RULES
FOR TECHNICAL SUPERVISION OF SEA-GOING SHIPS

Part 19 - CARGO HANDLING GEAR AND LIFTING APPLIANCES

2011

CROATIAN REGISTER OF SHIPPING

Hrvatska (Croatia) • 21000 Split • Marasovićeva 67 • P.O.B. 187
Tel.: (...) 385 (0)21 40 81 11
Fax.: (...) 385 (0)21 35 81 59
E-mail: tech.coord@crs.tel.hr
web site: www.crs.hr

By the decision of the General Committee to the Croatian Register of Shipping,
the Rules for Technical Supervision of Sea-Going Ships,
PART 19 - CARGO HANDLING GEAR AND LIFTING APPLIANCES
have been addopted on 7th December 2010 and enters into force 1st January 2011

REVIEW OF MODIFICATIONS AND ADDITIONS IN RELATION TO 2002 EDITION

RULES FOR TECHNICAL SUPERVISION OF SEA-GOING SHIPS

Part 19 - Cargo handling gear and lifting appliances

All major changes throughout the text are shaded (if any).

The grammatical and print errors, not expressly listed in this review, have been corrected throughout the subject part of the Rules. Items not listed in this review have not been changed in relation to 2002 edition.

The subject Rules include the requirements of the following international Organizations:

International Labour Organization (ILO)

Conventions:	ILO 152
Codes:	ILO code of practice "Safety and health in dock work", revised edition, third impression, 1984.

Contents:

1 GENERAL

1.1 APPLICATION

1.1.1 This part of the *Rules for technical supervision of sea-going ships* (hereinafter referred as: the Rules) of *Croatian Register of Shipping* (hereinafter referred as: the *Register*) applies to lifting machinery and gear intended for loading, unloading and transfer of cargo and persons on ships and other maritime objects.

The Rules also apply to auxiliary machinery for cargo spreading appliances, spreaders, lifting beams, frames and adjustable container spreaders etc. belonging to ships and other maritime objects.

When certifying cargo handling gear and lifting appliances on ships and other maritime objects any specific or additional requirements of the Flag State Administration (the Administration of the Government of the state whose flag the ship is entitled to fly), if any are to be taken into account.

In case of discrepancy between such national requirements and those of the Rules the former shall take precedence.

1.1.2 The Rules do not apply to drilling gear and technological cargo appliances on the drilling units, geological research ships and similar, as well as to grab dredges and crane electric magnets.

1.1.3 The requirements of the Rules do not apply to the lifts with the safe working load less than 250 kg and to the lifts of special construction such as outboard lifts as well as to the auxiliary installations used for cargo securing (e.g. rigging screws, hooks, shoes on rails, lighting gates, etc.), which are not the lift components.

1.1.4 The requirements of the Rules applies to ship's lifting platforms (SLP), intended for vertical loading/unloading of cargoes and vehicles on ships and other maritime objects as well as to methods, procedures and scope of supervision to which the lifting platforms are subjected.

The Rules do not apply to ramps on board or in board, cargo and passenger lifts, pilot hoists and movable working platforms.

1.1.5 The application of the Rules to the ship's lifting platforms having operating speed in excess of 0,1 m/s or to the ship's lifting platforms not covered by the Rules, shall be subjected to special consideration and compliance of the *Register*.

1.1.6 The Rules shall be fully applied to lifting appliances the technical documentation of which is submitted to the *Register* for consideration. In other cases the Rules are applicable to the extent which is practicable and reasonable and the *Register* shall specially consider and agree on each particular case.

1.1.7 The lifting appliances, which are not controversial to the Rules, or systems intended for use under special conditions not covered by the Rules, shall be specially considered and agreed by the *Register* in each particular case.

1.1.8 Compliance with the Rules is a prerequisite to issue or endorse the validity of the "Register of Lifting Appliances and Items of Loose Gear" ("Cargo Gear Book"), as well as of other ships documents in case that they are referring to the safety of cargo handling gear and lifting appliances. These documents do not relate to classification documents issued by the *Register*

1.1.9 The *Register* reserves the right to impose additional requirements not provided by the Rules, in case it is found to be necessary for the safe operation of the equipment.

1.2 DEFINITIONS AND EXPLANATIONS

For the purpose of the Rules the following definitions and explanations have been adopted:

Lifting appliance - all appliances on board (or on floating objects) which are intended for loading, unloading and transfer of cargo and persons (derricks, cranes, hoists, lifts, lifting platforms).

Ship's derricks - are lifting appliances designed for holding and transferring the cargo by means of the system of blocks and ropes attached to the derrick own structure and outside it (to masts, posts, decks, winches).

Light derrick - is a derrick with lifting capacity of less than 20 t.

Heavy derrick - is a derrick with lifting capacity of 20 t and more.

Mechanized derrick - is a derrick designed so as to ensure the change of its position under load by means of turning winches being an integral part of derrick structure.

Crane - is a lifting appliance capable of transferring the cargo without any blocks or ropes outside its own structure.

Hoisting appliance - is a stationary power-driven or hands operated lifting appliance of a simplified design of cat davit, telpher, purchase or whip type.

Upper structure of floating crane - is a lifting appliance installed on the open deck intended for carrying cargoes.

Lifting devices - are all the devices by means of which cargo can be attached securely to the lifting appliance but which is not integral part of lifting appliance or cargo, e.g. container spreaders, lifting beams, frames and other devices belonging to the ship. Unless otherwise agreed, lifting devices shall be considered as loose gear.

Container spreader - is a lifting device in form of a frame or a beam, which is manually or mechanically connected to the upper corner fittings.

Loose gear - includes items attached to a lifting gear by means of loose joints, such as blocks, hooks, chains, shackles, swivels, clips etc.

Standing gear - includes items attached permanently to the lifting appliance structural elements or to the ships hull, such as cargo runner and guy eye plates on derricks, span eye plates and heel gooseneck with their bearing, derrick heel fork lugs, deck eye plates, built-in sheaves etc.

Machinery - includes cargo winches and drums, topping and similar winches and also the machinery

used for topping, slewing or hoisting crane booms and movement of cranes and hoists.

Winch - a mechanism for lifting (hoisting), lowering and transferring the cargo.

Topping and similar winches - include machinery used for shifting the derrick booms without load or holding them securely when the derrick is loaded and driven either by cargo winches or independently.

Structural members - include derricks, masts, posts, cross trees, bridges, gantries, substructures etc., taking up loads acting on the lifting appliance.

Lifting capacity - is the greatest permissible mass to be lifted including the mass of accessories: slings, lifting beams, platform slings, nets etc. used for attachment of cargo as well as the mass of grabs, lifting electromagnets, boxes and buckets.

Lifting capacity indicator - is a device to indicate automatically and visually (no matter whether the cargo is suspended or not) the maximum allowable design load for a particular crane at different jib radii.

Automatic overload cut-out - is a device that automatically cuts off the power supply if the load upon the crane or its parts exceeds the safe working load.

Limit switch - is a device limiting automatically movement of the lifting appliance, derrick crane or some component thereof as well as the cargo by disconnecting the machinery drive in extreme positions.

Safe working load (SWL) - is the maximum allowable static load directly applied to the supporting element (e.g. cargo hook) of the lifting appliance.

Permissible rope pull (PRP) - is the maximum allowable force in a rope of single or multiple-sheave blocks.

Safety factor - is the ratio of the minimum breaking load to the safe working load.

Derrick outreach - is the distance between the perpendicular passing trough the center of gravity of the hoisted load and the perpendicular axis of rotation.

Effective derrick outreach - is the distance between the perpendicular passing through the center of gravity of the hoisted load and the ship's side plane, or pontoon transom plane when floating on even keel.

Floating crane - means a technical floating unit with the pontoon type hull specially intended for the purpose of lifting heavy cargoes. If the deck is specially reinforced may be used to haul heavy cargo.

Lift - lifting appliance intended for lifting and lowering of persons or cargo in a cabin, moving vertically in trunk with doors on standing positions.

Passenger lift - intended for lifting and lowering of persons and their luggage.

Cargo lift - intended for lifting and lowering of cargo, without persons.

Loading capacity - is the maximum number of persons or mass of cargo for lifting and lowering of loose gear including the mass of auxiliary loose gear temporarily used for securing the cargo.

Winch with drum - is a winch fitted with a drum for winding the rope thereon.

Winch with a traction sheave - is a winch fitted with a sheave producing the pull in the rope by means of its friction in the sheave groove.

Gripping device - is an automatically operated device for gripping and stopping the car or counterweight on the guides in downward direction in the case of overspeed or break of the ropes.

Overspeed governor - is a device by which the gripping devices are tripped when the rated speed is exceeded.

Lift trunk - is a completely enclosed space where the lift car and counterweight are placed.

Lift car - is a load carrying area of the lift enclosed over its entire height and provided with the floor and ceiling.

Acceptable number of persons - is the loading capacity in persons depending on the usable area of the car floor.

Ship Lifting Platform (SLP) - is a lifting appliance with platforms designed for vertical transportation of cargoes between cargo decks of ro/ro ships and other floating structures operated by hydraulic, electric or mechanical drives.

Lifting platform - is a load-carrying structure of the elevator, with handrails or without handrails on its sides, guided by wire ropes, lever system, hydraulic drives, gear rack or spindle.

Where necessary the platform may form a decked-in area of a ship, be secured in the working position by locking devices during operation. The lifting platform may be provided with one or two platforms ensuring simultaneous operation of different decks.

Guides - are the elements of the lifting platform designed for providing necessary direction of platform movement and also for holding platform in position when gripping devices are tripped.

Shoes - are movable elements of the lifting platform ensuring the required position of the platform with regard to guides.

Limit stops - are arrangements limiting the platform movement in the case of lifting mechanism failure or in the limiting working positions.

Buffers - are spring limit stops ensuring considerably absorption of movement energy of the ship's lifting platform.

Drives - are hydraulic pump units and winches.

Competent person - means a surveyor to the *Register* or a person authorized or acceptable as such by the *Register*.

Renewal survey - means a survey carried out in compliance with the *Rules for technical supervision of sea-going ships, Part 1. - General requirements, Chapter 5*, 4.13.2, 4.14.2 and 4.16.2.

Annual survey - means a survey carried out in compliance with the *Rules for technical supervision of sea-going ships, Part 1. - General requirements, Chapter 5*, 4.13.1, 4.14.1 and 4.16.1.

Test load - means a cargo intended for test loading.

1.3 SCOPE OF SUPERVISION

1.3.1 The following lifting appliances are subject to the supervision of the *Register*:

1. derricks, cranes and hoists;
2. upper structures of floating cranes and crane ships;
3. cranes on floating docks and offshore drilling units;
4. all ship's lifting platforms with raising and lowering speed not exceeding 0,1 m/s;
5. electric powered lifts intended to carry people or cargo in cabin suspended by ropes and running with the speed not exceeding 1,0 m/s;
6. cargo lifts.

The *Register* shall specially consider supervision of lifting appliances of other types and purposes in each particular case.

1.3.2 Supervision of the *Register* shall include:

1. consideration and review of the technical documentation;
2. supervision during manufacture of lifting appliance, installation on board (i.e. floating unit) and its repairs;
3. surveys and tests;
4. stamping;
5. the issue of certificates and extension of their validity.

1.3.3 The following items shall be subject to the supervision of the *Register*:

1. ship's derricks;
   - steel and wooden structural elements,
   - cargo winches and drums as well as standing and loose gear;
2. cranes and hoisting appliances;
   - steel structures;
   - machinery, breaks, drives;
   - standing and loose gear;
   - safety devices;
3. electrical equipment of the lifting appliances;
4. machinery drives;
5. boilers and pressure vessels which are parts of lifting appliances;
6. cargo gear systems and pipe lines of lifting appliances;
7. parts of ship's lifts: trunks, trunk doors, guides, cars, counterweights, buffers, safety device (gripping devices, overspeed governors), winches, ropes with details of wire runs and mountings (sheaves, cleats casings, cleakay belt, key etc.), electrical equipment (electric drives, control and signalling systems, safety devices, lighting);
8. components of ship's lifting platforms: platforms, guides, handrails, blocking devices, buffers, stopping and safety mechanisms, mechanical or hydraulic drives, lifting mechanisms (wires and chains, guides and their attachments, lever systems, gear racks and spindles), electrical equipment (electric drives, control and warning systems, safety devices, lighting).

The list of the corresponding structures, machinery and structural elements of the lifting appliances, which are subject to the supervision of the *Register*, is given in the Appendix to this Rules.

1.3.4 Supervision during manufacture, installation on board and repairing of lifting appliances, as well as their machinery, steel structures and safety devices shall be carried out in compliance with this Rules, *Rules for technical supervision of sea-going ships, Part 1*, as well as other relevant parts of the Rules for the classification of ships of the *Register*.

1.3.5 Supervision of machinery, hydraulic and steam drives, systems and piping, electrical equipment, manufacture and materials as well as of boilers and pressure vessels not covered by the specific requirements of the Rules, shall be carried out in compliance with the appropriate requirements of the relevant parts of the Rules.

If the requirements of the Rules differ from those of the relevant parts of the Rules, the former take precedence.

1.3.6 Supervision of derricks, cranes and lifting appliances on fishing vessels used for fishing facilities as well as stationary ship's derricks rigged in union purchase with the derricks of another ship, shall be carried out in a similar manner as of that adopted for the ordinary lifting appliances.

1.3.7 The supervision over the mechanized derricks and cargo hoisting appliances of the telpher type shall be carried out in compliance with the corresponding standards of calculations for ships cranes, and in the case of hoisting appliances with cargo purchase and whip type with those for cargo derricks.

1.3.8 Types and designations of components of lifting appliances in the Rules are shown in Figs 1.3.8.1 to 1.3.8.5.

Item	Designation
1.	Mast
2.	Gooseneck bearing
3.	Span trunnion piece
4.	Derrick boom
5.	Derrick head fitting
6.	Guy plate
7.	Derrick gooseneck fitting
8.	Gooseneck
9.	Cargo lead
10.	Span plate block holder
11.	Cargo winch
12.	Cargo runner
13.	Lower cargo runner block
14.	Cargo runner guide
15.	Derrick head cargo block
16.	Thimble
17.	Shackle
18.	Swivel

Item	Designation
19.	Cargo hook
20.	Span chain
21.	Triangle plate
22.	Topping winch
23.	Topping rope
24.	Span rope
25.	Head span block
26.	Topping span lead block
27.	Guy tackles
28.	Guy winch
29.	Guy tackles pendant
30.	Lower guy block
31.	Upper guy block
32.	Becket
33.	Guy pendant
34.	Rope socket
35.	Deck eye plate

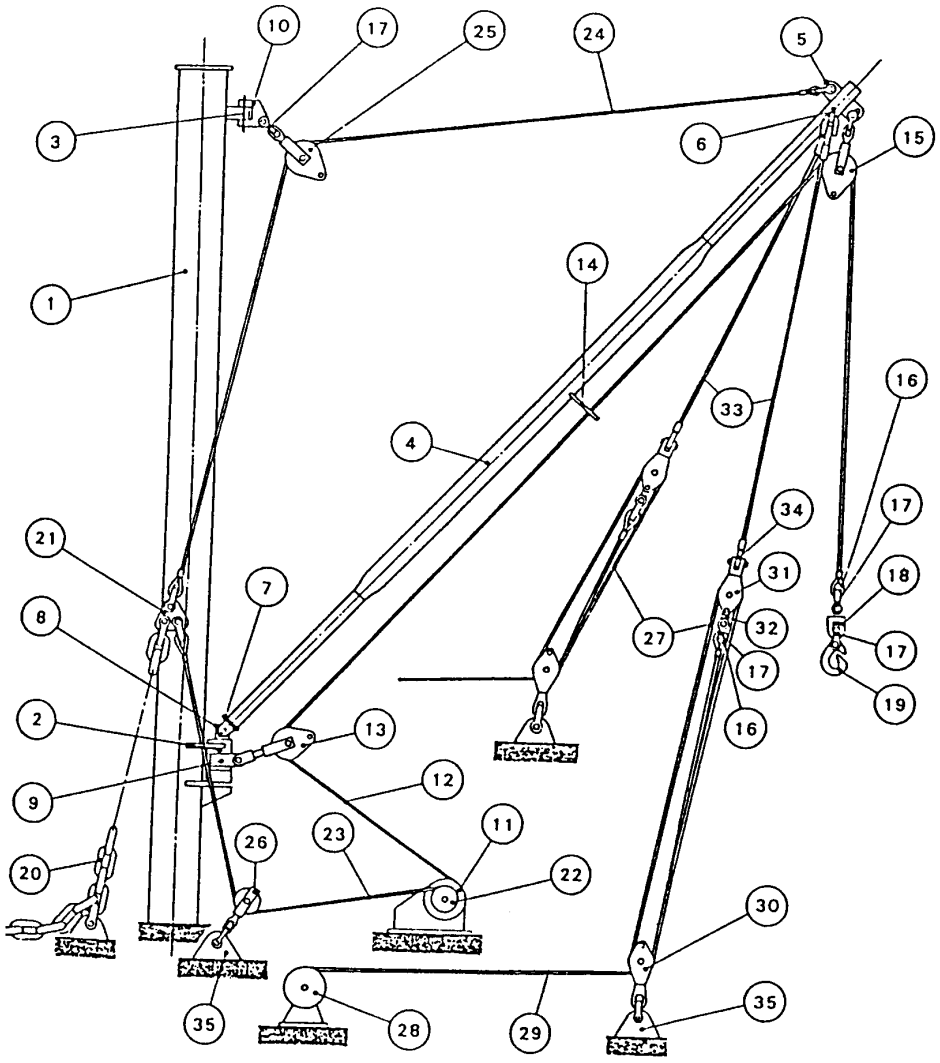


Figure 1.3.8.1
Light derrick

Item	Designation
1.	Mast
2.	Derrick boom
3.	Cargo winch
4.	Span winch
5.	Span bolt
6.	Span bearing and trunnion piece
7.	Span bearing
8.	Span block
9.	Span rope
10.	Shackle
11.	Derrick gooseneck fitting
12.	Gooseneck
13.	Cargo lead block holder
14.	Adjusting ring

Item	Designation
15.	Gooseneck bearing
16.	Lead block
17.	Derrick head fitting
18.	Upper cargo runner block
19.	Becket
20.	Cargo runner
21.	Lower cargo runner block
22.	Cargo hook
23.	Guy eye plate
24.	Guy pendant
25.	Tackle block
26.	Guy tackles
27.	Eye plate
28.	Topping rope

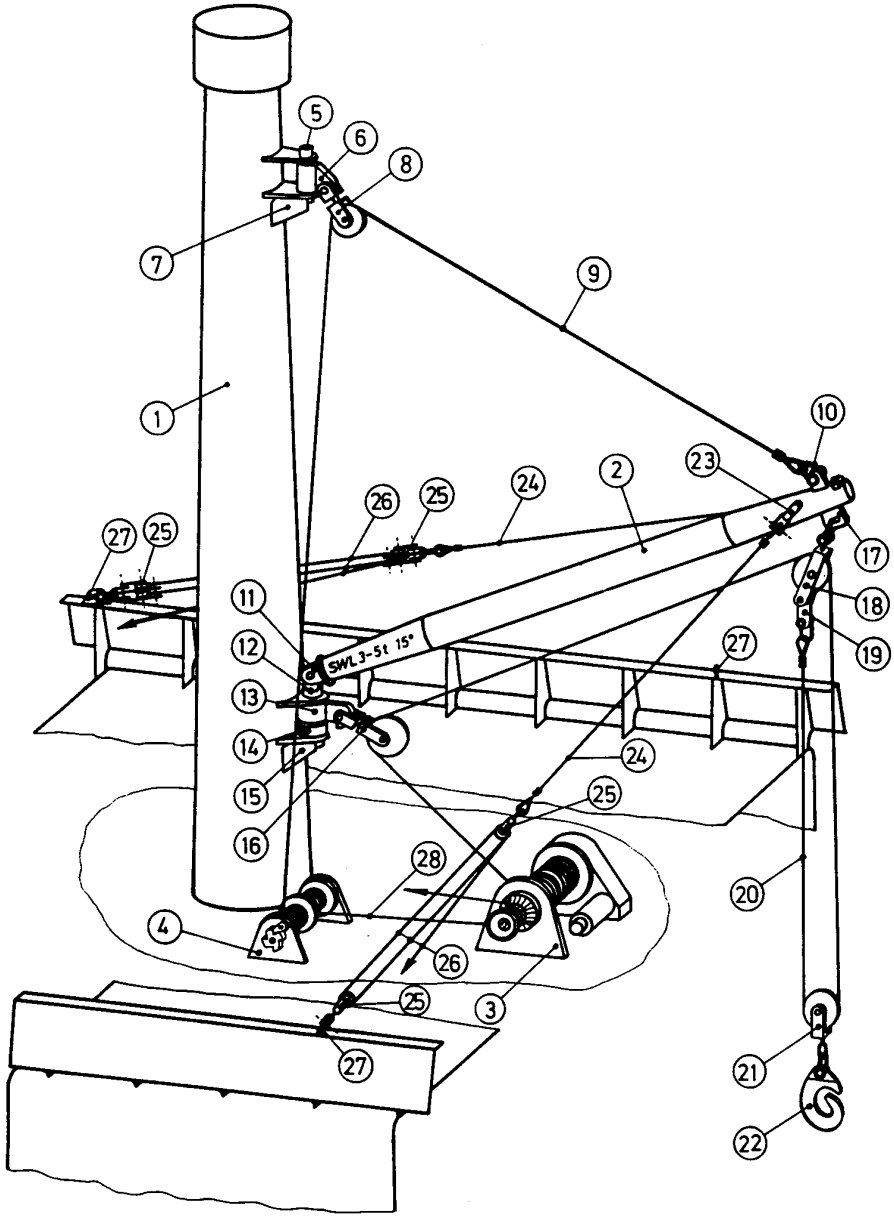


Figure 1.3.8.2
Heavy derrick

Item	Designation
1.	Mast
2.	Cross tree
3.	Cargo shackle
4.	Span trunnion piece
5.	Span lead block eye plate
6.	Derrick post
7.	Derrick
8.	Span eye plate
9.	Cargo runner eye plate
10.	Derrick heel fitting
11.	Gooseneck
12.	Cargo winch
13.	Cargo runner
14.	Cargo lead block
15.	Cargo eye plate
16.	Built-in sheave
17.	Shackle

Item	Designation
18.	Upper cargo runner block
19.	Lower cargo runner block
20.	Becket
21.	Cargo hook
22.	Cargo runner
23.	Span winch
24.	Span rope
25.	Span lead block
26.	Span lead block eye plate
27.	Lower span tackle block
28.	Triangle plate
29.	Swivel
30.	Span block eye plate
31.	Trunnion piece
32.	Head span tackle block
33.	Tackle span guy

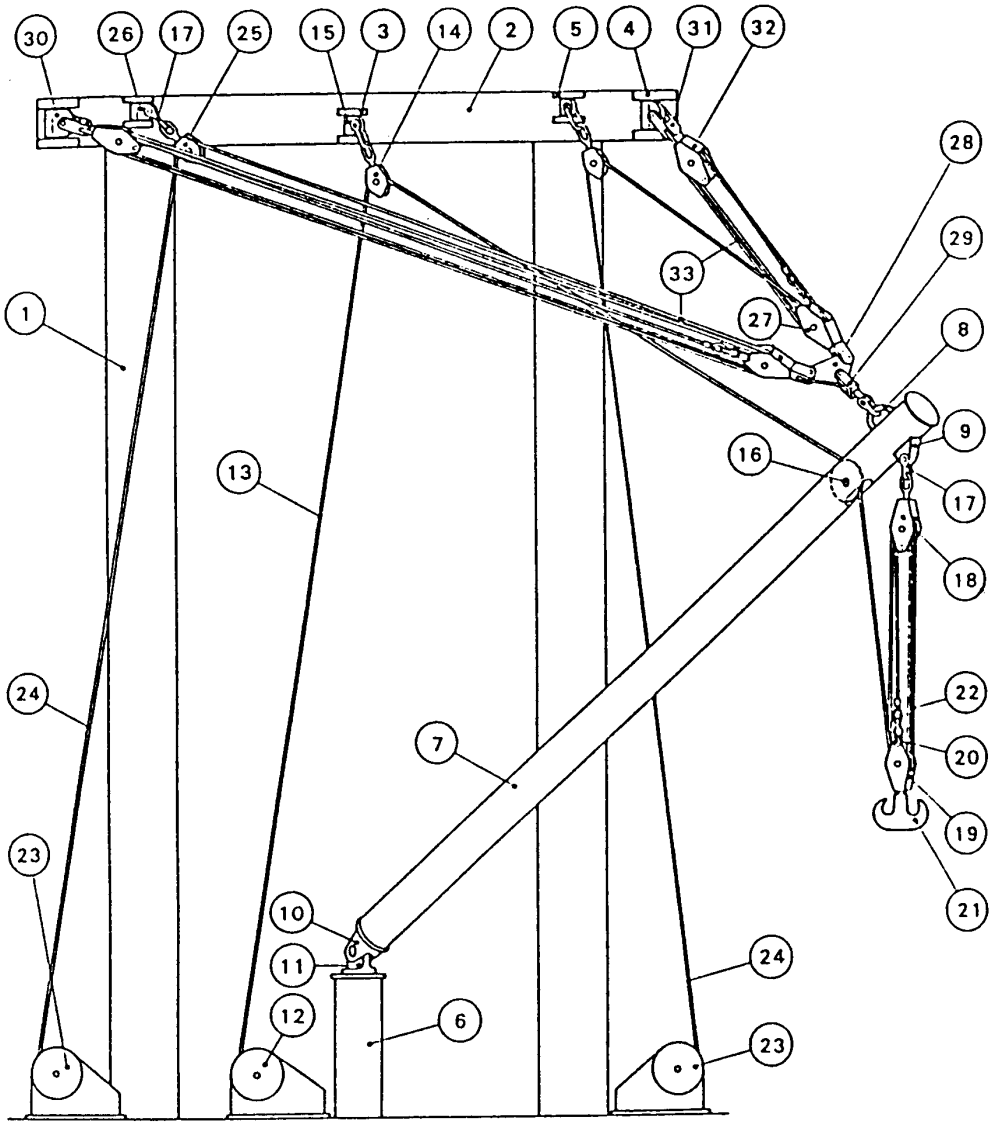


Figure 1.3.8.3
Twin span derrick

Item	Designation
1.	Mast
2.	Cross tree
3.	Hold derrick
4.	Side derrick
5.	Derrick heel fitting
6.	Derrick head fitting
7.	Cargo winch
8.	Cargo runner
9.	Triangle plate
10.	Cargo hook

Item	Designation
11.	Sling
12.	Span ropes
13.	Span eye plate
14.	Schooner guy
15.	Preventer
16.	Guy tackle
17.	Guy pendant
18.	Guy eye plate
19.	Oval eye plate

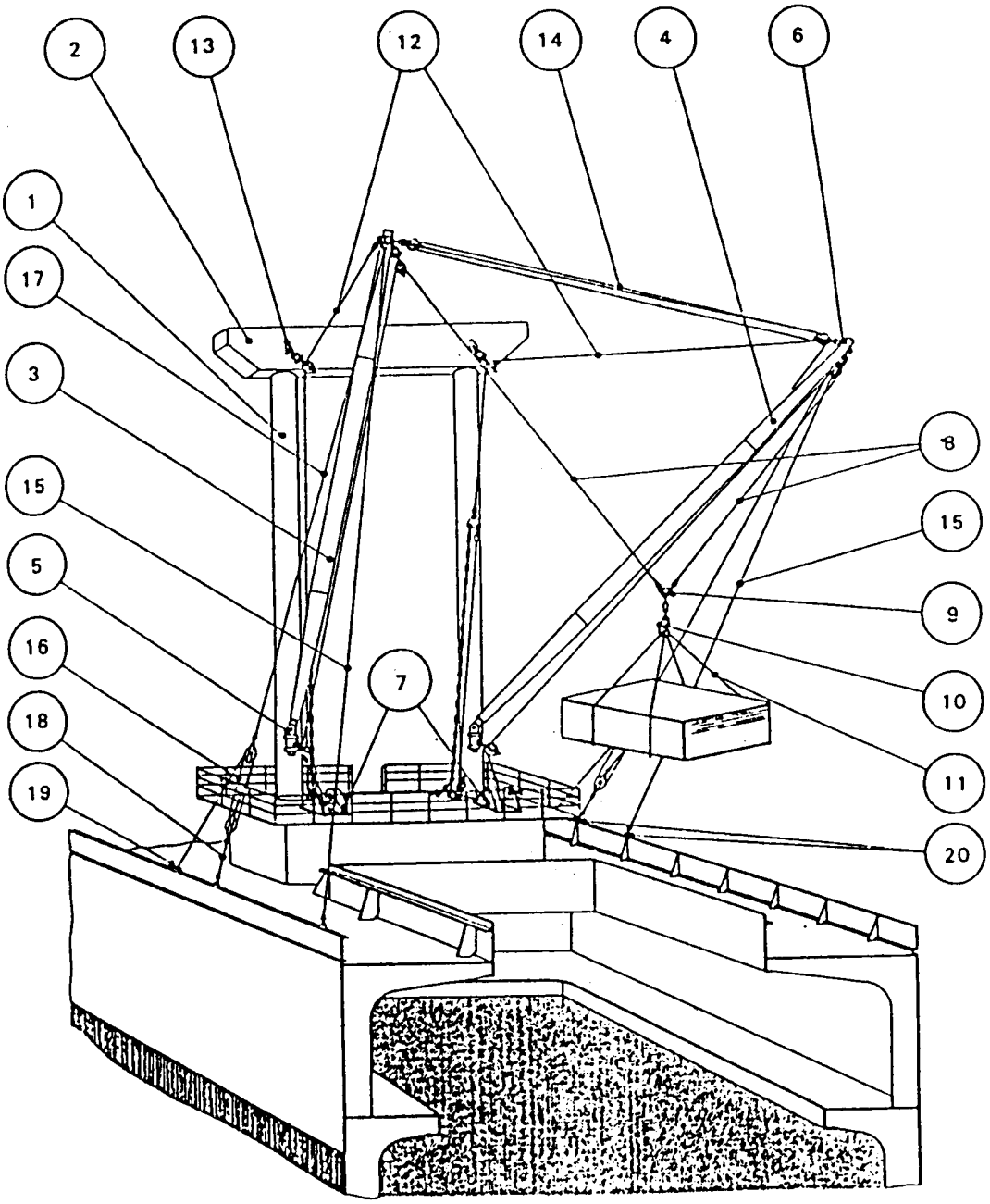


Figure 1.3.8.4
Schooner guy derrick

Item	Designation
1.	Crane pedestal
2.	Crane housing
3.	Slewing ring
4.	Crane cabin
5.	Crane jib
6.	Jib foot bearing
7.	Luffing cylinder
8.	Hoisting rope / cargo runner
9.	Crane housing cargo sheaves
10.	Jib top cargo sheaves
11.	Cargo winch
12.	Thimble
13.	Shackle
14.	Swivel
15.	Link
16.	Cargo hook
17.	Pressed clip

