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7.1 General Requirements

1. Every lifting appliance and item of loose gear shall be.
   a) of good design and construction, adequate strength for its intended use and free from any patent defect;
   b) made to a recognized international or national standard; tested, thoroughly examined, marked and inspected in accordance with section 4.2;
   c) maintained in good working order.

2. Occupational safety is affected not only by the design of lifting appliances but also by that of their accessories and other loose gear used with them. The proper design and maintenance of all are essential, since breakage of any of them may cause serious accidents. Deterioration may be visible, as when it starts from the surface or concealed internally, in either case, the mechanical strength of the material is reduced.

3. Documentation (as appropriate) relating to lifting appliances shall include.
   a) Driver’s instruction manual;
   b) Erection manual;
   c) Maintenance manual;
   d) Spare parts manual;
   e) Manufacturer’s certification of fitness for use;
   f) Certificate of test and thorough examination after initial erection;
   g) Manufacturer’s certificates for wire ropes installed on cranes;
   h) Examination and maintenance records.

7.1.1 Brakes

1. Every power-operated lifting appliance shall be provided with an efficient brake or brakes capable of stopping a load while it is being lowered.

2. The brakes shall normally be applied automatically when.
   a) the motion control lever is returned to its neutral position;
b) any emergency stop is operated;
c) there is any power supply failure;
d) in the case of electrically operated brakes, there is a failure of one phase or a significant drop in voltage or frequency of the power supply.

3. Band brakes generally act in a preferential direction and are sometimes jerky. They shall only be used for emergency braking. Brakes with symmetrical jaws and two pairs of pivots have a gradual action.

4. A slewing brake shall be capable of holding the jib stationary with the maximum, safe working load suspended at its maximum radius when the maximum in-service wind acts in the most adverse direction. Sudden application of the brake shall not damage the jib.

5. The brake lining or pads shall remain adequately secured during their working life. Unless the brake is self-adjusting, appropriate means shall be provided to permit brake adjustment to be readily carried out in safety.

6. The design of electrically operated brakes shall ensure that the operating solenoid cannot be accidentally energized by the back electromotive force of any motor driven by the crane, by a stray or rogue current or by breakdown of any insulation.

7.1.2 Electrical supply

1. Self-reeling flexible cables shall not allow long lengths of cable to drag on the ground where they can be exposed to damage. Outlets shall generally be not more than 50 m apart. The use of motorized reels is preferable to springs or counterweights. Reels on quay cranes shall be placed on the waterside, preferably on the outside of the gantry legs.

2. Trolley systems shall be fed by overhead conductors or conductors in channels.

3. Overhead conductors shall be sufficiently high to prevent contact by a vehicle or its load. Supports shall be protected by suitable barriers where necessary.

4. Channels for conductors shall be properly drained and designed to prevent entry of any object likely to cause danger.
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7.1.3 Safe Working load (SWL)

1. The safe working load (SWL) of all lifting appliances and items of loose gear shall be based on the factors of safety set out in Appendix E.

2. Every lifting appliance and item of loose gear shall be marked with its safe working load. The markings shall be in kilograms (kg) if the safe working load is 1 tonne or less or in tonnes if it is more than 1 tonne.

3. Lifting appliances where the safe working load varies with the radius of operation shall display a chart, showing the radius and the corresponding safe working load, in the cab in a position where the operator at the controls can clearly see it. The chart shall also state the maximum and minimum operating radius for the appliance and from where the radius is measured.

4. Such appliances shall also be fitted with a radius indicator that can be clearly seen by the operator at the controls and, where practicable, a safe working load indicator.

5. The maximum load that may be lifted when items of loose gear that have a significant weight are attached to lifting appliances shall be unambiguous. There shall be no confusion between the safe working load.

   a) below the header block/hook of the lifting appliance;
   b) of the loose gear;
   c) below the loose gear.

7.1.4 Controls

1. Controls of lifting appliances shall conform to ISO 7752 Lifting appliances – Controls – Layout and characteristics and ensure that the operator has ample room for operation when at the controls.

2. Controls shall be.

   a) so positioned that the operator has an unrestricted view of the operation or any person authorized to give the operator signals;
   b) marked with their purpose and method of operation.
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3. The operating pedals for travel motions of mobile lifting appliances shall follow road traffic practice with clutch (when fitted) on the left of the operator’s feet, accelerator or other power control on their right and a brake between the other two pedals.

4. Whenever driving considerations permit, controls shall return to the neutral position when released.

5. Consideration shall be given to fitting dead man’s controls to prevent inadvertent movement.

6. The control system shall be such that no motion can start when the power supply is connected or the engine started. Movements shall only be possible after a positive action.

7.1.5 Limiting devices

1. Limiting and indicating devices shall conform to ISO 10245 Cranes – Limiting and indicating devices.

2. Wherever possible, every limiter shall be positively actuated and designed to fail safe.

3. Where one motion of an appliance can cause a second motion to approach a limiter (e.g. a derrick-out motion that can cause a hoist motion to reach its limit), the limiter shall stop both motions.

4. Every power-operated lifting appliance other than a ship’s derrick shall, where practicable, be fitted with a safe working load limiter. This shall operate when the load being raised or lowered exceeds the safe working load by a predetermined amount, generally within the range of 3 to 10 per cent above the safe working load. The limiter shall only prevent motions that would increase the overload.

