Inspection Procedure for Mobile Cranes

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1- YOUR SAFETY IS FIRST:

Your safety wear is mandatory at job sites including in general: suit, shoes, helmet, gloves, ear plugs, glasses, and mask.

2- SCOPE:

This procedure covers the inspection and testing of mobile cranes.

3- REFERENCE STANDARDS:

BS 7121- 1: 2016	Code of practice for safe use of cranes- General
BS 7121- 2- 1: 2012	Code of practice for the safe use of cranes-Part 2-1: Inspection, maintenance and thorough examination- General
BS 7121-3:2017	Code of practice for safe use of cranes Part 3: Mobile cranes
BS 7121-2-3:2012	Code of practice for the safe use of cranes Part 2-3: Inspection, maintenance and thorough examination – Mobile cranes
BS ISO 4309:2017	Cranes — Wire ropes — Care and maintenance, inspection and discard
ASME B30.5 - 2021	Mobile and Locomotive Cranes

4- MOBILE CRANE DEFINTION:

self-powered crane with a boom, which may be fitted on a mast (tower) and capable of travelling laden or unladen, without the need for fixed runways and which relies on gravity for stability, the chassis of the crane not having any capability to carry goods.

5- PERIODIC THOROUGH EXAMINATION OF MOBILE CRANES:

5.1- GENERAL:

- Mobile cranes shall be thoroughly examined periodically whilst in service at intervals not exceeding **12 months** for mobile cranes that only lift goods, and **6 months** for mobile cranes used to lift personnel.
- The competent person carrying out a periodic thorough examination shall work to a defined scope of thorough examination established specifically for the crane they are required to examine.

Before examination, the following shall be Considered

- **Site conditions:**

Careful consideration shall be given to the condition of the area where the tests is to be conducted and the recommendation provided in the operating instructions for the crane relating to its operation within the rated capacity and more stringent requirement shall be applied when loads are being applied for the purpose of testing.

The area where the crane is sited shall be capable of withstanding any loads applied to it.

Sufficient clearance shall be maintained for the unobstructed movements of the crane and load throughout the test, for example slewing. All non-essential personnel shall be kept out the test area.

- **Weather conditions:**

For crane testing that are likely to be affected by the weather, careful attention shall be given to this aspect. Certain weather conditions such as electric storms, strong wind, heavy rains. Ice, excessive sea state can impose loads on a crane or adversely affect the safety of crane.

- **Wind speed:**

The Crane shall not be tested in wind speeds that are in excess of those specified in OEM operating instructions.

- **Inspection tools:**

Inspection tools shall be checked for functionality and validity of calibration certificates (Vernier caliper, sheave gauge, measuring tapes, angle indicator / spirit level, load cell, full body harness and lanyard, lighting equipment, distance meter)

For load test(s): Certified load cell(s), test weights shall be used for performing the test, either solid weight(s) or water bag(s).

- **Lifting crew:**

The crane operator shall be responsible for the correct operation of the crane in accordance with the manufacturer recommendations with in the safe system of work.

The crane operator shall respond to the signals from one slinger /signaler who shall be identified.

The Crane operator shall have a valid certificate of training / Assessment.

The rigger is responsible for attaching and detaching the load and for the use of the correct lifting gears and equipment in accordance with the planned operation.

The rigger is responsible for initialize and directing the safe moment of the crane, if more than one rigger/slinger only one of them shall have the responsibilities hence only certified riggers shall assist crane operator.

The Riggers shall have a valid certificate of training / Assessment.

5.2- THOROUGH EXAMINATION:

The following components shall be checked according during thorough examination:

- Manufacturer's information plate/label, CE mark, and load and duty charts;
- Tyres and wheels;
- Axle locking system;
- Crawler tracks;
- Crane chassis;
- Outrigger jacks and beams;
- Chassis braking system;
- All bolts, pins and other fastenings (visual inspection);
- Slew section structure, including fasteners and slew ring;
- Slewing mechanism (examination throughout its full range of movement with jib at maximum radius);
- All pipe work and connections (including rigid and flexible hoses) (visual inspection);
- All hydraulic cylinders (visual inspection);
- Hydraulic cylinder fittings (visual inspection);
- Oil and other fluids;
- Superstructure and jib (visual inspection);
- Fly jib and mounting attachment (visual inspection);
- All pivoting joints on the jib and attachments of the crane (visual inspection);
- Telescoping extensions on the crane (operation and visual inspection);
- Wire running and static ropes, including terminations;
- Pulleys/sheaves and drums, including guards;
- Access, including ladders, walkways, guard rails and hand holds;
- Cab, including controls, markings, indicators, seating, windows, heating, falling object protection structure (FOPS) bars, wipers and load charts;
- Limiting and indicating devices including:
  - Rated capacity system (measurement of load, moment and radius);
  - Anemometer;
  - Devices indicating: over hoist and over lower limits, luffing limits, trolley limits, slack rope limits, rail travel limits;
- Hook blocks, including sheaves, hook, safety catch and swivel bearing;
- Counterweights, including pendants, fasteners, lifting and locking mechanisms;
- Hoist and luffing winches and brakes, including hydraulic systems;
- Power and control cables and slip rings (visual inspection);
- Control cabinets and wiring;
- Markings, instructions and safety notices.
- Calibration check and functional test of rated capacity indicator/rated capacity limiter (RCI/RCL) as per 5.4 (RCI/RCL) CALIBATION CHECK AND FUNCTIONAL TEST

