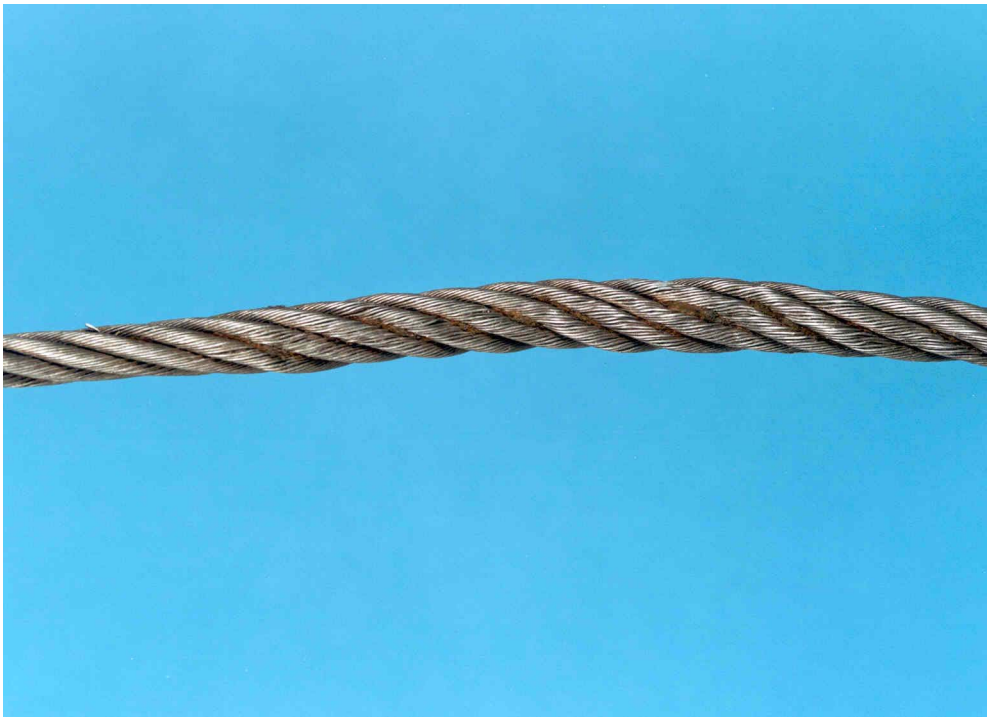

Figure 21 — Flattened portion

12.6 Cumulative effect of individual criteria

Guidance regarding individual discard criteria that should be considered when deciding whether a wire rope should be discarded is given in **12.2**, **12.3**, **12.4** and **12.5**. The competent person should also assess the cumulative effect of two or more of the criteria within each affected part of the wire rope. The severity of deterioration should be assessed between 0 % (perfect condition) and 100 % (discard condition). When a cumulative intermediate condition of 80 % or more is reached, the competent person should specify the period of time for which the wire rope may be used and could recommend a reduction in time between inspections or thorough examination of the rope. Table 1 gives the discard criteria for single layer and parallel-closed ropes working in steel sheaves and Table 2 gives the discard criteria for rotation-resistant ropes working in steel sheaves.

12.7 Chains

Chains used for lifting purposes should be subjected to checks, inspection and thorough examination in accordance with ISO 3056 and BS 6968.

Table 1 — Discard criteria for single layer and parallel-closed ropes working in steel sheaves

Rope category number[a]	Number of load-bearing wires in all outer strands of the rope[b]	Number of visible broken wires[c] which indicate immediate discard of the rope							
		Classification groups for M1, M2, M3 and M4 mechanisms[d]				Classification groups for M5, M6, M7 and M8 mechanisms[d]			
		Ordinary lay over length		Langs lay over length		Ordinary lay over length		Langs lay over length	
	n	$6d$[e]	$30d$[e]	$6d$[e]	$30d$[e]	$6d$[e]	$30d$[e]	$6d$[e]	$30d$[e]
RCN 01	$n \leq 50$	2	4	1	2	4	8	2	4
RCN 02	$51 \leq n \leq 75$	3	6	2	3	6	12	3	6
RCN 03	$76 \leq n \leq 100$	4	8	2	4	8	16	4	8
RCN 04	$101 \leq n \leq 120$	5	10	2	5	10	20	5	10
RCN 05	$121 \leq n \leq 140$	6	11	3	6	11	22	6	11
RCN 06	$141 \leq n \leq 160$	6	13	3	6	13	26	6	13
RCN 07	$161 \leq n \leq 180$	7	14	4	7	14	28	7	14
RCN 08	$181 \leq n \leq 200$	8	16	4	8	16	32	8	16
RCN 09	$201 \leq n \leq 220$	9	18	4	9	18	36	9	18
RCN 10	$221 \leq n \leq 240$	10	19	5	10	19	38	10	19
RCN 11	$241 \leq n \leq 260$	10	21	5	10	21	42	10	21
RCN 12	$261 \leq n \leq 280$	11	22	6	11	22	45	11	22
RCN 13	$281 \leq n \leq 300$	12	24	6	12	24	48	12	24

For ropes having outer wires in the external strands of larger size than the norm, the particular construction is down-graded in the table. In the case of wire ropes having outer strands of Seale construction, where the number of wires in the strands is 19 or less, the wire rope should be placed in the table two rows above that row which the wire rope construction would normally be placed.

Alternate lay ropes should be considered as Lang lay for the purpose of discard.

Where the classification of the mechanism is unknown, the numbers of visible broken wires applicable to groups M1 to M4 should be adopted.

NOTE The values in Table 1 may also apply to wire ropes working in sheaves that are exclusively made of a polymer material (or sheaves with a polymer lining) in combination with multi-layer coiling. They do not apply to wire ropes working in sheaves that are exclusively made of a polymer material (or sheaves with a polymer lining) in combination with single layer coiling.

[a] Information on rope category numbers will be available from ISO 4309 which is in preparation.
[b] Filler wires are not regarded as load-bearing wires and are not included in the value of n. In wire ropes having a number of layers of strands, only the visible outer layer is considered in the value of n. In wire ropes having a steel core, this is regarded as an internal strand and is not considered in the value of n.
[c] A broken wire can have two ends.
[d] In accordance with ISO 4301.
[e] d is the nominal diameter of the wire rope.

Table 2 — Discard criteria for rotation-resistant ropes working in steel sheaves

Rope category number[a]	Rope construction or number of load bearing wires in all outer strands of the rope[b] n	Number of visible broken wires[c] which indicate immediate discard of the rope			
		Classification group for M1, M2, M3 and M4 mechanisms[d] over length		Classification group for M5, M6, M7 and M8 mechanisms[d] over length	
		$6d$[e]	$30d$[e]	$6d$[e]	$30d$[e]
RCN 21	3 strand ropes, 4 strand ropes, (<100 total wires)	2	4	4	8
RCN 22	3 strand ropes, 4 strand ropes, (≥100 total wires)	2	4	2	4
RCN 23	10 to 15 outer strands rotation-resistant ropes	2	4	4	8
RCN 24	≥16 outer strands rotation-resistant ropes	2	4	4	8
Where the classification of the mechanism is unknown, the numbers of visible broken wires applicable to groups M1 to M4 should be adopted.					
NOTE The values in Table 2 may also apply to wire ropes working in sheaves that are exclusively made of a polymer material (or sheaves with a polymer lining) in combination with multi-layer coiling. They do not apply to wire ropes working in sheaves that are exclusively made of a polymer material (or sheaves with a polymer lining) in combination with single layer coiling.					

[a] Information on rope category numbers will be available from ISO 4309 which is in preparation.
[b] Filler wires are not regarded as load-bearing wires and are not included in the value of n. In wire ropes having a number of layers of strands, only the visible outer layer is considered in the value of n. In wire ropes having a steel core, this is regarded as an internal strand and is not considered in the value of n.
[c] A broken wire can have two ends.
[d] In accordance with ISO 4301.
[e] d is the nominal diameter of the wire rope.

13 Additional recommendations for mobile cranes

NOTE These additional recommendations also cover mobile self-erecting tower cranes.

13.1 Thorough examination of mobile cranes

13.1.1 *General*

Prior to thorough examination the mobile crane should be cleaned by appropriate means, e.g. pressure washed, to remove all spoil/dirt that would otherwise conceal the structure or mechanisms and prevent an effective examination. The examination should be carried out in a logical sequence, for example top to bottom, to ensure that nothing is overlooked.

13.1.2 *Rated capacity indicator/limiter (RCI/L) calibration check*

Thorough examinations of mobile cranes should include confirmation that the RCI/L has been calibrated to an accuracy within the tolerances given below. This calibration is not necessarily part of overload testing. This calibration check should be carried out at no more than 12 monthly intervals. At each successive calibration, a different configuration of the mobile crane should be chosen so that eventually all configurations are systematically covered.

NOTE Guidance on how to calibrate an RCI/L is given in BS 7262.

During the calibration check of the RCI/L it is essential that the mobile crane is not loaded beyond 110 % of its rated capacity. The radius/angle 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.

13.1.3 ***Examination scheme approach***

The examination scheme approach to thorough examinations, if used, should be based on regular assessments of the mobile crane in accordance with usage. This is known as condition monitoring.

NOTE Guidance on condition monitoring for cranes is given in ISO 12482-1. Implementation of ISO 12482-1 requires co-operation of the crane supplier (manufacturer), crane user (owner) and expert engineer (competent person).

The crane supplier should provide limiting criteria based on the crane design, for example the number of load cycles, load spectrum, critical parts, exceptional circumstances. These criteria should not be based on time alone.