5. Cranes shall also be fitted with the following limiters:

   a) hoisting limiter preventing the load-lifting attachment being raised to the position where it strikes the structure of the crane;

   b) lowering limiter ensuring the minimum number of turns is always left on the winch drum;

   c) derrick-in limiter ensuring that the crane jib cannot be derrick-ed back beyond the minimum radius position;
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d) derricking-out limiter ensuring that the jib cannot be derrick'd out beyond the maximum radius position;

e) trolley or crab limiter ensuring the trolley or crab is stopped before it reaches the track end stops;

f) slewing limiter on cranes with a limited arc of slew;

g) long travel limiter on rail-mounted cranes preventing them from approaching the track end stops.

7.1.6 Lubrication

Every greasing and lubrication point shall be located where lubrication can be carried out safely. Remote lubrication points shall be provided where necessary.

7.1.7 Operator’s cab

1. The operator’s cab shall provide the operator with a safe and comfortable working environment.

2. The cab and its fittings shall be constructed of fire-resistant material and conform to ISO 8566 Cranes – Cabins. In particular it shall have,

   a) an unrestricted view of the area of operation;
   b) adequate protection from the elements;
   c) windows that can be readily and safely cleaned inside and out;
   d) a windscreen wiper on any window that normally affords the operator a view of the load;
   e) a comfortable seat that enables the operator to look in the required direction;
   f) a sliding or inward-opening door that can be readily opened from inside and outside if the cabin is elevated;
   g) means of emergency escape;
   h) suitable fire extinguishers.

3. The operator’s cab shall be designed to limit noise and vibration to within nationally permitted levels.

7.1.8 Overhauling weight

An overhauling weight fitted at the end of a hoist rope shall be.
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1. Designed to minimize the danger of it catching on any part of a hold, ship’s superstructure or similar obstruction;
2. Connected to the hoist rope by means of a short length of chain, where practicable.

7.1.9 Swivels

1. A swivel shall be fitted between the hoist rope and the lifting attachment.
2. The swivel shall be fitted with ball bearings or roller bearings that can be regularly lubricated.

7.1.10 Tyres

1. Tyres of lifting appliances that travel on wheels shall be selected to be appropriate for the intended duty.
2. Radial and cross-ply pneumatic tyres shall never be mixed.
3. The correct pressure of pneumatic tyres shall be conspicuously marked near each wheel.

7.1.11 Access

Safe means of access shall be provided to all working positions on lifting appliances.

7.1.12 Winch and rope drums, leads and anchorages

1. Winch drums shall conform to ISO 8087 Mobile cranes – Drum and sheave sizes
2. Ropes shall be fastened to winch drums in the manner prescribed by their makers.
3. The derricking and hoisting drums of a ship’s derrick or derrick crane shall be capable of accommodating the maximum working length of rope and the number of complete turns to remain on the winch that is specified by the manufacturer.
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4. The angle of a wire rope lead to a winch drum shall be sufficiently small to ensure that the rope is not damaged in service. The angle between the rope and the plane perpendicular to the axis of the drum shall generally not exceed 1 in 16 for hoisting ropes and 1 in 12 for derrick ropes.

5. Where it would otherwise not be possible to avoid an excessive lead angle, a suitable coiling or spooling device shall be fitted.

6. Lowering operations shall normally be possible only with the winch connected to the power source. Free-fall lowering shall be possible only in exceptional circumstances and if the winch is equipped with an automatic speed-limiting device.

7.1.13 Maintenance

1. All lifting appliances and loose gear shall be maintained in good working order, and in efficient condition and good repair.

2. Maintenance, including lubrication, shall be carried out on a regular scheduled basis, in accordance with the manufacturer’s recommendations and operational experience.

3. Replacement components shall conform to the manufacturer’s manual or be of an equivalent standard.

4. Repairs to the structure of a lifting appliance shall follow the correct procedure specified by the manufacturer. Excessive heat can change the properties of steel.

5. Corrective maintenance shall also be carried out when necessary.

6. An accurate record of all routine and corrective maintenance shall be kept.

7.1.14 Testing, thorough examination, marking and inspection of lifting appliances and loose gear

7.1.14.1 Introduction
Regulation PM-7.0: Lifting Appliances and Loose Gear

Lifting appliances and loose gear shall be safe when first provided and remain safe throughout their operational life. The procedures for achieving this are well established, based on testing, thorough examination, marking and inspection. It is widely accepted that the testing of certain types of loose gear shall be treated differently. The present requirements and current good practice shall be seen as core requirements for safe operations in port work.

7.1.14.2 Testing of lifting appliances

1. All lifting appliances shall be tested in accordance with Appendix A and national requirements before being taken into use and after any substantial repair.

2. Lifting appliances shall be retested:
   a) at least once in every five years, if part of a ship’s equipment;
   b) as prescribed by the competent authority, if shore based.

3. The testing of cranes shall be carried out in accordance with ISO 4310 Cranes – Test code and procedures.

4. The tests shall cover all parts, and shall be supplemented with a detailed examination of the appliance as a whole. The tests are matters for specialists and shall be carried out by organizations whose competence has been recognized.