5.3- ASSESSMENT CRITERIA OF COMPONENTS:

The examined points are assessed according to:

- Accuracy of limiting and indicating devices – within manufacturer's tolerance;
- Adjustment – as specified by manufacturer;
- Alignment – within manufacturer's tolerance;
- Backlash – within manufacturer's tolerance;
- Bearing play – within manufacturer's tolerance;
- Brake performance – within manufacturer's tolerance;
- Corrosion – affecting strength or functionality;
- Cracks – affecting strength or functionality;
- Cylinder creep – within manufacturer's tolerance;
- Damage – affecting strength or functionality;
- Distortion – affecting strength or functionality;
- Fluid levels – within manufacturer's limits;
- Functionality – as intended by manufacturer;
- Guards – presence and condition;
- Leaks – affecting strength, functionality and slips;
- Lubrication – adequacy;
- Markings – presence, accuracy and condition;
- Mode of operation – as intended by manufacturer;
- Obstructions – impeding safe access;
- Rope fit – as specified by manufacturer;
- Rope reeving – as specified by manufacturer;
- Rope specification – as specified by manufacturer;
- Rope condition (as per 7- ASSESSMENT OF WIRE ROPE CONDITION AND DISCARD CRITERIA);
- Security – attachment of components and sub-structures, fasteners, welds, etc.;
- Seizure – full or partial seizure of rotating components;
- Tidiness – general housekeeping;
- Wear – affecting strength or functionality.

5.4- (RCI/RCL) CALIBATION CHECK AND FUNCTIONAL TEST:

The periodic thorough examination of a mobile crane should include a calibration check and functional test of the rated capacity indicator/rated capacity limiter (RCI/RCL) in accordance with BS 7121-2-1:2012, as follows:

5.4.1- CALIBRATION CHECK:

- A calibration check should be carried out when any major repair or modification has been carried out on the RCI or RCL.
- At each successive calibration check, a different configuration of the crane should be chosen so that eventually all configurations are systematically covered.
- The calibration should be checked by the suspension of calibrated weights on the crane in accordance with BS 7262.
- During the calibration: 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.

5.4.2- FUNCTIONAL TEST:

The RCI or RCL should be subjected to a functional test and should give the following warnings within the tolerance limits stated.

a) Warning of approach to rated capacity (clear and continuous warning):

The warning should commence at a load of 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 load as a percentage of rated capacity falls to below the value at which the warning was initiated.

b) Warning of overload (clear and continuous warning):

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

6- PROOF LOAD TESTING OF MOBILE CRANES:

Proof load testing of mobile cranes shall be carried out to supplement thorough examination in the following conditions:

- before the crane being put into use for the first time
- after major repairs or modifications.
- after heavy use
- after exceptional circumstance
- As per client's requirements

6.1- BEFORE TESTING:

Before performing proof load testing on a mobile crane, the following instructions shall be followed:

- The competent person should seek advice from the manufacturer (or other suitable design authority) before the test.
- A visual examination of the crane and the test area should be carried.
- Before the application of a load, a thorough examination of the crane should be carried out.
- The competent person should check the following:
  - 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
  - the table of rated capacities used by the RCI/RCL.

  (The rated capacities should all be identical.)
- A functional test with no load applied should be carried out to check crane correct operation.
- The adjustments of the brakes and limit switches should be checked and tests carried out to determine whether they are operating correctly.
- The competent person should take account of all the support systems when determining the conditions for proof load testing, as described in BS 7121-2-3-2010

6.2- PROOF LOAD TESTING:

a) As mentioned in (6.1), the crane should be functionally tested without a load applied to determine whether it is working properly.

b) After the functional tests without a load applied, the efficiency of the crane's hoist brake(s) should be tested with the load that gives the maximum line pull on the hoist rope(s), as follows:

- 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 re-applied 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 over-run or creep.

c) At every configuration in the test program, the crane should be set up with the test load at a radius/angle within the rated capacity of the crane.