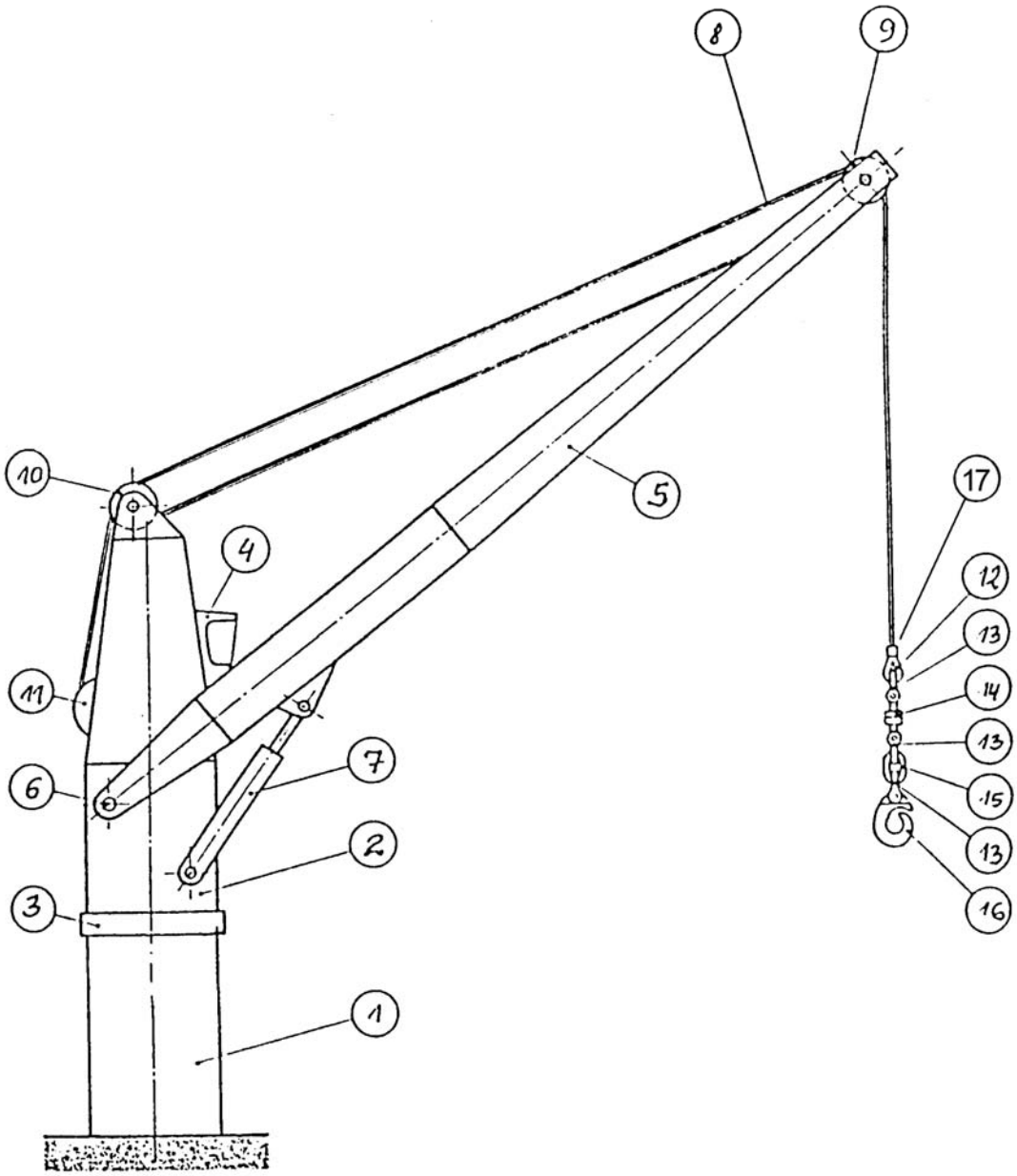


Figure 1.3.8.5
Deck crane

1.4 TECHNICAL DOCUMENTATION

1.4.1 Technical documentation needed to be submitted to the *Register* for approval shall be as follows:

1. specification;
2. general arrangement plans of lifting appliances with the data on general properties (range, hoisting capacity, side outreach, cargo lowering and hoisting speed, minimum and maximum outreach, slewing speed and similar);
3. general view drawings of masts with derricks, crane winches, hoists, lifts and lifting platforms and of their attachments to the ships structures as well as of reinforcements of the ships hull in way of attachments;
4. drawings of steel structures of lifting appliances (masts, derrick posts, bridges, portals, pedestals, lift trunks, crane bearings etc.) with strength and stability calculations;
5. drawings of lifting appliances accessory gear together with strength calculations or with particulars proving their strength as equivalent to that of the standard gear approved by the *Register*;
6. drawings of safety devices (with strength calculations, when required);
7. drawings of fastening the derricks and cranes when stowed for sea;
8. technical documentation of the machinery and their drives including:
   .1 assembly drawings with cross-sections,
   .2 drawings of load bearing shafts, gears, reduction gear and couplings.
   .3 drawings of pedestals together with the particulars of welding,
   .4 calculations or resultant strength of the stress bearing items,
   .5 testing program,
   .6 explanation or description of main technical data for machinery,
   .7 hydraulic installation basic scheme,
9. technical documentation of electrical equipment including:
   .1 description of the principle of operation and main performance data,
   .2 specification and the list of components of completed machinery, apparatus, devices and materials,
   .3 constructional assembly drawings,
   .4 schematic diagram of electric drives,
   .5 testing program;
10. equipment scheme;
11. scheme of forces acting on the elements of cargo gear appliance,
12. calculations of strength or resultant strength of the strength-structural members,
13. instructions for derricks used in union purchase with their working areas, safe working loads, dimensions and rigging scheme;
14. testing program of lifting appliance in the manufacturer workshop and after being installed on board.

1.4.2 Technical documentation for lifting appliances may be considered separately to the extent referred to in 1.4.1.1 to 1.4.1.14 (irrespective of the technical documentation relevant to ship design), or together with instructions on types and purpose of ships or other floating units.

1.4.3 When applying for initial certification of lifting appliances whose design is not approved by the *Register*, required technical documentation, including calculations are to comply with 1.4.1.1 to 1.4.1.14, and shall be submitted to the *Register*.

In exceptional cases, the *Register* may accept the reduction of the scope of technical documentation needed, taking into account the documents from the manufacturer and other supervision authorities (see 7.1.4).

1.4.4 For ship's lifts technical documentation to be submitted by the manufacturer to the *Register* shall comprise the following:

1. specifications and descriptions of lift structure;
2. general arrangement of lift;
3. calculations and diagrams of forces acting on lift components, strength calculations (and also strength calculations and resistance for certain components);
4. drawings of trunk and machinery space, drawings of trunk doors, guides and buffers with positions of their attachments, drawings of lift cars and counterweights with their suspension fittings, drawings of wire and rope runs and suspension attachments with their strength calculations or particulars or with proofs of their strength;
5. drawings of safety devices;
6. technical documentation of winches, including:
   .1 technical description of main technical particulars;
   .2 drawings of worm gear, pinions, worm wheels, reduction gear and couplings (or as a part of assembly drawings);
7. technical documentation of electrical equipment, including:
   .1 technical description with main technical characteristics;
   .2 schematic diagram of lifts' electric circuit;
   .3 scheme of electric connections and control commutation scheme;
8. program and procedure of testing;
9. list of associated and spare parts.

1.4.5 When applying for initial certification of lift whose design is not approved by the *Register*, the necessary documentation shall comply with the list specified in 1.4.4.

In exceptional cases, the *Register* may accept the reduction of the scope of technical documentation

needed, taking into account the documents from the manufacturer and other supervision authorities (see 7.1.4.).

1.4.6 The technical documentation of ship's lifting platforms to be submitted to the *Register* for approval shall comprise:

1. specification, description of the lifting platform structure and respective drives;
2. general arrangement plans of the lifting platform and relevant drives;
3. calculations and diagrams of forces acting on lifting platform components and relevant drives during operation and out of operation, strength and stability calculations;
4. drawings of lifting platform components and their attachments and drawings of drives with indication of material used;
5 list, description and drawings of protecting and safety devices;
6. circuit diagram, connections diagram and control wiring diagram;
7. test program and procedure;
8. list of associated equipment and spare parts.

1.4.7 For steel structures, gear, machinery and devices manufactured according to standards approved by the *Register*, no special documentation is to be submitted. Also, no special approval is needed for technological processes, heat treatment and calculations according to standards and technical conditions approved by the *Register*.

1.4.8 In justified cases, the *Register* may require the extension of the scope of technical documentation needed. Also, the scope may be reduced if the submitted documentation includes all necessary technical data to prove technical safety of the respective system.

1.4.9 When needed, the *Register* may require the strength calculations of ships structures and hull reinforcements in places of attachment of masts, posts, derricks, lifts, winches, hoists (lifting devices) eye plates as well as the fastening of derricks and crane jib when stowed for sea.

1.4.10 If lifting appliance has been altered or repaired, the technical documentation to be submitted shall correspond to the alternations made and shall be provided with the relevant calculations and be in compliance with the Rules.

1.4.11 Where all or some documents quoted in 1.4.1, 1.4.4 or 1.4.6 are not available, they are to be prepared on the basis of measurements made in co-operation with the surveyor to the *Register*. The extent to which documents may be dispensed with shall be decided in each individual case by the Head office of the *Register*.

2 TECHNICAL REQUIREMENTS

2.1 GENERAL

2.1.1 Construction, dimensions and technical design of lifting appliance shall be such as to enable safe handling of free suspended cargo, taking into account the initial calculations set forth in the Rules (maritime object heeling angles, wind pressure, etc.) as well as other designed parameters for the service area.

The load due to the declination of the cargo runner rope from the vertical, not being caused by the floating unit heeling or inertia forces as a resultant of lifting appliance operational movements or cargo swinging, shall be specially taken into account and indicated in the documentation submitted to the *Register*.

2.1.2 The lifting appliances installed on open decks shall be so designed as to provide their safe operation at the angles of inclination and trim referred to in Table 3.3.1.3 and at the ambient temperature.

The range of working temperatures taking into account the operational area and arrangement of lifting appliances on board i.e. floating unit, from +45°C to -25°C and for electrical equipment from +55°C to -25°C is recommended to be indicated.

2.1.3 The standing axles supporting rotating elements (drums, blocks, sheaves, wheels, etc.) shall be reliably fixed.

2.1.4 All bolts or key connections shall be secured against inadvertent loosening or disconnection.

2.1.5 Power, mechanical, hydraulic and steam drives, systems and piping, as well as the electrical equipment where not covered by the specific requirements of the Rules shall comply with appropriate other Rules of the *Register* (see *Rules for the classification of ships*, *Part 8 - Piping, Part 9 - Machinery* and *Part 12 - Electrical Equipment)*.

2.2 DERRICKS

2.2.1 General requirements

2.2.1.1 Derricks and hoists intended for handling for fishing facilities may be used with deck machinery other than cargo winches, with turns of the cargo runner laid onto the drum of the deck machinery and free end of the cargo runner held by hands. In such cases, for testing the lifting appliance, the runner shall be reliably secured to the drum.

The deck machinery used for the purposes mentioned, shall comply with the requirements of the Rules.

2.2.1.2 Schemes of derrick types are given in Section 1 of the Rules.

2.2.1.3 Derrick gooseneck and span plate shall be positioned in the same vertical line. The *Register* shall consider the place of span attachment to the derrick heel fitting in each particular case.

2.2.1.4 Provision shall be made for safe attachment of derrick "stowed for sea". In case that the derrick "stowed for sea" is positioned perpendicularly to mast and provision is not made for derrick attachment by means of span ropes, special equipment shall be provided for the derrick.

2.2.1.5 The use of cargo and span lead block shall not be permitted.

2.2.1.6 When the derrick is provided with common drive for both the lifting or lowering the derrick or cargo, attachments to drum shall be provided with blocking system which ensures that the connection does not drop off the drum until the span drum takes over the connection.

2.2.1.7 Each derrick, unless already provided with the mechanically driven span drum, shall be provided, if practicable, with the span drum in accordance with the requirements specified in 2.2.4. Where the installing of drum is impracticable or impossible, the span chains connected with span ropes by triangle plate shall be used.

2.2.1.8 The span chains of derricks shall be secured to the eye plates on deck or mast. Where the wire rope is used instead of span chain, it shall be securely attached to the drum of the topping winch or the span winch.

Fastening of the span ropes, guy units and preventer guys making use of friction forces (rope stoppers, bollards) shall not be permitted.

2.2.1.9 The change of horizontal position of derrick boom maximum outreach by derrick guy shall be permitted only when the angle of heel is up to 5° and trim up to 2°.

2.2.1.10 The span rope length as well as that of cargo runner shall be so selected as to enable that the number of reels on the drum is not less than three for all possible stowing and moving positions of derrick under operation.

For span rope, only one reel on the drum is permitted when the derrick is "stowed for sea".

2.2.1.11 Derrick heel bearing shall be positioned at the same height from the deck as winches to enable free access to personnel as well as proper reeling of cargo runner on the drum.

2.2.1.12 If the derricks are not provided with tackle guys which can fasten them in each position, each derrick of the capacity up to 20 t shall be provided with at least two tackle guys and that of the capacity over 20 t with three tackle guys.

2.2.1.13 When the cargo runner is released, provision shall be made to prevent the free fall of cargo lead block. Therefore the structure of cargo block holder shall be provided with limiters or other limiting devices.

2.2.1.14 The heavy derrick posts shall be of sufficient strength and especially where the post is fitted on the deck. The derrick posts shall be provided with the water drains.

2.2.1.15 The tubular mast shall be compassed by derrick heel bearing and span eye plate by at least 40° counting from the axis of bearing. For step bearings the reach of compass in the lower part may be diminished but shall not be less than 30°.

Where smaller angles of compass are used, the mast shall be reinforced in corresponding positions by thicker walls or inner stiffeners.

2.2.1.16 Eye plate for fastening the cargo block and span as well as those for guy units and preventer guys shall pass through derrick head and shall be welded at both sides along perimeter.

2.2.1.17 Derrick heel pins shall be fitted with nuts and locking devices; the stress-bearing portion of the pin thread shall not exceed 1/3 of the lug thickness.

2.2.1.18 The goosenecks shall be safeguarded against slipping out of the lower and upper bearings.

The bearing area shall be smooth. The bearings shall be properly adjoined to each other, lubricated and protected against wearing and water penetration.

2.2.1.19 Lead block straps shall be made in one piece, except the check plates that may be welded on strap.

2.2.1.20 Span eye plates and bearing may be forged, cast or welded. Eye plates of shackle type shall be forged only.

The pins shall be secured against slipping out of the bearing and against turning in bearing or shackle type eye plate. Adjoining areas shall be very smooth.

It is recommended to place a brass washer under the bearing surface of eye plate.

When derrick is at the smallest angle to the horizontal, the force in eye plate shall be directed across the pin axle in the upper half of distance between bearings.

2.2.1.21 Eye plates for attachment of standing rigging, preventer guys, slewing guy units, span chains, snatch blocks etc., to the ship's hull and steel structures of the lifting appliances shall have such a strength that shall be adequate to their loads and shall be shaped so as to fit the gear items attached to them.

Eye plates shall be fitted so that the maximum rigidity of the eye plates and the direction of the standing rigging ropes are in one plane; where the direction of ropes is variable, the plane of the eye plates maximum rigidity shall correspond to the central direction of rope.

The thickness of the plate with welded-on eye shall not be less than 1/3 of the eye plate thickness and in no case shall be less than 5 mm.

Stiffening ribs shall be generally positioned along the eye plate.

2.2.2 Derrick masts and posts

2.2.2.1 The requirements of the present part of the Rules apply to masts that are fastened as well as those which are not fastened on deck and which are used for general purpose.

2.2.2.2 The length L of the mast shall take into consideration the distance from its top to the deck position where its props are fitted with regard to the transversal and longitudinal planes of the ship.

2.2.2.3 The external diameter of the mast at the deck props shall not be less than L/27. External diameter of the mast between stay plates and the supporting deck shall be equal to or in excess of L/30.

2.2.2.4 The wall thickness of the mast shall not be less than the maximum value referred to in Table 2.2.2.4.

Table 2.2.2.4

Plate form	The minimum thickness, [mm]
Bent	$0{,}32\frac{d\sqrt{kR_{eH}}}{350+2SWL}$ or $\frac{d\sqrt{k}}{100}$ or 6,5
Flat	$0{,}32\frac{b\sqrt{kR_{eH}}}{220+2SWL}$ or $\frac{b\sqrt{k}}{60}$ or 6,5

d - maximum outer diameter of the mast at the position under consideration [mm]. Where the mast is not circular, d shall be taken as maximum diameter of the circle of which it forms a part.

b - plate width [mm], but not less than 60% of the mast width at that point taken parallel to the flat plate.

k - ratio between working and permissible stresses.

2.2.2.5 The masts and the posts shall have at least two rigid props.

2.2.2.6 The wall thickness of masts and posts passing through closed spaces shall not be less than 5 mm, for those standing outdoors or passing through spaces which have no access inside not less than 6,5 mm; and for those which have access inside not less than 5 mm.

Masts and posts used for ventilation shall have no wall thickness less than 6,5 mm.

2.2.2.7 The mast cross-sections shall be gradual. Where stresses and/or high stresses may occur, no openings or similar shall be fitted. If their fitting is indispensable, they shall be tightly closed and their edges well secured.

2.2.2.8 Masts and their structural members shall be so designed as to prevent corrosion on places that are not easily accessible. All structural members, except closed structures, shall be easily accessible for examination, painting and cleaning.

2.2.2.9 Stresses in masts shall be calculated for the derrick position (or derrick combination) which cause the maximum stresses.

2.2.2.10 Stays shall be fitted so as not to preclude the operation of derricks, runners and guys.

It is not recommended for stays to be fastened to cross trees.

2.2.2.11 The standing rigging ropes shall be provided with rigging screws, the shrouds and stay plates shall be securely attached to the ship hull. The direction of the fastening of plates shall be in accordance with 2.2.1.21. The use of one item (e.g. shackle) for fastening of two or more ropes shall not be allowed.

2.2.2.12 The mast height with regard to derrick boom length $\frac{L-a}{l}$ (see Fig. 2.2.2.12.) shall not exceed 1,0.

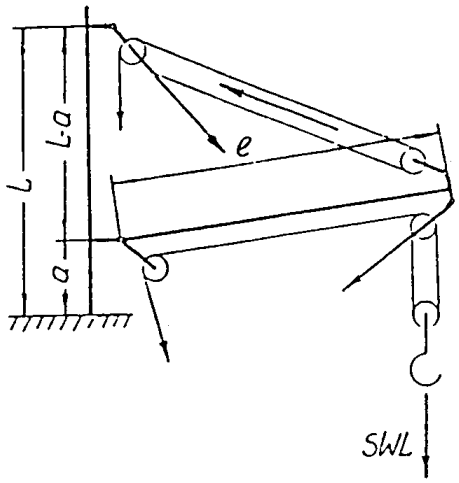


Figure 2.2.2.12

2.2.3 Derrick booms

2.2.3.1 The present Item applies to parallel, tapered and stepped derrick booms.

2.2.3.2 The dimensioning ratio of tapered and stepped derrick booms shall comply with Fig. 2.2.3.2. Other structures at the same values of compressive stresses in derrick boom may be used.

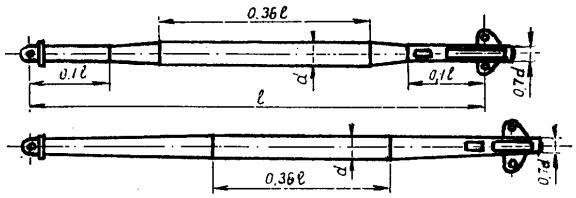


Figure 2.2.3.2

2.2.3.3 The wall thickness of the steel derrick boom shall be greater than $\frac{d}{70}$ +2, but not less than 4 mm.

2.2.3.4 At the length of the of the parallel part (l_1) of the derrick boom no transverse welded butt joints shall be placed. The arrangement of such joints shall comply with the standards approved by the *Register*.

2.2.3.5 The deflection of steel structure of derrick boom shall not exceed 1/1500 of its length, both in the plane of suspended load as well as in the plane perpendicular to it.

2.2.3.6 Eye plates for fastening of guys shall be fitted as close as possible to eye plates for fastening of cargo block at the end of derrick boom.

2.2.3.7 The derrick booms within the built-in sheave shall be additionally fastened so that the moment of resistance of that area is not less than the moment of resistance of the derrick without slots.

2.2.3.8 Derrick booms are to be sealed to minimize corrosion to their internal surfaces.

2.2.3.9 Internal surfaces, where practicable, shall be treated by coatings against corrosion after all welding are completed.

2.2.4 Cargo winches and topping winches

2.2.4.1 Cargo winches and span winches used for changing the position of the derrick booms under load shall comply with the technical requirements. Their drives shall have the breaking moment 1,5 times greater than the hoisting moment.

2.2.4.2 If the guy winch drive of heavy derricks with one span gives rise to stresses that are not permitted in the derrick boom and span, a limit moment switch shall be provided.

2.2.4.3 Span and preventer winches driven independently shall be provided with brakes which operate automatically in case the winches are out of operation, power supply is switched off or the control lever is at zero position.

Braking device shall be capable to withstand torsion moment 1,5 times greater than the maximum torsion moment arising from the derrick loading.

2.2.4.4 For span winches or other similar winches, the winch drum shall be divided by the flange into two sections: the section for reeling of the cargo rope and the section for the span rope. The fastening of the cargo rope to the drum of the span winch as well as for the load drum or the whipping drum of the cargo winch shall be provided.

2.2.4.5 Winches with glovless drums shall be so fitted that the angle between the reeling rope and the drum plane perpendicular to its longitudinal axis does not exceed 4^o.

2.2.4.6 No fibre or synthetic ropes shall be permitted for drive (see 2.6.2).

2.2.4.7 Clutch mechanisms (gears, couplings) shall be capable to withstand the torsion moment which does not exceed 1,5 times the maximum torsion moment resulted from stresses in derrick boom under maximum safe working load.

2.2.4.8 Span winches used to drive cargo winches by drive ropes shall not be used on the derrick boom which permissible load exceeds 3 t.

2.2.5 Union purchase derricks

2.2.5.1 The union purchase derricks regarding design and position shall be capable to operate with single derrick boom.

2.2.5.2 The outfittings of derricks rigged in union purchase shall include:

1. sufficiently strong preventer guys and their fittings for attachment to the deck and derrick head.
2. devices for bridling the cargo runners (in that respect the fitting of a chain between cargo runners);
3. measures enabling the control of the calculated extreme positions of derricks and

preventer guys in service as well as the angle between the cargo runners that shall be indicated in the instructions manual for union purchase derricks. Visual inspection of derrick boom fitting or limit height of cargo hoisting may be accepted if such inspection as well as operating conditions prove to be safe enough. The use of permanently attached indicators of the derrick position control with respect to the horizontal ship centerline plane is recommended. When the visual inspection of the derrick limit positions and the cargo runner separating angle fail to be safe, other measures shall be taken for the purpose such as the marking of the ropes, spans, cargo runners, preventer eye plates etc.

Attachments of preventers and their lengths shall be ensured structurally and not by visual inspection.

4. preventers or inner guys securing the derricks against the horizontal slewing towards the preventer guys.

2.2.5.3 Derricks rigged in union purchase, in general, shall be so fitted as to be capable for operation at each part of the deck.

2.2.5.4 The following requirements shall be complied with for all service conditions:

1. The minimum inclination angle to the horizontal shall not be less than 15^o, but it is recommended that the angle is not less than 30^o.
2. The maximum angle of wire rope of cargo runners shall not exceed 120^o.
3. The minimum hoisting height shall be such as to ensure that the cargo is easily carried out over the top of the bulwark handrails or the hatchway coaming.
4. The side derrick boom outreach shall not be less than 4 m.

2.2.6 Derricks with twin span

2.2.6.1 The derrick with twin span tackles shall be designed and installed in such a way that the derrick will not jack-knife horizontally when in extreme positions. If necessary, means shall be provided in design for limiting slewing angles of spans or derricks (see 3.5.1.2.7).

2.2.6.2 The derricks with twin span shall be provided with two individual spans attached directly or by means of balancer to the derrick end and the cross tree or to two separate masts.

2.2.6.3 To ensure derrick stability, the span ropes shall be so arranged that the maximum separation from the vertical passing through the derrick heel axis to the derrick span is not less than 0,11 of the boom length (see Fig. 2.2.6.3).

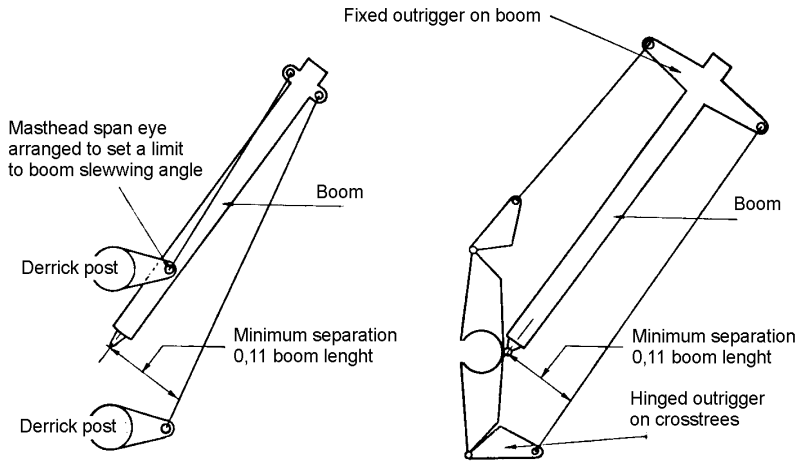


Figure 2.3.6.3

This shall be ensured by:

- limiting the slewing angle,
- fitting the limit switches on the derrick,
- fitting the stopper at the post or outrigger.

2.2.6.4 Slewing angle may be limited by fitting eye plate at the mast top. Also, limit switches on the drive system may be used.

2.2.6.5 Slewing angle shall not be limited by supports that may result into greater transverse buckling moments.

2.2.6.6 Strength and stability of the derrick with twin span shall be proved by relevant calculations as well as models.

2.2.7 Mechanized derricks

Mechanized derricks shall be provided with limit switches for the automatic stopping in extreme positions as well as for the derrick boom outreach and slewing mechanisms.

Safety devices for mechanized derricks rigged in union purchase shall be considered by the *Register* in each particular case.

2.3 CRANES

2.3.1 General technical requirements

2.3.1.1 Cranes shall be securely attached to the ship structure. Where the crane or hoist is installed, the members of hull framing shall be adequately stiffened.

2.3.1.2 Provision shall be made to ensure efficient fastening of the deck cranes and their booms when stowed for sea.

2.3.1.3 Derrick cranes with the elastic suspension shall be of such a design to prevent the risk of jack-knifing of boom to the side opposite to the outreach taking into account all possible heels and trims that may occur, limiters available, if necessary (see 3.5.2.3.4.).

2.3.1.4 Structure and installing of crane booms shall be such as to preclude the jack-knifing of cranes.

2.3.1.5 The design and equipment of the cranes intended for transfer by means of personnel carriers or other similar devices shall be considered in each particular case.

2.3.1.6 The requirements stated in Head 2.3 - Cranes shall apply to the cranes on floating docks, taking into account the operating conditions and structural properties.

2.3.2 Steel structures

2.3.2.1 The thickness of the walls of bearing elements of the steel structure readily accessible for inspection as well as of the elements arranged in enclosed spaces shall not be less than 4 mm; the thickness of the walls of box-type or tubular steel structures inaccessible for inspection from the inside, shall not be less than 6 mm.

