Don't gamble with your lifting equipment

When it comes to overhead lifting, nothing should be left to chance. Stay safe in the knowledge that TEAM cards are only issued to employees of LEEA member companies who have passed LEEA's rigorous Diploma examination.

The LEEA TEAM card

Putting safety first
Faulty, damaged or badly maintained equipment significantly increases the risk of potentially lethal accidents and often has serious financial and legal consequences. Regular inspection and maintenance is critical to ensure that equipment remains fit for purpose. More importantly, it should only ever be undertaken by technicians with the necessary specialist skills and experience.

Rigorous assessment
TEAM cards are only issued to employees of LEEA member companies. To earn full membership of LEEA, companies must pass a rigorous technical audit and are subject to further regular audits as long as they remain part of the Association.

The TEAM card proves that the holder has passed one of LEEA's Diploma examinations, the industry recognised qualifications for technicians responsible for the test, inspection and maintenance of overhead lifting equipment.

Reflecting the structure of the Diploma programme, each TEAM card lists the holder's precise qualifications. As a result, it is possible to ensure the lifting technician works only on equipment for which they have demonstrated the appropriate skills and expertise.

Valid for three years, the TEAM card also provides proof of the holder's identity and employer. All this information can be verified via the contact details shown on the card.

Issued by LEEA, the TEAM card provides unrivalled evidence of the holder's qualifications.

Equipment covered by the TEAM card scheme

The LEEA TEAM card covers several modules, covering the major overhead lifting product areas:

LEG **Lifting Equipment General**
Wire rope and chain slings • Textile slings • Shackles • Eyebolts • Plate clamps • Lifting beams

LMM **Lifting Machines Manual**
Hand chain hoists • Lever operated hoists • Travelling trolleys • Hand operated winches • Pulley blocks • Manual jacks

LMP **Lifting Machines Power**
Electric hoists • Power feed systems • Motors and electrical control systems • Protective devices • Pneumatic hoists

RCS **Runways and Crane Structures**
Runways • Crane structures and surveys • Mobile lifting gantries • Swing jib cranes

OTC **Overhead Travelling Cranes**
Overhead travelling and portal cranes • Bridge and hoist construction • Braking systems • Thorough examinations • Wire rope examination criteria

OCE **Offshore Containers**
Examination and test • Structures • Materials and construction • Lifting attachments and pad-eyes

MCE **Mobile Cranes Examination**
Thorough Examination • Hydraulic Systems • Structures • Crane Types RCIs • Telescoping Booms

Jacob

LEEA Academy

Developing Professionals for the Lifting Equipment Industry

Mobile Crane Examination (MCE)

Training Course Step Notes

LEEA Learning and Development Agreement

In the interests of all parties and to ensure the successful achievement of the LEEA Mobile Cranes Examination Diploma, the following arrangements are to be confirmed:

Student:

I agree to:

- Follow the instructions of my LEEA training facilitator at all times
- Follow all rules and procedures regarding health and safety matters whilst on site
- Respect the tidiness and cleanliness of training areas and rest area facilities
- Notify my LEEA training facilitator immediately if I have any concerns
- Inform my LEEA training facilitator of any learning difficulties at the soonest opportunity (this may be done privately between you and your LEEA training facilitator)
- Keep to agreed session times and return from rest breaks and lunchtime periods in a timely fashion
- Keep my mobile phone on "silent" for the duration all training sessions and to leave the class if I have to make or receive and urgent call, for the benefit of my fellow students
- Provide feedback to the LEEA facilitator regarding the training I have received
- Respect the opinions of my fellow students and to actively engage in group discussion
- Strictly adhere to the rules regarding LEEA Examinations.

Signed _____

Date _____

LEEA Training Facilitator

I agree to:

- Safeguard the health, safety and welfare of my students throughout the training programme
- Provide my students with quality training, maintaining the highest of professional standards throughout
- Maintain confidentiality for all students at all times
- Provide regular feedback to students on their progress, identifying areas which may need additional study
- Keep appropriate records of any assessments conducted
- Ensure that all students are able to discuss any issues or concerns which may arise during the training course

Signed _____

Date _____

Ownership

Name_____

Company_____

Department _____

Disclaimer

These Step Notes are a useful and authoritative source of information for the mobile crane examiner.

Whilst every effort has been made to achieve the highest degree of accuracy in the generation of the data and information supplied, ultimate responsibility remains with the person and their organisation to ensure that current legal requirements are followed.

First Edition .....July 2015

Introduction

- Because of the propensity to build towering structures, mobile telescoping cranes are playing an essential role in the construction, maintenance and freight industries globally

- Their ever increasing capacity (1,200 tonnes at present) mobility, versatility and speed of erection allow them to be quickly adapted for difficult, unusual tasks giving all industries greater capabilities to achieve the incredible

- Internationally, legislation, regulations or standards concerning mobile cranes are not always clear or being adhered to

- As a result, incidents involving mobile cranes appear to be on the increase and damage to property, injuries to persons or even fatalities are a result

- Economically, the outcome of this is loss of business, increased insurance costs and a loss of confidence in crane operations

- In an effort to reduce the extent of these incidents, this training course has been evolved to ensure that globally, personnel can be made aware of the standards that are expected to be met to ensure that mobile cranes are safe to take into use or continue in use

- By increasing the level of knowledge and understanding in this field it is hoped to achieve a significant decrease in adverse occurrences

NOTES

Legislation

Moral, Legal and Financial reasons for Health and Safety Legislation

- Employers have a moral responsibility to ensure appropriate working conditions are provided

- Unsafe working conditions are likely to have an impact on production

- Society and customer expectations of a company's approach to managing safety – health and safety culture

- Financial cost from loss of output

Legislation

- A need for common requirements throughout Europe

- European Directives implemented

- Main Directives are already regulations in the UK

- Most countries in the European Free Trade Area have similar laws

- 2 types of Directives:
  - Those that remove barriers to trade
  - Those that concern health and safety

- Lifting equipment legislation calls for:
  - Requirements for design
  - Condition of the equipment
  - The manner in which it is used

- Health and Safety at Work Act introduced in 1974:
  - Covers all work situations
  - Ensure safety of people at work
  - Goal setting: aims and achievements to be met are given
  - Does not specify how to achieve aims and achievements

Legislative Structure of Health and Safety

- Primary legislation sets out governing principles
- Establishes an agency to enforce them, e.g. HSE in the UK
- Subordinate legislation or regulations deal with particular industries and associated codes of practice - clarifying the standards to which entities must work.

In the UK the Health and Safety at Work Act 1974 is supported by LOLER Regulations 1998 and an Approved Code of Practice (L113)

Health and Safety at Work, etc. Act 1974 (UK)

- General in nature
- No reference to specific articles or substances
- Applies to all sectors
- Manufacturers/suppliers of articles or substances
- Employers
- Employees
- Enabling Act for specific regulations

Legal Requirement in the UK, adopted as best practice internationally.

Duty of Care

Employer and employee have a common law duty of care to each other and to other employees.

Health and Safety at Work Act Section 2

Employers' General Duty:

"Duty to ensure so far as is reasonably practicable, the health, safety and welfare at work of all his employees"

- Safe plant and systems of work
- Safe use, handling, storage and transportation of articles and substances
- Information, instruction, training and adequate supervision (I.I.T.S.)
- Safe place of work and a safe means of access and egress
- Safe working environment and adequate welfare facilities

Health and Safety at Work Act Section 6 –

Specific duties on designers, manufacturers, importers and suppliers:

- Ensure that articles they design, construct, make, import, supply etc. are safe and without risk to health at all times
- Carry out or arrange such testing and examination necessary
- Ensure end users have adequate information about its designed and tested use including essential conditions for dismantling and disposal
- Ensure that customers are given updated information where it becomes known that the item gives rise to serious risk to health and safety

Health and Safety at Work Act Section 7

Duty of Employees at Work:

- Must not endanger themselves, or others, by their acts or omissions
- Must co-operate with their employers

Health and Safety at Work Act Section 8

Misuse and interference of any provisions:

- No person (i.e. not just employees) shall knowingly, intentionally or recklessly misuse, or interfere with anything provided in the interests of health, safety and welfare

Management of Health and Safety at Work Regulations 1999

Key employer duty of care to employees is to provide: See. 2.4.7

I - Information
I - Instruction
T - Training
S - Supervision

The Competent Person

"One who has the requisite knowledge and experience, both theoretical and practical, of the type of material under examination to certify with confidence whether it is free from patent defects and suitable in every way for the duty for which the article is required."

- Appropriate qualifications
- Experience
- Morals and ethics
- Subject matter expertise
- Knowing your limits
- Access to information
- Understanding applicable legislation
- CPD

Constant Professional Development

NOTES

The Machinery Directive

Machinery Directive 2006/42/EC - Provides the harmonisation of the Essential Health and Safety Requirements (EHSRs) for machinery.

It applies only to products that are intended to be placed on or put into service in the market for the first time.

Machinery: "*an assembly, fitted with or intended to be fitted with a drive system other than directly applied human or animal effort, consisting of linked parts or components, at least one of which moves, and which are joined together for a specific application*".

Manufacturer responsible for verifying whether a particular product falls within the scope of the Machinery Directive.

Implemented in the United Kingdom under the Supply of Machinery (Safety) Regulations 2008

- Manufacturers to issue information for care and safe use of lifting equipment
- Coefficients of Utilisation (Factor of Safety)
- Static and dynamic loads that the equipment must withstand
- No requirement for a test certificate to be issued
- Certain safety information must be placed on the equipment

Compliance can be achieved through working to Harmonised European Standards.

Supply of Machinery (Safety) Regulations 2008 (Originally 1992)

- Implements the European Machinery Directive within the U.K
- Mandatory on member states of the European Union
- Designed to prevent barriers to trade

NOTES

Factory Act See 26.4.27

Under the Supply of Machinery (Safety) Regulations 2008, machinery needs:

- A Declaration of Conformity (DOC)
- To be "CE" marked
- A "technical file"

An EC Declaration of Incorporation (DOI) is a device to legally market machinery which can function but is not complete and may not be safe. Such machinery is not to be used until incorporated into an assembly for which a DOC has been issued – in doing so you assume the obligations of the manufacturer of the finished assembly.

Lifting Equipment should be:

- Designed, made and tested to ensure safety in use
- Marked that it complies with applicable regulations
- Constructed well, sufficiently strong, free of defects and well maintained
- Issued with information on care and safe use

An EC 'Declaration of Conformity' must be issued by the 'responsible person'

Lifting Equipment must be designed and built to sustain a static overload.

Manually operated machines	**1.5**	**x**	**W.L.L**
Other machines	**1.25**	**x**	**W.L.L**
Lifting accessories	**1.5**	**x**	**W.L.L**

Machinery must be capable of sustaining a dynamic overload of:-

1.1	**x**	**W.L.L**

Key Definitions from the Machinery Directive

WLL – Working Load Limit
The maximum load or mass that an item of lifting equipment is designed to sustain, i.e. raise, lower or suspend. This is the load required to be marked on an item by the product standards.

Technical File

SWL – Safe Working Load
The maximum load or mass (as certified by a competent person) that an item of lifting equipment may raise, lower or suspend under particular service conditions. It is the SWL which is required to be marked on the item by LOLER and which appears on any report of thorough examination.

MBL – Minimum Breaking Load FOS
The minimum breaking load is the calculated load at below which the item will not break or fail due to distortion.

Coefficient of Utilisation/Factor of Safety/Working Coefficient
It is a factor which is applied to the MBL to determine the WLL. It varies with the product to take account of the susceptibility to damage and considers the type of stresses the item will meet in normal use.

Mode Factor
A factor applied by the user (slinger or rigger) that takes into account the geometry of a sling assembly to obtain the maximum load it may lift for a particular mode of use.

Lifting Accessory
Any device such as a sling, shackle, eyebolt, clamp, spreader beam etc used to connect the load to a lifting appliance but which is not itself part of the load or the appliance.

Lifting Appliance
A device or mechanism, such as a crane, winch, pulley block, gin wheel, chain block, which does the work in lifting the load or provides the means of movement, or the supporting structure and anchoring devices for such a mechanism, e.g. runway, gantry etc., which may also permit a suspended load to be moved in the horizontal plane.

Static Test
Lifting machinery or a lifting accessory is first inspected and subjected to a force corresponding to the maximum working load multiplied by the appropriate static test coefficient and then re-inspected once the said load has been released to ensure that no damage has occurred.

Dynamic Test
Lifting machinery is operated in all its possible configurations at the maximum working load multiplied by the appropriate dynamic test coefficient with account being taken of the dynamic behaviour of the lifting machinery in order to check that it functions properly.

NOTES

PUWER and LOLER

PUWER: Provision and Use of Work Equipment Regulations 1998
(Applies to all work equipment) requirements, General

LOLER: Lifting Operations and Lifting Equipment Regulations 1998
(Applies to lifting equipment in addition to PUWER) Specific,

These are **legal requirements** in the UK.

Internationally these are **good practice** demanded by customers and local authorities and are integral to the **LEEA Code of Practice**.

The Essentials of PUWER

PUWER places duties on the employer to ensure that:

- Work equipment is suitable for the purpose for which it is to be used
- The working conditions and risk to health and safety of personnel in which the work equipment is used is to be considered
- Equipment is suitably maintained and a log kept up to date
- Equipment is inspected on a regular basis (ref. LOLER)
- All inspection and maintenance records are kept and recorded
- All persons using work equipment have sufficient information pertaining to its use, e.g. operating manuals and guides to safe use

PUWER requires employer to address risks or hazards of equipment from all dates of manufacture and supply.

NOTES www.hse.gov.uk

Equipment first provided for use after 31st December 1992 must comply with any **'essential requirements'**

Equipment may still present a hazard or risk if:

- Application different from that originally envisaged
- Safety depends upon the way it is installed
- Technical mismatch between the supply side and user side legislation

Employers can ensure compliance by checking:

- CE marking
- EC declaration of conformity

PUWER requires that, when providing equipment for use at work:

The purchaser obtains equipment complying with the relevant European Directives.

E.g. In the case of grade 8 mechanically assembled chain slings, specifying BS EN 818-4 and requesting the EC Declaration of Conformity will ensure that the slings meet this requirement.

PUWER Key Regulations

- Regulation 4: Suitability of work equipment
- Regulation 5: Maintenance
- Regulation 6: Inspection
- Regulation 7: Specific risks
- Regulation 8: Information and instructions
- Regulation 9: Training

Lifting Operations and Lifting Equipment Regulations (1998)

Applicable to all areas of industry within GB including offshore installations.
" Thorough Examination & Inspection "
Covers existing used leased and new equipment.

Lifting Operation:
An operation that includes lifting and lowering of a load. The "load" includes people.

Lifting Equipment:
Any work equipment used for lifting or lowering loads and includes attachments used for anchoring, fixing or supporting it.

LOLER Key Regulations

- Regulation 4: Strength and stability
- Regulation 5: Lifting equipment for lifting persons
- Regulation 6: Positioning and installation
- Regulation 7: Marking of lifting equipment
- Regulation 8: Organisation of lifting operations
- Regulation 9: Thorough examination and inspection
- Regulation 10: Reports and defects
- Regulation 11: Keeping of information

Regulation 4: Strength and stability

Employers must ensure that:

- Lifting equipment is of adequate strength and stability for each load, particularly when stress may be induced at mounting or fixing points
- Every part of a load and anything attached to it and used in lifting is of adequate strength

Regulation 5: Lifting Equipment for Lifting Persons

A mobile crane used for lifting people should be adequate and suitable for the task, have a freefall capability lock-out and should be equipped with appropriate devices such as a hoisting limiter, lowering limiter, rated capacity indicator and rated capacity limiter. The carrier should be adequately attached to the crane (e.g. by a shackle or a hook with a latch). The crane and carrier should be inspected every day by someone competent to do so (e.g. trained operator, person in charge of the lift, etc.) and if it is not regularly used then before it is first used each time it is put into service and every day it is used. The crane and associated equipment should be suitably de-rated (by 50%) and the crane should be operated in accordance with the recommendations in the BS 7121 series of standards.

For further information on specific crane types refer to the specific part of BS 7121 relevant to the crane type.

NOTES

Regulation 7: Marking of lifting equipment

All lifting equipment to be marked with its SWL and information that gives the items characteristics, e.g. boom length, radius, capacity (load charts) etc.

Regulation 8: Organisation of Lifting Operations (Standard BS 7121)

- Must be planned by a competent person
- Must be supervised
- Must be carried out in a safe manner

Regulation 9: Thorough examination and inspection

Before lifting equipment is put into service for the first time it is thoroughly examined for any defect unless the lifting equipment:

- Has not been used before
- Is less than 12 months old
- Owner holds the original DOC

Maximum fixed periods for thorough examinations and inspection of lifting equipment are: -

- Lifting accessories ..... 6 months
- Lifting equipment..... 12 months
- Man-Riding Equipment ..... 6 months

The information to be contained in the report of thorough examination is given in schedule 1 of LOLER.

NOTES

Written Scheme of Examination

Should be produced by a Competent Person, taking account of conditions of use, frequency of use and type of load being handled.

Example: a crane which is used infrequently in a clean environment

- Not necessary to thoroughly examine every part of the crane at 12 monthly intervals
- Written scheme could be used to specify which parts of the crane are inspected, paying attention to the wire rope or chain and all safety devices

The written scheme is to be fully detailed to reflect the risk associated with the various component parts.

Exceptional circumstances – such as a sudden and unexpected shock loading or a major repair to a load-bearing component – require a Thorough Examination before placing the equipment back into service, irrespective of whether or not it is due for its regular periodic examination.

Dependant on the associated risks, additional (non-routine) detailed inspections may be necessary at regular intervals between the thorough examinations to ensure that no damage or deterioration has occurred.

Regulation 10: Reports and defects

A person making a thorough examination for an employer under regulation 9 shall:

- Notify the employer immediately of any defect in the lifting equipment which in his opinion is or could become a danger to persons
- As soon as is possible, make an examination report in writing authenticated by him or on his behalf by signature or equally secure means and containing the information specified in Schedule 1 to the employer
- Where there is in his opinion a defect in the lifting equipment involving an existing or imminent risk of serious personal injury, send a copy of the report as soon as is possible to the relevant enforcing authority

Every employer who has been notified shall ensure that the lifting equipment is not used before the defect is rectified.

Regulation 11: Keeping of information

An employer obtaining lifting equipment shall:

- Keep the EC declaration of Conformity for so long as they operate the lifting equipment
- Ensure that the information contained in every report is kept available for inspection.

In the case of a thorough examination for lifting equipment:
- Until he ceases to use the lifting equipment

In the case of a thorough examination for lifting accessories:
- For two years after the report is made

LOLER and the Tester/Examiner

LOLER refers to 'Thorough Examination and Inspection' – of which a test may be part

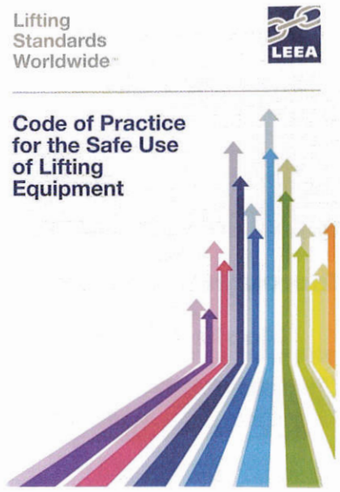
Report of Thorough Examination to include details of any tests carried out

The duties of the Competent Person include ensuring that:

- Lifting equipment has been thoroughly examined before it enters service
- Second-hand, hired or borrowed equipment has a current examination report before it is used
- And, where safety of equipment depends upon installation:
  - That it has a thorough examination after it has been installed
  - That it has a thorough Examination after it has been assembled

NOTES L A - inspection report are kept for life time
C.G - inspection report are kept for 2 yrs.

Codes of Practice



Codes of Practice and Guidance

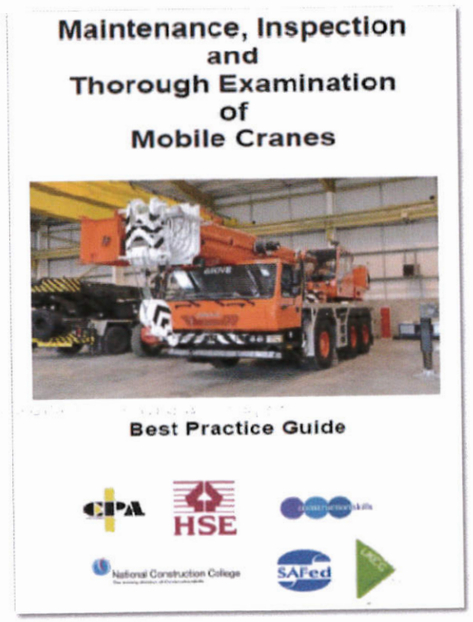
- Approved Codes of Practice (ACoP) legal LOLER, PUWER
- Recommended CoP (e.g. LEEA COPSULE)
- Trade or Professional Code of Practice
- Technical publications manf. docs, etc
- Safety information sheets

Status of the Approved Code of Practice (ACOP) = Quasi-Legal
- An ACOP is a step down from the regulations
- The requirements are not absolute
- Normally be expected to follow them
- Provide a benchmark against which a court may judge alternatives

Status of Guidance

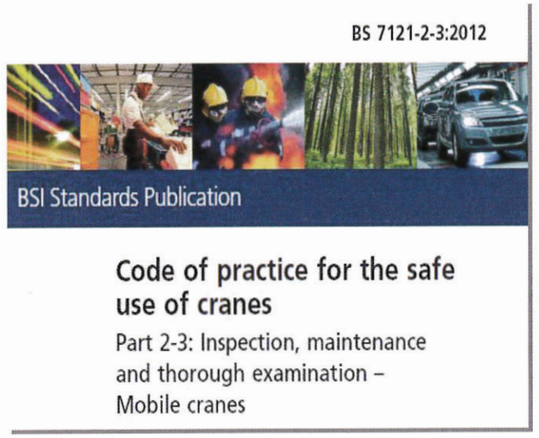
- Guidance is another step down in status
- Does not have a special status in law
- The guidance is not compulsory
- If you follow the guidance you will normally do enough to comply with the law

Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice. (Section 20, 21 and 22 of HSWA)



NOTES

Standards



Standards

The law places duties on manufacturers, suppliers, repairers and hirers of equipment who must meet certain minimum requirements.

Legal duties are also imposed on the owners and users of lifting equipment and on those who make the tests and examinations to verify the equipment.

The purpose is to ensure that lifting equipment is designed and manufactured to be safe and that it is regularly maintained and examined whilst in service to ensure that it remains safe.

Some reference is made in legislation to Standards and Codes of Practice and it is to these that we must refer for further information and guidance.

Manufacturing standards detail dimensions, materials and safe working loads.
E.g. BS EN 14492 (Winches and Hoists)

Performance standards offer a range of criteria that the final product must meet.
E.g. BS EN 13001 – Cranes (General Design)

ISO (or International Standards) generally take the form of performance standards, which are agreed internationally by a majority vote:

- Their use is **optional** but they are often used as the basis for writing national standards
- Where the UK accepts these as written, they are published in this country as British Standards
- A new practice has been adopted in recent years of using the ISO number and adding the prefix BS, for example ISO 2330 - Fork lift trucks - Fork arms - Technical characteristics and testing is published as BS ISO 2330

British Standards

Modern standards are written as safety standards for new products.

Older standards are more detailed covering, materials, workmanship, design, test and examination requirements.

Some standards take the form of recommended Codes of Practice, covering the use, maintenance or application of specific products or the conduct of certain processes.

CEN/CENELEC

A committee responsible for the introduction and development of EN harmonised standards.

A harmonised standard complies with a European Directive.

LEEA Doc. 015 (Reference)

British, European and International Standards. This lists most of the relevant standards, including some which have been withdrawn or declared obsolescent.

Standards lay down the verification methods, including proof loads or other tests to be applied, for new items and give the examination rejection and acceptance criteria for them. In the case of load tests, it is often left to the tester and examiner to decide how to apply the load and what the examination procedure should be.

Harmonised Standards

Harmonised standards have a quasi-legal status

- Harmonised standards become a legal, minimum requirement

Fulfils a large part of the manufacturers 'technical file'

- Saves time and work in putting the file together

Compliance = no deviation from the standard, no matter how small

EC Declaration of Conformity to be issued before placing equipment into service

- No requirement for a test certificate

Records of test and /or examinations made will be held in the technical file

- Some manufacturers may issue both test certificate and DOC

NOTES

On Site Safety

On-Site Safety

Mobile crane thorough examination is a legal requirement.

Site managers must schedule downtime for the cranes requiring thorough examination.

A thorough examination requires that the crane is operated through all its motions and to this end, a competent, trained operator must be made available by the user.

An area to perform the thorough examination in should be large enough to allow all necessary motions of the crane to be performed and should be secured such as to restrict access to the area by personnel not involved in performing the thorough examination.

Work at Height

Thorough Examination activities carried out on the mobile crane outside of edge protected areas should comply with The Work at Height Regulations 2005 which prioritise the fall protection measures which should be used.

NOTES

Regulation 6 states:

- Avoid work at height
  - If you don't have to go up there, don't!
- Prevent falls
  - use an existing, safe place of work at height
  - adopt the most suitable method of working
  - select the most suitable equipment
- Mitigate the consequences of a fall
  - have measures in place to arrest a fall i.e. air bags, nets, fall arrest equipment

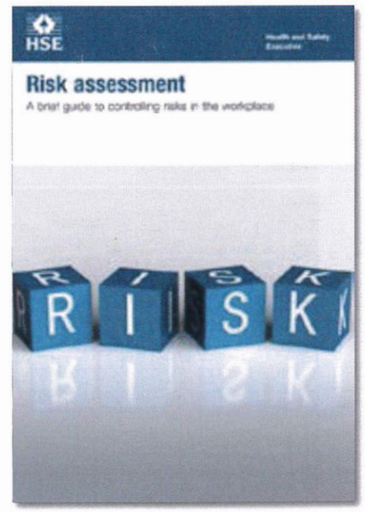
Risk Assessment

Identifying sensible measures to control risks.

Concentrating on real risks, those most likely and those which will cause most harm.

Looking at particular control measures as part of overall assessment.

