TÜRK LOYDU

Chapter 50 - Rules for the Construction and Survey of Lifting Appliances

This latest edition incorporates all rule changes. The latest revisions are shown with a vertical line. The section title is framed if the section is revised completely. Changes after the publication of the rule are written in red colour.

Unless otherwise specified, these Rules apply to ships for which the date of contract for construction as defined in TL-PR 29 is on or after 1st of January 2017. New rules or amendments entering into force after the date of contract for construction are to be applied if required by those rules. See Rule Change Notices on TL website for details.

"General Terms and Conditions" of the respective latest edition will be applicable (see Rules for Classification and Surveys).

If there is a difference between the rules in English and in Turkish, the rule in English is to be considered as valid. This publication is available in print and electronic pdf version. Once downloaded, this document will become UNCONTROLLED. Please check the website below for the valid version.

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Regulations for the Construction And Survey of Lifting Appliances

Section 11 – Materials

Section 12 – Welding

Section 13 – Testing and Examination of Lifting Appiances

Appendix A – Tables

Appendix B –Rigging plans

Appendix C – Documentation

AMENDMENTS

Revision	RCS No.	EIF Date*
Section 01	04/2020	01.01.2021
Section 04	04/2020	01.01.2021
Section 05	04/2020	01.01.2021
Section 06	04/2020	01.01.2021
Section 08	02/2020	01.07.2020

* Entry into Force (EIF) Date is provided for general guidance only, EIF dates given in Rule Change Summary (RCS) are considered valid. In addition to the above stated changes, editorial corrections may have been made.

SECTION 1

INSTRUCTIONS FOR USE

A. General Remarks

1. These "Regulations for the Construction and Survey of Lifting Appliances 1992", hereafter referred to as "Lifting Appliance Rules ", are applied by **TL** in all cases where the Society is commissioned to assess lifting appliances and loose gear within the terms of B.1.1

2. The dimensioning and testing of lifting appliances, including derrick masts, derrick posts and their standing rigging on board ships, does not constitute part of the classification of the ship.

3. Even if lifting appliances on offshore installations are not included in the scope of testing and examination by **TL**, at least this has to be done by **TL** to an extent as far as the safety of the installation as a whole is concerned. The extent of testing and examination in such cases can, for example, include the foundation of lifting appliances, the fire protection or the stability of the floating body.

4. Any liability incurred under the "General Conditions" of **TL** shall be limited to the scope of examination as defined in D. The serviceability and functional capacity of the lifting appliances and loose gear remain the sole responsibility of the manufacturer and resp. the operator.

B. Scope of Use

1. Field of Application

1.1 These Lifting Appliance Regulations apply specifically to all lifting appliances as defined in F.3 on ships of all kinds, and on offshore installations. Where this is permitted under national regulations, and an appropriate agreement is concluded, they may also be applied, as and where relevant, to onshore lifting appliances.

With regard to loose gear, these rules apply without restriction to the maritime sector.

1.2 These Lifting Appliance Regulations do not apply to:

- Drilling derricks
- Dredging appliances
- Signal and radar masts
- The rigging of sailing ships
- Launching gear for lifesaving appliances
- Towing gear
- Access ways to ships
- Devices for the transfer of pilots
- Car decks
- Launching gear for diving equipment

2. Entry into Force

2.1 These Lifting Appliance Regulations enter into force on 01.03.1992, with a transitional period until 31.12.1992.

2.2 Lifting appliances and loose gear whose design or manufacture commenced before 01.03.1992 are subject to the provisions of the "Regulations for the Construction and Survey of Cargo-handling appliances and other Lifting Appliances 1983", which finally cease to be applicable on 31.12.1992.

2.3 For existing lifting appliances and loose gear, these Lifting Appliance Regulations apply only to newly obtained parts and repairs.

2.4 Examinations of drawings performed by **TL** in accordance with "Regulations" which are now no longer in force to continue to serve as a basis for unmodified fabrication, provided this is not opposed by more recent knowledge and/or experience.

3. National Regulations

3.1 It should be noted that regulations issued by national authorities may differ from these Lifting Appliance Regulations. In such cases, **TL** may base the approval, testing and examination on these divergent regulations in so far as this is necessary or agreed, and provided that they are placed at the disposal of **TL**, as may be required.

C. Basic Principles of Approval

1. Design and Dimensioning

1.1 These Lifting Appliance Regulations are based on national and European standards, e.g. DIN 15018 (Cranes, Principles for Steel Structures, Stress Analysis) and F.E.M. standards (Section 1, Rules for the Design of Hoisting Appliances).

1.2 The standards mentioned in 1.1 are supplemented by special ship-related requirements arising, for example, from the inclinations of the ship, increased wind loading and seaway effects, as well as by other special factors inherent in the maritime environment.

2. Accident Prevention

2.1 The provisions aimed at accident prevention contained in these Lifting Appliance Regulations are based on the UW See, and on the code of practice "Safety and Health in Dock Work" issued by the International Labour Organization (ILO).

2.2 In addition to the basic principles referred to in 2.1, these Lifting Appliance Regulations embody special considerations resulting from the marine environment.

3. Testing, Examination and Certification

3.1 The provisions contained in these Lifting Appliance Regulations relating to the initial and periodical testing and to the thorough examinations of lifting appliances and loose gear on ships are based on ILO Convention 152.

3.2 Offshore cranes and onshore cranes are treated in a manner similar to that stated in 3.1, unless subject to special agreements (see Section 13).

3.3 The certificates issued by **TL** in respect of the initial and periodical testing of lifting appliances, the initial testing of loose gear and the thorough examination of ropes and interchangeable components are based on the ILO's specimen certificates of 1985. (For lift units see Section 5, F.3.4.)

3.4 For the acceptance testing of lifting appliances, lift units and loose gear at the manufacturer's premises, and for the class certificates of lifting appliances, **TL** issues certificates other than those mentioned in 3.3.

4. Other Applicable Rules and Standards

The following rules, resp. standards complement, where relevant, the provisions of these Lifting Appliance Regulations:

4.1 TL rules for construction and TL regulations

Rules for the Classification and Construction of Seagoing Steel Ships:

a) Material- Chapter 2

b) Welding-Chapter 3

c) Machinery - Chapter 4

d) Electrical installations- Chapter 5

e) Automation- Chapter 4-1

4.2 Standards and regulations

4.2.1 DIN, EN and ISO standards, where referred to in the text.

4.2.2 Fédération Européenne de la Manutention (F.E.M.), Section 1, Rules for the Design of Hoisting Appliances

D. Scope of Examination

1. Examination of Drawings (Plan Approval)

1.1 Drawings are examined to verify compliance with the applicable regulations, and with the design and contractual conditions, where this has been specially agreed.

1.2 Examination of the drawings is further intended to establish the degree of safety actually provided against failure. In this connection, the load test serves to prove that there are no hidden deficiencies or design faults (see Sections 5-7 and 13).

2. Components Subject to Examination of Drawings

2.1 Affected components of lifting appliances

Depending on the basic approval criteria and the field of application, the following components are subject to plan approval and to regular tests and examinations:

2.1.1 Lifting appliances conforming to ILO requirements

(These are lifting appliances used for cargo-handling on board ship or in harbours.)

- In the case of lifting appliances on board ship, the approval requirement covers load-bearing machinery components and steel structures, winch drums, ropes and interchangeable components.

  Harbour cranes can be treated as ship's cranes, unless national regulations stipulate more stringent approval criteria.

2.1.2 Offshore lifting appliances

(These are lifting appliances standing on the open deck of offshore installations, or used for loading/unloading ships.)

- In the case of offshore lifting appliances, the approval requirement includes, in addition to the ILO requirements: winch drives, complete slewing/luffing mechanisms, and swell compensators or shock absorbers.

2.1.3 Classified lifting appliances

(These are lifting appliances of all kinds, which, at the operator's request, undergo a comprehensive approval, testing and examination for the issue of a certificate of class.)

- The approval procedure for the allocation of class encompasses the steel structure, fittings for the absorption and transmission of forces, rope drives, winches, slewing/swinging, luffing and travelling gear, drives including the prime mover, power supply lines, steering gear, as well as control and safety devices.

Ships equipped with lifting appliances complying with these rules are given **LA** class notation.

2.2 Affected components of loose gear

In the case of loose gear, load-bearing machinery components and steel structures, ropes and inter-changeable components are subject to examination of drawings.

3. Tests and Examinations on the Manufacturer's Premises

3.1 Supervision of construction

3.1.1 The purpose of supervising construction, in conjunction with an acceptance tests at the manu-facturer's premises, is to control manufacture and ensure compliance with the approved documents.

3.1.2 A further purpose of supervising construction is to ensure that, besides properly executed manufacture, the following conditions are fulfilled:

- Use of certificated materials in accordance with Section 11, B.4.1,
- Use of approved methods of manufacture,
- Employment of qualified welders,
- Use of approved welding consumables and ancillary materials,
- Use of approved testing procedures,
- Use of tested and certified components (machinery components, electrical units, interchangeable components and ropes; see also Sections 7-10 and 13).

3.1.3 Supervision of construction is required even in those cases where complete assembly of the lifting appliances or loose gear takes place only on site.

3.2 Acceptance tests

3.2.1 The completion of manufacture of a lifting appliance or loose gear is to be followed by a final examination, in conjunction with functional testing of all movements and safety equipment. A test programme is to be agreed with the **TL** Surveyor.

3.2.2. The initial acceptance testing of new types of lifting appliance shall conform to a test programme whose scope at least meets the requirements stated in Section 13, and which is approved by the head office of **TL**.

3.2.3 An acceptance test at the work site is also required in those cases where lifting appliances or loose gear are not completely assembled in the manufacturer's premises.

4. Test and Examination Before Commissioning

4.1 Before being put into use for the first time, lifting appliances and loose gear are to undergo a load test, followed by a thorough examination by a **TL** Surveyor. These measures are deemed compulsory to prove that there are no constructional deficiencies or hidden faults (see Sections 5,7 and 13).

4.2 Fixed lifting appliances must be load-tested at their working site, so that their foundations and fastenings are included in the test.

4.3 For lifting appliances and loose gear on ships and offshore installations, the load test is performed in accordance with the ILO requirements. Different arrangements may apply, or be agreed upon, for onshore lifting appliances.

4.4 The scope of the initial test and examination shall also include the functional testing of all components, equipment systems and safety devices, although this is not separately certified.

5. Periodical Tests and Examinations

5.1 Lifting appliances subject to continued or regular supervision by **TL** must be load-tested at regular intervals in the presence of a **TL** Surveyor, who then has to carry out a thorough examination (see also Section 13).

5.2 For lifting appliances on ships, the periodical tests and examinations are carried out on the basis of the ILO requirements. Different arrangements apply to lifting appliances on offshore installations (see Section 13). Other arrangements may apply, or be agreed upon, for onshore lifting appliances.

5.3 Loose gear subject to regular supervision by **TL** must be thoroughly examined by a **TL** Surveyor at annual intervals (see Section 7).

E. Documents To Be Submitted for Approval

1. Basic Requirements

1.1 In general, drawings and other documents are to be submitted in triplicate, calculations in duplicate. Where these numbers of copies of documents requiring approval are submitted, the applicant receives one signed and stamped copy back in each case. Different arrangements may be agreed.

Documents subject to approval receive an approval stamp, all other items a perusal stamp.

1.2 Documents for approval (see 2) must contain all the data and information needed for examination. This includes the dimensions and details of materials and welding, and the tests applied.

Parts lists, specifications of materials, welding and test procedures, etc. are to accompany the documentation.

1.3 In the case of standardized parts, or parts which have been type-tested by **TL**, it is normally sufficient to refer to the relevant standard or type-test number, indicating the proposed size and type of unit with details of the material and (heat) treatment, where applicable.

1.4 Calculations must be set out in such a way that they can be easily interpreted and replicated. In particular, design loads, system dimensions, input and output data, maximum values, bearing reactions and safety against overturning must be clearly indicated.

For program-controlled calculations, descriptions and explanatory matter relating to the programs used are to be supplied on request.

The calculations to be submitted are required for control purposes. Examination of the calculations by **TL** is carried out only upon special agreement.

1.5 The manufacturer must ensure that the approval documents are ready for examination at the proper time, even if they are prepared by sub-contractors.

1.6 The client must provide the manufacturer with all the necessary details concerning the proposed operating conditions for the lifting appliances and loose gear (e.g. the inclinations and stability of the ship, the cargoes to be handled, environmental conditions, etc.).

1.7 When the submitted documents have been examined by **TL**, they are binding on the manufacturer. Later modifications require the consent of **TL**.

2. Documents for Approval

These are drawings and documents relating to components and equipment, such as:

2.1 Structural parts

- Masts, posts, cross-trees, derrick booms, fittings, foundations of all kinds
- Traverses, crane booms, crane housings, ec-centric platforms, crane columns, supporting structures
- Crane bridges, trolleys, gantries, bogies, runways, runway supports
- Stoppers, derailment guards, devices to pre-vent overturning
  Sea lashings, crane boom supports

2.2 Mechanical parts

2.2.1 Minimum extent

- Winch drums and their bearings
- Slew rings, with bolting system and limit load diagrams
- Other rotary bearings such as king pins and rollers
- Cylinders, pipe-fracture valves
- Racks, spindles

2.2.2 Additional extent for offshore lifting appliances

- Winch drives and brakes
- Slewing, swinging and luffing mechanisms, with drives and brakes
- Dismantling devices for slew rings
- Shock absorbers in luffing or hoisting systems
- Swell compensator systems

2.2.3 Additional extent for lifting appliances with certificate of class

- Slewing, hoisting, swinging, luffing and running gear
- All drives and brakes, including the prime mover
- Valves, control equipment
- Pipes, hoses
- Tanks
- Cooling, ventilation equipment

2.3 Electrical installations

2.3.1 Minimum extent

- Details of the rated characteristics and types of enclosure of the drive motors employed
- Details of all safety devices

2.3.2 Additional extent for offshore lifting appliances

- Wiring diagrams
- Emergency power supply
- Alarms
- Lighting diagrams

2.3.3 Additional extent for lifting appliances with certificate of class

- Circuit diagrams
- Wiring diagrams
- Emergency power supply
- Control equipment
- Alarms
- Lighting diagrams

2.4 Other documents

2.4.1 Minimum extent

- Circuit diagrams (hydraulic/pneumatic)
- Material specifications
- Welding and testing schedules
- Details of ropes, rope-end connections, rope sheaves
- Details of interchangeable components
- Access ways, ladders, platforms

2.4.2 Additional extent for offshore lifting appliances

- Fire protection plans
- Test and trial programmes
- Drawings of cabins resp. control stands

2.4.3 Additional extent for lifting appliances with certificate of class

- Design data, energy balance
- Fire protection plans

- Layout plans
- Specifications
- Corrosion protection
- Drawings of cabins resp. control stands
- Spare parts list
- Test and trial programmes

3. Documents for information

These are calculations and back-up documentation such as:

3.1 Strength calculations (steel structure/machinery)

- General stress analysis
- Proof of stability (crippling, tilting, buckling)
- Proof of fatigue strength

3.2 Other calculations

- Proof of rope drivesProof of safety against overturning
- Proof of safety against drifting off by wind
- Proof of resistance to earthquakes

3.3 Other documents

- Functional descriptions, where necessary
- Certificates for loose gear, interchangeable components and ropes
- Details of type tests

4. Particulars for Documentation

4.1 Minimum extent

- General arrangement drawings (showing overall layout)
- Load radius diagrams, where necessary
- Rigging plans
- Operating instructions, where necessary

4.2 Additional extent for offshore lifting appliances

- Load radius diagram
- Operating instructions

4.3 Additional extent for lifting appliances with certificate of class

- Load radius diagram
- Operating instructions
- Maintenance instructions

5. Existing Lifting Appliances and Loose Gear

5.1 Where existing lifting appliances and loose gear which have not been approved in accordance with **TL**'s Lifting Appliance Regulations are to be certified by **TL**, a thorough examination by a **TL** Surveyor, together with a load test, is required.

5.2 For an examination of drawings, the documents mentioned in 2 are to be submitted. Where such documents are not available, they are to be prepared on the basis of measurements made in cooperation with the **TL** Surveyor. The extent to which documents may be dispensed with shall be decided in each individual case by the **TL** head office.

5.3 The Safe Working Load shall be finally established by **TL** head office in every case.

6. Conversions

6.1 Conversions include the subsequent installation of new lifting appliances, increasing the Safe Working Load, changing the load radius and modifications to the load-bearing components of existing lifting appliances and loose gear.

6.2 In the event of conversions, drawings of the parts affected by modifications are to be submitted in addition to the documents relating to the new parts to be installed.

Where applicable, modified rigging plans are to be submitted.

F. Definitions

1. Ships

The term “ships” comprise all floating bodies, regardless of their shape or purpose.

2. Offshore Installations

The term “offshore installation” comprises installations for diverse purposes designed to be operated continuously or for a defined period at an offshore site.

3. Lifting Appliances

The term “lifting appliance” comprises power-driven gear for lifting, transporting or conveying goods or raw materials.

3.1 Offshore lifting appliances

Offshore lifting appliances are defined as lifting appliances which are exposed to offshore environmental conditions and/or handle cargo on the open sea.

3.2 Floating cranes

“Floating cranes” are defined as lifting appliances, regardless of type, Safe Working Load or purpose, which are mounted on a floating body whose purpose is to enable the lifting appliances to be transported by water.

3.3 Lifting appliances not used for cargo-handling

Lifting appliances not used for cargo-handling comprise of, for example, engine-room cranes, trolleys, manual and power-driven hoists, lifting appliances for hatch covers, provision and equipment, and for supporting hoses.

3.4 Gear

The term “gear” comprises conventional lifting, catching and transfer equipment, etc., consisting of derrick booms resp. tackles and their fittings, and of ropes and interchangeable components (lifting, fishing, transfer gear).

4. Lift/Elevator Units

The term "lift unit" encompasses all the prescribed, or functionally essential, components of a lift. Lifts move on vertical or inclined guide rails/runways and have an operating height of at least 1,8 m, a load-bearing device running at least partially in guides, and fixed access or landing positions.

5. Lifting Platforms

The term “lifting platforms” comprises lifting installations with a guided load-bearing device and variable stopping points, or with an operating height of less than 1,8 m.

6. Loose Gear

The term “loose gear” comprises all gear by means of which a load can be attached to a lifting appliance but which does not form part either of the lifting appliance or of the load.

7. Cargo-handling Appliances

The term "cargo-handling appliances" subsumes the terms "lifting appliances" and "loose gear" with which cargo is handled (ropes and interchangeable components form part of these).

8. Interchangeable Components

Interchangeable components comprise all parts such as:

- Chains
- Rings

- Hooks
- Shackles
- Swivels
- Sheaves, blocks, etc.

regardless of whether they form part of lifting appliances or loose gear.

9. Equipment for Conveying Persons

Equipment for conveying persons includes, for example, landing booms (Saint Lawrence Seaway booms), and loose gear for conveying persons by specially adapted and equipped lifting appliances.

10. Safe working Load (SWL)

10.1 The Safe Working Load (SWL) of a lifting appliance is the static load which may be directly applied to the supporting element (e.g. cargo hook) of the lifting appliance. A precondition is that the lifting appliance must be working within the loading parameters on which the design calculations have been based. The dead load imposed by loose gear forms part of this Safe Working Load.

10.2 Where the Safe Working Load is handled by a single lifting appliance, the designation SWL is used without additional symbols. When operating with a grab, the letter "G" is added. Where the Safe Working Load is handled by two lifting appliances, the following letters are added to the designation SWL:

(U) (Union purchase), for the operation of fixed derrick booms and coupled cargo runners;

(P) (Slewed pair), for the operation of pairs of jointly slewed derrick booms or cranes.

10.3 The hoist load consists of the Safe Working Load and the dead load of those parts of the lifting appliance carrying the SWL, e.g. the hook, the cargo block and a portion of the ropes, resp. a lift car.

11. Dead Load (WT)

Dead loads are the weights of all the fixed and movable components of lifting appliances permanently present in operation.

12. Working Load Limit (WLL)

12.1 The Working Load Limit (WLL) of the interchangeable components indicated in the Tables refers to the permissible load of these parts (e.g. shackles, hooks, chains, blocks, etc.) without regard to the hoist load and/or dead load coefficient.

12.2 For single-sheaved blocks without a the permissible rope tension equals half of the Working Load Limit at the suspension.

12.3 For single-sheaved blocks with a becket, the permissible rope tension equals one third of the working load limit at the suspension. (For exceptions, see the explanatory note to the Tables in Appendix A.)

12.4 It should be noted that the Working Load Limit (WLL) of an interchangeable component (see Section 8) is not normally identical to the Safe Working Load of the lifting appliances, as the components have to be dimensioned in accordance with the locally occurring fores. These forces are indicated in the rigging plans (see Appendix B).

13. Nominal Size

The "nominal size" of interchangeable components is the size of the components or blocks indicated in the relevant DIN standards or Tables (see Appendix A).

14. Rope Tension

The rope tension "SZ" is the maximum tension force occurring in a rope, calculated including the frictional and deflection losses induced by the rope sheaves but disregarding the hoist load and/or the dead load coefficients.

15. Test Load

15.1 The test load is a load increased by a specified amount relative to the Safe Working Load SWL or the Working Load Limit WLL, at which the load test has to be performed.

15.2 The test load "PL_{stat} " of an interchangeable component is the static test load to be applied in the loading test.

15.3 The test load "PL_{dyn}" of a lifting appliance is the test load which must be raised, lowered and braked (dynamic testing) when the lifting appliance is tested by using the drives (e.g. the winches).

16. Load Radius

The load radius is the horizontal distance from the working line of the load to the heel of the derrick or shear leg, or to the axes of rotation of single or double cranes, when the ship is upright. In the case of derrick booms, the load radius is defined by specifying the angle of inclination of the derrick boom relative to horizontal. For cranes, the minimum and maximum load radius is specified.

17. Heel

17.1 "Heel" refers to the inclination of the ship about its longitudinal axis in calm water with the lifting appliance swung outwards (the change in the angle of inclination when the lifting appliance is swung out plus or minus the initial heel, and minus the counter heel). The minimum heel required for the design is indicated in Section 2.

17.2 The "initial heel" refers to a fortuitous heeling of the ship with the lifting appliance unloaded.

17.3 The "counter heel" is an intentional heel, with the lifting appliance unloaded, away from the side over which the load is to be lifted.

18. Trim

"Trim" is the term used to refer to the inclination of the ship about its transverse axis. The minimum trim required for the design is indicated in Section 2**.**

19. Mechanical Strength

For the purpose of these Regulations, mechanical strength refers to the ability of a material or component to withstand fracture or unstable failure.

20. Units of Measurement

All calculations are to be performed in SI units (Systeme International d'Unites). Safe Working Loads and dead loads shall, however, be marked in metric tonnes.

21. Significant Wave Height $H_{1/3}$

The significant wave height $H_{1/3}$ is defined as the average of the 1/3 highest wave heights.

This wave height corresponds to the visual estimated wave height and is to be taken as a basis for the calculations according to Section 4, D.

22. Designation of Components

In these Lifting Appliance Regulations, the designations applied to components are those shown in Figs. 1-1 to 1-8. The figures in square brackets refer to the Tables in Appendix A.

Pos.	Designation	Dimension of parts acc. to tables in Appendix A:
1	Derrick mast	–
2	Derrick boom	–
3	Cargo winch	–
4	Span winch	–
5	Span bolt	–
6	Trunnion piece	[16]
7	Span bearing	[17]
8	Span block	[30]
9	Span rope	[44]
10	Shackle	[22]
11	Derrick heel fitting	[9]
12	Gooseneck	[10]
13	Lead block holder	[13]
14	Adjusting ring	[13]
15	Gooseneck bearing	[14]
16	Lead block	[27]
17	Derrick head fitting	[8]
18	Upper cargo block	[28]
19	Becket	[29]
20	Cargo runner	[44]
21	Lower cargo block	[27]
22	Cargo hook	[19]
23	Guy plate	[26]
24	Guy pendant	[44]
25	Tackle block	[34]
26	Guy	[43]
27	Pad eye	[26]
28	Topping rope	[44]
29	Rope catch	–

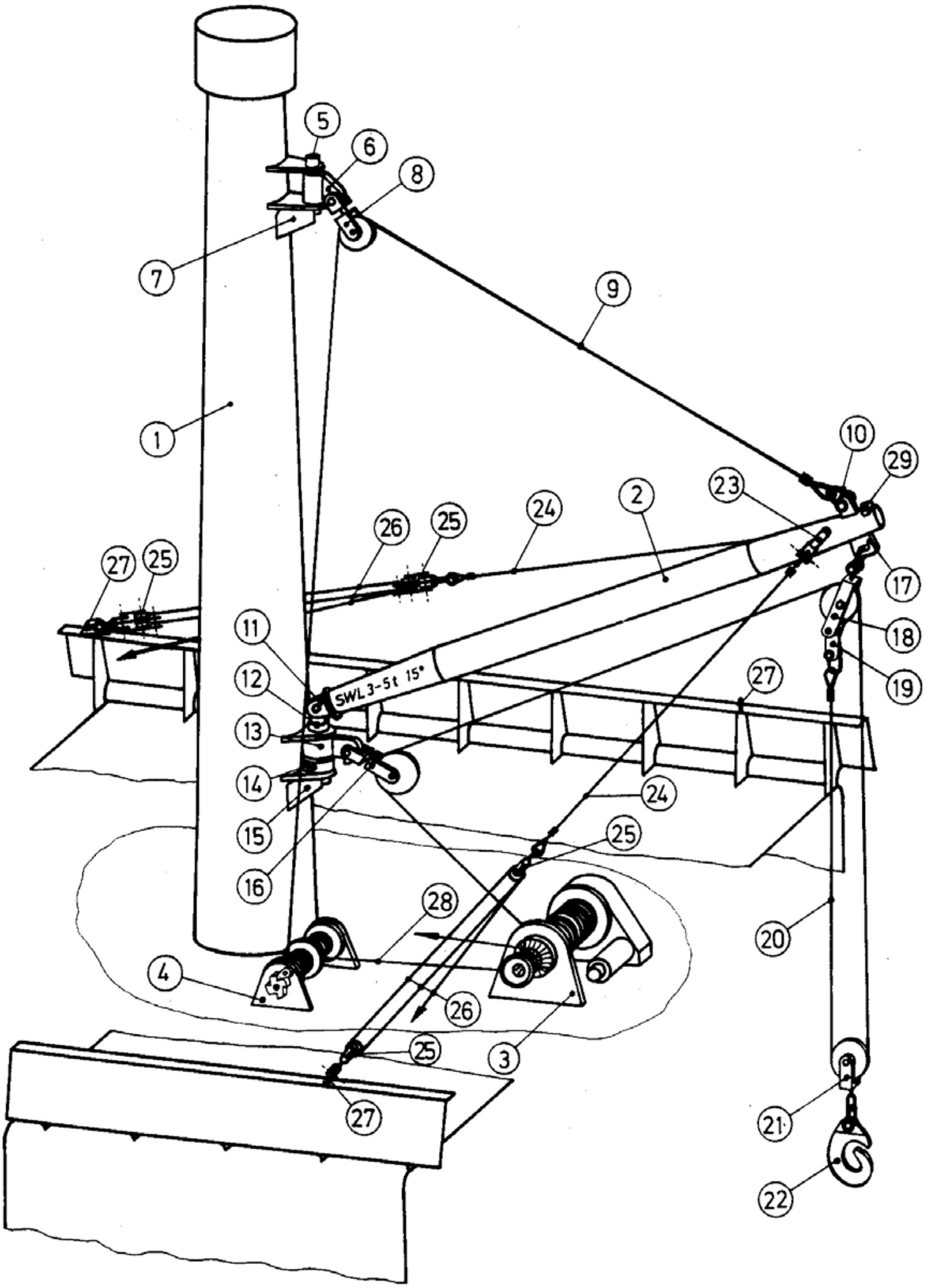


Figure 1.1 Derrick Boom Without Guywinches

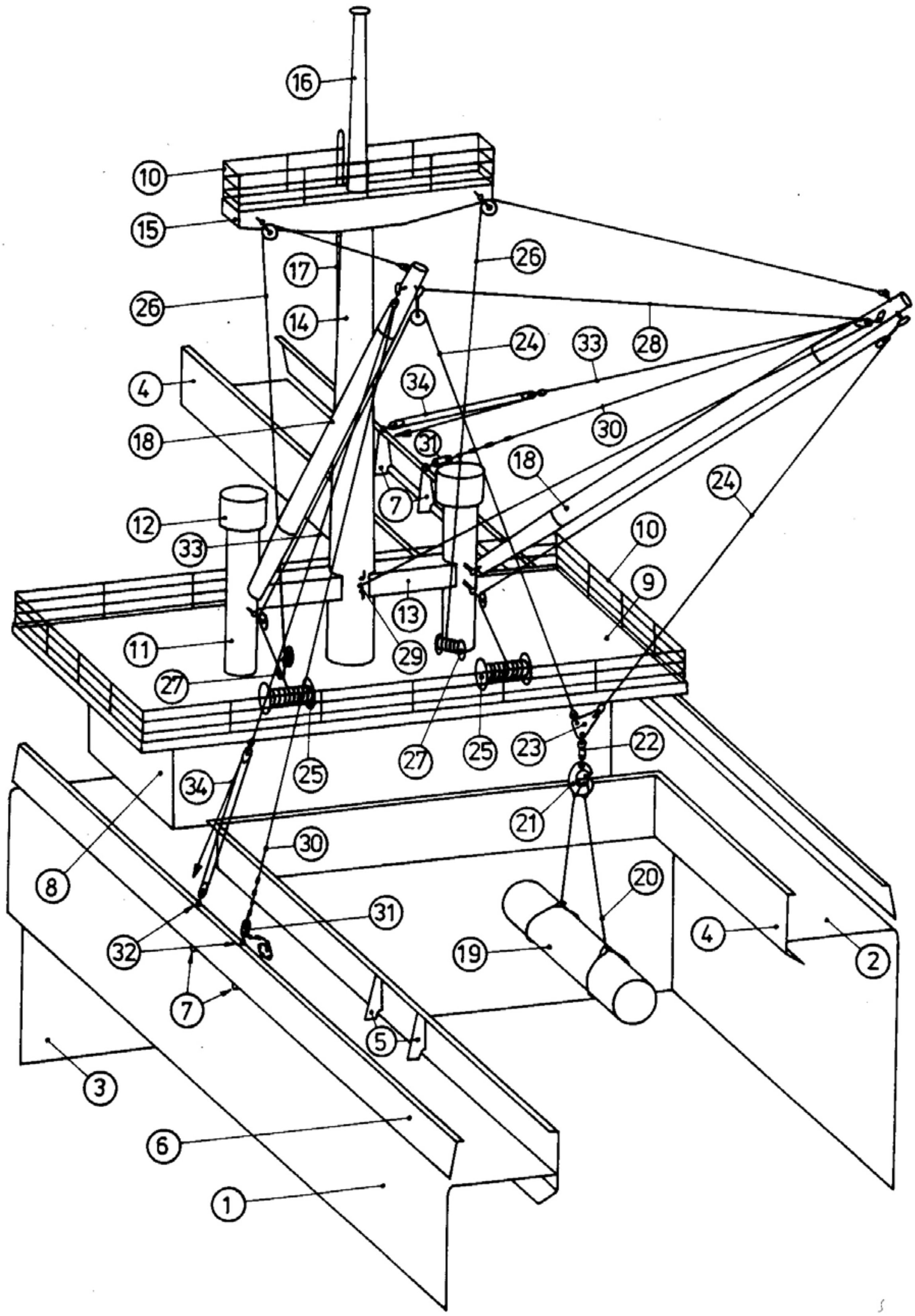


Figure 1.2 Derrick Booms in Union Purchase Without Guywinches

Pos.	Designation	Dimension of parts acc. to Tables in Appendix A:
1	Shell plating	–
2	Main deck	–
3	Transv. bulkhead	–
4	Hatchway coaming	–
5	Brackets f. hatchway coaming	–
6	Bulwark	–
7	Bulwark brackets	–
8	Deck house	–
9	Winch deck	–
10	Railing	–
11	Ventilation post	–
12	Ventilation head	–
13	Crossbar	–
14	Derrick mast	–
15	Cross tree	–
16	Top mast	–
17	Ladder	–
18	Derrick boom	–
19	General cargo	–
20	Loose gear	–
21	Cargo hook	[19]
22	Swivel	[20]
23	Triangle plate	–
24	Cargo runner	[44]
25	Cargo winch	–
26	Span rope	[44]
27	Span winch	–
28	Schooner guy	[44]
29	Belaying cleat	–
30	Preventer	[44]
31	Preventer grip	[46]
32	Pad eyes	[26]
33	Guy pendant	[44]
34	Inner / outer guy	[43]

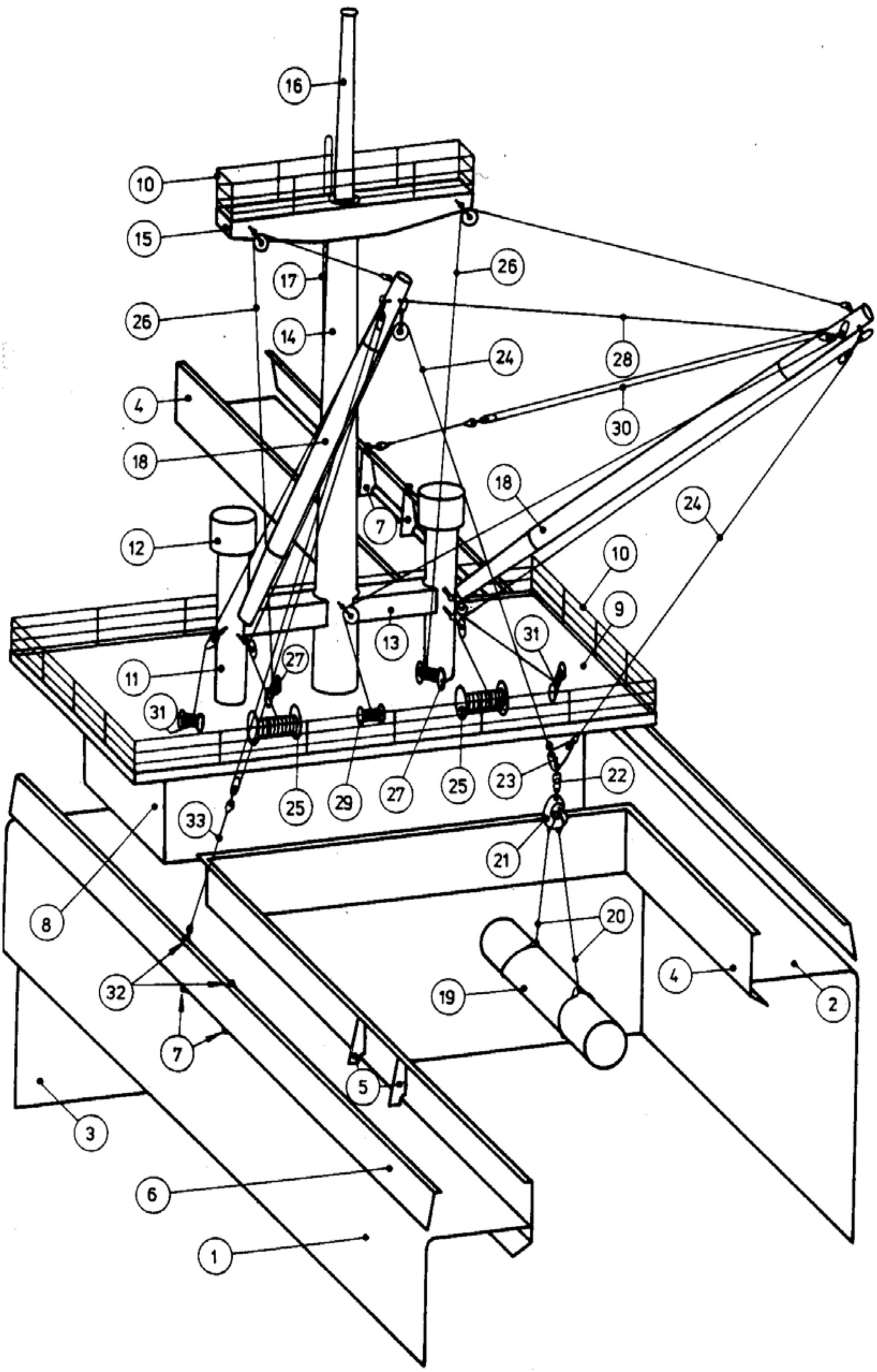


Figure 1.3 Derrik Booms in Union Purchase with Guywinches

Pos.	Designation	Dimension of parts acc. to Tables in Appendix A:
1	Shell plating	–
2	Main deck	–
3	Transv. bulkhead	–
4	Hatchway coaming	–
5	Brackets f. hatchway coaming	–
6	Bulwark	–
7	Bulwark brackets	–
8	Deck house	–
9	Winch deck	–
10	Railing	–
11	Ventilation post	–
12	Ventilation head	–
13	Crossbar	–
14	Derrick mast	–
15	Cross tree	–
16	Top mast	–
17	Ladder	–
18	Derrick boom	–
19	General cargo	–
20	Loose gear	–
21	Cargo hook	[19]
22	Swivel	[20]
23	TrianTLe plate	–
24	Cargo runner	[44]
25	Cargo winch	–
26	Span rope	–
27	Span winch	–
28	Schooner guy	–
29	Guy winch	–
30	Outer / inner guy	–
31	Guy winch	–
32	Pad eyes	[26]
33	Guy pendant	–

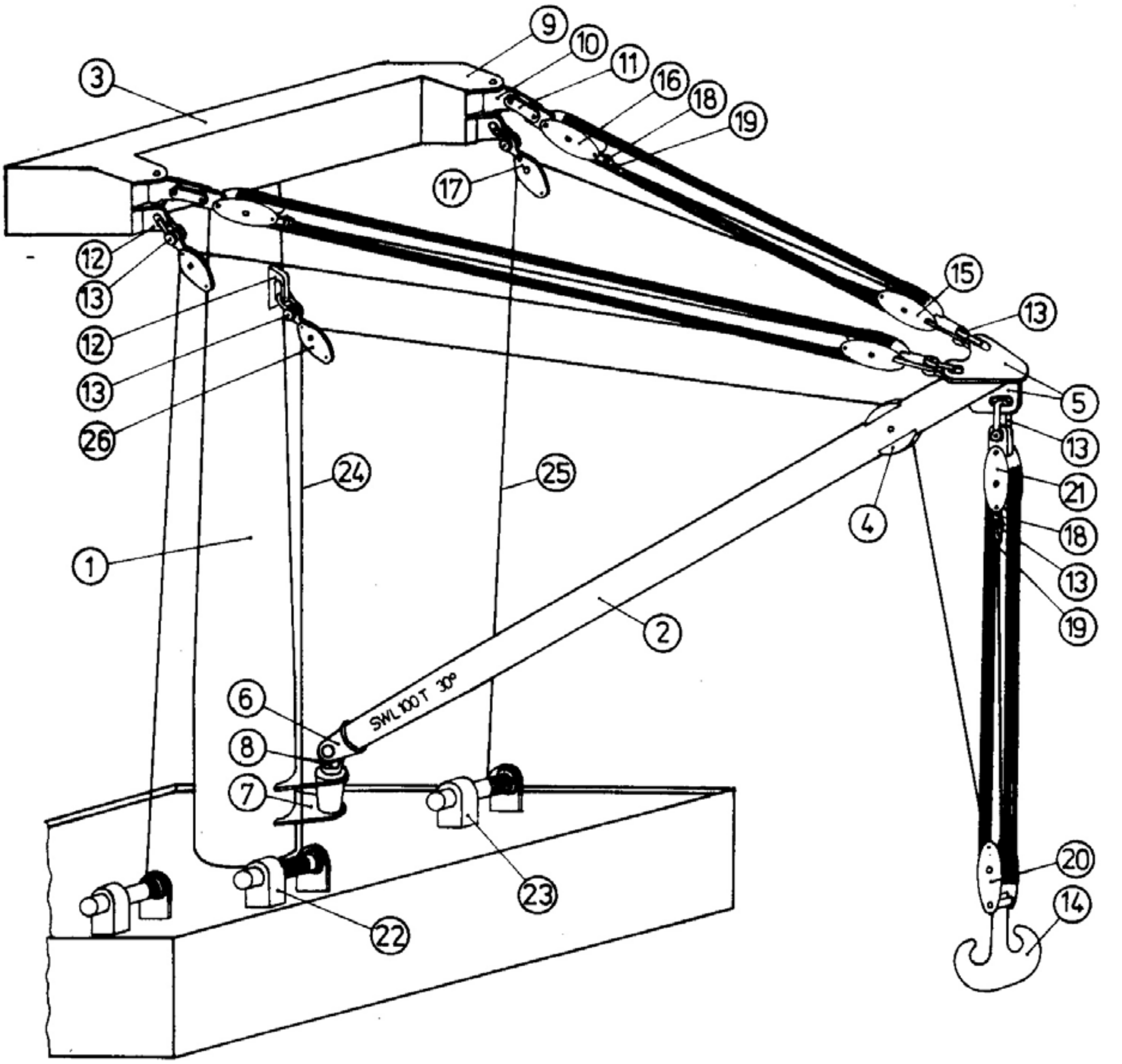


Figure 1.4 Twin Span Derrick

Pos.	Designation	Dimension of parts acc. to Tables in Appendix A:
1	Derrick mast, post	–
2	Derrick boom	–
3	Cross tree	–
4	Built-in sheave	–
5	Derrick head fitting	–
6	Derrick heel fitting	[9]
7	Gooseneck bearing	–
8	Gooseneck	[12]
9	Span bearing	[17]
10	Span trunnion piece	[16]
11	Connecting piece	–
12	Oval eye plate	[26]
13	Shackle form C	[22]
14	Cargo hook with swivel	[20]
15	Lower span tackle block	[33]
16	Upper span tackle block	[33]
17	Span lead block	[27]
18	Becket	[29]
19	Ferrule secured with thimble	–
20	Lower cargo block	[33]
21	Upper cargo block	[33]
22	Cargo winch	–
23	Span winch	–
24	Cargo runner	[44]
25	Span rope	[44]
26	Cargo lead block	[27]