5. All assembled parts of a lifting appliance shall be tested under a proof load, in accordance with Appendix D.1.

6. The test conditions for the various parts shall be those imposing the severest stresses on each part when in service. Derricks shall be tested at the lowest practical angle to the horizontal and the slewing motion of an appliance with a derricking jib shall

7. be test braked at the lowest practical angle of the jib.

8. A record of all tests of lifting appliances and related certificates shall be kept and be available.

9. The content and layout of the documents shall be as established by the competent authority and in accordance with the model documents recommended by the International Labour Office.

10. All loose gear attached to a lifting appliance shall be tested in accordance with section 4.2.3.
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7.1.14.3 Testing of loose gear

1. All loose gear shall be tested in accordance with Appendix B and national requirements before being taken into use and after any substantial alteration or repair.

2. Wire ropes taken into use shall:
   a) be made to a recognized national or international standard;
   b) have their minimum breaking load certified by the maker;
   c) be of a construction suitable for the purpose for which it is intended.

3. Requirements for the testing of wire ropes are generally set out in national or international standards. Wire rope slings with hand-spliced or mechanically secured eyes (with aluminum or steel ferrules) shall be made from wire, manufactured to a recognized national or international standard and supplied with a manufacturer’s certificate showing the minimum breaking load before the termination or eyes were made. Wire rope slings with ferrule-secured eyes shall be subjected to a proof test not exceeding twice the rated safe working load in straight pull.

4. Hand-spliced wire, fiber rope, webbing and round slings shall be made from wire or fibers manufactured to a recognized national or international standard and supplied with a manufacturer’s certificate showing the minimum breaking load. These slings are not supplied with a manufacturer’s test certificate. They shall never be subjected to a proof load that exceeds their safe working load. Proof loads in excess of the safe working load are carried out on slings made from man-made fibers by the manufacturer on a batch basis.

5. Wire rope slings with ferrule-secured eyes shall be individually tested.

7.1.14.4 Examination

1. Thorough examinations of every lifting appliance and item of loose gear shall be carried out periodically by a competent person, in accordance with Appendix C.
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2. Lifting appliances shall be thoroughly examined at least once every 12 months or after any repair or modification. Appliances used to lift persons shall be thoroughly examined at least every six months, or at shorter intervals determined by a competent person.

3. 

4. Loose gear shall be examined at least once every 12 months, or at such shorter intervals as may be prescribed by the competent authority or competent person and after any repairs or modifications. These examinations shall include hammer tests, removal of paint to expose the metal underneath, ultrasonic examination, radiographic examination and the dismantling of concealed components where appropriate.

5. Wire ropes and chains shall be examined more frequently. Some users use ropes rather than chains, since ropes show up wear more easily and broken wires project from the rope.

6. If a wire rope contains any grips, wedge sockets or the like, they shall be removed during the examination of the rope.

7. The thorough examination of blocks will usually require the block to be stripped and the pin examined.

8. Periodic examinations afford opportunities of deciding whether chains shall be discarded or, in the case of wrought iron, sent for heat treatment.

7.1.14.5 Marking

1. All lifting appliances shall be legibly and durably marked with their safe working load.

2. On derricks, the lifting capacity shall be shown near the seating (gudgeon pin) in painted letters and figures within a frame of indentations or welding spots incised on a brass plate or inscribed on other material sufficiently resistant to defacement. On cranes, the capacity shall be painted on metal plates that are then enamelled or covered with varnish.
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3. Every item of loose gear shall be legibly and durably marked in a conspicuous place with its safe working load, with an alphanumeric identification mark to relate it to records of test examinations and, where appropriate, with a mark to indicate the quality grade of the steel from which it is made. Where appropriate, the inscriptions shall be incised, stamped or outline-welded.

4. The marking shall be made in a place where it will not give rise to stress.

5. On long chains, the markings shall be in a number of places.

6. The quality grade mark on steel items shall be in accordance with Appendix F.

7. Where the markings are stamped directly on the gear, the stamps shall not exceed the following dimensions:

   Safe working load of gear Maximum size of stamp (mm)
   Up to and including 2 tonnes 3
   Over 2 tonnes and up to and including 8 tonnes 4.5
   Over 8 tonnes 6

8. Where stamps are used on chain links, the stamp size shall not exceed the following dimensions:

   Link diameter Maximum size of stamp (mm)
   Up to 12.5 mm 3
   Over 12.5 mm and up to 26 mm 4.5
   Over 26 mm 6

9. The stamp shall give a concave indentation without sharp corners, and shall not be struck with a blow greater than is necessary for a clear indentation.

10. If the material is too hard or if direct marking would affect or be liable to affect the subsequent safe use of the gear, the marking shall be made on some other suitable item of durable material permanently attached to the gear, such as a tablet, disc or ferrule. Marking on such items may be larger than the dimensions indicated in paragraphs 7 and 8 above.
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11. Larger items, such as lifting beams, container spreaders or similar gear, that have a significant weight shall also be conspicuously marked with their own weight. The markings shall be so positioned and of such size as to be immediately legible to those using the gear from the quay or ship’s deck.

12. Wire ropes used in long lengths without terminations are not usually marked. The manufacturer’s certificate for the wire is endorsed with its place of use to enable identification. A wire or wire sling with a thimble or loop splice ferrule shall be proof loaded and the safe working load stamped on the ferrule.