2.3.2.2 Outside diameter of tubular elements of crane steel structures shall not exceed the value referred to in 2.2.2.3.

2.3.2.3 The construction liable to loads (especially to vibration load) dangerous for breaking away rivet heads shall be avoided. Such a construction shall be permitted only exceptionally. The rivets with countersunk or half-countersunk heads shall not be permitted.

The holes for rivets and finished bolts shall be drilled in the joined items or in single items simultaneously through plate.

The diameter of rivets and bolts used in the bearing items shall not be less than 12 mm.

The maximum thickness of riveted items shall not exceed five diameters of the rivet.

The least number of rivets securing the item in the assembly or used on either side of the joint is two.

2.3.3 Machinery

2.3.3.1 Crane machinery shall comply with the applicable requirements specified in Head 2.1 of the Rules.

2.3.3.2 The safety factor of breaking of cargo lifting shall not be less than 1,5. The safety factor of breaking of the machinery outreach change shall not be less than 2 whereby the static moment of the brake shaft, produced by cargo mass, jib mass and counterweight, shall be calculated in that outreach position when the static moment shall have the maximum value.

Where a drive is fitted with two or more brakes, the safety factor of braking shall be determined on assumption that the whole cargo is maintained due to effect of one brake. The safety factor of braking shall not be less than 1,25 at simultaneous operation of all brakes.

2.3.3.3 Slewing and travelling motion brakes shall be of such design that they will either act or be controlled automatically. The use of "normally on" brakes shall be subject to special consideration by the *Register* in each particular case.

The safety factor of braking is not to be less than 1,25.

The safety factor of braking for upper structures of floating cranes (crane ships) and cranes intended for operation during rolling (waves) shall not be less than 1,5.

Hand braked slewing and travelling motion machinery shall be provided with stops against uncontrolled slewing or movement of cranes.

2.3.4 Safety devices

2.3.4.1 The cranes, mechanized derrick and hoists shall be provided with limit switches that automatically come into action in the extreme positions of lifting appliance parts.

1. hoisting;
2. jib luffing;
3. travel of crane, its trolleys and hoist;
4. slewing of crane (for cranes with limited slewing angle) or mechanized derricks;
5. interlocking of hook or grab in the highest position.

The possibility of the reverse movement of mentioned machinery shall be provided after the activation of limit switches.

Where closing switches are provided for shunting the limit switches (e.g. for lowering of boom when the crane is stowed) they shall be admitted only to authorized personnel.

The installation of safety devices for derrick cranes rigged in union purchase shall be specially considered and agreed by the *Register*.

For cranes where the boom during lowering, is superimposed on hoisting device, the hoisting appliance shall be simultaneously switched off with the topping machinery adjusted to boom lowering.

2.3.4.2 Cranes with variable hoisting capacity depending on the jib radius shall be provided with automatic indicators the hoisting capacity of which complies with jib radius. The indicator shall be fitted in full view of the crane operator.

In order to determine the permissible safe working load, the jib angle may be also taken into account. In this case a table or a diagram for reading the values obtained for permissible safe working load with appropriate jib radius shall be fitted in the control station.

2.3.4.3 The cranes the stability of which depends on the load position on hook shall be provided with limit load switches automatically disconnecting the crane machinery in lifting the load exceeding the hoisting capacity admitted for determined jib outreach.

The limit load switches shall be efficient in the case where the overloading as compared with hoisting capacity, exceeds 10%.

Limit load switches on cranes of other types and on hoists shall be fitted.

2.3.4.4 Where the auxiliary hoisting machinery is fitted the blocking appliance shall be provided to exclude the possibility of simultaneous operation of the main and auxiliary hoisting.

However, blocking appliance shall not be fitted if simultaneous operation of mentioned machinery is provided taking into account the total capacity of both machineries.

2.3.4.5 The cranes whose stability and stresses depend on wind pressure shall be provided with signal means that shall operate when design limit wind speed is achieved under working conditions.

Wind speed indicator shall be installed in a way that it is not sheltered with crane structure or ship's hull.

2.3.4.6 The cranes operating in tandem and mounted on common supporting and slewing bearing shall be fitted with monitoring systems, enabling control of both cranes.

2.3.4.7 Cranes with constant lifting capacity, irrespective of the jib radius, shall be provided with limit load switches of hoisting machinery.

2.3.4.8 Derricks-cranes with elastic suspension in all operating positions shall be fitted with properly tightened span rope.

2.3.4.9 Doors and openings in the forward crane parts, intended for passage of personnel shall be fitted with blocking appliance preventing the starting of mechanism movement of the crane and hoist when doors are open.

2.3.4.10 The lifting appliances, transporters, gantries and similar devices for loading and unloading, shall be equipped with audible warning that may be put in operation by the operator at any time. The audible warning shall be clear and distinctive among other audible warnings and operation noise.

2.3.5 Counterweight

2.3.5.1 The weight of the crane counterweight shall remain stable while the crane is in use. Fastening of separate cargoes in the counterweight shall exclude their displacement.

2.3.5.2 The adjustable counterweights shall either move automatically when the jib radii are changed. In the case of adjustable counterweight moving, the possibility of its jamming shall be excluded.

2.3.6 Travelling cranes and hoists

2.3.6.1 Stability of travelling cranes shall be ensured under all conditions, whether in service or not.

Checking of stability shall be carried out in accordance with standards approved by the *Register*.

2.3.6.2 Travelling cranes and hoists shall be provided with devices for anchoring the crane to its rails or with reverse rollers.

2.3.6.3 Travelling cranes and hoists shall be provided with efficient stops (detachable anchoring devices etc.).

2.3.6.4 Fastening of cranes and hoists when stowed for sea shall be such that any movement of the crane and hoist shall be impossible.

2.3.6.5 Wheels of cranes, trolleys and hoists shall be designed and fitted in such a way that their derailment shall be impossible.

2.3.6.6 Frames of travelling cranes and trolleys shall be provided with bearing struts arranged at a distance of not more than 20 mm from the rails and shall be used as a supports in the case of breaking of a wheel or axle. These struts shall be calculated for the maximum permissible load.

2.3.6.7 Travelling cranes, trolleys and power driven hoists shall be provided with buffers against possible contact with stops. The buffers may be fitted on stops.

2.3.6.8 Efficient stops shall be provided at both limits of travel, the design of which shall be such as to withstand the contact with crane, trolley or hoist moving with the maximum working load at the nominal speed.

2.3.6.9 If several cranes or trolleys travel at one railway, they shall be provided with stops so as to prevent collision.

2.4 LIFTS

2.4.1 General

2.4.1.1 The types of lifts that are subjected to the supervision and their elements shall be so designed and manufactured as to ensure their safe operation, in accordance with the Rules, recognized standards and manufacturing technical conditions.

2.4.1.2 In the parts of winch assemblies transmitting the torque (other than electric motor), the use of interference fits is permitted provided they are additionally secured by keys, studs, pins, bolts etc. The additional material for mounting parts shall be calculated for the maximum torque.

2.4.1.3 The ratio of drum, sheave or block diameter at the groove bottom to the rope diameter shall be in accordance with Table 2.4.1.3.

Table 2.4.1.3

Diameter ratio			
Type of lift	Drum or traction sheave	Leading pulleys	Blocks of overspeed governors, (gripping device operation, etc.)
Passenger	40	30	25
Cargo	30	25	25

2.4.1.4 The lift shall be provided with enclosed machinery space constructed to give weather protection and fitted with lockable doors.

The machinery space shall be large enough to ensure:

1. Access to the winch and motor from at least two sides with the width of passageway not less than 500 mm,
2. The clear opening from the front side of the control panel, with width not less than 750 mm.
   Where it is necessary to operate from the rear of the panel, the clearance between the panel and the wall shall not be less than 750 mm.
3. The free area of at least 1000 x 1000 mm at the entrance of the machinery space. The height of machinery space shall ensure mounting and dismantling of the equipment.

2.4.1.5 In the trunk and machinery space the installation of equipment not belonging to lifts shall not be permitted.

2.4.1.6 The slots for passage of ropes in the floor of machinery space shall have such dimensions that the clearance between ropes and slot edge shall not be less than 25 mm. The slots shall be surrounded by curtain plate at least 50 mm high.

2.4.1.7 Every deck opening for the cargo lift platform shall have handrails to a height of 1 m above deck at each side, with the exception of the side of access for lifting operations.

The machinery of the cargo lift shall be locked if the handrails are not fully closed.

2.4.1.8 Devices for automatic stopping the platform at a given deck shall be fitted along the perimeter of each deck opening and at all sides under the cargo platform.

Where locking devices by means of which the platform remains stationary during lifting operations are arranged on the deck, they shall be so interconnected with the cargo lift controls as to interrupt power supply to the drive until locking devices are released.

2.4.2 Trunk

The lift trunk shall be provided with ceiling and bottom and enclosed over the full height. Ceiling, bottom and enclosure of the trunk shall be calculated in accordance with the requirements of 3.5.3 and shall meet the requirements of other Rules of the *Register* (see *Rules for the classification of ships*, *Part 2 - Hull, Part 4 - Stability, Part 5 - Subdivision* and *Part 17 - Fire protection)*.

2.4.2.2 The trunk shall not be located before the collision bulkhead and at a distance of 0,2 B from the ship's side.

2.4.2.3 To ensure means of escape from the lift trunk in the case of emergency stopping of the car, fixed ladders shall be provided in the trunk or clamps shall be fitted over the entire height of the trunk.

2.4.2.4 At the lower part of the trunk, provision shall be made for a pit, the shelter space of which counting from the base plate of the car or the counterweight to the buffer is not more than 200 mm when the lift car is at the lowest position. With the lift car resting on the fully compressed buffer, the distance from the pit bottom to the lower prominent parts of the car shall be not less than 750 mm. This distance may be reduced if removable installations are fitted ensuring the distance of at least 750 mm when the car is setting down on them.

2.4.2.5 Possibilities of the trunk drainage may be carried out by hand pumps, water ejectors or other draining means, as well as through drain pipes leading into the nearest dry compartments to be drained.

Drain pipes shall be fitted with easily accessible cocks of not less than 39 mm in diameter.

2.4.2.6 For maintenance of the equipment located in the lift trunk, (leading pulleys, overspeed governors etc.), the openings with closing devices or removable plates may be permitted. They shall be opened outside.

2.4.2.7 The inner side of the trunk opposite to the car door shall be smooth and even, without recesses and protrusions.

Such trunk area shall be provided over the entire width of the door opening, plus 50 mm on each side and over the height 300 mm for passenger lifts and not less than 200 mm for cargo lifts.

For other trunk areas limited by the width of door opening plus 50 mm on each side, side recesses of not more than 150 mm shall be allowed. The protrusions and recesses exceeding 5 mm (other than lifts with power-operated doors) shall be provided with chamfers at an angle of not less than 60^{o} to the horizontal. With lifts with power-operated doors, chamfers shall be provided only from below and for protrusions exceeding 50 mm.

2.4.2.8 The height of the lift trunk shall be such that after operation of the limit switch and lift stop:

1. free movement of the lift car (counterweight) upwards for a distance of not less than 200 mm is ensured;
2. the distance between the platform and the car roof designed for attending personnel and the protrusions of the trunk ceiling or the equipment under the ceiling shall not be less than 750 mm.

2.4.3 Trunk doors

2.4.3.1 All entrance and loading openings in the trunk shall be provided with doors. The inner width of the door

shall be not more than that of the lift car. The hinged door shall be opened outside only.

The height of the trunk door for passenger lifts shall be not less than 1800 mm, the minimum inner width of the door being equal to 1600 mm.

Where loading and unloading operations are performed without entering the car, the height of the trunk doors for cargo lifts shall not be more than 1400 mm. The height of the trunk door shall be measured from the upper edge of the door opening.

2.4.3.2 The design and material of doors, if tightly closed, shall comply with the requirements of other Rules of the *Register* (see *Rules for the classification of ships*, *Part 3, Hull equipment* and *Part 17, Fire protection)*.

2.4.3.3 The doors shall be provided with sight openings. For lifts with power-operated doors and for lifts fitted with car landing indicators on the stop deck, the openings of trunk doors shall not be compulsory.

2.4.3.4 Lifting force of automatically and semi-automatically operated trunk doors shall be not more than 150 N.

2.4.3.5 The trunk doors shall be provided with locking devices to close the door before the car moves from its level for a distance of 150 mm.

2.4.3.6 Manually operated trunk doors other than automatic locking devices, shall be provided with a fixed device enabling the doors to be closed with locking devices unlocked.

2.4.3.7 Measures shall be taken to prevent unlocking of the automatic lock from the exterior of the lift trunk when there is no car at the door level or the movement of car is controlled from the lift machinery space (2.4.14.5).

The exception is done for the case when the trunk door may be unlocked by an authorized person when there is no car at the door level.

2.4.3.8 Where obstacles arise in closing the automatically operated doors, their panels shall be taken into initial position.

2.4.4 Guides

2.4.4.1 The lift car and counterweight shall be provided with guides of rigid and strong construction.

2.4.4.2 The guides and their joints shall be so designed as to exclude any possibility of their displacement in any direction.

2.4.4.3 The length of roller guides shall be such as to enable the lift car and counterweight to overtravel their limiting operating positions with shoes without slipping from the guides on fully compressed buffers.

2.4.5 Lift car

2.4.5.1 The lift car shall be fitted with floor and roof and enclosed over the entire height.

2.4.5.2 The lift car roof shall withstand without any deformation, the load produced by two persons on the covered roof (the mass of one person being 80 kg).

2.4.5.3 The lift car entrance of the passenger lifts shall be provided with doors. The cargo lift car may not have any doors provided the arrangements for cargo securing are available (see 1.1.3).

The lattice type sliding doors shall be permitted for the cars of cargo lifts only.

2.4.5.4 The hinged lift car doors shall be opened inside only.

2.4.5.5 Force of power-operated two part sliding doors shall not be more than 150 N.

2.4.5.6 A lockable escape hatch of 400x500 in size (in clear), shall be provided on the lift car roof. The lift car shall be provided with a spar ladder or other means of access to the lift car roof in the case of emergency. The instructions on leaving the lift car through the escape hatch shall be fixed inside the lift car.

On agreement with the *Register* the hatch size may be reduced for lifts designed before 1982.

2.4.5.7 Passenger lift car shall be provided with handrails.

2.4.5.8 The height of lift car doors shall be not less than that of the trunk doors (see 2.4.3.1).

2.4.5.9 The movable floor of the lift car shall be constructed of a solid slab. The dimensions of a slab shall be such that the width of fixed part of the floor (frame), at the side and rear walls does not exceed 25 mm.

In the lift cars provided with moving floor, sliding doors and system controlling the lift car movement only when doors are closed, the sill (lower guide) is allowed to be un-movable.

The function of the moving floor may be substituted by an electronic load-measuring device positioned between the lift car and ropes ensuring the required switching-on process under the minimum load.

The safety switch of moving floor shall operate when the load imposed on the floor reaches 250 N.

2.4.5.10 Under the lift car sill a vertical apron shall be provided over the whole width of the door.

The slab height shall not be less than 150 mm and for power-operated trunk doors with the lift car being fully stopped in, shall be not less than 300 mm.

2.4.5.11 Manual car doors shall be provided with sight openings.

2.4.6 Counterweight

2.4.6.1 Securing of cargoes in the counterweight shall prevent shifting of loads from their normal position by not more than 5 mm.

2.4.6.2 The counterweight masses shall be firmly clamped by hold-down straps and clamping bolts, whose nuts shall be secured by pins. Other suitable connecting elements shall be allowed as well.

2.4.6.3 The counterweight shall be fitted with guides. If the counterweight is equipped with roller shoes, provisions shall be made for fixed guides.

2.4.6.4 Lifts with a drum winch may be designed without counterweights.

2.4.7 Buffers

2.4.7.1 The buffers shall be located in the trunk bottom under the lift trunk.

2.4.7.2 The lifts may be provided with spring or hydraulic type buffers, which enable deceleration of lift car movement (or counterweight respectively), not exceeding 25 m/s^2 when setting down on these buffers.

This value may be exceeded if the deceleration time is not over 0,04 s.

Fixed limit stops with flexible gaskets may be applied only for lifts having rated speed not exceeding 0,7 m/s.

Fixed limit stops with flexible gaskets shall not be applied for medical lifts.

2.4.7.3 Deceleration of counterweights run during setting down on the buffer shall not cause lowering of lift car on gripping devices.

2.4.8 Gripping devices

2.4.8.1 The cars and counterweights shall be provided with gripping devices capable of stopping and gripping the lift car (counterweight) on the guide during lowering, namely in the case of:

1. Exceeding the limit speed specified in 11.5.9.1;
2. Breakage of rope;

2.4.8.2 The gripping devices of passenger lift cars shall be tripped by overspeed governors. Tripping of gripping devices of cargo lifts shall be allowed only in the case of breakage of suspension ropes (without overspeed governors) by connection of gripping mechanisms of gripping device operation:

1. with the suspension ropes;
2. with the counterweight;
3. with gripping devices of counterweight.

2.4.8.3 The counterweight gripping devices may be tripped by one of the following methods:

1. by overspeed governor, when the limit speed specified in 2.4.9.1 is increased;
2. by connection of mechanisms of gripping device operation with suspension ropes, and
3. by connection of mechanisms of gripping device operation with the lift car.

2.4.8.4 The lift cars and counterweights of all types of lifts may be fitted with gripping devices provided for both abrupt and smooth braking. In such a case the maximum value of deceleration of lift car or counterweight run wheel when setting down on gripping devices shall not exceed 25 m/s^2 (regardless of ship's motion). The value may be increased if deceleration time is not above 0,04 s.

2.4.8.5 The gripping devices shall be tripped only by means of mechanical devices.

2.4.8.6 After tripping, the gripping devices shall be automatically put into their operating position as soon as the lift car (counterweight) starts lifting.

2.4.9 Overspeed governors

2.4.9.1 The gripping devices shall be tripped by the overspeed governors at a speed of the lift car (counterweight) downwards movement exceeding rated speed within 15-40 %.

2.4.9.2 The possibility of checking of the trip of the overspeed governor and gripping devices during the lift car (counterweight) movement downwards at the rated speed, shall be provided. Where checking the overspeed governor tripping is impossible in this way, other means shall be provided.

2.4.9.3 The force exerted in the working part of the rope by the overspeed governor, when tripped, shall be not less than twice the force necessary to engage the gripping devices.

2.4.10 Winches

2.4.10.1 The winches may be both of the traction and of the drum type.

In both cases, the winch shall be equipped with a handwheel or other suitable means for manual force not exceeding 735 N.

2.4.10.2 Each winch shall be provided with automatic brake of closed type, the braking torque of which is equal to 1,5 times the rated load at the traction sheave or at the drum with loaded car moving downwards. The usage of band brakes is not permitted. When power supply from the electric motor is interrupted, the possibility of car movement by manual releasing of brakes shall be provided.

The brake drum or the brake sheave shall be fitted on the shaft that is cinematically connected with the traction sheave (drum).

When operation of releasing element is stopped, braking shall be automatically started.

2.4.10.3 Where the rope is wound in a single layer onto the drum, the latter shall have helical rope grooves, but if the rope is wound in multi-layers onto the drum, the latter may be smooth but in that case it shall be fitted with a coiler. The rims of smooth drums shall extend 2,5 rope diameters above the upper layer of the rope.

2.4.10.4 When the car and counterweight are at their lowest position, at least 1,5 rope turns shall remain on the drum, besides those under the clamps.

Fasteners of ropes to the drum shall be designed with the rope friction to be neglected.

2.4.10.5 The traction sheave shall be provided with grooves the shape of which at the given angle of rope contact and with selected material of the sheave enables the required coupling of ropes with sheave. Structural measures shall be taken to provide stopping of the lift drive and to exclude the

possibility of lifting the car in case of emergency of the counterweight and vice versa. Dropping of ropes (chains) from driving and guiding components shall be excluded in all operating conditions of the lift.

2.4.11 Ropes, elements of rope run and fastening of ropes

2.4.11.1 The ropes shall be chosen according to the calculation set forth in 3.5.3.2, but in no case shall the rope diameter for passenger ships be less than 8 mm for suspension ropes and 6 mm for overspeed governor ropes.

2.4.11.2 The number of individual ropes by which the car and counterweight are suspended shall be not less than that specified in Table 2.4.11.2.

Table 2.4.11.2

Number of special ropes		
Type of lift	Type of winch	
	with Drum	with Traction sheave
Passenger	2	3
Cargo	1	2

In the case of compound pulley suspension all rope runs shall be considered as one rope.

2.4.11.3 The ropes applied for lifts shall be one piece steel ropes, fitted with fibre or synthetic core.

Ropes with steel core shall be permitted for usage.

The ropes shall comply with national standards and requirements imposed on the ropes of lifting appliances (see 2.6.1).

2.4.11.4 The proper strength of all components of rope runs and attachment of ropes to the lift car, counterweight and winch drum (in case a drum winch is used) shall be provided. As to the blocks, thimbles, rope sockets, pressed clamps, the requirements of 2.7.3, 3.5.5.1, 5.2.4.1 and 5.2.4.9 shall be complied with.

2.4.12 Electric equipment

2.4.12.1 Electric equipment of the lift, if not covered by the requirements of this Rules, shall comply with other Rules of the *Register* (see *Rules for the classification of ships, Part 12 - Electrical Equipment)*.

2.4.12.2 Electric drive of the lift may be fed both from the main and section distribution board through a switching-off device fitted in the lift machinery space close to the entrance. The switch shall be so designed as to switch off simultaneously the drive motor the feeding of motor and control circuits.

If drive motors are fitted in the machinery space, they shall be fed through separate switch.

2.4.12.3 Provisions shall be made for protection of electric drive of the lift ensuring its switching off without time delay, in the case of overloading and short circuit current.

2.4.12.4 Control circuits of the lift electric drive shall be provided with switching-off device and short circuit preventing appliance.

2.4.12.5 All types of lifts shall be provided with devices designed to switch off the electric motor, brake operation and lift stopping:

- in any case of gripping device operation;
- in the case of breaking or slackening of one, some or all ropes, both of the lift car or counterweight;
- if the lift car exceeds its limit levels by more than 200 mm;
- where rope pulling arrangement of the overspeed governor exceeds limit operating positions;
- when opening the car or the trunk doors;
- when opening the automatic lock of trunk door (except if automatic locks are opened with a fitted switch).

2.4.12.6 On the fixed parts of manually operated switch, the "on" and "off" positions shall be clearly marked.

2.4.12.7 As for earthing of the lift car one of the rope cores or bus duct leads shall be used.

Carrying cable ropes or lift car suspension ropes are recommended to be applied as the additional earthing leads.

2.4.12.8 Steel guides of the lift car and counterweight as well as steel construction of trunk enclosures shall be provided with reliable earthing connections with the ship's hull.

2.4.13 Electric drive

2.4.13.1 The electric drive of passenger lift shall provide slow starting of the lift car, uniform increase of acceleration, smooth braking and deceleration of lift car movement when approaching the entrance station as well as accurate stopping at the trunk door.

The maximum acceleration (deceleration) of the car motion under the operating condition, disregarding rolling, shall not exceed 2 m/s^2.

The maximum deceleration of the car while stopping by means of "safety" switch (2.4.14.2) shall not exceed 3 m/s^2.

2.4.13.2 The driving electric motor shall be switched on to the circuit by at least two switches ensuring double break of electric motor supply circuit each time the car approaches the entrance station.

2.4.13.3 The lift electric drive with rated speed exceeding 0,71 m/s shall ensure the lift car movement at the speed exceeding 0,35 m/s (for speed of lift car movement during inspection of lift trunk, 2.4.14.5).

2.4.13.4 Release of electromagnetic brake shall be ensured simultaneously with switching on driving motor or immediately after its switching on. Switching off of the driving motor shall be followed by operation of electromagnetic brake or by switching on the electric braking with subsequent operation of electromagnetic brake.

2.4.14 Control and signalling systems

2.4.14.1 The control systems of the electric drive shall be supplied by a power feeder of that drive. Switching on shall be provided after the device has been switched off.

2.4.14.2 Lift control shall be provided by special push button desks. All control desks intended only for calling the lift car to the loading deck shall be fitted with a safety push button ensuring switching off of the electric drive power supply. The push buttons shall be painted red, bear clearly visible inscription "stop" and be located close to the control push buttons.

2.4.14.3 The control push buttons of the passenger lifts shall be fitted inside the lift car and those for the cargo lifts on the loading decks.

2.4.14.4 The interceptive call of the passenger lift car in the loaded condition by means of control push buttons placed on the loading decks shall be allowed only in the case of simultaneous closing of the trunk and lift car doors. In the cargo lifts, the interceptive call with the lift car moving in loaded condition shall not be permitted.

2.4.14.5 For the inspection of lift trunk the possibility of controlling the electric drive system from the lift car roof by means of a fixed or portable control post, shall be provided. In this case the speed of car movement shall not exceed the speed stated in 2.4.13.3.

The control desk shall be fitted with two control push buttons (one for upwards and another for downwards) with a self-return to "stop" position. For general control of electrical equipment operation, a desk with push buttons "up", "down" and "stop" shall be provided in the lift machinery space.

The lifts having rated speed of lift car movement of 0,70 m/s inclusive, for operation from the lift car roof shall be fitted with control devices to ensure the car movement only in downward direction, if it is impossible for electric drive to provide the speed of not exceeding 0,35 m/s. When the electric drive is operated from the lift car roof or from the lift machinery space, if provided, all other control devices shall be interlocked or switched off automatically.

2.4.14.6 Light signalling (signal "loaded") shall be fitted on the loading decks indicating car loading (if the lift car is fitted with control device), and also car movement and open position of the trunk door. The signal may be fitted in the calling device or placed in close vicinity.

2.4.14.7 Electric drive of the passenger lift shall be automatically switched off in attempt to lift the load exceeding the safe working load of the lift by 10 % with simultaneous operation of visual or audible signal "lift overloaded".

2.4.14.8 Passenger lifts shall be provided with signalling means operated from the inside of the lift car in the event of failure (if due to failure the lift car stops between decks, if the car is set down on gripping devices, etc.).

The circuit of the signalling means shall be independent of the power and control circuits. Feeding of the signalling means shall be ensured from the emergency source of ship's power supply. The telephone or any other two-way voice communication may be allowed instead of the signalling means.

2.4.14.9 The switching off push buttons of the external and internal control, located outside the trunk and machinery space shall be operated by means of a special spanner.

2.4.14.10 The trunk pit shall be fitted with the signalling means automatically operating when permissible level of water or bilge water in the pit is exceeded.

2.4.15 Safety devices

2.4.15.1 The limit switches of lift car lowering and hoisting, acting in the control circuit, the door and gripping device contacts shall be of a self-return type, and in this case the return of switch contacts to the initial position shall be performed only after stoppage of forced action.

2.4.15.2 All lift car and trunk doors shall be fitted with electric contacts switched on in the control circuit, which shall comply with the following requirements:

1. Starting and moving of the lift car shall be enabled only if trunk doors are closed and sealed and lift car doors closed. Starting and moving of the lift car with trunk doors closed but not locked may be permitted, at a distance not exceeding 150 mm from the lift car level. Starting and moving of the lift car with open door may be allowed provided that a device indicating the absence of persons is fitted.
2. Opening of the lift car and trunk doors as well as opening of the automatic locking device of trunk doors shall cause stopping of the moving lift car, except if the automatic locking devices are unlocked by means of a fixed spanner. While opening the door contacts shall operate in the case of stopping of the control circuit.
3. With multi-panel trunk or lift car doors, provisions shall be made for controlling the closure of door panels.

2.4.15.3 The usage of the limit switch of the main current circuit as the main switch under 2.4.12.2 shall not be permitted.

2.4.15.4 The manual switches of control circuit shall be located in the trunk pit and under the trunk ceiling.

2.4.15.5 Electric blocking of cover on the lift car roof shall be provided as to prevent the lift car movement with open cover.

2.4.16 Lighting

2.4.16.1 The lift car, trunk, pit, machinery space and means of access to the lift and its landing platforms shall be provided with stationary electric lighting complying with the *Rules for the classification of ships, Part 12 - Electrical Equipment*.

2.4.16.2 Power supply of the lift car lighting circuit shall be provided by a separate feeder (from ship's lighting circuits) irrespective of the electric drive power supply feeder.

2.4.16.3 Provisions shall be made for permanent switching on of the lift car lighting circuit when trunk doors are open or when the lift car of passenger lift is loaded.

2.4.16.4 The lighting fixtures shall be installed in the lift car in such a manner as not to disturb the persons and not to impede loading and unloading of the lift car.

2.4.16.5 The socket outlets for portable fixtures supplied by safe current shall be installed in the pit and machinery space.

2.4.16.6 Passenger lift car shall be provided with stationary emergency lighting complying with the *Rules for the classification of ships*, *Part 12 - Electrical Equipment*.

2.5 LIFTING PLATFORMS

2.5.1 General requirements

2.5.1.1 The design and location of lifting platforms shall ensure their safe maintenance and inspection.

2.5.1.2 The platforms designed for closing the cargo openings in weather decks and unprotected superstructures shall be weathertight to sea action, according to the *Rules for the classification of ships*, *Part 3- Hull Equipment*.

2.5.1.3 The platform surface when being raised or lowered and during lifting operations, considering the requirements of Table 3.5.4.2.1 relating to ship's inclination, shall always be in the plane parallel to the serviced cargo deck. The guide rails shall be provided as a counterweight.