HSE publication INDG 163 Risk Assessment Guide refers



Definitions

Hazard:

- A hazard is something (object or situation) that has the potential to cause harm

Risk: (a combination of likelihood and severity)

- Risk is that likelihood that the harm from the hazard is realised

Danger:

- A liability or exposure to harm; something that causes peril

Likelihood:

- How likely it is that someone could be harmed by the hazard

Severity:

- If the potential for harm was to occur, how severe would the accident be?

5 Steps to Risk Assessment..

Identify the hazards

Decide who may be harmed and how

Evaluate the risks and decide on precautions (control measures)

Record your findings

Review and monitor

Example Risk Assessment

What are the Hazards	Who might be harmed & how	What are you already doing	Do you need to do anything else to control this risk	Action by who	Action by when
Slips trips & falls	All personnel present Broken arms, broken legs, broken neck	Site cleared of unnecessary equipment & personnel. Correct PPE worn. Barrier tape strung	Monitor personnel accessing this area	Site safety officer	During Thorough examination Testing

Rescue Plan

A rescue plan must be developed whenever fall-arrest systems are in use and when personnel may not be able to perform a self-rescue should a fall occur.

Note: Use of a rescue kit should be considered a last resort – other methods should be evaluated first.

Rescue plan considerations include:

- Never rely upon the emergency services as a primary rescue plan
- What obstructions may be in the way of reaching a suspended worker?
- How will the rescue be assured within 15 minutes of the fall to minimise the risk of further injury or suspension trauma?
- How will the safety of the rescuers be assured as well as the suspended worker?
- What communications will be used between the suspended worker and the rescue team?

Monitor and Review

"Ensure control, measure compliance"

Note any changes during operations such as:

- additional hazards presented
- traffic, pedestrians etc.
- changes in production activity

Record your findings and change the risk assessment as necessary. This may result in the requirement for additional control measures.

NOTES

In summary, you have...

1. Identified the hazards
2. Decided who may be harmed and how
3. Evaluated risks and precautions
4. Recorded your findings
5. Reviewed and monitored the situation

You are now following a Safe System of Work

NOTES

Personal Protective Equipment

PPE

Making the workplace safe includes providing instructions, procedures, training and supervision to encourage people to work safely and responsibly.

Before initiating a Thorough Examination or test the competent person, having carried out his site risk assessment will be able to select the appropriate safety equipment to wear.

Even where engineering controls and safe systems of work have been applied, some hazards might remain. These include injuries to:

- the lungs, e.g. from breathing in contaminated air
- the head and feet, e.g. from falling materials
- the eyes, e.g. from flying particles or splashes of corrosive liquids
- the skin, e.g. from contact with corrosive materials
- the body, e.g. from extremes of heat or cold

PPE is needed in these cases to reduce the risk.

What do the Regulations require?

PPE should be used as a last resort. Wherever there are risks to health and safety that cannot be adequately controlled in other ways, the Personal Protective Equipment at Work Regulations 1992 require PPE to be supplied.

The Regulations also require that PPE is:

- properly assessed before use to make sure it is fit for purpose
- maintained and stored properly
- provided with instructions on how to use it safely
- used correctly by employees

Key points to remember

Are there ways other than using PPE to adequately control the risk, e.g. by using engineering controls?

If not, check that:

- suitable PPE is provided
- it offers adequate protection for its intended use
- those using it are adequately trained in its safe use
- it is properly maintained and any defects are reported
- it is returned to its proper storage after use

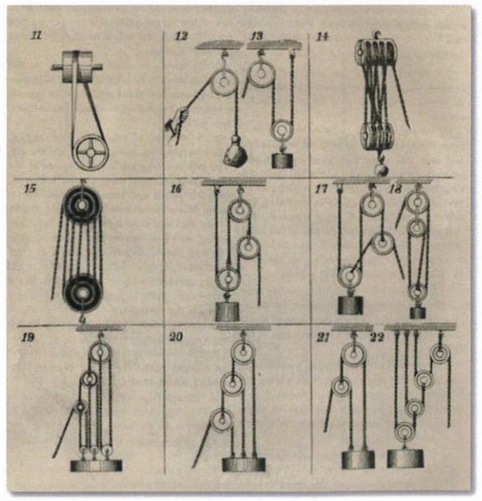
NOTES

Origins of Mobile Cranes

Democracy and Devotion: Greeks Invent the Crane

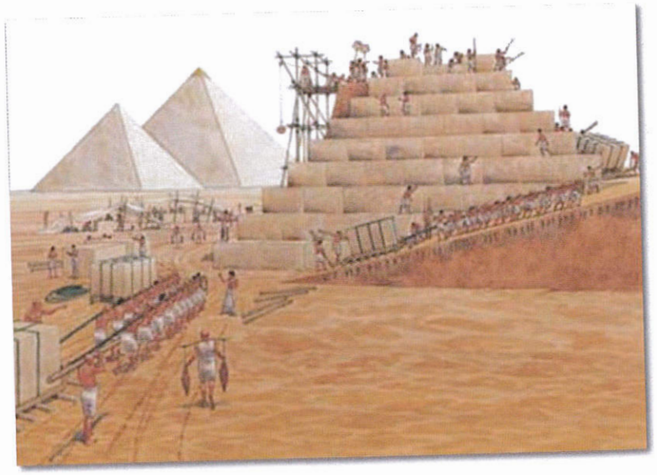
Traditional methods like ramps for moving and lifting the enormous building stones of massive monuments like the Parthenon just weren't going to get the jobs done.

Meet the crane: at first a simple winch and pulley system, and later a compound pulley system credited to Aristotle.



Today, you can see the difference in the way buildings were built in different time periods.

Pre-cranes, building blocks actually tended to be much larger, because so much effort was required to push each one up a ramp that it was less labour-intensive to use bigger and fewer blocks.



Post-cranes, blocks were smaller, but stacked higher, in more complicated and advanced structures, and more quickly.

In the end, the Greeks proved just how much more ambitious projects could be with the help of a crane.

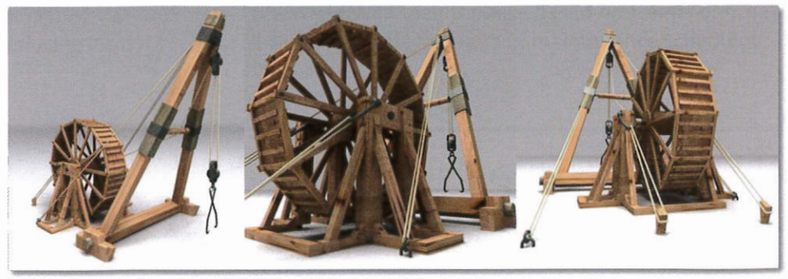
Rome wasn't built in a day, but without the introduction of and improvement upon the Greek cranes, construction would've taken much, much longer than it did.

In fact, the Romans were the first to use multiple cranes for cooperative lifting tasks, as is evident by the massive cornerstone blocks used in some of the famous structures.

But beyond the beautiful, historic, crane-built city still very visible today, perhaps the most impressive aspect of Roman crane use was the way they were used far from their home.

Again—necessity drives innovation. And as the Roman Empire stretched further and further away from Rome, and as conquering armies became more and more ambitious, mobility and versatility in their cranes became key.

The Roman army needed cranes that could move quickly, be assembled and torn down quickly, and perform a variety of tasks—all without losing their powerful lifting capabilities.



Today, you can see that influence in how mobile cranes are used all over the world. You find them on boats, docks, trains, and trucks, often able to be quickly adapted for difficult, unusual tasks.

Lifting capacity has skyrocketed, up to 1,000 tons. In the end, the Romans proved just how much mobility and versatility multiply capability.

NOTES

The Thorough Examination

The Thorough Examination

In accordance with LOLER and PUWER 1998 a thorough examination must be:

- A systematic and detailed examination of the equipment and safety-critical parts
- Carried out at specified intervals
- Undertaken by a competent person
- Used to determine whether the equipment under examination is safe to take into use or continue in use
- Documented in a written report.

Consider operating environment – hazardous and/or populated – when planning examination.

Owners/users may use report information to plan maintenance based on trends of breakdowns and repairs – reducing incidents – and to determine effectiveness of maintenance schedules.

NOTES

9(1)

Types of Thorough Examinations and Testing of Mobile Telescoping Cranes and Intervals

Periodic Thorough Examination - LOLER Reg. 9(3)(a)(i) and (ii)

LOLER specifies intervals of:

- 6 months maximum for mobile cranes used to lift personnel
- 12 months for mobile cranes that only lift goods

The maximum intervals may be reduced by a competent person, the mobile crane user or the mobile crane owner if they decide that environmental factors, the age or the condition of the mobile crane warrant it or if the frequency and likely load schedule justify it.

Thorough Examination after Exceptional Circumstances

A mobile telescoping crane that has undergone:

- Structural component failure
- Shock loading
- Overloading
- Jib collision
- Exposure to extreme weather conditions outside its design limits

Should be taken out of service and thoroughly examined to determine its capacity to continue to carry out its duties safely.

Defined Scope for Periodic Thorough Examination

A competent person carrying out thorough examination of mobile telescoping cranes should work to a defined scope of examination.

The defined scope should stipulate at what intervals within the specified maximum intervals of 6 and 12 months a mobile crane should undergo thorough examination and should specify what and when any accompanying tests or additional reports are required.

A defined scope of examination will detail:

- The standards and regulations applied during the course of examination
- The tools required to carry out such examination
- The requirements prior to carrying out that examination
- A list of all parts to be examined

This will take into account all configurations in which the mobile telescoping crane may be operated.

Overload Testing

Under LOLER there is no requirement for 4 yearly overload testing

Disadvantages of overload testing include:

- Damage over time to crane structure
- Structural failures are usually a consequence of fatigue; defects of this type will not be shown by an overload test
- The result of cranes that fail during testing can be both hazardous and costly
- Inspection organisations do not advocate it as there are no mechanical or structural benefits
- Some insurance contracts will not insure a crane that has been overloaded even if only for testing purposes

The requirement for any testing and the types of test are at the discretion of the competent person and the crane manufacturer should be contacted for guidance should load testing be deemed to be necessary.

NOTES

Verification Tools and Inspection Aids

When carrying out thorough examination and/or testing of a mobile telescoping crane it will be necessary at some stage to verify calculations, dimensions, measurements, radii, weights or angles.

To do so will require the use of some of or all of the following instruments:

- Vernier's
- Rope and sheave gauges
- Tape measure
- Load cell
- Angle indicator / inclinometer
- Sprit level
- Calculator and notebook
- Tyre pressure gauge
- DTI gauge
- Torch / supplementary lighting
- Inspection mirrors
- Engineers chalk / liquid chalk or paint

NOTES DTI - Dial Test Indicator - Slewing bearing

Test Weights

Concrete Test Weights

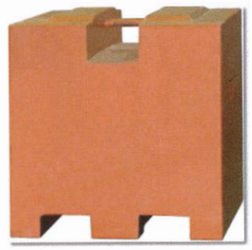
- Cheap to make
- Easy to use
- Easily damaged
- Calibrated annually because of damage or erosion

Annually calibrated.

Steel Test Weights

Initial weighing to verify weights

Init



Water bags

- Easy to transport
- Awkward to handle
- Requires disposal of water after use
- No requirement for verification but.....

LEEA recommendation is as per LEEA 051 – that, to meet LOLER and PUWER, bag and lifting gear should be inspected by a competent person at least 6 monthly. An examination before each use was also recommended.

NOTES

Types of Crane

Rough Terrain Crane

This crane is ideal for rough terrain and is capable of "free on rubber" duties. When function testing "free on rubber" duties it is advisable to have outriggers extended and jacks sufficiently clear of the ground to allow loading, as a safety precaution in the event of tyres failing.

Tyre pressure is more important

Truck Mounted Cranes

This type of crane may have front jacks which must be deployed to allow 360 slew.

Unless fitted with a fifth jack, this crane cannot lift over the front. When fitted with a front jack the crane will have 360° not 240° area of slewing operation.

All Terrain Crane

(Some have steering + brake in Op. Cab)

This crane is designed to be used under different ground conditions and one option is that the outrigger controls can be operated from the upper cab and a steering wheel and brake pedal are fitted that allows the operator to raise and stow the jacks and outriggers and travel around the site to a new position. When examining this type of crane it is essential that both sets of steering and braking systems are shown to operate.

City Crane

So called because the crane has a very short boom with more sections than a normal mobile crane to allow greater manoeuvrability while still retaining boom length, it is all-wheel steering and the boom is kept low to avoid overhead obstructions prevalent in an urban area.

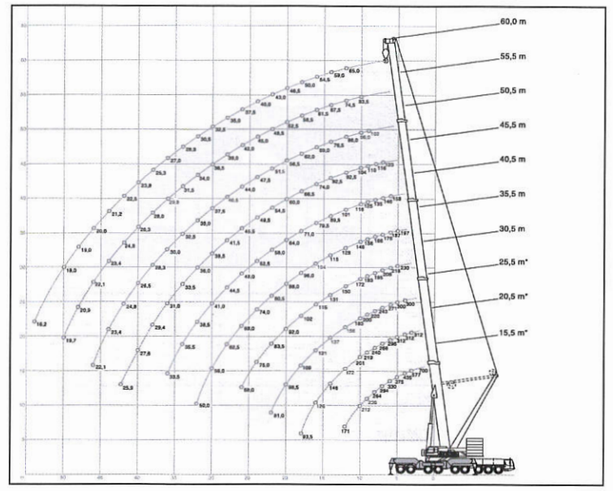
Yard Crane

This type of crane is designed for use in yards where it is not always convenient or possible to deploy outriggers and where a rough terrain crane is too large. The yard crane has free on rubber capabilities and a strong platform where light loads (e.g. pumps, motors, and valves) can be transported.

Crawler Mounted Telescoping Crane

Telescoping cranes mounted on tracks are usually used for onsite work and can be examined in the same manner as wheeled cranes with the exception obviously of the undercarriage. It is however easier nowadays to inspect the tracks as the drive system is hydraulic rather than mechanical so you don't have to worry about drive chains, gears etc.

Load Charts



Load Charts (Rated Capacity Chart)

Load Charts provide critical information to enable RCIs (Rated Capacity Indicators) to be calibrated correctly and lifting operations to be planned and carried out safely.

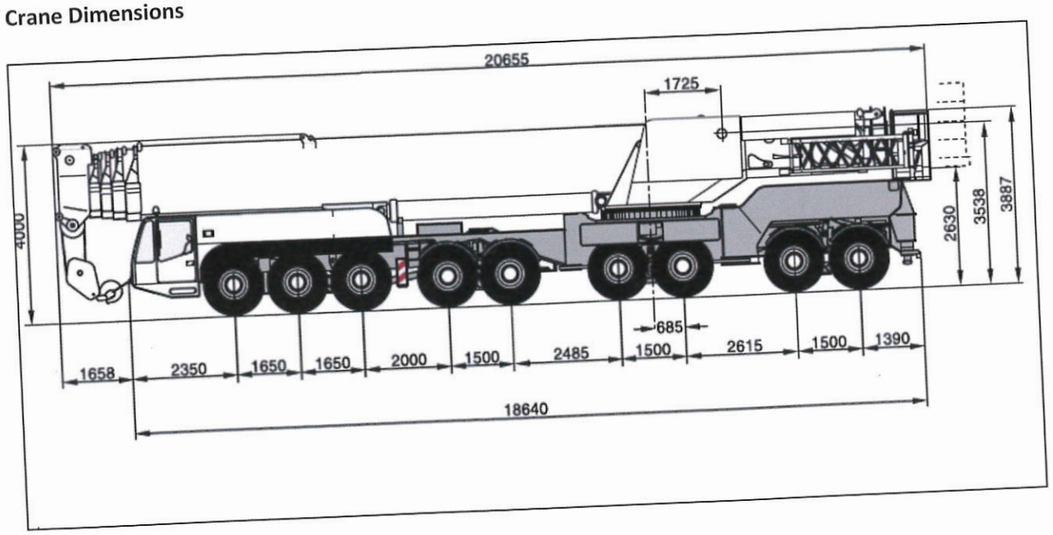
Load Charts are essential to the crane operator to enable him to input the correct information into his RCI so he can operate safely and within the design parameters of the crane.

The technical information contained in load charts is of importance to the competent person(s) and will assist them in carrying out their examinations.

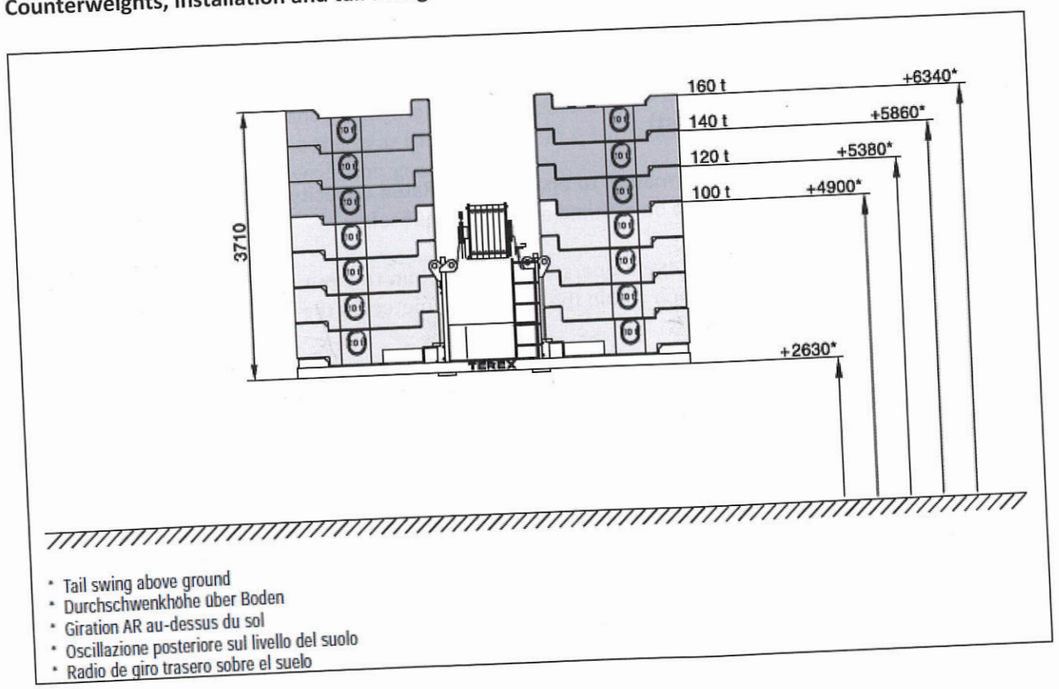
The following tables and diagrams are pages from an example of a load chart which shows the type of the information that the competent person requires to carry out a complete thorough examination and functional test of a mobile crane.

NOTES

Crane Dimensions

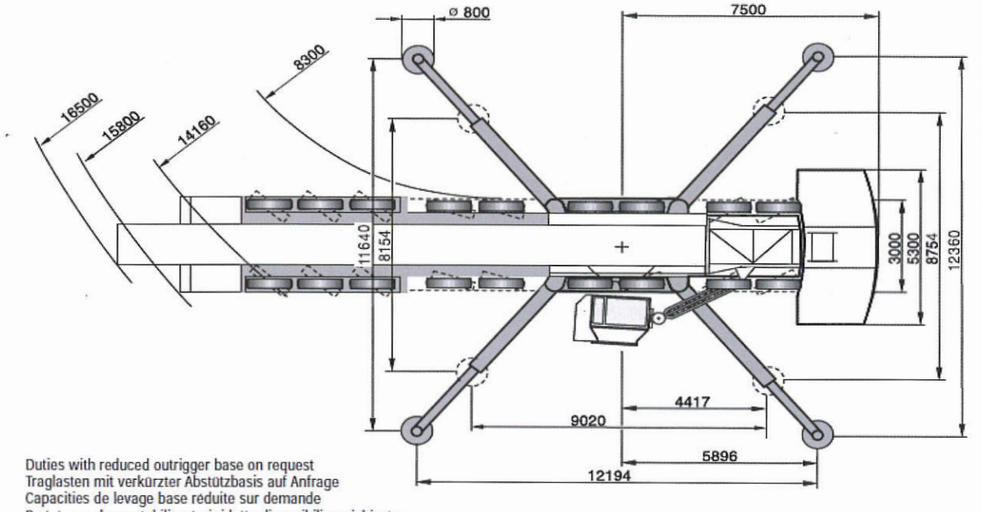


Counterweights, installation and tail swing



* Tail swing above ground
* Durchschwenkhöhe über Boden
* Giration AR au-dessus du sol
* Oscillazione posteriore sul livello del suolo
* Radio de giro trasero sobre el suelo

Outrigger Configuration



Duties with reduced outrigger base on request
Traglasten mit verkürzter Abstützbasis auf Anfrage
Capacities de levage base réduite sur demande
Portate con base stabilizzatori ridotta disponibili su richiesta
Capacidad de carga con bases de apoyo reducidas, disponibles bajo demanda

Hook Blocks

Types of hook blocks for specific maximum loads, their actual weight, number of sheaves and the reeving required to achieve maximum load lift.

HOOK BLOCK / HEAVY-LIFT ATTACHMENT · UNTERFLASCHE / SCHWERLASTEINRICHTUNG · CROCHET-MOUFLE / EQUIPEMENT LEVAGE LOURD · BOZZELLO / EQUIPAGGIAMENTO PESANTE · GANCHO / EQUIPO DE CARGAS PESADAS

Type Typ Type Tipo Tipo	Possible load Mögliche Traglast Charge possible Portata possibile Carga permitida	Number of sheaves Anzahl der Rollen Nombre de poulies N° di pulegge No de poleas	Weight Gewicht Poids Peso Peso	„D"	Number of lines Strangzahl Nombre de brins N° max avvolgim. Reenvíos máx.	Heavy-lift attachment Schwerlasteinrichtung Equipement levage lourd Equipaggiamento pesante Equipo de carga pesada
320	312,0 t	13	4000 kg	4,50 m	26	2 add. sheaves / Zusatzrollen / poulies suppl. / puleggie suppl. / poleas adicionales
250	235,0 t	9	2800 kg	4,50 m	19	
200	189,0 t	7	2600 kg	3,00 m	15	
160	141,0 t	5	2200 kg	3,00 m	11	
100	92,0 t	3	1800 kg	3,00 m	7	
40	40,0 t	1	1200 kg	2,70 m	3	
13,5	13,5 t	Single line hook / Hakengehänge / Boulet / A palla / Gancho de tiro directo	650 kg	2,00 m	1	

Key to Symbols

Not all will be used on the same chart, however.