13. Markings on slings shall be made in a permanent manner on,

   a) the terminal ring or link;
   b) a tablet, disc or ferrule attached to the sling, provided that the attachment will not cause damage to the rope;
   c) a ferrule of a wire rope having ferrule-secured eyes;
   d) the sling itself;
   e) a label; or
   f) by an approved electronic capture system.

14. Markings on slings shall include the number of legs and the safe working load in straight lift and when the angle between the legs and the vertical is 45°.

15. Non-metallic slings shall be marked with a label. The label shall show, or have electronically captured, the sling’s,

   a) safe working load in straight lift;
   b) material;
   c) nominal length;
   d) individual identification mark and traceability reference;
   e) manufacturer’s or supplier’s name.

16. Single-sheave blocks shall be marked in accordance with Appendix H.
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7.1.14.6 Inspection

All lifting appliances and loose gear in use shall be regularly inspected by responsible persons. The inspections shall comprise visual examinations to check that, so far as can be seen, the equipment is safe for continued use.

7.2 Lifting appliances

7.2.1 Shore cranes

1. Care shall be taken to ensure that cranes are designed for the type of application for which they are deployed and have an appropriate fatigue life. The modern method of achieving this is by giving the crane a classification based on the designer’s criteria for the use of that crane. Guidance on crane classification can be found in ISO 4301 Cranes and lifting appliances. National and international standards may specify the requirements for new cranes in ports.

2. Automatic audible and visual alarms that operate whenever the travel motion of the crane is engaged shall be fitted to the crane. The audible alarm shall be distinct from any other alarm, and loud enough to warn any persons who may be in the vicinity of the wheels of the crane. The visual alarm shall be a flashing light, normally of amber colour.

3. The crane shall be fitted with a separate horn or similar warning device and a flashing light that can be operated manually to warn or attract the attention of any person nearby.

4. The track of a rail-mounted crane shall be,

   a) of adequate section and bearing capacity;
   b) firm and level, with an even running surface;
   c) electrically bonded and earthed.

5. Shock-absorbing buffers shall be provided on rail-mounted cranes and end stops on rails.

6. Rail-mounted cranes shall be so designed that in the event of breakage of a wheel, failure of an axle or derailment, the crane will not overturn or collapse.
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7. Rail-mounted cranes shall be equipped with devices to clear the rails of dunnage and similar material automatically as the crane moves.

8. The wheels of rail-mounted cranes shall be provided with guards to prevent danger to feet.

9. Anemometers shall be fitted in the most exposed position of large rail-mounted cranes to provide warning of wind conditions requiring them to be taken out of service. The warning shall be given to the crane operator and repeated at ground level for the benefit of supervisory personnel.

10. Rail-mounted cranes taken out of service in high winds shall be secured, when necessary. Securing devices shall be designed for the purpose. The usual type is a pin or bolt that can be inserted into a socket in the quay surface. Other types include rail clamps, wheel scotchies and chains.

11. Arrester brakes shall be fitted to large rail-mounted cranes that are liable to be exposed to high winds during use if the travel motor brakes cannot prevent inadvertent movement along the track in such circumstances.

12. Rail-mounted cranes where the distance between the gantry legs is more than 30 m shall be equipped with means of synchronizing the motors to prevent any leg moving out of unison with the others.

13. If a number of rail-mounted gantry cranes working on the same track can be brought close together or come into contact with a ship’s superstructure, suitable sensors shall be provided to prevent them striking each other.

14. Any trapping points between a crane’s flexible power cable and winding drum shall be guarded, unless the drum is so placed as to be as safe as if it were guarded.

15. Old models of scotch derrick cranes may have only one motor driving both the hosting and the derricking drums. In order to avoid the possibility of interlock failure that may lead to an accident, it is recommended that such drive systems be replaced so that each motion has its own motor and brake.

16. Cranes used for lifting containers shall be fitted with devices that indicate when the container spreader is correctly lowered onto the container and when the twist locks are fully engaged and released.

17. Cranes used for lifting containers shall be fitted with interlocks that prevent
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a) twist lock movement, unless all four twist locks have entered the corner fittings;
b) lifting, unless all four twist locks are fully locked or unlocked;
c) twist locks unlocking when a load is suspended from them;
d) twist lock movement on a telescopic spreader, unless the frame is at the correct length;
e) telescopic spreaders telescoping, unless all four twist locks are unlocked and clear of the load.

18. Cranes used for lifting containers shall be fitted with load-indicating device that show the mass of the load being lifted.

19. The limits of stability of straddle carriers shall be determined in accordance with ISO 14829 Freight containers – Straddle carriers for freight container handling – Calculation of stability.

20. General-purpose mobile cranes are used in many industries. However, it shall be appreciated that they are designed to a relatively low classification and shall not normally be used intensively for long periods of time without consultation with the manufacturer or other design authority, who may well recommend a reduction of rated capacity for such applications.

21. The chassis of crawler cranes shall be clearly marked so that the operator can see the direction of travel at a glance.

22. Mobile harbour cranes shall only be used on well-prepared flat ground capable of supporting them and their load. Any slope on which they travel shall be within the limits specified by the crane manufacturer.

23. Great care shall be taken when adding or removing lattice strut jib sections. This shall always be carried out in accordance with the manufacturer’s instructions, with the jib adequately supported. Persons shall never be underneath the jib.

24. Every lifting appliance fitted with outriggers shall be fitted with a device to indicate to the operator whether the appliance is level.