2.5.2 Ropes

2.5.2.1 The wire ropes intended for lifting platforms may be applied either with or without steel core. The rated breaking strength shall be equal to that for running rigging.

2.5.2.2 It is recommended for lifting platforms that wire ropes are previously subjected to tension. In this case, the tensile load applied for at least 30 min shall be equal to at least 0,7 of the minimum breaking strength of wire rope load.

2.5.2.3 During mounting on board ship, socketing of wire rope ends may be allowed. The testing of rope connections under load shall be performed in accordance with 5.2.1.5.

2.5.3 Drive

2.5.3.1 Lifting platform drive shall provide smooth movement of platform, uniform acceleration, smooth deceleration and slowed motion of the platform when travelling and stopping as well as accurate standing at required level.

2.5.3.2 Lifting platform drives located in enclosed spaces of a ship shall be designed with respect to the temperature in those spaces.

2.5.3.3 If hydraulic drives safely prevent the platform against uncontrolled self-lowering, the brakes may not be fitted.

2.5.4 Control and signalling systems

2.5.4.1 Design and control system of lifting platform shall ensure that the platform and cargo deck are located at the same level and remain at that level during lifting operations.

If flexible lifting mechanisms are applied (e.g. wire ropes), and the level cannot be automatically reached by means of relevant devices, the deck shall be locked before loading. The locking shall be followed by visual alarm at the control panel. Lifting and lowering of platform shall be executed only after the platform has been automatically or visually unlocked.

In order to prevent inadvertent operation, the control system should be automated until the computing system is switched on.

2.5.4.2 When "stowed for sea" the platform shall be secured at the deck level and drives shall be disengaged. Visual alarm shall be operated from the control desk. Ship's heel and inclination shall not cause unlocking of the platform during ship's movement.

2.5.4.3 The control desks of lifting platforms shall be located as to be provided with such devices that will enable the operator to observe the entire platform travelling, either directly or with a help of a signalman. However, the control desk shall in no case be placed less than 1500 mm apart the platform deck opening.

2.5.4.4 Switchgear of the lifting platform control desk shall be equipped with a device for self-return to zero point. If during ship's navigation the inclination is resulted it shall not cause unintentional start of the lifting platform drive. The emergency switches shall be located as per 2.8.5.

2.5.4.5 If several control desks are fitted, provisions shall be made for operation of only one control panel and relevant means of communication shall be provided.

2.5.4.6 On agreement with the *Register*, the lifting platform may be operated from the platform itself.

2.5.4.7 The control desk shall be provided with the following visual and audible alarms, namely:

- activation of any protective device;
- platform movement (flashing light);
- open handrails;
- malfunction in circuit or hydraulic diagram.

At the discretion of the Owner, additional alarms may be provided.

2.5.4.8 All control desks shall be provided with suitable means for preventing their switching by an unauthorized person.

2.5.4.9 Controls and alarms shall be provided with inscriptions in English, written legibly and indelibly or using equivalent method.

2.5.5 Safety devices

2.5.5.1 In the case of failure of one of the lifting mechanism, the other components shall ensure structural and functional interaction between the platform and its control items. In such a case the drives of platform shall be automatically stopped.

Means shall be provided, in such cases, for lowering the platform in the position of blocking or supporting, thus enabling unloading of platform.

2.5.5.2 If the platform is suspended on wires or chains, it shall be attached with at least four separate lifting mechanisms.

Each wire or chain suspension shall be fitted with a switch automatically stopping the drive in the case of slacking or braking of the lifting mechanism.

2.5.5.3 The lifting platforms shall be provided with limit switches for lowest and highest deck levels and also with overload devices (safe working load limiters).

Hydraulic drives shall be protected against overload with rated working pressure of not more than 1.1.

2.5.5.4 In the case of failure of the main lifting mechanism, the safety devices shall automatically stop the platform.

2.5.5.5 Deck openings of the platforms shall be adequately guarded from falling of persons and engines into them. Movable handrails shall be fitted with locking devices that will automatically lock and unlock the handrails during platform travelling. Handrails and guard rails shall be marked with visible paint and provided with lighting devices.

2.5.5.6 Where persons employed in lifting operations work both in the car and on the platform, at least one side of the platform removable handrails shall be fitted and permanent marking containing inscription denoting areas shall be provided.

The handrails shall be at least 1 m high. Stanchions shall be spaced not more than 3 m apart. The intermediate rail shall be arranged at a height not less than 0,5 m.

2.5.5.7 Access of unauthorized persons to the space beneath the platform operated by lever system, spindles etc. shall not be permitted. Enclosed trunks shall be provided for the counterweights. The areas that are dangerous during platform travelling shall be marked with warning paint or fitted with light warnings.

2.6 ROPES

2.6.1 Steel wire ropes

2.6.1.1 The ends of ropes attached to the steel structures or other elements shall be provided with loops or they shall be inserted into sockets or clamps of the type approved by the *Register*. The rope ends fastened to the winch drums need not be provided with loops or sockets but satisfactory reeling of the rope into the rope drums must be ensured. In this case no less than two rope windings shall be around the drum.

2.6.1.2 The arrangement of sheaves, blocks and rope ends fastened to the steel structure shall prevent the fall out of rope from sheaves or drums and exclude friction between them or with steel structure. The rope fastening shall be calculated for the maximum static load due to proof load.

2.6.1.3 The ropes used in lifting appliances, where not covered by the Rules, shall comply with *Rules for the classification of ships, Part 25 - Metallic materials*.

The application of six-stranded wire ropes with calculated tensile strength within 1370-1960 MPa, is recommended.

2.6.1.4 For running rigging the wire ropes with one organic core shall be used, the number of wires being not less than 114. The use of more than one organic core shall be subject of the special consideration by the *Register*. The wire diameter in outer strands shall not be less than 0,6 mm.

2.6.1.5 The ropes with steel cores may be used on agreement with the *Register*. In this case the relation of sheaves and drums diameter shall be in compliance with the requirements of 2.7.3.1.

2.6.1.6 For standing rigging the steel wire ropes with one or more organic cores shall be used with diameter of wires in outer strands of not less than 1,0 mm, the number of wires being not less than 42.

2.6.1.7 The wires of running and standing rigging shall be provided with zinc coating complying with appropriate standards.

2.6.1.8 Spliced ropes shall not be used in lifting appliances.

2.6.2 Natural and synthetic fibre ropes

2.6.2.1 The natural fibre ropes (manila, sisal, hemp and coconut) and the synthetic fibre ropes may be used only for falls or slewing guy tackles of the light load derricks, inboard preventer guys or schooner guys, when derricks are working in union purchase rig, and for the hand operated lifting appliances.

The use of the synthetic fibre ropes shall be agreed by the *Register*.

2.6.2.2 The diameter of the natural or synthetic fibre ropes shall not be less than 20 mm. The force at the fall running end pulled by hand shall not be greater than 310 N.

Spliced ropes shall not be used in lifting appliances.

2.7 LOOSE GEAR

2.7.1 General

2.7.1.1 Loose gear shall be so attached as to exclude any bending or twisting and swivels may be used to prevent this. If in the cargo suspension system the cargo runner twisting is not excluded, a swivel shall be provided therein. The ball and roll bearing swivels may be used provided that they can be regularly lubricated. Swivels shall freely rotate under loading.

2.7.1.2 Loose gears such as cargo hooks, shackles, swivels, blocks, chains etc. of the lifting appliance on deck of oil tankers, gas carriers, chemical tankers and similar ships shall be of a spark-proof type complying with the recognized standards.

2.7.1.3 Parts in movable joints shall be so fitted that radial and axial clearances between the bearing surfaces will be the smallest permissible in service.

2.7.1.4 Thread joints of movable parts shall comply with the national standards.

2.7.2 Determination of load

The SWL of multi-sheave blocks is to be taken as the resultant load on the becket.

For single sheave blocks without becket, the SWL is equal to twice the permissible rope pull (PRP).

For single sheave blocks with becket, the SWL is equal to three times the permissible rope pull (PRP).

2.7.3 Blocks

2.7.3.1 The blocks shall be made so that the rope will not be jammed between the block frame plates and sheave.

Axles of sheaves shall be secured against turning and axial displacement.

Where bushed plain bearings are used, the block sheaves shall be provided with bushes made of anti-friction materials (e.g. bronze).

The eyes and lugs of blocks shall be forged integral with the latter. The nuts of swivels shall be reliably stopped. Blocks with open hooks shall not be used in lifting appliances.

Fastening of screwed forks with efficient stopping shall be specially considered by the *Register* in each case.

2.7.3.2 The diameter of sheaves for wire ropes measured in the bottom of the groove shall not be less than 14 times the rope diameter for ropes movable under load, and at least 9 times the rope diameter for ropes immovable under load.

The diameter of sheaves intended for use with natural or synthetic fibre ropes shall not be less than 5 times the rope diameter.

The groove shall be so shaped as to accept the rope tightly and without jamming.

The ratio of drum diameter to rope diameter for floating cranes, cranes ships and cranes on floating docks shall not be less than 16 for drum, 18 for block and 14 for compensation block.

2.7.3.3 The sheaves shall be made of forged steel and with large diameters by welding. The application of cast iron loops shall be specially considered and agreed by the *Register*.

Wooden sheaves shall be applied only for synthetic ropes.

Sheave diameter and groove profile shall be selected relative to the rope diameter with the minimum design wire safety factor.

2.7.3.4 In calculating dimensions of cargo block elements with movable axes relative to space, each sheave shall be considered as loaded with radial force equal to vector sum of forces in ropes. For cargo blocks with standing axes in relation to the space, in addition is taken the component of force determined by angle rope declination equal to 6^o which is parallel to sheave axis and fitted at the spacing of 0,5 sheave diameter to rope axis.

2.7.3.5 The groove shape of cargo block sheave, in principle, shall be equal to rope diameter but in no case shall be less than 3/4 rope diameter. Groove bottom shall have a wheel shape making a segment with an angle of not less than 120^o. Groove radius shall be larger than rope radius for at least 10%.

Groove side areas shall be slightly oblique and their inner edges rounded.

2.7.4 Cargo shackles

2.7.4.1 Cargo shackles and their fastening elements shall not be provided with protruding items and sharp edges.

The shackles shall be so arranged as to ensure the correct fitting of pins and to prevent twisting of the rope.

2.7.4.2 The shackles shall be forged straight, with pins that are screwed into the eye plate or secured with nuts. Pins or nuts shall be adequately fixed.

Bow shackles may be used as cargo shackles and also for the natural and synthetic fibre ropes.

The shackles used for cargo (cargo hooks, swivel, triangle plate, rings, counterweight and chains) shall be secured.

2.7.5 Cargo hooks

2.7.5.1 The cargo hooks shall not be provided with any protruding parts or sharp edges.

The hooks of cranes and derricks used in lifting appliances shall be so designed as to exclude any possibility of slipping of slings or catching the projected structures while lifting the load.

2.7.5.2 The cargo hooks shall be made of steel by smith forging or punching. The use of plastified hooks shall be specially considered and agreed by the *Register* in each particular case.

For cranes and derricks the safe working load of 10 t and more, ramshorn hooks may be used which shall meet the requirements for cargo hooks of standard design. On agreement with the *Register*, ramshorn hooks for floating cranes and lifting appliances installed in the vessels of dredging fleet need not be specially designed for protection from slipping off slings or catching the projected structures. Ramshorn hooks shall be subjected to symmetrical load only.

Swivels of cargo hooks and blocks shall be forged. The nut of the swivel shall be efficiently secured against turning of the thread.

2.7.5.3 The strength calculation for bent part of hook shall in principle be carried out according to the thick curved beam procedure. In compliance with the *Register*, the strength calculation of the curved hook part may be performed under any other procedure, disregarding the curve. In such a case the allowable stresses that may be compared with curved hook part shall not exceed 60%.

2.7.6 Spreaders, lifting beams and frames

2.7.6.1 The spreaders, lifting beams and frames shall be made of carbon structures and alloy steels, depending on the function of respective elements.

The application of aluminium alloys for some parts of the cargo gear shall be specially considered and agreed by the *Register*, in each particular case.

The spreaders, lifting beams and frames shall be considered as the loose gear elements in relation to the strength calculation and load tests of steel structural members or as the fixed gear.

2.7.6.2 Construction of spreaders for containers with wind load calculation and ship's inclination shall be ensured by means of specially orientated appliances (e.g. turning devices), their positioning (in space) necessary for holding and fitting of containers.

2.7.6.3 Simultaneous closing of rotating twistlocks shall be ensured structurally.

2.7.6.4 The possibility of safe fastening of telescopic spreaders' supports shall be provided in the appropriate working position. The spreaders shall be provided with equilibrium center equalizers. The means preventing rolling and uncontrolled rotating shall be provided.

2.7.6.5 Efficient entering of twistlocks in corner fittings of containers when mechanically operated shall be controlled by a contact sensor. Holding of twistlocks in position "engaged" and "disengaged" shall be ensured by limit switches.

Light indicator of the twistlock position shall be provided on the control panel of lifting device.

2.7.7 Gear parts

2.7.7.1 The triangular and multiangular plates used for connection of ropes or chains shall be so thick as to suit the shackles secured to them and to leave a minimum clearance enabling shackles to move easily. Symmetrically welded reinforcing pads may be used.

2.7.7.2 Forged eye ends and screwed forks shall be forged integral with rigging screws. The use of rigging screws with hooks shall not be allowed. Design of the rigging screws shall ensure efficient stopping of tightened screws.

The fastening of screwed forks with efficient stopping shall be specially considered and agreed by the *Register* in each particular case.

2.7.7.3 The thimbles shall be made of steel by smith forging or punching. The use of cast thimbles shall be specially considered and agreed by the *Register* in each particular case.

2.7.7.4 Chains used in lifting appliances shall comply with the *Rules for the classification of ships*, *Part 25 - Metallic Materials*.

2.7.7.5 Short-link chains shall be used as cargo chains. Span chains and chains used with preventer guys in union purchase rig shall be long-link chains.

2.8 ELECTRICAL EQUIPMENT

2.8.1 In electrically-driven lifting appliances the power supply to motors shall not be possible until the corresponding handles, wheels and levers of control posts are set in zero position.

Signalling of voltage in the power line (net) as well as visual signalling of switching "on" or switching "off" the electric drive are recommended to be fitted at the control posts or closely to them.

2.8.2 Short-circuits as well as other faults in the electric drive control system shall not affect electric drive operation regarding switching off or on, releasing the brakes or their remaining released.

When the electric drive control systems are deenergized, the drive systems shall be automatically stopped even if the control system is in neutral position.

2.8.3 The control systems of the independent electric drives of topping winches and preventer guy winches shall be such that any possibility of switching on the drives or continuous running of the drives with the load hooked is excluded.

Instead of locking, provision shall be made that only an authorized person may switch on the drives.

2.8.4 A push-button or an emergency switch for disconnecting the electric drive main circuit shall be provided within the operators hand reach, immediately at the control post of lifting appliances. The push buttons shall be painted red and bear an inscription "STOP".

The inscription "STOP" need not be fitted in case of hydraulic drive with the lever for automatic movement to neutral position.

2.8.5 A switch shall be provided in the main circuit of the lifting appliances accessible only to authorized persons of the crew, or means shall be provided for locking the switch in the "off" position.

2.8.6 The use of bare trolley wires for feeding current to travelling lifting appliances shall not be permitted.

2.8.7 Any possibility of switching on electric drive inadvertently shall be excluded.

The motor of the hoisting machinery shall start as soon as the control handle moves from the neutral position.

2.8.8 The electric drives of the lifting appliances fitted with the mechanical ventilation shall be provided with a locking arrangement which prevents starting or continuation of its running when the ventilation is cut off.

2.8.9 The moving parts of the crane shall be earthed by means of a special cable that is connected to the revolving part of the crane or to the rotating drum provided with not less than two brushes. The moving parts of the crane may be earthed through the rollers and rail tracks provided the efficient contact is ensured.

2.9 OTHER EQUIPMENT

2.9.1 Winches

2.9.1.1 The length of winch drums shall be such as to ensure the rope reeling up on drum in single layer. In no case the number of rope layers shall be more than three. The exception may be made for heavy derricks and for twin-span derricks where using of the drums capable to accept more than three layers of the rope shall be specially considered by the *Register* in each particular case, on condition that the drum is provided with the guide-on system or rope tightening device.

2.9.1.2 The rope ends of heavy derrick tackle span-guys shall be securely attached to winch drums.

Such an attachment shall enable the reeling up and fastening of ropes when derricks are used in union purchase.

2.9.1.3 The rope drum diameter shall not be less than the value obtained to the formulae:

$$D_{min} \geq K_i \cdot \frac{R_m}{1770} \cdot d_k , \qquad \text{[mm]}$$

where:

D_{min} - minimum diameter of drum [mm];
R_m - design wire rope tensile strength [MPa]
d_k - designed wire rope diameter [mm];
K_i - ratio factor according to Table 2.9.1.3.
$K_i = K_{1a}$ - for drum ropes;
$K_i = K_{va}$ - for block ropes.

Table 2.9.1.3

Ratio factor, K_i				
No.	Working conditions	For drum ropes, K_{1a}		For block ropes, K_{va}
		without grooves	with grooves	
1	2	3	4	5
1.	Movement without loading	13,5	11,5	10,5
2.	Movement under loading with the rope speed $V_k \leq 0{,}67$ m/s, maximum with 16 cargo operations of crane per hour	18	14	16
3.	Movement under loading at $V_k > 0{,}67$ m/s and more than 16 cargo operations of crane per hour	22	18	20
4.	For ship deck cranes without grabs	22	18	20
5.	For ship deck cranes with grabs	28	22	24
6.	For ship cranes with grab with main block	28	22	31

2.9.1.4 The rope drum shall be provided with flanges on both sides extending above the top layer of the rope by at least 2,5 rope diameters.

2.9.1.5 The drums of the motor-driven winches when the rope is reeled on the drum in single layer shall have screw shaped grooves with the groove diameter not less than 10 percent of the rope diameter. Two adjacent rope layers shall not be jammed.

Groove contour in the circumferencial direction shall not be less than 120°. Groove side surfaces, if practicable, shall be sloped.

2.9.1.6 For the winches serving the ships cranes and cargo or mechanized derricks, cargo and span drums shall additionally reel onto them the rope length necessary to hoist the cargo from the hold bottom when the derrick is in the extreme working position as well as from the hold bottom of the barge attached to the ships side at the maximum derrick outreach and the minimum ships draught.

2.9.1.7 The number of the full safety turns on the winch drum when the full operating rope length is unreeled shall not be less than: three - for smooth drums (without grooves) and two - for grooved drums provided that:

- one safety turn shall be reeled onto the derrick or crane winch drum when they are stowed for sea.
- two safety turns shall be reeled onto the derrick winch drum when the derrick is in its lowest position during the service.
- three safety turns shall be reeled onto the drum when the boom is at the lowest operating position for dismantling or providing for a boom extension; three safety turns shall be reeled onto the drum when the mechanized derricks are stowed for sea at the lowest position during the service.

2.9.1.8 The drum shall be so arranged as to ensure the correct reeling of the rope onto the drum. The deflection angle of a rope reeled onto the drum shall not be more than 4° about the cross-sectional plane vertical to the longitudinal axis of the drum. All winch drums, which cannot be seen by the operator when under operation, shall be provided with the devices ensuring correct reeling of the rope onto the drum.

2.9.2 Safety devices

2.9.2.1 The lifting appliances machinery and the drive shall be so designed as to prevent the falling of the load or uncontrolled movement of the derrick or crane when the drive is disconnected or when the speed is being changed.

The hydraulically driven machinery shall be provided with means against falling of the load or uncon-

trolled movement of the derrick or crane, when pressure in the hydraulic system drops.

2.9.2.2 The hoisting, topping, change of jib outreach and slewing of lifting appliances shall be of the design to ensure manual and machinery driving.

2.9.2.3 All the machinery of the lifting appliance, except the screw-driven machinery with self-breaking or machinery driven with hydraulic cylinders, shall be provided with the efficient automatic break which ensures breaking with the safety factor referred to in the relevant sections of the Rules.

2.9.2.4 Automatic brake shall be applied:

- when the control lever returns to its neutral position,
- when the power drive is disconnected under emergency situation;
- when power supply is interrupted including situations where phases are completely disconnected or voltage is significantly dropped.

Automatic brake shall be so designed that the actuating solenoid cannot be excited by the back electromotive force EMF outgoing from any motor, by stray currents or insulation puncture. In emergency, when power supply of electric drives of the hoisting machinery is interrupted, provision shall be made for manual release of brakes.

2.9.2.5 The brakes shall be of the closed type (unless otherwise specified in the Rules) and shall be applied smoothly, without shocks, and provided with simple and easily-accessible means of adjustment and enable easy replacement of the friction parts.

2.9.2.6 Machinery and its foundations shall be capable to withstand stresses due to braking. Inertia forces shall not exceed the values specified in Section 3 - Calculations.

2.9.2.7 Forces applied to the adjustable brakes shall not exceed 160N on the handle or lever and 310N on the brake pedal. For brakes used regularly in the normal duty cycle, the mentioned forces shall be reduced at least by half. Brake pedals shall have a non-slip surface.

2.9.2.8 Hoisting and topping machinery of lifting appliances intended for loading, unloading and transferring of dangerous cargo shall be provided with two self-locking brakes of closed type independent from each other which ensure holding the cargo when the brakes are not fed by power. The brakes may be designed for consecutive operation. When there is a coupling between motor and reduction gear, a brake shall be fitted on the coupling part located from the side of reduction gear or on the shaft of reduction gear. The second brake may be placed on the motor shaft or at any point of the driving mechanism. The brakes shall be situated in such a way that the check of reliable operation of one brake can easily prevent the action of the other brake.

Hoisting and topping machinery of lifting appliances driven hydraulically need not be provided with appropriate system for the other brake.

2.9.2.9 Manually driven hoisting machinery shall be provided with a self-locking crank handle or a safety handle in one construction line, handle safe-locking devices and brake.

2.9.2.10 Means shall be provided for keeping the disconnected brakes in the closed position. The braking forces induced by cargo loads shall not be permitted. For that purpose the brake springs shall be of a compression type.

2.9.2.11 The brake between the motor and the drive shall be placed in the drive direction.

2.9.2.12 Where several items of machinery are served by one drive, brakes shall be fitted on each item.

2.9.2.13 The brake drum shall be protected against rain, seawater, snow, ice, oils or fats unless the brake is designed for operation without such protection.

2.9.2.14 The brake springs shall be of a compression type and shall be of a corresponding direction.

2.9.2.15 Winch braking torque for the lifting appliance, when out of operation with nominal load shall not be less than the value obtained by:

$$M_k \geq \left(1 + \frac{\Psi_i}{2{,}2 \cdot n}\right) M_t \,, \qquad \text{[N/mm]}$$

where:

M_k - required brake torque [N/mm]
M_T - loading moment in the brake direction [N/mm] calculated in accordance with maximum static load reeled onto the drum.
Ψ_i - permissible load factor
n - number of simultaneously acting brakes.

2.9.2.16 A spare brake shall be fitted on the drum side in accordance with 2.9.2.9 when the cargo winches are provided with the alternating speed transmission and if the position of the speed control lever in the neutral (zero) position ensures free turning of drum.

The lever of the speed transmission control shall be provided with the appropriate blocking system that ensures the possibility of transmission when hoisting and lowering the cargo.

2.9.2.17 The supply of electro-magnetic brake coil shall preclude the possibility of non-intentional supply during the motor-in-generator operation by creeping currents or in case of insulation penetration.

2.9.3 Operating means

2.9.3.1 Manually driven lifting appliances shall be so designed as to require a force not exceeding 160N. Manually operated pull chains shall be protected against falling off the chain wheel.

2.9.3.2 Lifting appliances shall be such that the direction of movement of handles, levers or control wheel corresponds to the movement of the load.

Turning of the wheel clockwise shall correspond to lifting the cargo, topping the boom or jib and slewing to the right. Pulling the upright lever or lifting the slanted lever shall correspond to hoisting and topping the boom or jib; shifting the lever to the right, shall correspond to the right-hand slewing.

2.9.3.3 Handles, levers and wheels shall be fixed in the initial operating positions (when step-controlled) and shall be marked as indicated in 2.9.3.7. For the initial (neutral) position, the efficient braking shall be provided. Handles, levers, wheels or pedals shall be so fitted as to be easily used. The term "fixing" means keeping the handle in a definite position when the force required for shifting the handle out of that position is greater than the force required for moving the handle between the fixed positions.

2.9.3.4 The controls of lifting appliance shall be such as to ensure operation of not more than two mechanisms at a time, unless their design provides for combination of more than two movements.

2.9.3.5 Forces applied to the brake manual control shall not exceed 120N. Forces necessary to operate control handle, wheels, pedals and other control elements used frequently shall not exceed 40N. For control system, which is not frequently used, manual force applied to controls may be permitted to be up to 160N. The travel of the control lever shall not exceed:

- 60 cm in case of manual drive,
- 25 cm in case of foot drive.

2.9.3.6 A push-button shall be provided for each movement direction. The push buttons shall be provided with spring or other means for self-return to "stop" position when the operator removes his hands or relaxes its force.

2.9.3.7 Operating means and controls of the lifting appliance shall be so fitted in the control desk as to be clearly visible. The controls shall be provided with inscriptions indicating legibly and permanently the direction and purpose of their revolution. The control levers shall be provided with firmly attached labels indicating movement direction to start the relevant system. The inscriptions shall be in English.

2.9.3.8 Starting devices (controllers, switches, push-buttons) of lifting appliances used for handling of dangerous cargoes, or for provisional transportation of people in working stands as well as starting devices used in the remote control shall be provided with means for self-return to initial position.

If, with remote control, the operator does not see the winch drum, special attention shall be paid to ensure the correct reeling of rope onto drum.

2.9.3.9 The valves connecting the deck steam line to winch shall be arranged close to the latter and shall be accessible at any time and easily closed by hand.

2.9.3.10 The flywheels shall be provided with inscriptions indicating movement direction to start the relevant system.

2.9.4 Hydraulic devices

2.9.4.1 Dimensions and design of hydraulic systems shall be in accordance with the technical standards for hydraulic systems. Safe operation of hydraulic systems, in addition to all predetermined conditions of service, shall be ensured by appropriate means such as filters, cooling system, control system, pressure control in the primary cycle, corresponding oil, etc.

2.9.4.2 Hydraulic system design shall preclude the possibility of uncontrolled pressure. Working position of pistons shall be limited.

2.9.4.3 The pipes shall be connected by means of joints intended for high pressure. The joints shall be appropriate for the required working liquids, pressure, temperature, ambient conditions and shall comply with the relevant standards. Joint safety pressure shall be equal to three times safety valve pressure.

Unions with screwed bite joints shall be agreed with the *Register*.

2.9.4.4 Where the lifting appliance system is connected to other hydraulic system, other pump unit with corresponding valves shall be recommended for that hydraulic system.

2.9.4.5 Hydraulic pipe systems between a unit and hydromotor shall have higher safety factor. The same is applicable to all systems connected with them.

Flange and screw joints shall be calculated for strength equal to 1,5 times test load or 1,5 times maximum working pressure.

2.9.4.6 Hydraulic unit shall be provided with a device attached to a cylinder which will be activated in case of failure of the system to preclude falling of cargo or uncontrolled moving of the appliance.

2.9.4.7 Hydraulic cylinders shall be attached and connected to structural members in such a manner that no external bending moment shall be applied to piston rod.

3 CALCULATIONS

3.1 GENERAL PROVISIONS

3.1.1 Methods of calculation of forces and stresses in structural elements of lifting appliances are not completely specified in the Rules but the *Register* may require, in particular cases, the application of the approved methods of calculation.

In general, the strength calculations of lifting appliances may be done, in agreement with the *Register*, in accordance with the approved methods.

3.1.2 Where computer analysis is used for calculations, details of the programs describing the type of program, data and procedures are to be included together with the basic design criteria.

The *Register* may require additional control calculations to be made.

3.1.3 For mechanized derricks and hoists of telpher type, methods of calculations as used for deck jib cranes shall be applied and for hoisting appliances of cargo purchase and whip types, those used for ship derricks shall be applied.

For cranes used in mobile offshore drilling units methods of calculation as used for ships crane shall be applied with particular features of their service taken into consideration.

3.1.4 Structural members are divided into two groups according to the utilization coefficient of the lifting appliance under service conditions:

- the first group consists of the basic structural members exposed to great static and dynamic loads; masts, posts, crane and derrick foundations, mechanism hydraulic drives, outreach controls, bearing supports, transverses, lifting beams;
- the second group consists of the items exposed to small loads or are intended to ensure function of lifting appliance or for cargo adjustment, crane securing, span plates, derrick heel fitting and derrick head, hydraulic servo-motors of slewing mechanisms, sheaves, loose gear, eye plates, consoles, attachments.

3.1.5 Each knot of lifting appliances structural members shall be checked for the position where the highest stresses occur in movable members.

3.1.6 A combined allowance for sheave friction and wire ropes stiffness shall be taken as equal to 5% per sheave with plain bearings and 2% per sheave with rolling bearing.

Variation of forces in lifting appliances when ropes are pulled through the blocks shall be considered for the motion or motions that are the most unfavourable for the gear (hoisting or lowering the load or topping the boom).

3.1.7 Combined stresses in the structural members shall be determined in accordance with the relevant standards and stress theories.