KEY · ZEICHENERKLÄRUNG · LÉGENDE · LEGGENDA · LEYENDA

Counterweight · Gegengewicht · Contrepoids · Contrappeso · Contrapeso

Lifting capacities on outriggers · Tragfähigkeiten, abgestützt · Capacités de levage sur stabilisateurs · Portate su stabilizzatori · Capacidad de elevación sobre los apoyos · 360°

Radius · Ausladung · Portée · Sbraccio · Radio

Main boom · Hauptausleger · Flèche principale · Braccio base · Pluma principal

Main boom extension · Hauptauslegerverlängerung · Rallonge de flèche · Prolunga · Plumín, extensión de pluma

Fixed fly jib · Starrer Hilfsausleger · Fléchette fixe · Falcone fissa · Plumín fijo

Adapter · Adapter · Adaptateur · Adattatore · Aadaptador

Boom elevation · Ausleger-Winkelstellung · Relevage de flèche · Angolazione braccio · Elevación de pluma

Sideways Superlift · Seitlicher Superlift · Superlift latéral · Superlift laterale · Superlift lateral (SSL)

„D" D

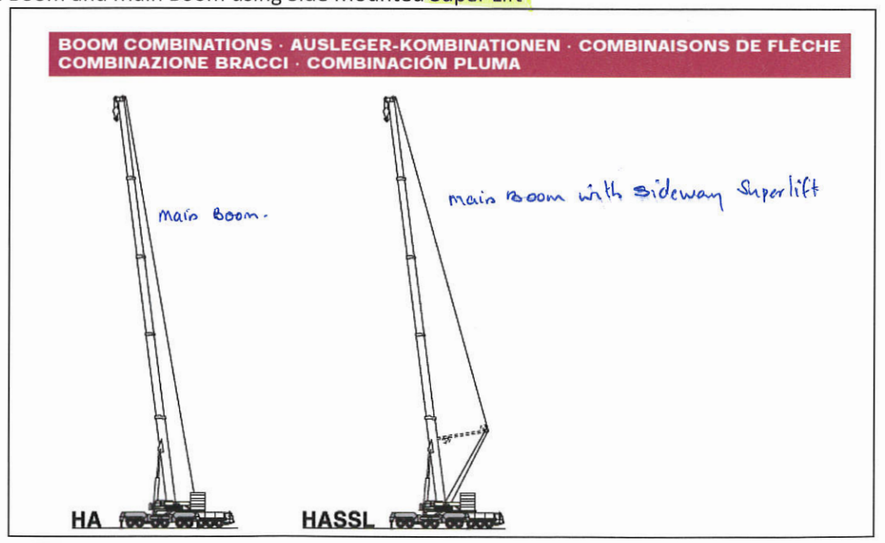
NOTES

Configuration Acronyms

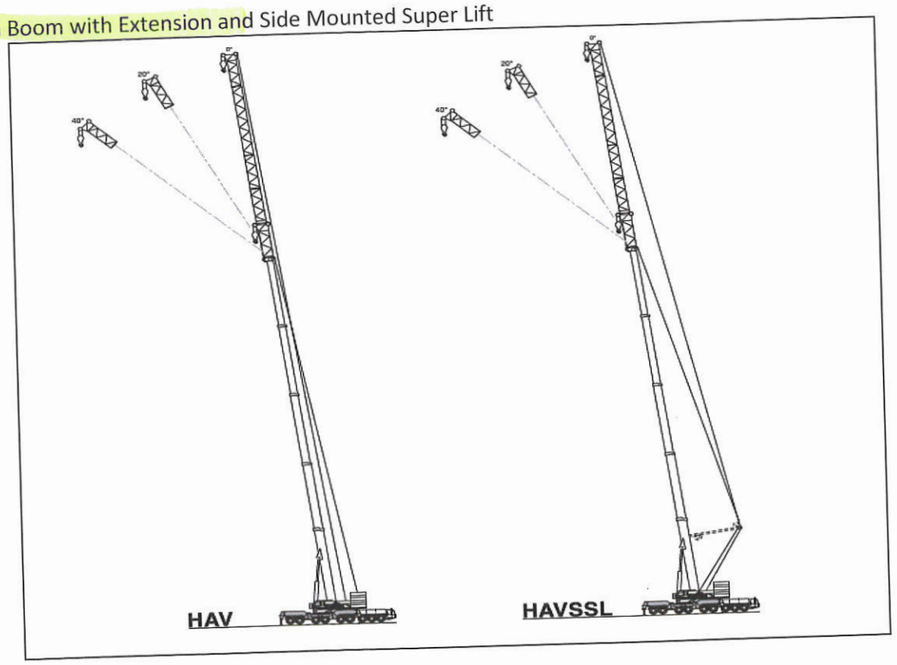
CONTENTS · INHALT · CONTENU · INDICE · CONTENIDO

Boom Combinations

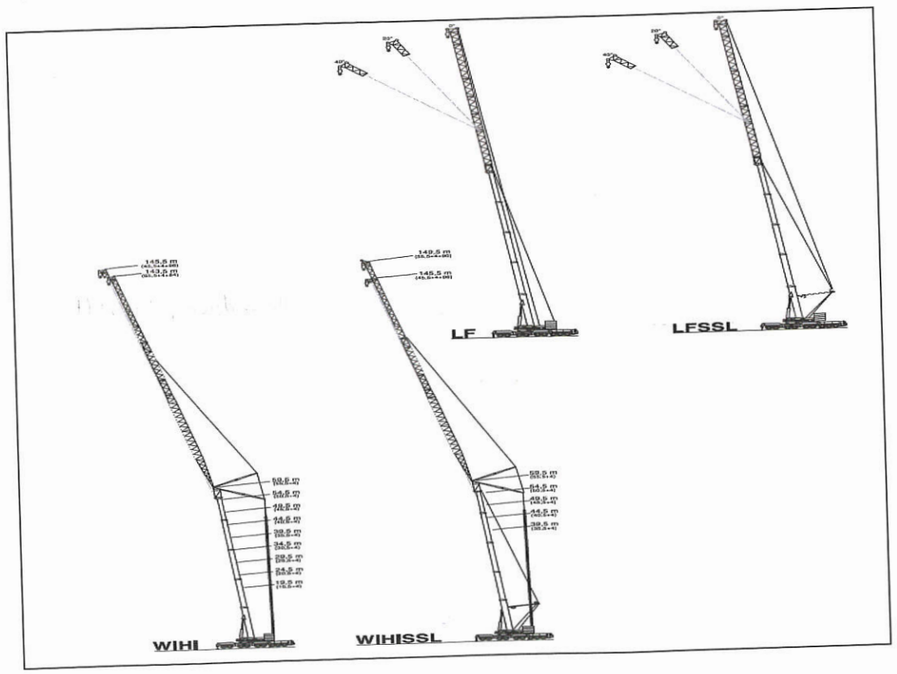
Main Boom and Main Boom using Side Mounted Super Lift



Main Boom with Extension and Side Mounted Super Lift



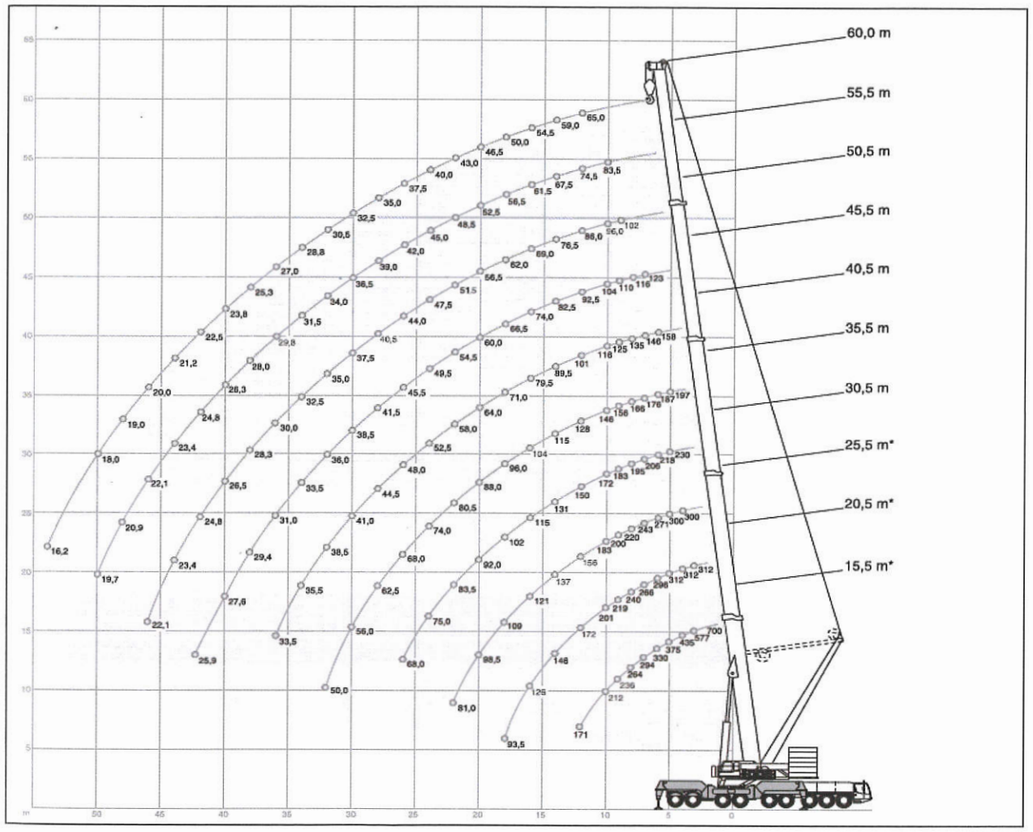
Fixed Fly Jib and Luffing Jib - Both with Side Mounted Super Lift



Range Diagram

This type of chart is commonly known as a range diagram rather than a load chart as it shows the positions of the boom rather than a load capacity.

It shows how to position the crane to pick at a specific radius and what boom configuration is required to lift to the specific height.



NOTES

Load Chart

Simple load chart showing required counterweight, range of swing, radius and boom length.

HA

140 t — 360° — ISO

(m)	15,5*	15,5	20,5*	20,5	25,5*	25,5	30,5	35,5	40,5	45,5	50,5	55,5	60,0	
m	t	t	t	t	t	t	t	t	t	t	t	t	t	m
	700,0[1)]	-	-	-	-	-	-	-	-	-	-	-	-	
3	577,0[2)]	312,0	312,0	312,0	-	-	-	-	-	-	-	-	-	3
3,5	473,0[2)]	312,0	312,0	312,0	-	-	-	-	-	-	-	-	-	3,5
4	435,0[2)]	311,0	312,0	310,0	300,0	300,0	-	-	-	-	-	-	-	4
4,5	403,0[2)]	293,0	312,0	291,0	300,0	292,0	-	-	-	-	-	-	-	4,5
5	375,0[2)]	276,0	312,0	275,0	300,0	275,0	230,0	197,0	-	-	-	-	-	5
6	330,0[2)]	248,0	296,0	246,0	271,0	247,0	218,0	187,0	158,0	-	-	-	-	6
7	294,0	224,0	266,0	223,0	243,0	223,0	206,0	176,0	146,0	123,0	-	-	-	7
8	264,0	205,0	240,0	203,0	220,0	204,0	195,0	166,0	135,0	116,0	-	-	-	8
9	236,0	188,0	219,0	186,0	200,0	187,0	183,0	156,0	125,0	110,0	102,0	-	-	9
10	212,0	174,0	201,0	172,0	183,0	173,0	172,0	146,0	116,0	104,0	96,0	83,5	-	10
12	171,0	150,0	172,0	149,0	156,0	149,0	150,0	128,0	101,0	92,5	86,0	74,5	65,0	12
14	-	-	146,0	130,0	137,0	131,0	131,0	115,0	89,5	82,5	76,5	67,5	59,0	14
16	-	-	126,0	116,0	121,0	116,0	115,0	104,0	79,5	74,0	69,0	61,5	54,5	16
18	-	-	93,5	93,5	109,0	104,0	102,0	96,0	71,0	66,5	62,0	56,5	50,0	18
20	-	-	-	-	98,5	92,0	92,0	88,0	64,0	60,0	56,5	52,5	46,5	20
22	-	-	-	-	81,0	81,0	83,5	80,5	58,0	54,5	51,5	48,5	43,0	22
24	-	-	-	-	-	-	75,0	74,0	52,5	49,5	47,5	45,0	40,0	24
26	-	-	-	-	-	-	68,0	68,0	48,0	45,5	44,0	42,0	37,5	26
28	-	-	-	-	-	-	-	62,5	44,5	41,5	40,5	39,0	35,0	28
30	-	-	-	-	-	-	-	56,0	41,0	38,5	37,5	36,5	32,5	30
32	-	-	-	-	-	-	-	50,0	38,5	36,0	35,0	34,0	30,5	32
34	-	-	-	-	-	-	-	-	35,5	33,5	32,5	31,5	28,8	34
36	-	-	-	-	-	-	-	-	33,5	31,0	30,0	29,8	27,0	36
38	-	-	-	-	-	-	-	-	-	29,4	28,3	28,0	25,3	38
40	-	-	-	-	-	-	-	-	-	27,6	26,5	26,3	23,8	40
42	-	-	-	-	-	-	-	-	-	25,9	24,8	24,8	22,5	42
44	-	-	-	-	-	-	-	-	-	-	23,4	23,4	21,2	44
46	-	-	-	-	-	-	-	-	-	-	22,1	22,1	20,0	46
48	-	-	-	-	-	-	-	-	-	-	-	20,9	19,0	48
50	-	-	-	-	-	-	-	-	-	-	-	19,7	18,0	50
54	-	-	-	-	-	-	-	-	-	-	-	-	16,2	54
58	-	-	-	-	-	-	-	-	-	-	-	-	-	58

Chart showing different counterweight and side mounted superlift attachment with a subsequent difference in load lifting capability.

HASSL 0°

160 t — 360° — ISO

(m)	35,5	40,5	45,5	50,5	55,5	60,0	
m	t	t	t	t	t	t	m
5	195,0	-	-	-	-	-	5
6	195,0	164,0	-	-	-	-	6
7	192,0	160,0	139,0	-	-	-	7
8	189,0	157,0	135,0	114,0	-	-	8
9	184,0	154,0	132,0	113,0	94,0	72,5	9
10	170,0	150,0	130,0	112,0	92,5	71,5	10
12	147,0	142,0	125,0	109,0	89,5	69,5	12
14	128,0	130,0	121,0	105,0	86,0	67,0	14
16	113,0	115,0	116,0	102,0	82,0	64,0	16
18	101,0	103,0	104,0	98,0	78,0	61,0	18
20	91,5	92,5	93,5	92,0	74,0	58,0	20
22	83,0	84,0	85,0	86,0	70,5	55,5	22
24	75,5	76,5	77,5	79,0	67,0	53,0	24
26	68,0	69,5	70,5	72,0	63,5	50,5	26
28	61,5	63,0	64,0	65,5	60,0	48,5	28
30	54,0	57,5	58,5	60,0	57,0	46,5	30
32	42,5	52,5	53,5	55,0	54,0	44,5	32
34	-	47,5	49,0	50,5	51,0	43,0	34
36	-	39,0	45,5	47,0	48,0	41,0	36
38	-	-	42,0	43,5	44,5	39,5	38
40	-	-	35,5	40,5	41,5	38,0	40
42	-	-	-	37,5	38,5	36,5	42
44	-	-	-	33,0	36,0	35,5	44
46	-	-	-	27,0	33,5	34,0	46
48	-	-	-	-	30,5	31,5	48
50	-	-	-	-	25,9	29,8	50
54	-	-	-	-	-	23,1	54

Load charts showing different counterweights and with jib extension attached and side mounted superlift deployed.

HAVSSL 0°

160 t — 360° — ISO

60,0 m + 0°

	6 m	12 m		18 m	
	0°	0°	20°	0°	20°
m	t	t	t	t	t
10	53,5	-	-	-	-
12	53,0	43,1	-	35,0	-
14	51,2	41,6	-	33,9	-
16	49,6	40,1	38,5	32,7	-
18	48,0	38,6	37,2	31,6	-
20	46,4	37,2	36,0	30,5	26,7
22	45,0	35,8	34,8	29,4	25,7
24	43,6	34,5	33,6	28,3	24,7
26	42,2	33,2	32,5	27,2	23,9
28	40,9	32,0	31,5	26,2	23,1
30	39,6	30,9	30,5	25,2	22,5
32	38,3	29,9	29,5	24,4	21,9
34	37,0	28,9	28,6	23,5	21,3
36	35,8	28,0	27,7	22,8	20,9
38	34,6	27,1	26,9	22,0	20,4
40	33,5	26,4	26,2	21,4	20,0
42	32,4	25,6	25,4	20,8	19,6
44	31,3	25,0	24,8	20,3	19,2
46	30,3	24,3	24,1	19,8	18,8
48	29,3	23,8	23,5	19,4	18,5
50	28,4	23,2	23,0	19,0	18,2
54	26,7	22,3	22,0	18,3	17,5
58	-	21,4	21,1	17,7	17,0
62	-	20,3	20,3	17,1	16,4
66	-	-	-	16,5	15,9

HAVSSL 0°

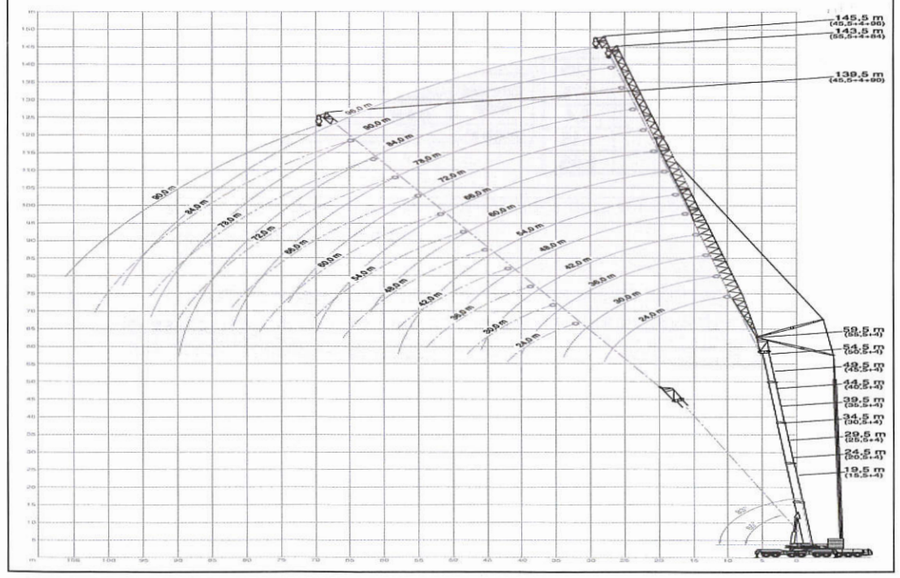
100 t — 360° — ISO

60,0 m + 0°

	6 m	12 m			18 m		
	0°	0°	20°	40°	0°	20°	40°
m	t	t	t	t	t	t	t
10	53,5	-	-	-	-	-	-
12	53,0	43,1	-	-	35,0	-	-
14	51,2	41,6	-	-	33,9	-	-
16	49,6	40,1	38,5	-	32,7	-	-
18	48,0	38,6	37,2	-	31,6	-	-
20	46,4	37,2	36,0	30,8	30,5	26,7	-
22	45,0	35,8	34,8	30,4	29,4	25,7	-
24	43,6	34,5	33,6	30,0	28,3	24,7	20,5
26	42,2	33,2	32,5	29,5	27,2	23,9	20,0
28	40,9	32,0	31,5	29,0	26,2	23,1	19,6
30	39,6	30,9	30,5	28,5	25,2	22,5	19,2
32	38,3	29,9	29,5	27,9	24,4	21,9	18,9
34	35,1	28,9	28,6	27,4	23,5	21,3	18,6
36	31,7	28,0	27,7	26,8	22,8	20,9	18,3
38	28,8	27,1	26,9	26,2	22,0	20,4	18,1
40	26,3	26,4	26,2	25,6	21,4	20,0	17,9
42	24,0	24,2	25,2	25,0	20,8	19,6	17,7
44	21,9	22,1	23,1	23,7	20,3	19,2	17,5
46	19,9	20,2	21,2	21,7	19,8	18,8	17,3
48	18,2	18,4	19,3	19,8	19,1	18,5	17,2
50	16,6	16,8	17,6	18,0	17,5	18,2	17,0
54	13,8	14,0	14,6	-	14,7	15,8	16,5
58	-	11,6	12,1	-	12,3	13,2	-
62	-	9,6	10,0	-	10,3	11,0	-
66	-	-	-	-	8,6	9,1	-

Range diagram for luffing jib where main boom remains static and luffing jib moves.

WIHI



This is a simple load chart which can be found on the wall in the crane operators cab.

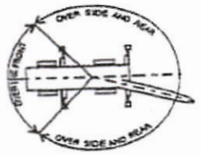
TADANO TR-250M-5 HYDRAULIC ROUGH TERRAIN CRANE
TOTAL RATED LOAD IN KILOGRAMS
THIS DOCUMENT SHOULD BE READ IN CONJUNCTION WITH THE A.M.L.

1. OUTRIGGERS FULLY EXTENDED (6.3m) - 360°

A (m) / B (m)	9.5m	16.5m	23.5m	30.5m	C / D / E	8.0m 5°	8.0m 25°	8.0m 45°	13.0m 5°	13.0m 25°	13.0m 45°
2.5	25.0	19.0	12.5		83°	3.0	2.1	1.6	2.0	1.2	0.8
3.0	25.0	19.0	12.5	7.0	76°	3.0	2.1	1.6	2.0	1.2	0.8
3.5	25.0	19.0	12.5	7.0	72°	3.0	2.1	1.6	1.75	1.1	0.8
4.0	23.0	19.0	12.5	7.0	70°	2.8	2.1	1.6	1.65	1.05	0.8
4.5	21.2	18.0	12.5	7.0	65°	2.35	1.8	1.5	1.4	0.95	0.78
5.0	19.4	16.7	12.5	7.0	60°	2.0	1.55	1.35	1.2	0.9	0.75
5.5	17.8	15.6	11.75	7.0	55°	1.45	1.35	1.2	1.05	0.85	0.74
6.0	16.3	14.6	11.1	7.0	50°	1.05	1.0	0.95	0.85	0.75	0.7
6.5	15.1	13.8	10.5	7.0	45°	0.75	0.7	0.7	0.6	0.55	0.55
7.0	13.7	13.0	10.0	7.0	40°	0.55	0.5		0.4	0.4	
8.0		10.55	9.0	7.0	35°	0.38	0.35				
9.0		8.65	8.2	6.3							
10.0		7.05	7.3	5.8							
11.0		5.85	6.4	5.3							
12.0		4.95	5.5	4.9							
13.0		4.2	4.75	4.5							
14.0		3.6	4.1	4.15							
15.0			3.6	3.8							
16.0			3.15	3.45							
17.0			2.8	3.05							
18.0			2.45	2.7							
19.0			2.15	2.45							
20.0			1.9	2.2							
21.0			1.7	1.95							
22.0				1.75							
24.0				1.4							
26.0				1.15							
28.0				0.95							

A = Boom Length
B = Working Radius
C = Jib Length
D = Jib Offset
E = Boom Angle

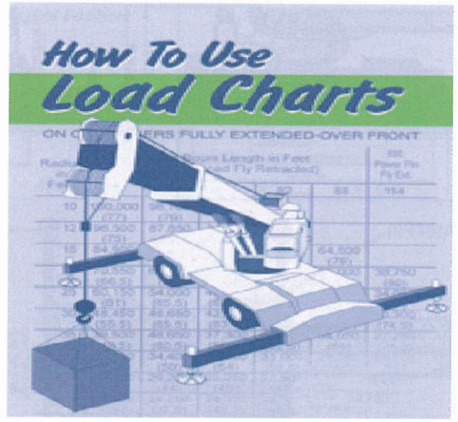
Extended Width	Middle Extended (5.0m)	Middle Extended (3.6m)	Minimum Extended
Angle a°	25	15	5



NOTES

Boom- main Structure.
Jib - attachment to main Structure

How to Read a Load Chart



Each crane has a load chart that specifies the crane's capabilities, detailing its features and how its lift capacity varies when considering distance and angle. Just like the old saying 'if you fail to plan, you plan to fail,' failing to consult a crane load chart before renting or employing a crane for a specific job could leave you with too much or too little capacity for your job.

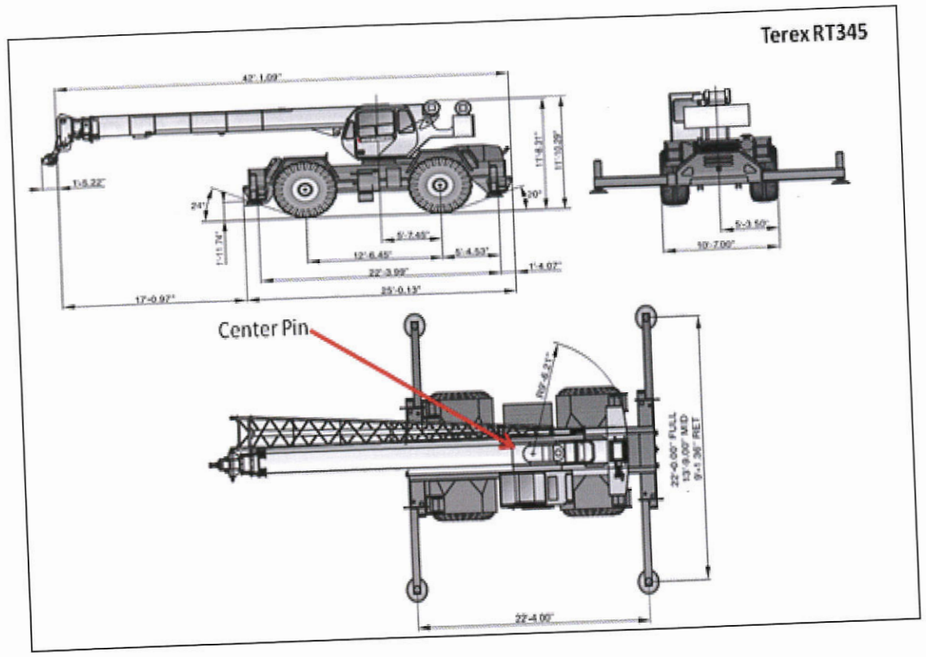
Before a crane is rented, transported, employed or purchased, the crane chart must be consulted. Everyone, from the crane operator, to the job supervisors, to even the sales people have to know how to read a crane chart.

To illustrate how to read a crane chart, we've chosen the chart for the Terex RT345XL, a rough terrain crane with a maximum lift capacity of 45 Tons.

Dimensions and Weight

The following chart shows the crane dimensions. It includes data for operation with the outriggers extended, transport weight, and steering dimensions.

Knowledge of this information is especially critical if the crane will be working in a confined space, as the lifting capacity varies depending on whether the outriggers are extended.



The transport weight (below) determines the trailer to be used, how to load the crane on the trailer, the route to take, and what permits are required to get it to the jobsite.

CRANE WEIGHTS

WEIGHTS	GVW		
	67915 lb	34557 lb	33418 lb
Add / Subtract for main optional equipment			
32 ft Stowed aside the boom	+1969 lb	+601 lb	-251 lb
32-49 ft Stowed aside the boom	+2575 lb	-78 lb	+446 lb
	+100 lb	+170 lb	-70 lb

Along the top axis, the first number is the gross vehicle weight. In the other two columns, the arrows indicate the weight load for each axle depending on what additional accessories are loaded.

Lift Capacity

Counterweight Outrigger Position

Terex RT345

6.5 ton | 22 ft x 22.3 ft | 360° | AMERICAN STANDARD ASME B30.5

ft	Boom Extension Required 33.75 ft	45.0 ft	57.0 ft	69.0 ft	81.0 ft	93.0 ft	105.0 ft	ft
9	90000	-	-	-	-	-	-	9
10	64400	46500	-	-	-	-	-	10
12	58000	46500	46500	-	-	-	-	12
15	50700	46500	44500	41600	-	-	-	15
20	40400	38800	36400	34800	30600	-	-	20
25	30600	31600	31000	29400	26000	23400	-	25
30	-	25000	25600	25600	22500	20300	18600	30
35	-	20300	20900	21300	19600	17700	16200	35
40	-	16700	17400	17800	17400	15600	14400	40
45	-	-	14700	15100	15300	14100	12900	45
50	-	-	12400	12900	13100	12600	11600	50
55	-	-	-	11100	11300	11500	10400	55
60	-	-	-	9500	9800	9900	9500	60
65	-	-	-	-	8400	8500	8600	65
70	-	-	-	-	7200	7300	7400	70
75	-	-	-	-	6100	6300	6400	75
80	-	-	-	-	-	5500	5600	80

In the legend at the top of the chart, you can see these ratings apply when using 6.5 Tons of counterweight, with the outriggers extended to 22 x 22.3 feet. Here, you'd graph out the specific lift the crane is needed for. The 'ft.' indicator on the left axis represents the radius, the distance from the centre pin to the centre of the load.

Example Lift

You need to lift a load of 15 Tons (30,000 pounds) a distance of 25 feet. The distance is measured from the centre pin of the crane to the centre of the load. Once you determine the distance, look on that line for the largest capacity; that will indicate how many feet of boom must be extended. In this case, it is 45 feet.