25. All mobile cranes operating within port limits shall obtain Trakhees’ NOC (6 month validity).
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7.2.2 Lift trucks

1. When lift trucks are selected, it shall be clearly understood that trucks powered by internal combustion engines carry flammable fuel, produce exhaust gases with toxic components and can create noise nuisance. Trucks to be used in ships, holds or other confined spaces shall preferably be electrically driven.

2. Every truck driven by an internal combustion engine shall,

   a) have an efficient exhaust system fitted with a silencer and a gas cleaner, where appropriate;
   b) carry an appropriate fire extinguisher.

3. The forks of lift trucks shall be designed to prevent their accidental unhooking or lateral displacement when in use.

4. The forks of a truck are items of loose gear and shall be tested and certified before being taken into use.

5. Trucks shall be fitted with devices to automatically limit the upward movement of the forks, and, unless it is non-powered, the downward movement.

6. Any trapping, crushing or shearing points within reach of the operator in the normal operating position on the truck shall be suitably guarded.

7. All trucks and battery containers on electric trucks that are intended to be hoisted aboard ship shall have suitable slinging points.

8. The steering system of trucks fitted with non-powered steering shall be designed, so far as is practical, to prevent the operator’s hands from being injured if one of the truck wheels strikes a kerb, dunnage or other fixed object.

9. Every prototype or modified truck shall have been stability-tested by a competent person in accordance with a national or international standard before being taken into use.
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10. All trucks shall be fitted with a manual audible warning device, an automatic audible warning device that operates during reversing movements, two headlights, rear lights, parking lights and reflectors, in accordance with national standards, even if they are not expected to leave the port area.

11. Where possible, the reversing movement warning device shall give a distinguishable sound that is standard throughout the port.

12. Headlights shall throw forward a yellow or white non-dazzling light. Rear lights (two, as near as possible to the extremities of the vehicle in the case of wide vehicles) shall throw a red beam backwards. All lights shall be visible from 150 m away on a clear night.

13. Two reflectors shall be fitted as near as possible to the extremities of the vehicle. These shall reflect red light visible from 100 m away when illuminated by headlights. As lift trucks generally move both in reverse and forward, the provision of appropriate headlights and work lights is recommended. Larger vehicles shall be fitted with additional reflectors at the front and sides.

14. All trucks shall be fitted with flashing orange or amber lights.

15. Trucks with an enclosed cab shall be fitted with one or two rear-view mirrors.

16. Centre-seated counterbalanced trucks shall have an operator restraint system fitted to prevent the operator from being thrown from the vehicle or trapped by the overhead guard if the truck tips over laterally. This may be an enclosed cabin, seat belt or other device.

17. An upholstered suspension seat shall be fitted to minimize the transmission of shock loads to the operator and avoid compression of vertebrae. Good seats shall have seat backs giving good support to the operator, but not obscuring the view to the rear of the truck.

18. Forklift trucks shall be fitted with a substantial overhead guard sufficiently strong to protect the operator as far as possible against the impact of objects falling from above. In some cases, an additional guard to protect against small falling objects may be necessary. This may be a solid or perforated metal sheet.
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19. Side windows shall be automatically locked in the closed position on some types of truck, e.g. side loaders, in order to prevent injury to the head of an operator leaning out of the cab while lowering a load.

20. All moving parts within the operator’s reach shall be securely guarded.

21. A load backrest extension is recommended if the truck handles small unsecured loads, e.g. small heavy boxes.

22. Sheet metal side and front guards protecting operators of platform trucks shall be of a shape that enables them to climb on and off easily and quickly.

23. Lift trucks shall be fitted with service and parking brakes that comply with national or international standards.

24. All trucks shall be marked with their safe working load or loads (where there is more than one load owing to the use of devices such as stabilizers or extension forks) and related load centre. The load plate shall show the safe working load of the truck at various load centers and lift heights.

25. All trucks shall be marked with the unladen weight of the truck.

26. Electric trucks shall be marked with their weights both with and without the battery and battery container. The battery container shall be marked with the total weight of the container and battery.

27. All trucks shall be provided with:

   a) a builder’s plate giving the authorized gross laden weight, machine type and the
   b) maker’s name and address;
   c) an operating plate giving the owner’s name and address and, if possible, maintenance
   d) particulars such as servicing dates.

28. No further weight shall be added to a counterweight for the purpose of increasing the lifting capacity.

29. The operating platforms of end-controlled powered trucks and tractors shall be provided with substantial guards to prevent the operators from being crushed in the event of collision with obstacles or other vehicles.
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30. Electrically driven trucks shall be fitted with at least one adequate mechanical brake and a mechanically operated current cut-off that comes into operation automatically when the operator leaves the vehicle. When the vehicle is stationary, it shall not be possible to close the circuit unless the controller has passed through the neutral position.

31. Measures shall be taken to prevent spillage of battery electrolyte, including using the minimum necessary quantity of distilled water, supporting the batteries on shock absorbers and providing drip trays.

32. Wherever possible, wheels shall be positioned within the truck body. If they are positioned outside, the wheel guards shall be conspicuously marked.

33. All lift trucks shall be painted in a bright colour that is highly visible against the backgrounds where they operate. The back ends of rear-wheeled steered trucks shall be painted in yellow and black stripes to warn of the dangers of the swinging back when maneuvering.