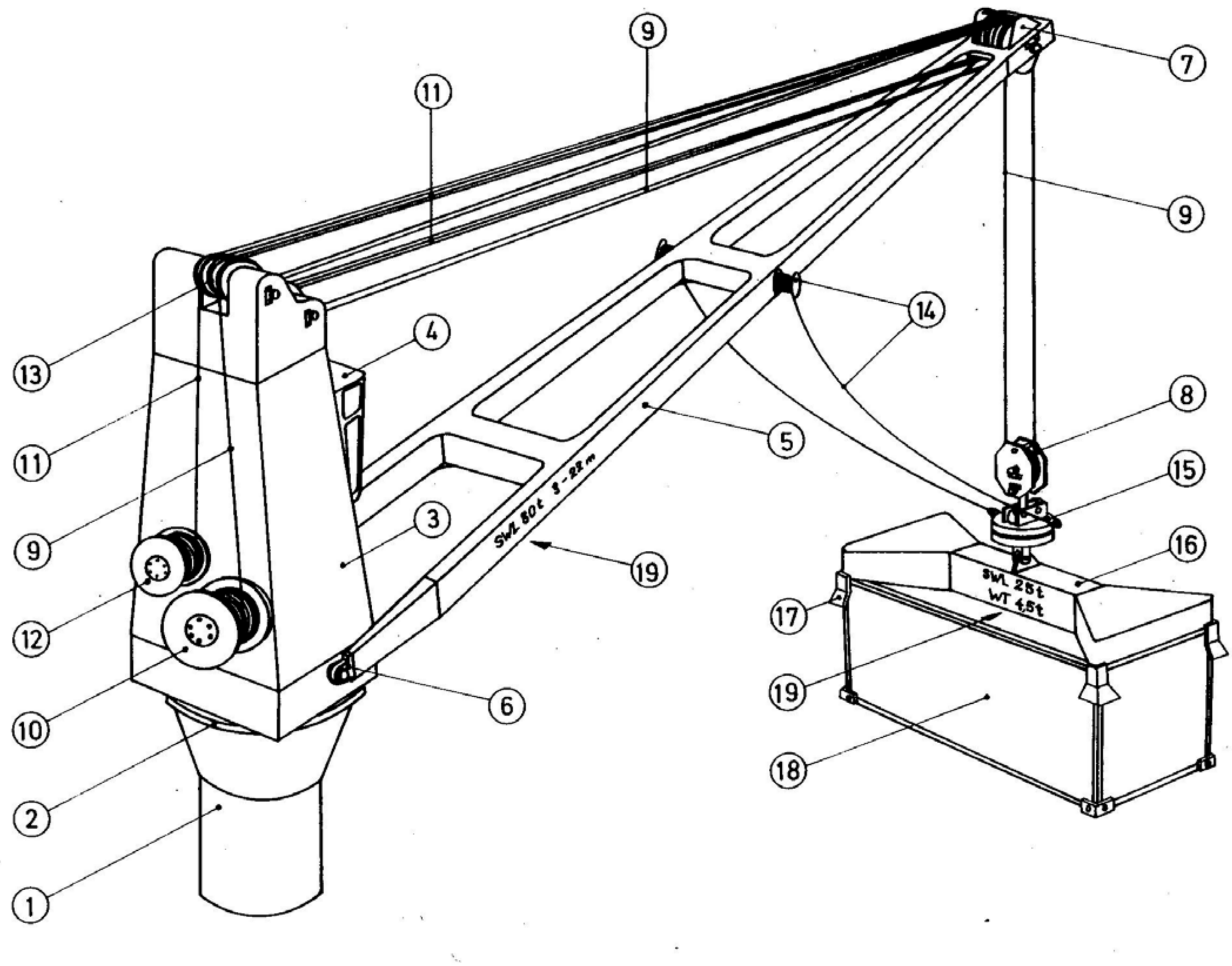


Figure 1.5 Slewing Crane with Luffing Ropes

Pos.	Designation
1	Crane pedestal
2	Slewing ring
3	Crane housing
4	Crane cabin
5	Crane boom
6	Boom foot bearing
7	Protection plate
8	Lower cargo block
9	Cargo runners / luffing ropes
10	Cargo winch / luffing winch
11	Span ropes / luffing ropes
12	Span winch / luffing winch
13	Rope sheaves
14	Stabilizing device
15	Power swivel
16	Container spreader
17	Corner flipper
18	Container
19	Marking

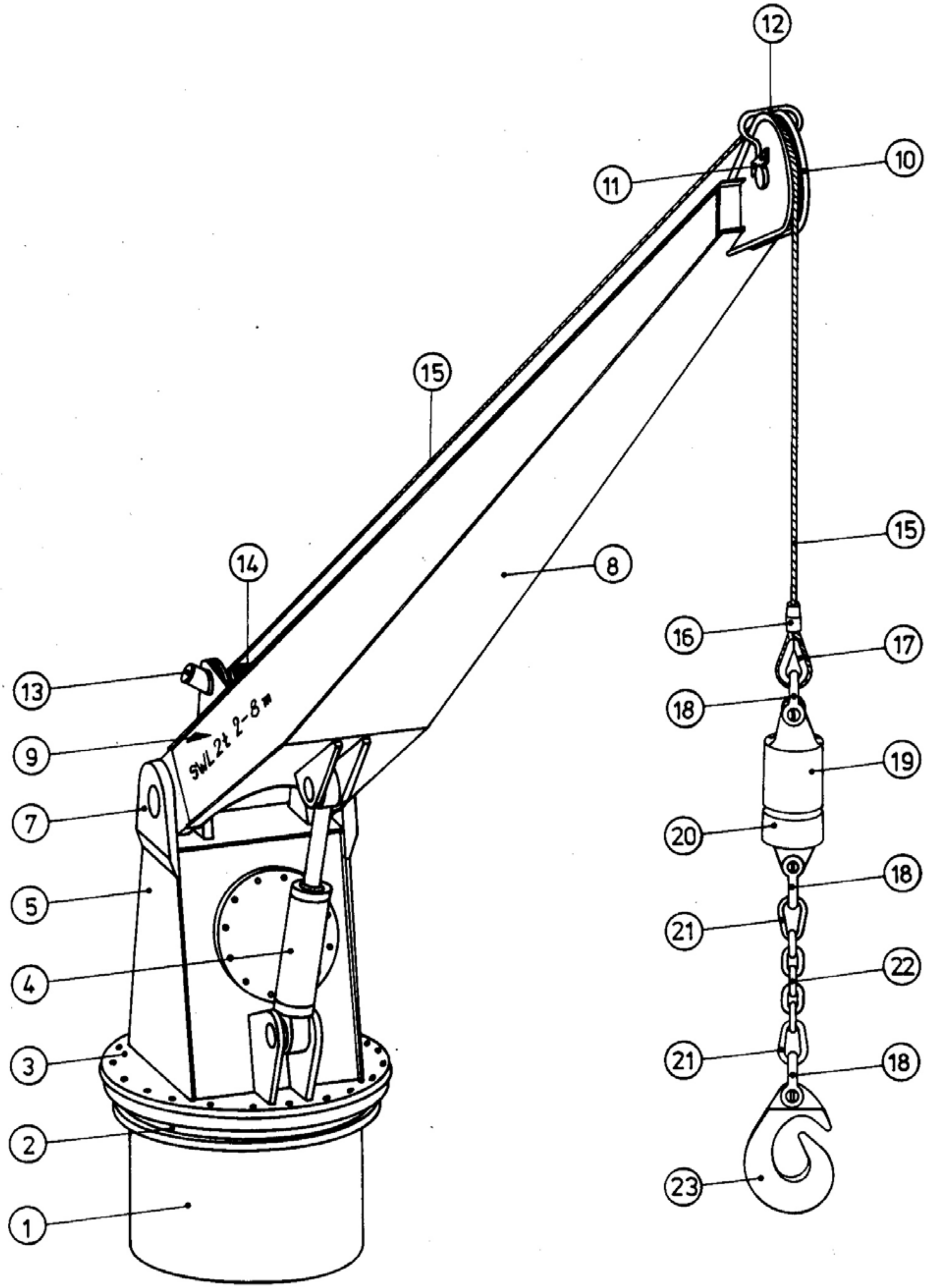


Figure 1.6 Slewing Crane With Luffing Cylinder

Pos.	Designation	Dimension of parts acc. to Tables in Appendix A:
1	Crane pedestal	–
2	Slewing ring	–
3	Base plate	–
4	Luffing cylinder	–
5	Crane housing	–
6	Jib foot bearing	–
7	Crane boom	–
8	Marking	–
9	Protection plate	–
10		–
11	Retaining piece	–
12	Rope protection	–
13	Hydraulic motor	–
14	Cargo winch	–
15	Cargo runner	[44]
16	Ferrule	–
17	Thimble	–
18	B-shackle	[22]
19	Rope weight	–
20	Swivel	–
21	Circular cross section	[23]
22	Short link chain	[23]
23	Cargo hook	[19]

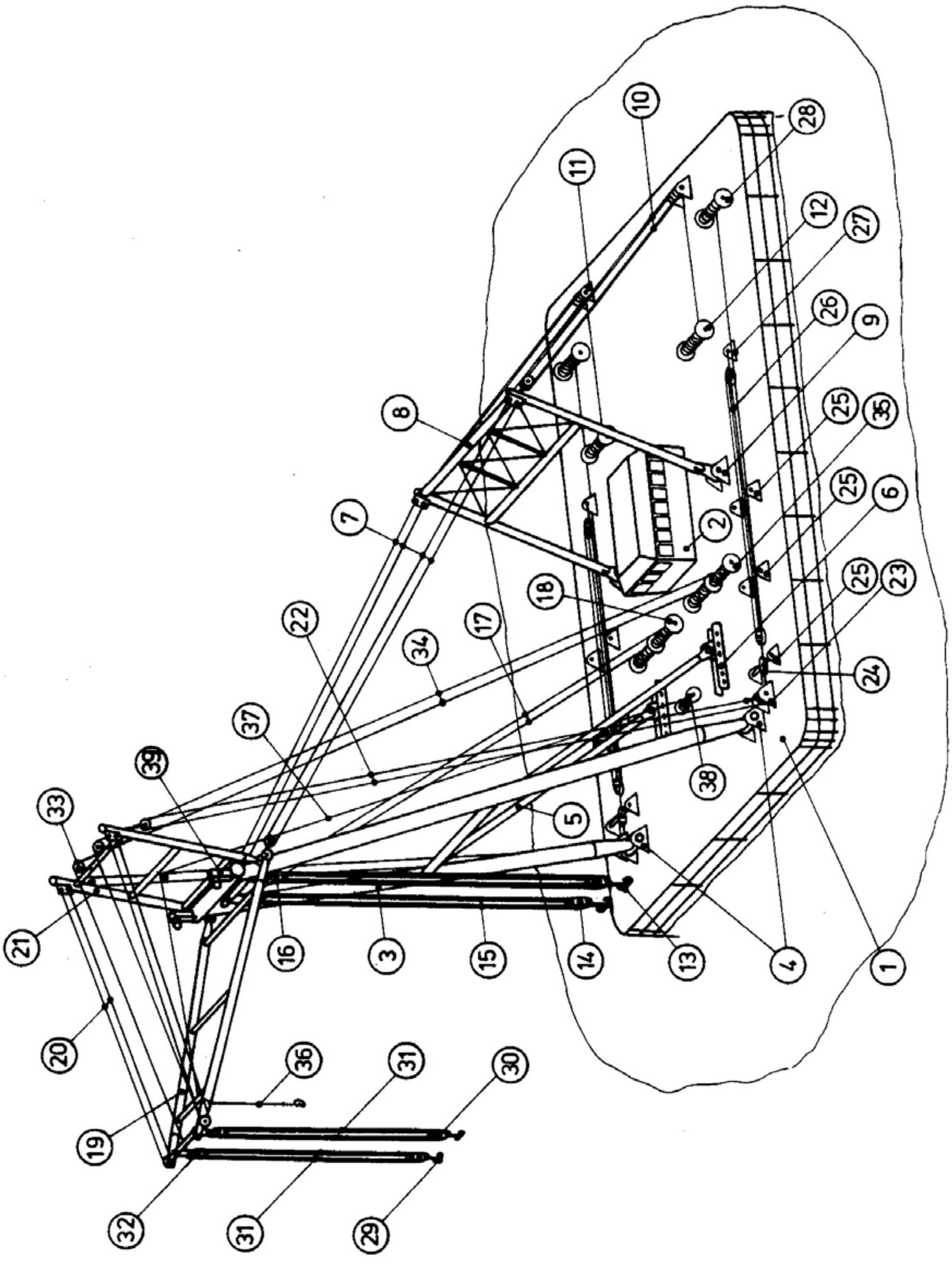


Figure 1.7 Floating Crane, A-frame Type

Pos.	Designation
1	Pontoon
2	Wheel house
3	Main frame (A-frame)
4	Main frame bearing
5	Main frame bracing
6	Guide for main frame bracing
7	Span pendant
8	Span bracing
9	Bearing for span bracing
10	Span tackle
11	Standing block for span tackle
12	Span winch
13	Ramshorn hook
14	Lower purchase block
15	Hoisting tackle for main frame
16	Upper purchase block
17	Hoisting rope of main frame tackle
18	Hoisting winch for main frame tackle
19	Flying jib
20	Span pendant for flying jib
21	Flying jib bracing
22	Adjusting pendant for flying jib
23	Standing block for adjusting pendant
24	Adjusting piece
25	Bearing for adjusting pin
26	Adjusting tackle for flying jib
27	Pad eye
28	Winch for adjusting tackle
29	Ramshorn hook
30	Lower purchase block
31	Hoisting tackle of flying jib
32	Upper purchase block
33	Guide sheave for hoisting rope
34	Hoisting rope of flying jib tackle
35	Winch for flying jib tackles
36	Auxiliary hoist
37	Hoisting rope of auxiliary hoist
38	Winch for auxiliary hoist
39	Bouncing back prevention

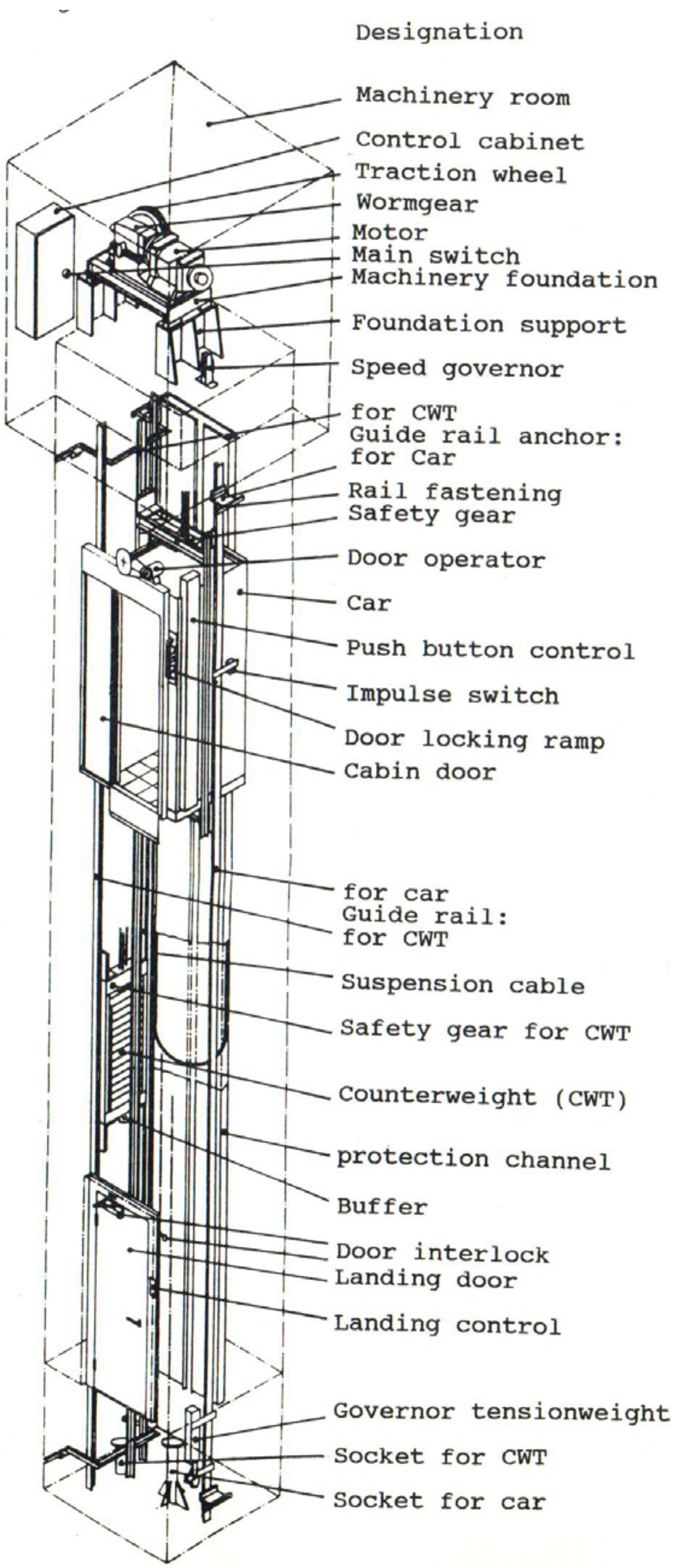


Figure 1.8 Passenger Lift

SECTION 2

DESIGN AND CALCULATION PRINCIPLES

Page

A. General

1. This Section contains provisions of general validity governing the design and calculation of lifting appliances on ships.

Special details, such as the hoist load coefficients for the various types of derricks and cranes, shall be taken from the Sections 3 Table-3.2, Section 4 Table 4-1 and item 3.2.2.

2. The following provisions are based on the assumption that lifting appliances on ships may normally be operated only in "calm water".

The term "calm water" does not exclude the possibility of waves or motion of the sea. However, these shall not cause any appreciable movements of the floating body.

3. The operation of lifting appliances and lifts in a seaway are subject to special provisions, in conformity with Sections 4-6, where applicable.

4. Loads due to the motions of ships in a seaway, when the lifting appliances are stowed, may for the sake of simplicity by calculated in the manner described under C. 2.6.2. In special cases, **TL** may demand a more accurate determination of the relevant loads.

5. The following provisions also apply, as and where appropriate, to loose gear and interchangeable components. Reference should be made to Section 7 with regard to certain special features.

B. Design Criteria

1. Design

1.1 Notes

The determination and specification of the operating conditions on which the design is based are in every case the responsibility of the customer and the manufacturer. The specifications decided upon are of decisive importance to the reliable operation and expected service life.

1. 2 Working conditions

1.2.1 Essential criteria are:

- The frequency of loading or use, i.e. the number of loading cycles within the expected service life,
- The loading condition, i.e. the relative or per-centage frequency at which the Safe Working Load is reached in all the expected loading cycles,
- The type of service, e.g. operation as general cargo, grab or offshore crane.

1.2.2 If case of changing the working conditions of existing lifting appliances, **TL** may, on request, check and if necessary redefine the Safe Working Load.

For instance, in the case of grab cranes which are intended to be used for general cargo, the Safe Working Load may be raised. In the opposite situation, the Safe Working Load may have to be reduced, to safeguard the mechanical strength or the service life of the lifting appliance

2. Special Provisions for Ship's Lifting Appliances

2.1 Notes

2.1.1 Lifting appliances on ships are subject to special loads, which sometimes considerably exceed those for onshore lifting appliances.

2.1.2 The design, dimensioning and construction of lifting appliances have to take account of the special considerations stated below. These are of fundamental importance, and are to be considered in conjunction with, or to complement, the design loads and basic assumptions for calculations. (For the dimensional quantities, see C and D.)

2.2 Inclinations of the ship

2.2.1 Ship's lifting appliances must be designed for the minimum static inclinations shown in Table 2-1, i.e. for operation under these conditions (see also F.4).

2.2.2 For operation in a seaway (larger inclinations, accelerations of the ship), the provisions of Sections 4-6 are to be observed, where applicable.

2.2.3 For the condition, "out of operation in a seaway" the minimum dynamic inclinations shown in Table 2-3, as well as the appropriate ship's accelerations and wind loads are to be observed (see D.5.4.2).

2.3 Wind loads

2.3.1 Ship's lifting appliances are to be designed for increased wind loads in accordance with C.3.1 and 3.2, i.e. both in the "In operation" and "Out of operation" conditions.

2.3.2 Regardless of the higher wind speed used for design purposes, ship's lifting appliances may generally be used only up to a wind speed of about 18 m/s, corresponding to a dynamic pressure of 0,2 kN/m^2 (wind strength of approximately 7 Bft). At higher wind speeds, lifting appliances shall normally be taken out of operation and stowed.

Floating and salvage cranes may be treated separately.

2.4 Sea lashings

2.4.1 Provision must be made for securely lashing all the moving parts of ship's lifting appliances, e.g. derricks, jibs, trolleys, gantries, etc., when at sea. Exceptions, such as topped jibs, require the consent of **TL** in every case.

2.4.2 Lifting appliances and their lashings must be designed in accordance with D.5.4.2, loading condition C.

2.5 Design temperature

2.5.1 The design temperature governing, for instance, the selection of materials (see Section 11, B.1.1) must be at least -10°C.

2.5.2 If the specified design temperature is below -10 C, this must be expressly noted in the drawings or other documentation to be submitted to **TL** for approval by the shipyard or lifting appliance manufacturer, and special consideration must be given to this fact in the choice and manufacture (welding) of materials, as well as in the design of low-temperature-sensitive systems, where applicable.

2.6 Environment conditions

Special attention is to be given to the operation site, weather conditions, humidity, dust, aggressive media, vibrations, etc.

2.7 Corrosion protection

2.7.1 Wall thicknesses

Allowances for rusting are not normally required, but the wall thickness of load-bearing parts of corrodible materials which are either totally enclosed or not easily accessible for inspection or preservation purposes shall be at least 6 mm, or 4 mm for pipes. Pipes, box girders and similar parts, which are not closed on all sides, shall not have a wall thickness of less than 7 mm. (For masts and posts see Section 3, E.I.2.5.1.)

2.7.2 Eyeplates

Welded-on reinforcing rings must be protected against rusting underneath.

2.7.3 Spring washers

Spring washers of corrodible materials may not be used, if they are exposed to the marine atmosphere.

2.7.4 Wire ropes

2.7.4.1 Drawn galvanized wire ropes must be used for running rigging. The wire ropes for standing rigging must be heavily galvanized. Exceptions may be allowed for hoisting ropes (see Section 8, B.1.4).

2.7.4.2 Wire ropes exposed to the weather, i.e. for use above deck, must have a minimum diameter of 10 mm. The minimum diameter for wire ropes used below deck is 8 mm.

2.8 Handling

2.8.1 Cargo hooks

Only cargo hooks in accordance with Table 19, or of similar type, may be used for lifting appliances located above deck. For safe working loads of 20 t and over, ramshorn hooks in accordance with Table 21 may also be used.

2.8.2 Shackles

Form A shackles in accordance with Table 22 may only be used for lower guy blocks, and for all connections on deck. Shackles for cargo hooks in accordance with Table 19, and for cargo chains and swivels, must correspond to form B in Table 22. Shackles of form C in accordance with Table 22 are to be used for all upper rope blocks of lifting appliances, and for the rope connections.

2.8.3 Fibre ropes

The minimum diameter of fibre ropes shall be as stated in Section 8, C.1.4.

2.9 Dimensioning of ropes and interchangeable components

2.9.1 The dimensioning of ropes, i.e. the determination of the minimum breaking load, and the ascertaining of the nominal sizes of interchangeable components in accordance with the Tables in Appendix A is to be based on dead loads and Safe Working Loads at rest, i.e. on purely static loading.

2.9.2 In all cases in which the hoist load coefficient ψ of the assigned lifting appliances exceeds a value of 6, the method of calculation does not conform to 2.9.1 (see Section 7, C.2.3 and Section 8, B.3.4).

3. Conveyance of persons (Section 6, G.4)

3.1 The permitted Safe Working Load (SWL) of lifting appliances for the conveyance of persons must be at least twice as high as the weight and the permissible Safe Working Load of the loose gear used for persons.

3.2 The control system must be able to maintain a maximum permissible lowering and hoisting speed of 30 m/min.

3.3 Where the lowering speed is greater than 18 m/min, the control system must enable the loose gear for persons to come to rest gently.

3.4 A locked shackles or other approved secure connection are to be used instead of the cargo hook. Hinged, e.g. spring-loaded, locking devices are not permitted.

3.5 Special means must be provided for rescuing the occupants from the loose gear in the event of a drive failure.

C. Design loads

1. Types of loads

1.1 The loads acting on the components of lifting appliances are to be distinguished as follows:

- Principal loads
- Additional loads
- Special loads

1.2 Where necessary, loads, resp. load assumptions which are not mentioned or specified in the following paragraphs can be determined by reference to DIN 15 018, ISO 8686-1 or F.E.M., Section 1.

2. Principal Loads

2.1 Dead loads

Dead loads are the weights exerted by all the fixed and movable structural members of lifting appliances permanently present in the system, and the weights of the loose gear.

2.2 Safe Working Load (SWL)

The Safe Working Load is the part of the hoist load which can be directly applied to the supporting element (e.g. cargo hook) of the lifting appliance. The dead loads of loose gear which is not permanently attached to the lifting appliance, but which serves as a connecting link between the load and the lifting appliance, form part of the Safe Working Load.

2.3 Hoist load

The hoist load comprises the Safe Working Load (SWL) and the dead loads of all the lifting appliance components carrying the SWL, e.g. the cargo hook, the cargo block, a part of of the hoisting ropes, etc.

2.4 Horizontal forces generated by inclinations of the ship

2.4.1 Ship's lifting appliances must remain functionally reliable under the action of the ship's inclinations shown in Table 2-1, and must be designed for this operating condition.

2.4.2 If the values in Table 2-1 are applied, the horizontal forces resulting from oblique pulling of the hoisting ropes due to operation, or from the swinging or slewing of derricks or jibs, may generally be regarded as covered. In special cases, **TL** reserves the right to demand more accurate verification.

2.4.3 The angles of heel and trim shown in Table 2-1 shall be deemed to occur simultaneously. If larger inclinations are likely in operation, the design calculations shall be based on these.

Table 2.1 Static inclinations of the ship

Type of floating body	Minimum static inclination	
	Heel	Trim
Ships and similar floating bodies	±5°	±2°
Pontoons	±3°	±2°
Floating docks	±2°	±2°
Floating cranes up to 100 t SWL	±5°	±2°
Floating cranes over 100 t SWL	±3°	±2°
Semi-submersibles	±3°	±3°
Fixed platforms	±1°	±1°

2.4.4 When operating in calm water heeling angles of more than 13° (including the initial heel) and counter heels of more than 6° are generally not allowed.

2.4.5 The above provisions assume that the ship possesses sufficient stability. If this is not the case, **TL** reserves the right to demand special measures.

2.5 Dynamic forces due to drives

2.5.1 Vertical dynamic forces

The vertical dynamic forces due to the acceleration or movement of lifting appliances, parts of lifting appliances or hoist loads are considered in calculation by the dead load coefficients φ and the hoist load coefficients ψ, by which the static loads must be multiplied.

2.5.1.1 Dead load coefficients φ

a) The weights of movable lifting appliance components, such as derricks or jibs, are to be multiplied by a dead load coefficient in accordance with Table 2-2.

b) For travelling lifting appliances or parts of lifting appliances, the coefficient is φ= 1,2. This value covers the dead load coefficients stated in a).

Table 2.2 Dead load coefficient φ

Type and SWL of lifting appliances	Dead load coefficient φ
Derrick booms up to 10 t SWL	1,2
All other lifting appliances and derrick booms over 10 t SWL	
up to 60 t SWL	1,1
over 60 t up to 100 t SWL	1,05
over 100 t SWL	1,00

2.5.1.2 Hoist load coefficients ψ

Hoist loads, or the resulting stresses thereof, are to be multiplied by a hoist load coefficient. The appropriate hoist load coefficients for various lifting appliances shall be as indicated in Sect. 3, 4 and 6.

2.5.2 Horizontal and other dynamic forces

2.5.2.1 Horizontal dynamic forces due to slewing or swinging movements are generally covered by the horizontal forces arising from static inclinations of the ship in accordance with Table 2-1. In special cases, these forces are to be calculated from the installed drive and braking power and the mass to be moved, at specified inclinations of the ship.

2.5.2.2 Horizontal dynamic forces due to travelling movements in the direction of motion are to be calculated from the installed drive and braking power and the mass to be moved (longitudinal horizontal forces). Where the centre of gravity does not coincide with the centre line, the simultaneously generated lateral horizontal forces are likewise to be taken into consideration.

2.5.2.3 It is not normally necessary to consider other dynamic and centrifugal forces. In special cases, **TL** reserves the right to demand that these forces are to be considered

2.6 Dynamic forces due to motions of the ship

2.6.1 Lifting appliances in operation

The provisions of this section apply in calm water.

Where lifting appliances and lifts are operated in a seaway, the provisions of Sections 4-6 are to be observed wherever appropriate.

2.6.2 Lifting appliances out of operation

2.6.2.1 The dynamic forces are to be calculated from the moving behaviour of the floating body. As a minimum requirement, the dynamic inclinations indicated in Table 2-3 are to be taken into consideration.

Table 2.3 Dynamic inclination of the ship

Type of floating body	Minimum dynamic inclination	
	Heel	Trim
Ships and similar floating bodies	±30°	±6°
Pontoons	±12°	±6°
Floating cranes	±12°	±6°
Semi-submersible	±6°	±6°

2.6.2.2 For ships, dynamic forces may be determined by simplified calculation in accordance with Figs. 2-1 and 2-2. In special cases, **TL** may demand more accurate determination of the relevant forces.

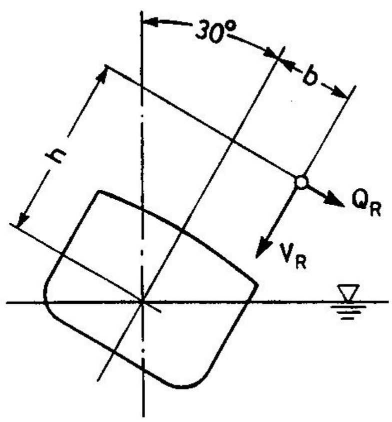


Figure 2.1 Rolling

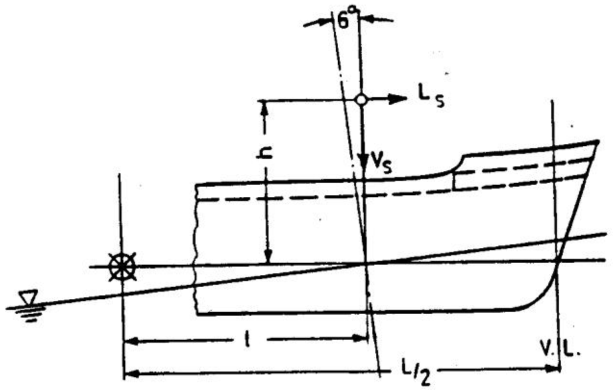


Figure 2.2 Pitching

V_R = WT · (1,04 + 0,02 · b) · 9,81 , [kN]

Q_R = WT · (0,6 + 0,02 · h) · 9,81 , [kN]

WT = Dead load, [t]

S = Centre of gravity of component [m]

h = Height above waterline, [m]

b = Distance from centre line of ship, [m]

V_S = WT · (1,2 + 1,6 · ℓ / L) · 9,81 , [kN]

L_S = WT · (0,125+0,167· ℓ / L+ 0,015· h) · 9,81,[kN]

WT = Dead load, [t]

ℓ = Distance from midship section, ahead or astern, [m]

L = Lenght of ship betw.perpendiculars, [m]

2.6.2.3 The following values are applicable to ponton-type floating bodies by analogy with Figs. 2.1 and 2.2.

V_R = WT·(1,19 + 0,034·b) ·9,81 , [kN]

Q_R = WT· (0,25 + 0,034·h) ·9,81 , [kN]

V_S = WT· (1,21 + 0,017·ℓ)·9,81 , [kN]

L_S = WT· (0,13 + 0,017·h) ·9,81 , [kN]

2.6.2.4 The values for rolling and pitching according to 2.6.2.2 and 2.6.2.3 include heaving in each case, and are to be considered separately, i.e. as not occurring simultaneously.

3. Additional Loads

3.1 Wind load on structural members of lifting appliances

3.1.1 The wind load on a structural member of a lifting appliance shall be deemed to act in the most unfavourable direction, and is to be calculated by the following formula:

$$F_w = c \cdot q \cdot A$$

Where;

F_w = Wind load, [kN]

c = Form coefficient, to be determined by reference to a recognized Standard e.g. F.E.M. Section 1.

q = Dyn. pressure $= \frac{v^2}{1600}$, [kN/m^2]

v = Wind speed, [m/sn] (see 3.1.2)

A = Area acted on by wind (m^2)

3.1.2 The following wind speeds shall be used as the basis for determining the wind load:

3.1.2.1 Ship's lifting appliances

- For the condition "lifting appliances in operation" [22 m/s]

- For the condition "lifting appliances out of operation" [44 m/s]

3.1.2.2 Offshore lifting appliances

- For the condition "lifting appliances in operation" [25 m/s]

- For the condition "lifting appliances out of operation" [50 m/s]

National regulations are to be observed, where applicable.

3.1.2.3 Onshore lifting appliances

The wind speeds used as the basis for calculation are to be determined by reference to a recognized standard, e.g. F.E.M., Section I.

National regulations are to be observed, where applicable.

3.1.3 For the sake of simplicity, wind loads for ship's and offshore lifting appliances may be determined as follows.

3.1.3.1 Ship's lifting appliances

A dynamic pressure of 0,3 kN/m^2 is to be applied for the "in operation" condition, and 1,2 kN/m^2 for the "out of operation" condition.

3.1.3.2 Offshore lifting appliances

A dynamic pressure of 0,4 kN/m^2 is to be applied for the "in operation" condition, and 1,6 kN/m^2 for the "out of operation" condition. National regulations are to be observed, where applicable.

3.1.3.3 The following form coefficients are to be used in conjunction with the dynamic pressures in accordance with 3.1.3.1 and 3.I.3.2.

- Rolled profiles and box girders C = 1,6
- Rectangular areas of closed superstructures e.g. machinery housings C = 1,3
- Circular cross-sections C = 1,2

Where areas acted on by the wind behind one another in the wind direction, the values taken for the rear areas shall be 75 **%** of the respective front areas.

3.2 Wind load acting on the SWL

3.2.1 The wind load acting on the Safe Working Load is to be determined in accordance with 3.1 on the basis of the maximum SWL wind-load area and the most unfavourable direction.

3.2.2 Where more accurate information on the wind-load area is not available, wind load calculations may be made as follows.

$$SWL \leq 50t : F_N = 0{,}36 \cdot SWL \quad , [kN]$$

$$SWL > 50t : F_N = \sqrt{6{,}5 \cdot SWL} \quad , [kN]$$

F_N = Wind Load, [kN]

SWL = Safe Working Load, [t]

3.3 Ice load

3.3.1 Where icing is to be taken into consideration, and no accurate data are available, it shall be assumed for the sake of simplicity that 3 cm thick ice is formed on all structural elements exposed to the weather.

The ice shall be assumed to have a density of 7 kN/m^3.

3.3.2 In case of icing, the wind load is to be based on the increased area of the structural members due to icing.

3.4 Lateral forces when moving (skewing)

3.4.1 When cranes or trolleys are moving, horizontal forces rectangular to the rail may act on the guided wheels. Where two wheels or bogies run on a rail and with guiding on one rail only, the resulting couple of forces may be calculated by multiplying the load on the wheel or bogie by the lateral force coefficient λ indicated in Fig. 2-3. The lateral force coefficient λ depends on the ratio of the span b to the wheel base ℓ.

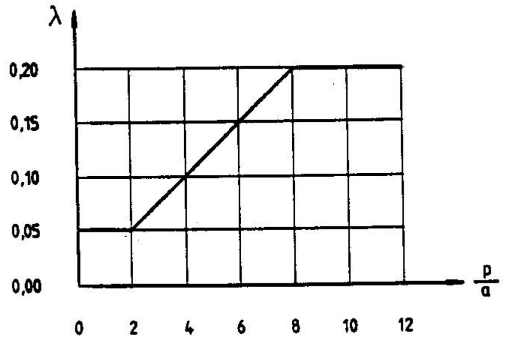


Figure 2.3 Lateral force coefficient λ

3.4.2 More than two wheels or bogies on a rail require special consideration.

3.5 Loads on stairways, platforms and railings

3.5.1 Access ways, platforms, etc. are to be designed for a distributed load of at least 3,0 kN/m^2, and for a moving concentrated load of 1,5 kN.

3.5.2 Hand rails and foot bars are to be designed for lateral loading in the form of a moving concentrated load of 0,3 kN.

3.5.3 The dimensioning of lifting appliances does not need to take account of the loads stated in 3.5.1 and 3.5.2.

4. Special Loads

4.1 Buffer forces

The ends of crane and trolley tracks must be provided with buffers capable of absorbing the kinetic energy corresponding to an impact at 70 % of the travelling speed induced by the action of the dead loads. The resulting forces are to be calculated from the buffer characteristic.

4.2 Test loads

4.2.1 The dynamic test loads for lifting appliances shall be as shown in Table 13-1.

4.2.2 The static test loads for loose gear and interchangeable components shall be as indicated in Tables 7-1 and 7-4 respectively.

D. Basic Details For Calculation

1. General requirements

1.1 The proofs of mechanical strength according to E. must conform to the generally accepted rules of statics, dynamics and stress analysis.

1.2 The data relating to dimensions, cross-sections, materials used, etc. in drawings and calculations must coincide.

1.3 Mobile loads are to be considered as acting in the most unfavourable position for the component in question.

1.4 In the case of system-related, non-linear relationships between loads and stresses, a stress analysis in accordance with second-order stress theory is to be carried out.

2. Materials

2.1 The intended materials are to be indicated in the calculation. Table 11-5 shows a selection of steels generally approved by **TL** for plates and profiles. Other steels may be approved, on application.

2.2 The materials for screws, axles, shafts, bolts, etc. and non-ferrous metals are subject to **TL**'s Rules for Materials.

3. Cross-sectional Values

3.1 The cross-sections to be applied are, for all parts subject to a compressive load, the gross cross-sections (i.e. without deduction for holes), and for all parts subject to a tensile load the net cross- sections (i.e. with deduction for holes).

3.2 Where cross-sections are subject to bending loads, calculations are to be based on the net cross-section on the tension side, and on the gross cross-section on the compression side. The centre of gravity shall be taken to be that of the gross cross- section.

3.3 Elastic deformations, e.g. for the calculation of statically undetermined structural members, are to be ascertained on the basis of the gross cross- sections.

4. Special considerations

4.1 Special evidence is required of the stresses occurring at points where forces are introduced or diverted, changes in cross-section, cutouts, etc., unless this is unnecessary due to special constructional measures.

4.2 Tie rods which can be subjected to compressive stresses in case of minor deviations from the planned design loads are to have a degree of slenderness $\lambda \leq 250$ and be capable of withstanding appropriate compressive stress.

$$\lambda = \frac{\ell}{i} = \ell \cdot \sqrt{\frac{F}{J}}$$

ℓ = Buckling length of the most unfavourable cross-sectional axis [cmj

i = Radius of inertia of the most unfavourable cross-sectional axis [cmj

J = Moment of inertia of the most unfavourable cross-sectional axis [cm^4]

F = Cross-sectional area [cm^2]

4.3 Where fillet welds are subject to compressive stress rectangular to the weld, e.g. between web and flange plates, no account may be taken of contact between the structural members to be joined.

4.4 When determining the cross-sectional values of sections comprising web and flange plates, allowance is to be made, where appropriate, for the effective load-bearing width of the flange plates. This may be done, for instance, in accordance with Chapter 1 of **TL**'s Rules for the Classification of Steel Ships.

4.5 For the connection of circular masts, posts and crane pillars to the deck plating, the thickness of the plate and the weld may be determined by the following formula:

$$\tau_{zul} = \frac{2}{D \cdot d \cdot \pi} \cdot \left(H + \frac{M_t}{D} \right) \left[kN/cm^2 \right]$$

τ_{zul} = Permissible shear stress (see E.6.1)

H = Maximum horizontal force to be transmitted [kN]

M_t = Torsional moment to be transmitted [kNcm]

D = Diameter of connection [cm]

d = Thickness of deck plating or weld [cm]

4.6 Regarding the effective load-bearing width of plates the provisions according to **TL** Hull Rules may be applied.

5. Load conditions

5.1 Instructions

5.1.1 For the purposes of strength calculation, the loads described in C. are to be applied to load conditions A to C in the manner defined below.

5.1.2 Not all load conditions or subordinate categories need to be calculated, where prior examination proves which conditions are relevant.

5.2 Load condition A (principal loads)

This load condition relates to the planned operating conditions of lifting appliances without taking account of additional loads, e.g. the wind load.

Calculations are to be based on: .**(1)**

- The minimum static inclinations shown in Table 2-1

- Dead loads x dead load coefficient φ

- Hoist load x hoist load coefficient ψ

- Horizontal and other dynamic forces as stated in C.2.5.2

5.3 Load condition B (principal and additional loads)

This load condition relates to the planned conditions of lifting appliances, in and out of operation, with taking account of additional loads, e.g. the wind load.