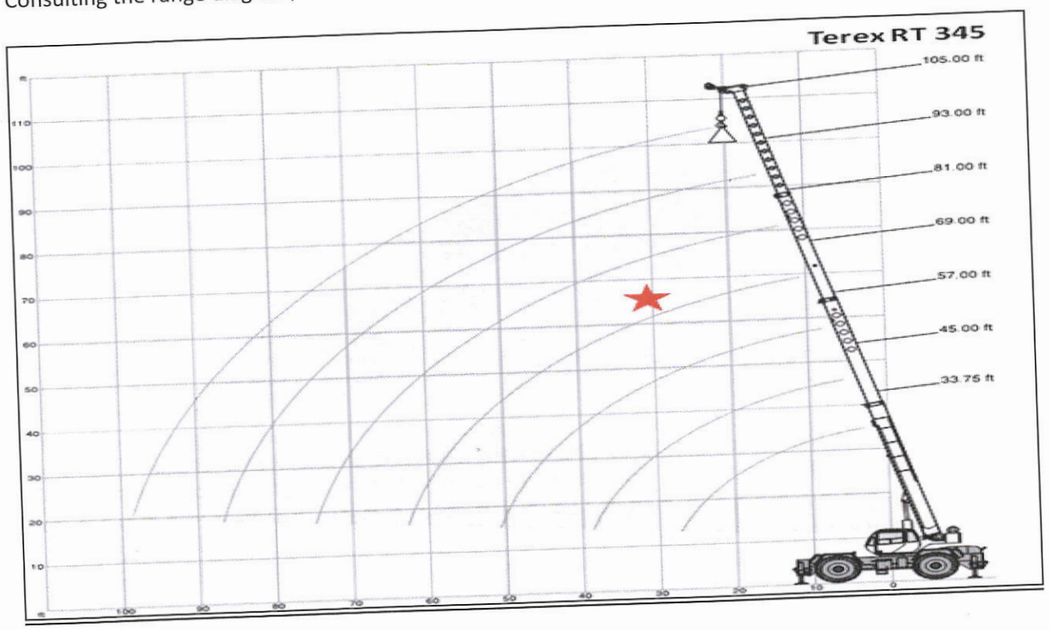
It's important to note that the maximum capacity is always measured by the shortest lift, usually over the rear of the crane, and with the outriggers fully extended. While the Terex RT345 has a maximum capacity of 45 Tons, lifts at any distance or height drops the maximum capacity dramatically.

NOTES

Lift Range

Just as important as lift capacity is lift range. For that, a range diagram is usually included in every chart which illustrates how much boom length is needed to pick up and lift a load both at a distance and at height.

Example: You need to pick up a load at 25 feet and lift it to the top of a five-story, 65-foot building. Consulting the range diagram, 69 feet of boom is required to make the lift.



NOTES

Lift Angle

This chart illustrates the maximum lift if a luffing or fixed jib is used. Lifts with jib lengths of 32 and 49 feet (in addition to boom extension of 105 feet) are illustrated. With higher angles of lift, the maximum load capacity decreases. With a luffing jib, the angle can be automatically adjusted from the operators cab. With a fixed jib, of course, the angle is fixed.

Terex RT 345

6.5 ton | 22 ft x 22.3 ft | 360° | AMERICAN STANDARD ASME B30.5

105 ft

	32 ft			49 ft			
	0°	15°	30°	0°	15°	30°	
ft							ft
50	8693	-	-	-	-	-	50
55	8005	-	-	-	-	-	55
60	7563	7991	-	-	-	-	60
65	7144	7420	6254	4908	3147	2514	65
70	6734	7070	6101	4176	3027	2460	70
75	6343	6772	5896	3859	2916	2409	75
80	5716	6493	5638	3636	2812	2360	80
85	5101	5840	5328	3448	2716	2314	85
90	4499	5054	4967	3277	2628	2269	90
95	3910	4328	4393	3077	2547	2226	95
100	3334	3661	3745	2974	2451	2185	100
105	2770	3052	3133	2843	2448	2145	105
110	2219	2499	2557	2684	2404	2087	110
115	1680	2003	2016	2497	2320	2140	115
120	1153	1563	1510	2282	2195	2102	120
125	639	1178	-	2041	2032	1972	125
130	-	-	-	1773	1828	1752	130
135	-	-	-	1478	1586	1444	135
140	-	-	-	1157	1304	-	140

Crane in Motion

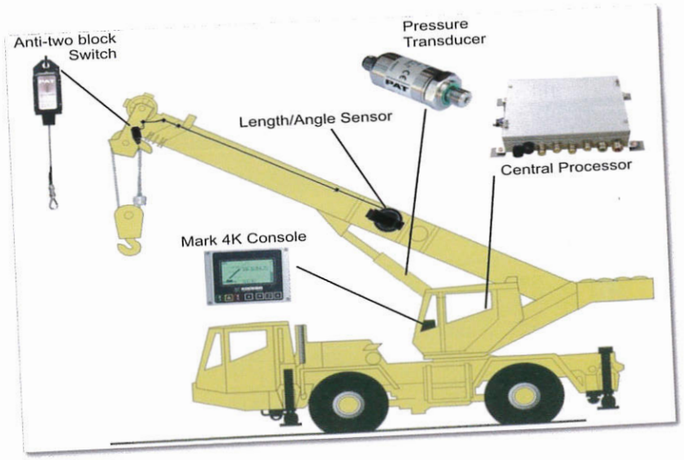
This illustrates the lift capacity for a pick and carry. It shows the total weight able to be picked up at 360-degrees while stationary on wheels, the total weight being able to be supported both while slowly rolling with the load at a zero degree angle (creep), and the total weight able to be supported while moving at 2.5mph. The column to the left indicates the radius of the lift, the one to the far right, the maximum boom length each weight can be carried at.

Terex RT 345

6.5 ton | AMERICAN STANDARD ASME B30.5

	(mph)			
	0	creep	2.5	
	360°	straight over front		max.
ft				ft
10	34200	48600	40600	33.8
12	34300	42100	33300	33.8
15	21300	34800	28700	45.0
20	13100	26400	21500	45.0
25	8300	20300	16500	45.0
30	5700	14600	12900	45.0
35	4100	11200	10700	57.0
40	3000	8700	8700	57.0
45	2200	7000	7000	57.0
50	1500	5700	5700	69.0
55	-	4600	4600	69.0
60	-	3800	3800	81.0
65	-	2900	2900	81.0
70	-	2100	2100	81.0
75	-	1300	1300	93.0

Load Indicators



Load Indicators

You may come across these referred to as:

RCI : Rated Capacity Indicator
RCL : Rated Capacity Limiter
LMI : Load Moment Indicator
ASLI : Automatic Safe Load Indicator

All aid the equipment operator by sensing (directly or indirectly) the overturning moment on the equipment, i.e., load multiplied by radius. They compare the lifting condition to the equipment's rated capacity, and when the rated capacity is reached warn the operator that an increase in the load or radius will result in the rated capacity being exceeded. This, of course could result in serious consequences.

Only a device known as a **Rated Capacity Limiter** will actually shut off elements of the crane's systems to prevent an increase in the severity of the loading on the equipment, e.g. hoisting, telescoping out, or luffing out. Typically, those functions which decrease the severity of loading on the equipment remain operational, e.g., lowering, telescoping in, or luffing in.

In some crane models the device informs the operator of the configuration of the boom, confirms that all the locking devices are in place and aids the operator in installing the counterweights.

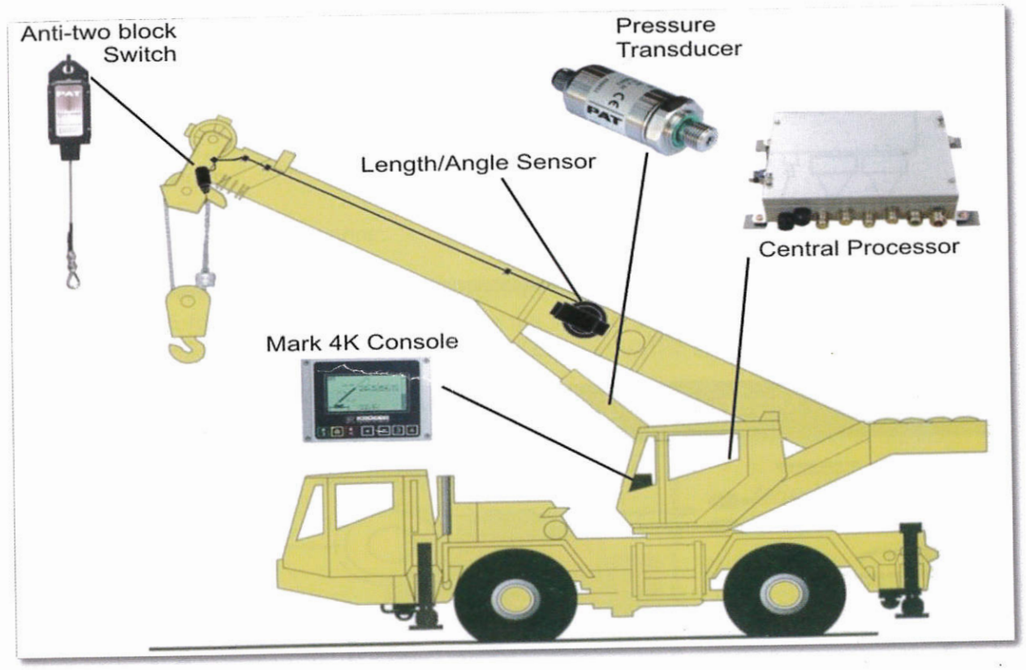
RCI, SLI or ASLI

This is a device which is installed on mobile cranes to alert the operator if the lift is exceeding the safe operating range of the machinery. In some cases, the device will physically lock the machinery in circumstances it determines to be unsafe.

SLI systems are usually composed of a microprocessor connected to various sensors on the crane itself. The SLI measures the angle and extension of the boom along with the load weight and compares this with the manufacturer's specifications to determine if the lift is safe.

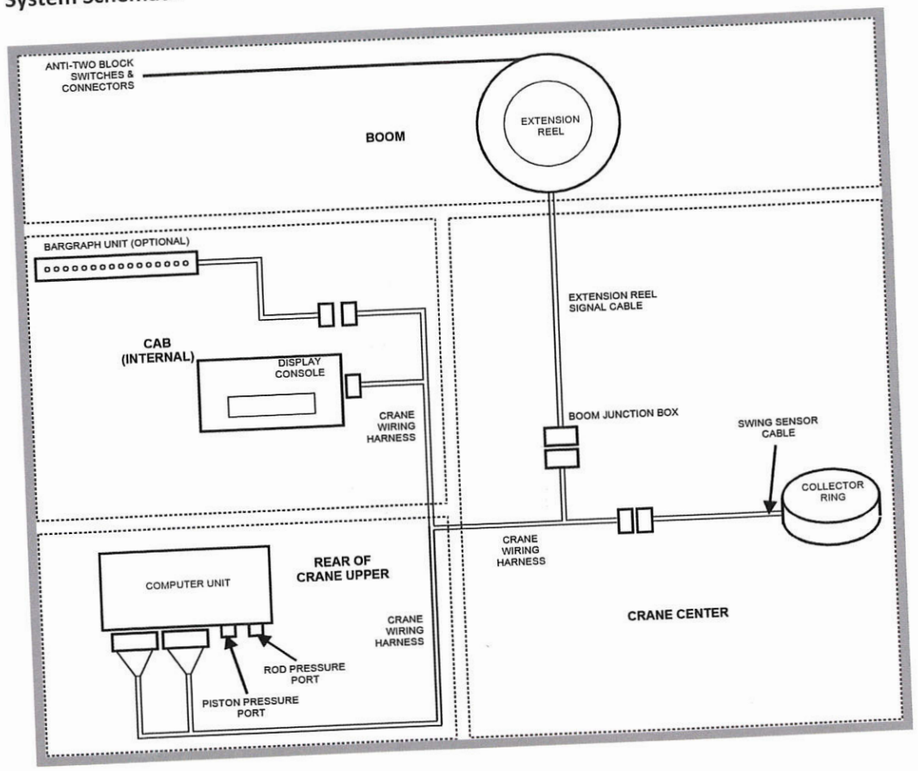
A safe load indicator has the capability of detecting the angle, weight of load lifted, and ground radius of any lifting device. It controls the lifting equipment to the level that it tries to keep the machinery functioning as per the manufacturer's suggested safety charts.

The crane is fitted with multiple sensors, for each of the measured parameters, which are then further displayed in the operator's cabin for his benefit.

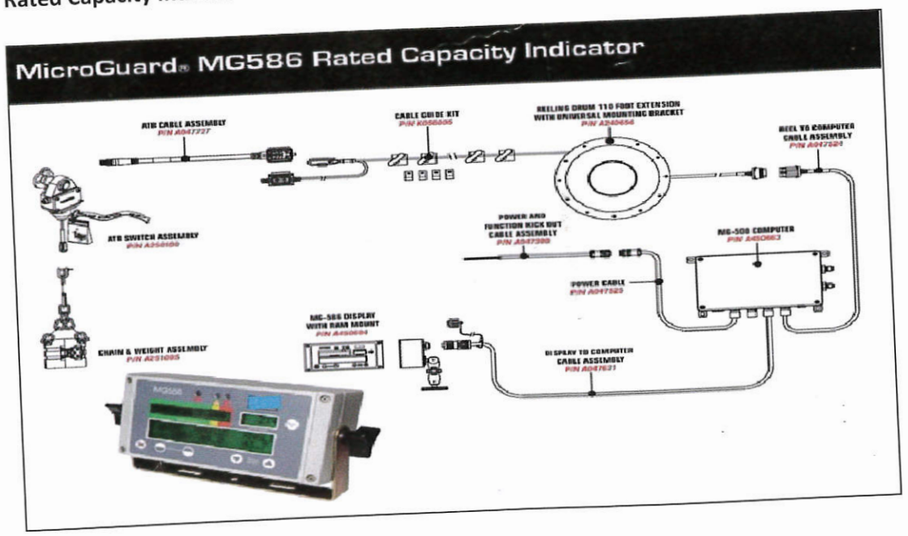


NOTES

System Schematic



Rated Capacity Indicator Assembly



Anti-Two Block Assembly

Part of the Rated Capacity Indicator system is the anti-two block assembly or cut out, this normally consists of a weight wrapped round the dead line of the crane hoist wire and suspended from a micro switch by a chain or small wire.

If a hook block travels past the limit of the chain or wire the weight is lifted and the micro switch is activated to send a signal to the operator cab and cut out any further hoist movement.

Reel Off Cable Drum

Checking the Reel-off Cable Layering:

The extension reel is designed to provide accurate measurement of boom extension when the REELOFF CABLE forms a single flat layer across the surface of the extension reel as the boom is telescoped in and out. Any stacking of the cable will cause extension errors as the boom retracts.

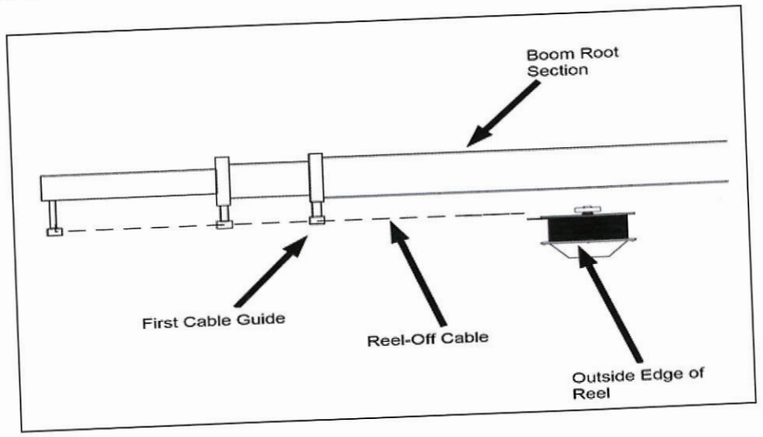
Telescope the boom fully out and then fully in. Check that the reel-off cable forms a flat single layer across the surface of the extension reel, with each successive turn of cable lying next to the last.

Reboss right side - cable 8mm on right

Reel Off Cable

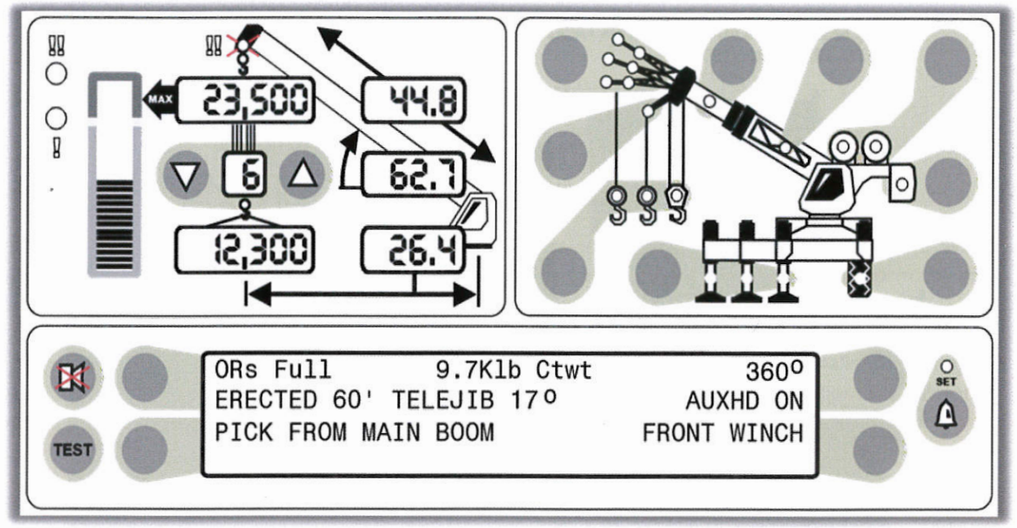
If any stacking or build-up of the cable occurs, make sure that the first cable guide at the top of the boom root section is correctly aligned with the outside edge of the extension reel, as shown in the illustration below.

Clean the reel-off cable; then lubricate it with a silicone oil.



Load Indicator Displays

Example Load Indicator



Readings are:- 44.8ft boom length; 26.4ft radius; 62.7° boom angle; 6 falls of rope; max capacity 23,500lbs; actual load 12,300lbs;

Remote Bar Graph Overview

The Remote Bar Graph, shown below, displays the percentage of rated capacity of the crane. The remote bar graph is mounted at the top of the cab front window, in the operator's line of sight. User selectable levels of brightness are available on the device, which is designed for reading under all lighting conditions. Defective remote bar graphs cannot be serviced. The remote bar graph is optional and is not used on all cranes.

Load Indicators

Прибор безопасности АС-АОГ-01м (НПК «АС»)
КС-55717 «Ивановец» (2006 г.)

Прибор безопасности AML M1 (Tadano)
TADANO TR-250 M (1992 г.)

NOTE: this equipment is only an operator aid and should not be expected to replace the training and experience of the operator. It will only perform correctly if given the correct information.

Example of an R.C.I. system

Liebherr cranes have their own crane computer called Liccon – stands for Liebherr Computer Controlling.

Liccon allows crane operator to enter information depending on crane's configuration, so the computer can work out what the crane can safely lift at all possible distances and heights with different boom angles and lengths, basically:

- Every crane configuration entered into the computer is given a unique code
- That code is displayed at the top of the screen
- Crane operator can enter the code directly into the computer for a given crane configuration without going through the steps of adjusting all the data separately

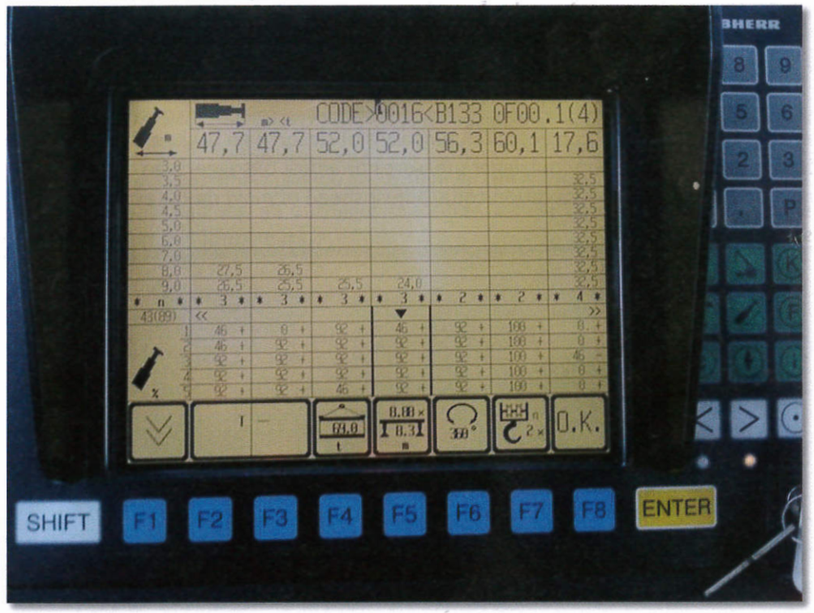
Information entered is:

- Type of boom and boom extension
- Amount of counterweight on crane
- Length of outriggers used
- Slewing area
- Reeving of main hook block

All data is entered via corresponding "F" keys directly under each data value.

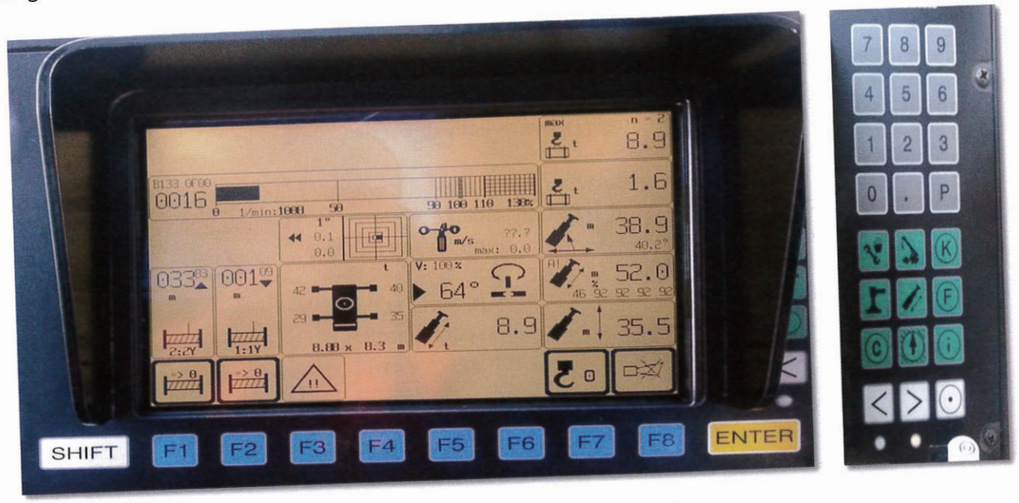
Once all data is entered, basic load chart picture appears, where crane operator can compare SWL with different boom lengths and at different radius. This enables the crane operator to make an informed decision about how much boom to extend for the lifting task.

Load charts displays the configuration code, radius, SWL, boom lengths, number of falls, percentage of each boom section to be used for chosen crane configuration, type of boom and boom extension, amount of counterweight on crane, length of outriggers, slewing range.

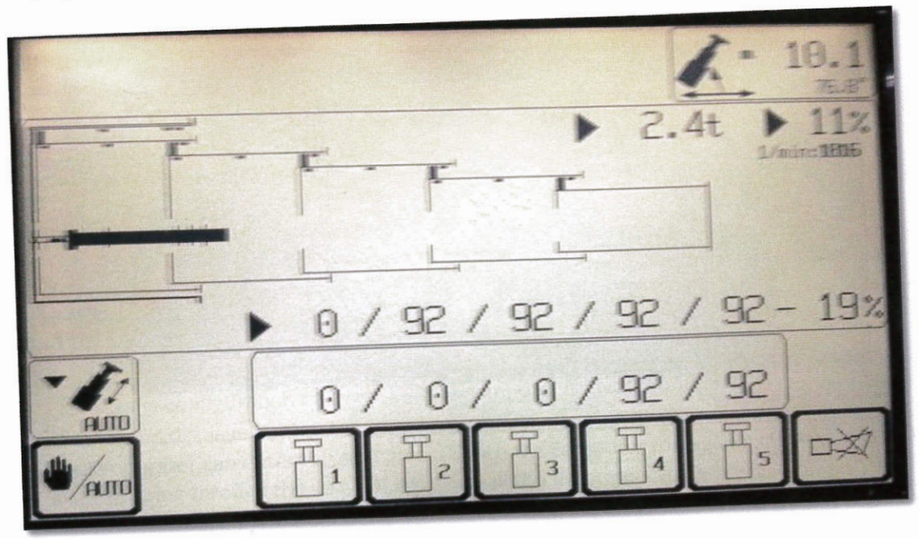


NOTES

Liccon Liebherr computer working screen displays utilization chart, winches and their movements, any warnings, wind speed (if anemometer is installed) SWL and tare weight, radius, boom angle, boom length with current percentages of each section used, possible head height and options. To the right of the screen there is key pad for entering more adjustments.

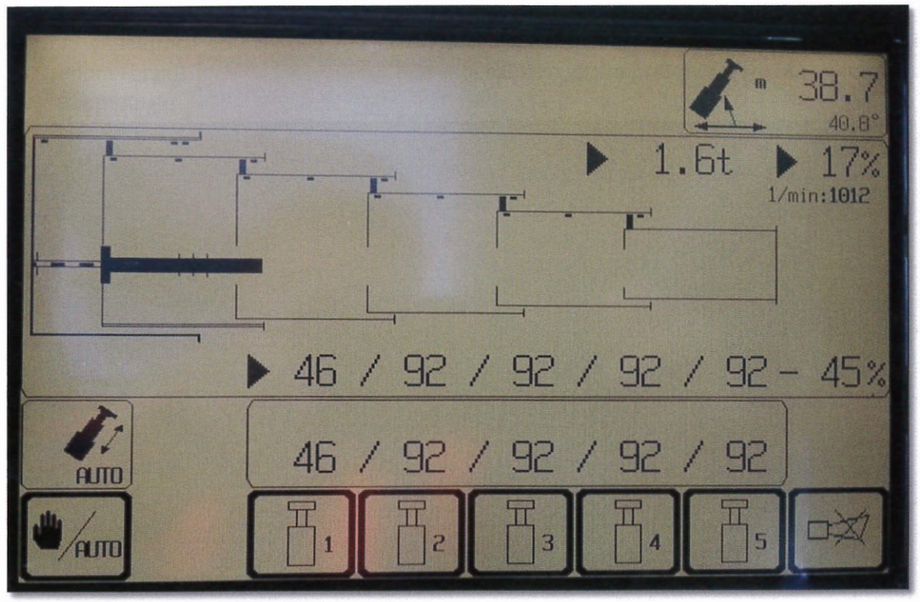


Via the key pad, crane operator can access all functions of Liccon – go back to the setup/load chart screen, retrieve information about outrigger pressures or adjust outriggers, go directly into telescoping mode, enter the configuration code, adjust speed of movements and more.