7.3 Loose Gear

7.3.1 General requirements

1. Wrought iron shall never be used in the manufacture or repair of any loose gear.

2. Any gear made wholly or in part of wrought iron shall be scrapped as soon as is practicable.

3. While any gear made wholly or in part of wrought iron remains in use, it shall be periodically heat-treated in accordance with Appendix G.


5. Every steel part of loose gear (other than wire rope) shall be made of the same quality grade of steel.

6. Any welding in the manufacture or repair of loose gear shall be carried out by qualified workers using appropriate techniques.
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7.3.2 Chains and chain slings

1. Chains and chain slings shall generally be constructed from steel bars of at least 10 mm diameter for Grade M chain and 7 mm for Grade T chain.

2. Chains that are to be used at temperatures below about -5°C shall be made of special steels. Grade T chains can be used with no reduction of their safe working load at temperatures between -30 ° and +200°C.

7.3.3 Wire ropes and slings

1. Wire ropes shall be of adequate strength for the frequency and type of intended use and selected in accordance with ISO 4308 Cranes and lifting appliances – Selection of wire ropes.

2. The guaranteed minimum breaking load shall not be less than the product of the safe working load and a factor of safety determined in accordance with Appendix E.

3. Hoisting ropes shall be in one length without any joins. If the lengthening of a cable is unavoidable, it shall be done by an approved method, such as fitting a thimble and shackle or a Bordeaux connection. In such cases, the safe working load shall be reduced by an appropriate amount. It may also be necessary to fit larger sheaves if the connection needs to pass over them.

4. A wire rope shall be properly terminated.

5. Capping and splicing are skilled operations that shall only be carried out by workers having the necessary expertise.

6. If a particular method of splicing is prescribed by national legal requirements, only that method shall be used.

7. All thimble or loop splices shall have at least three tucks with a whole strand of rope, followed by two tucks with half the wires cut out of each strand. All tucks other than the first shall be against the lay of the rope. If another form of splice is used, it shall be equally efficient.
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8. No splice, however well made, can equal the strength of the original rope. The strength of the splice gradually decreases with diameter. At the largest sizes, it may be only 70 to 75 per cent as strong as the original rope. This loss of strength shall be taken into account when the factor of safety is decided.

9. A splice in which all the tucks are with the lay of the rope (Liverpool Splice) shall not be used in the construction of a sling or in any part of a lifting appliance where the rope is liable to twist about its axis, even if the splice is protected by a swivel.

10. Any protection on a splice in a wire rope to a lifting appliance shall only be provided at its tail. This allows any deterioration of the splice (i.e. broken wires) to be seen.

11. Compressed metal ferrules shall be made to a manufacturer’s standard.

12. The material used shall be suitable in particular to withstand deformation without any sign of cracking; the correct diameter and length of ferrule shall be used for the diameter of the rope; the end of the rope looped back shall pass completely through the ferrule; correct dies shall be used for the size of the ferrule; correct closing or compression pressure shall be applied to the dies;

13. Tapered ferrules, where the end of the rope is not visible for inspection after closing, shall not be used.

14. Terminal fittings on wire ropes shall be capable of withstanding the following minimum loads:

<table>
<thead>
<tr>
<th>Diameter of rope</th>
<th>Percentage of rope’s minimum breaking load</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 50 mm</td>
<td>95</td>
</tr>
<tr>
<td>More than 50 mm</td>
<td>90</td>
</tr>
</tbody>
</table>

15. A wedge socket used as a terminal fitting of a lifting appliance shall be suitable for the size of rope and be properly fitted.

16. The tail of the rope shall protrude sufficiently from the socket to enable it to be bent back upon itself to form a loop, and for the end then to be clamped or lashed to itself after emerging from the socket (not clamped to the main part of the rope).

17. The wedge shall be inserted and driven home by gentle hammering with a mallet.
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18. A heavy load (up to the safe working load of the socket, if this is practicable) shall be lifted a short distance and then be allowed to descend and be braked normally in order to bed the wedge.

19. A Lang’s lay rope shall only be used if it is not free to twist about its axis (i.e. both ends of the rope are secured).

20. Bolted clamps (such as Crosby, plate or bulldog grips) shall not be used to form a terminal join in any hoist rope, derrick rope, guy of a ship’s derrick or derrick crane, or in the construction of a sling.

21. A rope made of fibre interspersed with wire strand shall not be used on a lifting appliance such as a crane, but may be used as a sling in certain circumstances, subject to testing and certification on the basis of a factor of safety.

22. Before a wire rope is put into service, it is essential to verify from tables or calculations that it is of the correct diameter for winding on winch ends or sheaves. The winding diameter shall generally be at least four times the circumference of the rope (practically 12 times its diameter), but it is advisable to use higher ratios. The following rules are frequently adopted:

   a) for slow-moving appliances, the diameter of pulleys and sheaves shall be 300 times the diameter of the thickest wire in the rope, and for most lifting appliances 500 times that diameter;
   b) the diameter of pulleys and sheaves shall also be at least 24 times the diameter of a rope with 6 x 37 wires, and at least 20 times the diameter of a rope with 6 x 61 wires.