3.1.8 Each node of the lifting appliance structure shall be calculated for the maximum possible loads of lifting appliances:

1. for elementary load under operating conditions not taking into account additional loads (see 3.3.1);
2. for elementary and additional loads under operating conditions, taking into account additional loads (3.3.1 and 3.3.2);
3. for special loads under service condition taking into account wind pressure and test loads.

The stated elementary and additional loads shall be taken as acting simultaneously, except for the loads resulting from the sea state (sea motion) (see 3.3.2.3) as well as wave strokes /see 3.3.2.5) which cannot be taken as acting simultaneously.

3.2 WORKING CONDITIONS

3.2.1 Sea effect

Lifting appliances, which are designed without taking into account forces due to sea motion, may be normally operated only in "calm water". In this case, the term "calm water" means the sea condition where no appreciable movements of floating objects can be seen.

The term "unsheltered waters" means the sea condition where movements of floating object can be seen.

3.2.2 Inclination of the floating object

Crane structural members at floating object inclination and trim are subjected to higher stresses than at the floating object even keel. In the documents of every lifting appliance of the floating unit, permissible heel and trim with the respective calculation shall be indicated.

3.2.3 Wind pressure force

Cargo handling appliance shall be designed to be used at the wind speed of up to 18 m/s that correspond to a dynamic pressure of 0,25 kN/m^2 (wind strength of approximately 7 Bf). At higher wind speeds lifting appliance shall be taken out of operation and stowed.

For floating cranes other values may be permitted, in co-operation with the *Register*.

Instructions for wind load calculations are given in 3.3.2.1.

3.2.4 Design temperature

3.2.4.1 The minimum working temperature governing the selection of materials (see Section 4) is, as a matter of fact, the ambient temperature which takes into account mean value of the temperatures recorded in the field of application for the long period of time.

3.2.4.2 If no special recommendations are given, the minimum working (design) temperature shall be -25^{o}C. The Owner of a ship shall undertake appropriate measures that the

lifting appliance is not used at the temperatures below -25°C, unless it has been intended for such temperatures.

3.2.4.3 Exceptionally, the use of lifting appliance at the temperatures below -25°C shall be indicated in the documents submitted to the *Register* for approval and the minimum ambient temperature shall be taken into consideration when the materials, technology of the manufacture and equipment sensitive to low-temperatures are selected.

3.3 DESIGN LOADS AND STRESSES

External loads acting on the components of the lifting appliance when used are divided into principal, additional and special loads.

3.3.1 Principal loads

3.3.1.1 Dead loads mean the dead mass of the crane structure, mechanisms, fixed structural members, constant counter-weights etc. which values and positions in relation to structural members remain unchanged during the service.

3.3.1.2 Hoisted load with the suspension gear load (mass of cargo hook, grab, traverse, spreader etc.). In calculations, the suspension gear load may be neglected provided that its value does not exceed 5% of the cargo.

3.3.1.3 In determining the forces acting on the structural members of lifting appliance built in ships and floating objects, trim and angles of heel shall be taken into account depending on the area of navigation and operating condition. Angles of heel taken in relation to area of navigation and the type of a floating object are shown in Table 3.3.1.3.

The angles of heel and trim shown in Table 3.3.1.3 shall be assumed to occur simultaneously. When the angles of heel and trim are assumed to exceed those values in the Table during the service of a floating object, the actual angles shall be taken and stated in the documents submitted to the *Register* for approval.

When the floating crane is operating in calm water, heeling angles (including initial heel) shall not exceed 13° and counter heels shall be up to 6°.

Table 3.3.1.3

Heels of floating objects to determine loads of lifting appliance										
	Type of floating unit	Sheltered waters				Unprotected waters				*Remarks*
		Operating condition		Out of operation		Operating condition		Out of operation		
		Heel	Trim	Heel	Trim	Heel	Trim	Heel	Trim	
1.	Ships and similar floating objects	5°	2°	3°	2°	10°	3°	30°	6°	
2.	Floating docks	2°	2°	2°	2°	-	-	7 and 8		*To conform the stated conditions for removal and anchorage
3.	Floating cranes ≤ 60 t	5°	2,5°	2°	2°	6°	3°	6 to 8*		
4.	Floating cranes > 60 t	3°	2°	2°	2°	6°	3°			
5.	Pontoons	3°	2°	2°	2°	6°	3°			
6.	Pontoons $B < \lambda$	-	-	-	-	-	-	15°	7,5°	See data on acceleration components stated in 3.3.2.4
7.	Pontoons $B \sim \frac{1}{2}\lambda$	-	-	-	-	-	-	10°	5°	
8.	Pontoons $B \sim \lambda$	-	-	-	-	-	-	5°	3°	
9.	Semi-loaded platforms	-	-	-	-	3°	3°	3°	3°	To follow the cargo positioning
10.	Self-adjustable and loaded platforms	-	-	-	-	1°	1°	1°	1°	Not considered to be floating objects

Note:
All angle values are with ±

B = width of pontoon [m]
λ = wave length [m]

3.3.1.4 Vertical inertia forces due to vibration resulting from hoisting and lowering the load with the hoisting device, slewing and luffing the boom shall be taken into calculations by increasing dynamic load coefficients Ψ and φ. Coefficient Ψ shall take into account forces of inertia resulting from the movement of cargo. Coefficient φ shall take into account forces of inertia resulting from other movements. Where the deck-lifting appliance in operating condition is exposed to sea motion effects, dynamic coefficient Ψ shall be taken in accordance with 3.3.2.3. Coefficient φ for floating cranes shall be taken in accordance with Table 3.3.1.4. Where the floating crane is exposed to sea motion, coefficient φ shall be increased by 15 %.

Values of coefficient φ are stated in the Table 3.3.1.4.

Table 3.3.1.4

Cargo handling appliance	Lifting force, kN	φ
Stationary	≤ 1000	1,05
	> 1000	1,00
Mobile	> 1000	1,20

When the floating crane under operation is exposed to sea motion effects, dynamic (load) coefficient Ψ shall be taken in accordance with 3.3.2.3.

3.3.1.5 Horizontal forces of inertia resulting from the lifting appliance or trolley (track) movements shall be calculated as a product of multiplication of masses to be moved and acceleration due to drive or braking. These forces may be approximately calculated by the formulae:

$$R_{hor} = K \Sigma R_{op} \quad [N]$$

where:

R_{hor} - horizontal force of inertia [N]
R_{op} - drive or brake load at wheel [N];
K - coefficient in accordance with Table 3.3.1.5.

Table 3.3.1.5

Movement speed, m/s	K
up to 2	0,025
up to 4	0,05
over 4	0,075

Horizontal forces of inertia, perpendicular to jib axis, resulting from the change of jib outreach (luffing) may be neglected.

Horizontal forces of inertia resulting from the slewing shall be taken into account as a product of multiplication of masses to be moved and drive acceleration or deceleration due to braking. These forces may be replaced with the forces arising from the inclinations of the floating objects for 2^o, without thorough calculations, taking into account dynamic coefficients Ψ and φ.

Centrifugal forces may be neglected in calculations. Horizontal forces of inertia, resulting from the floating object drive due to sea motion shall be taken into account only for the condition "stowed for sea".

3.3.2 Additional loads

3.3.2.1 Wind load

The wind load shall be determined assuming that wind forces act on horizontal area and that the wind direction is most unfavorable so that it causes the increase of lifting appliance loads having effect on lifting appliance motion or on its structural members.

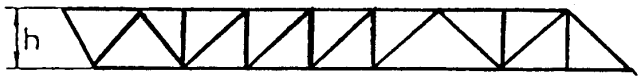
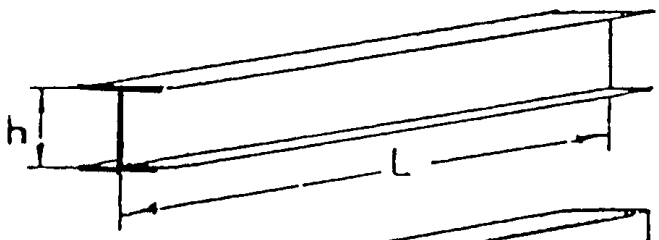
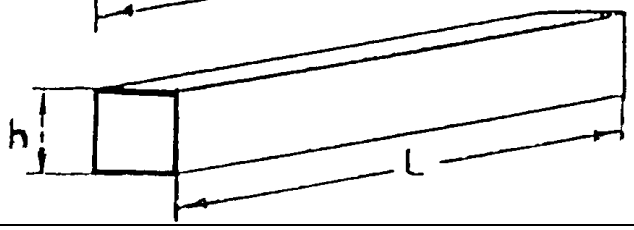
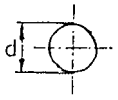
The wind load on lifting appliance structure shall be calculated by the formula:

$$W = k_i \cdot q \cdot A,$$

where:

W - wind pressure force, [kN];
k_i - aerodynamic coefficient with pressure effect included or divided into structural members, given in Table 3.3.2.1-1;
q - wind pressure:
$q = 0{,}613\ \upsilon^2 \cdot 10^{-3}$, kN/m^2; where: υ, m/s - wind speed (velocity);

Table 3.3.2.1-1

Steel structural members				k_i
	Structural members	Shape		
	Truss girder			1,6
Plate girders structures	Open		$\frac{L}{h}$ 20 10	1,6 1,4
	Closed		5 2	1,3 1,2
	Closed cylindrical cross-section Truss with cylindrical cross-section girders		Where $d\sqrt{q} < 1$ e.g. Rope Where $d\sqrt{q} > 1$ e.g.. Crane pillar d, [m] ; q, [N/m^2]	1,2 0,7

The weakest wind stroke for the lifting appliance is:

q = 0,25 kN/m^2 for operating condition,
q = 1,2 kN/m^2 for "out of operation " condition,
A = wind exposed area, [m^2]

Where one girder is covered by another (see Fig. 3.3.2.1), wind pressure force acting on the covered girder shall be calculated by multiplying wind pressure force W acting on the girder and coefficient η:

$$W_e = W \cdot \eta = \eta \cdot k_i \cdot q \cdot A,$$

where:

η - depends on dimensions b and h (see Fig. 3.3.2.1) and the degree of covering $\beta = \frac{A_n}{A_g}$,

where:

A_n - net wind exposed area of girder, [m^2];
A_g - girder wind exposed area, [m^2];
h - girder height, [m];
b - spacing between covering girder and the covered girder, [m]

The values of coefficient η are given in Table 3.3.2.1-2.

For cylindrical girders is taken $\beta = 1$.

For the truss girder with the coverage degree $\beta \geq 0{,}6$, the coefficient shall be taken as for cylindrical girders.

Wind pressure force shall be taken in accordance with Table 3.3.2.1-3

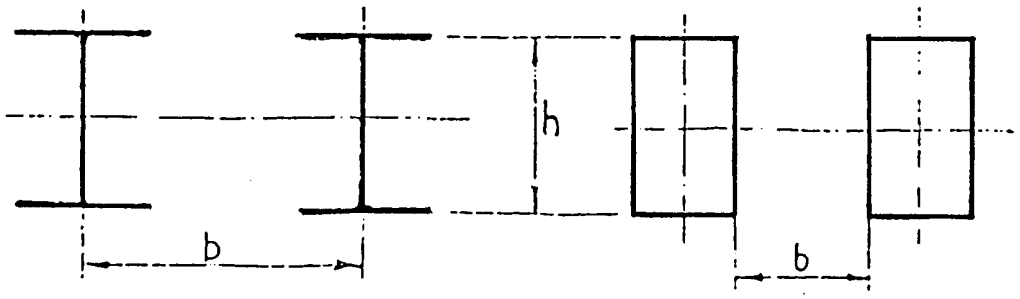


Figure 3.3.2.1

Table 3.3.2.1-2

$\frac{b}{h}$ \ β	0,1	0,2	0,3	0,4	0,5	0,6-1,0
0,5	0,75	0,4	0,32	0,21	0,15	0,05
1	0,92	0,75	0,59	0,43	0,25	0,10
2	0,95	0,80	0,63	0,50	0,33	0,20
4	1,0	0,86	0,76	0,66	0,55	0,45
5	1,0	0,95	0,88	0,81	0,75	0,68

Table 3.3.2.1-3

Hoisting capacity, [t]	Wind pressure force, [N]	Hoisting capacity, [t]	Wind pressure force, [N]
1	600	30	5500
2	1200	40	6500
3	1700	50	7500
4	2100	60	8000
5	2500	70	8500
6	2700	80	9000
8	2900	90	9500
10	3000	100 and more	0,01x*SWL*
20	4500		

Note:
Intermediate values shall be determined by linear interpolation

3.3.2.2 Ice load

In case of icing and if the detailed data are not available, the ice thickness on all structural members exposed to weather shall be assumed to be 3 cm and to have density of 7 kN/m^3.

The wind pressure force acting on structural members with the increased area of structural members due to icing shall be calculated taking into account wind stroke equal to 75% of the values referred to in 3.3.2.1.

For latticed structures, all changes for dimensions A and Ag due to icing and which affect the coverage values β, shall be taken into account.

3.3.2.3 Load due to sea state

The *Register* shall consider the operation of lifting appliance in a seaway, in unprotected waters, in each particular case.

For lifting appliances intended for operation in unprotected waters and which are not equipped with the appropriate buffers, the coefficient ψ shall be determined by the formulae:

$$\psi = 1 + 0{,}9(\upsilon_p + \upsilon_w)\sqrt{\frac{c}{g \cdot F}},$$

where:

υ_p - crane hoisting speed [m/s];
υ_w - vertical speed of deck shifting [m/s];
c - elasticity constant of lifting appliances in relation to the hook vertical shifting [kN/m];
g - acceleration due to gravity [m/s^2];
F - lifting capacity, [kN]

Speed υ_w, if the relevant data are not available, shall be taken in accordance with the Table 3.3.2.3.

Table 3.3.2.3

Wave height H	Vertical speed of deck shifting υ_w	Medium period, T_o
M	m/s	s
0,5	0,3	0,3
1,0	0,6	4,0
2,0	1,2	5,3
3,0	1,8	6,3
4,0	2,6	7,0
6,0	3,4	8,2
8,0	4,2	9,2

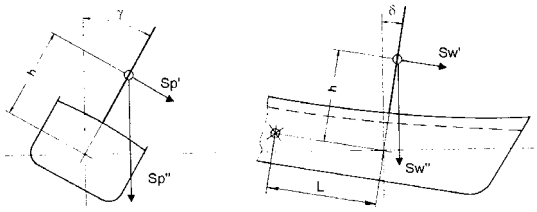
Intermediate values shall be determined by linear interpolation. Elasticity constant c shall be taken into calculations only with respect to ropes and derricks. Deformation of tackle ropes which increases vertical hook shifting shall not be taken into account. Calculations shall be made for static condition only.

If the relevant data are not available, for ropes with round strands module of elasticity E shall be equal to $1{,}1 \cdot 10^5$ MPa.

3.3.2.4 Inertia forces due to sea motion

Inertia forces for the operating condition of lifting appliance shall be determined in accordance with 3.3.2.3. Inertia forces acting on deck lifting appliance "stowed for sea" condition shall be taken into calculations of lifting appliances structure, its girders and attachments (fittings).

Inertia forces due to mass G resulting from rolling and pitching of the ship shall be determined in accordance with Fig. 3.3.2.4. and Table 3.3.2.4-1.



Rolling Pitching (including dipping)

Figure 3.3.2.4

Table 3.3.2.4-1

Lifting appliance	Angle of rolling γ	Angle of pitching δ
Deck lifting appliances	30°	6°
Pontoon		
$B < \lambda$	15°	7,5°
$B \sim \frac{1}{2}\lambda$	10°	5°
$B \sim \lambda$	5°	3°

For lifting appliances fitted on open deck, inertia forces may be determined as follows:

$S'p$ = 0,02 $G \cdot h$,
$S''p$ = 1,2 G
$S'w$ = 0,015 $G \cdot h$,
$S''w$ = 2,0 G - at the ends of the ship (ahead or astern)
midship length, $S''w$ = 1,5 G.

Note:
Intermediate values shall be determined by linear interpolation.

For the pontoon type lifting appliances engaged in unrestricted - term service in unprotected waters the following may be assumed:

$S'p = 0{,}04\ G \cdot h$ $S'w = 0{,}02\ G \cdot h$,
$S''p = 1{,}26\ G$, $S''w = 1{,}3\ G + 0{,}02\ G \cdot L$

For the pontoon type lifting appliances engaged in restricted - term service in unprotected waters depending on the maximum expected length of wave the following may be assumed:

$B < \lambda$ is assumed as for lifting appliances in unrestricted - term service in unprotected waters;

$B \sim \frac{1}{2}\lambda$ $S'p = 0{,}03\ G \cdot h$ $S'w = 0{,}015\ G \cdot h$,
$S''p = 1{,}17G$, $S''w = 1{,}21G + 0{,}015G \cdot L$

$B \sim \lambda$ $S'p = 0{,}015\ G \cdot h$ $S'w = 0{,}01\ G$,
$S''p = 1{,}09\ G$, $S''w = 1{,}15\ G + 0{,}01\ G \cdot L$

where:

h - the height of the center of gravity above the construction waterline, [m];
$S'p$; $S''p$; $S'w$; $S''w$ - components of inertia forces
L - distance from center line (midship section),[m];
B - pontoon breadth, [m];
λ - wave length, [m];

In calculating the loads, forces due to ships rolling need not be considered simultaneously with the forces due to the ships pitching (dipping). Each of these forces may be added either to wind pressure force or forces due to wave strokes.

3.3.2.5 Forces due to wave strokes

In addition to forces resulting from wind pressure (section 3.3.2.1.), forces due to wave strokes shall be taken into account taking the values of sea water pressure acting on the crane structural members.

P_w = 2,5 kPa/m^2 - at main deck level
P_w = 0 kPa/m^2 - 2,5 m and over above the main deck

Intermediate values of water pressure shall be taken for members between stated levels.

3.3.3 Special loads

Special loads include:
- test loads;
- loads on structure depending on the mounting method applied to lifting appliances as well as its technology:
- wave stroke;
- tearing off the cargo.

3.4 PERMISSIBLE STRESSES

3.4.1 Permissible stresses for structural members and their joints shall be determined by applying the formula:

$$R_o = \frac{235}{k \cdot \nu}$$

where:

R_o - permissible stress, [MPa];
k - material factor;
ν - safety factor (shown in Table 3.4.1-1 and 3.4.1-2), in relation to load condition.

The material factor shall be determined as follows:

$$k = \frac{295}{R_{eH} + 60},$$

where:

R_{eH} - yield point of the material, [MPa], according to specification stated in the *Rules for the classification of ships*, *Part 25 - Metallic Materials*.

The material factor shall be taken only for the steel grades for which the ratio $R_{eH}/R_m < 0{,}83$, where R_m means strength of material. When joining two grades of steel having different mechanical properties, permissible stresses of welded joints, R_{ez} shall be determined according to the steel with lower permissible stresses R_o.

3.4.2 Safety factor of wire ropes shall be determined by applying the formula:

$$K \cdot \kappa \le \frac{P_p}{S}$$

where:

P_p - wire rope breaking load, [kN];
S - maximum force acting in wire rope, [kN], for the load referred to in 3.1.8.1 not taking into account Ψ and φ (see 3.3.1.4) and taking into account frictional resistance in sheaves and wire rope resistance in sheave (see 3.1.6);
K - safety factor in accordance with Table 3.4.2;

Table 3.4.1-1

Steel member	Loads and stresses type	Safety factor – Load condition I	II	III
Plates Sections	Compressive and compressive/bending stress where proof of resistance to buckling, overturning or bulging is required	1,60	1,40	1,28
	Tensile and tensile/bending stress; compressive and compressive/bending stress where proof of resistance to buckling overturning or bulging is not required	1,40	1,20	1,12
	Shear, tangential stress	2,40	2,10	1,92
	Combined stresses	1,40	1,20	1,12
Tight-fitting bolts	Shear one-cross section multi-cross section Pressure one-cross section multi-cross section axial traction	2,70 2,00 1,10 0,80 2,50	2,35 1,75 0,95 0,70 2,15	2,16 1,60 0,88 0,64 2,00
Screws and screws for wood	Shear Pressure Tension	3,40 1,50 2,50	3,00 1,30 2,15	2,70 1,20 2,00

Table 3.4.1-2

Safety factor for welded joints					
Welded seam	Quality of welded seam	Loads type	Load condition		
			I	II	III
Joint - k	Standard special T[1)]	Compressive and compressive/bending, tensile and tensile/bending	1,40	1,20	1,12
	Standard	Tensile and tensile/bending [2)]	1,60	1,40	1,28
Fillet weld	Standard	Tensile and tensile/bending [2)]	2,00	1,70	1,60
		Compressive and compressive/bending	1,70	1,45	1,36
All types of welds	Optional	Transversal and longitudinal cross section to weld axis	2,00	1,70	1,60
		Equal stress	1,40	1,20	1,12

Notes:
[1]) Allowed only in exceptional cases
[2]) The permissible tensile and tensile/bending stresses perpendicular to the rolling material plane may be taken only if the joined elements are suitable for purpose.

Table 3.4.2

Safe working load SWL of lifting appliance, hoisting appliance and loose gear	Safety factor "*K*"		
	Running rigging Cargo runner Span tackle Slewing guys Preventer guys Shooner guys	Standing rigging Masts Stays	Wire rope sling
up to 10	5	4	6
10 up to 107	-	$\frac{8000}{(8{,}85xSWL)+1910}$	-
10 up to 160	$\frac{10000}{(8{,}85xSWL)+1910}$	-	$\frac{12000}{(8{,}85xSWL)+1910}$
Exceeding 107	-	2,8	-
Exceeding 160	3	-	3,6

Note:
The intermediate values shall be determined by linear interpolation.

κ - load factor; κ = 1,0 if the factor Ψ (according to Table 3.5.2.4.1) is equal to or less than 1,45; where the factor is in excess of 1,45, $\kappa = \frac{\Psi}{1{,}45}$

3.4.3 Safety factor of natural fibre ropes (regarding the breaking load) shall be not less than the factor stated in Table 3.4.3 and for synthetic fibre ropes not less than 10.

Table 3.4.3

Nominal diameter of rope, [mm]	Safety factor
12	12
14-17	10
18-23	8
24-39	7
40 and more	6

3.4.4 The safety factor of span chains, cargo runner chains and preventer guy chains (regarding their breaking loads) shall not be less than 4. For the manually operated winch, safety factor of calibrated chains used with sprockets shall not be less than 3,2. For the power operated winch, the *Register* in each case shall specially consider safety factor of chains.

3.5 PARTICULAR PROVISIONS

3.5.1 Derricks

3.5.1.1 Stability calculation

3.5.1.1.1 The stability factor shall not be less than the safety coefficient (regarding yield point) for the compression of the same element.

3.5.1.1.2 The compressed beams shall be checked for overall stability and their thin-wall members, for local stability. If they comply with the requirements of 2.2.2.4, the tubular members need not be checked for local stability.

Beams subjected to transverse bending shall be checked for overall stability and their vertical walls and compressed parts (strips), for local stability.

3.5.1.1.3 The critical force of the centrally compressed beams shall be determined taking into account initial eccentricity of the longitudinal forces and the initial bending; the total value of both shall not be less than 0,001 of the beam length.

3.5.1.1.4 In calculating steel derrick booms, the assumed factor of safety may be determined with regard to the cross-section variation along the boom length irrespective of initial eccentricity and bending. The safety factor shall not be less than 4,5.

3.5.1.1.5 The slenderness degree of each portion of steel truss girder structural members compressed or expanded shall not exceed 40.

3.5.1.1.6 The slenderness degree of steel structural members shall not exceed the values specified in Table 3.5.1.1.6.

Table 3.5.1.1.6

Slenderness degree of steel structural members		
Members of steel structure	Compressed members	Expanded members
Main girder parts (strips)	120	150
Single-beam derrick, posts and masts construction	150	180
Other main girders and auxiliary girder	150	250
All other beams	250	350

Note:
[1]) In calculating the degree of slenderness, the design length shall be determined with due allowance for the type of end fixing.
[2]) The degree of slenderness shall be calculated within the planes of the main inertia moments.
[3]) The degree of slenderness for the derrick booms may be assumed to be 175, and with the axial thrust down the boom of 19,60 kN and less, 200.

3.5.1.1.7 The tubular structural members without ribs and wall thickness $S > 15$ mm shall be checked for buckling applying the formula:

1. assumed stress due to buckling:

$$\sigma_{ki} = 1{,}21E\frac{S}{D},$$

where:

E = $2{,}06 \cdot 10^5$, [MPa] module of elasticity
S = wall thickness, [mm];
D = external radius, [mm].

2. normal stress due to buckling:

$$\sigma_{SP} = R_{eH}\left(1{,}277 - 0{,}555\sqrt{\frac{R_{eH}}{\alpha_w \cdot \sigma_{ki}}}\right),$$

where:

R_{eH} = yield point of material with respect to wall thickness, [MPa];

$$\alpha_w = 0{,}8\frac{\sqrt{\frac{S}{56}}}{\sqrt{1+\frac{1}{200S}}}$$

3. safety factor:

$$\nu = \frac{\sigma_{sp}}{\sigma_o}$$

where:

σ_o - stresses shall be less than
R_o = $\frac{235}{k \cdot 1{,}4}$ (see 3.4.1)

Safety factor shall not be less than 1,35.

3.5.1.2 Other requirements

3.5.1.2.1 The stresses in the lifting appliances structural members during operation of single derrick shall be determined at the angle to the horizontal of 15° for SWL ≤ 20 t and 25° for SWL > 20 t. When the minimum derrick boom angle under normal operating conditions exceeds the specified values, that minimum angle may be taken for the purpose of calculations. The angle of 30° or 45° is recommended to be taken into calculations.

Stress calculations for cargo runner sheave and cargo blocks with sheaves parallel to the derrick boom shall be made for operating conditions and for the maximum possible angle of the derrick boom but not less than 60°.

3.5.1.2.2 The angle between the boom and the horizontal shall not exceed 70°.

3.5.1.2.3 The angle between the horizontal and side derrick boom outreach shall not exceed 75°.

3.5.1.2.4 Stresses in structural members of derricks rigged in union purchase shall be calculated for the most unfavorable position. (see 2.2.5.4). In case of several operating positions, the operating position under which the maximum stresses would occur shall be taken into calculations. The same is applicable to the calculation of the derrick and guy position for the area necessary to serve the derricks rigged in union purchase.

Stresses in derricks, cargo runners and derrick spans rigged in union purchase, in general, shall not exceed the stresses in a single derrick under operation. If the stresses in derricks rigged in union purchase exceed those of a single derrick under operation, the strength of such member shall be calculated for the stresses of derricks rigged in union purchase.

3.5.1.2.5 When derricks operate in union purchase rig, the derricks and preventer guy units shall be so fitted as to preclude the risk of their vertical jack-knifing towards the mast under all possible ways of rigging and positions of load. Installing of additional inboard guys can prevent vertical jack-knifing. Slewing guys may be used for this purpose.

Positive tension in span when derrick is under load will prevent the vertical jack-knifing.

3.5.1.2.6 In stress calculations for the structural members of derrick with the twin span tackles, requirements referred to in 3.5.1.2.1. may be applied, provided that the change of span tension determines the span for the maximum slewing of the

derrick boom to the side opposite to that of the span concerned.

The requirements of 3.5.1.2.9. may be applied to derricks fitted with twin span tackles if its heel is shifted in respect to the vertical plane passing through the span eye fittings.

3.5.1.2.7 Provision shall be made to prevent the risk of jack-knifing of the derrick boom with twin span on rope suspension to the side opposite to its outreach. For heavy derricks, the angle of heel as well as trim referred to in 3.5.1.2.10. shall be calculated. Jack-knifing is prevented if there is a positive tension in the boom ropes and the tension component is perpendicular to the derrick in horizontal, the mass of which is not less than 0,1 of load mass being lifted.

3.5.1.2.8 Where two or more derricks shall be used simultaneously on a mast, the relative position of the derricks shall be such that maximum stresses produced in the mast cross-sections shall not exceed the allowable values and if the mast is provided with shrouds, the tension arising in them shall not exceed maximum allowable values.

If no special requirements are specified, the value equal to 1/12 of the rope breaking strength shall be assumed as the preliminary tension of the standing rigging.

3.5.1.2.9 Where the derrick heel is shifted with regard to vertical passing through the span eye plate at a value exceeding 0,025 of the span eye plate height above the derrick heel, the stresses in the derrick, span and slewing guy units shall be specially calculated.

3.5.1.2.10 The design load of slewing guys shall be assumed to be not less than 25% of the hoisting capacity of derrick. For heavy derricks the above value shall be verified at the heel of 5^o, trim of 2^o and the maximum derrick side outreach. If under working conditions, the heel and trim angles are greater than the above stated angles, their actual values shall be taken into calculations. When special measures are taken to reduce the heel angle when working with heavy derricks, e.g. ballasting of the ship, these measures shall be taken into consideration in calculating the load in the guy.

Design stress in guys or union purchase tackle connecting the boom heads shall not be less than 10 % of the safe working load for the single slewing derrick.

3.5.1.2.11 Where two derrick positions are possible, each of them shall be specially calculated. The allowable angle of heel shall be indicated in the Test certificate.

3.5.1.2.12 In calculating the derrick boom loads, the longitudinal forces as well as the initial eccentricity and bending shall be taken into account (see 3.5.1.1.4).