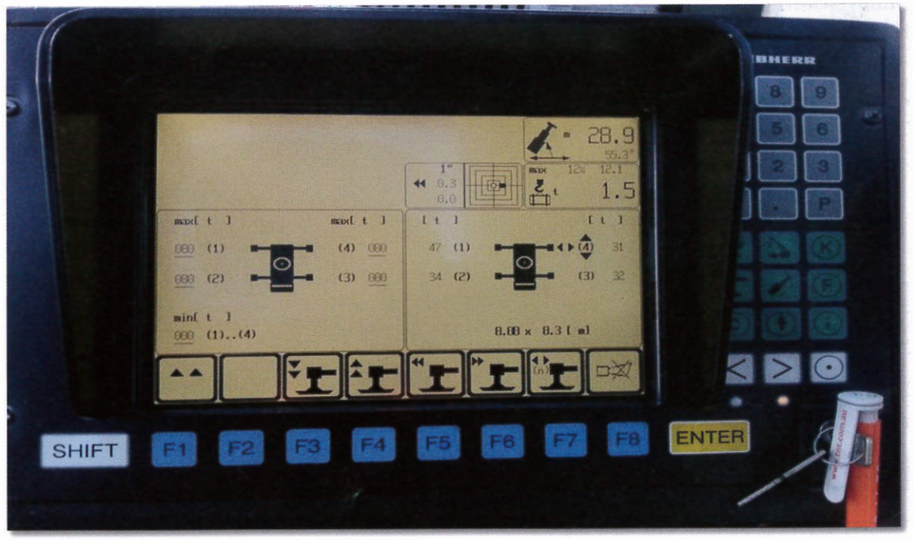


With the telescope button the crane operator can access the telescoping adjustments screen directly.

Liebherr Liccon computer telescoping screen – done. Note the difference between the two pictures.



From the same key pad, crane operator can go straight to the outriggers screen.
Here the crane operator can see all outrigger pressures, adjust outrigger lengths and height, see current crane level and main lifting data.



Another important function that can be accessed from key pad is adjusting the maximum speed of crane motions.

Besides entering the maximum speed, in this screen winches can also be completely blocked to prevent undesired movements made by mistake.

Maximum speed can also be altered via joystick directly – by pressing "rabbit" button. After pressing the high speed button, change is displayed on main working screen with rabbit symbol:

Load Indicators

Although all the systems shown display the same basic information i.e.

- Boom Length
- Boom Angle
- Radius
- Capacity
- Actual Load

They do require some input from the operator.

Unforeseen and even tragic results can result from inputting the wrong code, number of falls or amount of counterweight

Full Boom and Fly Jib Test

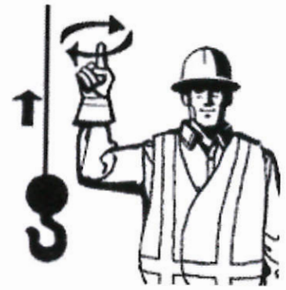
NOTES

©LEEA Academy – MCE – Step Notes – July 2015 – v1.4

The following images show a 200t mobile crane where the experienced operator had removed counterweights preparatory to travel and, when asked to extend the boom, forgot that he had done this and did not change the counterweight settings on the RCI.

NOTES

Crane Signals

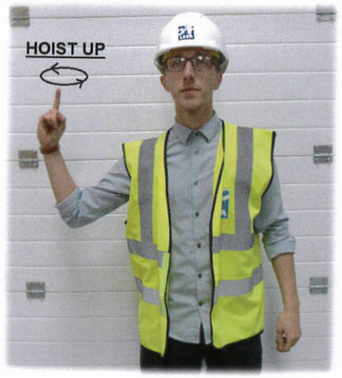


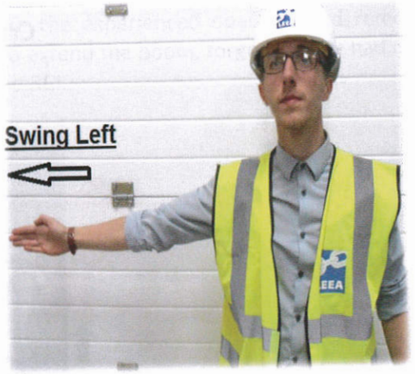
Crane Signals

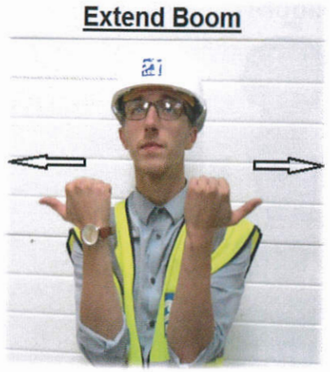
Confusion can be caused by riggers, banksmen, or labourers working with cranes who have evolved their own method of signalling - often in unconventional ways with various body parts including feet or heads!

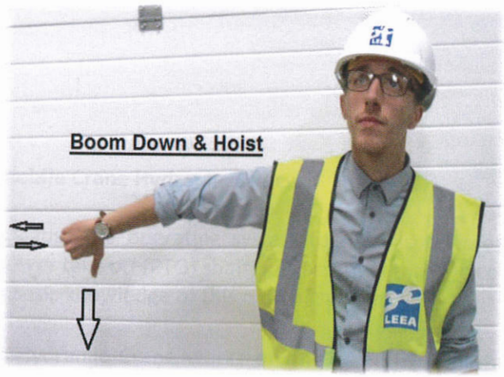
To counter this an internationally recognised set of signals, as per these illustrated in BS 7121-1, should be used by all competent persons when performing a thorough examination or test on a mobile crane.

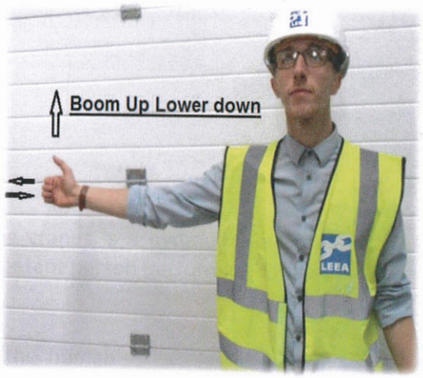
Examples of these signals are shown in the images that follow.





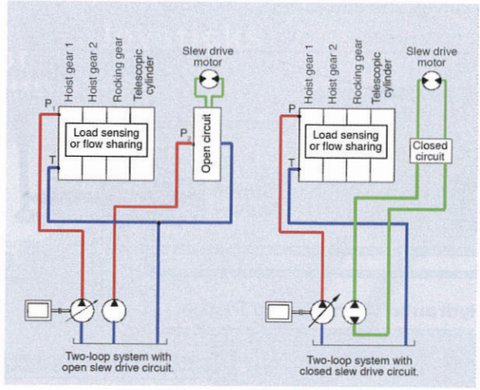






©LEEA Academy – MCE – Step Notes – July 2015 – v1.4

NOTES



Mobile Crane Hydraulic Systems

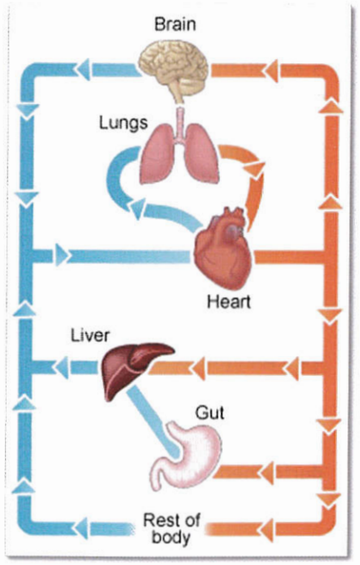
Because the operating system for mobile telescoping cranes is a hydraulic pump powered by a power take off (PTO) shaft, it is essential that the competent person performing the examination has a basic knowledge of this type of system.

A Hydraulic Crane works on the same principle as the human body as far as fluid, circulation and pressure are concerned.

The Heart is a pump that pumps blood round the system.
The hydraulic oil in the system is like the human blood and if we don't get enough blood circulating through the system, the system will get weak and ultimately break down (flow).
If our blood pressure is not correct, we will also be weak and tired (pressure).

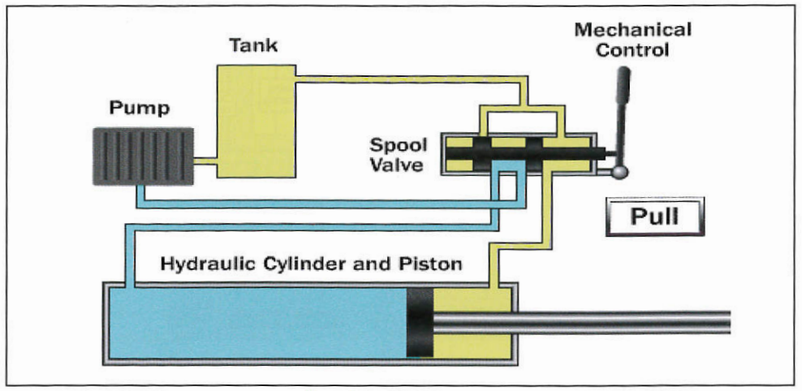
The crane also has a brain, (spool valves) the same as the human body, which gives it instructions on what part of the body to move.

If we want to run or exercise vigorously our heart pumps faster to allow us to do this (accelerator).



Mobile Crane systems have the following same basic components of any hydraulic system:

- A power source
- A hydraulic oil reservoir
- A pump
- Directional control valves and actuators



Mobile Crane.

Most hydraulic truck cranes use two-gear pumps that have a pair of inter-meshing gears to pressurize the hydraulic oil.

When pressure needs to increase, the operator pushes the foot throttle to run the pump faster.

Boom Truck
In a gear pump, the only way to get high pressure is to run the engine at full power.

EXAMPLE:
A 70-ton hydraulic truck crane uses a 12.7-L diesel engine that generates up to 365 horsepower. The engine is connected to three two-gear pumps, including:

Main pump - This pump operates the piston rod that raises and lowers the boom, as well as the hydraulic telescoping sections that extend the boom. The main pump is able to generate 3,500 pounds per square inch (psi) of pressure. It generates more pressure than the other two pumps because it is responsible for moving much more weight.

Pilot pressure counterweight pump - A hydraulic truck crane uses counterweights on the back of the cab to keep it from tipping over. These may be added and removed by a hydraulic lift that has its own pump. The counterweight gear pump can generate 1,400 psi.

Steering/outrigger pump - One pump controls the steering and the outriggers. The outriggers are used to stabilize the truck during lifting operations. Because steering and outrigger operation are not performed simultaneously, they can run off of the same pump. This pump generates 1,600 psi.

Mobile Crane Operator Cab

A mobile crane has two basic types of controls for manoeuvring a load:

Joysticks - There are two joysticks in the cab.

Most Mobile crane joysticks are configured so that one will control Hoist and Boom motions and the other will control boom telescoping and swing motions.

Foot pedals - One pedal controls the amount of pressure being generated by the pump, but ancillary pedals can be responsible for retracting and extending the telescoping sections of the boom.

Joy sticks and **foot pedals** are connected to hydraulic hoses that connect various hydraulic rams to spool valves.

The spool valve is connected to the hydraulic pump via a third hose that is placed between the two hoses that run from the spool valve to the hydraulic ram.

When a joystick is pushed in one direction, it causes the valve to shut off one of the hydraulic hoses leading to the ram and open the other.

NOTES

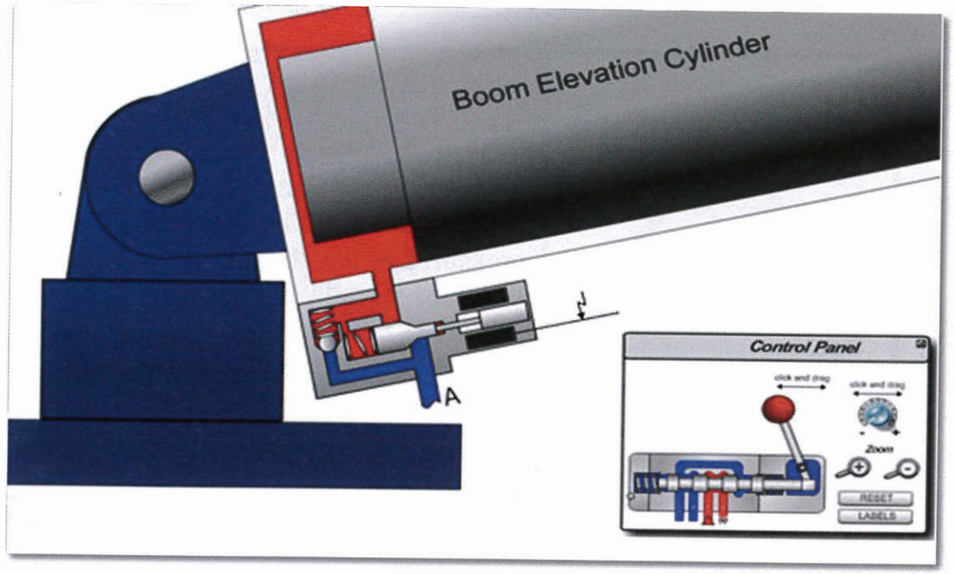
Some older style cranes may still be equipped with mechanical levers that use direct linkages to spool banks rather than electronic signals.

A Hydraulic circuit:

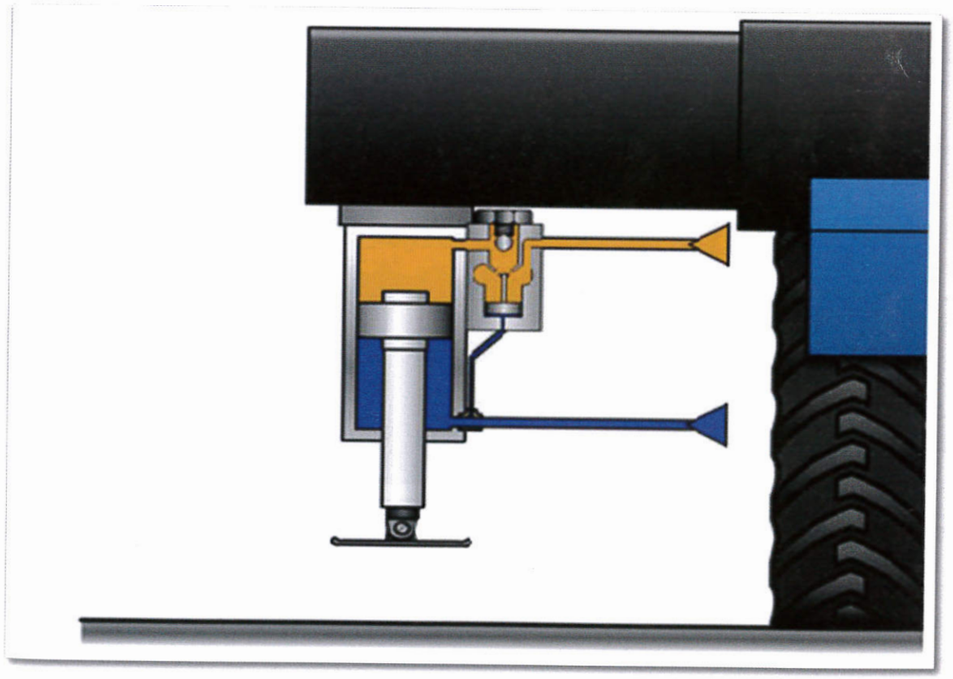
- Receives mechanical power in the form of a rotating shaft. (PTO – Power Take Off)
- Converts to hydraulic power with the pump
- Is directed with a valve to either a cylinder or a motor
- Is then converted back to mechanical power
- Motions then activated; hoist, boom, swing, telescoping

NOTES

Boom Circuit

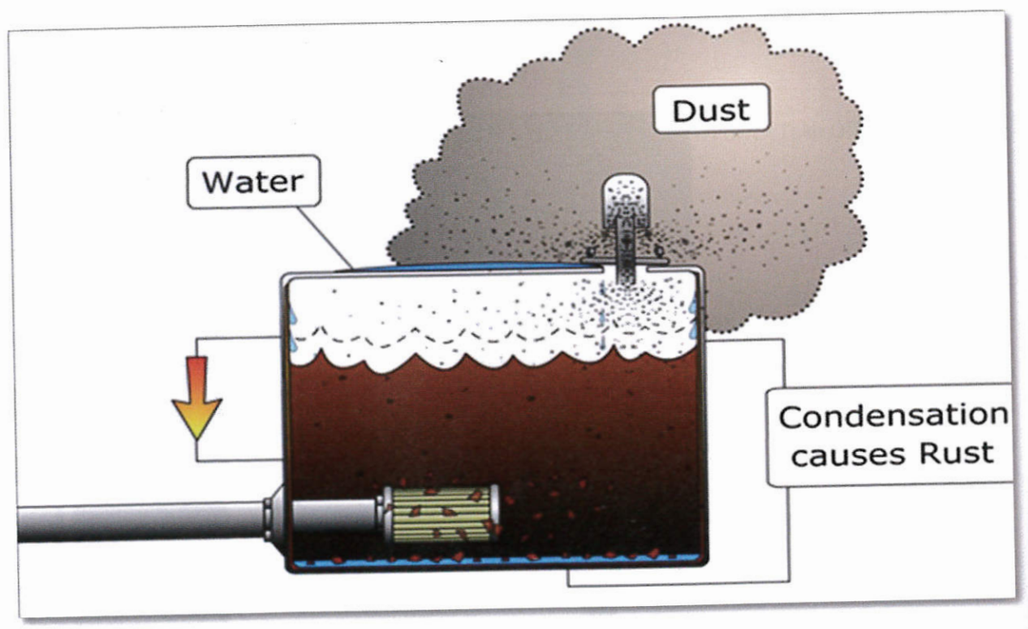


Outriggers



Safety! Anything under pressure is a potential hazard

Maintenance Issues



Thorough Examination of Mobile Cranes

Thorough Examination of Mobile Cranes

Modern Mobile Telescopic Cranes are complex pieces of equipment which are constantly developing and a competent person should take every opportunity to keep up to date with advancements.

Manufacturer's publicity releases can be quite helpful in providing updated product information

To ensure that a Thorough Examination is carried out methodically the following steps should be observed:

- Carry out examination of the mobile crane chassis/carrier as per BS 7121-2-1:2012 and BS 7121-2-3:2012
- Carry out examination of the mobile crane upper works as per BS 7121-2- 1:2012 and BS 7121-2-3:2012
- Perform wire rope examination as per BS.ISO 4309 : 2010 all crane wire rope
- Generate a Report of Thorough Examination as per Schedule 1 of LOLER
- Ensure that all details in the Report of Thorough Examination are correct

Thorough Examination of Crane Carrier/Chassis

NOTES

Mobile cranes are currently exempt from the Goods Vehicles (Licensing and Operators) Regulations 1995 (as amended) [15], and the Goods Vehicles (Plating and Testing) Regulations 1988 (as amended) [16].

However:
The Road Vehicles (Construction and Use) Regulations 1986 (as amended) [8] Regulation 100 requires that mobile cranes should:

"At all times be in such condition… that no danger is caused or is likely to be caused to any person in or on the vehicle or on a road"

To ensure this, the following should be checked as a minimum requirement:

- Manufacturer's information plate/label, including CE mark Serial, model, year;
- Lights
  - Headlights
  - Sidelights
  - warning lights
  - Indicators
  - Hazards
- Windscreen wipers/washers
- Registration plate
- Hook attachment point
- Steering
  - Steering should be checked to ensure all wheels are turning in correct direction; this is essential with all or multi-wheel steering. This can be done when crane is manoeuvring into position.
- Brakes
  - To check brakes, ask the operator to:-
    - Ensure gear is in neutral and apply handbrake put in first gear and check to see if crane moves.
    - Press footbrake and release handbrake, check to see if crane moves.
    - Put gear in neutral and apply handbrake.
  - The competent person should position himself with a rear view of crane and get operator to apply footbrake;
    - Check brake lights.

©LEEA Academy – MCE – Step Notes – July 2015 – v1.4

- Reverse alarm/lights
  - Ask operator to select reverse gear
    - check reverse alarm and light(s)

- Operator Cab on Carrier
  - Check housekeeping
  - Control identification
  - Seat
  - Safety belt
  - Condition of pedals

- Tyres and wheels
  - Tyre Pressure is important for any crane, but it is essential that it be correct for cranes that have free on rubber (free on wheels) duties

- Automatic carrier levelling/ suspension system

- Hydraulic tank and Systems
  - Check hydraulic tank oil level **before** setting up crane
  - Ensure cap is fitted to tank
  - If accessible check filter
  - Once P.T.O is engaged listen for any adverse sounds from the pump during operation
  - Check all pipes, flexible hoses and connections for leaks
  - Check all telescoping ram seals for leakage

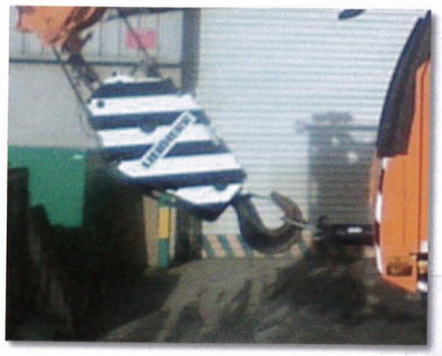
- Outriggers Beams
  - Visually examine outrigger beams to ensure they are level
    - beams that are offset could indicate that shims need adding or replacing
  - Examine all visible hoses, connections and pipes for cracks, deformation or leaks
  - If access holes are available on side of beam, remove covers and check interior of beam for hydraulic oil sitting there; this can indicate a leak in the system
  - Ensure locking holes line up and that lock pins are available and can be inserted

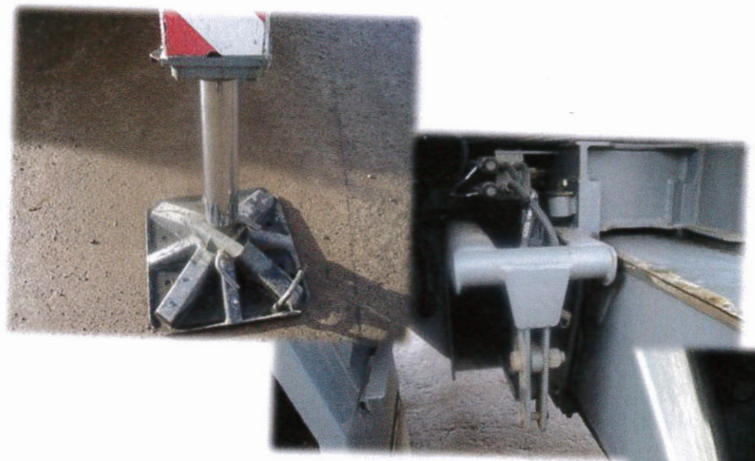
- Outrigger Jacks and Pads
  - Check that jack ram is dry, a film of oil can indicate the seal is leaking and it will get progressively worse.
    - Use a torch if necessary and check outer seal cover
  - Ensure pads are undamaged and lock pins are available and can be easily fitted

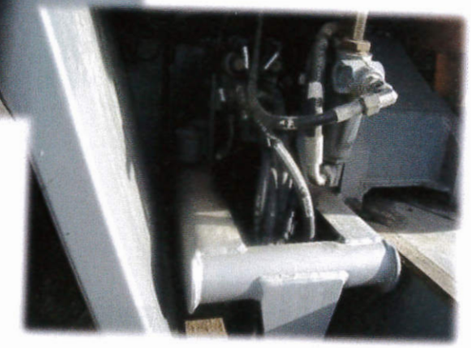
- Outrigger Controls and Crane Level Gauges

- Drive Shaft
  - Visually exam to ensure shaft is attached correctly
  - If visible check P.T.O. shaft is engaged

- Access Ladders








GROVE
VOGEL
Zentral-
Schmierung

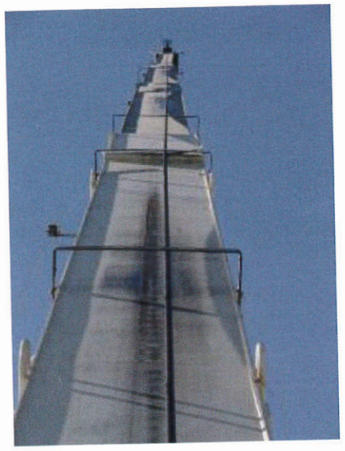
In summary, checks should include but not be restricted to:

- Drivers Cab
- Lights
- Brakes
- Gears
- Reverse Alarm
- Hydraulic tank oil level (should be checked before any hydraulic functions are operated)
- Fuel Tank
- Tyres and Pressures
- Suspension
- Drive shaft
- Power take off (PTO) is engaged
- Outrigger jacks, pads and beams
- All pipework and connections including flexible and rigid hoses and holding valves
- Hydraulic cylinders
- Access ladders
- All bolts pins and fastenings
- Superstructure for cracks or damage

NOTES

©LEEA Academy – MCE – Step Notes – July 2015 – v1.4

Thorough Examination of
Mobile Telescoping Crane Superstructure



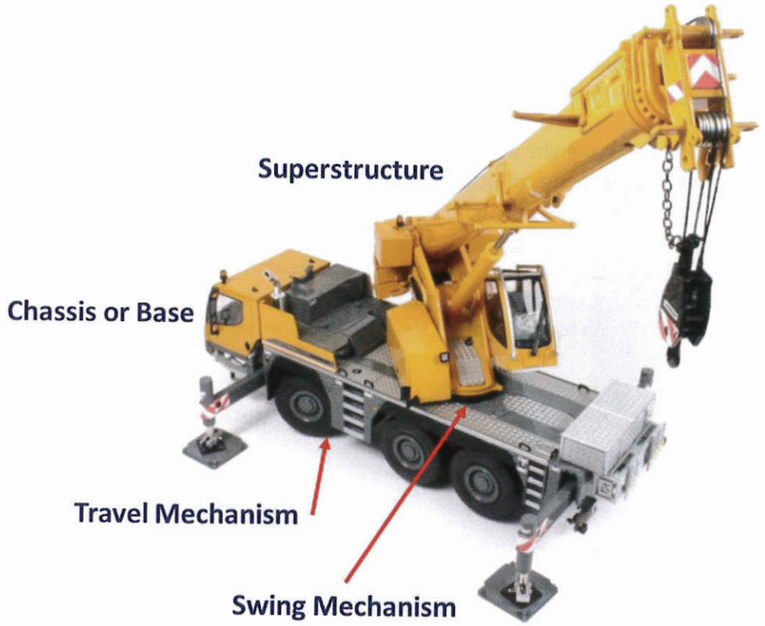
Mobile Telescoping Crane Superstructure

Although important in its own right, the function of the crane carrier is to transport the crane superstructure to its operational site.