The crane user and competent person should take into account the limiting criteria from the crane supplier when devising an examination scheme in accordance with LOLER. Data logging equipment greatly facilitates collection of information concerning crane usage for comparison with the crane design criteria. The data logging equipment needs to be fitted to the mobile crane from new to ensure that a complete record of all the usage of the mobile crane is maintained. Without a complete record of crane usage it is not possible to devise an appropriate examination scheme for a mobile crane and it should be subjected to periodic thorough examination in accordance with **13.1.4**.

For mobile cranes and other equipment subject to an examination scheme a calibration check should be carried out on the RCI/L at least once every 12 months as stated in **13.1.2**.

13.1.4 ***Specified period approach***

13.1.4.1 *Six monthly thorough examination*

Mobile cranes used to lift persons should either be examined by a competent person at least once every 6 months, or at a lesser interval if stipulated by the competent person. Lifting accessories should be thoroughly examined by a competent person at least once every 6 months.

13.1.4.2 *Twelve monthly thorough examination*

Mobile cranes not used to lift persons should be examined by a competent person at least once every 12 months. After carrying out the thorough examination the competent person should specify when the next thorough examination should be carried out.

13.1.4.3 *Items to check at the specified period thorough examination*

NOTE Information regarding additional items to check for cranes to be used with a personnel carrier is given in Clause **11**.

13.1.4.3.1 Visually examine the tyres for wear, damage, and inflation pressure.

13.1.4.3.2 Carry out a visual examination and functional check on the axle locking system for correct operation, freedom from leaks, damage, corrosion, distortion and correct operation of all indicators.

13.1.4.3.3 Visually examine the crawler tracks for wear and adjustment.

13.1.4.3.4 Visually examine the crane structure, including the chassis, for signs of damage, distortion, cracking and corrosion.

13.1.4.3.5 Visually inspect all bolts and fastenings to check that they are not coming loose.

13.1.4.3.6 Visually examine the slewing mechanism for security and wear during operation of the slew motion throughout its full range of movement and with the crane at maximum reach.

13.1.4.3.7 Visually examine all pipework on the crane for corrosion, damage, leakage, security and fretting.

13.1.4.3.8 Examine all hydraulic cylinders for leakage, corrosion on the rods and alignment. Visually check end fixings for wear, security and lubrication.

13.1.4.3.9 Visually inspect the super structure and jib of the crane for corrosion, damage, cracks and distortion.

13.1.4.3.10 Visually examine all pivoting joints on the jib and attachments of the crane for wear, corrosion, security and evidence of lubrication.

13.1.4.3.11 Operate telescoping extensions on the crane and visually examine them for wear and security.

13.1.4.3.12 Visually examine all wire ropes to determine whether they are of the size and type specified in the instructions and reeved in accordance with those instructions. Pay particular attention to the end terminations.

NOTE Guidance regarding wedge and socket anchorages for wire ropes is available in BS 7166.

13.1.4.3.13 Visually check whether all pulleys/sheaves and drums are free from damage and wear, whether the rope fits correctly on them and if they are effectively lubricated. Check whether all idler pulleys/sheaves turn freely and that all guards are undamaged and in place.

13.1.4.3.14 Thoroughly examine the whole length of the wire ropes for signs of wear, damage, broken wires and corrosion. See Clause **12**.

13.1.4.3.15 Visually inspect the braking mechanism for wear, damage and adjustment and check whether it conforms to the instructions for the crane.

13.1.4.3.16 Check any means of access for completeness and security of ladders, walkways and hand rails/hand holds.

13.1.4.3.17 Visually examine the outrigger jacks and beams for wear, security, freedom of movement and markings to show the correct extension for the beams. Extend the jacks and visually check whether they move freely and smoothly and that when left supporting the crane, they do not creep.

13.1.4.3.18 Check the oil and other fluids for condition (for example by debris monitoring) and level of the fluid.

13.1.4.3.19 Visually check whether the fixings for the operator's seat, where fitted, and restraint are all in place and secure.

13.1.4.3.20 Check whether all control levers are marked with their function and mode of operation.

13.1.4.3.21 Visually inspect the upper and lower hoist limit switches, check if they are in place and free from damage and excessive wear.

13.1.4.3.22 Visually examine the hooks, their attachments and safety catches for wear, fretting, distortion, corrosion and security.

13.1.4.3.23 Visually examine the fly jib and mounting attachment for corrosion, cracking, distortion and wear. Check whether the hoist limit switch is in good working order.

13.1.4.3.24 Check whether there is a table displayed in the operator's cabin showing the rated capacities for the mobile crane for all crane operating conditions (free on wheels, free on cushion wheels, all permitted outrigger positions etc.).

13.1.4.3.25 Functionally test all controls for smoothness of operation and to determine whether they are free from wear and other damage.

13.1.4.3.26 Check whether warning signs and other important instructions are present and readable, for example rating plate for load lifting.

13.1.4.3.27 Operate the mobile crane to check whether all motions operate smoothly and effectively without excessive play. The load lifting attachment should not drop excessively after the motion has been stopped and all limiters and safety devices should operate correctly.

On telescopic jib mobile cranes the jib should be dismantled at least once every 4 years to examine any hidden mechanism parts, for example rope and rope terminations, hydraulic cylinders.

On lattice jib cranes all of the jib sections should be covered by a test certificate.

13.2 Overload testing of mobile cranes

13.2.1 *General*

Mobile cranes with a rated capacity less than 500 t that are not thoroughly examined in accordance with an examination scheme should be overload tested every 4 years. Mobile cranes with a rated capacity that exceeds 500 t should be overload tested during the 12 monthly calibration of the RCI/L in the chosen configuration. At each successive calibration, a different configuration should be chosen so that eventually all configurations are systematically covered.

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 verification that the crane is rigged in accordance with the instructions for the crane.

The competent person should check the rated capacity specified on the manufacturer's certificate of test, the load radius indicator, the table of rated capacities displayed in the operator's cab and those used by the RCI/L. 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.

Mobile cranes have a large variety of support systems (for example crawler tracks, tyres and outriggers), jib configurations, counterweights and special attachments, all of which affect stability and strength. The competent person should take account of all variations.

13.2.2 ***Variations of mobile cranes***

13.2.2.1 *Outriggers*

Certain manufacturers give duties for intermediate outriggers extension. The competent person should check the following items.

a) The intermediate extension position is clearly and durably marked.

b) The manufacturer's certificate indicates the correct rated capacities applicable to the outrigger extension.

c) The duty charts give the specified intermediate extensions.

d) Provision is made in the RCI/L to accommodate the specified intermediate extension.

13.2.2.2 *Counterweight*

Variations in counterweights affect the stability of the crane. The manufacturer's duty charts specify the ratings applicable for each counterweight. Sometimes mobile cranes have additional weights and special rigs to enhance the lifting capacities.

The competent person should check whether the correct counterweight is on the crane.

13.2.2.3 *Jibs*

Manufacturers might supply jibs for different duties from materials of different specifications, which might not be apparent without careful checking. The correct jib sections should be used for the duty under consideration. There are a large variety of possible jib configurations on many cranes. The crane should be rigged in accordance with the instructions for the crane, for example for long jibs intermediate ties might be required. It is also sometimes necessary to identify precisely in which order the sections are fitted.

13.2.2.4 *Fly jibs*

Fly jibs should be erected and used in accordance with the instructions for the crane.

The fly jib, like the hook and block, has a maximum rated capacity. At small radii, the fly jib should not be overloaded. At larger radii, the load on the fly jib should be reduced in accordance with the lifting capacity of the main jib/fly jib combination.

When a load is lifted on the main hook with the fly jib fitted, the load on the main hook should be reduced to allow for the weight of the fly jib and fly hook. The maximum permissible angle of the main jib to the horizontal should not be exceeded when the fly hook is at its minimum radius as there is a danger of the jib falling back due to wind and dynamic loading.

Any necessary deductions and limitations in load value should be in accordance with the instructions.

Many fly jibs are capable of variation in length and/or angle of offset. The tie ropes should be of equal length and fitted in accordance with the instructions. The offset angle (if applicable) should be checked by calculation and/or measurement.

13.2.2.5 *Variable length jibs*

When jib lengths are increased by fitting intermediate sections it is necessary to identify them to ensure the sections are correct for the model of crane, for example to avoid mismatch of metric and imperial sections. The identification of the jib sections tested should be recorded on the test certificate.

NOTE Attention is drawn to LOLER Regulation 7 [1] which requires that all jib sections are marked to indicate to which crane they belong.

13.2.3 ***Levelling***

The importance of levelling the crane cannot be over-emphasized. The crane should be level to ±0.5 % slope and one method of determining the level of the crane is to use a spirit level. Alternatively, the hook block should be in the centre of the jib when viewed from the front with the jib fully extended at or near minimum radius and with the unladen hook block lowered to just above ground level. The procedure should then be repeated when the jib has been slewed 90°. This method of levelling can only be used when it has first been checked that the jib is correctly aligned. Any built-in levelling device should be checked at this time and reset if necessary. The levelling accuracy should be monitored throughout the tests, particularly when dealing with long telescopic and lattice jibs. Testing should be stopped if the level exceeds the limit given, any load should be removed and the crane re-levelled.

13.2.4 ***Lifting free on wheels***

Tyre pressures are a critical factor in retaining the desired stability margin of mobile cranes. The tyres of cranes under test should be as specified in the instructions. Some crane manufacturers stipulate higher tyre pressure for free on wheels (static condition fully mobile) duties than for road travel as a vehicle. Where the manufacturer permits lift and travel duties these can differ from the free on wheels duties and both types of duty should be subjected to test.