7.3.4 Fibre ropes and slings

1. Natural fibre rope for use on a lifting appliance or for slings shall be of good grade manila (abaca), sisal (aloe) or other fibre of equal quality manufactured to a national or international standard or in accordance with the requirements of a classification society.

2. Natural fibre slings are usually manufactured from three-strand rope. The splice shall be dogged off or a tail allowed. Natural fibre slings are usually made with soft eyes or endless.
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3. As natural fibre ropes are affected by damp, it may be advantageous to use ropes that have been treated with a suitable rot-proofing and/or a water-repellent agent.

4. A thimble or loop spliced in a natural fibre rope shall have not less than four full tucks, with all the yarns in the strand tucked against the lay. The splice shall then be dogged.

5. A man-made fibre rope shall not be used as a sling or as part of a lifting appliance unless:
   a) it is made to a recognized national or international standard or in accordance with the requirements of a classification society;
   b) the manufacturer has certified its guaranteed minimum breaking load;
   c) its diameter is more than 12 mm.

6. A man-made fibre rope shall not be:
   a) used on a pulley block that does not meet the requirements of section 4.4.5; reeved through a pulley block on which:
      - the groove of a sheave is less than the diameter of the rope; or
      - the sheave has any defect likely to cause damage to the rope.

7. A man-made fibre rope intended to be used for lifting shall not be spliced to a natural fibre rope.

8. When a man-made fibre rope is joined to a wire rope, the two ropes shall have the same direction of lay. A thimble shall be fitted to the eye of the fibre rope and the ropes shackled together.

9. Man-made fibre rope slings are usually manufactured from three-strand rope and spliced in the same way as natural fibre slings. The fibre can be indicated by the colour of the identification label as follows:
   a) green: polyamide (nylon);
   b) blue: polyester (terylene);
   c) brown: polypropylene.
10. A thimble or loop splice.

   a) in a polyamide and polyester fibre rope shall have at least four tucks with all the yarns in the strands, followed by one tuck with approximately half the yarns of each strand, and a final tuck with at least one-quarter of the yarns;
   b) in a polypropylene fibre rope shall have at least four full tucks, with all the yarns in the strands.

11. All tucks shall be against the lay of the rope. Tails protruding from the rope shall be at least three rope diameters long or be dogged.

12. Man-made fibre webbing slings for general use shall be at least 3.5 cm and not more than 30 cm wide. Specially designed slings may be wider. Slings can be manufactured endless or with soft eyes. The eyes of slings over 5 cm wide are reduced by folding at the time of manufacture to allow them to be accommodated in hooks and shackles of the correct safe working load. The eyes may be fitted with reinforcing at point of hook contact. Wear sleeves may also be fitted to reduce damage to the main body of the slings.

13. The minimum length of a soft eye measured internally when the webbing is laid flat shall be .

   a) three times the width of webbing up to 15 cm wide;
   b) two-and-a-half times the width of webbing, for widths greater then 15 cm.

14. Any substance used to increase the resistance of a webbing sling to abrasion shall be compatible with the man-made fibre.

15. Polypropylene webbing or rope slings likely to be exposed to prolonged bright sunshine shall be manufactured of material stabilized against degradation by ultraviolet light, as otherwise severe loss of strength may occur in a relatively short period.

16. The stitching material shall be of the same man-made yarn as the sling, and the join shall be such that, so far as is practical, the load is distributed equally across the width of the belt.

17. Webbing slings shall be manufactured to an internationally or nationally recognized standard, supported by an internationally recognized quality management system.
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18. Disposable or one-trip slings shall:

   a) be not less than 2.5 cm wide;
   b) have a breaking load at least five times their safe working load if up to 5 cm wide and at least four times their safe working load for wider slings.

19. Disposable or one-trip webbing slings shall be clearly and durably marked in a suitable place with the following:

   a) the safe working load at angles from 0° to 45° from the vertical;
   b) either the mark .U., indicating a disposable sling, or the word .disposable. or .one way. in English;
   c) the maker’s identification mark;
   d) the batch number relating to the test certificate or certificate of conformity of the sling;
   e) the year of manufacture.

20. Round slings shall not be used for cargo handling.

7.3.5 Blocks

1. Pulley blocks for use with man-made or natural fibre ropes shall have a cast housing or side and partition plates and straps of steel, or of wood suitably reinforced with steel, or aluminum straps.

2. Except in the case of a cast housing, the side straps shall be adequately and properly secured to the head fitting.

3. The diameter of the sheave(s) measured at the bottom of the groove shall not be less than 5.5 times the design rope diameter.

4. The rope groove shall have a depth of not less than one-third the diameter of the rope and a radius of not less than 1 mm greater than half the diameter of the rope.
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5. A block shall generally not be fitted with more than three sheaves and a becket, or four sheaves if the block has no becket.

6. Provision shall be made for the lubrication of all metal bearings and swivel-head fittings and, where necessary, any plastic bearings.

7. The safe working load of the block shall be based on use with best grade manila rope.

9. The block shall be marked with:
   a) the size of manila rope for which it has been designed;
   b) its own safe working load;
   c) its identification marks.

10. The safe working load of a single-sheave block is the maximum load that can be safely lifted by that block when it is suspended by its head fitting and the load is secured to a wire rope passing round its sheave.

11. When a single-sheave block is rigged with the load to be lifted secured to its head fitting and the block is suspended by a wire rope passing around its sheave, it shall be permissible to lift a load twice the safe working load marked on the block.