Calculations are to be based on:

5.3.1 Lifting appliances in operation .**(1)**

- The minimum static inclinations shown in Table 2-1

- Dead loads x dead load coefficient φ

- Hoist load x hoist load coefficient ψ

- Horizontal and other dynamic forces as stated in C.2.5.2

- Ice load

- Wind load (in operation) on lifting appliance and Safe Working Load.

Alternatively the following shall be considered, where appropriate:

- The minimum static inclinations shown in Table 2-1

- Dead loads x dead load coefficient φ

- Hoist load

- Wind load (in operation) on lifting appliance and Safe Working Load

(1) *The provisions of C.2.6.1 are also to be observed, wherever appropriate.*

- Lateral forces when moving (skew).

5.3.2 Lifting appliances out of operation

- The minimum static inclinations shown in Table 2-1

- Dead loads

- Ice load

- Wind load (out of operation)

5.4 Load condition C (principal and special loads)

This load condition relates to extraordinary stresses. Calculations are to be based on:

5.4.1 Lifting appliances in operation

- Dead loads

- Hoist load

- Buffer forces

5.4.2 Lifting appliances out of operation

- The minimum dynamic inclinations shown in Table 2-3

- Dead loads

- Dynamic forces due to motions of the ship as stated in C.2.6.2

- Wind load (out of operation)

5.4.3 Lifting appliances under dynamic test load

- Dead loads x dead load coefficient φ

- Test load in accordance with Table 13-1

Alternatively the following shall be considered:

- Dead loads

- Test load in accordance with Table 13-1 x hoist load coefficient ψ.

5.4.4 Interchangeable components under static test load

- Test load in accordance with Table 7-4

E. Strength Computation

1. Scope of Calculations

For the load conditions stated in D.5, at least the first, and where necessary all three, of the proofs stated below are to be performed:

- Proof against reaching the yield point (general stress analysis)
- Proof against failure due to instability, e.g. crippling, tilting and buckling (proof of stability)
- Proof against fracture as a result of frequently repeated stresses variable with time for load condition A (proof of fatigue strength)

2. General Stress Analysis

2.1 The "General stress analysis" is intended to prove the calculatory safety against reaching the material yield point in load conditions A to C.

2.2 Where multi-directional normal stresses, or normal and shear stresses, act simultaneously in a cross-section, the combined stress is to be calculated from the interrelated stresses. For biaxial stresses, o_v is to be calculated as follows:

$$\sigma_V = \sqrt{\sigma_x^2 + \sigma_y^2 - \sigma_x \cdot \sigma_y + 3\tau^2}$$

2.3 The calculated normal stress σ, the shear stress τ, or the combined stress (σ_v shall not exceed the permissible stress stated in 6.1.

2.4 For the calculation of welds, reference should be made to **TL** Hull Rules, Chapter 1.

3. Proof of Stability

3.1 Proof of resistance to crippling, tilting and buckling in load conditions A to C is to be provided in accordance with recognized regulations or standards, e.g. DIN 4114 (stability proofs) or F.E.M., Section I.

3.2 In the case of system-related, non-linear relationships between loads and stresses, proof of stability is to be provided by second-order stress theory. This shall demonstrate that, under ν-fold loading and taking into consideration the effect of deformation, the generated stresses do not exceed the yield point of the material. This can be computed, for instance, in accordance with DIN 4114 (stability proofs) or on the basis of the calculating procedure given in F.E.M., Section I, in which the values of v are also defined.

3.3 For material up to a yield point of R_{eH} = 355 [N/mm^2] the permissible outside diameters of steel tubes relative to wall thickness may be taken from Table 1 in Appendix A without special proof regarding to buckling. (Load condition A.)

For masts to special requirements, the provisions of Section 3, E.2 apply.

4. Proof of Fatigue Strength

4.1 Proof of the resistance of structural members and connecting means to fracture due to frequently repeated stresses variable with time for load condition A is to be provided in accordance with a recognized standard or basis of calculation. Proof may, for example, be based on DIN 15018, or on the calculating procedure given in F.E.M., Section I.

4.2 Proof of fatigue strength shall take account of the following parameters:

- The number of loading cycles, and the stress profile to which the structural member is subjected
- The material used, and the notch condition at the point in question

- The maximum stress σ_{max} in the structural member

- The ratio K of minimum to maximum stresses

$$K = \frac{\sigma_{min}}{\sigma_{maks}}$$

4.3 Without closer investigation for the purpose of proof in conformity with DIN 15018 or F.E.M., Section I, cranes may be categorized according to the details in Table 2-7.

4.4 Individual and clearly distinguished structural parts or members may be differently categorized based on detailed knowledge of the operating conditions.

4.5 In the case of certain types of crane, proof of fatigue strength may be dispensed with (see also Section 4).

4.6 In case of derricks, masts and posts a proof of fatigue strength is generally not required.

4.7 TL reserves the right to impose special demands in particular cases (e.g. for construction cranes working in unprotected waters.

5. Proof of Bolt Forces

5.1 Circular connections

5.1.1 For the bolts of slew rings and flanges in general the maximum tensile force in the most exposed bolt can be determined for the sake of simplicity as follows:

$$Z = \left[4 \cdot \frac{M}{D \cdot n} \pm \frac{N}{n}\right] \leq Z_{per}$$

Z = Tension force in the most exposed bolt, [kN]

M = Maximum bending moment [kNm]

D = Diameter of bolt circle, [m]

n = Number of bolts

N = Tension (+) resp.compression (-) force from the vertical load

Z_{per} = Allowable force in the most exposed bolt acc. to 5.1.3 and 5.1.4

5.1.2 The formula acc. to 5.1.1 is valid under the assumption that foundation and crane connecting flanges are sufficiently rigid and that at least 12 bolts are engaged.

5.1.3 Flanges in general

5.1.3.1 The permissible stresses of normal tensile bolts are to be in accordance with E.6.1 and Table 2-8.

5.1.3.2 Where high tensile bolts of the strength group 10.9 are used in connection with face plates or flanges the permissible loads may be as specified in DASt-Richtlinie 010.

5.1.4 Slew rings

5.1.4.1 For slew rings the following equation may be used for load condition A:

Z_{per} = $\sigma_{Aper} \cdot F_K \cdot 0{,}6 \cdot k$, [kN] (see Table 2-6)

σ_{Aper} = Permissible utilization stress of bolts according to Table 2-4 [kN/cm^2]

F_K = Core section of bolts according to Table 2-5 [cm^2]

k = Correction factor for slew rings according to 5.1.4.3.

5.1.4.2 The permissible utilization stress according to Table 2-4 is valid for preloading of bolts by applying a torsion moment (V_D in Table 2-6). In case of preloading by hydraulic elongation (V_L in Table 2-6) the values in Table 2-4 may be increased by 20 **%** for the strength groups 8.8 and 10.9.

Table 2-4 Permissible utilization stress

Strength group	8,8	10,9	12,9
$\sigma_{A,per}$ [kN/cm^2]	50	70	84

5.1.4.3 The correction factor k according to 5.1.4.1 is to be employed as follows:

- spherical bearings
  k = 0,909
- roller bearings
  k = 0,976

V_D = Preloading of bolts by applying a torsion moment (admissible until appr. 30 mm bolt diameter)

V_L = Preloading of bolts by hydraulic elongation

F_k = Core section of bolts according to Table 2-5 in [cm^2]

Table 2.5 Core sections of bolts

Bolts	F_k [cm^2]	
ϕ	V_D **(1)**	V_L **(1)**
20	2,25	
22	2,82	
24	3,24	
27	4,27	
30	5,19	
33		6,17
36		7,23
39		8,73
42		9,99
45		11,74
48		13,20
52		15,90
56		18,33
64		24,26
72		31,74
80		40,23

(1) *V_D and V_L, see Table 2.6.*

Table 2.6 Permissible bolt forces

Z_{zul} [kN] **(1)**				
Material of bolts	Spherical bearings		Roller bearings	
	V_D	V_L	V_D	V_L
8.8	27,2 · F_k	32,7 · F_k	29,3 · F_k	35,1 · F_k
10.9	38,2 · F_k	45,8 · F_k	41,0 · F_k	49,2 · F_k
12.9	45,8 · F_k	—	49,2 · F_k	—

(1) *Valid for load condition A, see D.5.2.*

5.2 Rectangular connections

5.2.1 In case of rectangular connections according to Fig. 2-4 and if the connecting plates possess sufficient stiffnes the maximum bolt forces may be calculated as follows:

5.2.1.1 Normal force and bending in one direction ::

$$Z = \frac{M_{x,y}}{W_{x,y}} \pm \frac{N}{n}$$

Z = Tension force in the most exposed bolt [kN]

$W_{x,y}$ = Section modulus of a group of bolts for the x- or y- axis according to Fig. 2.4

N = Tension (+) resp. compression (-) from the vertical load [kN]

n = Number of bolts

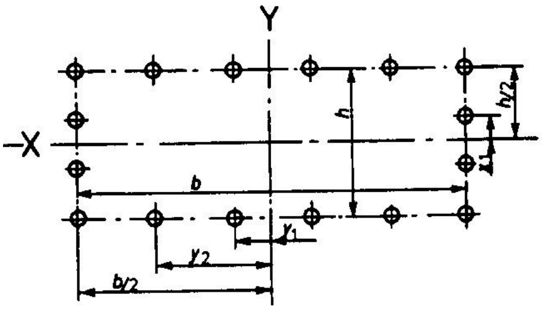


Figure 2.4 Section modulus of a group of bolts related to a single bolt

$$W_x = 2\left[6 \cdot \frac{h}{2} + 2\frac{x_1^2}{h/2}\right]$$

$$W_y = 2\left[4 \cdot b/2 + 2\frac{y_2^2}{b/2} + 2\frac{y_1^2}{b/2}\right]$$

Table 2.7 Categorization of cranes for proof of fatigue strength

Crane type	DIN 15018		F.E.M., Section 1
	Hoisting class	**Loading group**	**Appliance group**
Crane type A			
Lifting appliances not used for cargo handling	H1	B2	A2-A3
Crane type B			
General cargo cranes up to 60 t SWL	H2	B3	A3-A4
General cargo cranes over 60 t SWL	H2	B2	A2-A3
Container cranes	H2	B3	A4-A5
Crane type C			
Grab cranes, type C1	H3	B4	A4-A5
Cranes for palletized cargoes	H3	B5	A5-A6
Grab cranes, type C2	H4	B5	A5-A6
Offshore cranes			
Main hoist up to 60 t SWL	H2	B3	A3-A4
Main hoist over 60 t SWL	H2	B2	A2-A3
Hoist (whip hoist)	H3	B5	A5-A6
Working cranes on deck	H1	B2	A2-A3
Floating cranes			
Hook operation up to 60 t SWL	H2	B2	A2-A3
Hook operation over 60 t SWL	H1	B2	A1-A2
Hook operation over 500 t SWL	H0	B1	A1
Grab operation up to 60 t SWL	H4	B5	A4-A5
Grab operation over 60 t SWL	H2	B3	A3-A4

5.2.1.2 Normal force and bending in two directions:

In this case procedure to be applied is in analogy to Section 4, F.3.2 based on 5.2.1.1.

6. Permissible Stress

6.1 The permissible stresses for structural members and welds for the general stress analysis and proof of stability are to be calculated by the following formula.

$$\sigma_{perl}/\tau_{per}/\sigma_{vper} = \frac{23,5}{k+\nu} = \frac{0.8 \cdot R_{eH} + 4.8}{\nu}\left[\mathrm{kN/cm^2}\right]$$

σ_{per} = Permissible normal stress,

τ_{per} = Permissible shear stress,

σ_{vper} = Permissible combined stress,

ν = Safety factor in accordance with Table 2.8

k = material factor $= \frac{29,5}{R_{eH} + 6,0}$

R_{eH} = yield point of material according to material specification or Standard in [kN/cm^2] (see Table 11.5)

6.2 If accurate stress analyses according to recognized calculation procedures, e.g. using the finite element method, or proof based on measured data are provided, **TL** may, according to circumstances, agree to the permissible stresses stated in 6.1 being increased by up to 10%.

6.3 For masts to special requirements, permissible stresses other than those stated in 6.1 are applicable (see Section 3, E.2).

6.4 The permissible stresses stated in 6.1 apply to the longitudinal stresses in welds. For the transverse stress in welded seams, proof may, where appropriate, conform to DIN 15018 or F.E.M., Section I.

6.5 The permissible stresses for axles, shafts, bolts and rivets are to be calculated as described in 6**.**1**.**

6.6 The permissible stresses for proof of fatigue strength are to be determined in accordance with the categorization of the lifting appliances or parts thereof, the material used, the ratio κ**,** of the min. and max. stresses and the notch condition, based on DIN 15018 or F.E.M., Section I.

6.7 In calculations relating to non-preloaded bolt connections, the yield strength applied shall not be greater than 235 N/mm^2 even when bolts with a higher yield point are used (prevention of change by mistake).

Deviating from this, the higher yield point of bolt connections may be made use of provided that it is not intended to unscrew the bolts either in accordance with a schedule or for carrying out normal maintenance.

6.8 Regarding the permissible stresses acting in higher-tensile bolts the following is to be observed:

6.8.1 The calculation and the permissible loading of the bolts must conform to recognized regulations, rules or standards.

6.8.2 The loading of bolts for slewing rings shall not be greater than that stated under 5.1

6.9 The permissible stresses for aluminium alloys are to be calculated as follows:

- $$\sigma_{per}/\tau_{per}/\sigma_{vper} = \frac{R_{p,02}}{\nu}, \left[\mathrm{kN/cm^2}\right]$$

for σ_{zul} , τ_{zul} and σ_{vzul} see 6.1.

ν = Safety factor according to Table 2-8

$R_{p0,2}$ = 0,2 ***%*** upper yield point of aluminium alloy [kN/cm^2]

F. Special Proofs

1. Protection Against Jack-knifing

In the case of lifting appliances whose cargo runner or cargo tackle runner is reeved between the derrick or boom head and the mast or post a greater number of times than between the load and the derrick boom or head, and which are topped by ropes, proof shall be provided that jack-knifing of the derrick- or crane boom cannot occur.

2. Deflection of Boom Heads

The heads of booms which are held by luffing cylinders and operate on the cantilever principle shall generally show no greater deflection than 1% of the boom length under the static Safe Working Load.

3. Safety Against Overturning

3.1 Instructions

3.1.1 Proof of safety against overturning shall be provided for travelling lifting appliances, even where they move on a circular track.

3.1.2 Lifting appliances which travel on rails must be equipped with devices to prevent overturning, and must generally be stable even without such devices.

3.1.3 The safety against overturning of a lifting appliance is a measure of its resistance to overturning. The many factors which influence safety against overturning in the longitudinal and transverse directions include dead load and dead load distribution, track gauge, wheel base, Safe Working Load and load radius, motor power, and the deformations which occur under load.

3.1.4 Compliance with the parameters underlying the proof of safety against overturning ensures safe working, when the equipment is normally and carefully operated. It should be noted that the danger of overturning arising from inexpert or incorrect operation cannot be precluded, no matter how stringent the conditions for proof of safety against overturning.

Table 2.8 Safety coefficients

Safety factor ν for structural members						
Member	Type of stres	Load condition A	Load condition B	Load condition C	Relevant diameter or section	Type of stress
Plates, profiles, axles, shafts	Compressive and compressive /bending stress where proof of resistance to crippling tilting or buckling (e.g. to DIN 4114) is required.	1,60	1,40	1,28	—	σ
	Tensile and tensile/ bending stress; compressive and compres sive/bending stress where proof of resistance to crippling, tilting or buckling is not required.	1,40	1,20	1,12	—	σ
	Shear	2,40	2,10	1,92	—	τ
	Combined stres	1,40	1,20	1,12	—	σ_v
Fitted bolts and screws	Shear Single-shear Multi shear	 2,70 2,00	 2,35 1,75	 2,16 1,60	 Hole ϕ Hole ϕ	τ
	Bearing pressure Single-point Multi -point	 1,10 0,80	 0,95 0,70	 0,88 0,64	 Hole ϕ Hole ϕ	σ
	Axial tension	2,50	2,15	2,00	Stressed section	σ
Anchor bolts, non-fitted bolts and screws	Shear	3,40	3,00	2,70	Shank ϕ	τ
	Bearing pressure	1,50	1,30	1,20	Shank ϕ	σ
	Axial tension	2,50	2,15	2,00	Stressed section	σ
Rivets*) allowed only in exceptional cases	Shear Single-shear Multi shear	 2,70 2,00	 2,35 1,75	 2,16 1,60	 Hole ϕ Hole ϕ	τ
	Bearing pressure Single-point Multi -point	 1,10 0,80	 0,95 0,70	 0,88 0,64	 Hole ϕ Hole ϕ	σ
	Axial tension *)	8,00	7,00	6,40	shank ϕ	σ

3.2 Proof of safety against overturning

3.2.1 Lifting appliances in operation

3.2.1.1 With regard to safety against overturning, a distinction is made between lifting appliances on rails and fork lift trucks.

3.2.1.2 The stability of fork lift trucks must be determined on an inclinable platform for each new type.

On the basis of the results obtained, the manufacturer shall, on request, revise and certify the conditions ensuring stable operation on inclined planes (due to inclinations of the ship, or the camber and sheer of decks).

3.2.1.3 Mathematical proof is regarded as sufficient for the safety against overturning of lifting appliances on rails. This proof shall conform to the details in Table 2-9

Table 2.9 Proof of safety against overturning

1	2	3	4
Load condition	Dead load	Safe working load	Inclinations of deck and ship
1) operation with wind	1,0·WT	1,2·SWL	Allowed for
2) operation wihout wind	1,0·WT	1,45·SWL	Göz önüne alınacak
3) emergency test (without wind)	1,0·WT	$\psi \cdot PL_{din}$ **(1)**	Göz önüne alınacak
(1) *PL_{dyn}, according to Table 13.1, ψ according to C.2.5.1.2.*			

3.2.1.4 A lifting appliance is deemed to be safe against overturning if - relative to the respective most unfavourable tilting edge - the sum of all moments is ≥ 0 in the load conditions stated in Table 2-9. Moments tending to overturn the appliance are to be taken as negative.

3.2.1.5 Where desirable or necessary, e.g. in the case of existing lifting appliances, proof of safety against overturning may also be provided by a special loading test.

This test must in each case be agreed with the head office of **TL**, which will also determine the magnitude of the test load and the nature of the test (static and/or dynamic).

3.2.1.6 Devices to prevent overturning are to be dimensioned for the overturning moment which would result from twice the Safe Working Load, or where lifting appliances without prevention devices are not safe against overturning (exceptions to 3.1.2), in accordance with the forces occurring in operation.

3.2.2 Lifting appliances out of operation

3.2.2.1 Travelling lifting appliances must have a special parking or stowage position, where they can be securely lashed for sea (see B.2.4).

3.2.2.2 Subject to 3.2.2.1, no special proof of safety against overturning is required for the "stowed" condition.

4. Increase of Load Radius by Inclination of the Floating Body

4.1 The increased load radius of lifting appliances resulting from the allowed inclination, i.e. the minimum inclination on which the dimensioning was based, as shown by example in Fig 2-5, may generally be made use of

4.2 Calculation of load radius:

$$A = \cos\alpha \cdot \sqrt{A^2 + H^2}$$

$$A^1 = \cos(\alpha - \theta) \cdot \sqrt{A^2 + H^2}$$

5. Tearing off of the Load

For the lifting appliances of salvage vessels, mathematical proof is required that the lifting appliance cannot bounce back in the event of the load tearing off.
If no accurate proof can be supplied, a negative hoist load coefficient ψ of -0,3 is to be used in calculation.

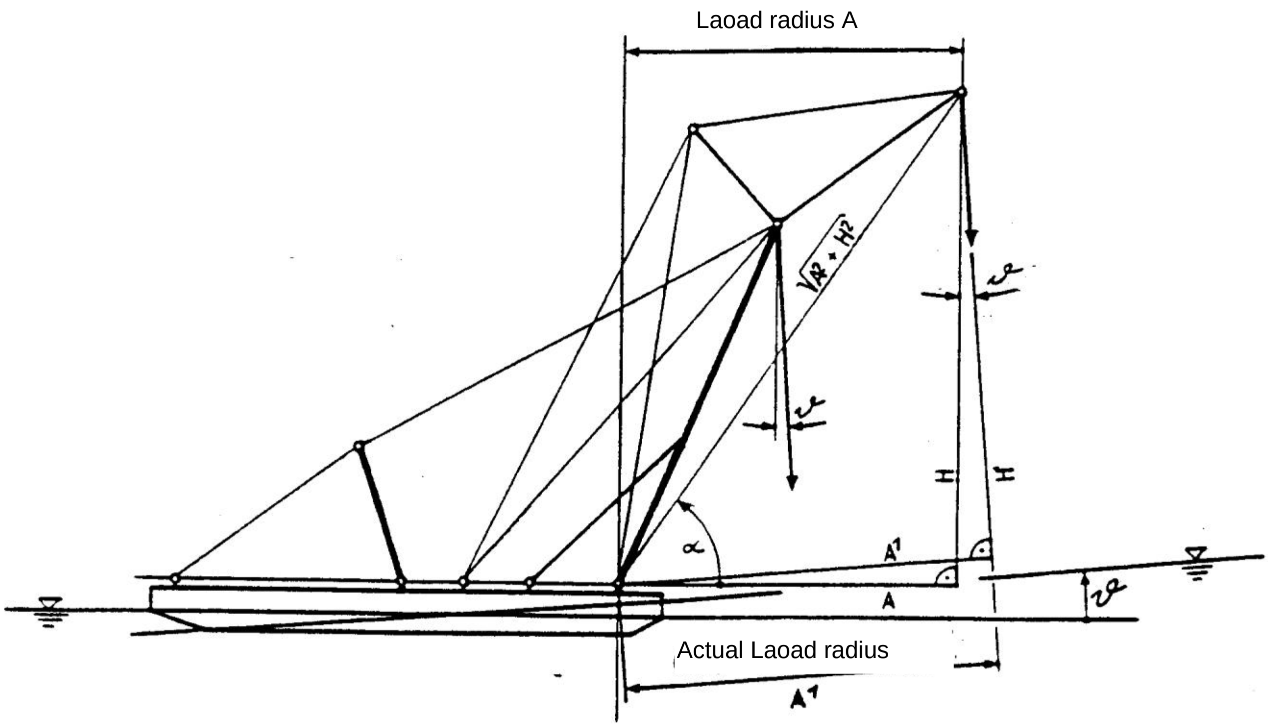


Figure. 2-5 Increase of load radius by inclination of the floating body

SECTION 3

DERRICK BOOMS, MASTS AND ACCESSORIES

A. General

1. The dimensioning and testing of derrick booms including derrick masts, derrick posts and their standing rigging on board ships does not constitute part of the classification of the ship. The classification does, however, include checking the structure of the ship's hull in way of the forces transmitted thereby.

2. As regards the materials to be used, and welding, the regulations in Sections 11 and 12 apply.

3. As regards design and dimensioning of interchangeable components and ropes, the regulations in Sections 7 and 8 apply.

4. As regards the requirements for winches, other mechanical parts or the electrical equipment, the regulations in Sections 9 and 10 apply.

5. In this Section a distinction is made in principle between three derrick boom systems. The designation of the different components of some derrick boom systems should be taken from Figures 1-1 to 1-4.

5.1 Derrick booms with a single span:

- without guy winches (Fig. 1-1)
- with guy winches (no illustration)
- with coupled cargo runners (Fig. 1-2 and 1-3)

5.2 Derrick booms with twin spans (Fig. 1-4)

5.3 Other derrick boom systems (no illustration)

6. The following regulations are based on the assumption that derrick booms may generally only be operated in calm water.

For operation in a seaway (e.g. when operating in harbours with a swell or in a roadstead) the Safe Working Loads (SWL) laid down for calm water are to be reduced appropriately. In the case of derrick booms with twin spans there must not be any slackening of either span (see also B.3.1).

B. Design criteria

1. Working ranges

1.1 In general, the determination of forces for derrick booms with SWLs up to 10 t is to be based on an angle of 15° between the boom and the horizontal; that for booms with higher SWLs, on an angle of 30°. On application, some other angle may also be permitted.

There is no prescribed maximum permissible angle between derrick booms and the horizontal. This angle is to be determined according to requirements and will generally be no more than 75°.

1.2 When working with fixed derrick booms and coupled cargo runners, the working range depends decisively on the boom length.

It is recommended that the derrick boom length should be chosen so that the entire length of the hatch and an adequately-sized area outboard can be served with one pair of booms, or with two pairs together if there are two working the hatch.

1.3 The determination of the slewing ranges of derrick booms with twin spans, are to be based on ship inclination, dead load and SWL.

1.4 The working ranges of fixed derrick booms with coupled cargo runners and of derrick booms with twin spans are to be stated in the rigging plans together with the permissible inclination of the ship.

2. Instructions for dimensioning

2.1 From the forces established statically according to C, the minimum breaking loads of ropes are to be calculated directly in accordance with Section 8. These static forces also form (directly or indirectly) the basis for the determination of the nominal sizes of the interchangeable components or the cargo gear fittings in accordance with the Tables in Appendix A.

2.2 For the steel components, such as derrick booms, masts and posts the forces and moments derived from the static loads are to be multiplied proportionately by the dead load coefficients according to Table 2-2 and the hoist load coefficients according to Table 3-2. The sectional loads thus obtained are to be used as a basis for dimensioning.

2.3 The hoist load coefficient ψ_1 is to be used if only the SWL has been considered in the determination of the forces; otherwise ψ_2 is to be used.

3. Special instructions

3.1 In the case of derrick booms with twin spans, proof must be provided that there is no slackening of either of the spans over the intended working range. This is to take into account heel and trim, and for derrick booms with SWLs below 20 t if applicable also the swinging acceleration.

3.2 In the case of derrick booms with guy winches, the swinging range is to be limited so as to prevent the forces becoming excessively large. In the case of two-drum guy winches, proof is to be provided that with the ship upright the derrick boom is held securely above the hatch by the guys.

3.3 In the case of masts and posts that are foldable, proof is to be provided that during these processes the permissible stresses according to load condition A are not exceeded.

C. Determination of system forces and rating of guys

For the determination of forces as described below as a matter of principle a static SWL and static dead loads are to be used, if necessary taking into account the inclination of the ship and other influences.

1. Derrick booms with a single span (Single-span gear)

1.1 Derrick booms without guy winches

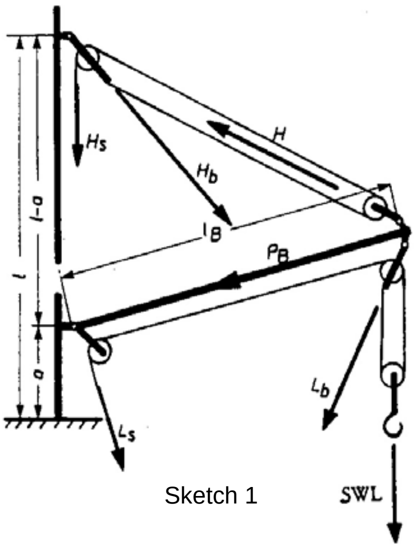
1.1.1 For the design calculations for gear with one span with manually operated guys and SWLs up to 10 t, only the SWL needs to be taken into account so long as the attributable dead load at the boom head does not exceed 0,15 x SWL. Otherwise, loads as in 1.2.2 are to be taken into account and the forces to be determined as described in 1.2.4.

1.1.2 The forces in gear with one span as in 1.1.1 can be determined either by calculation using Tables 2 to 6 in Appendix A or graphically after the example in Fig. 3-1.

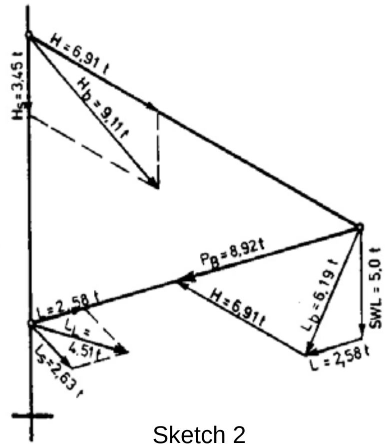
1.1.3 Each guy is to be rated at least to meet the connection loads shown in Table 3-1.

Table 3.1 Connection loads for rating the guys

SWL of the boom (t)	1	2	3	5	10	16	>16
Connection load in the guy (t)	1	1,5	2	3	3,75	4	0,25 · SWL



Sketch 1



Sketch 2

Figure 3.1 Diagram of forces for derrick booms with a single span

Designation of the forces

H = Span force,

H_b = Force on the suspension of the upper span block,

H_s = Tension in the span rope

L_b = Force on the suspension of the upper cargo block **(1)**

L_L = Force on the suspension of the lead block

L_s = Tension in the cargo runner stress,

1.2 Derrick booms with guy winches

1.2.1 The calculations for single-span gear swung by means of guy winches may, as described in 1.1.1, be carried out with simplified assumptions if with the derrick booms fully swung out and carrying the full SWL the ship heels less than 5 , or if the angle between derrick boom and the long guy (weather guy) equals or exceeds 30 .

1.2.2 The forces in single-span gear as in 1.2.1 can be determined either by calculation using Tables 2 to 6 in Appendix A or graphically according to example in Fig. 3-1.

1.2.3 If one of the conditions described in 1.2.1 is not complied with, in the determination of the forces, apart from taking account of the SWL, account must also be taken of the attributable dead load at the boom head and either of the minimum static inclinations according to Table 2-1 or, if greater, the maximum possible inclinations of the ship.

1.2.4 The forces in single-span gear as in 1.2.3 are to be determined in a suitable manner. For instance for the vertical plane this may be done analogously to 1.2.2, taking into account the attributable dead loads at the boom head. For the forces induced by the guys the procedure as shown in Fig. 3-2 may be applied analogously.

1.2.5 The rating of the guys is determined by the static forces obtained by calculation or from the diagram of forces. However each guy is to be rated at least to meet the connection forces as in Table 3-1

1.3 Derricks rigged in union purchase

1.3.1 For calculations of derricks in union purchase, whose guys and preventers are operated either manually or by means of winches, only the SWL needs to be taken into account.

1.3.2 The determination of the forces in union purchase derricks may be carried out either by calculation or simplified according to the graphic procedure as in Fig. 3-2.

(1) *$L_{bmax} \cong 1.5 \cdot SWL$ only valid in the case shown.*

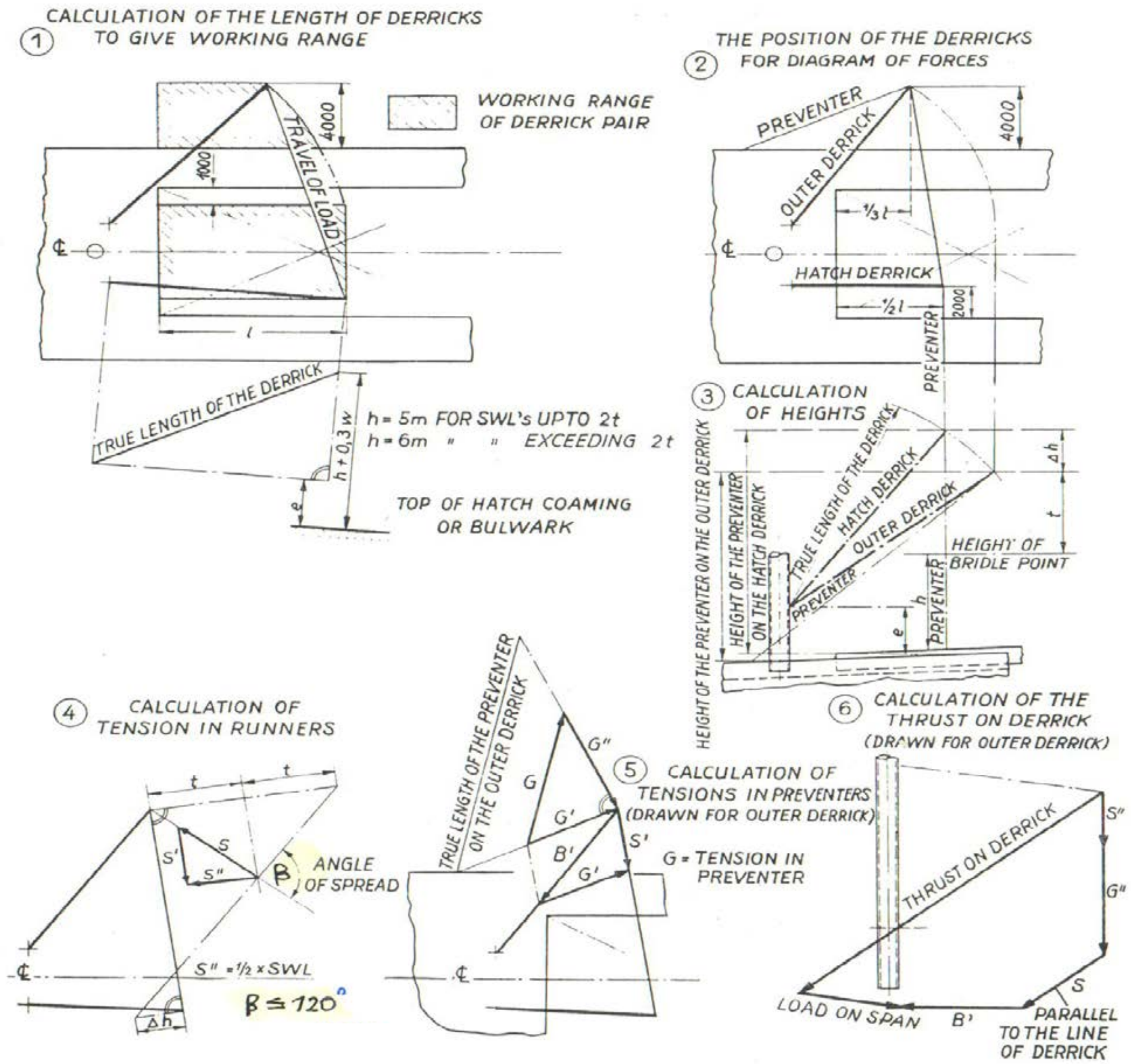


Figure 3.2 Diagram of forces for derricks in union purchase

1.3.3 Explanation of Fig. 3-2

1.3.3.1 One procedure for determining the required boom length where the working range has been fixed is shown in sketch (1). Here both derrick booms must be assumed to have the same inclination and thus be drawn with the same projected length. The same procedure may also be used to determine the associated working range, if the length of the booms has already been fixed for some particular reason. In that case, for the determination of the height of the derrick head (h + 0,3w) instead of the actual length w of the load path as a first approximation its athwartship component should be inserted.

Should the distance between the two derrick boom foot bearings be more than 0,25 times the length of the derrick boom, or the hatch width be more than 0,5 times the derrick boom length, then for the determination of the working range additionally the position of the head of the inner boom 1 m is to be assumed to be alongside the coaming of the hatchway being worked over.

1.3.3.2 The following conditions must be complied with:

a) Over the whole of the working range the height of the coupling point above the bulwark or the hatch coaming, with SWLs as envisaged for this method of working up to 2 t must be at least 5 m, above 2 t at least 6 m.

b) At the point where the two cargo runners are at the same angle to the vertical, their angle of spread may not exceed 120°.

c) The outer boom must be able to work out to an adequate distance from the ship's side (at least 4 m).

1.3.3.3 For the determination of the forces arising when working with derricks in union purchase it is sufficient to draw a force diagram for the derrick positions shown in sketch (2) (head of the inner boom halfway along its working range, 2 m clear of the hatchway coaming on the same side of the ship; head of the outer boom at 1/3 of the length of the working range of the inner boom at the greatest distance envisaged athwartship).

The position of the foot of the inner preventer is to be assumed to be roughly abreast the head of the inner boom in the position given in the previous paragraph, at the ship's side.

The position of the foot of the outer preventer is to be fixed in such a way that the determination of forces (see sketch (6)) does not reveal any negative span forces. A simple procedure for determining the forces is shown in the sketches (2) to (6). The determination of the preventer forces and the derrick boom load is to be carried out for both booms.

1.3.3.4 In the case of pairs of derrick booms with guy and/or preventer winches, the maximum forces are to be determined for the design of the winches.

In general the maximum forces arise with the derrick booms in the following positions:

the <u>inner boom</u> at its smallest angle of inclination at the opposite end of the hatchway;

the <u>outer boom</u> at its maximum permissible distance from the ship's side and its maximum possible angle of inclination.

1.3.4 Guys and preventers are to be rated to meet the maximum forces according to 1.3.3.4.

2. Derrick booms with twin spans (twin span gear) and other derrick boom systems

2.1 For calculations relating to gear with twin spans and other boom systems other than those in 1, account must be taken of the SWL, attributable dead loads at the derrick head and either the static minimum inclinations as in Table 2-1 or, if greater, the maximum possible inclinations of the ship.

For dimensioning masts, posts and derrick booms, the dead loads are to be multiplied by the dead load coefficient φ according to Table 2-2 and the hoist load by the hoist load coefficient ψ_2 according to Table 3-2.

2.2 In the case of gear with SWLs up to 20 t, account is to be taken of the swinging acceleration in addition to the load assumptions as in 2.1.

2.2.1 In the case of gear with SWLs up to 10 t, an angle of heel increased by 3° may be used instead of the swinging acceleration.

2.2 2 In the case of gear with SWLs over 10 t and up to 20 t, an angle of heel increased by 2° may be used instead of the swinging acceleration.

2.3 The forces arising are to be determined in a suitable way, either by calculation or graphically.

2.4 The guys are to be rated in accordance with the maximum forces.

D. Dimensioning of derrick booms

For calculations relating to derrick booms, the regulations in Section 2 apply. In addition the following applies, the largest as well as the smallest inclination of the derrick boom being investigated as a rule:

1. Derrick booms with one span

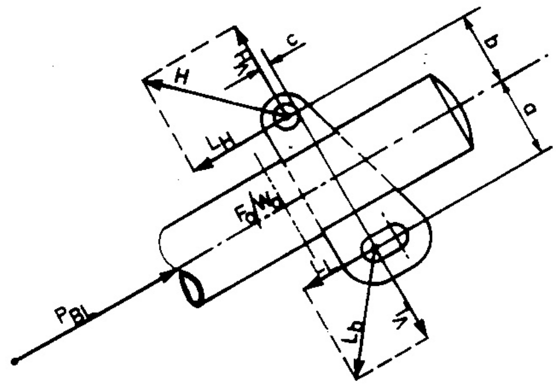
1.1 Derrick booms in accordance with C.1.1.1 and C.1.2.1

1.1.1 On the basis of the forces in the gear determined according to C.1.1.2, dimensioning can be according to Table 7 in Appendix A within the limiting conditions stated there.

1.1.2 As an alternative to 1.1.1, or if the limiting conditions in Table 7 are not complied with, the derrick-boom calculations may be as follows:

1.1.2.1 Derrick boom head

The loadings resulting from a static SWL can be seen from Fig. 3-3.



$V_H = V_L$ (*)

Figure 3.3 Boom head, vertical loads

(*) *Effect of M_{VL} neglected. (M_{VL} see Figure 3.4).*

H, L_b = forces resulting from static SWL, according to Table 2 [kN]

$$\sigma_{zul} \geq \Psi_1 \cdot \left(\frac{P_{BL}}{F_0} + \frac{M_{VL}}{W_0}\right), \left[kN/cm^2\right]$$

$$\sigma_{zul} = \frac{0{,}8 \cdot R_{eH} + 4{,}8}{1{,}6} \quad \text{, (Section 2, E.6.1)}$$

ψ_1 = Hoist load coefficient acc. to Table 3.2

P_{BL} = Boom load from SWL

= $L_H + L_s$, [kN]

M_{VL} = $L_H \cdot b - L_L \cdot a - V_L \cdot c$, [kNcm]

F_0 = Cross-sectional area at boom head fitting, [cm^2]

W_0 = Section modulus at boom head fitting [cm^3],

Table 3.2 Hoist load coefficients for derrick booms

Safe Working Load of gear (SWL) [t]	Minimum reeving of cargo tackle	ψ_1 **(1)**	ψ_2 **(1)**
Less than10	1 fold	1,80	1,45
10	2 fold	1,74	1,38
15	2 fold	1,69	1,37
20	3 fold	1,64	1,33
25	4 fold	1,59	1,29
30	5 fold	1,55	1,26
40	6 fold	1,48	1,21
50	7 fold	1,42	1,17
60	8 fold	1,35	1,12
80	9 fold	1,25	1,06
100 and over	10 fold	1,15	1,00

Should the number of reevings of the cargo tackle fall below the minimum given in the Table, the hoist load coefficients should be determined in accordance with the following equations:

$\psi_1 = 1,80 — 0,03 \cdot \text{reeving} — 0,0035 \cdot SWL$

$\psi_2 = 1,45 —0,03 \cdot \text{reeving} — 0,0015 \cdot SWL$

For gear with a book speed V_s, greater than 40 m/min the coefficients ψ_1 and ψ_2 to be multiplied by the factor $(0,9+V_s/400)$.

(1) *For gear which does not handle cargo, e.g. provision or hose-handling booms, these values may be reduced by 15%; however, values below 1,00 are not permissible.*

1.1.2.2 Derrick boom middle

The loadings resulting from a static SWL can be seen from Figure 3.4.