Once there the crane superstructure becomes the star of the show, and it is crucial that it performs as per the manufacturers specifications and works safely and efficiently.

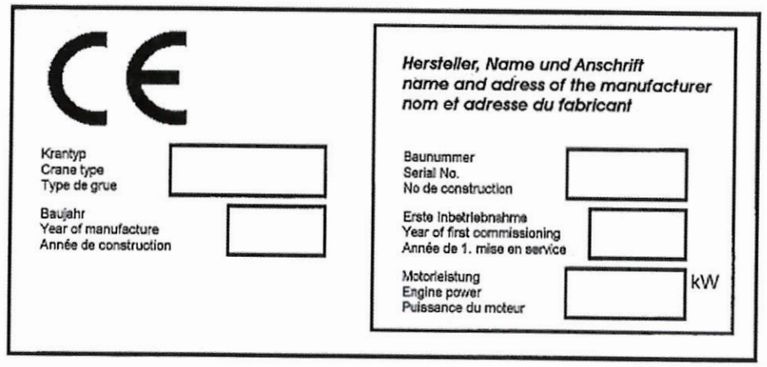
To this end it is required to perform the following checks as a **minimum**:

- Manufacturers plate: serial number; model; year of manufacture
- Counterweight and counterweight attachment system
- Operator Cab
- RCIs
- Boom cylinder
- Boom
- Boom telescoping sections
- Boom telescoping hose recoil drum
- Boom length/angle sensor recoil drum and cable
- Boom wear pads
- Winches
- Wire rope
- Wire rope anchors/terminations
- Hook block including sheaves
- Anti two block mechanism



Hoist Mechanism
- Jib
- Boom
- Sheaves
- Load Blocks
- Hook
- Rope
- Counterweights
- Winch
- Cab

Information for the written report can be found on the manufacturer's plate.



NOTES

Counterweights

Counterweights are essential to enable the crane to perform its duties. Fitting the counterweights as detailed in the load charts will ensure that the crane is working to its maximum efficiency.

It is necessary to observe the counterweight attachment rams while they are deploying to ensure that they extend fully and that they engage and lock.

Counterweights must be observed when being fitted to ensure that both rams deploy correctly and both activate (rotate) to lock.

Counterweight and Attachment

By closely observing the hydraulic rams for the counterweight we can ensure that each ram is extending fully and is locking in position before lifting the counterweight.

Check the operator's system display to ensure it is showing the sequence of moves.

Check the hydraulic rams and attachments for leaks, loose connections or damage.

Operator Cab

As the competent person, you are looking to ensure that:

- The housekeeping is good
- The seat is in good condition
- There are no loose wires or panels
- The RCI is fully functional and matches the load charts
- The load charts are present in the operator cab
- There are no obstructions to the operators view
- The glass in the cab is all safety glass and has not been replaced by plastic
- All control functions and switches are clearly marked and that they perform as marked
- The swing brake engages and holds
- The tilt cab mechanism if applicable operates
- Lights and windscreen wipers function correctly
- AC/Heater controls operate correctly

Speak to the operator or technician - they can tell you if there have been problems with the crane. Sometimes they will tell you more than they will report to their manager or maintenance colleague.

NOTES

Crane Controls

Superstructure Operator Cab

NOTES

Rated Capacity Indicator

To verify that the RCI is operating correctly the following steps may be taken:

- Check Rated Capacity (load) charts
- Pick a configuration and request operator to set boom length accordingly.
- Boom out to a selected radius/angle
- Verify that capacity shown on RCI is same as shown in Rated Capacity Chart
- Physically measure radius to verify it matches RCI
- Attach a known load, or lift a load using calibrated load cell and verify RCI
- Repeat for at least two to three different radii

NOTES

Cab Roof Located LMI Indicator (Bar graph)

Cab Mounted Load Chart

TADANO TR-250M-5 HYDRAULIC ROUGH TERRAIN CRANE
TOTAL RATED LOAD IN KILOGRAMS
THIS DOCUMENT SHOULD BE READ IN CONJUNCTION WITH THE A.M.L.

1. OUTRIGGERS FULLY EXTENDED (6.3m) - 360°

A (m) / B (m)	9.5m	16.5m	23.5m	30.5m	C / D / E	8.0m 5°	8.0m 25°	8.0m 45°	13.0m 5°	13.0m 25°	13.0m 45°
2.5	25.0	19.0	12.5		83°	3.0	2.1	1.6	2.0	1.2	0.8
3.0	25.0	19.0	12.5	7.0	76°	3.0	2.1	1.6	2.0	1.2	0.8
3.5	25.0	19.0	12.5	7.0	72°	3.0	2.1	1.6	1.75	1.1	0.8
4.0	23.0	19.0	12.5	7.0	70°	2.8	2.1	1.6	1.65	1.05	0.8
4.5	21.2	18.0	12.5	7.0	65°	2.35	1.8	1.5	1.4	0.95	0.78
5.0	19.4	16.7	12.5	7.0	60°	2.0	1.55	1.35	1.2	0.9	0.75
5.5	17.8	15.6	11.75	7.0	55°	1.45	1.35	1.2	1.05	0.85	0.74
6.0	16.3	14.6	11.1	7.0	50°	1.05	1.0	0.95	0.85	0.75	0.7
6.5	15.1	13.8	10.5	7.0	45°	0.75	0.7	0.7	0.6	0.55	0.55
7.0	13.7	13.0	10.0	7.0	40°	0.55	0.5		0.4	0.4	
8.0		10.55	9.0	7.0	35°	0.38	0.35				
9.0		8.65	8.2	6.3							
10.0		7.05	7.3	5.8							
11.0		5.85	6.4	5.3							
12.0		4.95	5.5	4.9							
13.0		4.2	4.75	4.5							
14.0		3.6	4.1	4.15							
15.0			3.6	3.8							
16.0			3.15	3.45							
17.0			2.8	3.05							
18.0			2.45	2.7							
19.0			2.15	2.45							
20.0			1.9	2.2							
21.0			1.7	1.95							
22.0				1.75							
24.0				1.4							
26.0				1.15							
28.0				0.95							

A = Boom Length
B = Working Radius
C = Jib Length
D = Jib Offset
E = Boom Angle

Extended Width	Middle Extended (5.0m)	Middle Extended (3.6m)	Minimum Extended
Angle a°	25	15	5

Swing Gear Mechanism

If internal gearing is used for the swing mechanism the only way, short of dismantling the assembly, to exam is by visual and audible observation.

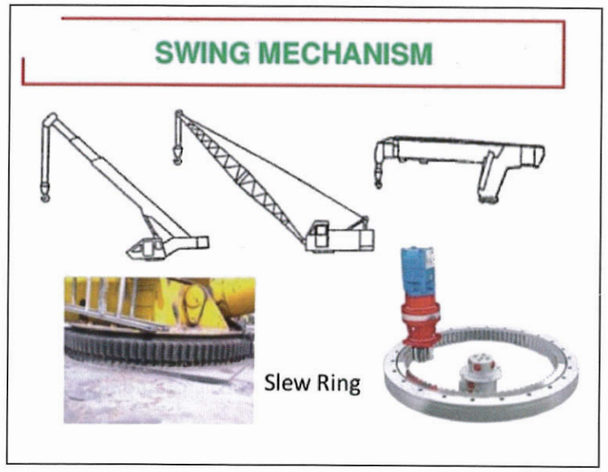
If swing drive is external it is relatively easy to examine. Points to consider are:

- Worn gear teeth
- Noisy drive motor
- Loose bolts

If excessive movement is noted when the crane is under load, then measurements can be taken using a DTI and compared with manufacturers readings if available.

Watch the crane whilst slewing and note if there is any discernible rocking movement that would indicate loose bolts or worn gearing, listen for any grinding of the drive motor.

Dial test indicator measurements are a last resort that is seldom utilised, and, unless previous data is available, are non-conclusive. However - it is another tool we can use.



NOTES

All Mobile telescoping Cranes must be fitted with a Positive Swing Lock to ensure that the boom cannot swing when in the locked position. This is essential if the crane is to be moved with the boom in the upright position.

Also while travelling with the boom on the rest it ensures the boom cannot rotate unexpectedly, (there have been cases of booms rotating whilst travelling and causing accidents to other road users).

The example shown is just one type there are many more different types.

Mobile cranes are fitted with a **central rotary distributor** to allow the crane to rotate through a 360° arc.

The rotational coupling for hydraulics and electrical connections allows all crane actions to be performed normally even when the cab is rotated.

Ensure that all fastenings are secure all hydraulic hose and connections are not leaking and no visible wires are broken.

On older cranes a safety chain was attached to ensure the coupling rotated with the crane in case securing bolts sheared.

Telescopic Booms

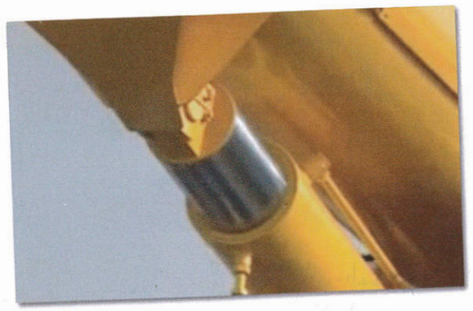
The telescopic boom on a mobile telescoping crane is attached to the swivel structure by boom pins and raised by a one or two hydraulic ram system.

Automatic Lubrication System

- Check upper and lower boom pins paying particular attention to boom derrick ram attachment pin
- Failure to ensure locking pins are in place can cause the pin to work loose resulting in boom collapse
- Check all hydraulic connections for loose fittings and leaks
- Observe derrick piston(s) while boom is being lifted if oil is detected on piston it can indicate that the seal is beginning to leak
- Operate boom up and down to clarify if there is actually a leak

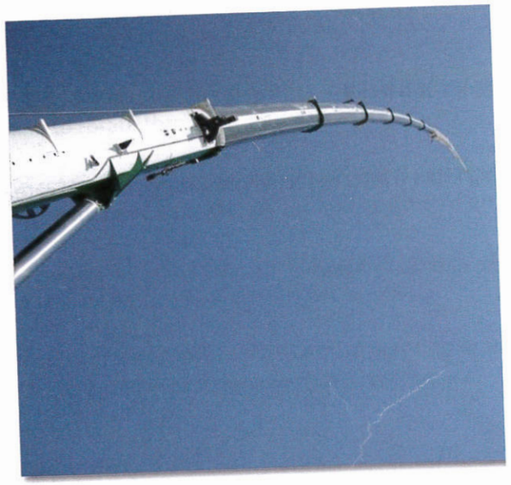
NOTES

Single cylinder boom derrick ram



Telescopic Boom Flexing

When fully extended and under load modern booms can flex quite extensively, this is normal and allowable. However if there is a downward bend whilst not under load it may indicate that the bottom and top wear pads may need adjustment or replacement.



Wear pad adjustment or replacement is a commonly reported action.

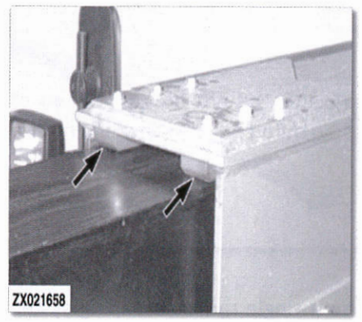
Crane owners and mechanics don't like to hear it as it sometimes means pulling the boom to replace the inner set of wear pads.

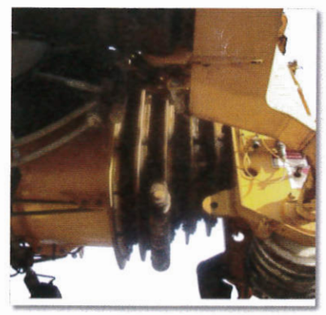
NOTES

Looking at a boom like this indicates that the side wear pads on the outer section of the boom require serious adjustment or replacement.

A simple method of checking to see if boom wear pads require replacing or adjustment is to fully extend the boom and get the operator to swing a short distance then stop suddenly, any movement in the boom can then be observed. all boom moves it is acceptable.

If the whole boom moves, this is expected and acceptable, if individual sections move back and forward adjustment or replacement of the wear pads in these sections are indicated.

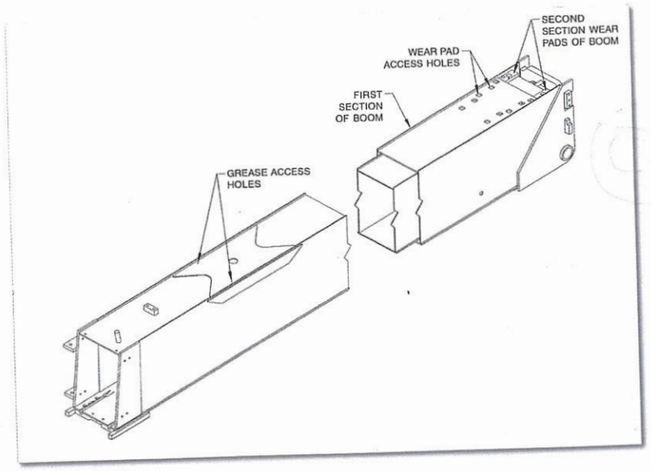




If all sections of boom's moves at same time to side ways it will be acceptable.

If Sections moves likes ~~Snake~~ Snakes it will not acceptable.

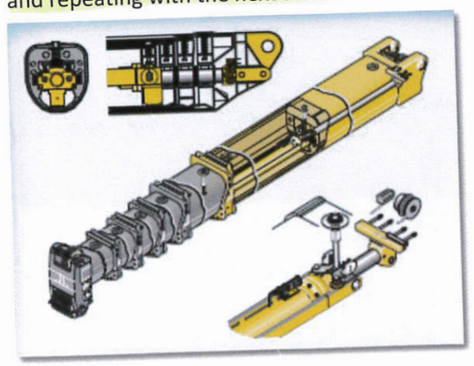
Boom Wear Pads

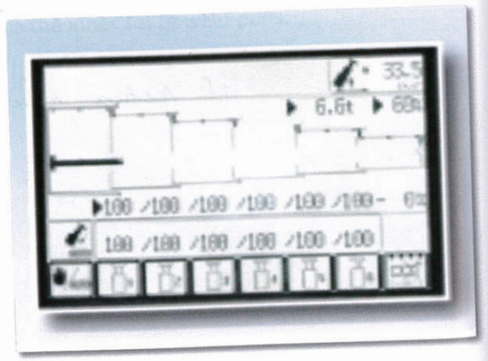


Telescoping Systems

Older cranes may use a multi ram system for telescoping the boom and in these cases all or most of the boom sections will move at the same time.

The modern tendency is to utilise a single ram telescoping system which will telescope the boom section a specific percentage of movement and then lock it in place before returning to its start point and repeating with the next section.





Because the telescoping rams are internal it is not always possible to examine them, however some cranes have viewports at the base of the boom that allows a person to observe the rams closing.

If there is no option for seeing the ram, by examining the boom base for signs of oil we can at least determine whether there are any hydraulic leaks.

in multi Ram.

The condition of the hydraulic hoses on the recoil drum is also a clue as to whether there are any leaks.

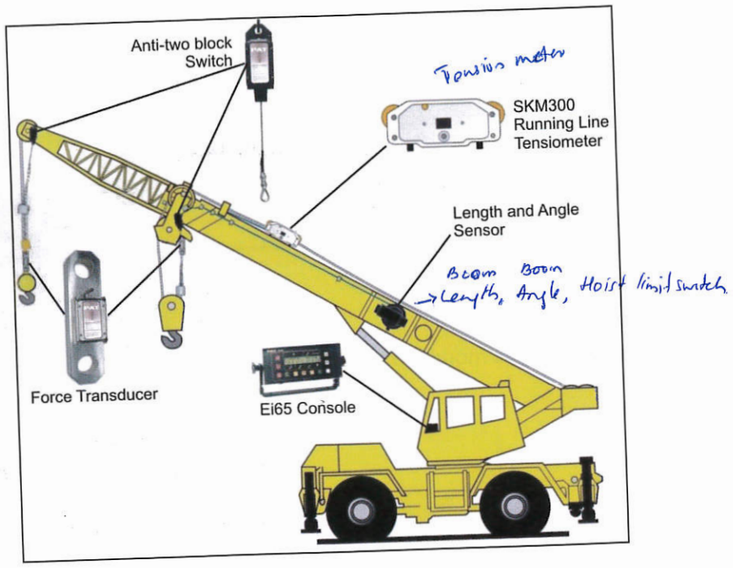
Single stage ram systems have to be checked on the R.C.I. display to ascertain whether they are operating to their correct configuration and whether the boom pin locking system is functioning.

©LEEA Academy – MCE – Step Notes – July 2015 – v1.4

Boom Furniture

Boom furniture may include:

- Boom length/angle sensor
- Cable Reeling Drum
- Limit switches
- Dynamometer
- Anti two block switch



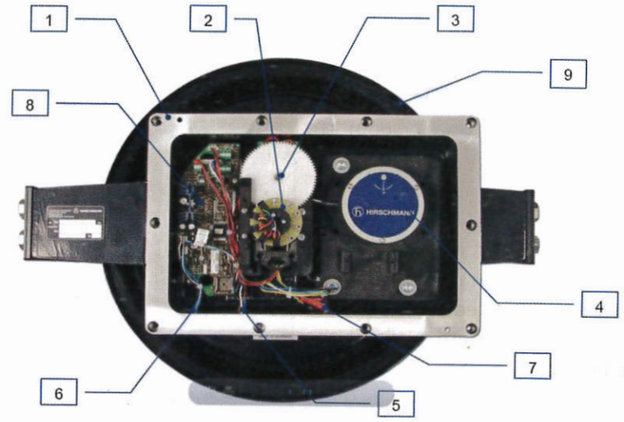
Attachments on booms are critical for the correct working of the Rated Capacity Indicator/Limiter.

Cable Reeling Drum (Power feed to angle sensor and other boom furniture) Ensure that cable is laid flat on drum otherwise false length readings may be obtained

The length of cable is mounted to the tip of the boom and transmits the anti-two block signal.

The number of turns and the diameter of the cable drum controls the length of the uncoiled cable, thus, the telescopic length is determined.

The angle measurement is determined by means of the angle sensor mounted inside the cable reel housing shown below:



#	Part #	SAP #	Qty	Description
1	068-000-110-133	530333	1	Cable Reel Housing W/Drum (No Cable)
1.1*	000-673-030-022	311035	140'	Sensor, Length Cable 3 core (Sold by the foot)
2	068-000-100-063	518748	1	Kit, Slip Ring, 5 Conductor, LWG508
3	068-000-300-024	536166	1	Length Sensor W/Wires
4	064-360-061-551	606700	1	Sensor, Angle, WGC360/1551
5	534306	534306	1	Connector, 5 Socket W/Wires and Plug
6	092-000-060-387	529959	1	Connector, 5 Pin W/Wires and Plug
7	933039100	N/A	1	Connector, 5 Pin Female W/Wires
8	068-000-300-104	534340	1	Board, Terminal
9	068-000-110-011	518654	1	Cable Reel Accy, Housing Drum
10*	005-682-000-001	518697	1	Cable Reel Accy, Housing Cover
11*	068-000-110-038	518681	1	Gear Wheel 75T

Fly jibs and Mounting Structures

The difference between a Fly Jib and a luffing jib is that a fly jib is normally fixed in position during a lift and the main boom moves up and down.

A luffing jib, however, is the main mover in luffing configuration and the main boom is normally set at a fixed length and angle.

When fly jibs are stowed on the side of the crane boom it is critical to ensure that the jib attachment pins are also stowed on the boom to ensure that the correct pins are available to pin the jib to the boom.

The jib attachment lugs should also be examined to ensure they have not been damaged or distorted.

NOTES

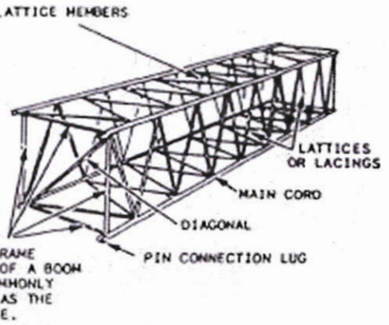
Boom stowed Fly Jib extensions, sometimes known as swing-aways, can be examined even when not erected.

With the main boom in a horizontal position over the side, the length of the boom can be examined.

Because most fly jib extensions are of lattice boom construction, particular attention should be paid to the main cord and lacings.

Check for:

- Damage
- Distortion
- Cracked welds
- Attachment lugs



NOTES

Fly Jib Angles

The angle of the fly jib may be variable from 0°- 60° and may be manually set or have a powered adjustable system in place.

Luffing Jibs

Luffing

Luffing Jibs are used in conditions where it is impractical to boom the main boom up or down, e.g. in close proximity to a building(s) and to offer a greater radius as well as height for the crane.

The luffing jib is attached for extra height and extended to clear all obstructions then it can be 'luffed' up and down covering a larger horizontal area than a fixed boom.

Luffing Jib Examination

Performing an examination of a luffing jib involves more individual parts than a simple fly jib.

The jib itself is also a lattice boom and all cords and lacings require examination for distortion damage and weld cracks.

The 'A' frame, Support frame and all pendants and attachments require thorough examination to detect any distortion, damage weld cracks or missing/unsuitable attachment pins.

This examination is performed at ground level during assembly.

Side Supported Super Lift

Old style superlift normally consisted of additional weights on a platform or wheeled trolley, which then had to be attached to the crane.

Modern technology has evolved a method of supporting the boom by rigging extendable boom side-mounted wings which can increase the crane capacity significantly.

NOTES

Some cranes have the side mounted superlift assembly permanently mounted on others it comes as a separate attachment for road weight restrictions. Shown here is a detachable version.

Boom Tip Sheaves

Examine boom tip sheave assemblies:

- Check for damage to sheaves
- Check sheaves are free running with no play in the bearings
- Ensure rope guides are in place and secured
- Check for wear caused by wire rope rubbing on guide

Severe damage can indicate wire rope may have damage as well.

Boom Tip Sheaves

Sheaves must all be checked for wear.

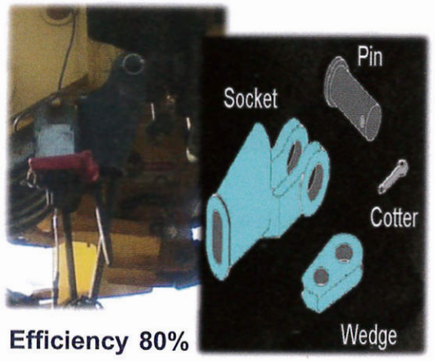
To do this apply a correctly sized sheave gauge and check.

Wire Rope Anchor

The Hoist Wire operates a hook block and to do this the wire is either attached to the hook block or reeved and attached to the boom tip by a wire rope anchor.

It is essential that the correct wire rope anchor is attached and that the wire hoist rope has been inserted correctly and locked in place.

Shown here are two methods currently in use to anchor the wire hoist rope.



Both of these methods are efficient if used correctly, however misuse, or incorrect assembly can cause wire rope damage and subsequent wire rope failure.

Both have drawbacks as detailed below:

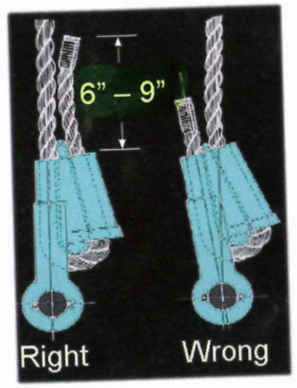
If the wire rope fitted with the manufactured end fitting for the easy assembly anchor gets damaged close to the fitting, it cannot be cut and reused in that fitting.
The wire rope has to be returned to the manufacturer for a replacement fitting or sent to a manufacturer recognised company for re-terminating.

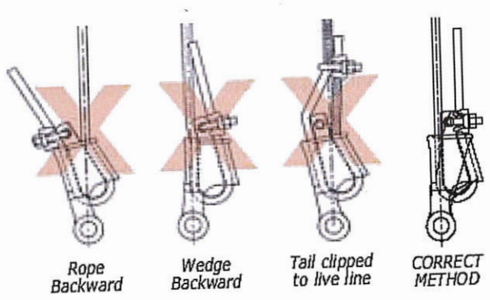
This can be as expensive as buying a new wire rope and often crane owners will just buy new.

With the wedge and socket it is imperative that the socket is of the correct size for the diameter rope being used and that the wedge and socket are a part of the same assembly and not mixed.

Note: Damaged end fittings are sometimes cut off and a suitable wedge and socket assembly fitted to allow the rope to continue in use. This is acceptable if correct assembly is used for the diameter wire and the mounting fittings.

There are a number of ways the wedge and socket can be fitted and shown is the wrong way and the correct way.