12. The safe working load of a single-sheave block incorporated elsewhere in a derrick rig that is secured by its head fitting and subjected to tension arising from a wire rope that forms part of the derrick rig and passes around or partially around the sheave is half the resultant load upon its head fitting. Allowance shall be made for the effects of friction in the block and rope stiffness, i.e. the extra load arising from the effort of bending the wire rope partially around the sheave.

13. The safe working load of a multi-sheave block is the maximum force that may be applied to its head fitting.

14. The design of blocks to be used with wire ropes shall be based on a wire rope having a tensile strength of 180 to 200 kg/mm² (1,770 to 1,960 N/mm²).
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15. A cargo block fitted to the heel of a derrick for the cargo runner or hoist rope shall be provided with a duckbill or similar type of head designed to restrict then downward movement of the block when the runner becomes slack.

16. A cargo block fitted to the head of a derrick used in union purchase, and in other cases where practicable, shall be fitted with a swiveling eye.

17. Cargo blocks shall be rigged in accordance with the ship’s rigging plan.

7.3.6 Other loose gear

1. Hooks shall be constructed so as to cause as little distortion and damage to the eye of a sling as possible. The larger the hook that can be used, the less distortion is caused to the sling.

2. Every hook shall be provided with an efficient device to prevent the displacement of the load from the hook, or be of such construction or shape as to prevent displacement. These may be safety catches, .C. hooks, ring assemblies for union purchase or ram shorn hooks for use with heavy lifts.

3. The screwed shank of a hook or other similar thread shall be undercut to a depth no greater than that of the thread. Any corner where a plain portion of the shank terminates at a sheller or flange of greater diameter shall be radiused as much as is practicable.

4. Hooks may be attached to chain slings by mechanical connection, shackled to slings of any material or be an integral part of a block.

5. The shape of thimbles shall be such that the internal length and width are six and four times the diameter of the rope respectively. The thickness of the metal at the bottom of the throat shall be 0.4 times the rope diameter.

6. The diameter of the body and pin of a shackle are given as well as its safe working load (13 mm (1/2.) x 16 mm (5/8.)). Shackle pins are always larger than their body.
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7. Shackles are usually manufactured from two types of steel, grade .T. (800 N/mm²) and grade .M. (400 N/mm²). .T. shackles are approximately twice the strength of grade .M. shackles. They are usually known as Alloy and HT. shackles.

Size High tensile Alloy
13 mm (1/2") 1.0t 2.0t
25 mm (1") 4.5t 8.5t
50 mm (2") 19.0t 35.0t

8. Where shackles are permanently rigged, the pins shall be locked by mousing a screw collar pin or by a split cotter pin on a nut and bolt pin.

9. A swivel shall always be inserted between the sling hook and the hoisting rope.

10. Every vacuum lifting device shall be fitted with the following:

   a) a suitable vacuum gauge or other device clearly visible to the lifting appliance operator;
   b) an audible warning to the operator and any person working nearby when the vacuum is 80 per cent or less of the designed working vacuum, or the vacuum pump ceases to operate;
   c) means for maintaining a sufficient vacuum to continue supporting the load for sufficient time to allow it to be lowered safely from the maximum height of lift of the lifting appliance to the quayside in the event of vacuum pump failure.

11. The vacuum gauge shall be marked in red with the lowest vacuum at which the appliance may be used.

12. The designed working vacuum shall be the vacuum necessary to support the test load which the lifting appliance is required to support.

13. Where the vacuum is controlled from the cab of the lifting appliance, the controls shall prevent accidental removal of the vacuum.

14. As far as is practical, the surface of a test load of a vacuum lifting device shall be similar to the worst type of surface the device is intended to lift. If the lift is to be wrapped, the test load shall be similarly wrapped.
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15. The voltage of the electric power supply to any magnetic lifting device shall not fluctuate by more than ±10 per cent.

16. A magnetic lifting device shall be:

   a) provided with an alternative power supply unless the magnet is only used to handle scrap metal or other cargo and no person will be near the device;

   b) constructed to withstand the entry of moisture.

17. A magnetic lifting device shall be marked with its safe working load as determined by tests using weights of the same characteristics as the load for which the device is intended to be used. When the load to be lifted is dissimilar to the test load, it shall be restricted to approximately 60 per cent of the safe working load.

18. Other loose gear includes lifting beams, spreaders, lifting frames and other attachments for lift trucks, tongs, claws and cradles for handling round bars or logs. All shall have adequate strength for their intended purpose with an appropriate factor of safety. The effectiveness of tongs and claws depend on the roughness of their surface or the condition of their teeth.

7.3.7 Flexible intermediate bulk containers (FIBCs)

1. Some FIBCs (for carrying powdered homogeneous cargo) are reusable but single trip FIBCs shall never be reused.

2. The lifting straps at the corners of FIBCs shall always be lifted vertically.

3. Before an FIBC is lifted, the certificate of conformity and a thorough examination certification (issued in the last 12 months) shall be checked and the bags shall be inspected.

7.3.8 Pallets

1. Pallets shall be free from visible defects liable to affect their safe use.

2. The decks of wooden shipping pallets shall be at least 35 mm thick. The space between the decks shall be sufficient to allow easy access by the forks of lift trucks or the arms of other pallet-lifting devices.