The test load (overload) value for proof load test = **1.25 × WLL**

Note: Proof load test shall be performed at Minimum Radius, Mid Radius and Maximum radius with the above-mentioned percentage

d) 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 at the proof load.

e) The load should be raised until every tooth in the train of the hoist gears has been subjected to the proof load

f) The load should then be lowered to between 100 mm and 200 mm above the ground

g) The load should be held in this position for 10 min. There should be no over-run or creep.

h) 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.

i) The load should then be slewed through the maximum slew angle permitted by the crane design.

Notes:

- During raising of any load, it might be necessary to derrick the jib in so that the radius is not exceeded.
- 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).

6.3- POST-TEST THOROUGH EXAMINATION OF MOBILE CRANES:

On completion of the proof load test a further thorough examination of the crane should be carried out, in accordance with BS 7121-2-1:2012, as follows:

After proof load testing, a thorough examination should be undertaken by the 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.

Note: NDT shall be carried out as per the discretion of 3rd party competent person on the structure of the appliance to establish the presence, location and extent of any defects that can affect the integrity of the structure.

7- ASSESSMENT OF WIRE ROPE CONDITION AND DISCARD CRITERIA:

When carrying out examination of wire ropes as part of the thorough examination of a crane, the competent person shall examine the rope in accordance with: **BS ISO 4309:2017:** *Cranes – Wire ropes – Care and maintenance, inspection and discard* Clause 5: *Inspection*, and Clause 6: *Discard Criteria*, as follows:

7.1- All wire ropes used on the crane shall be inspected over their entire length for the following defects:

- Check for Corrosion, kinks, broken wings, changes in rope diameter, wear, heat damage, and lack of lubrication.
- Check terminal fittings for wear, damage, distortion, signs of overloading (i.e. collapsed thimbles).
- Examine wire rope test certificate to ensure rope is the correct size, capacity, and construction for the crane.

7.2- Deterioration normally results from a combination of several defects occurring simultaneously giving a cumulative effect. The overall effect should be taken into consideration when deciding if a wire rope should continue in service. However, the
following defects would result in the rejection of the rope:

- Total number of broken wires in one lay length must not exceed 6.
- Total number of broken wires in one stand in one lay length must not exceed 3.
- Total number of broken wires in a measured length of 10 rope diameters must not exceed 5% of the number of wires in the rope.
- No broken wires are permitted where the rope enters the termination.
- Wear must not exceed 10% of the original diameter for a 6-stand rope and 3% for a multi stand rope.

Note: Any broken wire found in the course of the examination, which do not constitute rejection shall be broken off in the lay of the rope and their location noted for future reference.

7.3- The reeving configuration of the crane must be checked against the manufacturer's schematic, which shall be provided by the operator prior to the inspection. Particular attention should be paid to any area where the rope could come into contact with the crane structure during the travel of the jib.

8- ADDITIONAL REQUIREMENT FOR CRANES USED TO LIFT PERSONS:

As per BS 7121, the cranes to be used to lift persons shall be equipped with additional features, the following features shall be checked:

- The crane should have an RCI/RCL with an appropriate duty for lifting personnel (i.e. half the rated capacity for lifting other loads).
- The crane should be equipped with a motion control system that brings the crane to rest automatically when the controls are released.
- The crane should be equipped with an appropriate anemometer or other device to monitor in-service wind speeds.
- If the crane is equipped with a winch it should have 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.
- The load bearing hydraulic cylinders should be 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.
- A functional check should be carried out to determine whether the crane control system is able to provide a smooth movement of the personnel carrier. The control system should be such that the carrier can move gently, and the working speed should not exceed 0.5 m/s in all motions.
- Means should be provided such that if the power supply or control system fails, the personnel carrier can be positioned so as to enable access/egress without risk.
- The diameter of the wire rope used for hoisting and lowering the personnel carrier should be measured. The wire rope should have a diameter of at least 8 mm.

9- REPORTING AND CERTIFICATION:

A certificate of test and thorough examination will be issued upon the satisfactory completion of the examination, i.e. the lifting equipment is safe to operate

A defect report will be issued if the lifting equipment fails to meet the requirements.

10-Inspector Competency and Qualification:

Inspector shall have minimum qualification of LEEA Foundation - LEEA Mobile Crane Examination