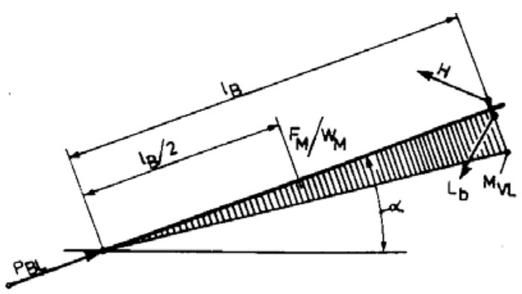


Figure 3.4 Derrick boom middle, vertical loading

P_{BL}, M_{VL} see Figure 3.3

ℓ_B = Length of derrick boom, [cm]

$$\sigma_{zul} \geq \psi_1 \cdot \left(\omega \cdot \frac{P_{BL}}{F_M} + 0,9 \cdot \frac{M_{VL}}{2 \cdot W_M} \right) \left[kN/cm^2 \right]$$

$$\sigma_{zul} = \frac{0,8 \cdot R_{eH} + 4,8}{1,6}$$, (See 2, E.6.1)

ψ_1 = Hoist load coefficient acc. to Table 3.2

F_M = Cross-sectional area at mid-length [cm^2]

W_M = Section modulus at mid-length, [cm^3]

ω = Buckling coefficient according to 1.1.2.3.

1.1.2.3 Buckling coefficient ω

The buckling coefficient ω, depends on the slenderness ratio λ of the derrick booms and can be obtained from the relevant publications, e.g. DIN 4114, or calculated as follows:

a) R_{eH} = 23,5 kN/cm^2

$\lambda \leq 20$

$\omega = 1,0$

$20 < \lambda \leq 100$

$\omega = 1,01 + 0,05 \cdot x^2 + 0,65 \cdot x^3$

$\lambda > 100$

$\omega = 1,69 \cdot x^2$

b) R_{eH} = 35,5 kN/cm^2

$\lambda \leq 20$

$\omega = 1,0$

$20 < \lambda \leq 80$

$\omega = 1,01 + 0,06 \cdot x^2 + 1,10 \cdot x^3$

$\lambda > 80$
$\omega = 2{,}53 \cdot x^2$

$\lambda/100$ is to be inserted for x.

1.1.2.4 Slenderness ratio λ

The slenderness ratio λ of derrick booms should in general not exceed 200 and is calculated as follows:

$$\lambda = \ell_B \cdot \sqrt{\frac{F_M}{c \cdot J_M}}$$

ℓ_B = length of derrick boom, [cm]

F_M = cross-sectional area at mid-length [cm^2]

J_M = moment of inertia at mid-length, [cm^4]

c = correction factor according to 1.1.2.5.

1.1.2.5 Correction factor c

a) For constant cross-section derrick booms:

c = 1,0

b) For derrick booms with tapered ends, c can be calculated on the basis of Figure 3.5 as follows:.

$$c = \sqrt{\frac{P \cdot \ell_B^3}{48 \cdot E \cdot f_M \cdot J_M}}$$

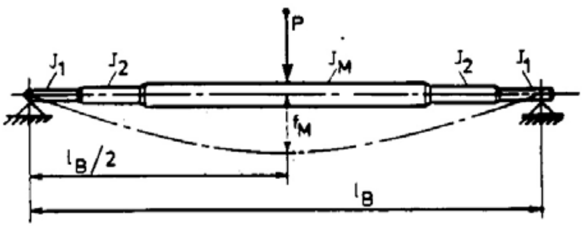


Figure 3.5 Derrick boom deflection

P = any load, [kN]

f_M = mid-length deflection for the load P, calculated or measured, [cm]

ℓ_B = length of derrick boom, [cm]

E = young's modulus = $2{,}1 \cdot 10^4$ [kN/cm^2]

J_M = moment of inertia at mid-length of the derrick boom, [cm^4]

c) As an alternative to b) the correction factor c may, on the basis of Figure 3.6, be calculated more simply as follows:

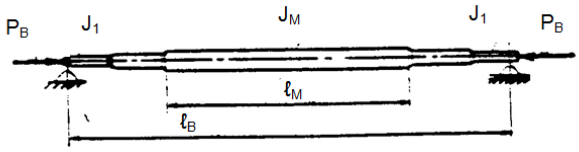


Figure 3.6 Tapered derrick booms

ℓ_M = length of central portion of boom

ca) $\ell_M \le 0{,}5 \cdot \ell_B$

$$c = (0{,}17 + 0{,}33 \cdot v + 0{,}5\sqrt{v}) + \ell_M/\ell_B \cdot (0{,}62 + \sqrt{v} - 1{,}62 \cdot v)$$

$$v = \sqrt{\frac{J_1}{J_M}}$$

For $\ell_M < 1/3 \cdot \ell_B$ agreement with **TL** head Office is required for each individual case.

cb) $0{,}5 \cdot \ell_B < \ell_M < 0{,}8 \cdot \ell_B$

first of all the value of c for $\ell_M = 0{,}5 \cdot \ell_B$ is to be determined from ca)

after that it is to interpolate along a straight line between ca) on the basis of the calculated value and cc).

cc) $\ell_M \ge 0{,}8 \cdot \ell_B$ c = 1,0

1.1.2.6 Explanation

The dimensioning of derrick booms described above is in a simplified way based exclusively on the SWL and is limited to the vertical derrick boom plane.

On the basis of the boom load the boom end is dimensioned according to the maximum bending moment from the head fitting, and the boom middle according to the maximum buckling stress.

For dimensioning, the calculated total loading according to Figs. 3.3 and 3.4, which is a combination of the boom load P_{BL} and the end moment M_{VL}, has still got to be multiplied by the hoist load coefficient according to Table 3.2.

The comparatively high value of the hoist load coefficient ψ_1 means that all other influences can be considered covered.

1.2 Derrick booms according to C.1.2.3

On the basis of the forces in the gear determined in accordance with C.1.2.4, which include the SWL, dead loads and ship inclination, the derrick booms can be dimensioned as follows:

1.2.1 Dimensioning factors

1.2.1.1 Stressing from SWL in the vertical boom plane

This component is to be covered as described in 1.1.2.1 and 1.1.2.2, but instead of ψ_1 the hoist load coefficient ψ_2 according to Table 3.2 is to be used.

1.2.1.2 Stressing from dead loads in the vertical boom plane

The stressing from dead loads can be seen from Fig. 3.7.

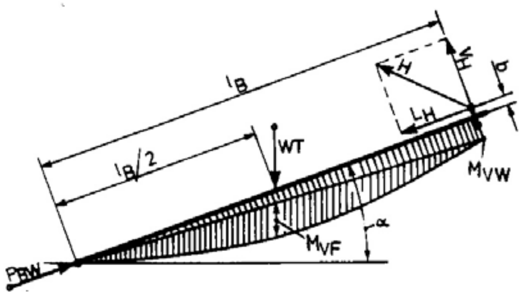


Figure 3.7 Vertical stressing from dead loads

$$P_{BW} = LH + WT \cdot \sin\alpha$$

P_{BW} = Boom load due to dead loads, [kN]

M_{VW} = $L_H \cdot b$, [kNcm]

L_H , b from Figure 3.2 with L_H calculated from WT/2 + rope components with blocks

$$M_{VF} = WT \cdot \frac{\ell_B}{8} \cdot \cos\alpha \ , \ [\text{kNcm}]$$

WT = Boom dead load, [kN]

ℓ_B = Boom length, [cm]

For dimensioning these values are to be multiplied by the dead load coefficient φ according to Table 2.2.

1.2.1.3 Stressing from SWL and dead loads in the horizontal plane

The loadings can be seen Figure 3.8.

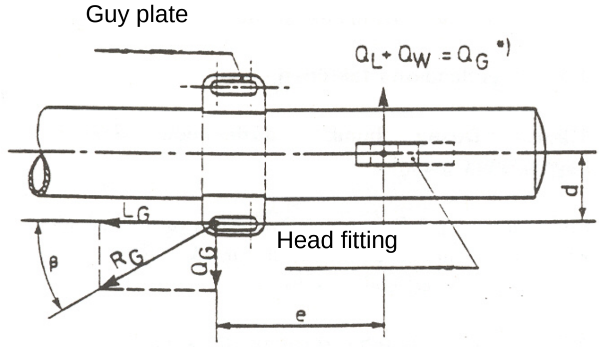


Figure 3.8 Derrick boom head horizontal stressing

*) ***Effect of M_{HL} and M_{HW} neglected.***
(as a simplification it is assumed that the guys apply no vertical force V_G).

L_G, Q_G = Longitudinal and transverse forces from the resultant force R_G in the guy, [kN]

Q_L = Transverse force due to SWL and ship's inclination, [kN]

Q_W = Transverse force due to dead loads and ship's inclination, [kN]

$M_{HL,W}$ = Horizontal bending moment resulting from SWL and the attributable dead loads at the boom head, [kNcm]

β = Angle between derrick boom and guy

The following apply:

$Q_G = Q_L + Q_W$

$$L_G = \frac{Q_G}{tg\beta}$$

$$M_{HL,W} = (Q_L + Q_W) \cdot \left(e - \frac{d}{tg\beta}\right), \; [kNcm]$$

1.2.2 Derrick boom head

From 1.2.1 the following is obtained:

$$\sigma_{zul} \geq \frac{\psi_2 \cdot P_{BL} + \varphi \cdot P_{BW}}{F_0} + \sqrt{\frac{(\psi_2 \cdot M_{VL} + \varphi \cdot M_{VW})^2 + M_{HL,W}{}^2}{W_0}}^{**)} \; , \; [kNcm^2]$$

$$\sigma_{zul} = \frac{0{,}8\,R_{eH} + 4{,}8}{1{,}6} \qquad , \text{(Section 2, E.6.1)}$$

1.2.3 Derrick boom middle

From 1.2.1 the following is obtained:

$$\sigma_{zul} \geq \omega \cdot \frac{\psi_2 \cdot P_{BL} + \varphi \cdot P_{BW}}{F_M} + 0.9\frac{\sqrt{(\psi_2 \cdot M_{VL/2} + \varphi(M_{VW/2} + M_{VF}))^2 + (M_{HL,W/2})^2}^{**)}}{W_M} \; , \; [kNcm^2]$$

*****)*** ***$M_{HL,W}$ must have ψ_2 or φ applied as attributable.***

$$\sigma_{zul} = \frac{0{,}8\,R_{eH} + 4{,}8}{1{,}6} \qquad , \text{(Section 2, E.6.1)}$$

1.3 Derrick boom middle C.1.3

1.3.1 Derrick boom head

The derrick boom heads are to be dimensioned according to the following:

$$\sigma_{zul} \geq \psi_1 \cdot \left(\frac{P_{BL}}{F_0} + \frac{\sqrt{M_{VL}^2 + M_{HL}^2}}{W_0}\right), \; [kN/cm^2]$$

$$\sigma_{zul} = \frac{0{,}8\,R_{eH} + 4{,}8}{1{,}6} \qquad , \text{(Section 2, E.6.1)}$$

(For F_0 , W_0 and M_{VL} see 1.1.2.1, for M_{HL} i see 1.2.1.3).

1.3.2 Derrick boom middle

On the basis of the boom load P_{BL} determined according to C.1.3.2, the booms can be dimensioned according to the following:

$$\sigma_{zul} \geq \psi_1 \cdot \left(\omega \cdot \frac{P_{BL}}{F_M} + 0{,}9\frac{\sqrt{(M_{VL/2})^2 + (M_{HL/2})^2}}{W_M}\right), \; [kN/cm^2]$$

$$\sigma_{zul} = \frac{0{,}8\,R_{eH} + 4{,}8}{1{,}6} \quad , \text{(Section 2, E.6.1)}$$

(For F_M and W_M see 1.1.2.2).

1.3.3 Torsional stressing

1.3.3.1 Derrick booms

In general the torsional stressing need not be considered.

1.3.3.2 Derrick heel fittings

Derrick heel fittings, goosenecks and gooseneck bearings are at least to be of a nominal size which, if the head fitting is used in accordance with Table 8 in Appendix A, corresponds to 4 times the SWL (U), unless mathematical proof is provided that lesser dimensions will suffice.

2. Derrick booms with twin spans and other derrick boom systems

2.1 Dimensioning of derrick booms as well as head- and heel-fittings has to be done on the basis of the forces determined in a suitable way and covering all influences from compression, bending and torsion (see also C.2.1).

2.2 If appropriate, forces deriving from the swinging acceleration (see C.2.2) are additionally to be taken into account.

E. Dimensioning of masts and posts

For the dimensioning of masts and posts the regulations in Section 2 apply. In addition the following applies:

1. Masts and posts generally

1.1 Signalling masts, radar masts

Free-standing or stayed signalling masts and radar masts are to be dimensioned according to the requirements in the (**TL**) "Hull Rules" - Chapter 1.

1.2 Derrick masts and -posts

1.2.1 Notes

1.2.1.1 The following explanations refer to circular or other full web sections.

Special construction forms, such as e.g. lattice masts, must as regards dimensions and design in each case be individually agreed with **TL** head office.

1.2.1.2 It is assumed that masts with derrick booms lashed to them and also derrick posts will generally be adequately dimensioned for the stressing in a seaway even at high wind speeds.

1.2.2 Basis for dimensioning

1.2.2.1 Generally, wind loading need not be taken into account.

1.2.2.2 For dimensioning the masts, the forces in the various derrick boom systems determined according to C are to be multiplied by the hoist load coefficient according to Table 3.2 and/or as attributable by the dead load coefficients according to Table 2.2.

The hoist load coefficient is to be used if only the SWL has been considered in the determination of the forces; otherwise ψ_2 is to be used.

Ropes and component parts are to be dimensioned based on the static forces according to B.2.1.

1.2.2.3 Where fitting several light-load derricks to one mast is envisaged, the maximum possible loading due to the simultaneous loading of only two derrick booms swung at a time, is to be determined. It should be noted that for the dimensioning of the standing rigging and the various cross-sections of the mast the determining element may not always be the simultaneous loading of the same derrick booms. So for instance for the mast the determining element may be the loading of the two booms for'd/aft of it over the hatchway, or the loading of the two booms on one side of the ship swung out to their maximum angle, or even the loading of just one boom for'd and aft of the mast on different sides of the ship in the fore-and-aft position.

1.2.2.4 Derrick booms for loads of 60 t or more installed on the centreline are as a rule assumed to be loaded alone. The simultaneous loading of other derrick booms on the same mast system may however be permitted on application.

1.2.2.5 In the case of single masts with crosstrees the torsional loading is also to be taken into account. The same applies to pairs of posts with a common crosstree, if one is loaded from the forward end and the other from aft.

1.2.3 Stayed masts

If stays are to be rigged only for special loadings, e.g. the occasional use of heavy-load booms, relevant data such as number, position and dimensions of the stays to be rigged when necessary are to be contained in the rigging plans.

1.2.4 Constraint in the ship's hull

1.2.4.1 In general, the fastenings of masts to the hull of a ship should extend over at least one deck- height.

1.2.4.2 In the constrained area, as a rule large transverse forces arise which have to be absorbed by the masts and the deck connections.

1.2.4.3 Regarding the dimensioning of deck plating and welded seams in the connecting area, reference should be made to Section 2, D.4.5.

1.2.4.4 If the upper support is formed by the plating of a deck house, the deck house must be checked for adequate structural strength.

1.2.5 Design details

1.2.5.1 Wall thickness

For cylindrical masts the maximum permissible outside diameters in dependence on wall thickness are to be taken from Table 1 in Appendix A.

Masts or posts closed all-round must have a wall thickness of at least 6,0 mm. For mast or posts with openings a wall thickness of less than 7,5 mm is not permissible.

For posts conveying exhaust gases a special rusting supplement of at least 1 mm is required.

1.2.5.2 Buckling resistance

Cylindrical masts and posts complying with Table 1 in Appendix A are considered to be adequately buckling-resistant.

In the connecting area of shrouds and stays as well as the span- and gooseneck bearings, anti-buckling reinforcement may be required.

For other cross-sections with flat or slightly curved plates, proof of buckling resistance is required as a matter of principle.

1.2.5.3 Discontinuities

If a plate mismatch or a conicity angle at a joint exceeds 0,15 • the lesser plate thickness (max. 3 mm) resp. an angle of 4°, calculation of the local additional stresses is to be provided separately.

Any increase of the locally permissible stresses must be discussed and agreed with the **TL** in each individual case.

1.2.5.4 Doubling plates

Doubling plates at mast feet are permissible only for the transmission of compressive forces since they are generally not suitable for the transmission of tensile forces or bending moments.

2. Masts to special requirements

2.1 Notes

2.1.1 Masts complying with the regulations according to 2.5 to 2.8 as regards design and construction may outside the areas of constraint be dimensioned according to the stresses given under 2.4.

2.1.2 For SWLs below 100 t agreement with the **TL** regarding additional regulations and possibly additional proofs, e.g. analyses of fatigue strength, is required in each individual case.

2.2 Designations

The following designations are used:

E = Young's modulus = $2{,}10 \cdot 10^5$ [N/mm²J

R_{eh} = Material yield strength in [N/mm²]
(see also 2.7)

R_m = Material tensile strength in |N/mm²]
(see also 2.4.2 and 2.7)

s = Wall thickness in [mm]

D = External diameter in [mm]

h = Plate mismatch acc. to Fig. 3.9 in [mm]

α = Conicity angle according to Fig. 3.10 in [°|

2.3 Load conditions

2.3.1 Load condition A

Planned operating conditions with the effect of SWL, dead loads and inclinations of the ship.

2.3.2 Load condition B

Test load, dead loads and ship's inclinations or limit conditions which depart from the planned operating parameters, such as e.g. the load condition "one span support" in the case of twin span gear.

2.3.3 Load condition C

The load condition "one span support" when test load is applied.

2.4 Permissible stresses

2.4.1 A precise determination of all the forces arising is required for proof that the permissible stresses are not being exceeded.

2.4.2 The stresses quoted below are permissible for tension, compression and as combined stress. Additionally the condition $R_{eH} \leq 0{,}75\ R_m$ is to be observed.

2.4.2.1 Load condition A

$\sigma_{zulA} = 0{,}72\ R_{eH}$ **(2)**

2.4.2.2 Load condition B

$\sigma_{zulB} = 0{,}83\ R_{eH}$

(2) *The sum of the stresses taking into account 2.6.3 and 2.6.4 may not exceed 1,44 · R_{eH}.*

2.4.2.3 Load condition C

$\sigma_{zulC} = 0{,}90\ R_{eH}$

2.5 Limiting conditions

2.5.1 The following condition is generally to be observed:

$$D/S \leq 490\sqrt{s/R_{eH}}$$

*) *This formula is applicable to the following yield range:*

$$355 \leq R_{eH} \leq 460$$

2.5.2 If at a constant bending-moment a larger tube diameter has to be selected because machinery is being installed, i.e. if the permissible stress cannot, or shall not, be utilized, the following applies:

Load condition A, $\sigma_{zulA} = 0{,}72\ R_{eH}$

$$D/S \leq 416\sqrt{s/\sigma_{vorh}}$$

2.5.3 In load condition C proof is required that the compression stresses arising comply with the following condition:

$$\sigma_C \geq (0{,}825 + 0{,}022\ E/R_{eH} \cdot s/D) \cdot R_{eH}$$

2.6 Tolerances

2.6.1 The mast-ring tolerances quoted below are to be observed for design and construction, whereby it is permissible to make full use of the tolerances according to 2.6.3 and those according to 2.6.4 simultaneously. **T**L approval may be given to exceeding the one while simultaneously deviating below the other.

2.6.2 Mast ring plates may not have minus tolerances.

2.6.3 The plate mismatch "h" of two mast rings may not exceed 0,1 · s (where there is a change of plate thickness, the lesser thickness is the relevant one, see Fig. 3.9).

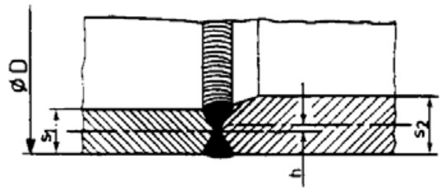


Figure 3.9 Plate mismatch "h"

2.6.4 The conicity angle "α" between (conicity of) two mast rings may not exceed 3 (see Fig. 3.10).

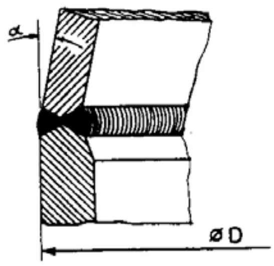


Figure 3.10 Conicity angle

2.6.5 The ovality, i.e. the difference between the largest and the smallest measured diameter, of a mast ring (D_{max} - D_{min}J, may not exceed 0,02 D.

2.7 Materials

2.7.1 All mast materials must have been tested by the **TL** in accordance with its material regulations. Their qualities must conform to these regulations plus the other applicable standards, specifications or materials tables, e.g. DIN EN 10 025.

2.7.2 Steels with a yield strength higher than 460 N/mm^2 may only be used with specific permission from the **TL**. When proving the permissible stresses and the limiting conditions according to 2.4.2 and 2.5, the tensile strengths and yield strengths according to the **TL** rules for materials and the standard in 2.7.1 are to be used as a basis.

2.8 Fabrication and installation

2.8.1 When fabricating the masts the requirements for ensuring the quality of welded joints contained in the **TL**'s Hull Rules - Chapter 1 - are to be observed.

2.8.1 The **TL**'s Hull Rules - Chapter 1 - also apply to the testing of the welded joints. The procedure for higher-strength- and high strength- fine grain steel with nominal yield strength of 380 N /mm^2 or more is to be in accordance with Fig. 3.11.

2.8.3 A report is to be drawn up covering the constructional tolerances.

2.8.4 For the fabrication and installation of higher-strength and high strength- fine grain structural steels the following additional regulations apply:

2.8.4.1 The welding-on of assembly aids is to be avoided as a matter of principle. If exceptionally this cannot be avoided the welding-on and removal of these parts must be approved by **TL**.

2.8.4.2 At the top fixing point, the masts may not be welded directly to the deck plating; this connection must be made via an annular collar which is to be welded-on in the workshop in accordance with a plan approved by the **TL**. If possible the mast rings affected are to be stress- relieved after the collar has been welded-on. Any substitute measures are in each individual case to be discussed and agreed with the **TL**.

2.8.4.3 The masts must be welded into the ship's hull in accordance with installation instructions approved by the **TL**.

2.8.4.4 Testing of the masts on completion of the installation must be carried out in accordance with a test programme approved by the **TL**. The load test is to be carried out in steps, possibly with crack tests being carried out in-between.

2.9 Explanations to Fig. 3-11

2.9.1 Mast fabrication

(1) **Longitudinal seams:** 10% NDT at each seam end, ≥ 30 mm primary ultrasonic (US); (for radiographic examination one length of film is enough).

(2) **Circumferential seams:** 100% NDT, ≥ 30 mm primary US (if 80% of the permissible stress is attained or exceeded, a radiographic test is to be carried out).

(3) **Collar scams:** 100% US and 100% magnetic particle (MP).

2.9.2 Fittings

(4) **All welded-on parts** (seams along the mast, including assembly-aid welds): 100% MP (where complete double-bevel seam connection is required, additionally 10% US).

2.9.3 Installation

(5) **Collar-to-deck connection:** 100% NDT, > 30 mm primary US.

(6) **Connections between the ship's structure and the mast:** 100% MP (where complete double-bevel seam connection is required, additionally 10% US).

(7) **Collar-to-mast connection:** 100% MP.

(8) **Removed assembly-aid weld sites:** 100% MP.

2.9.4 Testing

(9) **Collar-to-mast connection:** 100% MP**.**

F. Regulations for construction and equipment

1. Regulations for construction

1.1 Notes

1.1.1 Comprehensive explanations concerning derrick/mast fittings and interchangeable components precede the relevant Tables in Appendix A.

1.1.2 The explanations in Appendix A are supplemented by the regulations set out below.

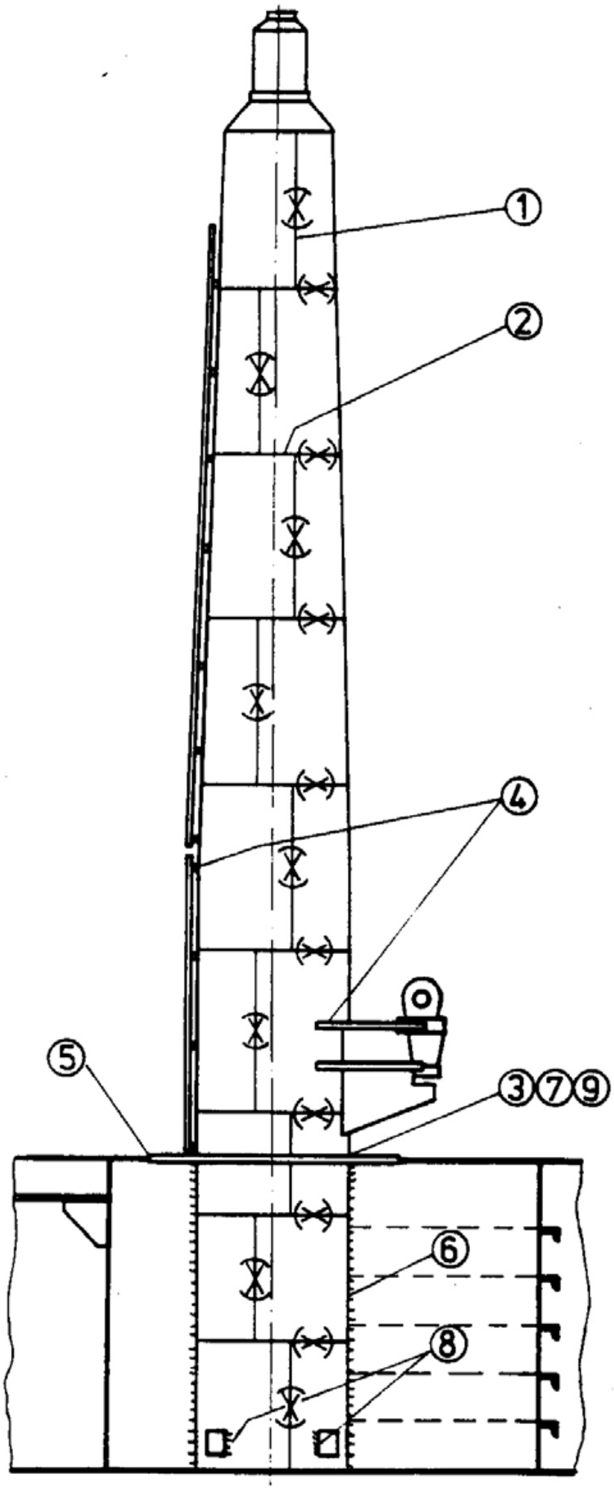


Figure 3.11 Non-destructive testing of masts made from higher- strength- and high strength- steels

1.2 Derrick booms

1.2.1 Where derrick booms have two head fittings for cargo-runners at different distances along the boom, the second fitting also must be provided with eyes for span and guys unless mathematical proof is provided that the boom dimensions are adequate even if the point-of-attachment of span and guys is not the same as that of the load.

1.2.2 There is to be a distance of at least 0,50 m between the bottom edge of derrick booms at their minimum inclination and any fixed part of the ship's structure.

1.2.3 For derrick booms laid down during sea travel, adequate stowage arrangements must be provided - even if there is deck cargo. For parts to be lashed (e.g. cargo hooks or topped booms), seaworthy lashing arrangements are to be provided.

1.3 Goosenecks and gooseneck bearings

1.3.1 Gooseneck bearings are to be mounted high enough to avoid interfering with winch operation even when the derrick booms are at their minimum inclination.

1.3.2 Goosenecks are to be safeguarded in such a way that they cannot be torn out of the bearings during laying-down (e.g. adjusting ring with pin). Clamping screws may not be used for securing.

1.4 Preventers

1.4.1 Only wire ropes may be used for preventers. If the end of the preventer is shackled to the deck or the bulwark, a 4-fold safety margin relative to the minimum breaking load will suffice. To allow for required variations in preventer length, lengths of chain or other suitable means may be used. If the preventers are secured to bollards or cleats, or are led through hawsers or blocks, they must have at least a 5-fold safety margin relative to the minimum breaking load.

1.4.2 The end of the preventer at the head of the boom is to be either shackled-on or have an eye which is slipped over the head. If the guy pendant is adequately dimensioned, this may be used as part of the preventer.

1.4.3 The derrick booms must be held inwards. Gear according to C.1.3 may be secured by setting the inner guys of the two booms or by linking the two boom heads by means of a steel-wire strop or a tackle reeved at least two-fold. It is sufficient if the strop or tackle is rated for 1/10 SWL.

1.4.4 The ship's hull is to have suitable eye plates fitted in adequate numbers for connecting the guys and preventers.

2. Regulations for equipment

2.1 Control positions

2.1.1 Control positions and equipments must be made and arranged in such a way that the operator(s) have a free field of view covering the load or at least the person guiding this.

2.1.2 The controls must be marked to indicate their function. The movements of the controls must be appropriately related to the corresponding movements of the load (see Section 4, E.2.2.3).

2.2 Winches

2.2.1 The cargo-, span- and guy winches are to be so arranged as to allow safe working at them and at the hatches.

2.2.2 Satisfactory winding of the rope onto the drums of the winches is to be checked during the first test on board. The check must be carried out with and without load (see also Section 13).

2.2.3 Should the driving power fail, it must be possible to set down the suspended load safely.

2.2.4 The constructional minimum requirements for winches are to be taken from Section 9.

2.3 Overload protection

2.3.1 Devices to indicate overloading are to be provided if the load is lifted by more than one boom and overloading is not inevitably excluded. This has to be watched for instance in the case of traverses with several possibilities of load attachment.

2.3.2 The indicating devices according to 2.3.1 must be fitted in the region of the control positions. They must also indicate the loading of the other booms involved to the winch operator. Possible examples are:

a) in the case of hydraulic winches, green lights that go out if there is an overload OL.

$OL = 1 + [1/3\ (\psi - 1)]\ SWL$
Max, however $1{,}07 \cdot SWL$

These lights must be provided for every lay of the rope on the cargo winches.

b) in the case of electric winches, calibrated amperemeters.

c) other load-measuring devices.

2.4 Limit switches

2.4.1 For derrick booms limit switches are generally not required.

2.4.2 Deviating from 2.4.1 limit switches are to be provided in case of twin span derricks for the upper boom position and for the limits of the working ranges.

2.4.3 Regarding the general requirements for limit switches see Section 4, E.2.3.1 and Section 10, F.2.

2.5 Emergency switches/keys

2.5.1 At the place of control an emergency switch or emergency cut out with mechanical locking device is to be provided. In hydraulic drives the emergency switch must also act on the electric drive of the hydraulic pump.

2.5.2 Return to service must be restricted to the zero position of the respective control elements or operating instruments.

3. Operating instructions

3.1 The angle of inclination to the horizontal of a derrick boom on which the determination of the forces was based is stated in the certificate and in the rigging plans and operation of the boom at a lesser angle is not permitted.

3.2 Suitable means must be provided for ensuring that the derrick boom is operated only within its permissible working range.

3.3 Every derrick boom must have affixed to it, durably and easily visible, a mark regarding the permissible SWL and the smallest permissible angle of inclination to the horizontal. See also Section 13.

SECTION 4

CRANES AND CRANE FOUNDATIONS

A. General

1. The dimensioning, testing and examination of shipboard cranes does not constitute part of the classification of the ship. The classification does, however, include checking the structure of the ship's hull in way of the forces transmitted by the cranes.

2. As regards the materials to be used, and welding, the regulations in Sections 11 and 12 apply.

3. As regards construction and dimensioning of interchangeable components and ropes, the regulations in Sections 7 and 8 apply.

4. As regards the requirements for winches, other mechanical parts or the electrical equipment, the regulations in Sections 9 and 10 apply.

5. In this Section a distinction is made in principle between the following types of cranes:

- Shipboard cranes
- Offshore cranes
- Floating cranes

6. The documents and rigging plans to be submitted are to indicate the type of crane (see B.2) and the working ranges (possibly restricted) permissible for strength- or ship's stability reasons, together with the permissible inclinations of the floating body. If necessary, special stability data shall be appended.

For provision and hose cranes on other ships, examination of drawings with a view to subsequent practical testing and certification is recommended on principle.

7. Ships equipped with classed lifting appliances like cranes, gantry cranes, A-frames, etc. complying with this Section are given **LA (CRANE)** class notation.

B. Definition and subdivision

1. Definition

In addition and extending the definition in Section 1, F.3., the following distinctions are made:

1.1 Shipboard cranes

1.1.1 Cargo- handling cranes

a) Cranes for general cargo and containers

b) Cranes for palletized cargo and bulk cargo (e.g. grab cranes)

1.1.2 Cranes that do not handle cargo

1.1.2.1 Deck cranes

a) Provision cranes

b) Hose handling cranes

c) Other cranes

1.1.2.2 Below-deck cranes

a) Machinery room cranes

b) Other cranes

1.2 Offshore cranes

1.2.1 Depending on their intended purpose, these cranes are subdivided as follows:

a) Shipboard cranes and floating cranes that work offshore

b) Cranes on offshore installations

- Supply cranes
- Working cranes on deck.

1.2.2 Explanation

1.2.2 1 The designation 'supply cranes' is applied to cranes needed on an offshore installation for supply/disposal from/to the water (e.g. loading/ unloading supply ships).

1.2.2.2 The designation 'working cranes on deck' is applied to cranes on an offshore installation, exposed to the environment without protection and not usable as supply cranes because of their position.

1.3 Floating cranes

1.3.1 Depending on their intended purpose, floating cranes are subdivided as follows:

a) Cargo-handling cranes

b) Lighter cranes

c) Construction cranes

1.3.2 Explanation

1.3.2.1 The designation 'cargo-handling cranes' is applied to floating cranes handling cargo in port, with a hook or a grab.

1.3.2.2 The designation 'lighter cranes' is applied to floating cranes handling bulk cargo in a roadstead, with a grab.

1.3.2.3 The designation 'construction cranes' is applied to floating cranes whose purpose is carrying out assembly-work in calm water as well as in unprotected waters.

2. Subdivision of cranes

2.1 Within the framework of these Lifting Appliance Regulations the cranes defined under 1. are with regard to the hoist load coefficients (Table 4-1) and the proof of fatigue strength (Section 2, E.4) subdivided into:

- Shipboard cranes
- Offshore supply cranes
- Floating cranes

2.2 For shipboard cranes there is a further sub-division into:

- Crane type A
- Crane type B
- Crane type C

2.2.1 Type A cranes

2.2.1.1 Type A includes all the cranes that do not handle cargo. They are characterised by an irregular usage pattern with lengthy rest periods.

2.2.1.2 Cranes as in 1.1.2 are generally allocated to type A.

2.2.2 Type B cranes

2.2.2.1 Type B includes all cranes that do handle cargo but do not always lift the full SWL. These cranes are characterised by a regular usage pattern with lengthy rest periods.

2.2.2.2 Cranes as in 1.1.1, a) are generally allocated to type B.

2.2.3 Type C cranes

2.2.3.1 Type C includes all cranes used for handling cargo and which regularly lift the full, or nearly the full, SWL.

2.2.3.2 Type C1 cranes are characterised by a regular usage pattern with lengthy rest periods. Cranes as in 1.1.1, b) are generally allocated to this type.

2.2.3.3 Type C2 cranes characteristically are operated continuously on a regular basis. This type is rarely found on board ship; if yes, then they will be cranes as in 1.1.1, b). Other cranes that approximate very closely to this type are lighter cranes.

2.2.4 Type change

If cranes in operation are stressed more highly than corresponds to their design classification, their SWL shall be reduced. Regarding this see C.1.3 and also Section 2, B.1.2.2.

C. Calculation procedures

For calculations concerning cranes the regulations in Section 2 apply. Additionally, the following applies:

1. Hoist load coefficient ψ

1.1 The hoist loads or the stresses arising there from shall be multiplied by a hoist load coefficient.

If a crane has several hoisting equipments, these may have differing hoist load coefficients.

1.2 The hoist load coefficients for various types of cranes may be taken from Table 4.1.

1.3 Type change

1.3.1 If for instance a crane classified as type **B** is temporarily or permanently to be used as a type C, its SWL must be reduced in the ratio of the hoist load coefficients (ψ_B/ψ_C)

1.3.2 To convert a general cargo crane into a grab crane, the procedure demonstrated in the example that follows shall be used:

Table 4.1 Hoist load coefficients for cranes

Type of crane	Hoist load coefficients ψ in dependence on hoisting speed V_H	
	$V_H \leq 90$ [m/min]	$V_H > 90$ [m/min]
Shipboard cranes type A	$\psi = 1,1 + 0,0022 \cdot V_H \geq 1,15$	$\psi = 1,3$
Shipboard cranes type B	$\psi = 1,2 + 0,0044 \cdot V_H \geq 1,3$	$\psi = 1,6$
Shipboard cranes type Q	$\psi = 1,3 + 0,0066 \cdot V_H \geq 1,45$	$\psi = 1,9$
Shipboard cranes type C2	$\psi = 1,4 + 0,0088 \cdot V_H \geq 1,60$	$\psi = 2,2$
Offshore supply cranes main hoist	$\psi = 1,2 + 0,0044 \cdot V_H \geq 1,3$	$\psi = 1,6$
auxiliary hoist	$\psi = 1,3 + 0,0066 \cdot V_H \geq 1,45$	$\psi = 1,9$
Offshore working cranes	$\psi = 1,1 + 0,0022 \cdot V_H \geq 1,15$	$\psi = 1,3$
Floating cranes		
Hook-operation, up to 60 t SWL	$\psi = 1,2 + 0,0044 \cdot V_H \geq 1,3$	$\psi = 1,6$
Hook-operation, over 60 t SWL	$\psi = 1,1 + 0,0022 \cdot V_H \geq 1,15$	$\psi = 1,3$
Hook-operation, over 500 t SWL	$\psi = 1,0 + 0,0011 \cdot V_H \geq 1,03$	—
Grab-operation, up to 60 t SWL	$\psi = 1,4 + 0,0088 \cdot V_H \geq 1,6$	$\psi = 2,2$
Grab-operation, up to 60 t SWL	$\psi = 1,2 + 0,0044 \cdot V_H \geq 1,3$	$\psi = 1,6$

1.3.2.1 Initial situation Type B crane

SWL_B = 25t

V_H = 30 m/min

ψ_B = 1,33 = 1,2 + 0,0044 · 30

1.3.2.2 Conversion Type C_1 crane

SWL_{C1} = 22,2t = 25t · 1,33/1,50

V_H = 30 m/min

ψ_{C1} = 1,50 = 1,3 + 0,0066 · 30

1.3.2.3 Disposable SWL

The reduced live load SWL_{C1} includes the weight of the grab. The disposable SWL for handling bulk cargo using a motorised grab weighing (e.g.) 3.2 t is thus:

SWL_{C1} — WT_{C1} = 22,2 — 3,2 = 19,0t

2. Waiving of proofs of fatigue strength

2.1 A proof of fatigue strength is generally not required for shipboard cranes which do not handle cargo. This also applies to working cranes on offshore installations.

2.2 A proof of fatigue strength is also generally not required for cargo-handling cranes in hook operation above 60 t SWL.

2.3 A proof of service strength is not required for construction cranes. Conditions relating to sea state shall be taken into account.

3. Buckling of crane booms

3.1 Notes

3.1.1 For the proof of resistance to buckling of crane booms (see also Section 2, E3.), the vertical plane (load plane) shall be considered as well as the horizontal plane.

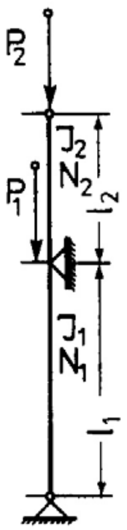
3.1.2 In view of the differing combination of pressure and bending, at least the maximum and minimum load radii shall be considered separately for each of the two planes. If necessary an intermediate load radius is also to be considered.

3.1.3 The explanation which follows is intended to provide some reference for statically easily comprehensible crane booms. Furthermore attention is drawn to the possibility of more accurate (e.g. F.E.) calculations if need be (see also Section 2, E.3.2.).

3.2 Buckling lengths in the vertical plane

3.2.1 If crane booms have cargo- and luffing ropes holding them at the tip, the buckling calculation shall be carried out as for a beam with two supports under bending and pressure. The buckling length S_K, is then the same as the crane boom length.

3.2.2 For crane booms held by luffing cylinders or luffing ropes lower down, the buckling length may be determined according to Fig. 4.1



$N_1 = P_1 + P_2$ **,** $N_2 = P_2$

$S_{K1} = \beta_1 \cdot \ell_1$ **,** $S_{K2} = \beta_2 \cdot \ell_2$

$\lambda = \ell_2 / \ell_1$

$$c = \frac{\ell_2 \cdot J_1}{\ell_1 \cdot J_2}$$

$n = N_2/N_1$; $k = 0,5 + \lambda \cdot n\,(1,65 + 2c)$

$$\beta_1 = \sqrt{k + \sqrt{k^2 - \lambda \cdot n(1,35 + 4c)}}$$

$$\beta_2 \frac{\beta_1}{\sqrt{\lambda \cdot c \cdot n}}$$

Figure 4.1 Buckling lengths of beams continuous over two spans

For luffing cylinders the formulae are valid only if the following applies: $|$ **P_1** $|$ **<** $|$ **P_2** $|$

3.3 Buckling lengths in the horizontal plane

3.3.1 If the crane boom is held at its tip by cargo- and luffing ropes, this is a case of a member fixed at one end and movable at the other.

As the crane boom tip moves in transverse direction, restoring forces are set up in the ropes which result in a reduction of the buckling length (polar buckling).