13.2.5 ***Lifting capacities***

The load ratings marked on mobile cranes and shown on the manufacturer's rated capacity charts indicate the gross loads, i.e. the loads quoted include the weight of the hook blocks, slings and lifting gear and often other deductions, for example stowed fly jib. This fact should be taken into account when the crane is being tested and an allowance should be made for the weight of suspended hook blocks, slings and lifting gear. The exact weight of these items should be ascertained. Certain cranes can become unstable when working with long jibs and fly jibs if the jib angle to the horizontal is reduced below the minimum angle given in the instructions. The hook block should always be rested on the ground before any lowering of the jib beyond the maximum operating radius commences.

13.2.6 ***Overload tests***

13.2.6.1 Before commencing any overload test the previous test certificate, where available, should be examined as this forms the basis for the test conducted. Where no test certificate is available the crane manufacturer's (or other suitable design authority's) advice should be sought as to a suitable test programme (see **13.5**) and the ability of the crane to withstand a 25 % overload.

13.2.6.2 The crane should be thoroughly examined to determine whether it is in a safe state and condition to be overload tested.

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

13.2.6.4 After the functional tests without a load applied, the efficiency of the crane's hoist brake(s) should be tested with the rated capacity that gives the maximum line pull on the hoist rope(s). The load should be lifted clear of the ground and the brake applied by returning the control to neutral. There should be no fall back or creep. The load should be re-hoisted and the brake reapplied to check the ability to re-hoist. The load should then be lowered and the control returned to neutral with the load still clear of the ground. There should be no overrun or creep.

At every configuration in the test programme the crane should be set up with the test load at a radius/angle within the rated capacity of the crane. The test load should then be raised just clear of the ground and the crane derricked out to the radius/angle where the test load is 125 % of the rated capacity of the crane. The load should be raised until every tooth in the train of the hoist gears has been subjected to the overload and then lowered to between 100 mm and 200 mm above the ground and held there for 10 min. There should be no overrun or creep. The load should be slewed at the lowest possible speed in both directions through a small arc to determine the ability of the structure to withstand lateral loadings. The test load should then be slewed through the maximum slew angle permitted by the design of the crane.

NOTE During raising of any load it might be necessary to derrick the jib in so that the radius is not exceeded. Similarly it might be necessary to jib out when lowering off a load at minimum radius (failure to do so can result in the jib falling backwards, particularly on a rope supported jib/fly jib).

13.2.7 *Major repair or modification*

Mobile cranes should be thoroughly examined and overload tested after major repairs or modifications.

13.2.8 *Post test examination and certification*

13.2.8.1 On completion of the test a thorough examination of the crane should be carried out, see **7.8**.

13.2.8.2 When the testing has been completed (see Clause **9**), the competent person should issue the appropriate certificate which should be appended to the report of thorough examination.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. A typical certificate is shown in Annex D.

13.3 Non-destructive testing (NDT) of mobile cranes

NDT of mobile cranes might be necessary, particularly when there is a suspicion that cracks or other damage are present in structural parts of the crane.

13.4 Mobile cranes mounted on water-borne craft

13.4.1 *General*

When mobile cranes are mounted on water-borne craft this should be considered a major modification requiring the assembly of the crane and the vessel to be assessed, tested and thoroughly examined as a floating crane.

13.4.2 *Information*

Information should be obtained regarding the amount of list and freeboard allowable under both rated capacity and overload conditions from a competent person or authority experienced in crane design and stability of water-borne craft. In addition, confirmation should be obtained from the crane manufacturer on how far the crane is derated from land based ratings whilst on the barge or pontoon. This is necessary to minimize any excessive loads in the structure which would be applied when any part of the barge or pontoon is at maximum list.

13.4.3 *Verification*

Before testing is carried out on the mobile crane the following details should be verified.

a) The calculated angle of heel and trim of the vessel when the crane is in operation, ensuring that a minimum freeboard is maintained.

b) The crane manufacturer's allowable rated capacity whilst working on the pontoon or barge, taking account of information obtained from the assessment in **13.4.1**.

c) The amount and position of any ballast required.

d) The depth of water below the vessel's keel.

NOTE This is to ensure the vessel does not ground during the test.

e) The limiting weather and sea state condition allowed by the crane designer, certifying authority or other competent person.

13.4.4 *Anchoring*

If it is not possible to anchor the vessel to the shore, the vessel should be anchored to a craft alongside. The anchorage should be sufficiently free to allow the vessel to take up a natural list in the water.

13.4.5 *Rated capacity indicator/limiter (RCI/L)*

The crane RCI/L should be checked to ensure that the rated capacity reduction and any increase in radius due to the list of the vessel has been taken into account.

13.4.6 *Thorough examination before testing*

A thorough examination of the mobile crane should be made before the application of any loads. The examination should include verification that ties, supports, anchorages, ballast counterweight and load radius configuration for the type of crane under test are in accordance with the crane instructions. A functional test with no load applied should be carried out to check for correct operation of controls, switches, contactors and other devices. The operation and correct adjustment of the brakes and limit switches should be checked and tests carried out to determine whether they are operating correctly.

13.4.7 *Stability margin*

The stability margin for a crane/vessel combination should be calculated by a competent person familiar with the use of mobile cranes on vessels. The margin should be such that the maximum overturning moment of the crane does not exceed two-thirds of the restoring moment of the crane/vessel combination.

13.4.8 *Overload test*

13.4.8.1 After establishing the appropriate stability margin the crane should be tested to the maximum rated capacity that is within the required stability and strength margins for both the crane and vessel.

With the jib set at its maximum working radius (i.e. minimum working load) the rated capacity should be applied and the crane operated through all motions. The load should then be raised 100 mm to 200 mm and held on the brake. An overload should then be applied by increasing the rated capacity by 25 % and again the crane operated through all motions, with the hoist and derrick brakes where applicable being proved to demonstrate whether they are capable of sustaining the load.

The overload should be handled through all motions at the lowest possible speeds.

13.4.8.2 The jib should be set at its maximum radius for the maximum load and the procedure in **13.4.8.1** repeated, first with the maximum rated capacity and then the 25 % overload.

13.4.8.3 The jib should be set at its minimum radius and the procedure in **13.4.8.1** repeated.

13.4.8.4 As a general guide, the maximum list of a vessel under any conditions (including test) should not exceed 7° with adequate freeboard remaining, i.e. 300 mm. These angles of list apply to vessels without cargo.

These listings are only permissible with the crane manufacturer's agreement to the load radius rating. The figures quoted in this clause are an absolute maximum. For cranes designed in accordance with BS 1757 these figures should be considerably reduced due to lateral strength considerations (see **13.4.2**).

13.4.8.5 In the case of a grabbing crane mounted on a vessel, the weight of the grab and contents should not exceed 75 % of the hook load and a further 25 % reduction should be made to allow for the suction effects. The weight of the grab and contents should therefore not exceed 56.25 % of the water-borne hook load rating.

13.4.9 *Post test examination and certification*

13.4.9.1 On completion of the test a thorough examination of the crane should be carried out, see **7.8**.

13.4.9.2 When the testing has been completed (see Clause **9**), the competent person should issue a certificate which should be appended to the report of thorough examination.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. A typical certificate is shown in Annex D.

13.5 Overload test for jib arrangements

13.5.1 *General*

All of the jib and mast/tower configurations given in Table 3, Table 4 and Table 5 should be tested with a 25 % overload except where the previous test certificate specifies a lower test load. Where the crane has duties on outriggers, free on wheels, crawler tracks, lift and travel then the test should be repeated for each permitted condition.

Table 3 — Test configurations for telescopic jib arrangements

Arrangement	Length of mechanized telescopic sections	Lengths of extended manual telescopic sections	Length of fly jib	
A) Mechanized telescopic jib	A.1 Shortest	—	—	
	A.2 Intermediate	—	—	
	A.3 Longest	—	—	
B) Mechanized telescopic jib with fly jib	B.1 Longest appropriate to maximum fly jib rating	—	B.1.1 At minimum offset	Shortest
				Longest
			B.1.2 At maximum offset	Shortest
				Longest
	B.2 Longest	—	B.2.1 At minimum offset	Shortest
				Longest
			B.2.2 At maximum offset	Shortest
				Longest
C) Mechanized telescopic jib with manual telescopic sections	C.1 Longest	C.1.1 Shortest	—	
		C.1.2 Longest	—	
D) Mechanized telescopic jib with manual telescopic section and fly jib	D.1 Longest	D.1.1 Shortest	D.1.1.1 At minimum offset	Shortest
				Longest
			D.1.1.2 At maximum offset	Shortest
				Longest
		D.1.2 Longest	D.1.2.1 At minimum offset	Shortest
				Longest
			D.1.2.2 At maximum offset	Shortest
				Longest

NOTE 1 If fly jib ratings for test configuration B.1 are similar to those for test configuration B.2, then B.1 is not applicable.

NOTE 2 If fly jib ratings at minimum offset are similar to those at maximum offset, then tests at minimum offset are not applicable.