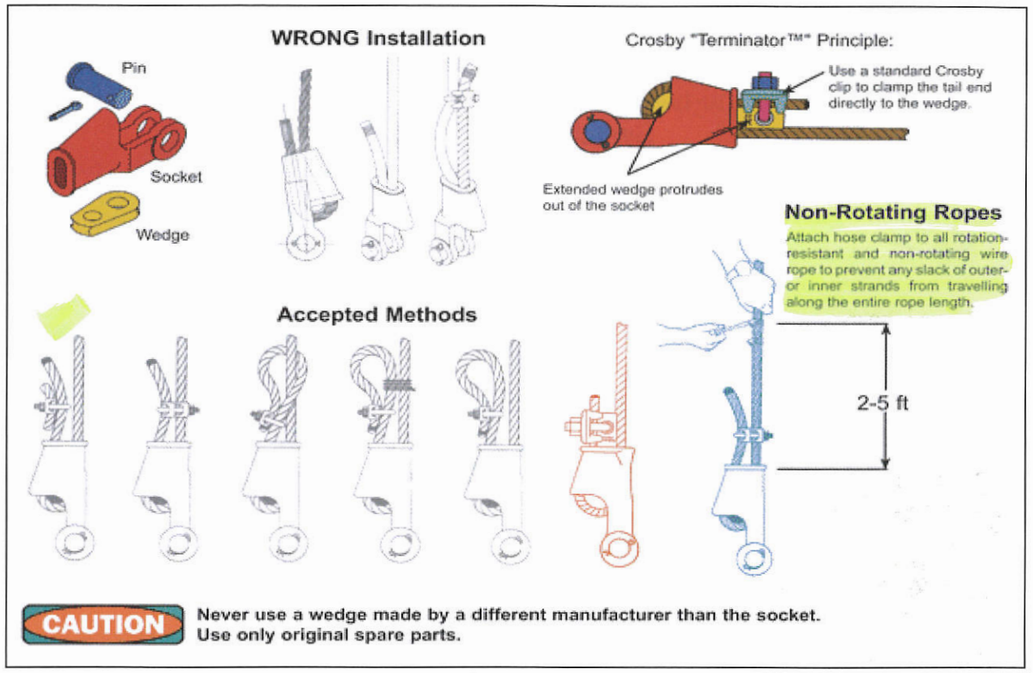


Also shown is a wedge with rope checker holes in it that can be used as a guide to check if the wedge and socket are suitable for the wire rope size.

A common method of wrongly fitting a wedge and socket anchor is to reeve the live end down the slanting side of the wedge and back up the straight side.

This causes the wire rope to sit at an angle and under load the pressure of the load will be concentrated on that small area at the anchor instead of being distributed over the whole diameter of the wire rope.

There are also a number of options for securing the tail:

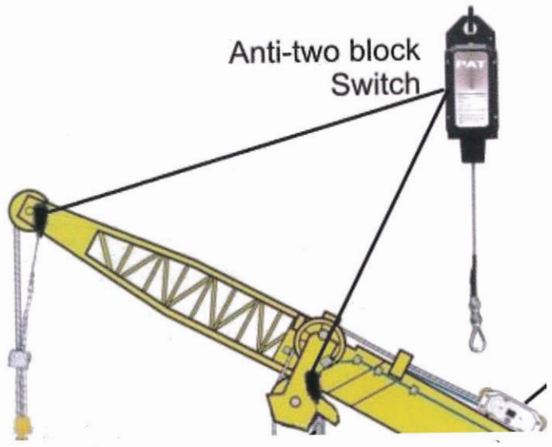


NOTES

Anti Two Block system

The anti two block actuator consists of a weight suspended a measured distance from the boom tip by a chain or wire rope attached to the anti-two block switch.

When the hook block moves the weight up, the switch is activated and sends a signal to the console in the crane cab alerting the operator by a flashing light and an audible alarm.



To test the anti-two block alarm request the operator to raise the hook block until it is just below the suspended weight then slowly raise the hook block until the alarm activates or the weight is raised so that the alarm should activate.

Care must be taken to ensure a block to block incident does not occur.

Ensure that all the assembly and safety pins are present and correctly in place.

Hook Blocks

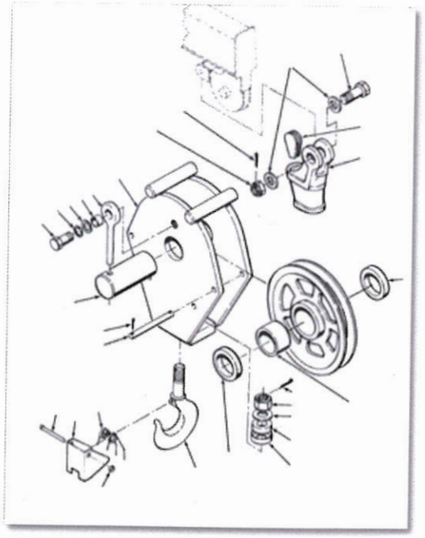
This hook block demonstrates the correct information that should be available on all mobile crane hook blocks.

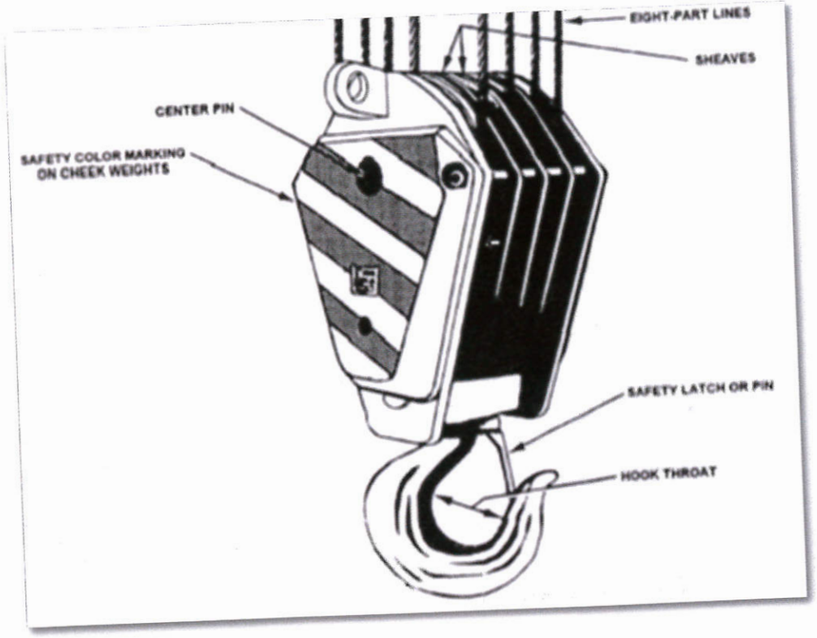
- Capacity or SWL: 25T
- Weight of Hook Block: 360kgs
- Manufacturer's plate (Side Plate)

If manufacturer's plate is not on side of hook, it can often be found on top of the hook.

Examination of the Hook Block should include but not be confined to the following:-

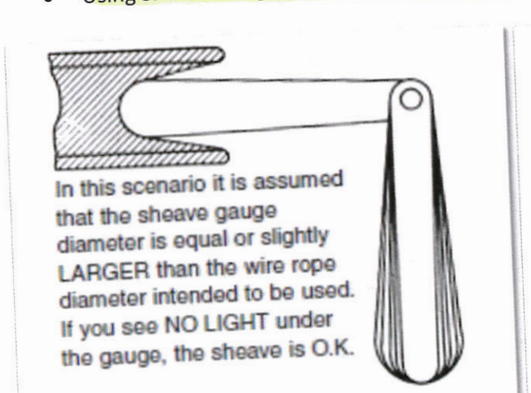
- Check for any visible damage to the hook block
- Check hook to ensure that it swivels in all directions and there is no excessive play in the bearings
- Check Hook Safety Latch and throat opening
- Check manufacturers plate to find Capacity; Hook Weight; Wire Rope diameter
- Confirm wire rope is of the correct diameter

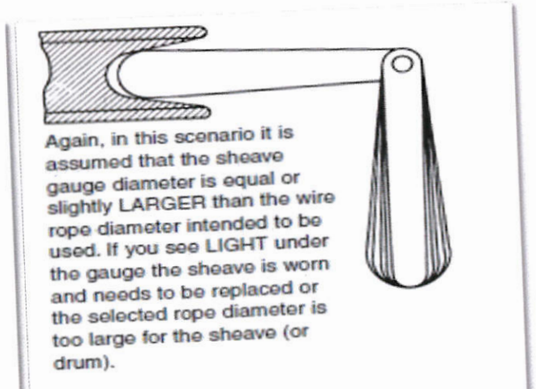


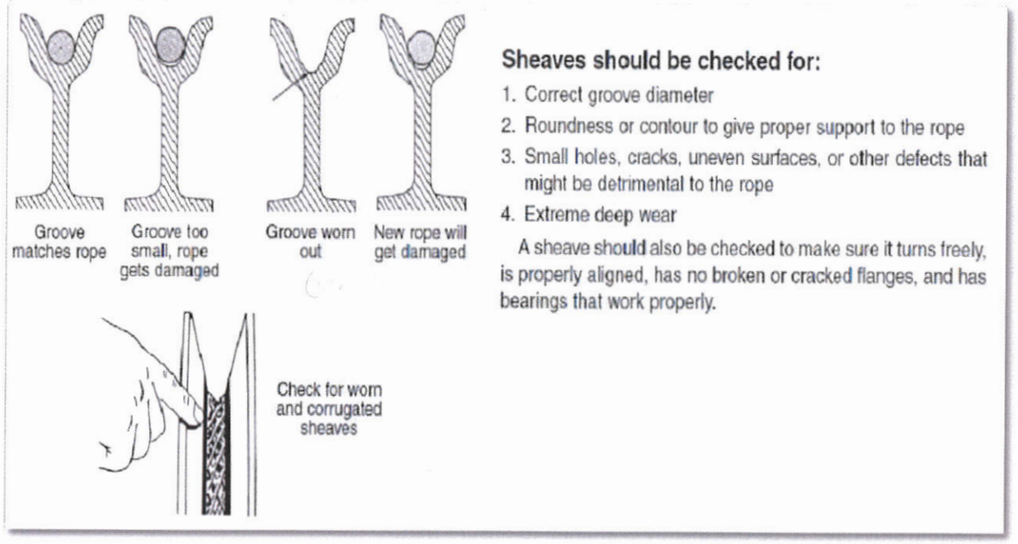


Note: On hook blocks that have a cross swivel it must be checked to ensure it is free and operating correctly.

- Check Block for overall damage
- Check sheaves for damage and free rotation with no excessive side to side movement
- Using Sheave Gauge, check for wear on sheaves





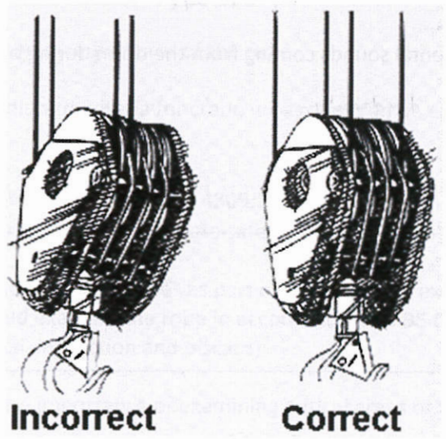


Hook block sheaves must be checked for wear with a sheave gauge, as previously covered in this course.

Hook Block Reeving

During the thorough examination, as the crane operator booms up, check to see that hook block is reeved correctly.

If in doubt consult the load chart or the manufacturer's recommendations.



Hoist Drum Examination

Hoist drums have to be thoroughly examined to ensure that:-

- They are securely fastened to the superstructure
- There is no visible damage to the drum
- The hydraulic hoses and connections are secure and not leaking
- The wire hoist rope is layered on the drum correctly
- The drum rotates correctly
- The hoist brake operates
- There are no detrimental sounds coming from the drum during operation

NOTES

Wire Rope Examination

BS ISO 4309:2010

Cranes — Wire ropes — Care and maintenance, inspection and discard

Crane Wire Ropes

- The wire rope is regarded as an expendable component
- Requires replacement when inspection shows condition has deteriorated and further use would not be suitable for safety reasons

Follow well-established principles, such as those detailed in various standards:

- LEEA COPSULE
- Specific instructions provided by the OEM of the crane or hoist
- Those provided by the manufacturer of the rope

Failure to recognize stated discard criteria for crane wire ropes can be extremely harmful, dangerous and damaging:

- Discard criteria is given in full in **BS ISO 4309:2010**
- Criteria is aimed at retaining an adequate safety margin

When carrying out examination of wire ropes as part of the thorough examination of a mobile crane, the competent person should examine the rope in accordance with **BS ISO 4309:2010**. (Cranes. Wire ropes. Care and maintenance, inspection and discard)

BS ISO 4309:2010 stresses the importance of examining critical areas of the rope such as:

- the termination points of both moving and stationary ropes
- that part of the rope which passes through the block or over sheaves
- in the case of cranes performing a repetitive operation, any part of the rope which lies over sheave(s) while the crane is in a loaded condition
- that part of the rope which lies over a compensating sheave
- any part of the rope which might be subject to abrasion by external features

Rope should always be clean – if this is not possible, consider electromagnetic wire rope inspection method.

Checks should be made for:

- Kinks
- Fatigue
- Wear
- Corrosion
- Other deformation and abnormalities

NOTES

Levels of Corrosion

Beginning of surface oxidation. Can be wiped clean, superficial
Rating: **0% towards discard**

Wires rough to touch, general surface oxidation
Rating: **20% towards discard**

Surface of wire now greatly affected by oxidation
Rating: **60% towards discard**

NOTES

Surface heavily pitted and wires quite slack, gaps between wires
Rating: **Discard immediately**

Broken Wires

- Check entire length of the rope
- Crane wire ropes do not have an indefinite life
- In 6 or 8 strand wire ropes, the wires tend to break at the surface
- In rotation resistant ropes, it is likely that the majority of broken wires will be internal
- One broken wire in a valley may be deterioration, but two or more should be considered grounds for discard
- Termination broken wires indicate high stress and therefore discard, although rope can be shortened if practicable

Heating and Arcing Damage

Ropes that are not normally operated at temperature, but have been **subjected to exceptionally high thermal effects**, externally recognizable by the associated heat colours produced in the steel wires and/or a distinct loss of grease from the rope, **shall be immediately discarded**.

If **two or more wires** have been affected locally, due to **electric arcing**, such as that resulting from incorrectly grounded welding leads, the **rope shall be discarded**. This can occur at the point where the current enters or leaves the rope.

Reduction of rope diameter resulting from core deterioration

Reduction of rope diameter resulting from deterioration of the core can be caused by:

- internal wear and wire indentation
- internal wear caused by friction between individual strands and wires in the rope, particularly when it is subject to bending
- deterioration of a fibre core
- fracture of a steel core
- fracture of internal layers in a rotation-resistant rope

If these factors cause the actual rope diameter to decrease by **3%** of the nominal rope diameter for rotation-resistant ropes, or by **10%** for other ropes, the rope shall be discarded even if no broken wires are visible.

NOTE: *New ropes will normally have an actual diameter greater than the nominal diameter.*

Calculating percentage reduction in diameter:

Nominal Diameter - Measured Diameter = ?

$$\frac{?}{\text{Nominal Diameter}} \times 100 =$$

E.g. A wire rope having a nominal diameter of 26mm is measured at 24.35mm what is the percentage reduction in diameter.

26mm – 24.35 mm = 1.65mm

$$\frac{1.65}{26} \times 100 = 6.34\%$$

NOTES

External Wear

Abrasion of the crown wires of outer strands in the rope results from rubbing contact, under pressure, with the grooves in the sheaves and drums. The condition is particularly evident on moving ropes at points of sheave contact when the load is being accelerated or decelerated, and is revealed by flat surfaces on the outer wires.

Wear reduces the strength of ropes by reducing the cross-sectional area of the steel strands.

If, due to external wear, the actual rope diameter has decreased by **7%** or more of the nominal rope diameter, the rope shall be discarded even if no wire breaks are visible.

External and Internal Corrosion

Corrosion occurs particularly in marine and polluted industrial atmospheres.

- Diminishes the breaking strength of the rope by reducing the metallic cross-sectional area
- Accelerates fatigue by causing surface irregularities which lead to stress cracking
- Severe corrosion can cause decreased elasticity of the rope

External corrosion

Corrosion of the outer wires can often be detected visually. Wire slackness due to corrosion attack/steel loss is justification for immediate rope discard.

Internal corrosion

This condition is more difficult to detect than the external corrosion which frequently accompanies it, but the following indications can be recognized:

a) **Variation in rope diameter**; in locations where the rope bends around sheaves, a reduction in diameter usually occurs. However, in stationary ropes it is not uncommon for an increase in diameter to occur due to the build-up of rust under the outer layer of strands
b) **Loss of clearance between the strands** in the outer layer of the rope, frequently combined with wire breaks between or within the strands

Confirmation of severe internal corrosion is justification **for immediate rope discard**.

Deformation

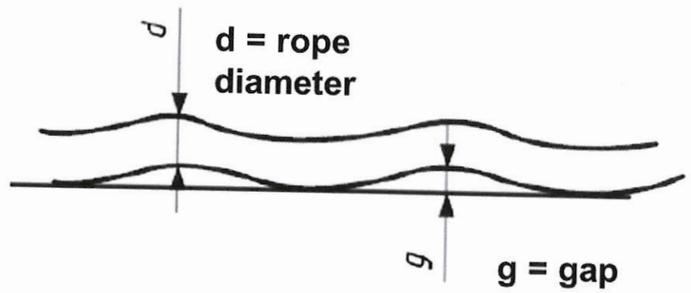
Visible distortion of the rope from its normal shape is termed "deformation" and can create a change at the deformation position which results in an uneven stress distribution in the rope.

Waviness

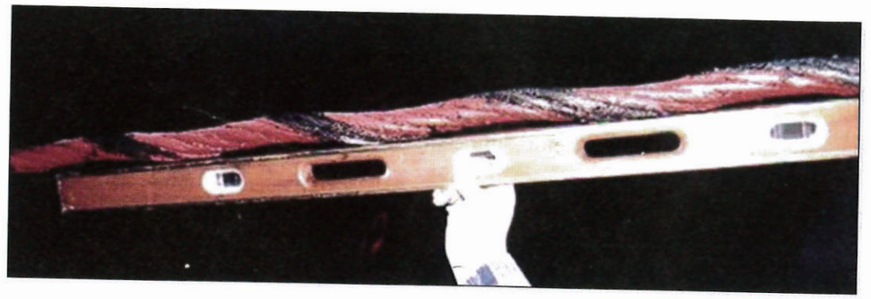
Waviness is a deformation in which the longitudinal axis of the wire rope takes the shape of a helix under either a loaded or unloaded condition. While not necessarily resulting in any loss of strength, such a deformation, if severe, can transmit a pulsation resulting in irregular rope drive. After prolonged working, this will give rise to wear and wire breaks.

The rope **shall be discarded** if, under any condition, either of the following conditions exists (see figure below):

a) on a straight portion of rope, which never runs through or around a sheave or spools on to the drum, the gap between a straight edge and the underside of the helix is 1/3 × *d* or greater
b) on a portion of rope, which runs through a sheave or spools on to the drum, the gap between a straight edge and the underside of the helix is 1/10 × *d* or greater



Wire Rope Waviness – Example:



Local Increase in Rope Diameter

If the rope diameter increases by **5 % or more for a rope with a steel core** or **10 % or more for a rope with a fibre core** during service, the reason for this shall be investigated and consideration given to discarding the rope.

NOTE: An increase in rope diameter that might affect a relatively long length of the rope, such as that resulting from the swelling of a natural fibre core, can occur due to excessive absorption of moisture, creating imbalance in the outer strands, which become incorrectly oriented.

Other Conditions which affect the safe use of wire can include but not be restricted to:

- Basket or lantern deformation
- Core or strand protrusion/distortion
- Wire protrusion
- Flattened portions
- Kinks or tightened loops
- Bends

Lubrication

Correct lubrication of wire ropes is essential if the ropes are to give satisfactory service. Good lubrication not only prolongs the life of the rope but also helps to reduce friction and preserves the internal parts.

All ropes are lubricated internally, and nearly all externally, during manufacture but care should be taken to see that an **approved neutral lubricant** is externally applied at frequent intervals during use and, if practicable, whilst not in use.

Thinner types of lubricant have the best lubricant qualities but if the rope is constantly exposed to the elements or to water, the heavy, thicker lubricants are more suitable. For certain applications dry lubricants may be preferable but in all cases the lubricant must be acid free in nature.

Wire ropes should be clean and dry before lubricants are applied.

neutral

Combined Effect Assessment

Although broken wires are a common reason for discard, deterioration often results from a combination of factors. In such cases, the competent person needs to:

- Take account of the different modes of deterioration, particularly when they occur at the same location in the rope
- Make an overall assessment of the "combined effect" of the different modes of deterioration
- Decide whether the rope is safe to remain in service and, if so, whether it needs to be subjected to any revised inspection/discard provisions

One method of determining the combined effect is as follows:

- Inspect the rope and record the type and amount of each individual mode of deterioration, e.g. number of broken wires in 6*d*, decrease in diameter in millimetres and extent of corrosion
- For each of these individual modes of deterioration, rate the severity and express it either as a percentage of the respective individual discard criteria, e.g. if 40 % of the allowable number of broken wires according to the individual discard criteria are found to exist, this represents a rating of 40 % towards discard, or in words, e.g. slight, medium, high, very high or discard
- Either add together the individual ratings at selected locations, only when they occur at the same location, and express the severity as a combined per cent value or make a judgement as to the combined degree of severity and express the rating in words, e.g. slight, medium, high, very high or discard

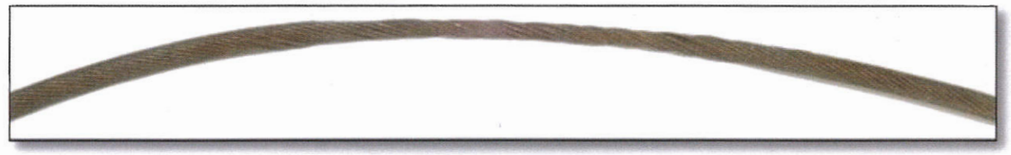
NOTES

©LEEA Academy – MCE – Step Notes – July 2015 – v1.4

Spooling Damage

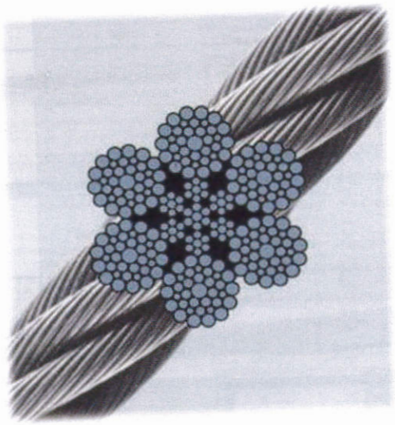
Faulty Ropes / Components

Examples of core damage:



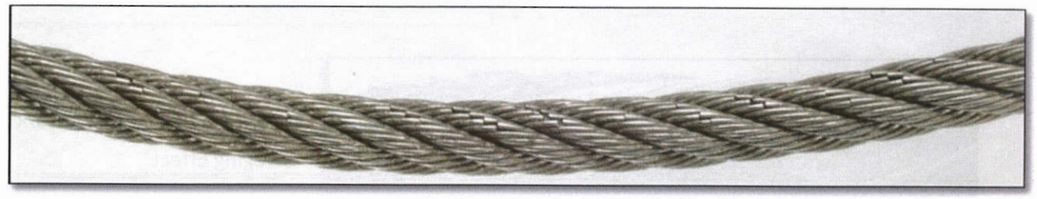
NOTES

Strand Indentations

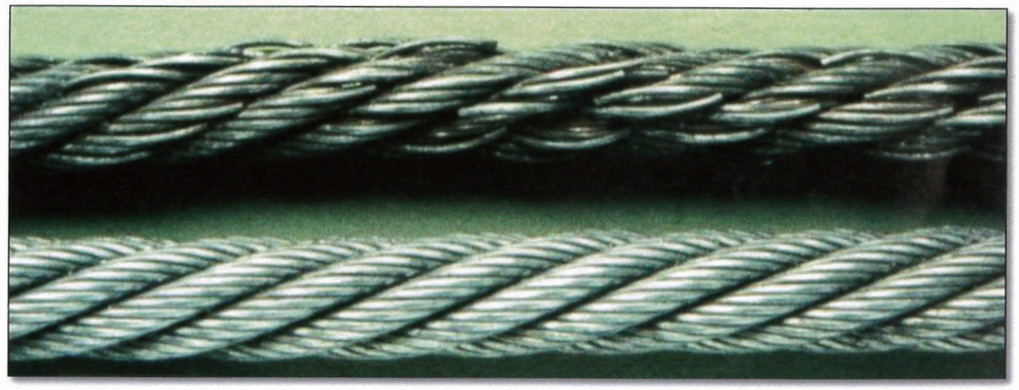


NOTES

Typical Fatigue Breaks



Broken Wires



NOTES

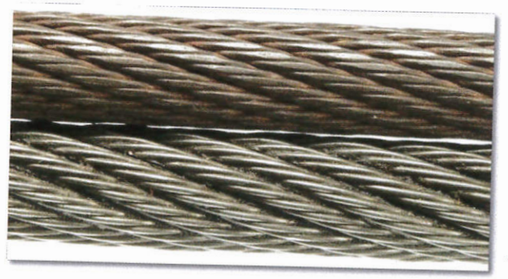
Core damage

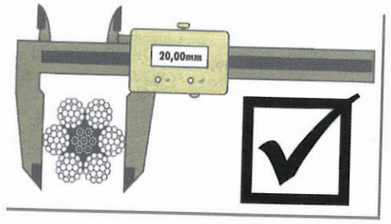
Swaging Effect

Shock Loading

NOTES

Rope Wear – Multi Strand Wire Rope

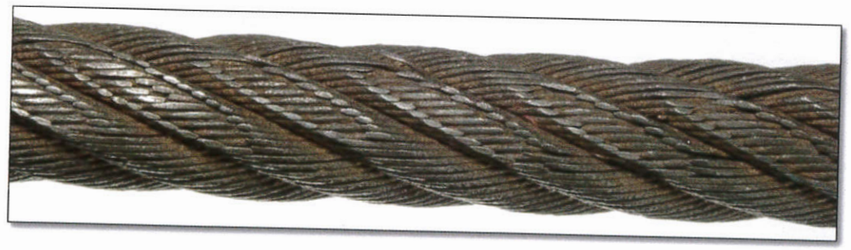




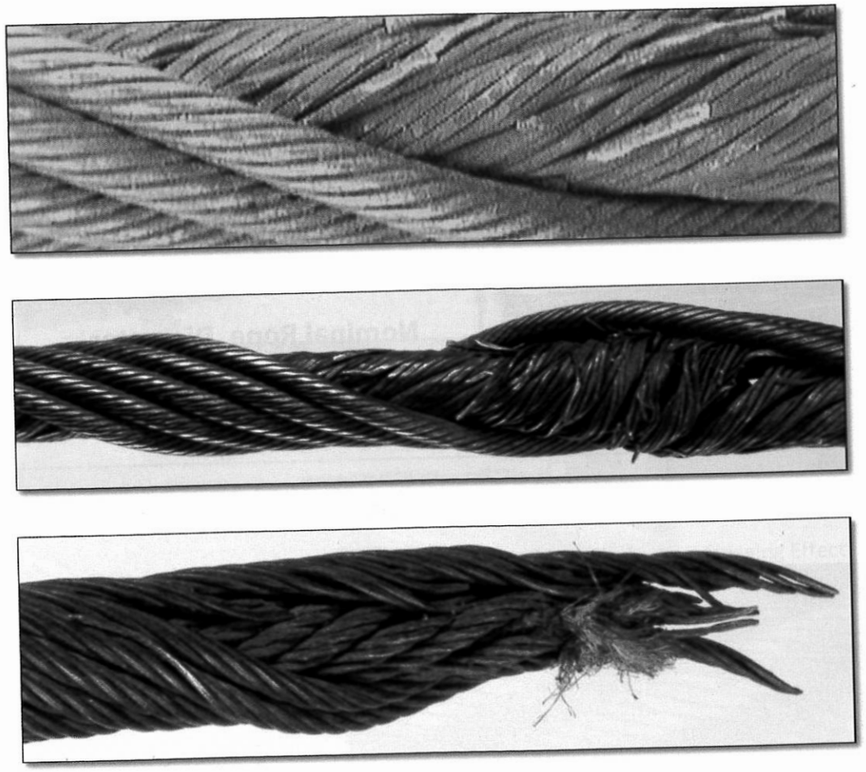
Measured 19.36mm
12% Loss

Nominal Rope Diameter
22.0mm

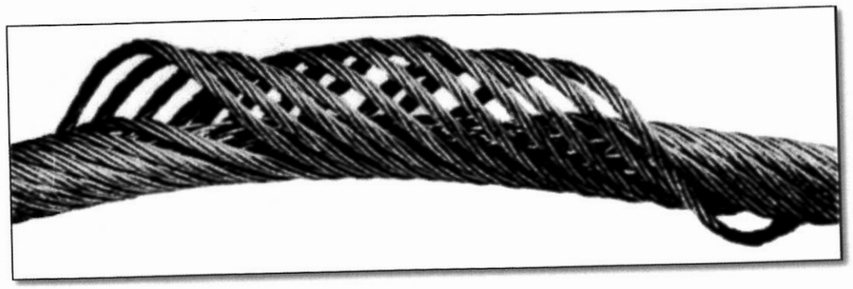
External Wear



Internal Corrosion



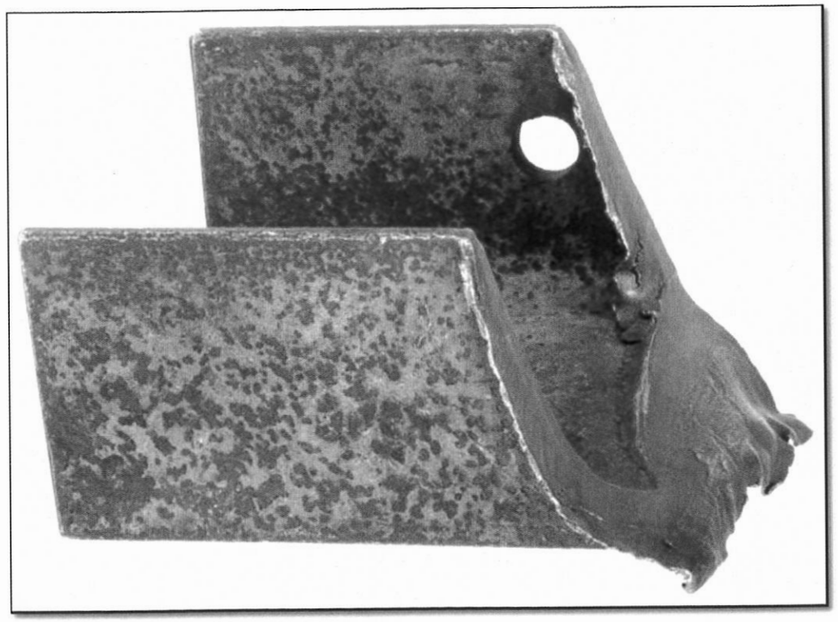
Birdcaging

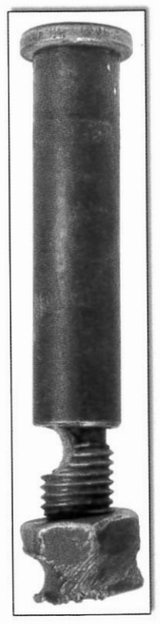


Trapped Rope

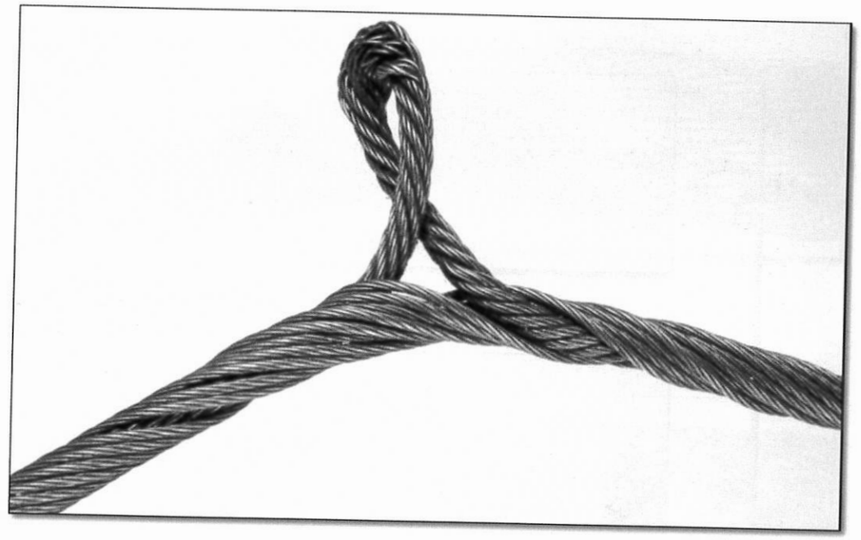
Mechanical Damage

Rope jumped from sheave and cut through steel section



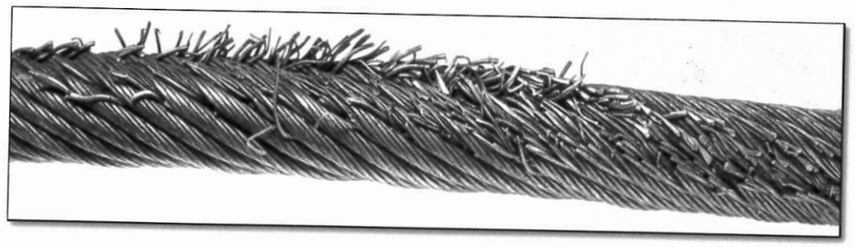


Core Knuckle



Shock loading

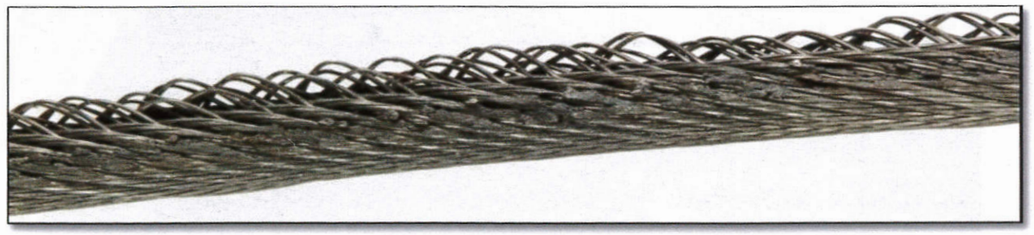
Spooling/Cross-over Damage

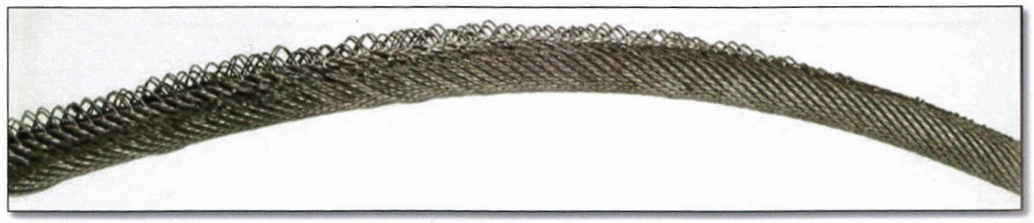


NOTES

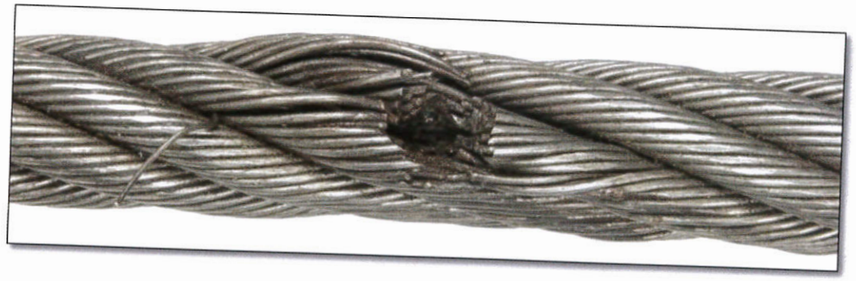
Spooling Damage

Mechanical Damage and Heat

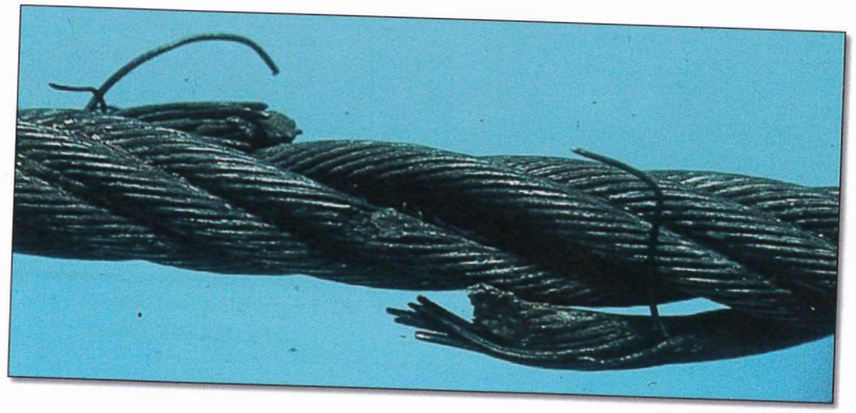




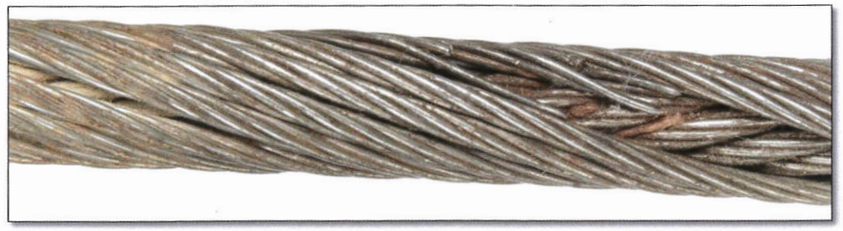
Electric Arcing



Fused Strand



Heat Effect



Brazed Repair?

NOTES

Testing as Part of the Thorough Examination

A competent person, under LOLER has no requirement to carry out a 4 yearly overload test on a mobile crane, this was a requirement of the old Construction (Lifting Operations) which LOLER replaced in 1998.

The ACOP to LOLER asserts that any testing is carried out at the competent person's discretion when carrying out a thorough examination, the nature and method to be decided by him and if necessary in consultation with the manufacturer.

Supplementary testing can be carried out to verify the accuracy of the Rated Capacity Indicator and its conformance to the Rated Load Capacity Charts.

- Check the weighing of the RCI by raising a known test weight or by verifying using a calibrated load cell

NOTES

To function test the RCI, configure the boom as per the Rated Load Charts for a selected load.

- Raise the selected load and boom load out to the maximum radius as allowed by the RCI
- Verify by measuring the radius and comparing it against the Rated Load Chart. Operate crane through all functions and return load to original start point

Configurations and weights generally used are:-

- Minimum Boom length, maximum weight allowable to test structural integrity
- Maximum Boom length, minimum weight allowable to test stability

Hoist Brake Test

A Hoist Brake test and examination may be carried out to determine if a major overhaul of the braking system or the replacement of brake pads or shoes has been carried out successfully.

As a minimum, the operational testing should conform to the following:-

- Dynamic testing to verify that a moving load can be halted at normal lifting and lowering speeds
- Dynamic testing to verify that a moving load can be halted at normal lifting and lowering speeds after the emergency stop has been operated
- A static test to verify that the brake can hold a load without slippage

Load Testing after Major Repair

After any major repair a Load Test should be completed shortly after to verify the structural integrity of the crane and to reveal any weaknesses.

The type, scope and method of the test should be as per the crane manufacturer's specifications.

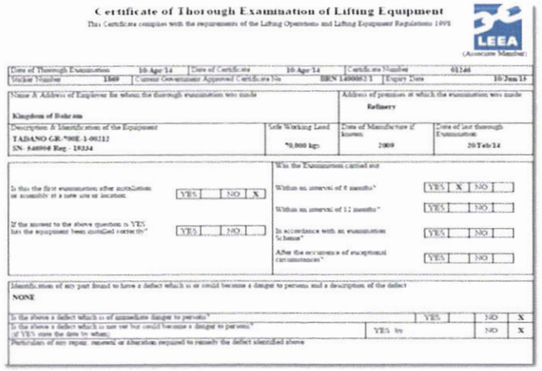
NOTES

In this case the Report should contain the following information:-

- Date of test and subsequent examination completion
- The crane configuration at time of test
- The unique serial number or identifying mark of the crane
- What test weights and at what radii they were used
- Details of any defects or deformations

NOTES

Reporting



Certificate of Thorough Examination of Lifting Equipment

This Certificate complies with the requirements of the Lifting Operations and Lifting Equipment Regulations 1998

LEEA (Associate Member)

Date of Thorough Examination	10-Apr-14	Date of Certificate	10-Apr-14	Certificate Number	01246
Worker Number	1569	Current Government Approved Certificate No		BEN 1400083/1	Expiry Date 10-Jun-15

Name & Address of Employer for whom the thorough examination was made

Kingdom of Bahrain

Address of premises at which the examination was made

Refinery

Description & Identification of the Equipment	Safe Working Load	Date of Manufacture if known	Date of last thorough Examination
TADANO GR-700E-1-00212 SN- 840960 Reg - 19334	*0,000 kgs	2009	20 Feb 14

Is this the first examination after installation or assembly at a new site or location	YES	NO X	Was the Examination carried out Within an interval of 6 months*	YES X	NO
			Within an interval of 12 months*	YES	NO
If the answer to the above question is YES, has the equipment been installed correctly*	YES	NO	In accordance with an examination Scheme*	YES	NO
			After the occurrence of exceptional circumstances*	YES	NO

Identification of any part found to have a defect which is or could become a danger to persons and a description of the defect

NONE

Is the above a defect which is of immediate danger to persons*		NO	X
Is the above a defect which is not yet but could become a danger to persons*	YES by	NO	X
If YES state the date by which			

Particulars of any repair, renewal or alteration required to remedy the defect identified above

Reports as per LOLER

The LOLER requirements for reporting necessitates that the competent person carrying out the thorough examination make a written report of that examination to the client for whom the examination has been carried out and also to the owner/hirer of the mobile crane. Often this may be the same person.

The competent person must sign his report or have it authenticated on his behalf and it must contain the information requested in LOLER Schedule 1. A verbal report should be given at the time of thorough examination especially if a defect has been discovered that is or could become a danger to persons.

LOLER Schedule 1

Minimum 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 where the thorough examination was made

3) Particulars sufficient to identify the equipment, including where known its date of manufacture (Serial, model, reg, no)

4) The date of the last thorough examination

5) The safe working of the lifting equipment or (where the safe working load depends on the configuration of the lifting equipment) it's 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 a thorough examination
   (b) (if such be the case) that it has been installed correctly and would be safe to use

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 under regulation 9(3)(a)(i);
      (ii) within an interval of 12 months under regulation (9)(3)(a)(ii);
      (iii) in accordance with an examination scheme under regulation (9)(3)(iii); or
      (iv) after the occurrence of exceptional circumstances under regulation(9)(3)(a)(iv)
   b) (if such be the case) that the lifting equipment would be 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 which 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;
   (d) the latest date by which the next thorough examination must be carried out;
   (e) where the thorough examination included testing, particulars of any test;
   (f) the date of the thorough examination

9) The name, address and qualifications of the person making the report; that if 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

REPORT OF A THOROUGH EXAMINATION OF LIFTING EQUIPMENT

This report complies with the requirements of the Lifting Operations and Lifting Equipment Regulations 1998

Date of thorough examination:	Date of report:	Report number:

Name and address of employer for whom the thorough examination was made:	Address of premises at which the examination was made:

Description and identification of the equipment:	Safe working load(s):	Date of manufacture if known:	Date of last thorough examination:

Is this the first examination after installation or after assembly at a new site or location?	YES		NO		Was the examination carried out: within an interval of 6 months?	YES		NO	
If the answer to the above question is YES, has the equipment been installed correctly?	YES		NO		within an interval of 12 months?	YES		NO	
					in accordance with an examination scheme?	YES		NO	
					after the occurrence of exceptional circumstances?	YES		NO	

Identification of any part found to have a defect which is or could become a danger to persons and a description of the defect: (If none state NONE)				
Is the above a defect which is of immediate danger to persons?		YES		NO
Is the above a defect which is not yet but could become a danger to persons? (If YES state the date by when)	YES by:			NO
Particulars of any repair, renewal or alteration required to remedy the defect identified above:				
Particulars of any tests carried out as part of the examination: (If none state NONE)				
IS THIS EQUIPMENT SAFE TO OPERATE?		YES		NO

Name of the person making this report:	Name of the person authenticating this report: Signature:	Latest date by which next thorough examination must be carried out:
Name and address of employer of persons making and authenticating this report: XYZ Lifting Equipment Co Ltd, Any Street, Any Town, Any County		

Certificate of Thorough Examination of Lifting Equipment

This Certificate complies with the requirements of the Lifting Operations and Lifting Equipment Regulations 1998

(Associate Member)

Date of Thorough Examination: 10/Apr/14	Date of Certificate: 10/Apr/14	Certificate Number: 01246
Sticker Number: 1569	Current Government Approved Certificate No: BRN 1400852/1	Expiry Date: 10/Jun/15

Name & Address of Employer for whom the thorough examination was made: Kingdom of Bahrain		Address of premises at which the examination was made: Refinery	
Description & Identification of the Equipment: TADANO GR-700E-1-00212 SN- 546956 Reg.- 19334	Safe Working Load: 70,000 kgs	Date of Manufacture if known: 2009	Date of last thorough Examination: 20/Feb/14

Is this the first examination after installation or assembly at a new site or location:	YES		NO	X	Was the Examination carried out: Within an interval of 6 months*	YES	X	NO	
If the answer to the above question is YES has the equipment been installed correctly*	YES		NO		Within an interval of 12 months*	YES		NO	
					In accordance with an examination Scheme*	YES		NO	
					After the occurrence of exceptional circumstances*	YES		NO	

Identification of any part found to have a defect which is or could become a danger to persons and a description of the defect: NONE

Is the above a defect which is of immediate danger to persons*		YES		NO	X
Is the above a defect which is not yet but could become a danger to persons* (If YES state the date by when)	YES by:			NO	X

Particulars of any repair, renewal or alteration required to remedy the defect identified above:

Particulars of any tests carried out as part of the examination: (If none state NONE) OVERLOAD TEST : FLY JIB EXPIRES 19/08/13

IS THIS EQUIPMENT SAFE TO OPERATE*	YES	X	NO	

Name of person making this certificate: Signature:	Name of person authenticating this certificate: ROD TOWNS Signature:	Latest date by which next thorough examination must be carried out: 10/Oct/14
Name and address of employer of persons making and authenticating this certificate: THE COMPANY BSC CLOSED P.O. BOX AWALI KINGDOM OF BAHRAIN		

NOTE: This equipment is approved solely for use within 's areas of operation. No warranty is expressed or implied by Company (BSC Closed) and/or its employees the above approval and the owner operator shall hold the harmless from any liability or claim arising thereon. The owner/operator is to confirm his understanding and acceptance of these conditions by legibly signing and returning a copy of this form to the specialist lifting equipment or his representative before using this equipment within operations.

Operator / Owner Name	Operator / Owner Signature

(Continued overleaf)

DESCRIPTION OF TEST				
	MAIN HOIST 1	MAIN HOIST 2	AUXILIARY HOIST	FLYJIB/SWINGAWAY
SAFE WORKING LOAD	30,000 KG	1,300 KG		2,700 KG
% OVERLOAD	3,000 KG	130 KG		270 KG
TOTAL PROOF LOAD	33,000 KG	1,430 KG		2,970 KG
BOOM LENGTH	15.56 M	44 M		44+17.7 M
RADIUS	7 M	32 M		12.5 M
ROPE CONFIGURATION	6 X 19 MM	1 X 19 MM		1 X 19 MM

Report Categorisation and Level of Detail

Should defects be found during the course of the thorough examination they must be categorised by the severity of the defect and how it could affect the safety of persons.

Defects can be classified in one of three categories:-

1) Defects that are an **immediate danger to persons** or could become so
2) Defects **affecting the safety of persons that have to be remedied within a stipulated time period**
3) Observations or recommendations which **may require planning to resolve** and which may fall outside the strict scope of the thorough examination
   (e.g. you may have noticed a working practice or location that the crane is in that is detrimental in the long term to the continued safety and integrity of the crane but which could be altered). This could be, for example, continuous lifting at the maximum radius or working near chemical/acid areas

The report should be such that it can be clearly comprehended by crane users.

The report should include such details of any defects that the crane owner can ascertain the exact nature and site of the defect thus allowing him instigate an appropriate course of remedial action.

Abbreviations should not be used when making this type of report to avoid confusion.

Report Distribution and Time Scale

It is usual for the crane owner to request a thorough examination be carried out on a mobile crane and the person carrying out this examination on behalf of the owner should send him a copy of the examination report.

The crane owner should send a copy of the report to the crane user as ultimately it is his duty to ensure the crane is safe.

The normal period in which a report of thorough examination should be completed and forwarded is a **maximum of 28 days**.

The owner and the user must be apprised right away of any defects found that constitute an immediate or forthcoming danger to persons (this is essential if crane is on site). This can be achieved by verbal or/and handwritten notification of the owner and user. (An in house competent person may have the authority to remove the crane from service immediately).

The crane can then be removed from service or prevented from entering service until such time as the defects have been remedied.

Where the competent person has ascertained that there are defects which if not remedied within a stipulated time period could become a danger to persons, a report should be submitted as soon as practical, to enable the owner to remedy the defects within the specified time limit.

Note: It is the **personal responsibility of the competent person** to ensure that a copy of the report has been sent not his company, or secretary, or manager. He should follow up on it. Should a case end up in court and the report had not been sent then the competent person could be held responsible.

NOTES

Cleared Defects and Notifications

At times maintenance personnel from the mobile crane owners company could attend the thorough examination and defects revealed by the thorough examination may be corrected immediately.

The defects must still be reported even if they have been cleared otherwise the report will not reflect the true condition of the crane at the time and will be undocumented in the history of the mobile crane.

A failure to document defects is contrary to LOLER.

If, according to the competent person, a serious defect has been revealed by the thorough examination that poses an existing or impending risk of personal injury when the crane is reused or shortly after, the competent person must send a copy of the report to the relevant enforcing authority.

In the UK this is the Health and Safety Executive (H.S.E)

NOTES

Example Checklist

Examination of:	Acceptable	Defective
Chassis		
Operator cab exterior		
Hook block attachment point		
Operator cab interior		
Cab Glass		
Windscreen wipers		
Lights		
Indicators		
Brake lights		
Reverse lights and alarm		
Warning horn		
Brakes		
Gears		
P.T.O		
Switches/Electrics		
Tyres/pressures		
Suspension		
Outrigger controls		
Outrigger level gauges		
Outrigger Beams		
Outrigger Jacks		
Outrigger pads		
Hydraulic Tank		
Fuel tank		
Air reservoirs		
Counterweights		
Counterweight attachments		
Auxiliary Hook blocks		
Superstructure		
Swing Ring		
Access ladders		
Operator cab external		
Safety glass		
Operator cab internal		
Rated capacity charts		
Rated Capacity Indicator		
Controls		
Hoist		
Swing		
Boom up/down		
Boom telescoping		
Throttle		

Lights		
Switches		
Steering if applicable		
Swing Brake		
Positive swing lock		
Windscreen wipers		
Cab tilt if applicable		
Crane platform		
Rotary distributor		
Boom attachment pins		
Boom Cylinders		
External R.C.I. components		
Counterweight attachment rams		
Hoist Drum		
Boom tip sheaves		
Rope guides		
Jib attachment lugs		
Swing Jib and Accessories		
Anti-two block		
Hoist rope anchor and attachment point		
Hook block		
Hook block sheaves		

Bibliography

Health and Safety at Work etc. Act 1974

The Provision and Use of Work Equipment Regulations (1998) (PUWER)

The Lifting Operations and Lifting Equipment Regulations (1998) (LOLER)

Management of Health and Safety at Work Regulations 1999

Machinery Directive 2006/42/EC

Supply of Machinery (Safety) Regulations 2008

LEEA COPSULE

Best Practice Guide: Maintenance, Inspection and Thorough Examination of Mobile Cranes

BS.7121-2-1:2012. Code of Practice for the Safe Use of Cranes: Inspection, Maintenance and Thorough Examination – General

BS.7121-2-3: 2012. Code of Practice for the Safe Use of Cranes: Inspection, Maintenance and Thorough Examination of Mobile Cranes

The work at Height Regulations 2005

The Personal Protective Equipment at Work Regulations 1992

LEEA 051 (01 Oct. 2012): Guidance on the design, Inspection and Use of Water Bags as Test Weights in the Offshore and Marine Industries

BS. ISO. 4309:2010. Cranes –Wire Ropes: Care, Maintenance, Inspection and Discard

The Road Vehicles (Construction and Use) Regulations 1986 (As Amended)