3.5.1.2.13 Hoisting capacity shall be taken as design load with the lifting appliance derricks. The dead mass of the derrick boom shall be taken into calculation of forces (except the union purchase) if it is equal to 20% or more of its hoisting capacity.

For derrick booms of special design (not tubular), wind pressure shall be taken into calculations for the deck boom cranes (see 3.5.2.3.2.). When determining the forces acting in slewing guys of the heavy derrick, angle of heel and trim shall be included according to 3.5.1.2.10.

3.5.1.2.14 Moments of heel in horizontal plane due to guys and preventers may be neglected.

3.5.1.2.15 Bending moments and torsion, which may occur in case of unequal distribution of forces in blocks, shall be taken into calculations for fixed outrigger on boom.

3.5.1.2.16 The span strength shall be such as to withstand SWL and the derrick boom load at the maximum side outreach. If there is any doubt that the strength of single derrick span shall not withstand the afore stated, then its strength shall not be less than 2/3 of block stresses.

3.5.1.2.17 Steel or synthetic ropes connecting the ends of derrick operating with double cargo runners shall be capable to withstand the stresses which are equal to 20% of the SWL but not less than 1 t.

3.5.1.2.18 Where the ship derricks are provided with structural members that are not typical, the *Register* may require additional calculations and/or testing of such members.

3.5.2 Cranes

3.5.2.1 For cranes and structural members thereof, the calculations shall prove:

- stability of the crane in operation as well as out of operation;
- that the connections, equipment and ropes are of sufficient strength and are in the direction of the applied forces;
- stability of the crane jib;
- that shifting and/or rolling of movable cranes are not possible.

3.5.2.2 The ships and floating units with cranes installed onboard are assumed to have sufficient stability. The ships and floating units where such cranes may substantially affect their stability, stability calculations shall be submitted for consideration.

3.5.2.3 Design loads

3.5.2.3.1 The load calculations for the cranes shall take into account:

1. mass of hoisting load,
2. dead mass of structure,
3. wind pressure on the wind exposed area of the deck crane and cargo in the longitudinal and transversal directions shall be equal to 0.25 kN/m^2.

In stress calculations for the crane structural members angles of heel shall be taken in accordance with 3.5.2.3.3.

Load calculations for the crane intended for operation in rough sea shall comply with the requirements referred to in 3.5.2.3.5 and 3.5.2.3.6.

3.5.2.3.2 In determining wind pressure for the design crane area it shall be taken: for the plate girders structure - area outlined by the contours of structure; for the truss girder structure - area outlined by contours of structure with open spaces between bars. For windage area of the crane with several girders of the same height (plate or truss) which run one behind the other, the total windage area of the front girder shall be taken into calculations; where the space between the

girders is equal to or greater than their height, but less than twice their height - the total windage area of the front girder plus 50% of each next girder shall be taken; where the space between the girders is equal to or greater than twice their height, the total windage area of all girders shall be taken into calculations.

Portions of rear girders that are not covered by the front girder shall be taken fully into calculations. For cylindrical structures the design area which is not exposed to wind may be reduced by the correction coefficient 0,75.

For cranes with safe working load up to 10 t, if sufficient data are not available, the cargo windage area may be taken to be equal to 2 m^2 per 1 t and for safe working load capacity to 2 t, 1 m^2 per 1 t. Intermediate values for cargo windage area shall be determined by interpolation.

3.5.2.3.3 Force calculations for structural members of the ship cranes shall be made for the angle of heel equal to 5^o and that of trim of 2^o. Where under working conditions the angles of heel or trim are greater than those stated above, the actual values shall be taken into calculations.

3.5.2.3.4 The calculations or tests shall prove that crane booms with elastic suspension are such that they prevent the risk of jack-knifing of crane opposite to their outreach. Jack-knifing shall be prevented if there is positive tension in the boom ropes at its minimum outreach and angle of inclination at the reverse side and the possible angle under operation (but not less than 5^o of heel and 2^o of trim) at wind pressure in accordance with 3.5.2.3.1.3.

3.5.2.3.5 Load calculations for cranes shall include:

1. Hoisted load;
2. Dead mass of the structure and the equipment thereof ;
3. Wind pressure (on the load and steel structure), shall be taken not less than 400 Pa for maximum loads in working condition, not less than 125 Pa for load drop and not less than 2000 Pa for maximum load in "out of operation" condition. The design wind pressure in "stowed for sea" condition may be reduced if well-grounded reasons are given for allowing actual conditions of service in water area, but in no cases it shall be less than 1000 Pa.
4. Loads due to heel and trim of the ship (stress calculation for structural members of the upper structures intended for operation in calm water shall be made on the basis of static heel equal to 5^o, transversally located and on the basis of static trim equal to 2^o, with derricks located alongside the ship; if under service conditions the angles of heel and trim are greater than those stated above, the actual values shall be taken for calculation); inertia forces acting on the upper structures as a result of rolling;
5. Inertia forces, resulting from hoisting (lowering) the load with the hoisting device, when operating in acceleration (deceleration) duty (dynamic load factor shall be calculated by the method approved by the *Register*; in this case, its value for the upper structure shall not be less than 1,15, when operating in calm water and not less than 1,4 when operating at rolling);
6. Inertia forces arising from deceleration of jib luffing, slewing or machinery travel and loads resulting from rolling (calculated by means of angles of deviation of load, determined by method approved by the *Register*, in all cases, the angles shall not be less than 3^o longitudinally and transversally of the jib at a same time).
   The angles shall be taken from the vertical with maximum dynamic heel of the upper structure;
7. Centrifugal inertia forces resulting from the upper structure turn;
8. Vertical inertia forces acting on the load in case of rolling (considered by means of dynamic load coefficient, determined by method approved by the *Register*; in all cases the value of dynamic load coefficient shall not be less than 1,25).

3.5.2.3.6 The design loads of the upper structures shall be taken as follows:

1. Normal loads in working conditions.
   The loads to be included in the calculations are: the safe working load, the weight of the structure, inertia forces in case of smooth starting and braking, the average wind pressure. They shall be taken into calculations of endurance (fatigue strength) of the upper structure carried out by the method approved by the *Register*. Thus obtained, the value of safety coefficient shall not be less than that determined by the calculation given in 3.5.2.3.6.2.
2. Maximum loads in working condition.
   Case 1. The upper structure is motionless (the hoisting machinery is operating only); the hoisting machinery operates for lifting the load from the deck or for braking while lowering the load, drop the load. The loads which shall be included in the calculations are: the safe working load taking into account the maximum dynamic factor, weight of structural members as well as wind pressure on the upper structure and the load in operating condition, inertia loads resulting from the drop of the load and the ships rolling.
   The dynamic load factor shall be calculated taking into account the maximum speed of load handling, rigidity of the structure (ropes included), the structure and load masses both for hoisting and braking (when lowering) the load.
   Case 2. The upper structure when the load is in motion (travelling, luffing or slewing), one of the mechanisms operating in acceleration or deceleration duty.

The loads which shall be included in the calculations are: the safe working load and the weight of the structural members with due allowance for the shock coefficient while moving along the track, maximum horizontal inertia forces of masses of the upper structure and the load allowing for skidding of the wheels, disconnection of limiting moment couplings and other design features, wind pressure on the upper structure, the load in the operating condition and inertia forces resulting from rolling. The shock factor shall be determined depending on the travelling speed and the rail joints;

3. Maximum load under "stowed for sea" conditions:

The loads to be included in the calculations are: the weight of structural members and wind pressure on the structure in "stowed for sea" conditions. In well-founded cases the design loads different from those stated above may be required with respect to service or the upper structures.

3.5.2.3.7 For the upper structures of simple design such as mast or mast-boom type, the loads referred to in 3.5.2.3.1 may be included in the calculations.

3-5.2.4 Allowable stresses, safety factor and stability

3.5.2.4.1 The stresses in steel structures of the ships lifting appliances when subjected to design loads shall not exceed the values referred to in Table 3.5.2.4.1.

Table 3.5.2.4.1

Hoisting capacity, t	Allowable stresses expressed as parts of yield point of material σ/R_{eH}	Safety factor R_{eH}/σ	Dynamic factor, $\Psi_H = 0{,}7\frac{R_{eH}}{\sigma}$	Maximum cargo hoisting or lowering speed at which verification of dynamic factor Ψ_H by calculation is not required (m/s)
5 and less	0,40	2,50	1,75	1,00
10	0,42	2,38	1,67	0,89
15	0,44	2,27	1,59	0,78
20	0,46	2,18	1,52	0,69
25	0,48	2,08	1,46	0,61
30	0,50	2,00	1,40	0,53
40	0,54	1,85	1,30	0,40
50	0,57	1,76	1,23	0,31
60	0,59	1,70	1,19	0,25
75 and more	0,60	1,67	1,17	0,22

Note:
Intermediate values shall be determined by linear interpolation.

For manually operated lifting appliances the allowable stresses may be assumed to be equal to 0,6 of the material yield point.

3.5.2.4.2 The values of allowable stresses referred to in the Table 3.5.2.4.1 include the following dynamic load coefficient:

$$\Psi_H = 0{,}7\ R_{eH}/\sigma$$

where:

Ψ_H - standard dynamic load factor determined as the ratio between sum of static and dynamic forces to the static stress when subjected to design load;

When maximum cargo hoisting or lowering speed is more than 1,33 (Ψ_H - 1) (m/s) the dynamic load factor shall be verified by calculations using the formula:

$$\Psi = 1 + 0{,}318\ \frac{V}{\sqrt{fst}}$$

where:

Ψ - design dynamic load factor which represents the ratio between sum of static and dynamic forces to its static value;

V - the maximum speed of load movement [m/s];

fst - design vertical shift of the load suspension point (including the change of rope length) under the action of a static force equal to the hoisting capacity, [m].

If so calculated dynamic load factor Ψ exceeds Ψ_H, the allowable stresses referred to in 3.5.2.4.1, shall be multiplied by ratio Ψ_H/Ψ. If the calculated factor is equal to or less than Ψ_H, the allowable stresses shall be assumed to be equal to those referred to in Table 3.5.2.4.1.

The calculations of dynamic factor may be carried out by other methods on agreement with the *Register*.

3.5.2.4.3 In determination of allowable stresses in steel structures, the value determined in the standard or specification shall be taken for the design yield point. However, design yield point shall not exceed 0,70 of minimum nominal tensile strength determined by the standard or specification.

3.5.2.4.4 The allowable stresses referred to in 3.5.2.4.1 apply to tensile, compression and bending deformations. Transition factor for calculations of allowable stresses of other type of deformations as well as for welded, forged and

pressure joints shall be taken according to standards approved by the *Register*.

3.5.2.4.5 Where normal and shear stresses act on the cross-section, the resultant stresses shall be determined, σ_s [MPa] by the formula:

$$\sigma_s = \sqrt{\sigma^2 + 3\tau^2}$$

where:

σ - tensile stress in the respective cross-section [MPa];

τ - shear stress in the respective cross-section [MPa].

The strength shall be checked for the above mentioned stresses.

3.5.3 Lifts

3.5.3.1 Calculation norms

The methods of calculation of forces and stresses in the lift components are not regulated by the Rules, but still, the *Register* may, in justified cases, require the application of approved calculation methods.

3.5.3.2 Design loads

3.5.3.2.1 In calculating the strength and stability of steel structures and loose gear as well as the items of safety devices and guides, the following shall be taken into account:

1. For operating condition:
   - loading capacity,
   - equipment mass,
   - weight components at an angle of heel of 15°,
   - weight components at an angle of trim of 3°,
   - inertia forces due to ship's motion,
   - inertia forces during lift car loading (counterweight) on gripping devices and buffers,
2. For non-operating condition:
   - equipment mass,
   - weight component at an angle of heel of 30°
   - weight components at an angle of trim of 6°,
   - inertia forces due to ship's motion.

Design loads shall comply with the most unfavorable operating condition of the relevant structural member.

3.5.3.2.2 For passenger lifts the available lift car area shall be determined according to Table 3.5.3.2.2.

The maximum available area of the car floor may be increased as follows to dimensions, m^2:

1,17 for 5 persons
1,66 for 8,
2,35 for 12,
3,56 for 20 persons.

In calculating the loading capacity of the lift , mass of one person is assumed to be 80 kg. Decrease of the available lift car floor area shall be permitted if:

1. handrail is installed by the amount proportional to the distance between the handrails and car;
2. where hinged doors are fitted by the amount of space occupied by one panel, if it is open.

In calculating the loads the position of the center of gravity of cargo in the lift car is assumed to be as follows:

1. for passenger lifts - at 1/6 of the width and 1/6 of the depth from the center of the lift car floor;
2. for cargo lifts - at 1/2 of the width and 1/2 of the depth from the center of the lift car floor.

The vertical center of gravity position of cargo or persons shall not be taken less than 1/2 of the lift car height, not calculating the floor.

Table 3.5.3.2.2

Lifting capacity, number of persons	Available car floor area not more than, m^2	Lifting capacity, number of persons,	Available car floor area not more than, m^2
3	0,70	13	2,35
4	0,90	14	2,50
5	1,10	15	2,65
6	1,30	16	2,80
7	1,45	17	2,95
8	1,60	18	3,10
9	1,75	19	3,25
10	1,90	20	3,40
11	2,05		
12	2,20		

Note:
The requirements of this Table do not apply to the lifts designed before 1982.

Table 3.5.3.2.3-2

No.	Load case	Resultant load component, [kN]		
		P_x	P_y	P_z
1.	Normal operation without ship inclination			11,8 x Q
2.	Normal operation at an angle of heel of 15° and trim of 3°	1,1 x Q	3,2 x Q	16,4 x Q
3.	Maine Breaking gripping devices or buffers at an angle of heel of 15° and of trim 3°	1,1 x Q	3,2 x Q	41,1 x Q
4.	Instantaneous gripping devices at an angle of heel of 15° and trim 3°	1,1 x Q	3,2 x Q	68,5 x Q
5.	Non-operating condition at an angle of heel of 30° and trim 6°	2,1 x Q	6,3 x Q	16,9 x Q

Note:
The resultant components shall take into account the load of inertia forces due to heel and trim as specified in 3.5.3.2.1.

If the cargo is transported on trucks, the actual position of cargo in the lift car shall be taken into account.

3.5.3.2.3 Inertia forces due to ship's motion, taken in the calculation, shall be not less than determined from the formula:

rolling:

$$P_y = \alpha Q\left(0{,}061\frac{\theta_{max} z}{T_1^2} + sin\,\theta_{max}\right)$$

$$P'_z = k\alpha Q\left(0{,}061\frac{\theta_{max} y}{T_1^2} + cos\,\theta_{max}\right)$$

pitching:

$$P_x = \alpha Q\left(0{,}061\frac{\psi_{max} z}{T_2^2} + sin\,\psi_{max}\right)$$

$$P''_z = k\alpha Q\left(0{,}061\frac{\psi_{max} x}{T_2^2} + cos\,\psi_{max}\right)$$

where:

P_x - component of load parallel to the longitudinal axis of ship, [kN];

P_y - component of load parallel to the transverse axis of ship, [kN];

P_z - component of load parallel to the vertical axis of the ship's center of gravity, [kN];

P'_z - vertical component of load due to roll, [kN];

P''_z - vertical component of load due to pitch, [kN];

α - 11,38 - factor calculated by multiplying constant 1,16 and g = 9,81, where g is gravitational acceleration, [m/s^2];

Q - mass of structural members of lift and/or allowable safe working load, [t];

θ_{max}, ψ_{max} - amplitudes of rolling and pitching, respectively in degrees.
The pitching amplitudes for operating condition of lift shall be taken as maximum at which the operation of lift shall be permitted and for non-operating condition they shall not be less than 30° and 6°, respectively, with rolling period of 12 s and 7 s;

x,y,z - co-ordinates of the center of gravity of the lift structural elements in relation to the axis passing through the ship's center of gravity, [m];

T_1 and T_2 - periods of rolling and pitching, [s];

g - acceleration of the gravity [m/s^2];

k - dynamic load factor, calculated with due account to lift movement, the minimum value for basic operating conditions is shown in Table 3.5.3.2.3-1.

Table 3.5.3.2.3-1

No.	Operating condition of lift	Dynamic load factor [k]
1	Starting and stopping	1,2
2	Setting down on buffers	3,5
3	Setting down on abrupt braking gripping devices	3,5
4	Setting down on smooth braking gripping device	3,0
5	Entering the truck in the lift car	1,5

The values of Table 3.5.3.2.3-2 for load components may be used having regard to a considerable effect of lift position on the resultant components.

3.5.3.2.4 The strength calculation of winches and their foundations are based on the values of rope pull load according to 3.5.3.3.2, taking into account losses due to friction forces, as well as the heel and trim of the ship. Dynamic load factor shall be determined by calculation or experiment, but in no case shall be less than 1,4.

3.5.3.2.5 The design deceleration of empty car or counterweight run, when setting down on buffers, at the rated speed shall not exceed 25 m/s^2. This value may be exceeded if deceleration time is not longer than 0,04 sec.

The buffers in the car shall be so designed as to take up the kinetic energy effect of the car, with the test load exceeding the safe working load of the lift by 10 %.

3.5.3.3 Strength requirements

3.5.3.3.1 The comparable stresses in structural members if subjected to loads specified in 3.5.3.2.1 , taking account of 3.5.3.2.3 shall not exceed stresses given in Table 3.5.3.3.1,

the requirements of 3.5.2.4.3 and 3.5.2.4.4 shall be taken into account.

In calculating the strength of the details made of cast iron, the safety factor shall exceed the safety factor given in Table 3.5.3.3.1.

Table 3.5.3.3.1

Load case according to Table 3.5.3.2.3-2	Allowable stress not more than [MPa]
1	0,40 R_{eH}
2	0,50 R_{eH}
3	0,70 R_{eH}
4	0,80 R_{eH}
5	0,60 R_{eH}
For winches and foundations	0,60R_{eH}
Note: R_{eH} yield stress of the applied material	

3.5.3.3.2 The safety factor of cargo ropes in relation to breaking force, shall be not less than those stated in Table 3.5.3.3.2.

Table 3.5.3.3.2

Safety factor of cargo ropes		
Lift load	Type of winch	
	with Drum winch	with Traction sheave
Passenger:		
static	9	12
dynamic	6,5	8,5
Cargo:		
static	8	10
dynamic	5,5	7,0

Static rope safety factor operating at limited speed or of other ropes, including gripping devices shall not be less than 5.

Parts of loose gear and as well ropes and chains attached thereto, shall be calculated to the maximum breaking load.

The safety factors of cargo ropes specified in Table 3.5.3.3.2 shall be determined with regard to one rope run of the car. The load, kN, imposed to one rope run shall be determined by the following formula:

$$S = \frac{Q + Q_k + Q_1 + 0{,}5Q_2}{100n}$$

where:

Q - rated loading capacity of lift [kg];
Q_k - lift car mass [kg];
Q_1 - mass of ropes running from drum, traction sheave or block positioned to the point of attachment to the lifting car at its lowest level, [kg];
Q_2 - mass of pulling arrangement of equalizing ropes, [kg];
n - number of ropes on which the lift car is suspended.

For the ropes operating the gripping device, the ratio of breaking load to the permissible load calculated under the dynamics of rolling, shall not be less than 5.

3.5.3.4 Standards of rigidity and stability

3.5.3.4.1 The rigidity of trunk structures to which the guides are attached shall be such that the total deformation measured by rod gauge (distance among guides) shall be not more than ±2 mm when subjected to the rated loads specified in 3.5.3.2.1 and with regard to 3.5.3.2.3 and 3.5.3.2.4.

The guides' deflection of base girders carrying the winches under the same loads shall not exceed 0,001 the distance between supports of guides' attachments to the trunk.

The deflection of the base girders carrying the winches under the same loads shall not exceed 0,0005 the distance between the supports of the girders.

3.5.3.4.2 Buckling of guides shall not exceed 120.

3.5.4 Lifting platforms

3.5.4.1 General

3.5.4.1.1 Unless otherwise specified, the applicable and general requirements for lifting appliances especially for cranes specified in Section 2 of the Rules, shall be taken into consideration in strength and stability calculations of lifting platforms.

3.5.4.1.2 Raising and lowering of platform with speed not exceeding 0,1 m/s shall be taken as a design condition only in the port environment. When unloading the platform shall be secured at the deck level.

3.5.4.1.3 The permissible loading of the lifting platform shall at least comply with the allowable load of deck area with which the lifting platform when "stowed for sea" is to be integral.

3.5.4.1.4 The calculation shall be performed for the most inconvenient load arrangement.

3.5.4.1.5 The platforms secured at the weather deck and unprotected superstructures intended as covers of cargo openings shall be designed according to the *Rules for the classification of ships*, *Part 3 - Hull Equipment*.

3.5.4.2 Design loads

3.5.4.2.1 Design loads for lifting platforms are given in Table 3.5.4.2.1.

3.5.4.2.2 Apart from the loads specified in Table 3.5.4.2.1 the platform shall be designed to withstand axial load taking account of tire traces produced by vehicles.

Loads and their arrangement are specified in the *Rules for the classification ships*, *Part 2 – Hull*, Head 3.2.

Table 3.5.4.2.1

Loading condition	Case of loading	Conditions	Design loads	Notices
Cargo handling (loading and unloading)	1,1	Attached to deck	Dead mass and loading capacity (unfavorable arrangement), static loads due to ship's inclination 5° heel, 2° trim), dynamic loads due to movement of cargo vehicles	The lifting mechanism is not subjected to load, torsion moment and bending moment are not transferred by locking
	1,2	Platform attached by means of lifting mechanism	Similar to case of loading under 1.1	-
Lifting and lowering	2,1	Required load	Dead mass and loading capacity are uniformly distributed over platform, static loads due to ship's inclination (5° hell, 2° trim), dynamic loads due to starting and braking	On agreement with the *Register* dynamic loads due to starting and breaking need not be taken into account
	2,2	Maximum load under unfavorable operating conditions with respect to operating phase	Dead mass and loading capacity, static loads due to ship's inclination (5° hell, 2° trim), dynamic loads due to starting and braking	
	2,3	Crash of lifting mechanism	Dead mass and loading capacity, static loads due to ship's heel (5° hell, 2° trim), dynamic loads due to crash of lifting mechanism	Remaining lifting mechanisms shall be so designed as to withstand additional loads and to be suitable for further operations
Platform "in service"	3,0	Geometrical blocking of platform to the same plane with deck	Dead mass and loading capacity, tensile forces, inertia loads due to ship's movement at rough sea	See note, case of loading 1.1

3.5.4.3 Permissible stresses, safety factors and stability

3.5.4.3.1 The stresses in steel structures and fixed gear of lifting platforms induced by loads specified in 3.5.4.2 shall not exceed the values stated in Table 3.5.4.3.1.

Table 3.5.4.3.1

Loading condition under Table 3.5.4.2.1	Allowable loading not greater than	
	in structural elements and parts	in plating
1,1	0,7 R_{eH}	0,75 R_{eH}
1,2	0,7 R_{eH}	0,75 R_{eH}
2,1	0,7 R_{eH}	0,75 R_{eH}
2,2	0,8 R_{eH}	0,85 R_{eH}
2,3	0,9 R_{eH}	0,95 R_{eH}
3,0	0,7 R_{eH}	0,75 R_{eH}
Note: R_{eH} - Yield point of the material		

3.5.4.3.2 The safety factor of lifting lose gear (wire ropes, chains and other loose gear), with respect to the breaking force shall not be less than 5.

In the case of loading 2,3 as per Table 3.5.4.2.1, the breaking safety factor may be reduced to 50% related to the values required in normal cases.

3.5.4.3.3 In stability calculations of lifting platforms the requirements of 3.5.1.1.1 to 3.5.1.1.3 shall be satisfied.

3.5.4.3.4 Under normal loading conditions (see 1.1, 1.2, 2.1, 2.2) of Table 3.5.4.2.1 the platform deflections shall not exceed L/250 (where L is either the length between supports or the length of unsupported parts of platform). Platform deflections that shall be watertight when "stowed for sea" shall not exceed the values stated in the *Rules for the classification of ships*, *Part 3- Hull Equipment*.

3.5.5 Loose Gear

3.5.5.1 Structure and dimensions of loose gear shall be such that no relieve stresses shall occur during load testing in accordance with Table 5.2.4.1, and no fracture of structural members shall occur during testing with limit load in accordance with 5.2.4.9. Structural members manufactured in accordance with standards agreed with the *Register* shall be acceptable.

Permissible stresses for non-standard fixed members shall be taken as permissible stresses for steel structures (3.4.1).

3.5.5.2 In determining the strength of loose gear structural members, total stresses that do not exceed the stresses obtained by the below formula shall be taken as permissible stresses:

$$\sigma_r = 0{,}80 R_{eH} \frac{SWL}{P_p},$$

where:

σ_r - permissible stress, [MPa];
R_{eH} - yield point of material, [MPa];
SWL - safe working load, [t];

P_p - test load (Chap. 5.2.4.), [t].

Stresses exceeding those obtained by the mentioned formula or designing the structural members on the empirical formulae basis, shall be permitted provided that they comply with the requirements stated in 3.5.5.1.

3.5.6 Other equipment

3.5.6.1 Platforms and stairways shall be calculated for the uniformly distributed loads of 3 kN/m^2 and for a moving point load of 1,5 kN. Handrails shall be calculated for sideways load forces of 0,5 kN/m.

These loads may be disregarded in calculations for the structural members.

3.5.6.2 The manufacturer of crane shall submit to the *Register* calculations of ball and roller type slewing rings which determine its static and dynamic strength. The bolt connections of ball bearing slewing shall be checked for the maximum possible (allowable) stresses due to external loads.

Force in the maximum loaded bolt may be calculated by the formula:

$$Fv = \frac{4 \cdot M}{nd} - \frac{V}{n},$$

where:

M - designed overturning moment, [Nmm];
V - design load, [N];
d - diameter of bolt circle, [mm];
n - number of bolts.

Permissible stresses in bolts shall be determined according to 3.4.1.

3.5.6.3 In calculating the lifting appliance mechanisms, the following requirements shall be complied with:

1. In load testing of mechanisms to comply with the Rules, no deformations or other defects shall occur.
2. Design loads of mechanisms shall be determined taking into account the lifting appliances loads as well as stresses in structural members;
3. Safety factor of the structural members of mechanism shall not be less than safety factor of structural members of crane (see Head 3.4).

3.5.6.4 Starting principles for design and calculation of winches are stated in the *Rules for the classification of ships*, *Part 9 – Machines*, Head 6.4.

4 METALLIC MATERIALS AND WELDING

4.1 METALLIC MATERIALS AND HEAT TREATMENT

4.1.1 General requirements

4.1.1.1 Metallic materials intended for the manufacture and repair of stress-bearing elements of the steel structures, component parts and mechanisms of lifting appliances as well as heat treatment of forging and castings, where not covered by the Rules, shall comply with the requirements of the other Rules of *Register* (see *Rules for the classification of ships*, *Part 25 - Metallic materials)*.

4.1.1.2 All stress-bearing elements of the steel structure, parts thereof and mechanisms, other than those referred to in 4.1.5., shall be manufactured from killed steel. The properties of such steel shall ensure safe operation of lifting appliances on open decks under low temperatures. Steel for stress-bearing elements of loose gear items shall have the guaranteed elongation A_5 not less than 20%.

The *Register* shall consider the use of other materials for each particular case.

4.1.1.3 The hardwood types are permitted for the manufacture of sheave housing for the leading of the natural or synthetic fibre ropes.

4.1.1.4 Grey iron may be used for the manufacture of the following items:

1. toothed, worm and travelling wheels of the hand-operated lifting appliances;
2. worm wheels with bronze rim;
3. load drums and whipping drums of winches, gear boxes and sheaves of blocks;
4. brake shoes, drum brackets and bearing casing.

4.1.1.5 The use of cast steel for the manufacture of items other than those referred to in 4.1.1.4. shall be approved by the *Register* in each particular case.

4.1.1.6 The choice of metallic materials shall take into consideration not only their mechanical properties (yield point, impact strength etc.) on which the structural elements calculation depends, but also their tensile strength (resistance to brittle fracture) and, if necessary, their weldability and their abilities in the direction of product thickness.

4.1.1.7 The use of higher tensile strength metallic materials for the adjusting elements and items may be permitted taking into account the service temperature in each particular case. Also provision shall be made that the material has the elongation not less than A_5 = 12% at normal temperature.

4.1.2 Rolled steel

4.1.2.1 Bearing elements of steel structures which apply to the group I and II shall be manufactured from the following shipbuilding steels under the supervision and approved by the *Register*:

Normal strength, $R_{eH} \geq 235$ MPa grades *A*, *B*, *D* and *E* respectively.

Higher strength 315 MPa $< R_{eH} \leq$ 390 MPa grades:

A 32; D 32; E 32
A 36; D 36; E 36
A 40; D 40; E 40

These steels are indicated in the Table 4.1.3. as steels of grades AN, DN or EN respectively.:

High strength, 390 MPa $< R_{eH} \leq$ 690 MPa grades:

D 420; E 420; F 420;
D 460; E 460; F 460;
D 500; E 500; F 500;
D 550; E 550; F 550;
D 620; E 620; F 620;
D 690; E 690; F 690.

These steels are indicated in the Table 4.1.3. as steels of grades DNN, ENN or F.

4.1.2.2 In agreement with the *Register*, elements of steel structures which apply to II group may be manufactured from the steel provided with the manufacturers approval and the rolled items up to 12,5 mm in thickness may be manufactured from the semi-killed steel.