Table 4 — Test configurations for strut jib arrangements

Arrangement	Length of jib	Length of fly jib	
A) Jib	A.1 Shortest	—	
	A.2 Intermediate	—	
	A.3 Longest	—	
B) Jib with fly jib	B.1 Longest appropriate to maximum fly jib ratings	B.1.1 At minimum offset	Shortest
			Longest
		B.1.2 At maximum offset	Shortest
			Longest
	B.2 Longest	B.2.1 At minimum offset	Shortest
			Longest
		B.2.2 At maximum offset	Shortest
			Longest

NOTE 1 If fly jib ratings for test configuration B.1 are similar to those for test configuration B.2, then B.1 is not applicable.

NOTE 2 If fly jib ratings at minimum offset are similar to those at maximum offset, then tests at minimum offset are not applicable.

Table 5 — Test configurations for mast/tower and jib arrangements

Arrangement	Length of mast/tower
A) Mast/tower with jib	A.1 Shortest
	A.2 Longest
B) Mast/tower with jib and fly jib	B.1 Shortest
	B.2 Longest

13.5.2 ***Long jib lengths***

13.5.2.1 The crane should be set up with the longest jib configuration (see designation A.3 of Table 3 and Table 4).

13.5.2.2 The 25 % overload for maximum radius should be assembled at a reduced radius where it is less than the rated capacity of the crane and at a slew position where the stability of the crane is minimal. The load should be raised just clear of the ground and derricked out very slowly keeping the load just clear of the ground until the maximum radius is achieved.

13.5.2.3 The maximum rated capacity for the jib given on the test certificate should then be assembled at the maximum radius of the jib and lifted just clear of the ground.

13.5.2.4 If the same rated capacity is permitted at a lesser radius, the load should be derricked in to the minimum permitted radius keeping the load just clear of the ground.

13.5.2.5 The load should then be lowered to the ground and increased by 25 %. The overload should be lifted clear of the ground and held for 10 min. Where possible, the derricking motion should be checked by first derricking in the smallest practicable distance and then derricking out to the same position.

13.5.2.6 If the same rated capacity is permitted at a greater radius the test load should be derricked out to the maximum permitted radius keeping the load just clear of the ground.

13.5.2.7 The load should then be slewed at the lowest possible speed in both directions through a small arc to determine the ability of the structure to withstand lateral loadings.

13.5.2.8 These tests should be repeated for each configuration of the jib and mast/tower shown in Table 3, Table 4 and Table 5 except for the minimum length of jib in Table 3 and Table 4 and with the minimum tower height in Table 5 when this is appropriate.

13.5.3 ***Short jib lengths***

13.5.3.1 For the minimum length of jib in Table 3 and Table 4 and the minimum tower height in Table 5 the crane should be set up either with the shortest jib or the shortest tower with the shortest jib.

13.5.3.2 The 25 % overload for the maximum radius should be assembled at a reduced radius where it is less than the rated capacity of the crane and at a slew position where the stability of the crane is minimal. The load should be raised just clear of the ground and derricked out very slowly keeping the load just clear of the ground until the maximum radius is achieved.

13.5.3.3 The load should be slewed at the lowest possible speed in both directions through a small arc to determine the ability of the structure to withstand lateral loadings and then slewed through 360° where the design permits.

13.5.3.4 The maximum rated capacity for the jib should be assembled at the minimum radius and raised until each tooth of the train gear has been subjected to the load. The crane should then be operated through its permitted motions at the lowest possible speeds including full circle slew.

13.5.3.5 The rated capacity should be lowered off and increased by 25 % to form an overload test load which should be hoisted until each tooth of the train of gears has been subjected to the overload, then lowered to 100 mm to 200 mm above the ground. The crane should be operated through its permitted motions at the lowest possible speeds.

NOTE 1 It is recognized that for certain types of crane the structure does not permit full slewing with the load just clear of the ground. In these cases it is necessary to rest the test load and reposition the crane to ensure as much of the crane structure as possible is subjected to the test load.

NOTE 2 For lengths of jib (telescopic or strut) and fly jib, see Table 3 or Table 4, as appropriate.

13.5.3.6 It is important that the derrick brakes are tested with the 25 % overload suspended no more than 100 mm above the ground by derricking in from the maximum load radius the smallest practicable distance and derricking out and applying the derrick brake immediately. Extreme care should be taken during this test.

14 Additional recommendations for overhead travelling cranes

14.1 Items to check at the specified period thorough examination

14.1.1 Verify that the identification and rated capacity marked on the crane are compatible with the records, for example test certificate, declaration of conformity, information for use and report of last thorough examination.

14.1.2 Determine if there is any history of defects or malfunctions, and whether any repairs, alterations or additions have been made. The last report of thorough examination should be consulted.

14.1.3 Operate the crane through all the motions. Listen for any sounds that might indicate defects and observe any other malfunctions.

14.1.4 Make the crane safe by isolating power when necessary and reinstating as appropriate.

14.1.5 Examine the general appearance and condition of the crane.

14.1.6 Examine the structure of the crane for damage, cracks, wear, distortion, corrosion and missing parts including the following parts:

— end carriages;

— bridge girders, mechanism for;

— crab;

— gantry rails;

NOTE 1 These are the whole length of the long travel and cross travel.

— bolts and fastenings;

NOTE 2 This is to ensure that they are not coming loose.

— end stops and buffers.

14.1.7 Examine the long travel mechanism for damage, cracks, wear, alignment, distortion, corrosion, missing parts and lubrication including the following parts:

— motor;

— gearing;

— transmission machinery;

— bearings;

— brakes;

— long travel wheels;

— gear cases;

— covers and guards.

14.1.8 Examine the cross travel mechanism for damage, cracks, wear, alignment, distortion, corrosion, missing parts and lubrication including the following parts:

— motor;
— gearing;
— transmission machinery;
— bearings;
— brakes;
— cross travel wheels;
— gear cases;
— covers and guards.

14.1.9 Examine the hoist mechanism for damage, cracks, wear, alignment, distortion, corrosion, missing parts and lubrication including the following parts:

— motor;
— gearing;
— transmission machinery;
— bearings;
— rope spooling mechanism;
— brakes;
— hoist drum;
— gear cases;
— covers and guards.

14.1.10 Examine all the wire ropes/chains, anchorages and their fittings. Bull dog grips should not be used.

14.1.11 Examine the hook/bottom/return block assembly for damage, seizure, alignment, cracks, wear, distortion, corrosion, missing parts and lubrication.

14.1.12 Examine the cab and seating for security, integrity and tidiness.

14.1.13 Examine controls (including pendent and cable-less) for markings of their function and mode of operation.

14.1.14 Functionally test all controls for smoothness of operation and freedom from wear and other damage.

14.1.15 Examine the audible and visual warning devices for damage, security and integrity, and functionally test the warning devices for correct operation.

14.1.16 Examine all limit switches for damage, security and integrity.

14.1.17 Functionally test all limit switches including hoist, lower, long travel, cross travel and proximity, for correct operation.

14.1.18 Examine the platforms and access ladders for damage, corrosion, integrity and security, obstructions and tidiness.

14.1.19 Examine fire extinguishers to determine whether they are within date, seal intact, of appropriate type and where possible pick them up to check if they are full by their weight.

14.1.20 Examine the electrical system for integrity, deterioration, damage and security including the following parts:

— isolators;
— motors;
— leads and collectors;
— lighting;
— wiring;
— catenaries;
— trailing cables.

14.2 Overload testing of overhead travelling cranes

14.2.1 *Overload tests*

14.2.1.1 For overhead travelling cranes the crane, gantry and supporting structure should be thoroughly examined, tested and certified. However in some circumstances it might be necessary to treat them as separate entities, for example where a gantry supports more than one crane. The certificate of test should clearly identify the extent of such examination and testing.

14.2.1.2 A visual examination of the crane gantry and track within the test area should be made prior to commencing the test to determine their suitability to withstand the test loads.

14.2.1.3 Before the application of any load, a thorough examination of the crane followed by a functional test with no load applied should be carried out to determine whether the controls, switches, contactors, relays and other devices operate correctly. The operation and correct adjustment of the brakes and limit switches should be checked and tests carried out to determine whether primary safety and emergency systems are operating correctly.

14.2.1.4 At the start of the test the crane should be positioned over a supporting stanchion or column of the gantry with the crab positioned adjacent to the end carriage. With the crane in this position, provision should be made for measuring the deflection of the crane main girders at the centre span. The rated load should then be raised until each tooth of the train of gears has been subjected to the load, then the load should be lowered to 100 mm to 200 mm above the ground. The load should be held in this position for 10 min to check the brake. The load should then be raised from the suspended position by a further 200 mm and then lowered to 100 mm to 200 mm above the ground. The crab should be traversed to mid span and the deflection measured. The load should be lowered to the ground to relieve the structure and then raised to determine whether the deflection remains constant.

14.2.1.5 The load should be traversed to the opposite gantry, and the crane should be travelled along the track until each tooth of the train of gears of the long travel motion has been subjected to the load. The load should be traversed across the bridge to the opposite gantry and the crane should be returned to its original lift position.

14.2.1.6 The maximum deflection of the main bridge with the crab and rated load at the centre of the bridge should not exceed 1/750 of the span.

14.2.1.7 The rated load should be increased by 25 % to form an overload test load and the overload test load should be hoisted until each tooth of the train of gears has been subjected to the overload, then lowered to 100 mm to 200 mm and the procedures detailed in **14.2.1.4**, **14.2.1.5** and **14.2.1.6** repeated with the test load suspended from the crane.

14.2.1.8 During the overload test the crane should remain stable, structurally sound and fit for the use for which it was designed and the brakes on each motion should function effectively. The traverse and travel brakes should also function effectively with the overload applied.