3.3.2 Determination of the buckling length

The buckling length S_K in the horizontal plane may be determined as follows:

a) determination of the buckling length from the following formula:

$$\mathrm{tg}\frac{\pi}{S_k} - \left(1 + \frac{1}{a}\right)\cdot \pi \cdot \frac{S}{S_K} = 0$$

b) determination of the buckling length according to Fig. 4.2:

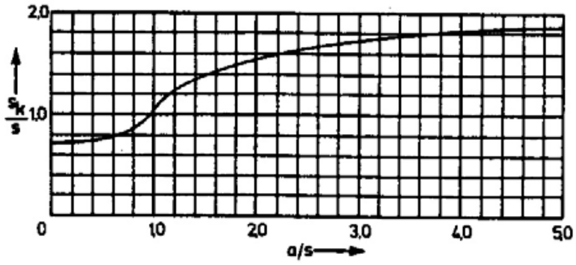


Figure 4.2 Buckling-length diagram

c) For determining the polar distance a, Figure 4.3 applies; the possible buckling-length patterns are shown in Table 4.2.

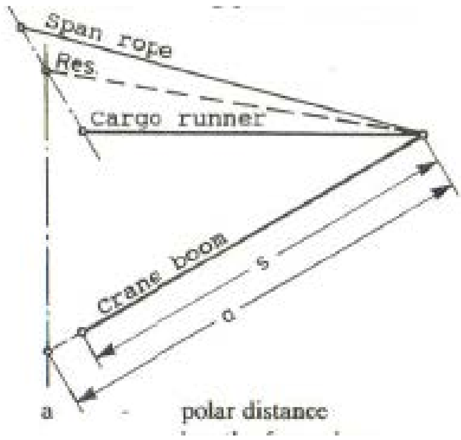
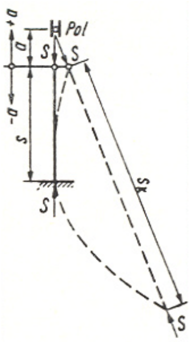
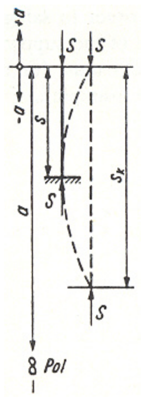
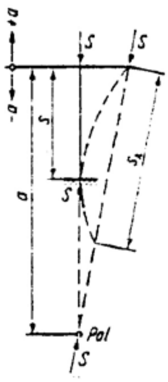
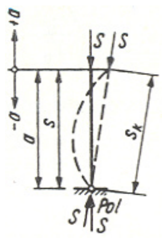
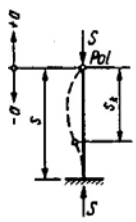


Figure 4.3 Determining polar distance a

Table 4.2 Buckling length patterns

Buckling figure					
Polar dist a	> 0	- ∞	< 0	-s	0
α = s/a	> 0	0	< 0	-1	∞
Buckling length S_K	> 2s	2s	< 2s	s	0,7s

a - Polar distance

s - length of member

S_K - buckling length

D. Operation in a seaway

1. Cranes generally

1.1 In the case of shipboard cranes and cranes intended to operate in a seaway, reduction of the calm-water SWL is required for safety reasons.

1.2 The SWL reduction as in 1.1 shall be established/laid down using the same procedure as described for offshore supply cranes under 3.

2. Offshore cranes

2.1 Basic principles

2.1.1 The regulations that follow apply to offshore supply cranes located on fixed or floating offshore installations, which load or unload ships.

2.1.2 Working cranes on deck are treated like shipboard cranes which do not handle cargo; however the special environmental conditions according to Section 2, B. and C. shall be given consideration.

2.1.3 The design temperatures laid down for offshore installations apply on principle also to the cranes on these installations.

2.1.4 All other cranes on offshore installations are treated as shipboard cranes which do not handle cargo.

2.2 Special provisions for offshore supply cranes

2.2.1 Offshore supply cranes are basically to be designed for a specified SWL in calm water, i.e. unaffected by seaway. The SWLs to be reduced according to the various sea states shall be calculated according to 3., or rather the SWL to be defined for calm water shall be determined on the basis of the SWLs called for in agreed seaway conditions (see also recommendation under 3.2.5).

2.2.2 Depending on the significant wave height, cargo hooks should operate with the following minimum speeds (see also Table 4.4):

$$\min V_H = 72 \cdot \frac{H_{1/3}}{T_0} \text{ , } [\text{m/dk}]$$

$H_{1/3}$ = Significant wave height in, [m]

T_0 = Average wave period in, [s]

2.2.3 An example of a compilation of the loading parameters is given in Table 4.3.

3. SWL reduction of offshore supply cranes

3.1 Notes

3.1.1 When loading or unloading ships in a seaway the movement of the cargo hook and that of the cargo deck of the supply ship, and thus of the load, may become superimposed unfavourably, as a result of which the supply crane will be subjected to increased dynamic stressing.

Furthermore even more additional stressing may arise from the motion of the offshore installation on which the supply crane is mounted.

In order to safeguard the safety and the operating life of the supply crane, the calm-water SWLs (see 2.2.1) must for this case be reduced according to the example in Fig. 4.4.

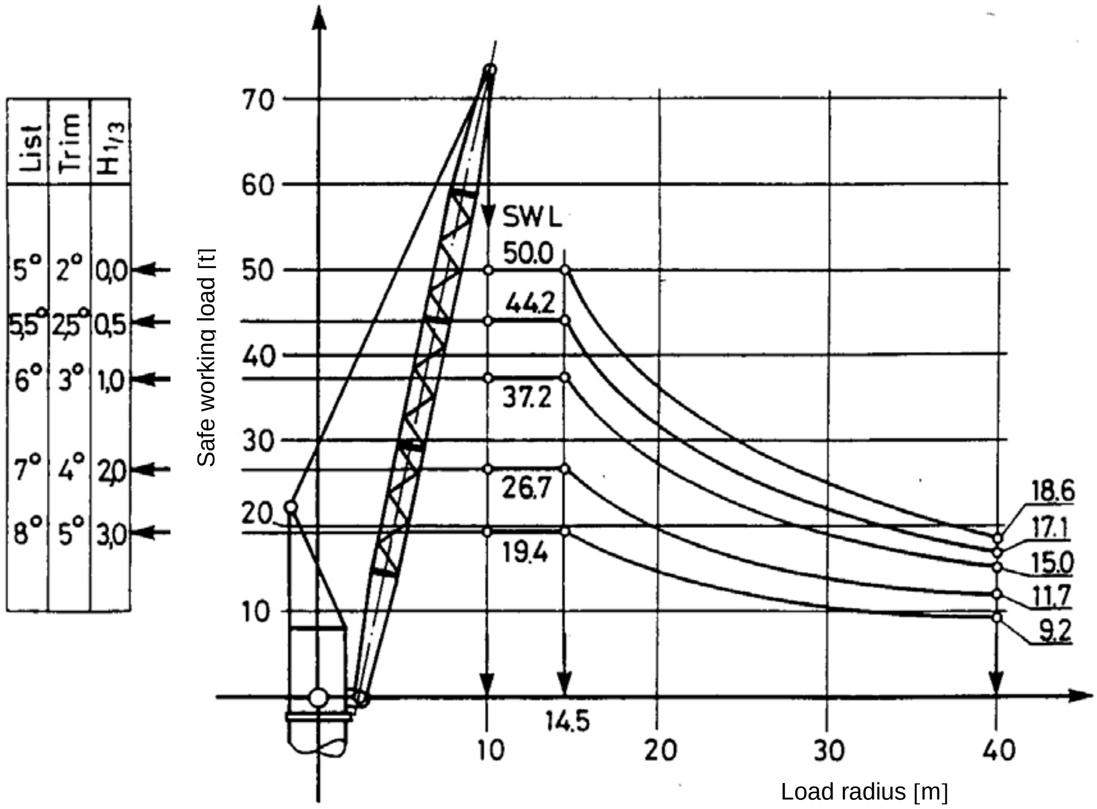


Figure 4.4 Load radius diagram

3.1.2 As regards loading or unloading ships in a seaway, the first thing is to investigate, using the instructions that follow, whether the envisaged operating conditions necessitate a reduction of the live load. If this applies, the reduced SWLs shall be determined for various significant wave heights for the entire load radius range.

3.1.3 The SWL-reduction either may be done using the simplified method described under 3.2 or shall be established on the basis of a motion response analysis (see 3.3).

3.2 SWL reduction using a simplified method

3.2.1 The reduced SWL may be obtained iteratively from the following relationship:

$$\mathrm{SWL} \cdot \psi = \overline{\mathrm{SWL}} \cdot \overline{\psi} \cdot f_e$$

From this follows;

$$\overline{\mathrm{SWL}} = \mathrm{SWL} \cdot \frac{\psi}{\overline{\psi} \cdot f_E}$$

$\overline{\mathrm{SWL}}$ = Reduced SWL for working in a seaway SWL

SWL = SWL in calm water (see also 2.2.1)

φ = Hoist load coefficient according to C.1

$\overline{\psi}$ = Hoist load coefficient for working in a seaway, according to 3.2.2

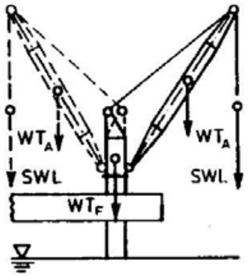
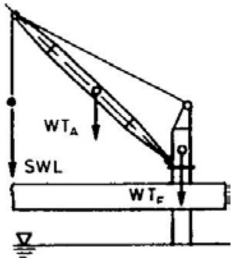
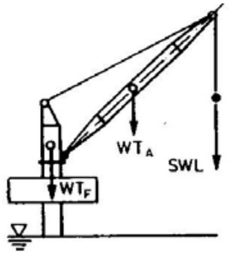
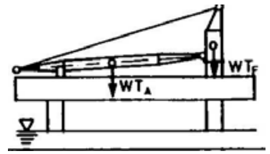
f_e = Influence factor according to 3.2.3 and Table 4.5

Table 4.3 Loading parameters

Summary of load parameters for offshore lifting appliances

Remarks:

1) The dead weight component of the hoisting load (see 2/C.2.3) has been disregarded.
2) Load case B for "lifting appliance out of operation" has not been listed.
3) For lifting appliances on fixed platforms, in addition to the minimum inclination as shown in Table 2.1, only angle ρ in accordance with D.3.2.4 need be taken into account.
4) These values are to be appliance separately (see 2/C.2.6.2.4).

in operation			out of operation
			
No swell	Slight swell		Heavy swell
Crane jib position (working range)			Crane jib position

Load case 2/D5.3	Load case 2/D5.2	Possible loads	Any: Load assumption	Any: Sec. /Para.	Over the deck: Load assumption	Over the deck: Sec. /Para.	Over the water: Load assumption	Over the water: Sec. /Para.	Sea lashing: Sec. /Para.	Sea lashing: Load assumption	Load case 2/D.5.4
B	A	Dead load	$WT_F + WT_A \cdot \varphi$	2/C.2.1 2/C.2.5.1.1	$WT_F + WT_A \cdot \varphi$	2/C.2.1 2/C.2.5.1.1	$WT_F + WT_A \cdot \varphi$	2/C.2.1 2/C.2.5.1.1	2/C.2.1	$WT_F + WT_A$	C[2)]
B	A	Hoisting load[1)]	$SWL \cdot \psi$	2/C.2.2 2/C.2.5.1.2 4/C.1	$SWL' \cdot \psi \cdot f_e$	2/C.2.2 2/C.2.5.1.2 4/C.1 4/D.3.2.3	$SWL \cdot \overline{\psi} \cdot f_e$	4/D.3.2.1 4/D.3.2.2 4/D.3.2.3			C[2)]
B	A	Horizontal force from slewing	To be calculaded if need be	2/C.2.5.2.1	To be calculaded if need be	2/C.2.5.2.1	To be calculaded if need be	2/C.2.5.2.1			C[2)]
B	A	Deck inclination	Static minimum inclination	2/C.2.4.2	Static minimum inclination	2/C.2.4.2	Static minimum inclination	2/C.2.4.2	2/C.2.6.2.1	Dynamic minimum inclination	C[2)]
B	A	Cargo fall angle of attack	Corresponding to total inclination	2/C.2.4.2 2/C.2.5.2.1	Corresponding to total inclination	2/C.2.4.2 2/C.2.5.2.1	Corresponding to total inclination [3)]	2/C.2.4.2 2/C.2.5.2.1 4/D.3.2.4			C[2)]
B	A	Swell			To be calculated or influence factor	4/D.3.1 4/D.3.2.3	To be calculated or influence factor	4/D.3.1 4/D.3.2.3	2/C.2.6.2.2	Transv.acceleration Longt. Acceleration [4)]	C[2)]
B		Wind load	Lift. applia. / load; V=25 m/sn	2/C.3.1 2/C.3.2	Lift. applia. / load; V=25 m/sn	2/C.3.1 2/C.3.2	Lift. applia. / load; V=25 m/sn	2/C.3.1 2/C.3.2	2/C.3.1	V=50 m/sn; Lift. applia.	C[2)]
B		Ice load	If to be taken into account	2/C.3.3	If to be taken into account	2/C.3.3	If to be taken into account	2/C.3.3	2/C.3.3	If to be taken into account	C[2)]
SWL available			SWL	4/D.2.2.1	$SWL' = \frac{SWL}{f_e}$	4/D.2.2.1 4/D.3.2.3	$\overline{SWL} = \frac{SWL}{f_e} \cdot \frac{\psi}{\overline{\psi}}$	4/D.2.2.1 4/D.3.2.1	None		

3.2.2 The hoist load coefficient for working in a seaway shall be calculated as follows:

$$\overline{\psi} = 1 + \left(V_{H/60} + V_D\right) \cdot \sqrt{\frac{c}{g \cdot \overline{SWL}}}$$

V_H = Hook velocity in [m/min],

V_D = Vertical velocity of cargo deck in [m/s] according to Table 4.4,

c = Spring constant of lifting appliance and its foundation in [kN/m],

g = Gravitation constant 9.81 [m/s^2],

$\overline{SWL}$ = Reduced SWL in [kN] according to 3.2.1.

3.2.3 Without any more detailed investigation, the influence of the motion of the offshore installation on the crane located on it may be covered by means of the influence factor f_e according to Table 4.5 and an increase in the deck inclination by the angle ρ according to 3.2.4.

3.2.4 For working in a seaway the cargo runner angle-of-attack at the supply crane shall be increased by calculation, in the longitudinal and transverse direction of the crane boom, in addition to the heel angle κ and the trim angle by the following angle φ (based on the static inclination according to Table 2.1):

$$\rho = H_{1/3} \text{ in degrees}$$

$H_{1/3}$ = significant wave height in [m] (see Table 4.4).

3.2.5 Crane booms and slewing resp. swinging gear generally react sensitively to lateral loading. Proof shall be provided therefore that with a cargo runner angle-of-attack increased transversely (as in Fig. 4-5) by the angle ρ as in 3.2.4 the stresses in the slewing gear and in the horizontal boom structure do not exceed the permissible stresses for load condition C. With attention drawn to 2.2.1 it is recommended that crane booms and slewing or swinging gear of supply cranes be designed right from the start for an appropriately increased lateral force. Otherwise a further reduction in SWL is necessary.

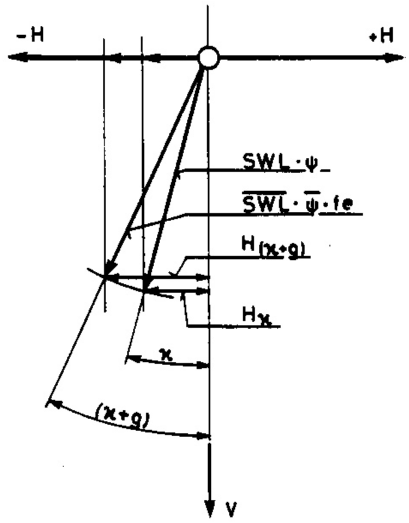


Figure 4.5 Horizontal forces

κ = Static angle of inclination acc. to Table 2.1

ρ = Angle according to 3.2.4.

3.2.6 For the calculation of the spring rate c according to 3.2.2 it should be assumed that the ropes are stationary. Since spring stiffness depends on the load radius, the spring constant must be established for various load radii. For the cargo runner length to be applied, it should be assumed that the cargo hook will be about 6 m above the surface of the water. When calculating the spring rate, an Young's-modulus of 0,75 x 10^4 [kN/cm^2] may without detailed proof be inserted for round- strand ropes.

3.2.7 If the lifting appliance is equipped with shock absorbers or swell compensators approved by the **TL**, a reduction of the SWL may be dispensed with totally or partially if the **TL** agrees.

$H_{1/3}$ = Significant wave height

T_0 = Average wave period

min V_H = Minimum hook velocity

V_D = Vertical velocity of cargo deck

Table 4.4 Wave period, hook and deck velocity

$H_{1/3}$ [m]	T_0 [sec]	Min. V_H [m/min]	V_D [m/sec]
0,5	3,1	13,2	0,34
1,0	4,1	19,8	0,61
1,5	4,8	25,2	0,86
2,0	5,4	30,0	1,09
2,5	5,9	34,2	1,31
3,0	6,3	37,8	1,53
4,0	7,1	45,0	1,95
6,0	8,3	57,6	2,73

Table 4.5 Influence factor f_e

Offshore Installation	f_e
Fixed platform	1,00
Semi –submersible	1,05
Ship	1,10
Pontoon	1,15

3.3 Reduction in SWL due to a motion response analysis

3.3.1 Instead of the simplified procedure described in 3.2, the reduction in SWL may be obtained by way of an investigation of the motion behaviour of the offshore installation, the crane and the supply ship. With this procedure the accuracy attainable depends on how well the motion of the offshore installation and of the supply ship can be represented by computation and how well the load-bearing structure of the crane is presented in the computer model.

3.3.2 The investigation according to 3.3.1 must comprise the following influences:

- Vertical movement of the load
- Horizontal movement of the load
- Load-bearing structure of crane
- Motion behaviour of offshore installation on which crane is located.

3.3.3 In the absence of more accurate information, the average wave period T_Q and the vertical deck velocity V_D of the supply ship based on the significant wave height according to Table 4-4 may be used for the investigation according to 3.3.1.

E. Regulations for construction and equipment

1. Construction regulations

1.1 Notes

1.1.1 Detailed explanations regarding interchangeable components and eyeplates are given ahead of the relevant Tables in Appendix A.

1.1.2 For sea lashing of all movable and also rotatable masses, special measures are required (see also Section 2, B.2.4).

1.2 Mobile cranes

1.2.1 Rail-mounted cranes and trolleys shall be safeguarded against derailment, overturning and dislodging and against unintentional movement in a seaway and in operation. Rail stops, warning devices and rail clearers shall be provided.

1.2.2 Cranes which can be moved athwartships shall be fitted with a direct drive (rack and pinion drive or equivalent).

1.2.3 Where cranes which can be moved fore-and-aft are not fitted with a direct drive, calculations are to be submitted proving that the cranes are able to move against a 2° inclination and against a wind load 50 % higher than specified in Section 2, C.3.1 with and/or without load, by friction contact.

1.2.4 The top of the crane rail shall lie parallel to the construction waterline (CWL) of the ship.

1.2.5 Where the operator has to move with the crane control unit, the speed of travel may not exceed 0,5 m/s.

1.2.6 Cranes which do not handle cargo

1.2.6.1 For cranes moving on rails, up to a SWL of 1,5 tons the requirement according to 1.2.2 is considered met if the load can be held safely by means of suitable restraints (tackles, pulley blocks, etc.) even against movement of the ship.

1.2.6.2 The requirement according to 1.2.2 is considered met in the case of engine room cranes with a SWL greater than 1,5 tons if the danger of slipping is averted by constructive engagement, that of accidental rolling by a self-locking drive or by brakes.

1.3 Access to crane cabins

1.3.1 Crane cabins of shipboard cranes must be so designed and arranged, and of such size, that they are easily accessible no matter what the position of the crane. An accident-proof standing position for a second person must be provided within the crane cabin.

1.3.2 If normal access is impossible when the cabin is occupied, a second entrance of sufficient size, which may also be the emergency exit, shall be provided.

1.3.3 Where the floor of the crane cabin is not more than 5 m above the deck, it is sufficient if the cabin can be reached without particular danger when the crane is in one position but can be left via an emergency exit no matter what the position of the crane.

1.4 Accesses in general

1.4.1 The headroom of entrances must be at least 2 m, the clear width at least 0,6 m. The clear height of the opening may be reduced by an up to 0,6 m high sill (freeboard convention).

1.4.2 The railings of access ways, platforms etc. must be at least 0,90 m high with a handrail at the top and an intermediate rail half way up. Additionally a foot rail at least 0.10 m high shall be provided.

1.4.3 Ladder rungs and climbing irons shall be of 20/20 square steel bar set edgewise.

1.5 Safety distances

1.5.1 In accessible areas, the distance between fixed parts of the ship and moving parts of the crane shall be at least 0,50 m in all directions and where passageways adjoin at least 0,60 m. Where guard rails are used as boundaries for working spaces and passageways, these must be at least 0,10 m from any moving parts.

1.5.2 If at certain points a distance of 0,50 m cannot be provided, the area concerned shall be identified with prominent black and yellow paintwork. Warning notices are to be fitted.

1.5.3 A distance of at least 0,50 m shall be provided between the lower edges of the jib in its lowest working position and fixed parts of the ship.

1.6 Utility spaces

1.6.1 In utility spaces (on board ships and in cranes) adequately-rated securing facilities for pull- lift hoists or holding devices shall be fitted in suitable places and suitable facilities for setting down of engine parts shall be provided.

1.6.2 To permit the performing of load tests on existing hoist's within the framework of the five- yearly thorough examination, eyeplates shall be provided at suitable points.

1.7 Miscellaneous

1.7.1 Subordinate members and auxiliary structures such as ladders, consoles, cable trays, etc. shall not be welded to highly stressed members. Where necessary, proof of fatigue strength shall be supplied.

1.7.2 Rope drums which cannot be under observation by the operator at all times must be provided with a forced guide system for the rope running onto the drum. This forced guide system must be fitted as a matter of principle where the rope cannot wind itself satisfactorily onto the drum. Such a forced guide system may take the form of a grooved drum, coiling gear or similar device.

1.7.3 The sheaves of cranes shall be fitted with a rope guard to prevent the ropes jumping out of the groove.

2. Equipment regulations

2.1 Crane booms

2.1.1 Direct or indirect acting luffing or swinging cylinders shall be fitted with safeguards in case of pipe fracture.

2.1.2 Cranes whose booms are held by luffing ropes shall be provided with stoppers for the upper end-position.

2.1.3 When a jib is in the stowed/lowest working position, at least three safety turns must remain on the rope drum.

2.2 Control stands, equipment

2.2.1 Control stands and controls must be so designed and located that the crane driver has an unobstructed view of the load itself or at least of the person guiding him.

2.2.2 Control stands of cranes of type B and C must take the form of closed drivers' cabins with adequate lighting, heating and ventilation. They must be fitted with accident-proof window panes, sun shields, window wipers and protective grids.

2.2.3 The controls must be marked to indicate their function. Movements of the controls must be appropriately related to the corresponding crane movements, e.g.:

a) When a vertical lever is pulled towards the operator, a horizontal lever is raised or a swivelling lever or handwheel turned clockwise, the load should rise or the crane move backwards;

b) When a vertical lever is pushed away from the operator, a horizontal lever is pushed down or a swivelling lever or handwheel turned anticlockwise, the load should descend or the crane move forwards;

c) As regards the slewing of slewing cranes, the direction of rotation of the crane must be the same as that of the control.

2.3 Safety devices

2.3.1 Limit switches

2.3.1.1 Limit switches shall be provided on principle when the operator is unable to oversee the entire execution of the movement. This does not apply to those movements of the load for which there is visual communication with the observer.

2.3.1.2 The following end positions are to be controlled by limit switches:

- Highest hook position
- Lowest hook position
- Highest crane boom position
- Lowest crane boom position
- Ends of travel

- Limit of swinging range.

2.3.1.3 Limit switches must be so designed and positioned that their efficiency is not affected by the weather or by fouling. Movement in the opposite direction must be possible following their response. Preferably, proximity switches should be used.

2.3.1.4 It should not be possible to overrun end positions, with the exception of the lowest crane boom position, should this be necessary for setdown. When the end position is overrun, the crane driver must receive a continuous warning.

2.3.1.5 Limit switches are to be located and adjusted in such a way that no damage can occur, even if they are approached at maximum speed and with full Safe Working Load. If necessary, pre-limit switches are to be used.

2.3.1.6 End position limitation for the highest crane boom position must be such that after depositing the Safe Working Load, no damage can occur as a result of released luffing ropes.

2.3.1.7 If necessary, limit switches must also act on other movements in order to prevent damage. This can for example be necessary for the highest hook position in conjunction with the luffing of the crane boom.

2.3.1.8 Regarding additional requirements for limit switches see Section 10, F.2.

2.3.1.9 In the case of electric hoists (rope or chain) which do not handle cargo and whose SWL does not exceed 6 t, the upper limit switch may be replaced by an adjustable slipping clutch.

2.3.1.10 In the case of cranes with hydraulically operated hoisting gear, whose SWL does not exceed 1 t, the upper limit switch may be replaced by a relief valve. A prerequisite for this is a low hoisting speed, appropriate design of the upper hook stop and an adequate safety factor of the rope.

2.3.2 Emergency switches/keys

2.3.2.1 At the place of control or inside the cabin an emergency switch or emergency cut out with mechanical locking device is to be provided. In hydraulic drives the emergency switch must also act on the electric drive of the hydraulic pump.

2.3.2.2 Return to service must be restricted to the zero position of the respective control elements or operating instruments.

2.3.3 Load radius-dependent SWLs

2.3.3.1 If cranes have different SWLs for differing load radii,

a) a jib angle indicator must be fitted in cases where the angle of the boom can be changed only in the unloaded condition

b) a load moment limiter must be fitted in cases where the angle of the boom can be altered under load.

2.3.2.2 Cranes of type B and C with load radius-dependent SWLs must have a load radius diagram in the driver's cabin.

The actual load radius must be indicated continually visibly to the driver. If what is indicated is not the load radius but the boom inclination, an appropriate conversion table must be provided.

2.3.4 Overload protection

2.3.4.1 Cranes and hoisting winches must be so designed or pre-set that it is not possible to exceed the SWL by more than 10% (exceptionally, in the case of certain hydraulic drives, by 15 %).

2.3.4.2 Where the SWL of a crane varies with the load radius, the overload protection device must adjust automatically to load radius changes.

2.3.4.3 In cases as in 2.3.4.2 the overload protection device must act also on the luffing system of the crane, i.e. the load moment must be limited.

2.3.4.4 After an overload protection device has responded, crane movements to reduce the load/ load moment must still be possible.

2.3.5 Control of slack rope

2.3.5.1 It is to be ensured by appropriate measures that either slack rope can not develope or that proper running of wire rope onto the drum is still maintained.

2.3.5.2 In case that slack rope may occur it must further be ensured that the hoist load coefficient on which the design is based may not be exceeded when picking up the load (see C.I.).

2.3.6 Warning devices

2.3.6.1 Cranes in general

2.3.6.1.1 Outside the crane operator’s cab, a signal horn is to be provided with which the crane driver can issue audible warnings which are well perceptible within the operating range of the crane.

2.3.6.1.2 Mobile cranes should issue a visual and audible alarm when in motion.

2.3.6.2 Offshore supply cranes

2.3.6.2.1 If the hook load reaches 90 % of the Safe Working Load or more, continuous visual warning of the crane driver is required.

2.3.6.2.2 In addition, continuous audible warning of the crane driver is required if the hook load reaches or exceeds 100 % of the Safe Working Load.

2.3.7 Working hours counter

Cranes for cargo handling and grab operation as well as offshore supply cranes are to be provided with counting mechanisms, with which the working hours are recorded.

2.3.8 Ship stability

2.3.8.1 Where the safe operation of cranes requires the simultaneous operation of a system for limiting the heel or trim, this system must either function automatically or must be so installed that the driver can clearly oversee the operation of all deck cranes.

2.3.8.2 Devices must be fitted, or operating instructions provided, to allow the accident-proof transmission of instructions from the supervisor to the driver. (Operating instructions must be enclosed with the rigging plans.)

2.4 Miscellaneous

2.4.1 In the event of a failure of the drive power, it must be possible to set down the suspended load without danger.

2.4.2 Devices enabling the slewing- or hoisting mechanism to be disconnected from its drives are not permitted.

2.4.3 All cranes must have a data plate containing at least the following details:

- Manufacturer or supplier
- Year of construction
- Serial number
- Type (if a type designation exists).

2.4.4 A plate prohibiting access to unauthorised persons must be fitted to each crane.

2.4.5 For lifting appliances located below deck, not used for handling cargo, load hooks with a safety flap according to DIN 15401 are permitted

3. Operating instructions

3.1 Cranes in general

3.1.1 Each crane must be permanently and prominently marked with the maximum permitted SWL and load radius. See also Section 13.

3.1.2 Any special working conditions, restrictions or operating instructions are to be embodied in the rigging plans or enclosed with these.

3.1.3 Provision shall be made to ensure that when the designated boundary weather conditions (seaway, wind) occur, the crane is securely lashed and/or refuge is sought in sheltered waters.

3.2 Floating cranes

3.2.1 Where pontoons carrying floating cranes under load are operated in calm water a safety distance of at least 0,50 m must be maintained between the deck edge at the lowest comer and the surface of the water. When working in unprotected waters, a safety distance of at least 1,00 m shall be maintained.

3.2.2 The transport across unprotected waters of loads suspended from the crane hook is subject in each case to approval by the **TL**.

3.2.3 In the event of a grounding of the floating structure, the cranes located on it may only be operated if the structure is designed for that situation.

F. Foundations and crane pedestals

1. Notes

1.1 Foundations, crane pedestals and also boom stowages arc regarded as being part of the ships classification if they are firmly welded to the hull.

1.2 The bolt connection is to be dimensioned according to recognized guidelines, calculation principles or standards according to which, if need be, also a fatigue strength proof for the bolts can be conducted.

1.3 For proof of fatigue strength, crane foundations/pedestals shall be categorized in the same stress group as the associated cranes.

2. Crane foundations and boom stowages

2.1 Foundations must be dimensioned adequately for the conditions **"crane in operation"** and **"crane out of operation".** For boom stowages, the condition **"crane out of operation"** is the decisive one (see Section 2).

2.2 Wherever bending moments have to be transmitted and the constraint does not extend over two decks of the ship, foundations and boom stowages must be so joined to the connecting-deck and the stiffening arrangements associated with it that the stresses can be accepted and transmitted safely.

2.3 Doubling plates underneath foundations and boom stowages make sense and are permitted only for the transmission of compression forces.

2.4 If high-strength pre-stressed bolts of the strength group 10.9 and 12.9 are used, constraint may be taken into consideration for the dimensioning of flanges at the location of bolts.

3. Crane pedestals

3.1 Cylindrical crane pedestals

3.1.1 The upper portion of crane pedestals provided with a flange for connecting a slewing ring should generally be constructed as shown in Fig. 4.6.

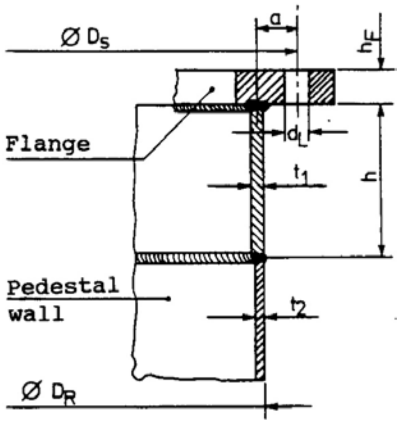


Fig. 4.6 Upper portion of crane pedestal

D_s = Hole pitch circle diameter,

D_R = External diameter of cylinder,

h_F = Thickness of flange,

d_L = Bolt hole diameter,

$$a = \frac{D_s - D_R + t_1}{2}$$

h = Height of connection region,

t_1 = Thickness of cylinder wall in connection region,

t_2 = Thickness of cylinder wall below connection region.

3.1.2 Compliance is recommended with the following conditions:

$h_F = 3 \cdot t_1$

$a \leq 2 \cdot d_L$

$t_1 \geq 1{,}5 \cdot t_2$

Furthermore the following is to be observed:

3.1.2.1 Running circle of slewing rings

The diameter of running circle should generally correspond to that of the upper and lower connecting cylinders to avoid the need for supplementary measures such as welding-on brackets.

If brackets do have to be fitted, they may not be more than two bolt hole pitches apart.

3.1.2.2 Flange dimensions

Flange thickness may be calculated as follows:

$$h_F \geq \sqrt{5 \cdot \frac{\sigma_R \cdot t_1 \cdot a}{\sigma_{Fzul}}}\ , [\text{cm}]$$

a/t_1 see Figure 4.6.

σ_{Fzul} = Permissible stress in the flange according to Section 2, D.5.2 load condition A [kN/cm^2],

σ_R = Stress in the connection portion of the cylinder in load condition (see Figure 4.6),

$$\sigma_R = \frac{M_{Kr}}{W_z} \pm \frac{V_{Kr}}{F_z}$$

M_{Kr} = Bending moment from the crane including dead load- and hoist load coefficients in load condition A, [kNcm],

V_{kr} = Vertical load [kN] from the crane associated with M_{Kr} Any simultaneously occurring radial load may not exceed 20% of V_{Kr},

W_z = Section modulus of the cylinder in the connection region [cm^3],

F_z = Connection surface area of cylinder [cm^2]

3.1.2.3 Flatness of flange

The flatness of the connection surface for the slewing ring must meet the requirements of the manufacturer of the ring.

The flange thickness required according to 3.1.2.2 must still be guaranteed after the flange has been faced.

The use of cast filling material to achieve the flatness required by the manufacturer of the slewing ring must be individually approved by the **TL** in each case.

3.1.2.4 Determination of cylinder wall thickness t_1 (Fig. 4.6)

The wall thickness t_1 is to be determined on the basis of fatigue strength.

For proofing this according to DIN 15018 the various connections are to be categorized according to the notch conditions in Fig. 4.7.

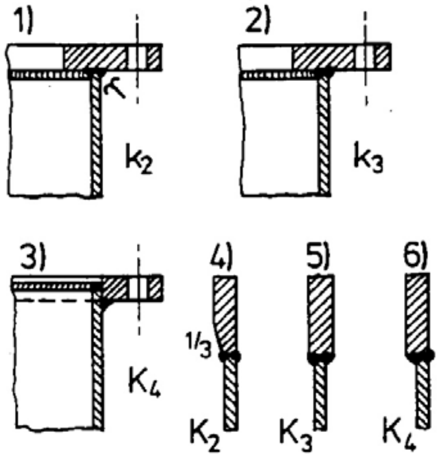


Fig. 4.7 Notch condition categorization

For the frequently occurring limiting stress relationship

$$\kappa \cong -0{,}9 = \frac{\sigma_{Rmin}}{\sigma_{Rmax}}$$

the values of σ_{Rzul} from which t_1 may be calculated can be taken from Table 4.6.

3.1.2.5 Height of connection region h (Fig.4.6)

The height h of the uppermost ring of the cylinder must be at least $0{,}2 x D_s$ the upper reference point being either the underside of the flange or the lower edges of brackets.

3.1.2.6 Connecting weld

Connecting welds according to Fig. 4.7, sketch 3) are suitable only for low-stress applications and require the TL's approval in each individual case.

Connecting welds according to Fig. 2.7, sketches 1) and 2) must be fully connected and in the form of a double-bevel weld with double fillet weld.

The values in brackets apply in cases where buckling is not decisive. (Also when using Table 1 in Appendix A.)

Table 4.6 Permissible stress in connection cylinder

σ_{Rzul} [kN/cm²]									
Material		St 37 or similar				St 52.3 or similar			
Loading group		B2	B3	B4	B5	B2	B3	B4	B5
Notch condi-tion	K2	14,7 (16,8)	14,7 (16,8)	13,1	9,3	20,7 (23,6)	18,6	13,1	9,3
Notch condi-tion	K3	14,7 (16,8)	13,3	9,4	6,4	18,8	13,3	9,4	6,4
Notch condi-tion	K4	11,3	8,0						

3.1.2.7 Determination of cylinder wall thickness t_2 (Fig. 4.6)

The wall thickness t_2 shall be determined without any special restriction but if applicable taking into account buckling resistance and/or fatigue strength.

3.2 Rectangular crane pedestals

Rectangular crane pedestals shall be dimensioned on the basis of the maximum corner stress according to Fig. 4.8.

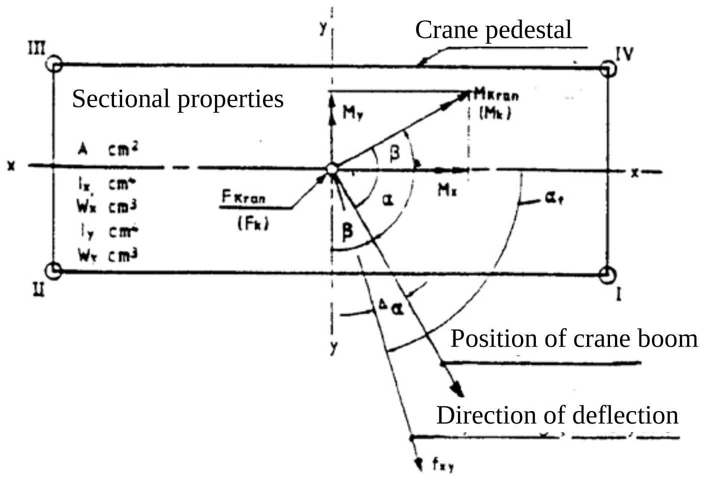


Figure 4.8 Corner stresses in rectangular crane pedestals

Bending moments:

$M_x = M_k \cdot \sin\alpha = M_k \cdot \cos\beta$

$M_y = M_k \cdot \cos\alpha = M_k \cdot \sin\beta$

Position of crane boom to reach max. corner load:

$$\alpha = tg^{-1}\frac{W_y}{W_x}, \quad \beta = tg^{-1}\frac{W_x}{W_y}$$

$M_x = M_k \cdot \sin\boldsymbol{\alpha} = M_k \cdot \cos\boldsymbol{\beta}$, [kNcm]

$M_y = M_k \cdot \cos\boldsymbol{\alpha} = M_k \cdot \sin\boldsymbol{\beta}$, [kNcm]

$$\boldsymbol{\alpha} = tg^{-1}\frac{W_y}{W_x}$$

$$\boldsymbol{\beta} = tg^{-1}\frac{W_x}{W_y}$$

M_k = Bending moment from the crane

W_x = Section modulus referred to the x axis, [cm^3]

W_y = Section modulus referred to the y axis, [cm^3]

3.2.2 In contrast to cylindrical crane pedestals, where under certain circumstances proof of buckling strength may be omitted (see Section 2, E.3.3), proof of buckling strength is required on principle for rectangular crane pedestals. If necessary, anti-buckling stiffeners are to be fitted.

3.3 Transitions and sharp bends

3.3.1 Where crane pedestals have conical or trapezoidal transition regions the corners of the sharp bends, particularly where these are in flat plates, must be stiffened to be able to absorb the deflection forces.

3.3.2 In the case of conical transition regions from a cylindrical crane connection to a rectangular pedestal, the corners of the sharp bends between the curved parts and the flat gussets shall be given special attention. If appropriate the corners are to be stiffened.

3.3.3 The stiffening called for by 3.3.1 resp. 3.3.2 may be omitted if the deflection forces can be absorbed by having thicker plates or cylindrical walls of adequate bending strength.

3.4 Connection to the hull

3.4.1 Wherever possible, crane pedestals should be linked to the hull over a full deck-height; if necessary, e.g. in the case of crane pedestals located at the ship's side, even to a greater depth to the structure of the ship.

3.4.2 Crane pedestals which by virtue of their location act as stiffness-discontinuities in the longitudinal structure of the ship, such as for instance crane pedestals at the sides, are to have suitable taper brackets fitted along the longitudinal walls.

3.4.3 Bulkhead transit openings above deck must be at least 2 m high and have a clear width of 0,60 m. This does not preclude having rounded corners, and a sill up to 0,60 m high above the deck.

SECTION 5

LIFTS AND LIFTING PLATFORMS

Page

A. Generell

1. The dimensioning, testing and examinating of lift units on board ships does not constitute part of the classification of the ship.

The classification does, however, include checking the structure of the ship's hull in way of the forces transmitted by lifts plus testing for weathertightness and structural fire protection.

2. As regards the materials to be used, and welding, the regulations in Sections 11 and 12 apply.

3. As regards the ship-specific demands made on mechanical parts or the electrical equipment, the regulations in Sections 9 and 10 apply.

4. Shipboard lifts frequently operate under less favourable conditions than comparable units ashore. To ensure safe operation therefore, supplementary measures shall be taken if necessary (see also D.2.4).

5. The regulations that follow apply to lifts on board ships and offshore installations. The mandatory or agreed application of national rules however remains unaffected as a matter of principle.

B. Definition and rules

1. Definition of types of lift

Supplementing and extending beyond the definition in Section **I,** F.4 and 5., the following distinctions are made between lifts:

1.1 Passenger lifts

Passenger lifts are lift units designated to carry persons or persons and goods.

1.2 Goods passenger lifts

Goods passenger lifts are lift units designated to carry goods and/or members of the crew.

Other persons may be carried if goods passenger lifts are operated by attendants, or if the cars are provided with doors.

1.3 Goods lifts

Goods lifts are lift units exclusively designated to carry goods.

1.4 Simplified goods lifts

Simplified goods lifts are lift units exclusively designated to carry goods with the following restrictions:

- At most three landing positions
- Lifting capacity up to 2,000 kg
- Car floor area up to 2,5 m^2
- Speed up to 0,3 m/s.

1.5 Service lifts

Service lifts are lift units not accessible to persons and exclusively designated to carry goods with the following restrictions:

- Car inaccessible to persons *)
- Lifting capacity up to 300 kg
- Car floor area up to 1,0 m^2

*) *Lift trunk door maximum height 1,2 m.*

2. Exceptions

2.1 The units listed under 2.2 are not considered lifts.

Apart from the regulations under E, dimensioning, testing and examinating of these lifting devices may be carried out analogously to the regulations in these Lifting Appliance Regulations.