The *Register* may require that the bearing elements of the welded structures that are loaded in the direction of their thickness be manufactured from the steel of grade 2 with the minimum reduced cross-section value of 35%.

4.1.2.3 The choice of the rolled steel for the welded bearing elements of steel structures shall be done by determining the steel grade according to the Table 4.1.3 depending on the bearing structure group, service temperature and the material thickness.

4.1.3 Steel forgings

Steel forgings intended for the manufacture of bearing elements of lifting appliances systems shall comply with the *Rules for the classification of ships*, *Part 25 - Metallic materials*, Head 3.14.

The defects may be rectified by welding only in case of steel forgings with carbon content maximum 0,23 % and that of manganese minimum 2,5 x C.

Repair conditions, its technology and control shall be agreed with the *Register* in each particular case.

Forgings that apply to the bearing structure group 1 shall be subjected to the appropriate non-destructive method in order to detect the defects that may affect the strength of the structure.

4.1.4 Steel castings

Steel castings intended for the manufacture of bearing elements of lifting appliances shall comply with the *Rules for the classification of ships*, *Part 25 - Metallic materials*, Head 3.15.

The *Register* may approve the use of steel castings manufactured to the national standards.

Table 4.1.3

Group of bearing structure	Minimum design temperature / Steel grade	0°C	-10°C	-20°C	-30°C	-40°C	-50°C
I	A	20	10	x	X	x	x
	B	25	20	10	x	x	x
	D	35	25	20	10	x	x
	E	50	50	50	40	30	20
	AN	25	25	10	x	x	x
	DN, DNN	45	40	30	20	10	x
	F	on special agreement with the *Register*					
II	A	30	20	10	x	x	x
	B	40	30	20	10	x	x
	D	50	40	30	20	10	x
	E	50	50	50	50	45	35
	AN	40	30	20	10	x	x
	DN	50	50	45	35	25	15
	EN, ENN	50	50	50	50	45	35

Note:
1. Intermediate temperatures shall be determined by linear interpolation.
2. For steel grades see 4.1.2.

Castings that apply to the bearing structure group 1 shall be subjected to the corresponding non-destructive tests in order to detect the defects that may affect the strength of the structure.

The *Register* in each particular case shall agree with the use of steel castings for the manufacture of rigging, except those covered by the Rules.

The removal of defects by welding and gas cutting of pouring system shall be carried out prior to final heat treatment.

Castings joined to other bearing elements of lifting appliances by welding shall be manufactured from steel casting with proper weldability.

4.1.5 Grey iron castings

Grey iron, nodular and malleable castings are intended for the manufacture of the bearing elements of lifting appliances and shall comply with the *Rules for the classification of ships*, *Part 25 - Metallic materials*, Head 3.16.

Register may permit the use of nodular casting instead of steel casting provided that:

- an element does not apply to the 1st group of bearing elements;
- casting is not intended for welding connection with another portion;
- casting is manufactured from the ferritic nodular cast with $A_5 \geq 12\%$

For the nodular castings the *Register* may require ratio $R_{p0,2}$ and the use of one of the non-destructive methods of testing.

The repair of gray iron castings by welding shall not be permitted in general.

4.1.6 Steel wire ropes, synthetic fibre ropes and chains

Steel wire ropes used in the lifting appliances shall comply with the *Rules for the classification of ships*, *Part 25 - Metallic materials,* and natural or synthetic fibre ropes with the *Rules for the classification of ships*, *Part 24 - Non-metallic materials,* as well as with the requirements of the Rules.

Steel for chains of lifting appliances intended for service at the temperatures lower than -20°C, shall comply with the requirements for the second and third grade steel chains in accordance with the *Rules for the classification of ships, Part 25 - Metallic materials*, Head 6, Table 6.2.5.

4.1.7 Ship's lifts

The materials used in the manufacture of stress-bearing steel structures, equipment and lift elements, heat treatment of forged and cast items, and also of steel structures, equipment and lift elements, quality control of welded joints and their heat treatment, in if not covered by the Rules, shall comply with the requirements of other Rules of the *Register* (see *Rules for the classification of ships*, *Part 25 - Metallic materials)*.

For traction sheaves and rope clamp wedges the gray cast iron may be used. Grey cast iron shall be of Grade 1 in accordance with the *Rules for the classification of ships*, *Part 25 - Metallic materials*.

4.1.8 Ship's lifting platforms

4.1.8.1 The materials used in manufacture of stressed steel structures, components and drives of lifting platforms as well as heat treatment of forgings and castings and welding of steel bearing structures, machinery and gear, quality con-

trol of welds and their heat treatment, shall comply with the requirements of *Part 4*

4.1.8.2 Steel castings may be applied for the manufacture of wire sockets in order to attach wire ends and also for locking devices exposed to pressure.

4.1.8.3 Blocking elements (catching devices) which are exposed to tensile strength and/or tensile strength due to bending are to be manufactured as forgings or rolled steel.

4.1.8.4 On agreement with the *Register* the loose gear of lifting platforms may be manufactured of higher tensile steel.

4.1.9 Heat treatment

4.1.9.1 All steel castings and forgings used in lifting appliances as well as welded items with stressed, closely spaced or intersecting welded joints, shall be heat treated , forgings of alloyed steels shall be forged and relieved, forgings and castings of carbon steels shall be forged, relieved or normalized, while electrically welded items shall be annealed for stress relieving.

Chains who need not be heat-treated for the improvement of their quality or strength shall be normalized.

4.1.9.2 Heat treatment of the items shall be carried out in closed (muffed) furnaces with the accurate temperature control. The method of heat treatment shall be determined depending on the steel grade, purpose and dimensions of items and shall be agreed with the *Register*.

4.1.9.3 The manufacturers Certificate shall indicate the heat treatment that has been carried out.

The corresponding entries on heat treatment of loose gear shall be made in the Certificate. If the loose gear heat treatment has been carried out under supervision of an authorized person, the surveyor to the *Register* shall enter that in the "Register of Lifting Appliances and Items of Loose Gear" ("Cargo Gear Book") on the basis of the certificate signed by the competent person.

If approved by the *Register*, the heat treatment need not be carried out.

4.2 WELDING

4.2.1 The present Head apply to the design, manufacture, modernization and the repair of bearing steel structures of the lifting appliances intended to be installed or already installed on the floating units which are subject to the supervision of the *Register* (hereafter: structure).

4.2.2 The welding of steel structures, elements and mechanisms of the lifting appliances, quality control of welded joints and their machining, where not covered by the Rules, shall comply with the requirements of the other Rules of the *Register* (see *Rules for the classification of ships*, *Part 26 – Welding).*

4.2.3 The dimensions of the fillet welds shall be as small as possible for the reason of strength or technology. The leg length of the fillet weld shall not be less than 4 mm and shall not exceed 1,2 of the least thickness of the welded items.

If for the welding of T joints of more important items such as eye plates, guy units, sheave housing, span eye plates, eye plates on the ships hull and steel structures, the short fillet welds are used, the particular attention shall be paid to the quality of welding and checking of welds. In particular cases, the quality of welded joints shall be examined on the whole length by the method approved by the *Register*.

4.2.4 The welding of the cold bent elements manufactured from the shipbuilding or other equivalent steel, may be permitted if bending radii are equal to or greater than those referred to in Table 4.2.4-1.

Table 4.2.4.-1

Bent plate thickness [mm]	Minimum permitted internal radius of bending [mm]
Up to 8	1,5 x plate thickness
8 - 12	2 x plate thickness
12 - 24	3 x plate thickness
more than 24	10 x plate thickness

4.2.5 Round and ring shaped items of small diameter (chains, rod shrouds) shall be carried out by electric resistance welding.

4.2.6 The butt joints of masts, derrick posts or other tubular elements shall be made with full penetration or by back sealing run or using the steel back rings.

4.2.7 In the enclosed contour structures, if not readily accessible from inside, the welds for fastening the bent plate on the inside bulkhead may be permitted.

4.2.8 Worn-out items shall not be repaired by welding. The *Register* shall consider the use of plasma-powder or laser-powder welding in each particular case.

4.2.9 The distance between parallel welds irrespective of their direction shall not be less than 200 mm between butt welds and 75 mm between butt welds and fillet welds.

4.2.10 The fillet welds exceeding 5 mm in thickness in welded joints shall be carried out in several layers.

4.2.11 The welds on profile steel structures exposed to high bending or tensile stresses shall not be recommended.

4.2.12 The quality of the welds of the stress-bearing elements of the steel structures shall be radiographically examined or with any other non-destructive method approved by the *Register*. Not less than 20% of joint welds shall be examined. Crossings of welds shall be subjected to the compulsory examination. Circumferencial continuous butt welds on masts, posts, derricks, guys and other steel structural members shall be examined on the whole length.

The welded joints on masts (posts) on which the booms with safe working load of more than 25 t are installed shall be examined radiographically to the height of 3,5 m from the deck of their installation.

5 EXAMINATIONS AND TESTING

5.1 GENERAL

5.1.1 Examinations, inspections and testings are carried out in order to ascertain the compliance of lifting appliance with the Rules and to state a fit for safe use.

5.1.2 The shipowner or the manufacturer shall submit the lifting appliances for examinations and testing in the cases and at intervals specified by the present Rules and also shall carry out all the necessary preparations and tests.

5.1.3 The surveyor to the *Register* shall refuse the supervision of examinations and tests in the case when lifting appliance proves to be unfit for those, or in the case any defects which may endanger the tests are found.

5.1.4 When a surveyor to the *Register* examines the lifting appliance, the competent person shall inform him of all defects observed or alterations made or repairs and replacement of parts and ropes that have been done since the previous examination.

5.1.5 In the case of an accident with the lifting appliance in service, the competent person or the shipowner shall provide for a timely examination of the specified appliance by the surveyor to the *Register*.

5.1.6 Examinations and supervision of tests of the lifting appliances, their machinery and gear, after they have been built, re-rigged or repaired shall be performed by the surveyor to the *Register* upon submission of documents certifying the readiness for use and final acceptance by the manufacturer.

5.1.7 Where examinations, inspections or testings reveal that the lifting appliances, their steel structures, machinery and gear do not comply with the Rules, or are not fit for safe use, the *Register* shall not issue the certificates for the specified appliance or its elements, the certificates for the lifting appliances which are in service shall become invalid until the appliances are brought into compliance with the Rules or until the defects are eliminated.

5.1.8 The certificates issued by the *Register* for the lifting appliance shall become invalid in the case when some of the examination or testing certificates required by the Rules are not available, or the entry about timely execution of periodical examinations has not been made, or the lifting appliance does not comply with its certificates, or after an accident.

5.1.9 For the initial survey of the lifting appliance built without supervision of the *Register*, the shipowner shall submit the plans and calculations as specified in Head 1.4 and also the certificates issued by the supervision authorities or by the manufacturer and certifying that the specified appliance has been tested and accepted.

The initial examinations and testing of lifting appliances shall be carried out as specified in Head 5.2.

Where the testing of loose gear and ropes is provided by the certificates issued by the competent supervision authority (7.1.4), the repeated testing shall not be needed if the test loads applied to conform to the requirements of 5.2.4.

5.1.10 Test loads intended for testing, shall be prepared for that purpose and shall have the mass accompanied with relevant certificates. The test loads mass shall be determined by weights accompanied with the respective certificates. Where the determination of test load mass is not possible, then they shall be obtained by calculations.

The test loads mass shall not be less than those specified in Table 5.2.1.4 or 5.2.4.1.

5.1.11 Manufacture, mounting and testing of lifts subject to the supervision of the *Register* (load-carrying steel structures, machinery, load-carrying facilities, mechanisms, parts of electrical equipment), shall comply with the technical documentation, test programs and terminology approved by the *Register*.

5.2 SURVEYS AND TEST OF MOUNTED APPLIANCES

5.2.1 Lifting appliances

5.2.1.1 The assembled cranes, winches and topping winches shall be tested and examined by the surveyor to the *Register* at the premises of the manufacturer in accordance with the testing program approved by the *Register*, and in accordance to the Rules of the *Register* (see *Rules for the classification of ships*, *Part 9 - Machines, Part 24 - Non-metallic materials, Part 25 - Metallic materials* and *Part 26 – Welding)*.

The examinations and testing shall be approved by the *Register*.

Stamping of tested cranes, winches and topping winches shall be carried out in accordance with Section 6.

Power units of lifting appliances shall be thermally insulated and painted after examination and testing.

5.2.1.2 Before examination and load testing of the mounted lifting appliance on deck, the certificate issued by the *Register* for cranes, winches and topping winches shall be presented to the surveyor.

The certificate on testing of the loose gear and ropes both signed by the competent person certifies that the lifting appliance complies with the technical documentation approved by the *Register*, with quality control of welded joints report, material certificate and certificate of heat treatment.

In the case of structural alterations of cargo gear after performed alterations or repair, the extent of submitted documentation shall comply with the made alterations.

In the case of inspection and testing of the lifting appliances in service, that have not be re-rigged, renewed or repaired, the extent of the documentation to be presented to the *Register* shall be in compliance with Head 7.1.

5.2.1.3 Mounted on deck lifting appliance shall be submitted for tests in fixed-up state.

Before testing the lifting appliance shall be thoroughly examined by a responsible representative of the

manufacturer who has mounted and fixed the appliances on deck or by another person responsible for testing. Lifting appliance may be submitted for testing provided no defects have been found during examination which may endanger the tests.

5.2.1.4 After fitting of lifting appliances on board, but prior to operation of the crane, the hoisting device, derrick with winches and all relevant gear shall be subjected to test load in accordance with Table 5.2.1.4.

Table 5.2.1.4

Safe working load (SWL) (t)	Test load, (t)
SWL ≤ 20	1,25 x SWL
20 < SWL < 50	SWL + 5 t
SWL > 50	1,1 x SWL

5.2.1.4.1 As a rule, the tests shall be carried out with the test load. No exceptions shall be allowed during first testing. In the case of repair, replacement of items or where retests are required due to periodical tests, the use of dynamometers shall be allowed (with spring or hydraulic) if SWL of the lifting appliance does not exceed 15 t. Dynamometers used shall be calibrated to accuracy of ± 2%. Their indicator shall remain immovable for 5 min. A competent person shall carry out the calibration once in a twelve months time.

The use of dynamometers whose term of validity has expired shall not be allowed. Dynamometer shall be safely secured. Appropriate winches or test load mechanisms shall be compulsorily provided and safety measures shall be taken.

Where owing to the limitations of pressure, the hydraulically operated lifting appliance fails to hoist the test load as specified in Table 5.2.1.4, it will be sufficient to hoist the greatest possible load at the maximum permissible hydraulic pressure but not less than 1,1 SWL.

If the winch pull is not sufficient to hoist the test load, the latter shall be allowed to be hoisted by other winch, however the breaking and holding the test load in suspension shall be done by the winch to be tested.

5.2.1.4.2 If the rigging of heavy-lift derrick includes detachable stays and shrouds they shall be fitted during testing of derricks.

Collapsible derricks shall be tested with a test load on every prop with which they are normally used.

Where the stationary derricks are intended for operation at two hatches, they shall be tested in the operating position at each hatch separately. Derricks with two eye plates shall be tested with a test load on each plate.

The test load shall be hoisted with derrick booms at an angle of 15^{o} to the horizontal for light load derricks and 25^{o} for heavy-lift derricks; where these angles exceed these values, the test load shall be hoisted with derrick booms at the greatest angles occurring in the actual service (see 4.2.1). Derrick cranes shall be tested with a test load also at the maximum angles allowable in the actual service.

The inclination of derrick boom shall be stated in the Certificate.

5.2.1.4.3 With derrick cranes and cranes with variable jib radius, the test load shall be hoisted at the maximum and transferred to the minimum radii of the jib; where the safe working load of the crane varies with the jib radii, the test load shall be hoisted at the maximum and transferred at the minimum jib radii for each appropriate safe working load.

The crane jib radii shall be stated in the Certificate and variable jib radii shall be recorded on the crane.

After hoisting the test load shall be transferred to the extreme positions by slewing the crane or derrick or by travelling the crane (lift).

5.2.1.5 Test load

5.2.1.5.1 Static test

Static test shall be carried out with a test load according to Table 5.2.1.4 under still weather conditions. The movement begins at the slowest speed.

In the motionless state, the test load shall be held by the crane for at least 5 min.

5.2.1.5.2 Dynamic test

Dynamic test shall be carried out with a test load of 110% of the nominal load. All types of movement shall be obtained with a full speed.

The luffing test of movements of the crane with luffing jib shall be carried out between two allowable extreme positions.

During test loads the load limiter shall be switched off.

The work of brakes of cargo winches, derricks and cranes shall be tested by quick lowering of test load for about 3 m and sharp braking. This test shall be done in two extreme positions and in the middle of derrick or crane.

Keeping the test load in suspension with the winch drive switched off as well as manual releasing of electric brakes shall also be tested.

5.2.1.5.3 Testing with the normal SWL

After testing with a test load, the cranes shall be tested with the normal safe working load, with the hoisting, slewing, luffing and travelling motion machinery operating in the maximum speed duty. The slewing, luffing and travelling motion brakes shall be tested by sharp braking.

The limit switches and jib radius indicators shall also be tested.

Where the hoisting, luffing, slewing and travelling motions of the crane are combined then working of the crane shall be tested for each allowable variant of that combination.

If the crane is provided with limit-load switches, they shall be tested for functioning by hoisting the limiting load.

For heavy-lift derricks, the derrick boom radius shall be varied under the test load to check the functioning of the span winch brake.

5.2.1.6 After testing according to 5.2.1.4 and 5.2.1.5 all steel structures, machinery and gear of the lifting appliance shall be submitted to the *Register* for thorough examination to ascertain the absence of defects or permanent deformations.

Where during tests some defects are revealed that may endanger the safe use of the lifting appliance, the

defective items shall be either renewed or repaired and then the test shall be repeated.

Execution of the specified examinations and testings shall be verified on the certificate.

5.2.1.7 The derricks shall be tested in a similar way.

5.2.1.7.1 The derricks rigged in union purchase shall be tested with the test load separately according to 5.2.1.4. In addition, the derricks rigged in union purchase shall be tested with the test load equal to 1,25 x of the safe working load in union purchase.

5.2.1.7.2 During the test the load shall be transferred from one derrick head to the other in the positions providing almost limiting included angle between the cargo runners.

5.2.1.7.3 Where the derricks are rigged in different ways, the testings shall be performed under the conditions that are likely to exert the greatest stresses in preventer guys. Selection of the booms positions for testing of derricks rigged in union purchase shall be done after the analysis of calculations and thus such choice shall be performed at the phase of designing and included in the program of testing.

5.2.1.7.4 During the test, means enabling to control the included angle between cargo runners and the adjustment of derricks and preventer guys shall be tested for proper functioning.

5.2.1.7.5 After the test, all equipment, machinery and gear of the derricks rigged in union purchase shall be submitted to the surveyor to the *Register* for thorough examination to ascertain the absence of defects or permanent deformations.

5.2.1.7.6 In the case of satisfactory results, the execution of examinations and testings shall be verified by a Certificate and the entry in the Instructions for operating the derricks in union purchase.

5.2.1.8 Where the testing of hoist placed in the machinery space, shaft alley and similar closed spaces is difficult owing to the structural or technological reasons, on agreement with the *Register* it may be subjected to the testing on a specially equipped bench outside these spaces.

5.2.1.9 Monorails shall be tested by means of a dynamometer applying a test load at different points over the monorail length. After mounting on board ship the hoist operation shall be checked without load.

5.2.1.10 Test load of floating cranes

5.2.1.10.1 Static test

Static test of floating cranes shall be carried out with a test load according to Table 5.2.1.4 under still weather conditions. The movement begins at the slowest speed. In the case of static test, the semi-slewing crane shall be cautiously turned for a full slewing angle, so that during pontoon inclination, a sufficient freeboard height shall be provided.

In the motionless state, the test load shall be held by the crane for at least 5 min.

5.2.1.10.2 Dynamic test

Dynamic test shall be performed in accordance with 5.2.1.5.2.

The inclination of pontoon shall be measured during dynamic test.

5.2.2 Lifts

5.2.2.1 Before testing of the lifts mounted on board ship, the documentation as stated in 5.2.1.2 shall be submitted to the *Register* surveyor. When testing the lift in service, not subjected to reconstruction, replacement or repair, the presented documentation shall comply with the documentation specified in Head 7.2.

5.2.2.2 The lift shall be tested on board ship taking into account the requirements specified in 5.2.1.3.

5.2.2.3 The lifts shall be subjected to static and dynamic tests.

5.2.2.4 Lifting capacity of traction sheave shall be checked by static and dynamic tests.

5.2.2.5 The static tests shall be performed to check the strength of the lift machinery, car, wires and their attachments as well as the brake action. For the lifts with traction winch, the lack of wire slipping in the grooves of traction sheave shall be checked.

Static tests shall be performed with the following test loads:

$P_{st} = 1{,}5\,P$ - for cargo lifts with drum;

$P_{st} = 2P$ - for all types of passenger lifts and for cargo lifts with traction sheave,

where:

P - loading capacity of lift, according to Head 1.2.

When performing static tests the lift car shall be located in the lowest position with applied load of at least 10 min.

5.2.2.6 The dynamic tests shall be performed to check the operation of the lift machinery, brakes, gripping devices and buffers.

The dynamic tests shall be performed with the following proof loads:

$P_d = 1{,}1P$

where:

P = loading capacity of lift, according to Head 1.2

When testing the gripping devices with smooth braking and hydraulic buffers, the action of the winch brake shall be disregarded.

5.2.2.7 The checking of the winch, brake and buffers operation shall be performed at the rated speed.

When testing the buffers, the switches of the upper and ground floors shall be disconnected. Disconnection of gripping devices and buffers shall be performed with brake released. If the spring break or seizing of plunger occurs during buffer testing, the test results shall be deemed unsatisfactory.

5.2.2.8 Testing of gripping devices tripping the overspeed governors, shall be carried out at the rated speed of the lift movement.

When gripping devices are not tripped by overspeed governors, the lift car (counterweight) at its lowest position shall be placed on the support or suspended by the auxiliary rope. The cargo ropes shall be removed and after what support shall be put away (auxiliary ropes shall be cut). The way travelled by the car (counterweight) in free fall to the tanding on its gripping devices shall not exceed 100 mm.

5.2.2.9 After testing by test load the cargo lift shall be tested by the load equal to loading capacity. In this case, the controlling and signalling systems, door contacts, limit switches and other safety devices, shall be checked. The efficiency of lift operation shall be checked during sea trials of a ship.

5.2.2.10 After testing according to 5.2.2.5 - 5.2.2.9 all steel structures, machinery and parts of lift shall be submitted to the *Register* for the thorough examination, for elimination of failures and defects occurred.

If the defects are revealed during examination affecting the safety of lift operation, damaged parts or details shall be replaced, after what the tests shall be repeated. The satisfactory results of tests and checks shall be verified by respective Certificate. Marking of lifts after testing shall be performed according to 6.2.

5.2.3 Lifting platforms

5.2.3.1 The breaking load test of chains manufactured from round sections and wires shall be carried out in accordance with the *Rules for the classification of ships, Part 25 - Metallic materials*, Heads 6.4 and 7.4.

The *Register* shall approve the tests of special structure chains.

The test of loose gear shall be carried out in accordance with 5.2.4.

5.2.3.2 The novel types of lifting platforms shall be tested under the operating conditions either with foreseen allowable load or test load, subject to approval. In this case, considering the requirements of 3.5.4.3.4 the platform deformations shall be measured and breaking of lifting mechanism shall be simulated.

5.2.3.3 Unless otherwise provided, the requirements of Head 5.1 and 5.2.1 shall apply to the ships lifting platforms.

5.2.3.4 The functioning test shall include several cargo handling operations in accordance with foreseen operating conditions: with trailers and tractors or similar vehicles.

In this case, the safety devices, securing devices for hatchway covers and locking devices for holding platform at deck level shall be carefully checked. If the platforms are not provided with locking devices at the level of decks during the cargo handling operations, the maximum clearance between platform and deck shall not exceed 20 mm.

5.2.3.5 The performed examinations and tests of the ships lifting platforms shall be confirmed by issuing the respective Certificate. The testing results shall be entered in the "Register of Lifting Appliances and Items of Loose Gear" (Part II).

5.2.4 Ropes and loose gear

5.2.4.1 All newly manufactured items of loose gear of the lifting appliances shall be tested under the supervision of the competent person with test load as specified in Table 5.2.4.1.Table 5.2.4.1

No.	Loose gear	Safe working load *SWL* t	Test load t
1.	Chains, rings, hooks, shackles, swivels etc.; single-sheave blocks	$SWL \le 25$ $SWL > 25$	2 x *SWL* (1,22 x *SWL*) + 20
2.	Multiple-sheave blocks	$SWL \le 25$ $25 < SWL \le 160$ $SWL > 160$	2 x *SWL* (0,933 x *SWL*) +27 1,1 x *SWL*
3.	Transverses, frames, supports, spreaders and similar devices	$SWL \le 10$ $10 < SWL \le 160$ $SWL > 160$	2 x *SWL* (1,04 x *SWL*) + 9,6 1,1 x *SWL*

The testing shall be carried out on the adequately calibrated testing machine or by suspending a load of a definite weight. The accuracy of the testing machine shall be ± 2% that shall be certified with the appropriate documents.

The test load shall be applied statically, the period of the test time application shall not be less than 5 min.

All movable items of loose gear shall be submitted to tests and surveys possibly protected with anticorrosive coating.

Where the SWL of loose gear is excessively large or dimensions are such as not to allow the usage of testing machines the proof test shall be performed by load suspension on appropriate structure or lifting appliance and also by additional proof load.

5.2.4.2 Some items of loose gear may be simultaneously tested if connected in the same way, as to operate under actual conditions.

5.2.4.3 After testing all items of loose gear shall be thoroughly examined by a competent person to ensure that no defects or permanent deformations are left. The blocks shall be dismantled for inspection of axles and sheaves.

The satisfactory results of testing and subsequent examination shall be certified in compliance with 7.1.1.

Stamping of tested items of loose gear shall be carried out in compliance with 6.4.1.

5.2.4.4 After load testing container spreaders shall be additionally subjected to the functional tests corresponding to operating conditions.

Lifting beams for heavy cargoes of high safe working loading relating to determined lifting appliance may be considered as tested if had been tested with lifting appliances.

5.2.4.5 After testing all items of loose gear shall be thoroughly examined and surveyed by a competent person in accordance with 5.2.4.1.

5.2.4.6 Breaking test of chains and wire ropes shall be carried out with test load in accordance with the *Rules for the classification of ships*, Head 7, *Part 25 - Metallic materials*, and provided with a certificate, while the testing of natural and synthetic fibre ropes shall be carried out in accordance with the *Rules for the classification of ships*, *Part 24 - Non-metallic materials*, Head 2.

Performed testing of chains and ropes with or without pressed clips, with loops and clamps as well as chains, shall be provided with the Certificate.

5.2.4.7 Ramshorn hooks shall be subjected to test load according to Fig.5.2.4.7. The testing may be carried out by one operation (a) or by two (b).

5.2.4.8 Blocks with forks shall be subjected to test load by suspending a load according to Fig. 5.2.4.8a for single-sheave blocks without becket, or according to Fig. 5.2.4.8b for single-sheave blocks with a becket, or according to Fig. 5.2.4.8c for multi-sheave blocks with more sheaves (where n - number of ropes).

5.2.4.9 The prototype specimens of standardized loose gear as well as those of the loose gear the manufacture of which has been mastered at the manufacturer's, shall be tested with the limiting load of two times the test load as specified in 5.2.4.1. The *Register* may require that similar tests be done for the prototype specimens of fixed gear as well. On agreement with the *Register* the loose gear with the great safe working load (100 t and over) need not be tested with limiting load if their adequate strength is proved by the calculations and result of the test load.

The *Register* may require the periodical quality control of the manufactured items of loose gear by testing them with a limiting load. The number of items to be tested out of the batch shall be approved by the *Register*.

Thimbles and pressed clips, sockets and clamps used to restrain the ends of wire ropes and preventer guy thimble with the pressed bushes shall be tested together with the rope after socketing.

The item is considered as successfully tested if it remains unbroken after the limiting load is applied. If required by the surveyor to the *Register*, the testing may be continued until the item is broken.

The limiting load test shall be carried out by the manufacturer and shall be proved by the certificate verified by the surveyor to the *Register*, whose supervision of test shall be compulsory.