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

14.2.1.10 For cranes with two or more hoists, separate tests should be carried out for each hoist. Where the use of more than one hoist at a time is permitted, all tests including the measurement of deflection should be carried out with all these hoists loaded simultaneously.

14.2.2 *Post test examination and certification*

14.2.2.1 On completion of the tests, a further thorough examination of the crane should be carried out, see **7.8**, and any overload protection devices should be reset and their correct operation verified.

14.2.2.2 When the testing has been completed (see Clause **9**), the competent person should issue the appropriate certification which should be appended to the report of thorough examination.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. A typical certificate is shown in Annex D.

14.3 Overload testing of crane gantries

14.3.1 *Overload tests*

14.3.1.1 Crane gantries can be situated in the open, supported by stanchions or in a building either on independent stanchions or on those supporting the roof structure. They can also be supported directly from the roof trusses for use with underslung cranes or transfer bridges.

14.3.1.2 Unless the crane structure is erected solely for the use of the crane, the crane test certificate issued applies only to the gantry beams and their direct fixings. A civil engineer or architect should confirm the integrity of the remaining supporting structure.

14.3.1.3 Testing should be carried out using the combination of loadings, cranes and crane positions that imposes the maximum loadings on the gantry under test. This includes cranes in an adjacent bay.

14.3.1.4 Prior to the application of the load, the competent person should carry out an examination of the gantry. An unloaded crane should be travelled the full length of the gantry.

14.3.1.5 The rated load on each crane should then be lifted 100 mm to 200 mm above the ground and applied simultaneously to the same point on the gantry by travelling the load the complete length of the gantry. The deflections should be measured. For gantries built in accordance with BS 449-2 the maximum deflection should not exceed 1/360 of the span. For gantries built in accordance with BS 5950-1 the maximum deflection should not exceed 1/600 of the span. During this test the behaviour of the gantry, track joints and supports should be carefully observed for undue movement or flexing. The function of any safety devices and gantry limits should be checked at this time.

14.3.1.6 An overload of 25 % in excess of the rated load should be applied to each crane and raised just clear of the ground and the bridges travelled the full length of the gantry.

14.3.2 *Post test examination and certification*

14.3.2.1 On completion of the test a further thorough examination of the crane should be carried out, see **7.8**.

14.3.2.2 When the testing has been completed (see Clause **9**), the competent person should issue a certificate which should be appended to the report of thorough examination.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. A typical certificate is shown in Annex D.

15 Additional recommendations for tower cranes

15.1 Thorough examination of tower cranes

15.1.1 *General*

Tower cranes should be thoroughly examined on the ground before first erection. This not only ensures that the crane is in a suitable condition for erection but also enables parts that are not easily accessible on an erected crane to be examined.

Prior to thorough examination the base of the crane should be cleaned by appropriate means, e.g. pressure washed, to remove all spoil/dirt that would otherwise conceal the structure or mechanisms and prevent an effective examination. The examination should be carried out in a logical sequence, for example top to bottom, to ensure that nothing is overlooked.

15.1.2 *Rated capacity indicator/limiter (RCI/L) calibration check*

Thorough examinations of tower cranes should include confirmation that the RCI/L has been calibrated to an accuracy within the tolerances given below within the last 12 months.

NOTE Guidance on how to calibrate an RCI/L is given in BS 7262.

During the calibration check of the RCI/L it is essential that the tower crane is not loaded beyond 110 % of its rated capacity. The radius/angle 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.

15.1.3 *Examination scheme approach*

The examination scheme approach to thorough examinations, if used, should be based on regular assessments of the tower crane in accordance with usage. This is known as condition monitoring.

NOTE Guidance on condition monitoring for cranes is given in ISO 12482-1. Implementation of ISO 12482-1 requires co-operation of the crane supplier (manufacturer), crane user (owner) and expert engineer (competent person).

The crane supplier should provide limiting criteria based on the crane design, for example the number of load cycles, load spectrum, critical parts, exceptional circumstances. These criteria should not be based on time alone.

The crane user and competent person should take into account the limiting criteria from the crane supplier when devising an examination scheme in accordance with LOLER. Data logging equipment greatly facilitates collection of information concerning crane usage for comparison with the crane design criteria. The data logging equipment needs to be fitted to the tower crane from new to ensure that a complete record of all the usage of the crane is maintained. Without a complete record of crane usage it is not possible to devise an appropriate examination scheme for a tower crane and it should be subjected to periodic thorough examination in accordance with **15.1.4**.

For tower cranes subject to an examination scheme a calibration check should be carried out on the RCI/L at least once every 12 months as described in **14.1.2**.

15.1.4 *Specified period approach*

15.1.4.1 *Six monthly thorough examination*

Tower cranes used to lift persons should either be examined by a competent person at least once every 6 months or at a lesser interval if stipulated by the competent person. Any passenger carrying device such as a elevating control station, access hoist or climbing frame should either be examined by a competent person at least once every 6 months or at a lesser interval if stipulated by the competent person.

Lifting accessories should be thoroughly examined by a competent person at least once every 6 months.

15.1.4.2 *Twelve monthly thorough examination*

Tower cranes not used to lift persons should be examined by a competent person at least once every 12 months. After carrying out the thorough examination the competent person should specify when the next thorough examination should be carried out.

15.1.4.3 *Items to check at the specified period thorough examination*

NOTE Information regarding additional items to check for cranes to be used with a personnel carrier is given in Clause **11**.

15.1.4.3.1 Visually examine the crane tower structure, including the cast-in anchors/cruciform base/ chassis/internal climbing collar/grillage, for signs of damage, distortion, cracking and corrosion.

15.1.4.3.2 If applicable, visually examine the crane travelling base rail track for signs of damage, distortion, cracking and corrosion.

15.1.4.3.3 Visually inspect any central (base) ballast of the crane for corrosion, damage, cracks and security. Visually check the total mass of the central (base) ballast and positioning of individual weights.

15.1.4.3.4 Visually inspect all bolts, pins and other fastenings to check that they are not loose.

15.1.4.3.5 Visually examine the slewing mechanism for security and wear during operation of the slew motion throughout its full range of movement, and with the tower crane at maximum reach.

15.1.4.3.6 Visually examine all electrical cables on the crane for damage, security and fretting.

15.1.4.3.7 Visually examine all electrical enclosures on the crane for corrosion, damage and security.

15.1.4.3.8 Visually examine all pipework on the crane for corrosion, damage, leakage, security and fretting.

15.1.4.3.9 Examine all hydraulic cylinders for leakage, corrosion on the rods and alignment. Visually check end fixings for wear, security and lubrication.

15.1.4.3.10 Visually inspect the counter jib, slewing platform, A frame, trolley and jib of the crane for corrosion, damage, cracks and distortion.

15.1.4.3.11 Visually inspect any trolley rope breaks safety device, if fitted, for corrosion, damage, cracks and distortion. Check any bearings and pivots for freedom of action.

15.1.4.3.12 Visually inspect the counter ballast of the crane for corrosion, damage, cracks and security. Visually check the total mass of the counterweight and correct position of individual weights.

15.1.4.3.13 Visually examine all pivoting joints on the jib and attachments of the crane for wear, corrosion, security and evidence of lubrication.

15.1.4.3.14 Visually examine all wire ropes to determine whether they are of the size and type specified in the instructions and reeved in accordance with those instructions. Pay particular attention to the end terminations.

NOTE Guidance regarding wedge and socket anchorages for wire ropes is available in BS 7166.

15.1.4.3.15 Visually check whether all pulleys/sheaves and drums are free from damage and wear, whether the rope fits correctly on them and if they are effectively lubricated. Check whether all idler pulleys/sheaves turn freely and all guards are undamaged and in place.

15.1.4.3.16 Thoroughly examine the whole length of the wire ropes for signs of wear, damage, broken wires and corrosion. See Clause **12**.

15.1.4.3.17 Visually inspect all motors, drive couplings, gearboxes and winch drums for wear, damage, security and leakage.

15.1.4.3.18 Visually inspect the braking mechanisms for wear, damage and adjustment and check whether it conforms to the instructions for the crane.

15.1.4.3.19 Check any means of access for completeness and security of ladders, hoops, walkways, rest platforms, hand rails/hand holds and safety line anchorages. Examine powered access including elevating control stations and access hoists in accordance with the instructions.

15.1.4.3.20 Check the oil and other fluid for condition (for example by debris monitoring) and level of the fluid.

15.1.4.3.21 Visually inspect the operator's cab of the crane for corrosion, damage, cracks and security.

15.1.4.3.22 Visually check whether the fixings for the operator's seat are in place and secure.

15.1.4.3.23 Visually check whether the cab windows are secure (including guard bars) and clean, and whether any wiper is working correctly.

15.1.4.3.24 Check whether all controls (including those located in remote control stations where fitted) are marked with their function and mode of operation.

15.1.4.3.25 Visually inspect the upper and lower hoist limit switches, check whether they are in place and free from damage or excessive wear.

15.1.4.3.26 Visually examine the hooks, their attachments and safety catches for wear, fretting, distortion, corrosion and security.

15.1.4.3.27 Check whether there is a table displayed in the operator's cabin showing the rated capacities for the crane for all crane operating conditions (free on wheels, free on cushion wheels, all permitted outrigger positions etc.).

15.1.4.3.28 Functionally test all controls (including those located in remote control stations where fitted) for smoothness of operation and to determine whether they are free from wear and other damage.

15.1.4.3.29 Check whether warning signs and other important instructions are present and readable, for example rating plate for load lifting.