2.2 The following units are not considered lifts:

- Lifting platforms (definition see Section 1, F.5)

- Goods lifts loading and unloading automatically
- Lowerable wheelhouses
- Escalators
- Equipment and units for serving shelves
- Manually operated lifts.

Table 5.1 Regulations to be applied to lifts and lifting platforms on board ships

Type of lift		**TL** Lifting Appliances Regulations Foreign flag	
		Section 5, D	Section 5, E
	Passenger lifts	X	—
	Goods passenger lifts	X	—
Goods lifts		—	X
Simp.goods lifts		—	—
Service lifts		X	—
Lifting platform		—	X

C. Plan approval and supervision during construction

1. Plan approval

1.1 For new-construction lift units and lifting platforms and in the case of significant modifications, plan approval by the **TL** Head Office is required as a matter of principle.

1.2 For lift units, the following count as significant modifications:

1.2.1 Modification:

- of the lifting capacity
- of the operating speed
- of the current type or voltage
- of the number of landing positions
- of the location of the driving machinery
- of the height of the lift trunk to the safety system of the controls
- of the selector gear, insofar as it has any safety function
- of the guide rails of the oil buffers of the speed governor of the door locks of the car doors
- of the car frame and the car generally, insofar as safety is affected
- of the safety gear
- of the gearing
- of the traction sheaves
- of the driving machinery shafts
- of the rope drums
- of the chain wheels
- of the means of suspension
- of the brake in the hydraulic system
- of the driving motor.

1.2.2 Renewal:

- of safety gear
- of traction sheaves
- of the selector gear, insofar as it has any safety functions.

In the case of renewal of the abovementioned parts, in lieu of plan approval confirmation by the manufacturer that the new parts are identical in construction with those used originally may suffice. In the case of safety gear, additionally a component test certificate is to be submitted, plus a certificate from the manufacturer that the safety gear is covered by the component test certificate.

1.2.3 Not considered significant modifications are the **renewals** of the following parts:

- means of suspension
- gearing
- driving machinery shafts
- rope drums
- chain wheels
- brakes
- brake linings
- parts of the hydraulic system
- door-actuating motors
- guide rails
- parts of the car
- contactors, relays or their coils, electrically controlled master switches or contacts
- speed governor
- speed-governor component parts
- restoration of the original adjustments following a partial repair

1.3 Documents to be submitted

For all lifts transporting persons, the following documents shall be submitted for examination:

1.3.1 Description of the lift unit (for ships and signed by manufacturer and operator).

1.3.2 Drawings of/concerning:

- driving machinery room, access
- sheave compartment, access
- switchgear compartment
- lift trunk accesses
- overrun spaces
- safety spaces
- trunk-pit access (or means for climbing down)
- space below car track
- space below counterweight
- arrangement of equipment and ventilation openings in the driving machinery room
- arrangement of accessories in the sheave compartment
- location and dimensions of rope sheaves
- maintenance- and emergency accesses
- car dimensions
- clearances to trunk and counterweight
- location of traction sheaves and rollers
- location of lifting cylinders or spindles.

1.3.3 Circuit diagrams:

- electrical
- hydraulic

1.3.4 Copies of the component test certificates from recognized testing bodies for the following safety-relevant components:

- door locks of lift-trunk doors whose clear height exceeds 1,2 m
- any kind of safety gear
- speed governors
- energy-absorbing and energy-storing buffers
- electronic components of electrical safety switchgear.

For series-production items, the component manufacturer will receive only one component test certificate per series. The manufacturer or supplier of a lift must therefore in addition to the copy of that certificate supply an own certificate which indicates that the component test certificate covers the component supplied.

1.3.5 TL test certificates for the following safety-relevant components:

- suspension ropes
- chains
- cylinders with pistons
- pressure hoses
- pressure pipes
- explosion-proof electrical machinery.

With Head Office approval, makers' certificates may be accepted.

On demand by **TL**, the manufacturer may have to provide weight certificates for moving parts.

1.3.6 Calculations

- For the components or requirements listed below, calculations shall be submitted:
- means of suspension (loading)
- driving capacity and specific pressure between traction grooves and ropes
- guide rails (holding forces, bending forces from the car)
- traction sheaves- or drum shafts
- cylinders and pistons
- pressure lines
- V-belt drives
- other safety-relevant components such as:
  - shafts of turning round sheaves
  - hoist-limiting stops
  - buffers lacking a component test certificate
- machinery supports
- frameworks of lifts whose lifting capacity exceeds 2000 kg.

1.3.7 Specific salvaging and maintenance instructions shall be submitted for every lift. These instructions are later to be filed in the Register Book for lift units and put up in the machinery compartment in the form of two notice boards.

1.3.8 In special cases **TL** may call for the compilation of a trials programme and an operator's manual.

1.4 For lifts for transporting persons on board foreign-flag ships, drawings and calculations to the extent shown under 1.3 are to be submitted.

1.5 For goods lifts on board foreign-flag ships and for lifting platforms in general, drawings to the extent called for in Section 1, E are to be submitted.

1.6 From the documents submitted in duplicate for examination, TL compiles a Register Book for lift units, which after the initial test on board the vessel is handed over by the TL Surveyor to the ship's management or the yard to remain on board.

If the submitting party wants an examined copy of each of the submitted documents back, the documents must all be submitted in triplicate.

In the case of goods lifts on board foreign-flag ships and lifting platforms in general, the Register Book to be handed over by the **TL** Surveyor is identical with **TL** "Register Book for Lifting Appliances and Cargo-handling Gear" on the basis of international ILO regulations.

2. Supervision during construction

For supervision during construction and the final test and examination at the manufacturers, the regulations in Section 13 apply.

D. Passenger lifts and service lifts

1. Notes

1.1 The regulations that follow apply as a matter of principle to all the shipborne lifts named in the title.

1.2 Construction may deviate from the regulations/standards listed under 1.1 if due to special circumstances (ship-constructional constraints) or technical or operational advantages this is necessary or makes sense.

1.3 For tests and examinations the regulations under F apply.

1.4 Ships equipped with classed passenger lifts complying with this subsection are given **LA (PL)** class notation.

2. Design criteria

Apart from complying with the constructional requirements according to 4., shipborne lifts must comply with the conditions described below.

2.1 Ship inclination

2.1.1 Operation in harbour

Lifts units operated in harbour or other calm waters must be designed for the static minimum inclinations according to Table 2.1.

2.1.2 Operation at sea

Lifts units operated at sea must at least be designed for the following ship movements and must remain safely operable under these conditions:

- ship's rolling movement ±10°; associated roll period T_R = 10s
- ship's pitching movement ±5°; associated pitch period T_s = 7s

The acceleration forces may be calculated in accordance with the regulations under 3.1.3.1.

Electrical installations must operate reliably up to a heel of 15 and up to a trim of 7,5°. For electrical components which must not fail even in an emergency situation, these values are 22,5° and 10° respectively.

2.1.3 Putting out of operation

If the seaway conditions according to 2.1.2 or the deviating design conditions are exceeded, the lift units must be put out of operation and if appropriate brought to special stowage positions. (As a rule the lowest landing position.)

Up to a 45° inclination of the ship, there must be no inadvertent switching processes or changes of function. For calculation of the acceleration forces, the regulations in Section 2, C.2.6.2.2. apply.

2.2 Operating speed

Generally, the operating speed should not exceed 1 m/s.

2.3 Environmental conditions

Lifts units shall be designed for the expected environmental conditions such as humidity, temperature variation, increased attack by corrosion, and vibration (see also Section 2, B.2.5 and 2.6, Section 9, B.1.1 and 3., and Section 10, B.3.).

2.4 Operating conditions

If special operating conditions make an operator's manual necessary to guarantee accident-proof and uninterrupted operation, the operator's manual must contain all relevant information.

3. Dimensioning

3.1 Design loads

Regarding the design loads to be used for calculations, in principle the regulations in Section 2, C. apply. The following apply additionally:

3.1.1 Dynamic forces due to drives

3.1.1.1 Loading coefficient

In the case of cars loaded or unloaded by powered appliances, e.g. fork lift trucks, a loading coefficient β = 1,2 is to be taken into account for the moved load (load plus loading appliance).

3.1.1.2 Hoist load coefficient

For the car plus the load, a hoist load coefficient ψ= 1,2 is to be taken into account. (For a definition of hoist load, see Section 1, F.10.3.).

3.1.1.3 Dead load coefficient

For the dead load of moving parts, such as for instance a counterweight, a dead load coefficient φ = 1.2 is to be taken into account.

3.1.2 Inclination of the ship

3.1.2.1 Operation in harbour

The static minimum inclinations as in Table 2-1 apply.

3.2.1.2 Operation in a seaway

Lifts are at least to be designed for the ship inclinations according to 2.1.2. Higher values may be agreed.

3.1.2.3 "Out of operation" condition in a seaway

The dynamic minimum inclinations according to Table 2-3 apply.

3.1.3 Dynamuc forces due to motions of the ship

3.1.3.1 Operation in a seaway

The rolling/pitching acceleration can on the basis of the information in 2.1.2 be calculated as follows:

$$b_R = 1.2\left[\left(\frac{2\pi}{T_R}\right)^2 \cdot \sqrt{h^2 + b^2} \cdot \kappa \cdot \frac{\pi}{180}\right]$$

$$b_S = 1.2\left[\left(\frac{2\pi}{T_S}\right)^2 \cdot \sqrt{h^2 + \ell^2} \cdot \vartheta \cdot \frac{\pi}{180}\right]$$

b_R/b_S = rolling/pitching acceleration in [m/s^2] at right angles to the gravity vector

T_R/T_S = roll/pitch period in [s]

h, b, ℓ = distances of centers of gravity in [m] according to Fig. 2.1 and 2.2

κ, ϑ = angle of heel, of trim

The acceleration values for rolling and pitching include a 20 % surcharge for heaving in each case, and are to be considered separately, i.e. as not occurring simultaneously.

3.1.3.2 "Out of operation" condition in a seaway

The rolling/pitching acceleration can be established as described in Section 2, C.2.6.2.2.

3.1.4 Guide rails

For dimensioning the guide rails, an off-centre location of the load centre of gravity of 10 % longitudinally respectively transversely shall be used as a basis.

3.2.1 Requirements to be met by the calculation

In principle, the regulations in Section 2, D. apply. The following apply additionally:

3.2.1 Load conditions

3.2.1.1 Load condition A

For operation in harbour the basis of proof is to be:

- static minimum inclination acc. to Table 2.1
- dead loads x dead load coefficient φ
- hoist load x hoist load coefficient ψ

Applying to the condition "when being loaded":

- static minimum inclination acc. to Table 2.1
- dead loads
- loads
- loads moved x loading coefficient β

3.2.1.2 Load condition B

For operation in a seaway the basis of proof is to be:

- ship inclinations acc. to 2.1.2 or as agreed
- dead loads x dead load coefficient φ
- hoist load x hoist load coefficient ψ

or alternatively:

- ship inclinations acc. to 2.1.2 or as agreed
- dead loads
- hoist loads
- accelerating forces according to 3.1.3.1.

3.2.1.3 Load condition C

For the condition "out of operation" in a seaway the basis of proof is to be:

- dynamic inclinations of the ship according to Table 2.3
- dead loads
- accelerating forces according to Section 2, C.2.6.2.2.

For the condition "lifts when safety gear is actuated", the basis of proof is to be:

- static inclinations of the ship according to Table 2.1
- dead loads
- loads
- accelerating forces arising from the arrest (at least 2 g up to a max. of 5 g, corresponding to the component test certificate of the safety gear).

3.2.2 Guide rails

Guide rails shall be dimensioned in accordance with the load conditions described above. No allowance shall be made for any continuity effect for extending over several supporting points.

3.3 Strength computation

In principle the regulations and permissible stresses in Section 2, E apply. The following apply additionally:

3.3.1 For all means of suspension, safety against breaking shall be proved. This applies for example to ropes, chains, spindles, hydraulic rams and pressure lines.

3.3.2 Wire ropes may be stressed up to 1/10 of their minimum breaking load; in the case of service lifts, up to 1/6.

3.3.3 Pitched chains may be stressed up to 1/10 of their breaking load; in the case of service lifts, up to 1 /8 if more than one chain is used.

4. Design requirements

4.1 Lift trunk

4.1.1 Lift units must have lift trunks.

4.1.2 Lift trunks must be enclosed on all sides by steel-plate partitions/cover plates. They must have a head-space and a pit.

4.1.3 Trunks of lifts which may transport persons must have an upper and a lower safety space. The lower space must have a minimum height of 0,5 m; the upper, of 0,75 m.

In the case of service lifts it must be possible to create a lower safety space at least 1,5 m high.

4.1.4 Several lifts in one trunk plus the associated counterweights are to be separated by continuous plate partitions.

4.1.5 Trunks of lifts which may transport persons must have an independent ventilation system.

4.1.6 No components, installations or units unconnected with the lift may be accommodated in the lift trunk.

4.1.7 Components inside lift trunks must be so arranged or secured that persons in the trunk for test-, maintenance- or repair purposes are not endangered.

4.1.8 Ropes hanging in the trunk must be protected against damage due to seaway.

4.1.9 Lift trunks must be sealed so that water cannot enter.

4.1.10 Lift trunks must comply with the SOLAS fire protection regulations.

4.1.11 As regards special means of escape, the regulations under 4.8 apply.

4.2 Doors and flaps

4.2.1 Trunks and lift cars in which persons may ride must have adequately rigid and unbroken- surface doors at all accesses.

4.2.2 Lift trunk doors may not open into the track of the lift.

4.2.3 The drive must only be able to start if all doors are closed.

4.2.4 Opening of a lift trunk door must be possible only when the drive has been switched off and the car is level with that door.

4.2.5 The mechanism controlling doors and flaps must prevent self-acting opening, closing or slamming shut even in a seaway.

4.2.6 Door openings must have a minimum clear height of 2000 mm and a width of 800 mm (600 mm for doors intended exclusively for members of the crew).

The clear height of doors may be restricted by a sill of max. 0,6 m height, if this is necessary because of the freeboard convention.

Flaps intended for passing through must in lift trunks have a clear opening of at least 600 x 600 mm.

4.2.7 All doors must have emergency unlocking arrangements.

4.2.8 Lift trunk doors are not to give direct Access to dangerous areas, e.g. machinery compartments.

4.2.9 The deck areas giving access to lift trunk doors must have a non-slip covering.

4.2.10 Lift trunk doors must comply with the SOLAS fire protection regulations.

4.2.11 As regards special means of escape, the regulations under 4.8 apply.

4.3 Car and counterweight

4.3.1 Cars in which persons may ride must have a non-slip floor covering and a handrail along at least one side.

4.3.2 Cars for transporting persons must have ventilation openings of adequate size and be adequately lit.

4.3.3 In the case of cars for transporting persons the allowed load must in dependence on the floor area comply with the following conditions:

$N \geq 360 \times F^{1,2}$

N = load in [kg]

F = car floor area in [m^2]

4.3.4 Only counterweights of steel or similar solid materials are permitted; counterweights of concrete are not permitted. Fill or balance weights must be inside a steel frame or fixed permanently and undetachably in some other way.

4.3.5 Cars and counterweights must be held in position by guide rails over their entire length of travel, including possible overruns.

The maximum deflection of guide rails during operation shall not exceed 3 mm.

4.3.6 The guide shoes sliding or rolling along the guide rails shall be fitted with emergency guide plates or other means of emergency guidance.

4.3.6 As regards special means of escape, the regulations under 4.8 apply.

4.4 Means of suspension

4.4.1 The only means of suspension permitted are wire ropes, pitched chains, hydraulic rams, spindles or toothed racks.

4.4.2 The means of suspension must be so dimensioned and secured that they will withstand the expected loadings safely.

4.4.3 Cars must be suspended from at least two ropes or chains. For service lifts with a lifting capacity of less than 100 kg, one chain is sufficient.

4.4.4 Counterweights must be connected to the car by at least two ropes.

4.4.5 Cars with traction sheave drives must hang from at least three ropes. If there arc several traction sheaves, there must be at least two ropes per sheave.

4.4.6 If tensioned balance ropes are used, the tension must be applied by weights.

4.4.7 Wire ropes or pitched chains must be connected by means of special fittings so as to guarantee even loading.

If springs are used for this, these must be loaded in compression. If whipping bars are used, the leverage must not vary.

4.4.8 Lang lay ropes may be used only with TL approval.

4.4.9 Rope end fastenings must be as follows:

- according to DIN 3092 poured

- according to DIN 83813 spliced
- fastened with rope sockets acc. to DIN 15315
- fastened with wedge sockets according to DIN 43148
- fastened with ferrules according to DIN 3093.

Rope sockets and wedge sockets shall be secured by wire grips according to DIN 1142. In the case of wedge sockets, the wire grips should seize only the loose end of the rope.

4.5 Free fall protection and buffers

4.5.1 Cars and counterweights must have safety gears which in the event of excessive downward speed or of breakage of the suspension are engaged by independent speed governors.

In the case of service lifts this applies only if the runway of the car or the counterweight extends down to the double bottom or if there are accessible compartments underneath.

4.5.2 Cars supported directly by hydraulic rams do not require a safety gear. However, the hydraulic rams must then be provided with a pipe fracture protection device.

4.5.3 Pipe fracture protection devices must after actuation be disengaged automatically by upward movement of the piston.

4.5.4 The travel of the car and the counterweight must be limited at the bottom by buffers. This does not apply to lifts which due to their construction cannot overrun the end stopping points.

4.5.5 In the case of drives with drums, upward travel also must be limited by a buffer fitted with a device for switching-off the drive.

4.5.6 Buffers must be capable of absorbing the kinetic energy of bringing to a stop cars loaded with the allowed load or counterweights, moving at normal operating speed. In the case of lifts for transporting persons, the deceleration of the car must not exceed 1 g.

4.6 Drives

4.6.1 In general the operating speed should not exceed 1 m/s.

4.6.2 The electrical equipment must be insensitive to current fluctuations in the ship's mains and must comply with the regulations in IEC publication 92.

4.6.3 Each lift must have its own power unit. Power units must be protected against the weather.

4.6.4 Power units must be so constituted and equipped that they move and arrest the load bearing means safely when operated in the envisaged manner.

4.6.5 Power units must be accessible, maintainable and repairable unobstructed. The access to the power unit must be lockable.

4.6.6 Traction sheave drives must satisfy the following conditions:

4.6.6.1 Adequate traction capacity is to be proved mathematically (for a relevant test see F.3.I.3.6., E.).

4.6.6.2 The suspension ropes must not become slack when the car or the counterweight sets down.

4.6.6.3 Traction grooves must be made dimensionally stable.

4.6.6.4 The diameter of traction sheaves, referred to the rope centres, must as a minimum correspond to 40 times the rope diameter.

4.6.6.5 Suspension ropes must be safeguarded against the rope leaving the grooves.

4.6.6.6 Traction sheaves projecting into the trunk with the ropes going upwards must be protected against dropping particles entering the driving mechanism.

4.6.6.7 Traction drives must arrest a lift and hold it in place if:

a) A command to move is given but the drive does not start.

b) The car or the counterweight sets down. The response time may not exceed 45 s, or else the total travel time + 10 s or a time of 20 s if the travel distance is less than 10 m.

These safety devices must not affect the controls for inspections or the controls for emergency electrical operation.

Rope drums may only be used for lifts without counterweights.

4.6.8 The diameter of rope drums referred to the rope centre must be at least 35 times the rope diameter.

4.6.9 There must be only one layer of rope and the ropes must run in grooves.

4.6.10 If the ropes are not prevented from running off the drum by special measures, flanges must be fitted which extend ***2Zi*** rope diameters beyond the uppermost layer of rope.

4.6.11 The groove diameter of rope sheaves must correspond to at least 40 times the rope diameter.

4.6.12 Rope sheaves made of plastic may be used only with TL approval.

4.6.13 Sheaves must be safeguarded so that the rope cannot jump out.

4.6.14 Lifts for transporting persons must be equipped with a dual brake system, the two being independent.

4.6.15 For the eventuality of driving power failure, lifts for transporting persons must be provided with mechanical means with make it possible to move the lift to the nearest landing position.

For traction drives a handwheel and a brakeventing device can be provided for this; for hydraulic drives a drain valve, and if there is a safety gear additionally a hand pump.

In the case of traction drives, it is recommended to provide a emergency electrical operation system.

4.6.16 Hydraulic cylinders must be designed for 1.7 times the static pressure and cylinders and pistons must have a wall thickness supplement of 1 mm.

4.6.17 Before being put into use for the first time, the cylinders are to be pressure-tested in accordance with Section 13, B.3.3.4.2.

4.7 Equipment

4.7.1 Lifts for transporting persons must have the following equipment in the car:

- movement command unit
- landing position indicator
- emergency brake switch or key
- emergency lighting
- emergency alarm
- intercom.

The emergency lighting, emergency alarm and intercom must all be connected to the ship's emergency power supply.

Emergency alarm and intercom must be in contact with a permanently manned area in the ship.

The emergency lighting must switch on automatically in the event of a power failure.

4.7.2 Cars of lifts for transporting persons must have an inspection control unit on the cage roof.

By switching the inspection control on, push buton switches on the car roof which can be used to drive the car must be made operational; automatic door movement must be prevented. Control by means of the push button switches must not involve any locking.

4.7.3 The electrical operating means must be so installed and switched that the lift unit can be operated properly.

The lines to the controls and to the power unit must be capable of being switched under load (master switch).

4.7.4 Technical safety equipment (c.g. door locks, safety gear, speed governor, energy-absorbing buffers) intended to prevent operation of the unit if danger threatens is to be controlled electrically (safety switches).

Should mains voltage or that in control circuits of technical safety equipment fail or be absent, this must result in the car being stopped or not starting.

4.7.5 Earths, body contacts or short circuits must not create threatening conditions in the lift unit.

4.7.6 Power units and associated switchgear must be located in separately lockable compartments protected against the weather, dry and ventilated. The requirements for power unit compartments apply also to switchgear-, transformer- and similar compartments.

4.7.7 A free space with a floor area of at least 0,5 m x 0,6 m and a clear height of at least 1,8 m must be available for the purpose of maintaining and testing power units, traction sheaves, brakes, handwheels, hand pumps, etc. The free spaces must on one side adjoin the items to be maintained and tested; the floor need not be rectangular.

4.7.8 In front of switchgear there must be a space free from any built-in items at least 0,7 m deep, 1,8 m high and corresponding in width to the full width of the switchgear frame but at least 0,5 m wide.

Above rotating parts of the power unit there must be a clear space at least 0,3 m high.

Moving parts of machinery lacking a casing must be marked with the safety-colour yellow.

4.7.9 Sheaves for suspension means arranged outside the lift trunks or the power unit compartments must be accommodated in sheave compartments.

Sheave compartments must be easily accessible.

4.7.10 In the case of hydraulic cylinders, bypass valves must be provided to permit testing of the pipe fracture protection valves.

4.8 Escapes

4.8.1 Lift units for transporting persons must be so constructed that trapped passengers can be rescued and crew members can escape.

Lift units on board cargo vessels, carrying up to 12 passengers, count as lift units for crew members.

4.8.2 General requirements for cars

The following requirements apply to all lift units for transporting persons.

4.8.2.1 The car roof is to embody an escape flap with a minimum area of 0,24 m^2, the length of one of the sides being not less than 350 mm. Car escape flaps may only open outwards. Escape flaps may not project beyond the edge of the car when open.

The escape flap must be controlled electrically, i.e. opening of the flap must result in the lift being stopped. Mere closing of the flap must not permit travel to continue; operability must only be restored by virtue of intentional re-locking.

4.8.2.2 Inside the car of lift units for crew members at least one notice describing the escape route in two languages must be put up, which refers to the presence and operation of the escape flap. In the case of cars of all lift units for transporting persons there must be notices on the roof of the car and by the exits from the trunk on the inside.

4.8.2.3 Emergency lighting is to be provided in the cars.

4.8.3 Additional requirements for lift cars for passengers

The escape flap on cars for the transport of passengers is to be provided with a mechanical spring catch. The flap shall have a handle only on the outside. For passenger-transporting cars a ladder is to be provided which permits access to the car through the escape flap in the roof. The ladder is to be kept in a supervised place accessible only to persons authorised to operate the lift unit.

4.8.4 Additional requirements for lift cars for crew members

4.8.4.1 Cars for the transport of crew members shall be provided with a permanently installed ladder or comparable equipment in the car.

4.8.4.2 The escape flap on cars for the transport of crew members must be openable from outside the cage without a key; from inside, with a key e.g. a triangular emergency release key. This emergency key shall be placed visibly in the car, in a small box with a glass front. The escape flap is to have a handle on both the outside and the inside.

4.8.5 Escape ladders/steps and escape hatches in lift trunks for crew members

4.8.5.1 In the upper region of the trunk of lift units for crew members, an escape hatch is to be provided. This is to have a minimum area of 0,24 m^2, the length of one of the sides being not less than 350 mm. The flap of the hatch must open outwards.

4.8.5.2 Inside the lift trunk and extending over its entire length there shall preferably be a fixed ladder, or else step irons. These must lead to the trunk doors and to the escape hatch in the trunk's upper region. Ladders or step irons shall be arranged at transverse walls.

4.8.5.3 The escape hatch must be electrically monitored like the escape flap from the cage (see 4.8.2.1).

4.8.5.4 Opening the escape hatch from inside the lift trunk must be possible without a key. From outside, the escape hatch must be openable only with an emergency release key. This is to be placed in the immediate vicinity of the escape hatch, in a small box with a glass front. A second key is to be kept in the power unit compartment.

4.8.5.5 The proper locking of the escape hatch is to be monitored. Resumption of operation of the lift must be possible only after intentional relocking of the escape hatch.

4.8.5.6 Emergency lighting shall be provided in the lift unit trunks.

E. Goods Lifts And Lifting Platforms

1. Notes

1.1 For goods lifts on board and for lifting platforms in general, in principle the regulations for lifting appliances in these "Lifting Appliance Regulations" apply. The regulations that follow supplement these.

1.2 For tests and examinations the regulations under F apply.

2. Dimensioning

2.1 Coefficients

For calculation and dimensioning of lifting platforms the Safe Working Loads and dead loads of the car or the platform shall be multiplied by a hoist load coefficient ψ according to Table 4.1 as for ship's cranes type B.

The dead loads of all other moving parts are for calculational and dimensioning purposes to be multiplied by a dead load coefficient φ according to Table 2.2.

2.2 Guard rails for motor vehicles

Guard rails for motor vehicles must be dimensioned to meet the line loads according to Table 5.2.

Table 5.2 Loading of guard rails

Vehicle type	Line load	Height of action
Passenger cars	2 kN/m	0,3 m
Trucks	5 kN/m	0,5 m

2.3 Inclinations of the ship

2.3.1 Goods lifts and lifting platforms must continue to be safe to operate at inclinations of the ship according to Section 2, C.2.4. If inclinations exceeding these are a possibility, these shall be used as the basis for dimensioning.

2.3.2 Up to an angle of inclination of the ship of 45°°, no inadvertent switching processes or changes of function may occur.

2.4 Means of suspension

2.4.1 Chains must have at least a fourfold margin of safety against breaking, based on static loading by dead loads and SWL.

2.4.2 For wire ropes, the coefficient of utilization K_1 apply, according to Table 8.1, plus the additional regulations in Section 8.

3. Constructional regulations

3.1 Guide rails

The guidance of goods lifts and lifting platforms may be effected either by guide rails or by the operating equipment itself, as for instance in the case of a scissors lift.

3.2 Locks

3.2.1 No goods lift or lifting platform may be supported purely by its means of suspension except when moving up or down; mechanical locks or setting-down arrangements shall be provided at all landing positions.

3.2.2 In special cases, such as side-loading installations, mechanical locking may be dispensed with.

3.3 Overload protection

In an overload situation the goods lift or lifting platform must remain in place following actuation. As regards the settings of overload protection devices, Section 4, E.2.3.4.1 applies.

3.4 Emergency lowering devices

Every goods lift and every lifting platform must be provided with emergency lowering devices which permits safe, controlled lowering.

3.5 Pipe fracture protection devices

Hydraulic cylinders for carrying dead and/or hoist loads must be fitted with suitable pipe fracture protection valves which must be screwed directly into the cylinder.

3.6 Counterweights

Counterweights must move in enclosed trunks and be provided with guide rails.

3.7 Tilting

Tilting of goods lifts and lifting platforms under load is to be prevented by suitable means.

3.8 Safeguards against persons falling into openings.

3.8.1 Openings/deck penetrations shall be safeguarded as necessary by fixed or movable railings. Movable railings must have automatic locks controlled by the movement of the car or lifting platform.

3.8.2 If the decks with the trunk openings can also be used by vehicles, a 30 cm high guard rail for passenger cars or a 50 cm high one for trucks is to be provided in addition to the railings.

4. Regulations for equipment

4.1 Marking

4.1.1 On every goods lift and every lifting platform, and at every landing position, details of the Safe Working Load (SWL) and if necessary its distribution (axle loads) are to be displayed.

4.1.2 On every goods lift and every lifting platform, and at every landing position, notices must be put up prohibiting the transport of persons.

4.1.3 Safeguards against persons falling into openings such as railings and guard rails should be painted a warning colour and well illuminated.

4.2 Control stands and controls

4.2.1 Control stands must be so located as to allow the best possible supervision of all movements to be controlled.

4.2.2 All control stands are to be safeguarded against unauthorized operation.

4.2.3 All controls must be made in such a way that their movements make sense.

4.2.4 Regulating and control elements must be approved and permitted by **TL**.

4.2.5 If a goods lift or lifting platform has several control stands, these must be connected by telephone.

4.2.6 Each control stand must be equipped with an emergency stop. Resumption of operation of the unit brought to a stop with this must be possible only from the machinery compartment.

4.2.7 Inscriptions in each control stand must be in the language of the country and also in English.

4.3 Miscellaneous

Dangerous regions as regards the movement of goods lifts or lifting platforms must be safeguarded by suitable means, e.g. warning lamps and warning paint.

F. Tests and examinations

1. Notes

1.1 As regards approval of drawings and supervision during construction the regulations under C apply.

1.2 For goods lifts on board foreign-flag ships and for lifting platforms in general the regulations in Section 13 apply.

1.3 For goods lifts on board, and lifts transporting persons as well as service lifts generally, the following regulations apply to the initial and also to periodical tests and examinations.

2. Initial test and examination

2.1 On completion and after every significant modification (see C.1.2) an initial test and thorough examination is required before being put into use for the first time or being put back into use.

2.2 Initial tests and examinations always presuppose a plan approval by **TL** Head Office.

2.3 Check on performance

2.3.1 Before being put into use for the first time or being put back into use, lift units shall be examined for compliance with the approved drawings.

This examination must cover the following:

2.3.1.1 Lift trunk

A. Head space

a) height of protective space

b) safety clearances to trunk ceiling

B. Trunk pit

a) height of protective space

b) protective surface

c) safety clearances to trunk bottom

d) buffers

C. Trunk sides

a) performance

b) counterweight casing

c) illumination openings and glazing

d) guide rails

e) setting-down arrangements

f) non-lift-related equipments (not permissible)

g) step irons, ladders

D. Trunk openings

a) accesses

b) notices at the accesses

c) doors, door locks

d) windows in doors

e) maintenance openings and emergency accesses

E. Trunk lighting

2.3.1.2 Lift car

a) size and carrying capacity

b) notices
- on the car
- in the car

c) floor

d) walls

e) roof
- performance
- protection area
- roof flap

f) accesses, doors, door locks

g) guide shoes

h) ventilation

i) lighting

k) safety gear

2.3.1.3 Counterweight

a) performance

b) enclosure

c) guide shoes

d) Suspension

e) safety gear

f) buffer

2.3.1.4 Means of suspension

a) construction, dimensions

b) number

c) end fastenings

d) load distribution (length equalization)

e) tensioning arrangements

2.3.1.5 Power units compartment, sheave compartment

a) accesses, notices

b) doors

c) ascents

d) floor flaps

e) walls, ceilings, floors

f) compartment heights

g) clear space above rotating parts

h) safety paint on moving parts

i) non-lift-related equipments (not permissible)

k) ventilation

l) lighting

m) car speed governor

n) counterweight speed governor

2.3.1.6 Power unit

a) traction sheaves

b) rope drums

c) rope sheaves, chain sheaves

d) V-belts

e) dual circuit brake

f) pipe fracture protection device

g) emergency operating system

h) emergency lowering device

i) hand pump

k) hydraulic drives

2.3.1.7 Electrical equipment

A. General

a) master switch (labelled)

b) control system switches

c) lighting

d) light switches

e) sockets

f) emergency brake switch

g) emergency call equipment

h) emergency power supply

i) movement command unit

k) lines

l) switchgear

m) indicating devices

n) intercom

B. Monitoring equipments

a) brake venting arrangements

b) end-of-operation switching-off gear

c) emergency shut-down gear

d) deceleration control switchgear for shortened buffer stroke

e) standstill monitoring gear

f) running-time monitoring gear

g) switching delays for lifts without car doors

2.3.2 In particular a check shall be made to establish whether the safety-relevant components listed below correspond in design and construction to the component test certificates required under C.1.3.4:

- door locks
- safety gear
- speed governors
- buffers
- electronic components of electrical safety switchgear

2.3.3 Furthermore, in all cases where there is an "exemption approval" from Head Office a check is to be made whether the associated conditions have been complied with.

2.4 Function- and safety test

2.4.1 The tests required are the same as those described under 3.1. Additionally, the following tests are to be carried out on the car and the counterweight:

a) car overrun, top

b) car overrun, bottom

c) counterweight overrun, top

d) counterweight overrun, bottom

2.4.2 Deviating from the regulations under 3.1, as part of the initial test and examination the following function tests are required:

2.4.2.1 Safety gear

Test of the effectiveness of the car safety gear in downward travel with 1,5 x allowed load at normal operating speed, or with allowed load at trigger speed with braking.

2.4.2.2 Setting-down device

Test of the effectiveness of the setting-down device by setting down on it the car loaded with 1,25 x allowed load from the associated landing position.

2.4.2.3 Hydraulic drives

Test of the car stops by running up against them with the car.

2.4.2.4 Buffers

Test of the effectiveness of buffers by setting down on them the car loaded with the allowed load or the counterweight with the car empty, at normal operating speed. (Where the buffer stroke is shortened and there is deceleration control switchgear, with the reduced velocity.)

3. Regular tests and examinations

3.1 Quinquennial tests and examinations

3.1.1 At no more than five-year intervals, a thorough examination by a **TL** expert is required together with the tests listed below.

3.1.2 In the case of lifts transporting persons, additionally the attendance of a mechanic from the manufacturer of the lift or a lift maintenance firm is required for this.

3.1.3 Function- and safety test

For these tests the following scope is laid down:

3.1.3.1 Lift trunk

Test and examination of:

a) doors, door locks

b) lighting

3.1.3.2 Lift cage

Test and examination of:

a) doors, door locks

b) ventilation openings

c) lighting

d) landing position indication

e) behavior in motion

f) emergency call device

3.1.3.3 Means of suspension, end fastening

Visual check:

a) condition

b) discard criteria

3.1.3.4 Power unit compartment, sheave compartment

a) accesses

b) lighting

3.1.3.5 Controls

Test of :

a) inspection controls on top of the car, if existing (see D.4.7.2)

b) emergency electrical operation controls, if existing (see D.4.6.15)

3.1.3.6 Electrical safety devices

Test and examination of:

A. Emergency power supply

B. Emergency brake switch

a) on top of the car

b) in the car

c) elsewhere

C. Monitoring equipment

a) door locks

b) closing conditions (doors, flaps, closures)

c) safety gear

d) buffers (car, counterweight)

e) slack rope

f) length equalization (ropes, chains)

g) overrun (end stopping point)

h) switches for landing positions

i) emergency brake switch

k) folding supports in the trunk pit

l) setting-down devices

D. Intercom

3.1.3.7 Mechanical safety devices

Test and examination of:

A. door locks

B. emergency operating system

C. emergency lowering equipment

D. mechanical brakes

a) braking effect when travelling downwards
- with allowed load (for traction-drive lift)
- with 1,25 x allowed load (for lift not with traction drive)

b) effectiveness of dual-circuit brake

E. Traction sheaves

a) traction capacity

- with 1,5 x allowed load (at least 200 kg for service lifts whose carrying capacity exceeds 100 kg)

- with twice allowed load (only for service lifts with up to 100 kg carrying capacity)

b) cancellation of traction capacity by setting-down test with unloaded car

c) counterweight balance

F. Safety gear

Test of safety gear:

a) of the car by downward travel at normal operating speed without braking. (In the case of brake safety gear the allowed load must be carried.)

b) of the counterweight by running the counterweight downwards with the car empty.

c) additionally of the triggering speed and adequate arresting capacity of the speed governor, if the functional safety of the safety gear has not been proved by the tests.

G. Setting-down devices

Test of the effectiveness of the setting-down devices by setting down the empty car from the associated landing position.

H. Hydraulic drives

Test of :

a) actuating limit of the pressure limiting valve when travelling upwards (the pressure limiting valve must at the latest act at 1,4 times static pressure, referred to the static pressure under allowed load.)

b) actuating limit of the pressure limiting switch

c) actuating limit of the hand-pump pressure limiting valve for indirect hydraulic drives (pumping against the closed gate stop valve. This pressure limiting valve must at the latest act at 1,7 times static pressure, referred to the static pressure under allowed load.)

d) behaviour in motion and anticreep device with the pressure limiting valve set as it should be and the car running with allowed load.

e) functioning of the pipe fracture protection device with the car carrying the allowed load.

I. Buffers

Test of the buffers' readiness to function.

3.2 Annual tests and examinations:

3.2.1 A thorough examination in combination with various tests by a **TL** Surveyor is required at yearly intervals.

3.2.2 Tests and examinations to be carried out:

3.2.2.1 Lift trunk, counterweight trunk

- doors, door locks

- lighting

3.2.2.2 Car

- doors, door locks lighting

- landing position indication

3.2.2.3 Means of suspension, end fastenings

- condition

- condition of ropes

3.2.2.4 Power unit compartment, sheave compartment

- accesses

- lighting

- traction sheave

3.2.2.5 Behavior in motion

3.2.2.6 Emergency call equipment

3.2.2.7 Intercom

3.2.2.8 General condition of the unit

3.2.2.9 Other tests, if required

3.3 Extraordinary tests

Such tests may be necessary after putting out of service before resuming operation, should damage occur, or for some special reason, and are always set out in detail by **TL**.

3.4 Documentation

3.4.1 Notes

3.4.1.1 The register books and certificates to be issued by TL are based on international as well as national regulations as interpreted by **TL**.

3.4.1.1 The responsibility for secure stowage throughout the life of the lifts and lifting platforms, and for submitting register books, certificates, survey reports and form sheets to the **TL** expert/Surveyor before the start of every test and/or examination, rests with the ship management or the operator.

3.4.2 Register book

3.4.2.1 Every lift and every lifting platform must have a register book which must always remain at the place of operation and shall be submitted to the TL expert/Surveyor or other supervisory person on demand.

3.4.2.2 The register book serves as the storage- place of examination documents, test certificates, test reports etc. and for the documentation of tests, examinations, maintenance procedures, etc.

The title page of the register book is shown on page C-4. It consists of a file with the following contents:

- test certificates

- examined drawings

- description of the lift unit

- operating- and maintenance instructions

- salvage instructions

- component test certificates

- calculations

3.4.2.3 As regards the type of register book the regulations under C.1.6 apply. Every lift unit must have its own register book. This applies also to units in parallel. (Side-loading lifts in parallel operation.)

3.4.2.4 For goods lifts on board a register book based on the international ILO regulations in TL form ST LA1.

3.4.2.5 Should register books get lost, new ones may be compiled based on a test and examination and with assistance from the Head Office (supply of certified true copies, etc.).

3.4.3 Test certificates

3.4.3.1 In addition to the required certificates added to register books when these are issued or supplemented, such as for instance component test certificates, rope certificates, etc., after every test or load test resp. certificates are to be issued by the **TL** expert/Surveyor and filed in the register book.

3.4.3.2 For lifts transporting persons and service lifts on board, the **TL** expert after the test and examination issues appropriate **TL** Form .

3.4.3.3 For goods lifts on board foreign-flag ships and for lifting platforms in general, the **TL** Surveyor after the load test and thorough examination issues the **TL** certificate ST LA2.

3.4.4 Survey report

3.4.4.1 Survey reports should provide information about the findings of tests and examinations and each is filed in the register book by the **TL** expert/Surveyor.

3.4.4.2 For goods lifts on board and lifting platforms in general, the TL Surveyor issues necessary survey report.

SECTION 6

SPECIAL LIFTING APPLIANCES AND MEANS OF TRANSPORT

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A. General

1. The design and testing of shipboard lifting appliances and means of transport does not constitute part of the classification of the ship. The classification does, however, include checking the structure of the ship's hull in way of the forces transmitted by these.

2. As regards the materials to be used, and welding, the regulations in Sections 11 and 12 apply.

3. As regards construction and dimensioning of interchangeable components and of ropes, the regulations in Sections 7 and 8 apply.

4. As regards the requirements for winches, other mechanical parts or the electrical equipment, the regulations in Sections 9 and 10 apply.

5. The documents and rigging plans to be submitted are to indicate the working ranges (possibly restricted) permissible for strength- or ship's stability reasons, together with the permissible inclinations of the floating body. If necessary, special stability data shall be appended.

6. For design and calculation purposes the regulations in Section 2 apply, unless otherwise stipulated in the following paragraphs.

B. Lifting appliances on research vessels

1. Notes

1.1 Examples of lifting appliances on research vessels within the meaning of these lifting appliance regulations are:

- Stern gallows
- Swinging gallows
- Side booms
- Sliding beams
- Special-purpose lifting appliances

1.2 Lifting appliances on research vessels are considered lifting appliances not used for handling cargo.

1.3 As regards supervision during construction and all subsequent tests and examinations the regulations in Section 13 apply.