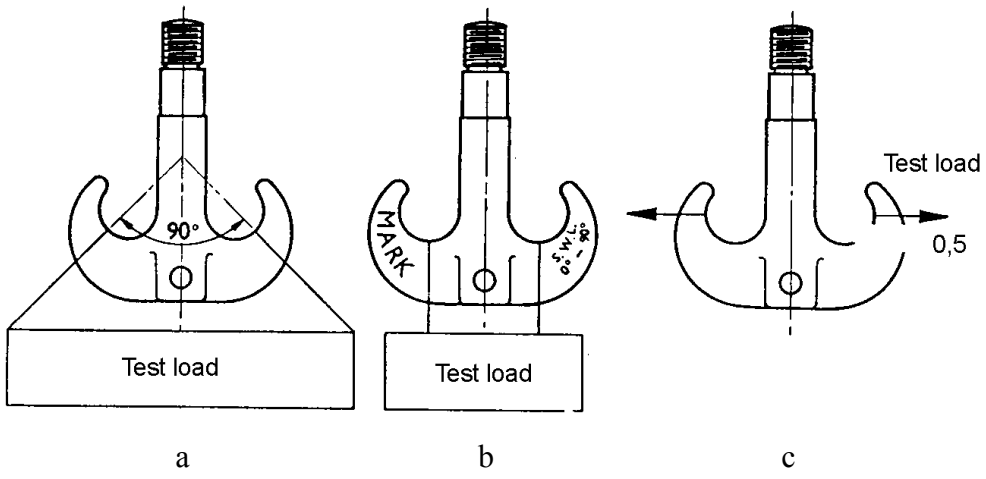


Figure 5.2.4.7

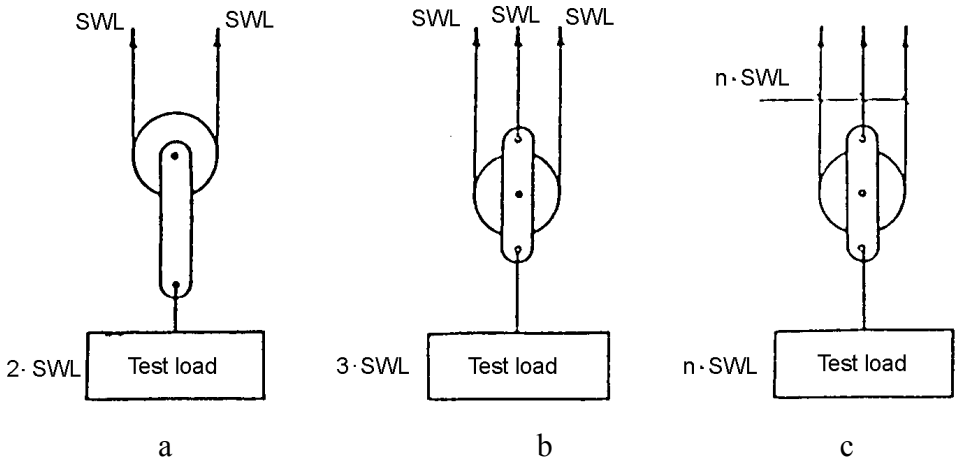


Figure 5.2.4.8

5.3 PERIODICAL SURVEYS AND TESTS

Surveys and tests are to be carried out according to the *Rules for technical supervision of sea-going ships, Part 1. - General requirements, Chapter 5*, Sections 4.13, 4.14 and 4.16.

5.4 OCCASIONAL SURVEYS AND TESTS

5.4.1 Lifting appliances and platforms

5.4.1.1 The examinations and tests of the lifting appliances, in accordance with 5.2.1, shall be carried out after renewal, modification or repair of the lifting appliances, their machinery or gear.

Such examinations and tests, in particular, shall be carried out:

1. after renewal of lifting appliance as a whole or after its transference to another position;
2. After modification (re-rigging) of lifting appliance, general overhaul or damage;
3. After general overhaul, alterations or renewal of steel structures, machinery and fixed gear of the lifting appliances;
4. After change of height of span rope fastening and during transferring of fastenings of central and side stays;
5. After removal of the crane from the foundation and installation on previous position;
6. After dismantling of lifting appliance and its installation on previous position.

After renewal of loose gear and ropes, the load test of the mounted lifting appliance shall not be needed, however the certificates on survey shall be provided.

After renewal of spreaders, the lifting appliance shall be subjected to operational tests with a suspended spreader and container.

The occasional surveys and tests shall be verified by the certificates on survey.

5.4.1.2 After damage of a lifting appliance during its service, an occasional examination shall be performed to ascertain the technical reasons of the damage.

The extent of examination required in that very case shall be determined by the surveyor to the *Register*. The examination shall be carried out regardless of the validity of the lifting appliances' certificates.

5.4.2 Lifts

5.4.2.1 In the case of repeated equipping or repair of lifts, their machinery, steel structures or equipment, the survey and test of the lift shall be carried out. In particular, such surveys and tests shall be performed in the following cases:

1. after general overhaul or repair of the lift damage;
2. after renewal or overhaul of winch or brake, after renewal of lift car, counterweight, suspended ropes, winch drum, after repair or renewal or replacement of traction sheave;
3. after renewal of electric motor.

After renewal of gripping devices, overspeed governors or buffer, the static test may be performed (see 5.2.2.5).

5.4.2.2 When alternating the wiring diagram, or renewing ropes in control circuit, and also when modifying limit switch design, door contacts, automatic locks, deck switches, central deck apparatus or any other devices performing the same function, the static test may be dispensed with (see 5.2.2.5 and 5.2.2.6). The tests specified in 5.2.2.9 are sufficient to be executed.

5.4.2.3 The *Register* shall verify the satisfactory results of surveys and tests.

5.4.2.4 After damage of a lift, occurred during usage, an occasional test shall be performed in accordance with 5.4.1.2.

5.5 CARGO GEAR INSPECTION ON SHIPS OF MORE THAN 15 YEARS OF AGE PRIOR TO DISCHARGING CARGO AT SAUDI ARABIAN PORTS

5.5.1 Application

These requirements are based on the "Rules and Regulations for Saudi Arabian Seaports", Part 1, Edition June 1980.

Prior to loading for a Saudi Arabian port, vessels of more than 15 years of age, at the start of a voyage, must carry out a cargo gear inspection of all cargo gear including deck machinery and the supply of power thereto. On the basis of that Inspection certificate is to be issued by the competent authority or class society acceptable to Ports Authority of Saudi Arabia.

Tankers and ships with L_{oa} < 70 m engaged in coastal trades, Red Sea including ports in Somalia, Arabian Gulf and Gulf of Oman, are exempted from these requirements.

In the case of gearless dry cargo vessels a written declaration to confirm this might be requested.

Exemption certificate can only be issued by the Ports Authority of Saudi Arabia, based on:

.1 the Inspection certificate issued by the competent authority or class society, or

.2 the vessel's actual cargo handling performance in Saudi Arabia.

5.5.2 Request for survey

Request for survey is to be placed to the *Register* by the shipowner or his authorized representative.

Survey can only be undertaken for ships classed with the *Register* and for which the *Register* has issued statutory certificates on behalf of Flag state administration. In all other cases acceptance for request for survey is pending prior written confirmation from Saudi Arabian authorities on acceptance of the Inspection certificate issued by the *Register*.

5.5.3 Survey requirements

Before commencing the survey, the Surveyor should check that the "Register of Lifting Appliances and Items of Loose Gear" is in order. In general no deficiencies are acceptable. Deficiencies must be dealt up with before issuance of the Inspection certificate.

The following items are to be checked:

.1 Booms shall be lowered as far as possible for close examination. Special attention is to be paid to straightness, pins and bolts.

.2 Functional testing of winches and their brakes are to be performed and fastening to be examined. Opening up may be required if found necessary by the Surveyor. Foundations and fastening bolts are to be checked. Open gears shall have appropriate protection.

.3 Blocks are to be examined and particular attention is to be paid to sheave rotation, efficient lubrication and verification that there is no serious wear on the pin and in the groove. If sheaves do not rotate freely, or if the examination indicates that the block may not have been efficiently maintained, the block should be stripped down. Repairs should be carried out in a properly equipped workshop, and if the repair affects the strength of the block, it should be retested and recertified.

.4 Shackles, links, rings, hooks, triangle plates (or monkey faces) and chains are to be examined for wear, deformation or other defects. Items should be sufficiently free from paint, grease, scale, etc. to enable a proper examination to be made, and number identified. Confirmation that material is recorded on the corresponding certificate on testing is to be made.

.5 It is to be assured that the wire ropes are in a satisfactory condition and that splices, etc. are sound. Faults include wear, broken wires and internal corrosion.

.6 All loose gear constructed from wire rope are to be inspected prior to being put into use and should immediately be removed from the ship if deemed suspect.

5.5.5 Testing

Each winch, crane, etc. is to be functionally tested separately. Attention to be paid to speed control, brakes and safety devices. The functional testing may be carried out without load.

It is to be checked that all diesel generators are operable. Also, it is to be checked when the auxiliary engines were last surveyed and tested. Load test may be carried out if considered necessary by the Surveyor.

If one auxiliary engine is inoperable, an electro-balance must be made with respect to power consumption for cargo handling.

5.5.6 Certification

On satisfactory completion of the survey the Surveyor shall issue certificate on testing – "Inspection Certificate – Cargo Gear Inspection on Ships of More than 15 Years of Age Prior to Discharging Cargo at Saudi Arabian Ports".

6 MARKING

6.1 LIFTING APPLIANCES

6.1.1 Each lifting appliance tested with a test load in accordance with 5.2.1.4, if the test results are satisfactory, shall be marked with:

1. safe working load in [t]; in addition, for derricks the minimum allowable angle to the horizontal and for cranes and derrick cranes with variable jib radius, the maximum and minimum jib radii; where the safe working load varies with jib radii, the marking shall indicate the maximum and minimum jib radii for each appropriate safe working load;
2. month and year of test;
3. identification number of crane and derrick;
4. stamp of the *Register*.

The stamp is impressed on the derrick boom heel fitting and on the lower end of crane boom close to the bearing. In all cases the stamp shall be readily visible and easily accessible. The stamp shall have rounded contour to avoid concentration of stresses and must not be impressed on welded places.

6.1.2 The stamps shall be clear and durable, and marking positions shall be distinctively painted.

If the material on which the stamp is impressed is very tough or marking on the gear part may affect subsequent safe working load, the marking may be put on name plate made of stainless material, firmly attached to that gear part.

6.1.3 If it is found that the markings specified in 6.1.1.1 are unnecessarily large, the number of intermediate values of the safe working load of crane may be reduced on agreement with the surveyor.

In such cases, the cranes where the safe working load varies with jib radii are to be provided with a steel plate containing jib radii for each appropriate safe working load. The plate shall be fitted in the crane driver cabin in a conspicuous and easily accessible position.

6.1.4 On steel structures of derricks and cranes the marks shall be punched.

6.1.5 A permanent marks of SWL according to Table 6.1.5 shall be placed on visible position on each cargo gear. Marks may be welded on or placed in a table fixed to gear. The marks shall be in a colour contrast to background and impressed in Arabic figures, in height of not less than 77 mm.

The particulars on safe working load of lifting beams, beams, spreaders and other similar appliances shall be placed on visible position and letters shall be large enough to be easily read by the operating staff.

If marking is made directly on the movable part the following requirements shall be followed:

Height of letters, [mm]	Safe working load, [t]
3	to 2 inclusive
4,6	from 2 to 8 inclusive
6,0	over 8

Table 6.1.5

Derricks	
Marking	Signification
1	2
SWL 1,5 t 15°	Safe working load of derrick is 1,5 t with derrick boom inclination of at least 15°
SWL 5 t 30°	Safe working load of derrick is 5 t with derrick boom inclination of at least 30°
SWL 3-5 t 15°	With derrick boom inclination of at least 15° and over, safe working load of derrick is 3 t for single-reeved runner and 5 t for double-reeved runner
SWL 3-5 t 30°	With derrick boom inclination of at least 30° and over, safe working load of derrick is 3 t for single-reeved runner and 5 t for double-reeved runner
SWL 3-5 t 15° 10 t 25°	With derrick boom inclination of at least 15°, safe working load of derrick is 3 t for single-reeved runner and up to 5 t with one double reeved Under special conditions specified in the documentation safe working load of derrick is 10 t with derrick boom inclination of at least 25°
SWL 20 t 25°	Safe working load of derrick is 20 t with derrick boom inclination of at least 25°
SWL 3-2 t 15°	Safe working load of derrick is 3 t with derrick boom inclination of at least 15° and over Safe working load of derrick is 2 t when operating in union purchase as specified in the Instructions for operating derrick in union purchase
Cranes	
SWL 3 t	Safe working load of crane is 3 t (for non jib cranes, hoists and cranes with fixed jib radius)
SWL 1,5 t 4-12 m	Safe working load of crane is 1,5 t with jib radii from 4 to 12 m
SWL 3 t 4-12 m	Safe working load of crane is 3 t with jib radii from 4 to 12 m
SWL 5 t 4-6 m	Safe working load of crane is 5 t with jib radii from 4 to 6 m
SWL 32/8 t - 22/24 m	Safe working load for main hoisting device operation is 32 t, for auxiliary hoisting device operations 8 t Maximum jib radius of main hook is 22 m and of auxiliary hook is 24 m
SWL $\frac{100}{32}$ t $\frac{16}{24}$ m	Safe working load is 100 t with jib radius 16 m and 32 t with jib radius 24 m

When marking the loose gear parts of round section (chains and similar) the following requirements shall be met:

Height of letters, [mm]	Diameter of gear part, [mm]
3	to 12,5 inclusive
4,6	from 12,5 to 25 inclusive
6,0	over 25

Higher letters may be permitted on tables, discs and other attached gear parts (when justified or at request of responsible person).

The samples of marking are specified in Table 6.1.5.

6.1.6 In addition to properties mentioned in 6.1.5, every cargo derrick and crane shall be marked with ship's inventory number.

The ship's inventory number shall be registered in the "Register of Lifting Appliances and Items of Loose Gear" ("Cargo Gear Book").

6.2 LIFTS

6.2.1 Every lift shall be provided with a metal plate containing the following data:

1. manufacturer's name;
2. allowable capacity (for passenger lifts and permissible number of persons), [t];
3. month and year of test;
4. identification number of lift;
5. seal.

Items 3 and 5 of the plate shall be filled if the test results of the lifts' test load are satisfactory, according to 5.2.2.5 - 5.2.2.9.

The plate shall be attached and fitted at a visible and accessible place.

6.2.2 The winches shall be provided with the manufacturer's name plate with instructions on use, type, rated traction force, manufacturer's number, date of manufacture and stamp on winch acceptance.

6.2.3 The gripping devices and overspeed governors shall be provided with the name plate containing manufacturer's name, type, rated safe working load and speed for which they are designed, manufacturer's number and date of manufacture.

6.2.4 Hydraulic buffers shall be provided with manufacturer's name plate, type, rated safe working load and speed for which they are designed, manufacturer's number and date of manufacture.

6.2.5 One of the suspension ropes shall be provided with the name plate containing data of rated diameter, construction, rated breaking strength, standard number, type of manufacture and date of application.

6.3 LIFTING PLATFORMS

6.3.1 The ship's lifting platforms shall be marked according to 6.1.1. The markings shall be placed close to hinged joints of the lifting mechanism.

6.3.2 The ship's lifting platforms shall be provided with inscriptions or plates comprising the data on loading capacity and if necessary, the arrangement of cargoes on platform.

6.4 LOOSE GEAR

6.4.1 Every item of the loose gear, tested with a proof load in accordance with 5.2.4 shall be marked and stamped if the test results are satisfactory. Marking shall contain the following data:

1. cargo weight corresponding to the permissible safe working load SWL, [t];
2. month and year of test;
3. identification number of item;
4. stamp of the *Register* or manufacturer's stamp (where tested by authorized person);
5. Own weight in [kg] (for lifting beams, frames and spreaders);
6. For steel quality grade mark, see Table 6.4.1.

Table 6.4.1

Quality grade mark	Grade of steel	Mean stress at the breaking load specified in ISO standard, R_m*, [N/mm^2]
L	Low carbon steel	300
M	High tensile steel	400
P	Alloy steel	500
S	Alloy steel	630
T	Alloy steel	800
* Rm - tensile strength		

The stamps shall be positioned on the following items:

- hooks - to side close to suspension, on ramshorn hooks, on wide portion between horns;
- swivels - on wider side of bow-piece close to the eye shank;
- shackles - on any side of shackle close to the eye;
- blocks - on strap, or if there is no strap on the cheek plate between the eye and sheave axle pin;
- block cross-head - in the middle of side surface;
- block swivels - on the side portion of casing close to the pin;
- sockets - on the taper portion;
- chains - on the ending link of each chain length;
- rigging screws - on tubular body (identification number may be stamped on the eye or lug);
- lifting devices, frames and beams - on one of side surfaces close to eye or shackle.

The marking of loose gear is shown in Figs. 6.4.1.1-6.4.1.5.

Where small dimensions of items make stamping difficult, month and year of test may be omitted.

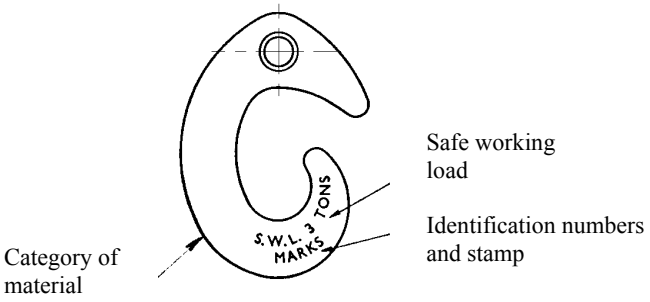


Figure 6.4.1.1

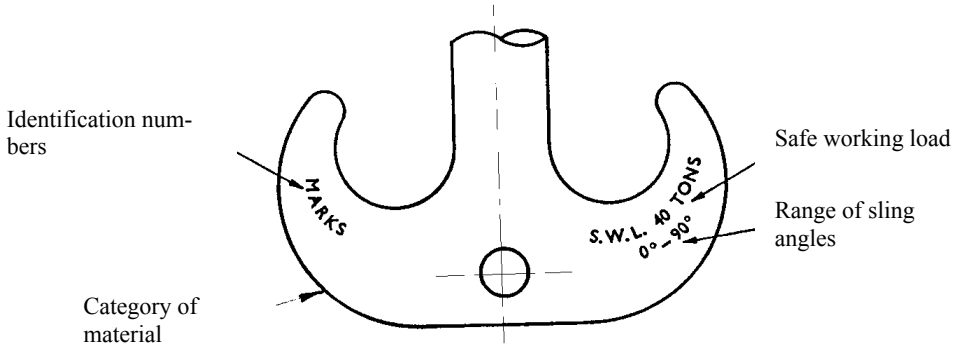


Figure 6.4.1.2

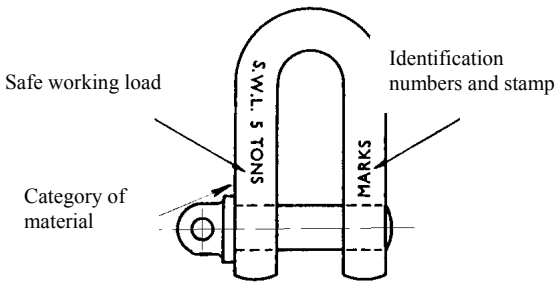


Figure 6.4.1.3

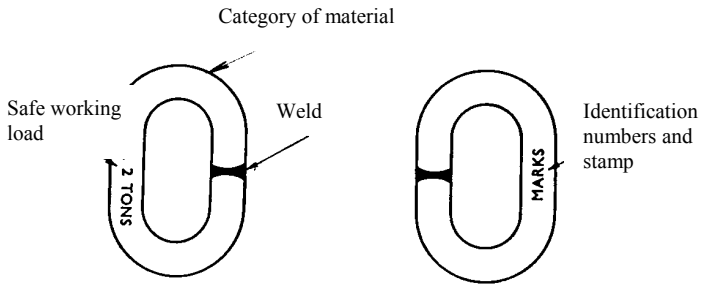


Figure 6.4.1.4

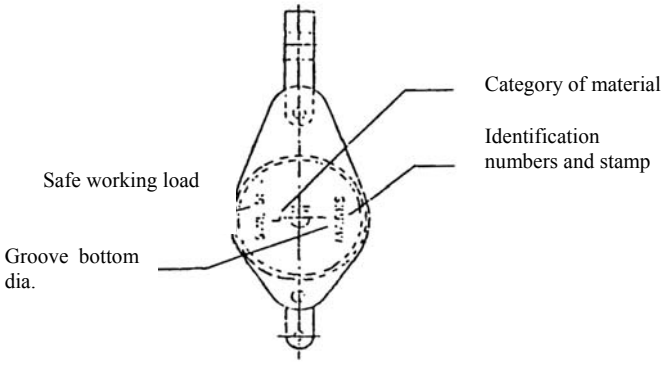


Figure 6.4.1.5

6.4.2 The cranes, cargo and topping winches tested in accordance with approved test program and the *Rules for the classification of ships*, *Part 9 - Machinery*, if the testing results are satisfactory, shall be marked with:

1. permissible load, [t] (pull, tension in span rope, kN);
2. month and year of test;
3. identification number;
4. stamp of the *Register* (if tested under supervision of the *Register*), or manufacturer's stamp (if tested by an authorized person).

7 CERTIFICATION

7.1 LIFTING APPLIANCES AND LIFTING PLATFORMS

7.1.1 Ships, floating cranes, floating docks and mobile drilling units (platforms), the lifting appliances of which are subject to the technical supervision of the *Register*, shall be provided with the following documents:

1. Register of Lifting Appliances and Items of Loose Gear;
2. Certificate of thorough examination and testing of lifting appliances;
3. Certificate of thorough examination and testing of loose gear;
4. Certificate of thorough examination and testing of wire ropes;
5. Certificate of thorough examination and testing of derricks operating in union purchase rig;
6. Certificate on test load and inspection of hoists before put into service;
7. Certificate of the manufacturer for natural and synthetic ropes (5.2.4.6);
8. Instructions for derricks and hoists operating in union purchase.

7.1.2 The entries in the "Register of Lifting Appliances and Items of Loose Gear" ("Cargo Gear Book") and in the certificates shall be written in English.

7.1.3 The particulars of the tested items shall include designation in accordance with standards or allowable load for non-standard items, type of material and kind of heat treatment, together with the following sizes:

1. for shackles, diameter of pin and in the case of an uncommonly sized jaw opening, clear jaw opening and shackle diameter;
2. for block swivels, hook swivels and rigging screws, diameter of thread;
3. for blocks - diameter measured in the bottom of the sheave groove and diameter of the axle pin;
4. for chains - gauge and kind of chain (short link, long link).

7.1.4 Availability of valid certificates issued by foreign competent supervision authorities whose requirements are recognized by the *Register* as equivalent to the requirements of the Rules, shall be sufficient to consider the lifting appliances fit for the safe use. If, however, there is any doubt as to the state of the appliance or its being in conformity with the available certificates, the appliance may be subjected to an examination or test in accordance with the Rules whether the certificates are available or not.

7.1.5 The lowest range of the working temperatures shall be entered in the "Register of Lifting Appliances and Item of Loose Gear" ("Cargo Gear Book").

7.2 LIFTS

7.2.1 The ships, mobile offshore drilling units, floating cranes and floating docks the lifts of which are subjected to the technical supervision of the *Register*, shall be provided with the following documentation:

1. Register of Lifting Appliances and Items of Loose Gear (Cargo Gear Book);
2. Certificate of Thorough Examination and Test of the Lift;
3. Certificate of Examination and Test of Wire Ropes before Operation.

The data in the "Register of Lifting Appliances and Items of Loose Gear", as well as in other, before specified certificates shall be recorded in English.

7.2.2 If the ship is provided with lifting appliances, the entries relating to the lift shall be recorded in the part of the "Register of Lifting Appliances and Items of Loose Gear" where the entries concerning the lifting appliances are made.

8 SUPERVISION IN USE

8.1 LIFTING APPLIANCES

8.1.1 General

In the intervals between periodical inspections and examinations, the responsibility for continuous supervision of keeping lifting appliances in compliance with the certificates and the Rules issued by the *Register*, the maintenance of established restrictions of the permissible safe working load, jib radii of cranes and inclination of derrick booms, control of adjustment of derricks and preventer guys and also the angle between the cargo runners when operating in union purchase, then keeping of the lifting appliances in the state fit for safe use, rests with the ship's Administration.

8.1.2 Periodical examinations of lifting appliance carried out by the ship's authorized person

Before commencement of loading and unloading operations lifting appliances shall be regularly examined by an authorized person on board ship. In the case of any defects that may affect the safety of equipment usage, the authorized person shall make a record in the "Register of Lifting Appliances and Items of Loose Gear" ("Cargo Gear Book"), Part II and also in the Ship's Log Book, and all steps for removing defects shall be taken. The lifting appliances may be subsequently used after the defects have been eliminated. If necessary the occasional survey shall be performed, as per 7.5.

8.1.3 Periodical examinations of loose gear, wire ropes and lifting appliances carried out by an authorized person on board

8.1.3.1 Loose gear, wire ropes and lifting appliances shall not be used during loading operations, unless an authorized person on board examines them before they are used.

8.1.3.2 All loose gear parts and ropes shall be thoroughly examined by an authorized person on board, at least once in a three months.

8.1.3.3 If broken wires are found in a rope, the ropes shall be examined at least once a month.

8.1.3.4 The testing results and measures taken for eliminating defects shall be recorded in the "Register of Lifting appliances and Items of Loose Gear" ("Cargo Gear Book"), Part II and in the Ships Log Book.

8.1.4 Periodical examinations of lifting appliances with safe working load (SWL) < 1 t

8.1.4.1 They are to be carried out according to the *Rules for technical supervision of sea-going ships, Part 1. - General requirements, Chapter 5*, Section 4.13. Examination performs the responsible person on a ship.

8.1.4.2 The responsible person on a ship must have good knowledge of lifting appliance, especially of critical parts that, if broken, may bring into danger safety and health of appliance manipulator and other persons.

The responsible person on a ship may be a captain, crew member, employee of a firm dealing with adequate activities, etc.

8.1.4.3 After examination, the captain enters remarks, name of responsible person and survey date in Inspection book for derricks / lifting appliances SWL < 1 t.

8.2 LIFTS

8.2.1 During the intervals between two examinations of lifts concerning their compliance with the issued documents and the Rules, and as well control of the lifts' state, the competent staff shall be responsible.

8.2.2 All loose gear and ropes shall be thoroughly examined by the responsible person on board at least once in a three months period.

Besides, the following shall be checked:

- functioning of door locks, limit switches, alarm and lighting controls,
- operation of brakes and other structural parts subject to wear, as far as examination may be followed.

If broken wires are revealed in the rope, it shall be examined at least once a month.

The results of examinations and inspections shall be recorded in the ship's log book.

In the case of equipping or repair of a lift the requirements set forth in Head 5.4 of the Rules shall be met.

APPENDIX

Nomenclature of main structures, machinery and gear of lifting appliances subject to supervision of the *Register* (according to 1.3.3 of the Rules):

1. Cargo derricks

1.1 Winches and drums
1.1.1 Cargo winches
1.1.2 Span winches
1.1.3 Guy winches
1.1.4 Topping winches
1.1.5 Preventer guy winches
1.2 Steel structures
1.2.1 Masts
1.2.2 Short posts for mounting derrick heel fittings
1.2.3 Cross trees
1.2.4 Outriggers
1.2.5 Booms
1.2.6 Wooden booms
1.2.7 Seats of winches and topping winches
1.2.8 Stiffening of ship's hull in way of masts, winches and eye plates
1.2.9 Supports of derricks when "stowed for sea"
1.3 Ropes and gear
1.3.1 Loose gear:
1. Blocks
2. Hooks
3. Chains
4. Shackles
5. Swivels
6. Rigging screws
7. Thimbles, rope sockets and pressed clips
8. Triangular and polygonal plates
9. Derrick head eye fittings
10. Cross heads of blocks
11. Accessories of outrigger type forming part of cargo (heavy lift) derricks, subject to special consideration by the *Register*, in each case.
12. Stops for fastening preventer guys with pressed-clips

1.3.2 Fixed gear:
1. Derrick head eye plates for cargo runners, span ropes, slewing and preventer guys
2. Eye plates secured on ship's hull, deck or steel structures
3. Derrick double lug heel fittings
4. Span eye plates with bearings
5. Derrick heel gooseneck with bearings
6. Built-in sheaves with straps

1.3.3 Ropes:
1. Cargo runners
2. Shrouds and stays
3. Span ropes, tackles and slewing guy pendants
4. Preventer guys and schooner guys in Union Purchase.

2. Cranes and hoists

2.1 Machinery
2.1.1 Hoisting machinery
2.1.2 Luffing machinery
2.1.3 Slewing machinery
2.1.4 Travelling motion machinery
2.1.5 Brakes
2.2 Steel structures
2.2.1 Bridges
2.2.2 Gantries
2.2.3 Jibs
2.2.4 Frames
2.2.5 Substructures
2.2.6 Stiffening of ship's hull, pontoons and docks in way of cranes
2.2.7 Fixed and turning columns
2.2.8 Balance beams and rods of movable counterweights
2.2.9 Supports of cranes when "stowed for sea"
2.3 Ropes and gear
2.3.1 Loose gear:
1. Blocks
2. Hooks
3. Chains
4. Shackles
5. Swivels
6. Thimbles, rope sockets and pressed clips
7. Accessories of lifting beam type, forming part of heavy cranes, subject to special consideration by the *Register*, in each case

2.3.2 Fixed gear:
1. Eye plates
2. Trunnions, axles with bearings
3. Screws

2.3.3 Ropes
1. Cargo runners
2. Span or luffing ropes
3. Grab ropes

2.4 Safety devices
1. Limit switches
2. Jib radius automatic indicators
3. Limit-load switches
4. Signal means
5. Locking devices
6. Safety push-buttons or switches

3. Lifts

3.1 Steel structures (lift trunks, guides, ceiling, bottom, cabin) with all fixed gear
3.2 Lift components (trunk doors, counterweights, buffers, gripping devices etc.)
3.3 Ropes

4. Electrical equipment

1. Electric motors
2. Electric brakes
3. Control stations
4. Limit switches
5. Safety push-buttons and switches
6. Cargo mass control device
7. Cabling
8. Other electrical equipment required for the safe operation of the lifting appliance