15.1.4.3.30 Operate the tower crane and check whether all motions operate smoothly and effectively without excessive play. The load lifting attachment should not drop excessively after the motion has been stopped and all limiters and safety devices should operate correctly.

Climbing frames, whilst not always part of the crane's permanent equipment, are devices for lifting persons and should be thoroughly examined either in accordance with a scheme of examination or at intervals not exceeding 6 months. Further advice regarding the minimum inspection criteria for examination of climbing frames is given in Annex G. The 6 month thorough examination should only be attempted if the top sections of the climbing frame have landings that are completely decked out. Any further work outside the 6 month thorough examination should be carried out in accordance with a written scheme.

15.2 Overload testing of tower cranes

15.2.1 *General*

Overload testing of tower cranes that are not subject to a scheme of thorough examination should be carried out after each erection, after reconfiguration (alteration of jib length, alteration of tower height, addition or removal of ties etc.), and for cranes remaining on the same site for long periods, at least once every 4 years.

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 verification that the crane is erected in accordance with the instructions.

The competent person should check that the rated capacity specified on the manufacturer's certificate of test, the load radius indicator, the table of rated capacities displayed in the operator's cab and those used by the RCI/L. The rated capacities given should 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 ensure that they are operating correctly.

15.2.2 *Levelling*

The importance of the verticality of the tower crane mast cannot be over-emphasized. The mast should be vertical to within the limits specified by the manufacturer and should be checked by an engineer or surveyor with a theodolite. Annex H gives a typical foundation pre-erection inspection certificate.

15.2.3 *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 weight of the hook block, but not slings and lifting gear. Therefore when the crane is being tested allowance should be made for the weight of suspended slings and other lifting gear. The exact weight of these items should be ascertained.

15.2.4 *Overload tests*

15.2.4.1 *Preparation*

15.2.4.1.1 Before commencing any overload test where available the previous test certificate should be examined as this forms the basis for the test conducted. Where no test certificate is available the crane manufacturer's (or other suitable design authority's) advice should be sought as to a suitable test programme (see **15.3**) and the ability of the crane to withstand a 25 % overload.

15.2.4.1.2 At the start of testing a rail-mounted crane should be positioned on a straight and level track with firm foundations and free from obstructions, and a rubber tyred crane should be used with jacks or outriggers. The jacks or outriggers should be set to completely relieve the tyres of the load and set in accordance with the instructions.

15.2.4.1.3 The crane should be thoroughly examined to determine whether it is in a safe state and condition to be overload tested.

15.2.4.2 *Test procedure*

NOTE During the raising of any load it might be necessary to derrick the jib or trolley in the load so that the radius is not exceeded due to deflection of the tower.

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

15.2.4.2.2 With the trolley or jib at maximum radius of the rated capacity, the test load 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.

15.2.4.2.3 The rated capacity should then be increased by 25 % 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 just clear of the ground and the crane operated through its permitted motions.

15.2.4.2.4 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, to prevent the trolley from moving beyond this point. For other cranes the load lifting attachments should be positioned at the maximum radius for the maximum rated capacity.

15.2.4.2.5 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 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.

15.2.4.2.6 The load should then be increased by 25 % 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 due 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 (see **9.13**).

15.2.4.2.7 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.

15.2.4.2.8 During the overload test the crane should remain stable, structurally sound and fit for the use for which it was designed and the brakes on each motion should function effectively.

15.2.4.2.9 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.

15.2.5 ***Major repair or modification***

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

15.2.6 ***Post test examination and certification***

15.2.6.1 On completion of the test a thorough examination of the tower crane should be carried out, see **7.8**.

15.2.6.2 When the testing has been completed (see Clause **9**), the competent person should issue the appropriate certificate which should be appended to the report of thorough examination.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. An example of a test certificate is shown in Annex D.

15.2.7 ***Non-destructive testing (NDT) of tower cranes***

NDT of tower cranes is a valuable aid to the identification of cracks and other defects in tower crane structures damaged by fatigue, corrosion or overloading. Older cranes are often prone to these defects and particular care should be taken when carrying out thorough examinations on these cranes.

15.3 Indicator test

15.3.1 *General*

During the testing of the indicator 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.

15.3.2 *Horizontal jibs with trolleys*

Having established the effectiveness of the trolley brake by carrying out the tests in **15.3.3** and **15.3.4** the clamps should be removed and a known load, 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 indicator gives the rated capacity warning and indicators. The radius should be between 90 % and 97 % of the rated capacity for that radius. The load required to cause an overload warning as it is carefully hoisted from the ground can then be found. This should be between 102.5 % and 110 % of the rated capacity for that radius.

15.3.3 *Derricking jibs*

A known weight of 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 indicator gives the approach to rated capacity warning and indicators. When the radius is measured, the load on the crane should be between 90 % and 97.5 % of the rated capacity for that radius. The radius should 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. When the radius is measured, the load on the crane should be between 102.5 % and 110 % of the rated capacity.

15.3.4 *Repeat tests*

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

16 Additional recommendations for loader cranes

16.1 Thorough examination of loader cranes

16.1.1 *General*

Prior to thorough examination the loader crane should be cleaned by appropriate means, e.g. pressure washed, to remove all spoil/dirt that would otherwise conceal the structure or mechanisms and prevent an effective examination. The examination should be carried out in a logical sequence, for example top to bottom, to ensure that nothing is overlooked.

16.1.2 *Rated capacity indicator/limiter (RCI/L) calibration check*

16.1.2.1 Thorough examinations of loader cranes should include confirmation that the RCI/L has been calibrated to an accuracy within the tolerances given in **16.1.2.3**. This calibration is not necessarily part of overload testing. This calibration check should be carried out at no more than 12 monthly intervals.

16.1.2.2 Calibration checks should include the suspension of calibrated weights on the crane, to determine whether the rated capacity indicator and limiter are accurate to within the tolerances in **16.1.2.3**.

16.1.2.3 The usual format of loader cranes has a boom system consisting of boom, articulating jib, and a telescopic extension within the jib section. The horizontal reach of a loader crane with its telescopic extension retracted is invariably less than 70 % of the reach of the crane with its telescopic extension extended. A load equivalent to 10 % overload at maximum extension, lifted from the ground with the jib fully extended and the telescopic section fully retracted is less than 90 % of rated capacity of the loader crane. Keeping the load as close as possible to the ground, the radius should be increased until the indicator gives the approach to rated capacity warning. 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 may then be further increased until the indicator gives an overload warning. The radius should be measured and the load on the crane should be between 102.5 % and 110 % of the rated capacity. The radius may then be further increased until the telescopic extension is fully extended, at which point the overload protection should have operated.

16.1.3 ***Examination scheme approach***

The examination scheme approach to thorough examinations is not normally applied to loader cranes, but if used should be based on regular assessments of the loader crane in accordance with usage. This is usually known as condition monitoring.

16.1.4 ***Specified period approach***

16.1.4.1 *Six monthly thorough examination*

Loader cranes used to lift persons should either be examined by a competent person every 6 months or at a lesser interval if stipulated by the competent person. Lifting accessories should be examined by a competent person at least once every 6 months.

16.1.4.2 *Twelve monthly thorough examination*

Loader cranes not used to lift persons should be examined by a competent person at least once every 12 months. After carrying out the thorough examination the competent person should specify when the next thorough examination should be carried out.

16.1.4.3 *Items to check at the specified period thorough examination*

16.1.4.3.1 Visually check the sub frame attached to the lorry chassis for damage, or signs of distortion, cracking and corrosion.

16.1.4.3.2 Check for tightness, all bolts and fastenings used to attach the crane to the sub frame, and the sub frame to the lorry chassis.

16.1.4.3.3 Carry out a functional check on the hand brake interlock, to determine whether the power take off disengages when the hand brake is released.

16.1.4.3.4 Carry out a functional check of the height warning device which is used for the prevention of collisions with bridges.

16.1.4.3.5 Check that there is a label visible from the operator's seat, displaying the travelling height of the lorry loader.

NOTE The Road Vehicles (Construction and Use) (amendment) Regulations [8] require that a label displaying the travelling height of the lorry loader is visible from the operator's seat of a crane.

16.1.4.3.6 Visually inspect the pipe connections between pump and crane, crane and oil tank, oil tank and pump, for chafing, leakage, damage, security and erosion.

16.1.4.3.7 Check the level and condition of the fluid in the oil tank.

16.1.4.3.8 Visually inspect the crane control valve for damage, leakage and security.

16.1.4.3.9 Check whether all control valve levers are marked with their function and mode of operation.

16.1.4.3.10 Functionally test all controls (levers, buttons etc.) for smoothness of operation and to determine whether they are free from wear and any other damage to any linkage. Check that all controls return to neutral when released.

16.1.4.3.11 Check whether all manufacturers' load plate(s) are firmly attached and readable from the control positions.

16.1.4.3.12 Deploy the stabilizers and check for wear, security and freedom of movement. Check whether the cam locks and automatic latches on the beams (to prevent inadvertent extension) function correctly and are free from wear, distortion and corrosion. Lower the leg jacks to make firm contact with the ground and check that they do not creep during crane operations.