2. Dimensioning

For calculations concerning the lifting appliances on research vessels the regulations in Sections 2 - 4 apply; additionally the following applies :

2.1 Lifting appliances for towing

Lifting appliances used for towing of equipment or nets shall, like fishing gear, be dimensioned according to C.

2.2 Lifting appliances for launching

2.2.1 Lifting appliances used for launching equipment shall be dimensioned for a defined static SWL and according to the minimum breaking load of the hoisting rope (see 2.2.5).

2.2.2 For dimensioning all component parts it is to be assumed that the live load (the hoisting rope) angle-of-attack will be 15° to the vertical in any direction.

2.2.3 As a simplification, the effect of seaway may be taken into consideration by increasing the hoist load coefficient ψ according to Sections 3 and 4 and the dead load coefficient φ according to Section 2, each by 15%.

2.2.4 The regulations according to 2.2.2 and 2.2.3 are generally valid up to a significant wave height $H_{1/3}$ of about 1 m (see Section 4, D.).

In the case of greater significant wave heights the regulations in Section 4, D. are to be applied analogously.

2.2.5 For dimensioning according to the minimum breaking load of the hoisting rope the following applies:

2.2.5.1 Component parts are to be dimensioned according to Section 2, E., load condition B.

2.2.5.2 Interchangeable components are to be dimensioned as though the actual loading corresponded to the test load PL_{stat}.

The nominal size can be calculated from the formula for PL_{stat} in Table 7.4.

C. Fishing gear

1 Notes:

1.1 Fishing gear is considered as lifting appliances not used for handling cargo.

1.2 Derrick booms, cranes, hoists, guy tackles and other appliances used for handling the catch or other cargo count as lifting appliances for handling cargo.

To these lifting appliances the regulations in Sections 3 and 4 apply (if applicable additionally).

1.3 If there is a demand for a register book to be issued and for regular examinations by the **TL**, the regulations in Section 13 also apply.

2. Documents to be submitted for approval

2.1 Deviating from/supplementing the regulations in Section 1, E. the following documents for fishing gear shall be submitted to the **TL** Head Office in triplicate (where indicated, in other numbers):

- General arrangement (layout drawing)
- Strength calculations and diagrams of forces (2-fold)
- Rigging plans (6-fold)
- Drawings of the masts, gantries, gallows and booms including the associated fittings
- Drawings of the substructure showing how the masts, gantries and gallows are fixed to the ship's hull and any local reinforcements
- Drawings of the interchangeable components insofar as these are not manufactured to recognised standards (e.g. trawl warp blocks)
- Information about the trawl warps
- Information about the machinery equipment such as hoisting, slewing and topping gear plus the winches including their design data. Also circuit diagrams of the hydraulic and pneumatic circuits and/or the steam system.

2.2 The drawings to be submitted must contain dimensions as well as details concerning materials and welding. If necessary, parts lists are to be included.

3. Design criteria

3.1 Gear on fishing vessels is to be designed for a defined static SWL. The loads used for dimensioning shall be stated fully in the drawings and calculations.

Possible oblique loading by the hoisting ropes and simultaneous stressing of a supporting structure by several lots of gear are to be taken into account. (Defined as load condition I.)

3.2 If towing of nets is intended, the following loading situations shall be covered in calculations in addition to 3.1:

- The trawl warp acting in the longitudinal direction at an angle of 30° to the horizontal;
- The trawl warp acting at an angle of 45° to the longitudinal axis of the ship and at an angle of 30° to the horizontal.

3.3 The rope tension "S" when trawling is to be calculated by reference either to the holding force or the slip torque of the trawl winch, or to the installed propulsive power. The dimensions may be based on the lower value. (Defined as load condition II.)

The minimum breaking strength of the trawl warp shall be 2,5 x S.

3.4 The total trawling force "F" may be roughly calculated from the installed propulsive power [kW] as follows:

- propeller with nozzle

$$F = 245 \cdot kW \; [N]$$

- propeller without nozzle

$$F = 160 \cdot kW \; [N]$$

3.5 Where a breakage of the trawl warp (caused e.g. by the net becoming caught) cannot be prevented by suitable means (e.g. by the use of constant pull winches), the supporting structure shall be designed on the basis of the minimum breaking load of the rope. (Defined as load condition III.)

3.6 If a fishing gear is designed for trawl warp breakage, the nominal size of the associated inter-changeable components must correspond to stressing by half the rope minimum breaking load.

4. Permissible stresses

4.1 The permissible stresses as defined under 4.2 take appropriate account of dynamic influences due to handling the load and/or the influence of seaway conditions.

4.2 Calculation of permissible stresses for masts, gantries, gallows, booms and other load-bearing steel components is carried out as described in Section 2 under E.6.1.

Deviating from this, the safety coefficient ν is to be taken from Table 6.1.

Table 6-1 Safety coefficient *v* for fishing gear

Type of stress	Load Condition I	Load condition II	Load Condition III
Compression	2,3	1,6	1,4
Tension	2,0	1,4	1,2
Shear	3,5	2,4	2,1
Combined-stress	2,0	1,4	1,2

5. Construction regulations

5.1 Centre fairleads on ships fishing over the side must be provided with a protective guard extending at the sides at least 0,30 m beyond the outer periphery of the fairleads.

5.2 Portable guide rollers are forbidden unless fitted with an efficient and adequately designed rope restraining device.

5.3 Chains used for fishing gear under load must be tested in accordance with **TL** rules.

5.4 Towing blocks may only be located in the bulwarks.

D. Ramps

1. Notes

1.1 The information that follows relates to movable shipbomeehicle ramps moved and/or used for loading/unloading in calm water.

1.2 As regards naval-architectural concerns such as ship's strength, watertightness, stressing by sea impact, etc. the regulations in the **TL** Hull Rules, Chapter 1, apply.

1.3 All data relevant to dimensioning, such as dead weights, location of centres of gravity, end positions, methods of actuating, permissible loads, operating conditions, etc. are to be submitted for examination together with the drawings and calculations.

1.4 The loading conditions must be laid down precisely. This shall include, as well as consideration of dead loads, movable loads and the inclinations of the ship, also the dynamic additional loads due to movement of ramps and vehicles as well as ship motion plus possible stressing by sea impact.

1.5 Ships equipped with classed movable ship borne vehicle ramps complying with this subsection are given **LA (CR)** class notation

2. Dimensioning of deckplating for wheel loads

The thickness of deck plating necessary for wheel loads may be determined as follows.

2.1 Dimensioning formula

$$t = c \cdot \sqrt{Q/n \cdot K}$$

c = a factor acc. to the following formulae :

for b/a = 1 ::

$$c = 1{,}90 - \sqrt{\frac{f}{F}\left(3{,}5 - 4{,}4\frac{f}{F}\right)}\ , \text{ for } \quad 0 < \frac{f}{F} \leq 0{,}3$$

$$c = 1{,}22 - 0{,}41\frac{f}{F}\ , \text{ for } \quad 0{,}3 < \frac{f}{F} \leq 1{,}0$$

for b/a ≥ 2.5 :

$$c = 2{,}04 - \sqrt{\frac{f}{F}\left(5{,}4 - 7{,}2\frac{f}{F}\right)}\ , \text{ for } \quad 0 < \frac{f}{F} \leq 0{,}3$$

$$c = 1{,}21 - 0{,}50\frac{f}{F}\ , \text{ for} 0{,}3 < \frac{f}{F} \leq 1{,}0$$

for intermediate values of b/a linear interpolation is to be used.

For a, b, f and F see Fig. 6.1.

Q = Axle load in, [kN]

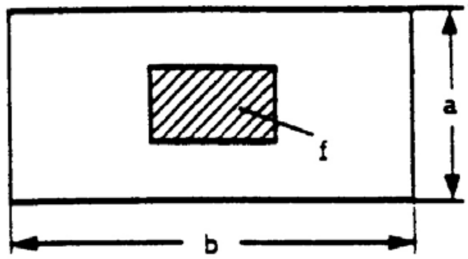


Figure 6.1 Deck panel

n = Number of wheels or Wheel-groups per axle,

k = Material factor acc. to Section 2, E.6.1,

f = Wheel bearing area,

F = Area of deck panel a · b,

a = Shorter side of deck panel (generally, distance between beams)

b = Longer side of deck panel

It is not necessary to insert a value greater than $2{,}5a^2$ for F.

2.2 Load

In the case of fork lift trucks the axle load to be applied shall generally be the total weight (dead weight + live load) of the truck.

Where the wheels are close together, the individual wheel bearing areas may be combined into a single bearing area f.

For loading in harbour the factor c may be reduced by 10%.

2.3 Corrosion supplement

The plate thickness calculated according to 1.5.1 shall for ramps and other ship-constructional parts be increased by a corrosion supplement t_K according to the **TL** Hull Rules, Chapter 1.

2.4 Unknown wheel bearing area

If the wheel bearing area is not known it can be approximately determined as follows:

$$f = \frac{100 \cdot Q}{n \cdot p}\ ,\ \left[cm^2\right]$$

p = Specific Wheel pressure (tyre pressure) according to Table 6.2.

Table 6.2 Specific wheel pressure

Type of vehicle	Spec, wheel pressure p [bar] with	
	Pneumatic tyres	Solid tyres
Passenger car	2	—
Truck	8	—
Trailer	8	15
Fork lift truck	6	15

2.5 Stiffenings and girders

Stiffenings and girders shall be so dimensioned that a stress of 16,5 [kN/cm^2] is not exceeded.

3. Load assumptions

3.1 For calculation, the dead load and the axle loads as well as number and spacing of the wheels shall be taken into account.

3.2 Besides the regulations according to 3.1, the distances between, as well as the types of, suspension/seating points and the intended loading, if appropriate asymmetrical, shall be taken into account.

3.3 If ramps in their stowed position form part of a deck, the deck loading according to the **TL** Hull Rules, Chapter 1, shall be taken into consideration for calculation and dimensioning.

Account is to be taken of the torsional loading of ramps due to oblique seating or inclination of the ship, and/or of the increased forces in joints, seatings or suspensions.

The inclinations of the ship taken into account must be either the static minimum inclinations according to Table 2-1 or other ones to be agreed.

4. Dynamic loadings

4.1 Where ramps are in the working position, moving loads shall be multiplied by the factor 1,2.

4.2 Where ramps are moving, the live loads and/or the dead loads shall be multiplied by the factor 1,1.

4.3 Ramps as well as their seatings or locks must be adequately dimensioned for the condition "ship in a seaway", i.e. for the acceleration forces according to Section 2, C.2.6.2.

5. Calculation

For calculation the following load conditions, analogous to Section 2, D.5, are to be investigated:

5.1 Load condition A

5.1.1 Ramp in working position

- Dead loads
- Live loads x 1,2
- Static minimum inclinations according to Table 2.1

5.1.2 Ramp moving

- Dead loads x 1,1
- Live loads x 1,1
- Static minimum inclinations according to Table 2-1

5.2 Load condition B

5.2.1 Ramp in stowed position

- Dead loads

- Live loads

- Dynamic minimum inclinations acc. to Table 2-3

- Dynamic forces due to ship motion according to Section 2, C.2.6.2.

5.2.2 Ramp under test load

- Dead loads

- Test load according to Table 13-1

- Ramps, forming part of the outer hull, such as stern ramps or others must comply with the **TL** Hull Rules, Chapter 1 (see also 1.2).

6. Permissible deflection

6.1 The permissible deflection of the ramp in load condition A is:

$$f = L/100$$

f = Deflection

L = Spacing of supports (span)

6**.2** In the stowed position, the deflection may not endanger either the watertightness of the ship or any cargo (e.g. vehicles) underneath.

7. Hoisting ropes

7.1 Hoisting ropes are covered by the regulations in Section 8.

7.2 Deviating from Table 8.1, the coefficient of utilization K1 in the case of ramps adjusted only when not carrying any live load has a top limit of 3,3, i.e. there is no need to apply a higher value.

8. Construction notes

8.1 Ramps may not hang from ropes, either when operating or in the stowed position.

8.2 Ramp inclination should in general not exceed the ratio 1 : 10.

8.3 The dimensions of locking devices must match the forces arising and must guarantee the watertightness of the hull if the ramp acts as external hull closure.

8.4 Interchangeable components shall be dimensioned in accordance with Section 7.

8.5 Ramps shall be provided with welded- or bolted-on anti-slip safeguards.

Anti-slip paint may in special cases be permitted in lieu.

8.6 Ramps must have scratch boards and railings. The boundary conditions of movable railings, barriers, etc. (colour markings, photoelectric barriers, warning signals) shall in each individual case be cleared with the **TL** Head Office as regards their extent and the need for them.

8.7 Ramps must have a notice showing the permissible load (SWL) affixed durably and easily visible.

E. Rope and chain hoists

1. Notes

1.1 The regulations that follow apply to rope- and chain hoists in series production.

1.2 For individual- or special production rope- and chain hoists, the regulations according to Section 4 apply.

2. Plan approval

2.1 A plan approval in accordance with Section 1, E. is required in principle.

2.2 If a design approval certificate from a recognised institution is available, the examination of drawings may be omitted.

3. Acceptance test on the manufacturer's premises.

3.1 An acceptance test at the manufacturer's premises in accordance with Section 13 is required in principle.

3.2 If a design approval certificate from a recognised institution is available, or if a type test has been carried out by the **TL**, the acceptance test may be omitted.

4. Type approval

In addition to the **TL** "Regulations for the Performance of Type Tests", the following explanations apply:

4.1 On completion of the examination of drawings, the requirements for the rope- and chain hoists for use in ships are determined. This refers also to the electrical engineering, the material and the general design.

4.2 At the manufacturer's works, a test of the first rope- and chain hoists is then carried out, plus a general inspection of the production facilities and review of valid documentation for manufacturer's quality system. Load tests are carried out using the test loads stated in Section 13.

4.3 Following successful completion of the tests, TL issues a type test certificate and includes the rope-/chain hoists in its "List of type tested appliances and equipment".

4.4 The type test certificate gives the manufacturer the right to independently-responsible manufacture, acceptance testing and certification of his products. However no changes may be made to the type-tested design.

4.5 If the orderer wishes, **TL** acceptance test certificates may also be provided. For this, a thorough examination including a load test has to be carried out at the manufacturer's works, in the presence of a **TL** surveyor.

5. Construction notes

5.1 Rope- and chain hoists used for handling cargo must have upper and lower limit switches for the cargo hook in accordance with Section 10.

5.2 In the case of hydraulic lifting appliances and for SWLs up to 1 t, the upper limit switch may be replaced by a pressure relief valve (see Section **4, E.2.3.1.10).**

5.3 In the case of electrically powered rope- and chain hoists, up to a SWL of 6 t the upper limit switch may be replaced by a slipping clutch provided these appliances do not handle cargo.

5.4 For use on board ships, consideration is to be given to the following special items:

5.4.1 The protective system for use below deck must be at least IP 54.

5.4.2 The protective system for use on deck must be at least IP 56, under certain circumstances even IP 66.

5.4.3 Deviating from the regulation in Section 8, B.1.3, wire rope in hoists for use below deck may be less than 10 mm in diameter (see Section 2, B.2.7.4.2).

5.4.4 Deviating from the regulation in Section 2, B.2.8.1, for rope- and chain hoists for use below deck other types of cargo hooks, and also ones with a safety flap may be used.

F. Industrial Cargo-Handling Vehicles

1. Notes

1.1 The regulations that follow apply to industrial cargo-handling vehicles in series production.

1.2 For individual- or special production industrial cargo-handling vehicles, the regulations according to Section 4 apply.

1.3 The employment of industrial cargo-handling vehicles on board presupposes that decks and hatch covers are adequately dimensioned to be run over. Fastening arrangements (e.g. eyeplates) for securing for sea are to be fitted both to the vehicle and to the hull.

2. Plan approval

2.1 An examination of drawings in accordance with Section 1, E is required in principle.

2.2 In general a limited examination is sufficient, for which suitable drawings of the load-bearing frame and the lifting frame complete with information about materials and the associated load assumptions, plus general drawings are to be submitted to the **TL**.
Furthermore in the case of electrically powered industrial cargo-handling vehicles information and general drawings concerning the power supply are to be submitted.

2.3 If a design approval certificate from a recognised institution is available, the examination of drawings may be omitted.

3. Acceptance test on the manufacturer's premises

3.1 An acceptance test at the manufacturer's premises in accordance with Section 13 is required in principle.

3.2 If a design approval certificate from a recognised institution is available, or if a type test has been carried out by the **TL**, the acceptance test may be omitted.

3.3 The type test for safety against overturning by an expert acknowledged by the appropriate authority for the manufacturer will be accepted by the **TL**. A copy of the certificates and reports issued is to be submitted to the **TL** Head Office.

4. Type lest

As regards type tests by the **TL**, the regulations according to E.4 analogously apply.

5. Construction notes

5.1 The use of industrial cargo handling vehicles powered by IC engines or by non-explosion-proof electric motors is not permitted in hazardous locations and areas.

5.2 Industrial cargo-handling vehicles run on fuel may be used in cargo spaces only if there is adequate ventilation. Where ventilation is not adequate, only battery-powered industrial cargo-handling vehicles or ones driven electrically via trailing cables are permitted.

5.3 The use of fuels with a flash point below 60°C is not permitted.

5.4 In general only fork-lift trucks with a tiltable lifting frame are permitted on board.

6. Tests on board

All tests on board according to Section 13, including the initial thorough examination before being put into use combined with a load test, are carried out by a **TL** surveyor who issues the necessary certificates. Load tests shall include performance of the lifting movements. If appropriate the vehicle shall for this be additionally secured against turning over.

SECTION 7

LOOSE GEAR AND INTERCHANGEABLE COMPONENTS

A. General

1. Loose gear and interchangeable components are defined in Section 1, paras F.6 and F.8 respectively.

2. The materials used are subject to the regulations in Section 11, unless otherwise stated below.

3. Welding is subject to the regulations in Section 12, unless otherwise stated below.

B. Loose gear

1. Notes

1.1 For the purposes of these Regulations, loose gear includes, for example:

- Lifting beams
- Spreaders
- Grabs
- Lifting magnets
- Claws
- Clamps
- Gripping tongs

1.2 For the purposes of these Regulations, loose gear also includes:

- Rope slings
- Chain slings
- Lifting straps
- Hooks
- Rings
- Shackles

1.3 The items of loose gear mentioned in 1.2, with the exception of rope slings, are to be treated as interchangeable components, unless they are inseparably connected to loose gear covered by 1.1.

Rope slings do not need to be load-tested as interchangeable components, provided that the rope is covered by a test certificate and the end connections have been manufactured by firms approved by **TL**.

1.4 If it is agreed that electrical, hydraulic or pneumatic systems shall also be given approval by **TL**, these are then subject, as and where applicable, to the Society's Rules for Construction set out in Section 1, C.4.1.1 c) and d).

2. Design criteria

2.1 Lifting beams with more than one connection point may only be loaded symmetrically, unless they are dimensioned for unsymmetrical loading and marked accordingly, or devices are fitted which indicate any overloading.

2.2 Where longitudinal lifting beams have underslung transverse lifting beams, the transverse lifting beams must be so suspended, e.g. by universal joints, that they are able to rotate about the longitudinal and transverse axes.

2.3 Container spreaders must be equipped with visual indicators showing whether the twist locks are locked or unlocked.

2.4 In the case of adjustable container spreaders, the movable beams must either lock into the desired working positions, or constructional measures must be taken to ensure that the beams are accurately placed and held in these positions.

2.5 Locking pins which automatically unlock when unloaded may not be used.

2.6 High-tensile materials may be used for loose gear components, and the dimensions of such components may then be reduced accordingly.

2.7 In designing rope and chain slings, it shall be borne in mind that the opening angle at the rams- hom hook is not to exceed 90°.

3. Calculations

Calculations relating to loose gear are subject to the regulations in Section 2. In addition the following applies:

3.1 Loose gear covered by 1.1 is to be dimensioned in accordance with a general stress analysis, and proof of stability under the most unfavourable of the following load conditions, in conformity with Section 2:

3.1.1 Load condition A

Load comprising dead load and Safe Working Load multiplied by the hoist load coefficient of the lifting appliance (see Section 2, C.2.5.1.2).

In the case of container spreaders it shall be assumed that the centre of gravity of the loaded container is situated 1/10 of the length and breadth away from the geometrical centre point.

3.1.2 Load condition B

Loading as for load condition A, with additional wind load in accordance with Section 2, C.3.2.

3.1.3 Load condition C

Load comprising dead load, symmetrical test load PL_{stat} to Table 7-4, resp. impact load in accordance with 3.4.

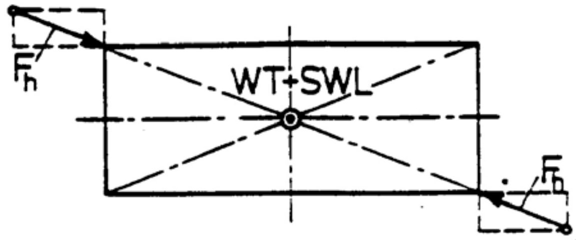
3.2 The fatigue strength of loose gear covered by 1.1 is to be proved exclusively for load condition A in accordance with Section 2, E.4.

The proof shall be based, for centric loads, on loading group B 4, and, for off-centre loads as stated in 3.1.1, on loading group B 2 specified in DIN 15018.

3.3 Loose gear items covered by 1.2 are to be designed for test load PL_{stat} to Table 7.4 for load condition C (see also Section 2, D.5.4.4). Ropes are also subject to the regulations in Section 8.

3.4 Where spreaders are suspended on ropes, lateral forces generated by movements of the trolley or the crane may be disregarded. On the other hand, it must be taken into consideration that the spreader or the container suspended from the spreader may strike against fixed objects.

If not proven precisely, it is to be assumed that on each occasion 10% of the total load (Safe Working Load + dead load) acts horizontally at two container corners located diagonally to each other.



$$F_h = 0{,}1\ (WT+SWL)$$

Figure 7.1 Horizontal impact force

3.5 Calculations relating to 4-leg rope slings or chains (crawfoots) not provided with length compensation shall take into consideration 1,5 times the dead load of the corresponding loose gear and/or the Safe Working Load.

The dimensioning of rope slings for container spreaders shall also take into consideration an eccentricity of the container Safe Working Load in accordance with 3.1.1.

3.6 Deviating from 3.5, the dimensioning may correspond to the mere dead load and/or the mere Safe Working Load if:

- with 4-leg rope slings, the wire ropes do not differ from each other in length by more than 0,2 %,

- with 4-leg chain slings, the chain legs are calibrated in pairs.

3.7 Sling ropes made of wire must conform to standard DIN 3088 resp. ISO 7531, and sling ropes made of natural or chemical fibre must conform to standard DIN 83302.

Lifting straps must conform to standard DIN 61360.

3.8 With I-section lifting beams as shown in Fig. 7.2, proof must be provided of sufficient resistance to lateral buckling for load condition C. A more accurate proof may be dispensed with, if the width B of the compression flange is, for the sake of simplicity, calculated by the following formula:

$$B \geq 0{,}094 \cdot L \cdot k \ , \ [cm]$$

L = Buckling length of lifting beam [cm]

k = Dimension factor to Fig. 7.3

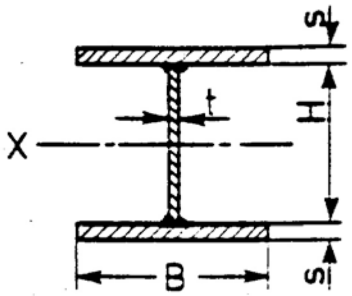


Figure 7.2 I-section lifting beams

$H/t \leq 60 \quad ; \quad B/s \leq 18$

s = Thickness of compression flange

t = Thickness of web

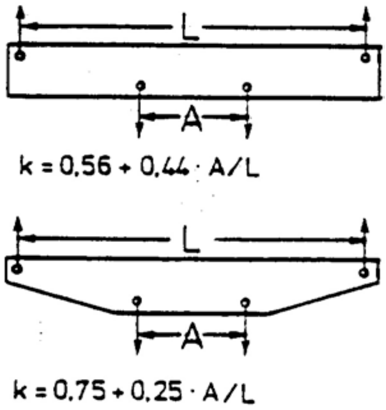


Figure 7-3 Dimension factor "k"

3.9 With box-section lifting beams, as shown in Figure 7.4, proof of resistance to lateral buckling is not normally required. With double-webbed lifting beams, the dimensioning of the transverse elements shall be such that the action of the imaginary transverse force Q_i does not cause the permissible stresses to be exceeded (Standard DIN 4114).

$$Q_i = \frac{PL_{stat} \cdot L}{400 \cdot H} \text{ or } Q_i = \frac{F_G \cdot \sigma_{zul}}{80}$$

The larger of the two values is applicable.

PL_{stat} = Static test load to Table 7.4, [kN]

L = Buckling length of lifting beam, [cm]

H = Web height of lifting beam, [cm]

F_G = Area of compression flange, [cm^2]

σ_{zul} = Permissible stresses for "load condition C", [kN/cm^2]

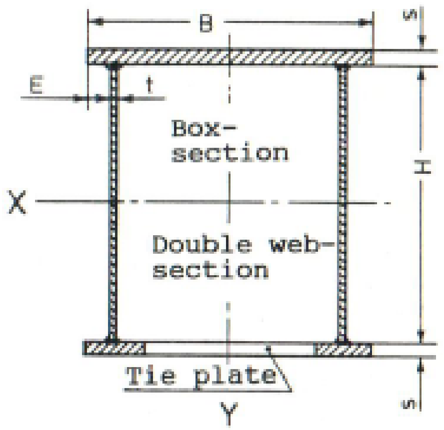


Figure 7.4 Box-section, / double-webbed lifting beams

$H/t \leq 60$; $E/s \leq 9$

s = Thickness of compression flange

t = Thickness of webs

4. Plan approval

The following regulations are supplementary to those of Section 1, E.

4.1 For loose gear covered by 1.1, the following documents are to be submitted to the head office of **TL**:

- Scale drawings of load-bearing structural members, in triplicate

- Force diagrams and strength calculations for load-bearing steel structures and machinery components, in duplicate.

4.2 Where the relevant examination has been agreed, the following documents are also to be submitted in triplicate for examination:

4.2.1 For hydraulic or pneumatic equipment:

circuit diagrams giving details of all structural elements such as valves, pumps, etc., together with drawings of the hydraulic cylinders.

4.2.2 For electrical equipment:

circuit diagrams giving details of all structural elements, together with details of cable types, types of enclosure, operating periods, switching frequency, voltages, etc.

4.3 For loose gear items covered by 1.2 which conform to recognized standards, reference to these standards is sufficient. Otherwise, the following documents are to be submitted to **TL**:

- Scale drawings in triplicate

- Strength calculations in duplicate

4.4 The drawings must be capable of being checked, and must indicate dimensional data together with details of the materials used and any welds and their method of inspection. The provision of the relevant parts lists is also required.

4.5 The function of the item in question must be clearly apparent from all documents. Wherever necessary, a functional description is to be provided.

5. Supervision of construction

5.1 For loose gear covered by 1.1, supervision of construction and acceptance testing on the manufacturer's premises are required as a matter of principle.

5.2 For loose gear covered by 1.1 which is still accessible for comprehensive examination after completion, supervision of construction may be dispensed with subject to the consent of the **TL** Surveyor. Acceptance testing is required in every case.

5.3 The general requirements to be met by the manufacturer are set out in Section 13, B.

6. Testing, examination, certification

6.1 Testing

6.1.1 Before being put into use, and after every major modification or repair to load-bearing parts, loose gear shall be subjected to a functional and load test in the presence of a **TL** Surveyor.

6.1.2 Regularly repeated load testing of loose gear is not prescribed. It should be noted, however, that various harbour states do have regulations of this kind.
It is recommended that onshore loose gear should be regularly load tested at intervals of not more than 5 years.

6.1.3 The following test loads are applicable to loose gear covered by 1.1 and used without limitation on board ship and on shore:

Table 7.1 Static test loads for loose gear

Safe Working Load SWL of loose gear	Test load "PL_{stat}"
up to 10 t over 10 t up to160 t over 160 t	2 x SWL (1.04 x SWL) + 9,6t 1.1 x SWL

6.1.4 Deviating from 6.1.3, ship's loose gear covered by 1.1 with a Safe Working Load of more than 10 t, which is intended for lifting appliances of the same construction, may be dynamically tested together with these when they are subjected to a load test. The following test loads then apply:

Table 7.2 Dynamic test loads for loose gear

SWL of lifting appliance	Test load "PL_{dyn}"
up to 20 t between 20 t and 50 t over 50 t	SWL + %25 SWL + 5t SWL + %10

6.1.5 The test loads shown in Table 7.4 are applicable to the loose gear cove

6.1.6 Grabs are to be tested together with the corresponding lifting appliance in accordance with 6.1.4.

6.1.7 With regard to the breaking loads, and breaking load losses due to deflections, of rope slings, the regulations in Section 8, B.3.6 and 3.7 apply.

6.2 Examination

6.2.1 Before being put into use, after each load test, and after each modification or repair to load- bearing parts, all loose gear is to be subjected to a thorough examination and, where necessary, a functional test by a **TL** Surveyor.

6.2.2 In addition to the regulations according to 6.2.1, all loose gear shall be subjected, at least every 12 months, to a thorough examination and, where necessary, a functional test by a **TL** Surveyor.

6.3 Certification

6.3.1 After each load test using the prescribed test load, the **TL** Surveyor issues a relevant certificate (functional tests are not specially certified).

6.3.2 For ship's loose gear, form STLA3 is used to certify the load test (see Appendix C, page C-7).

The thorough examinations called for in paras 6.2.1 and 6.2.2 are recorded in the Register of Ship's Lifting Appliances and Cargo Handling Gear, Form No STLA1.

6.3.3 For loose gear which is used both on board ship and on shore, form STLA3 is used to record the load testing. In addition, at the operator's wish, a separate Register of Ship's Lifting Appliances and Cargo Handling Gear can be issued for each item of such loose gear.

C. Interchangeable components

1. Notes and requirements

1.1 The inclusion of components in the category of interchangeable components, as defined in Section 1, F.8, is based on their mutual interchangeability.

On the other hand, components such as goosenecks, heel fittings, head fittings and trunnion pieces do not count as interchangeable components, but as components which are tested and examined together with the lifting appliances.

1.2 Bolted connections must be secured in every case. Spring washers are not admissible for this purpose, if they are exposed to the marine environment.

1.3 Block frames must be so designed that ropes cannot get caught between the sheave and the block cheeks.

1.4 Ramshom hooks may be used for Safe Working Loads of 20 t and over.

1.5 Cargo hooks, shackles and swivels must be forged. Exceptions to this rule require the consent of **TL**.

1.6 Grades of cast steel shall conform to the Tables (see Appendix A), or to the relevant standards. The consent of **TL** is required in every instance for other grades of cast steel.

1.7 The use of welding procedures is subject to the provisions of Section 12.

1.8 The galvanizing of cold-formed components is permitted only if the suitability of the material for this purpose has been proved.

Galvanization of forged interchangeable components may take place only after the load testing of the components.

2. Dimensioning

2.1 Interchangeable components must conform to recognized standards or the Tables in Appendix A, in which the main dimensions and materials of the most common components arc indicated.

2.2 It is recommended that the dimensions of all components should comply with the details in the Tables in Appendix A, to facilitate interchangeability and the procurement of replacements. Otherwise, the differing dimensions and materials of these components must be indicated in the rigging plans.

2.3 For interchangeable components conforming to standards or the Tables in Appendix A, a choice has to be made among the indicated nominal sizes. The nominal sizes correspond to load condition A in Section 2, though without considering the dead load and/or hoist load coefficients.

In all cases where the hoist load coefficient ψ is greater than 1,6, the nominal size is to be increased by the factor f_e prior to application of the standards or the Tables in Appendix A.

$$f_e = \frac{\psi}{1,6}$$

f_e = increasing factor,

ψ = hoist load coefficient according to Section 2, C.2.5.1.2.

2.4 Interchangeable components for lifting appli-ances may be made from high-tensile materials only with the agreement of **TL**. The recommendation in para 2.2 is to be observed. (This does not apply to components with Working Load Limits of 100 t and over.)

2.5 Interchangeable components for loose gear may be made of high-tensile materials and have correspondingly smaller dimensions.

3. Calculations

Calculations relating to interchangeable components are subject to the regulations in Section 2. The following also apply:

3.1 Components with circular cross-sections

3.1.1 Annular components

For these components, as shown in Fig. 7.5, the stress due to tensile loading may be roughly calculated as follows:

$$\sigma = \frac{PL_{stat} \cdot (w + d)}{\alpha \cdot W} \leq \sigma_{zul}$$

Here;

σ = Existing bending stress, [kN/cm^2,]

$\sigma_{müs}$ = Perm. Bending stres in load condition C as stated in Section 2, D.5.4 [kN/cm^2],

PL_{stat} = Static test load of component in accordance with Table 7.4 [kN],

w, d = Dimensions shown in Figure 7.5, [cm],

W = Section modulus of solid section of component, [cm^3] (see 3.3),

α = Form coefficient in acc. with Table 7.3.

3.1.2 Shackle bolts

The calculation may be effected by the following formula

$$\sigma = \frac{PL_{stat} \cdot (w + d)}{5{,}4 \cdot W} \text{ , } [\text{kN/cm}^2]$$

Designation as in para 3.1.1.

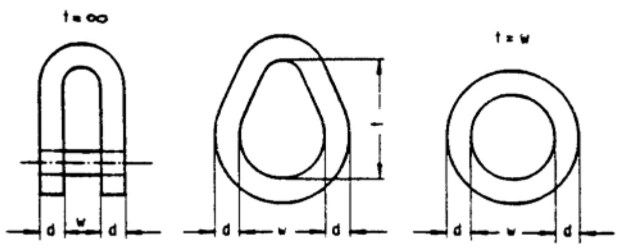


Figure 7.5 Annular components

Designation as in para 3.1.1

3.2 Eyeplates with rectangular cross- sections

3.2.1 For eyeplates with rectangular cross-sections, as shown in Fig. 7.6 the dimensions determined by the shear stress due to tensile loading may be calculated as follows:

$$\tau = 2/3 \cdot \frac{PL_{stat}}{(r_1 - r_2) \cdot s} \leq \tau_{zul}$$

where;

PL_{stat} = Static test load in acc. with Table 7.4, [kN],

τ = Existing shear stress, [kN/cm^2],

$\tau_{müs}$ = Perm. shear stress in load condition C as stated in Section 2, D.5.4, [kN/cm^2],

r_1, r_2, s = Dimensions shown in Figure 7.6 [cm].

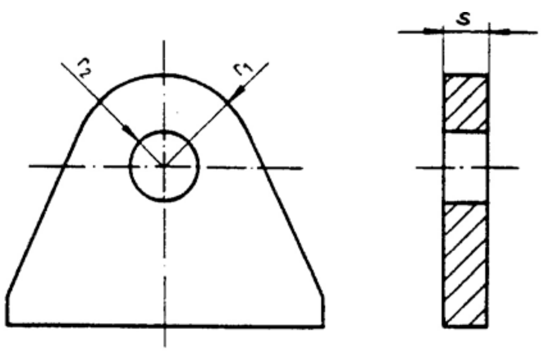


Figure 7.6 Eyeplates with rectangular cross-sections

3.3 Solid sections

When considering the bending stress in load condition C, as stated in Section 2, D.5.4, in relation to structural components with a round or rectangular (solid) cross-section, the plastic section modulus W_p of the section may be incorporated in the safety consideration.

The following values apply:

for circular cross-sections

$W_p = 0{,}16 \cdot d^3$, [cm^3]

for rectangular cross-sections

$W_p = 0{,}23 \cdot b \cdot h^2$, [cm^3]

d = Diameter , [cm]

b,h = Width, height, [cm]

4. Plan approval

4.1 Examination of drawings is not required in respect of interchangeable components which conform to recognized standards or the Tables in Appendix A.

4.2 Details or drawings, as necessary, are to be submitted for examination in respect of interchangeable components which are made of materials and/or to designs which conform neither to a standard nor to the Tables in Appendix A.

Where such components are to be repeatedly manufactured, the relevant drawings may also be approved as works standards. Where reference is made to such works standards on other drawings, the date and journal number of the **TL** approval shall also be indicated.

5. Testing, examination, certification

5.1 Testing

5.1.1 Before being assembled or put into use, interchangeable components in the unpainted and ungalvanized condition must be subjected, in the presence of a **TL** Surveyor, to a static load test performed on a calibrated and approved testing machine using the test loads mentioned in Table 7.4.

This load test must be repeated following modification or repair.

5.1.2 Deviating from 5.1.1, components with a Working Load Limit of 100 t and over may, with **TL**'s agreement, be subjected to a dynamic load test together with the corresponding lifting appliances (see B.6.1.4).

5.1.3 Where the origin of components is unknown, or no certificates for the materials are available, the **TL** Surveyor is entitled to demand that one component undergo a tensile test at 4 times the Working Load Limit.

The specimen must withstand this load without breaking. A further increase of the load until the specimen breaks is not generally required. However, the **TL** Surveyor is entitled to demand a test to establish the actual breaking load. Specimens which have undergone tensile testing at 4 times the Working Load Limit are overstressed, and are to be destroyed after the test.

5.2 Examination

5.2.1 The manufacturer or dealer has to present all interchangeable components to the **TL** Surveyor, in an unpainted and ungalvanized condition, for examination of the dimensions and workmanship, together with the certificates covering the materials used.

5.2.2 After the static load test, each component is thoroughly examined by the **TL** Surveyor, and must, if the Surveyor considers it necessary, be taken apart for closer scrutination.

5.3 Certification

5.3.1 The **TL** Surveyor issues a certificate for each interchangeable component which has successfully undergone the load test and the thorough examination. This certificate gives details of the manufacturer or supplier, the date of the test, the size of the test load and the Working Load Limit.

5.3.2 Form STLA3 is used for interchangeable components on ships.

5.3.3 For the closer determination of tested and examined components, the following details are entered on the certificates:

- **For shackles:**
  the bolt diameter; where the inside width is non-standard, the following dimensions are to be indicated in the order shown:
  diameter of the shackle in the middle of the bow, bolt diameter, and inside width.

- **For cargo hooks and swivels:**
  the nominal size.

Table 7.3 Foam coefficient α

Ratio t : w	Foam coefficient α Ratio w : d											
	1,0	1,2	1,4	1,6	1,8	2,0	2,5	3,0	3,5	4,0	5,0	6 and over
Up to 2,5'a	20	17,5	15,2	13,2	11,9	10,9	9,6	8,9	8,6	8,4	8,1	8
3,0	20	16,6	14,1	12,2	11,0	10,0	8,7	8,0	7,6	7,4	7,1	7
3,5	20	16,2	13,4	11,5	10,2	9,2	7,8	7,1	6,7	6,4	6,1	6
4,0	20	15,8	12,7	10,7	9,4	8,4	6,9	6,2	5,7	5,4	5,1	5
4,5 and over	20	15,7	12,2	10,0	8,6	7,6	6,0	5,3	4,8	4,4	4,1	4

Table 7.4 Static test load for interchangeable components

Interchangeable components	Working Load Limit "WLL" **(1)**	Static test load "PL_{stat}"
Chains, rings, hooks, shackles, swivels, etc.	Up to 25 t Over 25 t	2 x WLL (1.22 x WLL) + 20 t
Multi-sheaved blocks	Up to 25 t Over 25 t up to 160 t Over 160 t	2 x WLL (0.933 x WLL) + 27 t 1.1 x WLL
Single-sheaved blocks without becket	Up to 12.5 t Over 12.5 t	4 x WLL (2.44 x WLL) + 20 t
Single-sheaved blocks with becket	Up to 8 t Over 8 t	6 x WLL (3.66 x WLL) + 20 t

(1) *With multi-sheaved blocks, the working load limit is equal to the permissible load on the suspension.*
With single-sheaved blocks without becket, the Working Load Limit is equal to half the permissible lqad on the suspension. If the two parts of the rope led over the block sheave run parallel to each other, the Working Load Limit is equal to the rope tension.
With single-sheaved blocks with becket, the working load limit is equal to one third of the permissible load on the suspension. If the three parts of the rope led over the sheave and fastened to the block becket are parallel to each other, the working load limit is equal to the rope tension. (For exception, see the explanatory note to the Tables in Appendix A.)

- **For blocks:**
  the groove diameter of the sheave, and the sheave pin diameter, together with the type of head fitting and an indication of whether or not a becket is fitted.

- **For double yoke pieces:**
  the bolt diameter, and the length of the double yoke piece between the bolt centres.

- **For rope sockets:**
  the nominal size, and details of the test on the material.

- **For rigging screws:**
  the nominal size, or the thread diameter, and the type of bolt head (oval eye, round eye or fork eye).

- **For chains:**
  the diameter of the round steel bar, the external width of the chain link, and the length of the chain.

5.3.4 Where interchangeable components are manufactured to approved drawings, the certificates also indicate the relevant drawing, together with the date and **TL** journal number of the approval.

D. Stamping and marking

1. Stamping

1.1 Loose gear and interchangeable components have to be stamped to establish the link with the relevant certificate. All unstamped parts must therefore undergo (renewed) load testing, if a certificate is required.

1.2 Loose gear

1.2.1 All loose gear which has successfully undergone testing and thorough examination is stamped as follows:

- The certificate number, together with the code letters of the examining inspecting office

- The **TL** stamp , with the month and year of testing "d-*

- The Safe Working Load in tonnes preceded by the letters SWL

1.2.2 Loose gear subject to supervision of construction and/or acceptance testing on the manufacturer's premises is double-stamped (see Table 7.5).