16.1.4.3.13 Visually inspect all pipework on the loader crane for chafing, leakage, damage, security and corrosion.

16.1.4.3.14 Visually inspect all hydraulic cylinders for alignment, and for leakage and corrosion on the cylinder rods.

16.1.4.3.15 Visually inspect all pivoting joints on the crane for wear, corrosion, security and evidence of lubrication.

16.1.4.3.16 Visually inspect the crane structure for corrosion, damage, cracks and distortion.

16.1.4.3.17 Operate telescopic extensions on the loader crane and examine them for wear, lubrication and security.

16.1.4.3.18 Check any means of access for completeness and security of ladders, walkways and hand rails/hand holds.

16.1.4.3.19 Visually check whether the operator's seat and restraint, where fitted, are complete and secure.

16.1.4.4 *Additional checks for loader cranes fitted with winches*

16.1.4.4.1 Check whether the hoist rope is of the size and type specified by the manufacturer, and is reeved in accordance with the instructions. Pay particular attention to the end terminations.

NOTE Guidance on wedge and socket terminations is available in BS 7166.

16.1.4.4.2 Visually check whether all pulleys/sheaves and drums are effectively lubricated, free from damage and wear and that the rope fits correctly. Check whether all idler pulleys/sheaves turn freely and all guards are in place and undamaged.

16.1.4.4.3 Thoroughly examine the entire length of the hoist rope for signs of wear, damage, corrosion and broken wires.

16.1.4.4.4 Visually inspect the hoist limit switches, when fitted, check they operate correctly and are free from damage and excessive wear.

16.1.4.4.5 Operate the loader crane to check whether all motions operate smoothly and effectively. The creep rate should be within the tolerance set by the manufacturer.

NOTE Creep rate is the distance that a load equal to the rated capacity drops in 1 min on a fully extended crane, expressed as a percentage of the crane radius.

If a loader crane has a lifting capacity in excess of 1 t or a load moment in excess of 40 000 N·m then it should be fitted with loading control, which should be examined and tested to determine whether it is in working order.

16.2 Testing of loader cranes

16.2.1 *General*

Recommendations for periodic testing and examination of loader cranes are given in Table 6.

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

The purpose of the test is to check the integrity of the crane and its mounting, and to establish the stability of the loader crane on an unloaded vehicle. The test may be considered successful if no crack, permanent deformation, paint flaking or damage to the lorry loader occurs as a result of the test.

The competent person should check the rated capacity quoted on the manufacturer's specification for the crane equates with the rated capacity plate on the crane and the capacities given on the previous certificate of test.

Hydraulic oil should be at normal operating temperature before testing commences.

A functional test with no load applied should be carried out to determine whether all control devices operate correctly.

16.2.2 *Levelling*

All tests should be carried out on firm level ground, with a slope of no greater than ±0.5 %.

16.2.3 *Stabilizers*

Stabilizers should be fully extended to maximum spread, and with the vehicle tyres inflated to the manufacturer's recommended pressure. Stabilizers should be in firm contact with the ground, enough to provide adequate support for the crane but not enough to take the load from the wheel and reduce the efficiency of the parking brake.

16.2.4 *Lifting capacities*

The load ratings shown on the crane's load plate and given in the manufacturer's rated capacities for a given crane, indicate the gross loads. The weights of all additional lifting equipment fitted to the loader crane should be regarded as part of the test load.

16.2.5 *Lifting of vehicle wheels and stabilizers*

During overload testing it is acceptable for one or more stabilizers and wheels to lift clear of the ground. It is essential, however, that at least one of the parking braked wheels remains in firm contact with the ground.

16.2.6 *Test conditions*

The test loading should be carried out using an unloaded vehicle without the operator present in the cab, and should be conducted in two stages in the following order:

— overload test;
— dynamic functional test.

16.2.7 *Overload test*

The overload test is designed to ensure that a margin exists against structural failure of the lorry loader, including all the anchorages to the vehicle, all vehicle structural parts, stabilizers and hydraulic equipment.

This test should be determined according to the following formula:

$L = (K_s P) + (0.1\ G_b)$

where

L is the test load;
P is the rated load;
G_b is the mass of the boom system referred to the point of load attachment;
K_s is the test factor (equal to 1.25).

The test should be carried out at the following radii:

— maximum radius with any special extensions;
— maximum radius attainable with hydraulic outreach;
— one intermediate radius, preferably corresponding to one of the ratings shown on the load plate;
— smallest practical radius given on the load plate.

An intermediate radius is required with a statutory test certificate.

At each radius the load should be slewed, slowly, through the full slewing arc.

To enable an overload test to be carried out, the relief valve system, rated capacity indicator and overload protection system, if fitted, should be overriden or disconnected.

Where safety devices have been overridden or disconnected for testing, the devices should be reconnected, and where appropriate reset, re-tested and re-sealed, before the lorry loader is released from testing.

16.2.8 *Dynamic functional test*

For dynamic and functional tests the rated capacity indicator and all safety relief valves should be set at their correct values. The main relief valve and the overload protection system, where fitted, should be overridden until later in the test.

These tests are designed to subject system hydraulics and structural members to dynamic conditions and fluctuating loads. The tests also incorporate checks on each powered function for movement through its full range of travel, and to confirm the operation of load decelerating valves and the rated capacity indicator when fitted.

The recommended test load is the rated capacity times 1.1 at the maximum radius attainable with hydraulic outreach.

The dynamic testing should continue, without interruption, until the full range of movements and positions throughout the speed range has been carried out.

The correct functioning of load decelerating valves should be checked by introducing sudden arrests of the moving suspended load. Such tests should be conducted well clear of persons, the ground and any obstructions.

The set points of the rated capacity indicator should be noted in terms of radius and load at which the audible and visual warnings occur.

At the end of this continuous period of testing, the temperature of the hydraulic oil should be checked and recorded.

The overload protection, if fitted, should be reconnected at the set point for operation. This should be noted in terms of radius and load after any necessary adjustments have been made.

The main relief valve should then be set to lift the rated capacity at maximum hydraulic outreach.

At the end of the test all adjustable relief valves should be re-sealed with tamper proof seals.

16.2.9 *Structural repair or modification*

Loader cranes should be thoroughly examined and overload tested after structural repairs or modifications.

16.2.10 *Post test examination and certification*

16.2.10.1 On completion of the test a thorough examination of the loader crane should be carried out, see **7.8**.

16.2.10.2 When testing has been completed (see Clause **9**), the competent person should issue the appropriate certificate which should be appended to the report of thorough examination.

NOTE Attention is drawn to LOLER Regulation 9 [1] regarding the certificate of test of lifting equipment. An example of a typical certificate is shown in Annex D.

16.2.11 *Non-destructive testing (NDT) of loader cranes*

NDT of loader cranes might be necessary, particularly where there is a suspicion of cracks or other damage being present in structural parts.

Table 6 — Recommendations for periodic testing and examination of loader cranes

Occasion	Minimum test and examination
Before being first taken into use	Full test as detailed in **16.2.7**
Annually after being first put into service	Proof load test of rated capacity + 10 % at full radius and through the full slewing arc, and a thorough examination as detailed in **16.2.8**
4 years after first being put into service	Full test as detailed in **16.2.7**
8 years after first being put into service	Non-destructive test of structure Full test as detailed in **16.2.7**
After each structural repair or component change	Full test as detailed in **16.2.7**
When chassis is changed	Full test as detailed in **16.2.7**
NOTE These tests are in addition to the legal requirements for inspection, testing and examination.	

Annex A (informative)
Information to be contained in a report of a thorough examination

The following is an extract from the Lifting Operations and Lifting Equipment Regulations [1]. Schedule 1 of Regulation 10 is quoted here in full. It details information to be contained in a report of a thorough examination.

1) The name and address of the employer for whom the thorough examination was made.

2) The address of the premises at which the thorough examination was made.

3) Particulars sufficient to identify the equipment including where known its date of manufacture.

4) The date of the last thorough examination.

5) The safe working load of the lifting equipment or (where its safe working load depends on the configuration of the lifting equipment) its safe working load for the last configuration in which it was thoroughly examined.

6) In relation to the first thorough examination of lifting equipment after installation or after assembly at a new site or in a new location:

a) that it is such thorough examination;

b) (if such be the case) that it has been installed correctly and is safe to operate.

7) In relation to a thorough examination of lifting equipment other than a thorough examination to which paragraph 6 relates:

a) whether it is a thorough examination:

i) within an interval of 6 months;

ii) within an interval of 12 months;

iii) in accordance with an examination scheme;

iv) after the occurrence of exceptional circumstances;

b) (if such be the case) that the lifting equipment is safe to operate.

8) In relation to every thorough examination of lifting equipment:

a) identification of any part found to have a defect which is or could become a danger to persons, and a description of the defect;

b) particulars of any repair, renewal or alteration required to remedy a defect found to be a danger to persons;

c) in the case of a defect which is not yet but could become a danger to persons:

i) the time by which it could become such a danger;

ii) particulars of any repair, renewal or alteration required to remedy it;

iii) the latest date by which the next thorough examination must be carried out.

9) Where the thorough examination included testing, particulars of any test:

a) the date of the thorough examination;

b) the name, address and qualifications of the person making the report; that he is self-employed or, if employed, the name and address of his employer.

10) The name and address of a person signing or authenticating the report on behalf of its author.

11) The date of the report.

Annex B (informative)
Beaufort scale

Table B.1 gives information regarding the wind conditions for the Beaufort scale.

Table B.1 — Beaufort scale wind conditions

Beaufort number	Description of wind	Specifications for use on land	Wind speed mph	Wind speed m/s
0	Calm	Calm; smoke rises vertically	0 to 1	0 to 0.2
1	Light air	Direction of wind shown by smoke	1 to 3	0.3 to 1.5
2	Light breeze	Wind felt on face; leaves rustle; ordinary vanes moved by wind	4 to 7	1.6 to 3.3
3	Gentle breeze	Leaves and small twigs in constant motion; wind extends light flag	8 to 12	3.4 to 5.4
4	Moderate breeze	Raises dust and loose paper; small branches are moved	13 to 18	5.5 to 7.9
5	Fresh breeze	Small trees in leaf begin to sway; crested wavelets form on inland waterways	19 to 24	8.0 to 10.7
6	Strong breeze	Large branches in motion; whistling heard in telephone wires; umbrellas used with difficulty	25 to 31	10.8 to 13.8
7	Near gale	Whole trees in motion; inconvenience felt when walking against wind	32 to 38	13.9 to 17.1
8	Gale	Breaks twigs off trees; generally impedes progress	39 to 46	17.2 to 20.7
9	Strong gale	Slight structural damage occurs (chimney pots and slates removed)	47 to 54	20.8 to 24.4

Annex C (informative)
Sea state code

Table C.1 gives information regarding the condition of the sea and the associated sea state code.

Table C.1 — Sea state code and sea conditions

Code	Description of sea	Significant wave height m
0	Calm (glassy)	0
1	Calm (rippled)	0 to 0.10
2	Smooth (wavelets)	0.10 to 0.50
3	Slight	0.50 to 1.25
4	Moderate	1.25 to 2.50
5	Rough	2.50 to 4.00
6	Very rough	4.00 to 6.00
7	High	6.00 to 9.00
8	Very high	9.00 to 14.00
9	Phenomenal	over 14.00

Annex D (informative)
Example of load test certificate

Certificate No. ……

Certificate of Test of Lifting Equipment

Lifting Operations and Lifting Equipment Regulations 1998,

Regulation 9

1. Name and address of owner of crane and its location				
2. Make of crane				
3. Type of crane and nature of power (e.g. Scotch derrick-manual; Tower derrick-electric; Mobile telescopic- hydraulic)				
4. Date of manufacture of crane				
5. Identification (e.g. makers serial number, owners identifying mark				
6. Make and type of rated capacity indicator				
7. Date of last previous test of crane				
8. Date of last previous thorough examination of crane				
9. Safe working load or loads In the case of a crane with a variable operating radius (including a crane with a derricking jib or with interchangeable jibs of different lengths) the safe working load at various radii of the jib, jibs, trolley or crab should be given. Test loads at various radii should be given in column (iii) and in the case of a safe working load which has been calculated without the application of a test load "NIL" should be entered in that column	(i) Length of Jib (m)	(ii) Radius (m)	(iii) Test Load (Kgs)	(iv) Safe Working Load (Kgs)
10. Maximum radius at which the jib or jibs may be worked (in metres)				
11. Defects noted and alterations or repairs required before crane is put into service. (If none enter "None")				

I hereby certify that the above item described in this Certificate was tested and thoroughly examined on ……
and that the above particulars are correct.

Signature Qualification

Name and address of person, company or association by whom the person conducting the test and examination is employed.

Date of Certificate ……

BSI 22 April 2003

Annex E (normative)
Example of personnel carrier pre-use check form

PERSONNEL CARRIER — PRE-USE CHECK		
Inspector:	**Date:**	
Platform ID:		
Markings	**Satisfactory**	**Unsatisfactory**
Platform (all information legible)		
Suspension system		
Structure		
Load supporting welds/bolts		
Load supporting members		
Barrier from toe board to intermediate rail		
Hand rail		
Fall protection device		
Anchorage points		
Gate locking mechanisms		
Platform flooring		
Suspension attachment points		
Attachment mechanisms		
Pins/eyes		
Wire rope/chain		
Master links and shackles		
Special purpose items (e.g. overhead protection, platform controls)		
1.		
2.		
3.		
4.		
General comments:		
Weather conditions and lighting:		
Appointed person/crane supervisor:		
Signature:		

Annex F (informative)
Example of a wire rope test certificate

Name and Address of Customer: .....

.....

.....

Test Certificate No.: .....

Certificate of test of wire rope

1) Name and address of the maker or supplier of the rope

2) a) Nominal rope diameter

b) Number of strands

c) Number of wire per strand and core type

d) Lay type and direction

e) Wire finish

f) Tensile grade

3) a) Minimum breaking load (tonnes) or minimum breaking force (kN)

b) Example of safe working load at a coefficient of utilization of 5

I certify on behalf of the above named company that the above particulars are correct

Signature ..... Date .....

Annex G (informative)
Example of typical procedure for climbing frame thorough examinations and checks

G.1 Procedure for the thorough examination of frame for top climbing of tower cranes

G.1.1 *Procedure for 6 monthly thorough examination*

NOTE The 6 monthly thorough examination may be supplemented by NDT examination at the discretion of the competent person.

G.1.1.1 Confirm the identification number of the frame and all corresponding sections, to confirm all parts are of the same frame.

G.1.1.2 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.

G.1.1.3 Confirm the free movement of all guide rollers and check for damage.

G.1.1.4 Check the rollers for undue wear and check that all keep plates are in place and secure.

G.1.1.5 Check the hydraulic ram mounting brackets for security and check the welds for signs of cracking.

G.1.1.6 Check the lifting yoke at the base of the hydraulic ram for signs of wear and any cracking or deformity.

G.1.1.7 Check the hydraulic ram joint pin for lift and that it is correctly locked in position.

G.1.1.8 Check that the rollers (to allow horizontal motion of the ram) are free to rotate.

G.1.1.9 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.

G.1.1.10 Check the travelling platform for damage to itself and its supports.

G.1.1.11 Check the walkways for damage and security of fixing. Close off the walkways.

G.1.1.12 Record the results of the examination on the appropriate form and retain on file.

G.1.2 *Procedure for 2 yearly thorough examination*

NOTE This work is to be carried out with the frame on the ground at rest.

G.1.2.1 Carefully examine the main load bearing parts and subject them to NDT examination as necessary. The examination should include the following:

— 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.

G.1.2.2 Remove the reaction roller pins and measure them to assess wear. Subject the pins to NDT examination.

G.1.2.3 Carry out the 6 monthly thorough examination at this time.

G.1.3 *Procedure for 4 yearly thorough examination*

NOTE This work is to be carried out with the frame on the ground at rest.

G.1.3.1 Subject the hydraulic ram and relief valves to a pressure test in accordance with the manufacturer's recommendations for that system.

G.1.3.2 Remove the ram-jointing pin, measure it for any wear, and subject it to NDT examination.

G.1.3.3 Carry out the 6 monthly thorough examination at this time.

G.2 Procedure for post installation thorough examination report

NOTE The post installation thorough examination may be supplemented by NDT examination at the discretion of the competent person.

G.2.1 Confirm the identification number of the frame and all corresponding sections to confirm all parts are of the same frame.

G.2.2 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.

G.2.3 Confirm the free movement of all guide rollers and check for damage.

G.2.4 Check the rollers for undue wear and check that all keep plates are in place and secure.

G.2.5 Check the hydraulic ram mounting brackets for security and check the welds for signs of cracking.

G.2.6 Check the lifting yolk at the base of the hydraulic ram for signs of wear and any cracking or deformity.

G.2.7 Check the hydraulic ram joint pin for lift and that it is correctly locked in position.

G.2.8 Check that the rollers (to allow horizontal motion of the ram) are free to rotate.

G.2.9 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.

G.2.10 Check the travelling platform for damage to itself and its supports.

G.2.11 Check the walkways for damage and security of fixing. Close off the walkways.

G.2.12 Record the results of the examination on the appropriate form and retain whilst the frame is installed for use at that location.

G.3 Procedure for pre-use check of frame for top climbing of tower cranes

G.3.1 Confirm that the frame has current thorough examination and installation reports.

G.3.2 Confirm that the test of the hydraulic system is current.

G.3.3 Confirm that all personnel have been issued with a copy of this procedure or a checklist that relates to it.

G.3.4 Confirm that all personnel are trained in the operation and understand the procedure.

G.3.5 Confirm that communication either by radio or telephone is available.

G.3.6 Examine all connecting pins/bolts prior to erection to determine whether they are the correct type and undamaged.

G.3.7 Check the frame to ensure the jointing bolts are in place and secure.

G.3.8 Check the main guide roller pin keep plates are in place and secure.

G.3.9 Check the walkways are secure with no missing bolts or guardrails.

G.3.10 Check that the hydraulic system is free from leaks.

G.3.11 Check the apron for the support of the section to be inserted is secure and free to move.

G.3.12 Engage the slew lock or physically lock the slew and inform the operator of the importance of maintaining this action.

G.3.13 Obtain authorization of the checklist and permit to climb from an appointed person at the site.

Annex H (informative)
Tower crane foundation pre-erection inspection certificate

TOWER CRANE FOUNDATION PRE-ERECTION INSPECTION CERTIFICATE			**Certificate No.:**
Project:			**Tower crane No./location:** **Tower crane type:**
	Item (delete where not applicable)	**Checked by**	**Date**
	Compliance with design drawings/specification		
	Level check		
	Cast-in items within tolerance		
	Concrete quality/strength		
	Pile tests		
	Steel grade		
	Weld quality		
	Bolts – grade, torque, tightness, quantity		
	Track rails – levels, spacing, fixings, ramps, end stops, earthing		
Documents against which foundation has been checked (drawing nos./document references)**:**			**Design certificate No.:** **Design check certificate No.:**
Notes and observations:			
The above inspections having been carried out satisfactorily, erection of the tower crane superstructure may proceed.			
Signed:			**Date:**
Name:			
Position:			
Company:			

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