1.3 Interchangeable components

1.3.1 Each interchangeable component which has successfully undergone testing and thorough examination is stamped as follows:

- The certificate number

- The **TL** stamp , with the month and year of testing

- The Working Load Limit in tonnes preceded by the letters WLL. With single-sheaved blocks with becket, the Working Load Limit on the suspension is added, e.g. "WLL 51/15 t" (see the explanatory note to the Tables in Appendix A).

1.3.2 On small parts to which it is difficult or impossible to apply the whole stamp, the month and year of testing may be omitted, followed, if necessary, by the certificate number.

The following provision relates to small interchangeable components:

- **Components with a WLL of 1,6 t and over**
  These are stamped in full
  (with the Working Load Limit, the certificate number, the date and the **TL** anchor stamp).

- **Components with a WLL between 0,25 t and 1,0 t**
  These receive only the **TL** anchor stamp.

- **Components with a WLL of less than 0,25 t**
  These do not require to be stamped.

Table 7.5 Examples of stamping and marking

Documentation			Loose gear	Interchangeable components
Stamping		Acceptance test	94190 10 TL 94	94190 10 TL 94 WLL 5t/15t (single-sheaved block with becket)
	YD03	Load test	94190 12 TL 94 SWL 30 t WT 5 t	
Marking	Rigging plans		SWL 30 t WT 5 t	-
Abbreviations:			Safe Working Load: SWL Weight: WT	Working Load Limit: WLL

1.3.3 The stamp is to be applied to the positions stated below:

- **On shackles**
  to one of the limbs close to the eye

- **On cargo hooks**
  to the side of the hook close to the suspension

- **On swivels**
  to the traverse; the oval eye gets the anchor stamp only

- **On blocks**
  to the side bar, if any; otherwise to the side plate close to the point of suspension of the block

- **On double yoke pieces**
  to the middle of one side

- **On rope sockets**
  to the conical section, opposite the already existing stamp for the testing of the material

- **On rigging screws**
  on the body; the two eye screws receive only the **TL** anchor stamp below the eye

- **On chains**
  to the last link at each end

1.3.4 Galvanization may normally take place only after load testing and stamping.

1.3.5 Galvanizing is permissible only in case of forged parts made of killed steels. Cold formed parts may not be galvanized (see also C.1.8).

1.4 With Safe Working Loads or Working Load Limits up to 15 t, the figure in the stamp shall be rounded to one decimal place. With values of 15 t and over, the figure shall be rounded to a whole number.

1.5 If, with the agreement of **TL**, an examination of the drawings has been dispensed with in the case of loose gear or interchangeable components, the broad **TL** anchor stamp is applied to these parts.

2. Marking

2.1 Loose gear must be permanently marked in a prominent position on both sides in the manner described in 2.2 and 2.3. The inscription shall comprise characters at least 80 mm in height, the permanence of which shall be assured by punching or applying weld seams.

2.2 Lifting beams and spreaders must be marked as follows:

- Safe Working Load "SWL" in t or kg

- Dead load "WT" in t or kg

2.3 Grabs for bulk cargoes must be marked as follows:

- Safe Working Load "SWL" in t or kg

- Dead load "WT" in t or kg

- Capacity in m^3

2.4 In addition to the marking, all loose gear covered by B.1.1 must be fitted with a plate giving at least the following details:

- Name of manufacturer

- Year of construction

- Type

- Serial number

- In the case of lifting beams and spreaders, a symbol showing the angle of inclination of the corresponding rope slings or chains

E. Damage and wear

1. A reduction of the Safe Working Load of loose gear covered by B.1.1 is an alternative to removal from service in the event of damage, inadmissible wear or other causes.

In all such cases, a load test, a thorough examination and certification for the reduced Safe Working Load are required.

2. For plates, cheeks and profiles, the admissible reduction of the plate thickness is 10 %. With localized rusting or wear, a reduction in the plate thickness of up to 20% is permitted, provided this does not jeopardize the load-carrying capacity of the cross-section.

3. In cases of isolated pitting a reduction of plate thickness of up to 30 % is acceptable.

4. Components such as eyeplates, bolts, chains, rings, etc. must be replaced if the parts are visibly deformed, if the diameter is reduced by 10 % at some points, or if the area of the load-bearing cross-section is reduced by 20 %.

5. The use of welding to repair cracks in, or worn portions of, interchangeable components is not permitted. The same applies to bolts and other dismountable elements of loose gear.
TL reserves the right to approve such repairs in special cases.

SECTION 8

ROPES AND ROPE ACCESSORIES

A. General

1. The following regulations apply to wire and fibre ropes used as running and standing rigging for lifting appliances on ships, loose gear and rope slings.

The following regulations apply to lifts only in so far as they do not conflict with the "Safety rules for the construction and installation of lifts (EN 81-20, EN 81-50, EN 81-3+A1)."

2. The approval, manufacture, testing and marking of ropes are subject to the requirements set out in the most recent edition of Türk Loydu Rules, Chapter 2 - Materials.

3. With regard to manufacture and quality assurance, rope manufacturers must conform to the conditions stated in Türk Loydu Rules for Materials, and must have been approved by **TL**.

Application for approval is to be made in writing, with submission of a description covering at least the following details:

a) Type, composition and strengths of the ropes concerned

b) Production equipment

c) Copies of the last calibration reports of the testing machines

4. In addition, the manufacturer must prove, during a tour of the works, that the necessary equipment is available for the proper manufacture and testing of ropes. **TL** reserves the right to demand that a qualification test be performed on specimen lengths of rope.

5. On application, approved rope manufacturers can also be approved for testing and certificating ropes on their own responsibility. After such approval, **TL** assigns the manufacturer a special code number.

B. Wire ropes

1. Requirements and instructions

1.1 Wire ropes must conform to recognized national standards (e.g. DIN 3051, sheet 1) or international standards (e.g. ISO 2408). On application, special rope constructions may be approved (see also 1.5).

1.2 The minimum breaking load of common wire ropes is indicated in Table 44 in Appendix A.

1.3 Wire ropes with diameters of less than 10 mm are not permitted for lifting appliances or loose gear exposed to the weather.

1.4 Wire ropes for running rigging must be drawn galvanized, and wire ropes for standing rigging must be fully galvanized. Subject to the operator's agreement, the hoisting ropes of deck cranes used for cargo handling need not be galvanized.

1.5 Special rope constructions, Lang lay ropes, ropes with a nominal tensile grade of more than 1960 N/mm^2, and ropes of austenitic or stainless materials may, on application, be approved, provided that they are suitable for the proposed use.

1.6 Wire ropes of stainless materials for the running and standing rigging of seagoing ships must be suitable for use in marine atmospheres.

To avoid crevice corrosion, the materials used for the wires must have a sufficiently high chromium and molybdenum content.

Steels are regarded as resistant to crevice corrosion in a marine atmosphere if the sum "W" of the effective constituents in the following expression is 29 or over:

$$W = Cr\,[\%] + 3{,}3\,Mo\,[\%] \geq 29$$

2. Definitions

2.1 "Running rigging" refers to all wire ropes passing over rope sheaves or guide rolls, or wound on winches, irrespective of whether or not the ropes are moved under load.

2.2 "Standing rigging" refers to all wire ropes which are not turned round or wound on to winches, such as shrouds, pendants, stays, etc. Standing rigging must be fitted with thimbles or rope sockets.

2.4 "Rope slings" refer to ropes, not forming an integral part of lifting appliances or loose gear, which are used to attach loads, and can be employed without special adaptation or fitting operations.

2.4 The "nominal breaking load" F_r of a rope is the product of the metal cross-section and the nominal tensile grade of the wires.

2.5 The "minimum breaking load" F_{min} of a rope is the product of the nominal breaking load F_r and the spinning factor k.

2.6 The "actual breaking load" F_w of a rope is that which is determined by performing a tensile test to destruction on a sample of the rope.

2.7 The "proven breaking load" F_n of a rope is the product of the "measured aggregate breaking load" F_e and the "spinning factor" k.

2.8 The "measured aggregate breaking load" F_e of a rope is the sum of the individually determined breaking loads of all the wires in the rope, ascertained by tensile tests.

2.9 The "spinning factor" k is an empirical factor which takes account of the strength reduction due to stranding.

The spinning factors of the commonest wire ropes have been published in standards DIN 3051, sheet 3, and ISO 2408.

3. Dimensioning

3.1 The "actual breaking load" or "proven breaking load" of wire ropes for lifting appliances and loose gear shall not be less than the product of the rope tension "S" and the coefficient of utilization "K_1" shown in Table 8.1.

3.2 The rope tension "S" is the maximum force for load case A, disregarding the hoist load coefficient ψ and the dead load coefficient φ, but taking into consideration the friction and bending resistance in the rope sheaves.

3.3 The forces in the hauling parts of tackles are indicated in Table 7 in Appendix A. The determination of rope tensions, taking into consideration the sheave friction and the bending resistance of the ropes, is based on a frictional coefficient of 5 % per turn for friction bearings, and 2 % per turn for anti-friction bearings. Where calculations are to be performed with smaller frictional coefficients, special proof of these is to be provided.

3.4 For lifting appliances and loose gear where a hoist load coefficient ψ > 1,60 has to be applied, the coefficient of utilization K_1 in Table 8.1 is to be multiplied by the factor f_e.

$$f_e = \frac{\psi}{1,60}$$

f_e = Increasing factor

ψ = Hoist load coefficient

3.5 In the case of wire ropes for grab cranes with multi-rope grabs, the closing rope shall be rated for 100 % of the Safe Working Load, and the holding rope for at least 67 % of the Safe Working Load.

3.6 For rope slings, the "actual breaking load" or "proven breaking load" shall not be less than the product of the maximum rope tension in the individual rope and the coefficient of utilization K_2 in Table 8.1.

3.7 Where the ropes of slings are turned around small bending radii (D/d < 9), a reduction of the breaking load is to be assumed.

The reduction "W" of the breaking load can be calculated by the following formula

$$W = 50 \cdot \sqrt{\frac{d}{D}} + 15 \ , \ [\%]$$

Where ;

d = rope diameter

D = bending diameter

Table 8.1 Coefficients of utilization for wire ropes

K_1 Coefficient of utilization	
Safe Working Load of lifting appliances or loose gear	Wire ropes for running rigging
Up to 10 t	5
10 t - 160 t	$\frac{10000}{(8{,}85xSWL+1910)}$
160 t and over	3
Safe Working Load of lifting appliances or loose gear	Wire ropes for standing rigging
Up to 10 t	4
10 t - 107 t	$\frac{8000}{(8{,}85xSWL+1910)}$
107 t and over	2,8
Coefficient of utilization K_2	
Safe Working Load	Rope slings **(1)**
Up to 10 t	6
10 t - 160 t	$\frac{12000}{(8{,}85xSWL+1910)}$
160 t and over	3,6
(1) *Rope slings which are not turned round may be treated as wire ropes for standing rigging, provided that both ends are fitted with thimbles or rope sockets*	

3.8 Deviating regulations for the dimensioning of wire ropes for special lifting appliances, equipment and means of transport, can be found in Section 6.

4. Requirements for rope drives

4.1 In determining the necessary length of wire ropes, and the length of drum, it is to be borne in mind that at least 3 safety turns have to remain on the drum at all times. (For the auxiliary hoists of offshore cranes, at least 4 safety turns are required. See Section 4.).

4.2 Not more than 3 layers of rope may be wound on each other on the ungrooved drums of winches which can at all times be seen by the operator. Where the number of layers exceeds 3, a special coiling device, or other system or equipment, must be provided in every case.

4.3 It is recommended that heavily loaded ropes which are wound on to drums in several layers should have a steel core.

4.4 Rope sheaves are to be fitted with a protective device which prevents the ropes from jumping out of the sheaves.

4.5 The ends of rope drums are to be fitted with flanges whose outer edge projects by at least 2 1/2 times the rope diameter beyond the topmost layer of rope, unless other measures are taken to prevent the rope from jumping over the flanges.

4.6 Rope-end attachments on winch drums must be so designed that

- the rope is not pulled over sharp edges,

- the rope does not knot

- it is impossible for the end attachment to be unintentionally released.

4.7 The lateral deflection of wire ropes relative to the plane of the groove in the rope sheave, or relative to the plane of the groove in the rope drum (fleet angle), shall not be greater than 1:15 (4°).

In the case of non-rotating or poor-rotating ropes, it is recommended that the fleet angle should not be greater than 1:40 (1,5°).

4.8 Rope sheaves made of plastic may be used only with the consent of **TL** and the operator.

4.9 The required rope sheave and rope drum diameters relative to the rope diameter "d" shall be as shown in Table 8.2.

C. Fibre ropes

1. Requirements and instructions

1.1 Fibre ropes must conform to recognized national standards (e.g. DIN 83305) or international standards (e.g. ISO 1140, 1141, 1181, 1346). On application, special rope constructions may be approved.

1.2 The prescribed minimum breaking loads of the commonest ropes are shown in Table 43 in Appendix A.

1.3 Fibre ropes (of natural or synthetic fibre) may be used for the guy tackle runners of derricks and other gear with Safe Working Loads up to 10 t.

Fibre ropes may also be used for the single-reeved cargo tackles of landing booms for the conveyance of persons in accordance with Section 6, and for rope slings. The agreement of **TL** is required for other applications.

1.4 The diameter of fibre ropes should be at least 16 mm. It is recommended that fibre ropes with nominal diameters of 20 to 24 mm be used.

1.5 Synthetic fibre ropes must be stabilized with respect to light and heat.

2. Definitions

2.1 The "actual breaking load" F_w of a rope is that which is measured by performing a tensile test to destruction on a sample of the rope.

2.2 The "proven breaking load" F_n of a rope is the load calculated from the breaking load of the yarns contained in the rope multiplied by a reduction factor.

2.3 The "reduction factor" is an empirical value which takes account of the stranding loss.

The reduction factors for the commonest fibre ropes are indicated in **TL**'s Rules for Materials.

Table 8.2 Minimum diameters of ropes sheaves and rope drums

Application	Rope sheave groove diameter **(1)** min.	Rope drum diameter **(1)**		Nominal tensile grade of wire rope **(2)**
		ungrooved min.	grooved min.	
Wire ropes not operated under load	9 d	10 d	9 d	1570 N/mm^2
Derrick rigs, occasional use	14 d	16 d	12.5 d	1570 N/mm^2
Derrick rigs, frequent use	18 d	20 d	16 d	1770 N/mm^2
Deck cranes, types A and B	20 d	22 d	18 d	1770 N/mm^2
Deck cranes, type C1	22 d	25 d	20 d	1770 N/mm^2
Deck cranes, type C2	25 d	28 d	22 d	1770 N/mm^2

(1) *Where non-rotating or poor-rotating ropes are used, it is recommended that the diameters indicated be increased by 10 %.*

(2) *Where ropes with a higher nominal tensile grade are used, the prescribed diameters are to be increased in proportion (see also B.1.5).*

3. Dimensioning

3.1 In the case of fibre ropes used for lifting appliances and loose gear, the "actual breaking load" or the "proven breaking load" shall not be less than the product of the static rope tension "S" and the coefficient of utilization "N", as shown in Table 8.3.

3.2 For the definition of rope tension "S", see B.3.2.

Table 8.3 Safety factors for standardized fibre ropes

Nominal diameter of rope çapı [mm]	Coefficient of utilization N
18 - 23	8
24 - 39	7
40 and over	6

4. Requirements for rope drives

4.1 Synthetic fibre ropes are not to be used on motorized winch drums or capstan heads.

4.2 The required rope sheave diameters relative to the rope diameter "d" shall be as shown in Table 8.4.

Table 8.4 Minimum diameter of rope sheaves

Rope material	Rope sheave groove diameter min..
manila, hemp.	5,5 d
polypropylene	4 d
polyamide	6 d
polyester	6 d

4.3 The required diameter of rope drums and capstan heads are to be agreed with **TL** in each case.

D. Rope-end attachments

1. Splices

1.1 Wire ropes and fibre ropes are not to be made up of parts spliced together.

1.2 Eye splices and thimble splices must conform to standard DIN 3089, or be of equivalent design.

The dimensions of thimbles shall comply with standard DIN 3090 (Shaped steel thimbles for wire ropes), or standard DIN 6899 (Steel thimbles for fibre ropes), as appropriate.

1.3 Hoisting rope ends on derrick booms, and rope ends connected to winches, may be spliced without thimbles.

1.4 Splices are unsuitable for the hoisting and luffing ropes of cranes, because of their inadequate fatigue strength.

1.5 Splices shall not be sheathed.

2. Rope sockets

2.1 Rope sockets (open and closed sockets) into which wire rope ends are to be socketed must conform to standard DIN 83313.

On application, other designs may be approved.

2.2 The socketing shall be performed as prescribed in standard DIN 3092, and may be carried out only by companies whose casting equipment has been inspected by **TL**, and which have subsequently been approved for socketing of wire ropes. Only cast metal approved by **TL** may be used. Rope sockets must be marked with the code letter identifying the approved company.

3. Ferrules

3.1 Wrought aluminium alloy ferrules must conform to standard DIN 3093.

Flemish eyes to standard DIN 3095 are to be used wherever possible for the end attachments of the hoisting and luffing ropes of deck cranes, if the cranes are working with grabs.

3.2 On application, swaged or rolled-on end fittings (terminals) may be approved.

3.3 Application of ferrules and terminals in accordance with 3.1 and 3.2 may be carried out only by companies whose fabricating equipment has been inspected by **TL**, and which have been approved by **TL**. Ferrules and terminals must be marked with the code letter identifying the approved company.

4. Detachable rope joints

4.1 Wedge sockets may be used only with the special consent of **TL**, if the ropes are permanently in tension. The rope joints must be clearly visible and readily accessible to facilitate inspection. The free end of the rope must be safeguarded against being pulled through. This safeguard shall not involve a force-transmitting connection to the load- bearing part of the rope.

The wedge sockets must be manufactured to approved drawings.

4.2 Wire rope clips and other detachable clamps are not permitted.

This does not apply to the attachment of rope ends to winch drums, provided the requirement stated in B.4.1 is satisfied.

E. Tests and Examinations

1. Tests and examinations before being put into use

1.1 With regard to testing and examinating of ropes by the manufacturer the Türk Loydu Rules, Chapter 2, apply.

1.2 Production and quality assurance have to comply with the **TL** Rules and manufacturers must be approved by **TL** for production. On application manufacturers may be approved for independent testing and certification.

1.3 Manufacturers have to check the galvanizing and deformation ability of the wires and perform the tensile test to destruction.

1.4 The tensile test is to be performed in the presence of the **TL** Surveyor to whom the protocols on the checks performed by manufacturers are to be presented.

1.5 Following the tensile test, checking of the diameter tolerances, construction and manufacturers' protocols, the **TL** Surveyor will issue a certificate of test and thorough examination of wire rope.

2. Periodic examinations

2.1 Ropes are to undergo visual examinations by a **TL** Surveyor at least once a year with regard to condition and fitness for use.

2.2 Wire ropes are to be visually examined with regard to deformation, crushing, corrosion and broken wires. If necessary the ropes have to be twisted open for an internal examination.

2.3 Special attention is to be paid to the end attachments. At the dead end increased corrosion is to be expected on the other end broken wire ropes are more likely.

2.4 Ropes which are regularly used under water must be shortened once a year near the load bearing means (i.e. the cargo hook) for subjecting the cutted off peace of wire rope, which must have a length of at least one meter, to a thorough examination and a tensile test to destruction.

In case the remaining breaking load is less than 80 % of the original one the rope is to be discarded. If the remaining breaking load is between 80 % and 90 % of the original one it is to be estimated on the basis of condition and time in use whether or not the rope may be used for another year.

3. Ropes to be discarded

3.1 Wire ropes

3.1.1 Wire ropes must be discarded when, over a length equal to 8 times the rope diameter, the number of visible broken wires is greater than 10 % of the total number of wires in the rope.

3.1.2 Wire ropes must also be discarded in the event of

- The rope diameter being reduced, owing to friction or wear, by more than 10 % of the nominal diameter, or in case of wear to the core,

- Corrosion (external or internal),

- Deformations of the rope, such as "bird caging", formation or looping, buckling, kinking, crushing, loosening of individual wires or strands, etc.

3.2 Fibre ropes

3.2.1 Fibre ropes must be discarded when more than 10 % of the total number of yarns in the rope arc broken.

3.2.2 Fibre ropes must also be discarded in the event of

- Breakage of a strand,

- Mechanical damage or wear,

- release of fibre particles,

- Rotting,

- Loosening of splices,

- Considerable fused patches (synthetic fibres).

SECTION 9

MECHANICAL PARTS

A. General

1. This section contains generally applicable regulations for mechanical parts for lifting appliances and loose gear.

The scope of application depends on the range of parts covered by the **TL** approval. (See Section 1, D.2. and E.2.)

Other, possibly more comprehensive, regulations if applicable are to be taken from the **TL** Rules for Machinery, Chapter 4. (See also Section 1, C.4.1.)

2. As regards the materials to be used, and welding, the regulations in Sections 11 and 12 apply.

3. As regards supervision during construction and final test and examination at the manufacturers, the regulations in Section 13 apply.

4. Designs differing from the regulations which follow may be approved if examined by **TL** for their suitability and approved as being equivalent.

5. Mechanical parts developed on the basis of novel technical concepts but not yet sufficiently tried out, require particular approval by **TL**. Such systems may be subjected to more stringent supervision, if the prerequisites as per Part B, Chapter 4. are not given.

6. In the cases mentioned in item 4. and 5., **TL** is entitled to demand presentation of additional documentation and performance of special trials.

7. **TL** reserves the right to impose additional requirements for all kinds of mechanical parts, should this be necessary on account of new findings or operational experience.

B. Design Criteria

1. General Regulations

1.1 Mechanical parts of lifting appliances and loose gear must be designed for the environment conditions agreed on or prescribed and be capable of being operated fault-free under these conditions.

1.2 The effects of deformation of the supporting structure on machinery and equipment are to be observed.

1.3 Mechanical parts are to be designed so that repairs and regular maintenance are easy to perform.

1.4 Lifting appliances are to be provided with a device which in the event of a power failure allows a suspended load to be set down safely.

2. Dimensioning

2.1 Mechanical parts shall be so dimensioned as to provide adequate strength in respect of dynamic stress peaks plus adequate fatigue strength in the light of the loading and the service life.

In this respect in the dimensioning of the parts attention is to be paid particularly to the stress peaks arising during acceleration and retardation, and if applicable the dynamic influences resulting from high rope speeds.

Proof of fatigue strength may be provided in accordance with the FEM, Section 1.

2.2 In the case of shipborne lifting appliances and loose gear, all mechanical parts must measure up to the special circumstances of operation on board ships, such as ship movement, increased corrosion attack, temperature changes, etc.

2.3 All materials must suit the envisaged purpose. Proof has to be furnished of the quality features of the materials employed. Identification of the materials on the basis of the test certificates/records is to be ensured.

3. Vibration Effects

3.1 Machinery and equipment must not cause any vibrations and shocks which may unduly stress other components or the structure of the lifting appliances and loose gear. The permissible amplitudes and accelerations are stated in the **TL** Machinery Rules.

3.2 If compliance with the permissible values of amplitude and acceleration cannot be ensured by structural measures, damping measures are required.

3.3 Within the frequency ranges occurring, there shall be no resonance phenomena at components, support- and suspension arrangements - also inside appliances.

4. Lubrication

4.1 Lubrication of the moving parts of lifting appliances and loose gear must be guaranteed under all operating conditions.

4.2 Each grease-lubricated bearing shall be provided with its own proven-type grease nipple.

4.3 Accessibility of the hand-fed greasing points must be assured.

5. Corrosion Protection

Components at risk from corrosion are to be given suitable corrosion-protection.

C. Winches

1. General Regulations

1.1 Winches must be of reversible type, i.e. the lowering process also must be motor-controlled.

1.2 Design features incorporated in each winch must ensure that the load cannot run back inadvertently (such features include e.g. a pawl- and-ratchet wheel, self-locking gears, non-return valves, automatic brakes, etc.).

1.3 The use of belts or friction discs to transmit power between the winch drum and the reverse- travel prevention device referred to in item 1.2 is not allowed.

2. Rope Drums

2.1 The drum diameter shall be determined in accordance with the intended purpose of the winch, in accordance with Section 8, B.4.

2.2 Satisfactory reeling of the ropes onto the rope drums must be ensured. The length of the rope drum should normally be such that the rope can be reeled-on in not more than three layers. If more than three layers are to be reeled on, special drum versions and/or rope-spooling devices shall be provided. Smooth drums, i.e. ones without grooves, may be used only with special approval from **TL**.

In the case of offshore supply cranes, a guide-on system must be provided as a matter of principle where the rope is unable to reel itself satisfactorily onto the drum, or if the drum cannot be supervised by the operator at all times. Such a guide on system may take the form of a grooved drum, spooling gear or similar device

2.3 Rope drums shall be provided with flanges whose outer edges extend above the top layer of rope by at least *2.5* times the rope diameter unless the rope is prevented from overriding the flange by a spooling device or other means. It is to be ensured that ropes can wind onto drums properly and without excessive angle of deviation.

2.4 The number of safety-turns of rope left on the drum shall not be less than 3 - for the auxiliary hoist of offshore supply cranes 4 safety turns are required - and is to be selected so that the maximum rope tension can under all working conditions be safely withstood by the rope end fastening. Rope end fastenings must be so designed that

- the rope is not pulled over sharp edges, the rope is not ttangled during spooling,
- the end fastening cannot be released unintentionally,
- the end fastening is easy to inspect.

2.5 The way in which the first layer of rope is wound onto the drum shall be chosen in dependence on the lay of the rope so that the rope does not unlay.

The direction in which the rope reels onto the drum must be clearly indicated on the drum.

3. Brakes

3.1 Each winch must be fitted with a braking device capable of braking and holding the maximum permitted load safely under all operating conditions and this action shall not generate inadmissible dynamic forces (see Section 2, C.2.5.). The winch and its substructure must be able to safely withstand the forces set up during braking.

3.2 Having regard to the dynamics of the braking action, the braking torque must exceed the maximum load torque by an adequate safety margin. As a guide, the maximum braking torque may be set at about 80 % above the maximum load torque.

3.3 The required braking device may take the form of

- Self-locking gears,

- An automatically operated brake, or

- A hydraulic or pneumatic device which prevents lowering of the load,

and must be actuated when

- The control returns to the neutral position,

- A safety device comes into action, or

- The power supply fails.

3.4 Braking devices must be so designed that on one hand they may be adjustable, on the other the designed braking effect cannot be interfered with by simple means.

3.5 In the case of cargo- and hoisting winches, a device shall be provided which allows a suspended load to be lowered safely following a power failure.

3.6 The hand force to be applied to manually operated brakes should not exceed 160 N.

4. Drives

4.1 Manual drives

4.1.1 Manual drives shall incorporate the following features:

- The crank handle turns in the same direction for all gear ratios,

- Crank handles have a crank radius of approximately 350 mm and a rotatable grip sleeve,

- Detachable crank handles are safeguarded against being detached unintentionally,

- The load is hauled in with a hand force is not exceeding 160 N,

- a speed of about 30 rev/min is not exceeded.

4.1.2 Where winches are constructed for both powered and hand operation, the power- and hand drive systems must be mutually interlocked to prevent operator injury.

4.2 Power-drives

The regulations under item F apply to these.

5. Couplings

5.1 Clutch couplings between the drive and the rope drum are only permitted where the means to prevent running back stipulated in 1.2 has been provided.

5.2 Where winches have more than one disengageable drum, only one drum shall be in operation at any time.

5.3 Control levers must be safeguarded against being operated unintentionally.

6. Gearing

6.1 The design of gearing must conform to established engineering practice; location, positioning and mode of operation are to be taken into account.

6.2 Gearing shall, amongst others, include the following characteristics:

- Easy access for maintenance,
- Facilities for checking the oil level,
- Ventilation- and oil filler pipes appropriate to the location,
- Inspection openings.

7. Controls

7.1 The controls and monitoring instruments must be clearly arranged on the control platform.

7.2 Controls and monitoring instruments must be permanently, clearly and intelligibly marked with the direction or the function of the movements they control (re this see Section 4, E.2.2.3).

7.3 The arrangement and direction of movement of controls and monitoring instruments must match the direction of the movement which they control.

7.4 The operating movement of control levers shall be less than 300 mm, and when released they must return automatically to the neutral position.

7.5 In the case of pushbutton controls there shall be a separate button for each direction of movement.

8. Marking

8.1 Each winch shall be fitted with a manufacturer's plate permanently inscribed with the following details:

- Manufacturer
- Year of manufacture
- Type
- Serial number
- Hoisting load/holding load.

8.2 The direction in which the rope(s) reels (reel) onto the drum must be clearly indicated on the drum.

D. Slewing Gears, Slew Rings

1. Slewing Gears

1.1 Slewing gears are to be designed for the maximum operating torque; if not of the selflocking type, they are to be equipped with a slewing gear brake.

1.2 Slewing gears on board ships are to be designed so that in the event of the vessel's permissible inclination being exceeded by 5° none of the materials employed shall be stressed beyond 90 % of their yield point.

1.3 In the case of slewing gears on board ships it is to be taken into account that it might be necessary in the "out of operation" condition to reduce the load on the slewing gear brakes by means of locking devices.

2. Slew Rings

2.1 **TL** must be provided with specifications of the materials used for races/supporting rings.

The rings must receive heat treatment appropriate to the material, the running surfaces to be additionally hardened.

2.2 The connecting flanges on the lifting appliances and foundations must be adequately distortion-resistant, their surfaces machined.

Accuracy of plane and distortion must be within the tolerances stated by the manufacturer.

2.3 Casting of synthetic material require **TL** approval in each individual case.

2.4 If slew rings have to be dismantled at set intervals for a detailed examination, as may be the case in certain circumstances with offshore supply cranes, either there must be a special dismantling equipment which can hold the lifting appliance and raise it after the connecting bolts have been undone, or the appliance must have special eyebolts for lifting by another appliance and a safe place for setting-down.

2.5 As regards proofs of material quality, see Section 11, B.4.

3. Bolting

3.1 Slew rings are to be bolted at distances evenly distributed around their circumference.

32 Threads must be formed using a non-cutting method.

3.3 Up to a diameter of about 30 mm, bolts may be preloaded according to the instructions of the slew ring's manufacturer by applying a torque.

For larger diameters, preloading should be by hydraulic elongation. This calls for increased thread tolerances.

3.4 The test certificates required according to Section 11, Table 11-1 must in addition to the details of materials used also contain information on

- Breaking strength
- Yield strength and
- Elongation.

E. Hydraulic Systems

1. General Regulations

1.1 The dimensions and design of hydraulic systems must conform to the established rules of engineering practice. Safe operation under all envisaged service conditions shall be ensured by suitable measures (e.g. filters, coolers, control devices and primary pressure control) and by selecting an appropriate hydraulic oil.

1.2 Instead of pipes, high pressure hoses may be used between movable structural parts or machinery. These must comply with the requirements of DIN 20066 or an equivalent standard. The hoses must be suitable for the proposed operating fluids, pressures, temperatures, operating- and environmental conditions and be appropriately laid.

The hose screw-joints must be of an approved design.

1.3 For hydraulically powered winches, a standstill brake to prevent slip is required if necessary for the intended purpose of the winch. Generally no slip is allowed however in case it is unavoidable the rate of revolution should be limited to a level which will not interfere with the function of the unit.

1.4 The piping system may be connected to other hydraulic systems for which such a connection is permitted. In this case a second pump unit and the provision of suitable shut-off valves is recommended.

2. Hydraulic Cylinders

2.1 Hydraulic cylinders categorised as being components of the first order (see Section 11, 2.1.1) must be equipped with pipe-burst safety valves or load holding valves immediately adjacent to the cylinder.

2.2 The hydraulic cylinders must be connected in such a way that no unacceptable external bending moments can be transmitted to the piston rod.

F. Power Drives

1. Notes

1.1 Power drives must be adequately dimensioned for the working conditions laid down.

1.2 For electrical drives of shipborne lifting appliances, reference is made to Section 10.

1.3 Power drives located in spaces where there is an explosion hazard are additionally subject to national and international regulations in force.

2. Safety Appliances

2.1 Winches and drive systems must be equipped with adjustable overload protection devices (e.g. pressure relief valves, thermal overload relays for windings and slip clutches). For cranes, reference should be made to Section 4, E.2.3.4. Following a power failure, drives shall not restart automatically.

2.2 Safety appliances shall not be rendered unserviceable by the environmental conditions at the point of installation, or by dirt or the breakage of springs. Means shall be provided for checking the appliances.

2.3 Measures shall be taken to provide power supply lines with effective protection against mechanical damage.

G. Protection Devices

1. Moving parts, flywheels, chain and belt drives, rods and other components which might come to constitute an accident hazard must be provided with protection against accidental contact. The same applies to hot mechanical parts, pipes and walls not provided with insulation.

2. Cranks for starting IC engines must disengage automatically once the engine starts running.

3. Working floors resp. floor coverings in service spaces must be of non-slip type.

4. Service alleyways, operating platforms, stair-ways and other places to be entered during operation must be safeguarded by railings. Outside edges of platforms and working floors must be provided with a coaming, unless persons and objects are prevented from falling off by other means.

H. Examination of Drawings and Supervision of Construction

1. Examination of Drawings

1.1 The general requirements in Section 1, D.1 are to be observed.

1.2 In addition to the requirements in Section 1, E.2, the mechanical parts listed in Table 9.1 are subject to examination of drawings within the scope indicated there.

2 Supervision of Construction

2.1 General notes

2.1.1 Mechanical parts shall be manufactured by staff qualified in handling the installations and devices necessary. During manufacture and before delivery the parts have to undergo the quality tests required in accordance with state-of-the-art technology and experience.

2.1.2 All materials shall be suited to the intended purpose. Proof of the mechanical properties of the materials used is to be furnished. Identification of the materials shall be possible on the basis of test certificates or reports.

2.1.3 Mechanical parts which require an inspection certificate 3.2 according to Table 9.1, are subject to supervision of construction by **TL**, with the restrictions described in the explanations to Table 9.1 where required.

2.1.3.1 The **TL** inspector in charge decides in coordination with the manufacturer on type and scope of supervision of production and certification, taking the in-house quality control and/or approval for production into consideration.

2.1.3.2 With respect to assistance by the manufacturer during supervision of production by **TL**, the requirements in Section 13, B.2 are to be observed.

2.2 Tests and examinations

The following requirements contain general test requirements, and in addition, provisions for the supervision of production by **TL**.

2.2.1 General notes

2.2.1.1 For the acceptance tests before delivery and, if applicable, also for the supervision of production, the **TL** Surveyor shall be given material test and internal control certificates, test reports and manufacturing documents, in particular approved drawings, including the relevant examination reports, as a prerequisite for the tests and examinations described below.

2.2.1.2 Test reports shall include the following information, if applicable:

- Designation of type and nominal dimensions
- Purchase and order number
- Drawing number
- Results of internal controls
- Certificate numbers of material tests and non-destructive tests
- Additional details, as necessary

2.2.1.3 For series-production components, other test procedures may be agreed with **TL** instead of the prescribed ones, if they are accepted to be equivalent.

2.2.1.4 **TL** reserves the right to extend the scope of testing, if necessary, and also to subject such components to a test, for which testing is not expressly required in these Rules.

2.2.1.5 Where mechanical parts are to be used for the intended purpose for the first time, **TL** may ask for a type approval.

2.2.2 Winches

2.2.2.1 After completion, winches are to be subjected to an examination and functional test at nominal rope tension by repeated hoisting and lowering of the nominal load. During the functional test, in particular the brake and safety devices are to be tested and adjusted.

2.2.2.2 Where winches are designed for a holding force greater than the nominal rope tension, the nominal rope tension is to be tested dynamically and the holding force statically.

2.2.2.3 Where winches are designed with a constant tension device, the maintenance of constant tension is to be proven for all levels of tension set by the design.

2.2.2.4 The above tests, including the setting of the overload protection, can also be performed on board, together with the functional testing of the loading gear. In this case, a functional test at available load is to be performed at the manufacturer's. Testing of winches with test load will be performed within the scope of initial tests of the loading gear, see Section 13, C.

2.2.3 Load-bearing hydraulic cylinders

2.2.3.1 Load-bearing or 1st order components are hydraulic cylinders designed for hoisting, luffing, telescoping and slewing.

2.2.3.2 Load-bearing hydraulic cylinders shall undergo a functional test at relief pressure and a pressure test at test pressure. The test pressure shall be 1.5 times relief pressure pc, however with relief pressures over 200 bar, it need not be higher than pc + 100 bar.

2.2.3.3 With reference to E.2, in the case of series-production of loading gear of the same type and with multiple cylinders, e.g. with slewing cranes with luffing, folding and/or telescopic crane booms, a regular check on the cylinders at a minimum of 1.25 times the relief pressure may be accepted. The **TL** Surveyor is entitled to ask for cylinders to be tested which are selected at random, in accordance with 2.2.3.2.

2.2.4 Large roller bearings

2.2.4.1 The material properties of forged rings shall be tested according to the **TL** Rules for Materials, see Chapter 2, by tensile tests and by notched-bar impact tests and shall comply with the requirements in the agreed specification.

The manufacturer shall, in addition, ultrasonically test the rings for internal defects and certify that the materials are free from defects which may impair the performance characteristics.

2.2.4.2 Rings shall be heat-treated as appropriate to the material, and the running surfaces are to be hardened additionally. After hardening and grinding of races, the runway surfaces of the rings shall be crack-tested along their entire length.

Cracks may be removed by grinding, if by this measure the functional capability of the slewing ring is not impaired. Residual cracks are not permitted. The **TL** Surveyor may demand the crack test be performed in his presence.

2.2.4.3 The hardened runways are to undergo a hardness test at least 8 points equally distributed along the circumference. The hardness values shall be within the specified range.

Where there are reasonable doubts about the hardened depth, proof shall be furnished using specimens which have been hardened under the same conditions as the ring under consideration.

2.2.4.4 For the acceptance test before delivery, the large roller bearing shall be assembled and presented to the **TL** Surveyor. The functional capability (slewing without load), the bearing clearance and the accuracy in plane and round travelling are thereby to be tested. In addition, the dimensions shall be checked randomly, as deemed necessary by the Surveyor.

2.2.5 Bolts and nuts for large roller bearings

With respect to tests and examinations of bolts and nuts, the **TL** Rules for Materials, Chapter 2 and Rules for Welding, Chapter 3 apply.

2.2.6 Mechanical and hydromechanical parts

2.2.6.1 With respect to tests and examinations of mechanical and hydromechanical parts, the **TL** Additional Rules apply, where relevant.

Parts not covered by the **TL** Additional Rules shall be tested and examined using appropriate procedures agreed with the **TL** Surveyor.

2.2.6.2 Instead of testing at the manufacturer's, tests can also be performed on board within the scope of initial tests of the loading gear, if practicable.

I. Documentation

1. Marking

1.1 Each mechanical part shall be marked by the manufacturer in a suitable way. The marking shall at least include the following, if applicable:

- Manufacturer's name
- Year of construction
- Type
- Designation of type
- Purchase order number or serial number
- Characteristics such as nominal load, nominal pressure, nominal voltage, etc.
- Additional details, as necessary

1.2 If, after the acceptance test before delivery, the requirements for issuing a test certificate of Form F132, F190, F208 are complied with, the tested mechanical part will be stamped in a prominent position.

The stamp shall include the following information:

- Certificate number, together with the code letters of the examining inspecting Office

- Stamp **TL** stamp with the month and year of testing

for hydraulic cylinders additionally:

- Working pressure

- Testing pressure

for winches additionally:

- Rope tension [kN]

- Holding force [kN]

for slewing gear rings additionally:

- Abbreviation for the material type

- Melting charge number

- Specimen number

1.3 The winding direction of ropes on rope drums shall be clearly recognizable on the drums.

Where required, the winding direction shall be indicated appropriately on the drum or winch.

2. Certificates

2.1 Table 9.1 shows the required types of certificates for essential mechanical parts.

The loading gear manufacturer shall order the stated parts together with the required certificates, the parts manufacturer shall include them in the delivery.

2.2 The inspection certificate 3.2 shall be issued by **TL**.

2.3 The certificates listed in Table 9.1 are not part of the loading gear documentation on board.

Table 9.1 Examination of drawings and certification of mechanical parts

Components		Loading gear in general[5]		Offshore cranes		Classified loading gear	
		Examination of drawings	Certificate	Examination of drawings	Certificate	Examination of drawings	Certificate
Winch drum		Z	–	Z	–	Z	–
Winch mounting		Z	–	Z	–	Z	–
Winch, complete unit		I	2.2	Z	3.2[1]	Z	3.2[1]
Hydraulic cylinder, load-bearing		Z	3.2	Z	3.2	Z	3.2
Large roller bearings		Z	3.2[2]	Z	3.2[2]	Z	3.2
Bolts and nuts for large roller bearings	≤ M52	I	2.2	I	3.1	I	3.1
	> M52	I	3.1	I	3.1	I	3.2
King pin/support rolls		Z	2.2	Z	3.1	Z	3.2
Slewing gear, complete unit		I	2.2	Z	3.1	Z	3.2
Slewing gear	Cylinder	Z	2.2	Z	3.1	Z	3.2
	Rack bar	Z	2.2	Z	3.1	Z	3.2
Luffing gear (Cylinder/ spindle)		Z	3.2	Z	3.2	Z	3.2
Travelling gear, complete unit		Z	2.2	–	–	Z	3.1
Main drive (diesel)		–	2.2	I	3.1	I	3.1
Hydromotors and pumps	≤ 50 kW	–	2.2	I	2.2	Z	3.1
	> 50 kW	–	2.2	Z	3.1	Z	3.2
Pressure lines	≤ 40 bar ≤ 32 DN	–	–	I	2.2	I	2.2
	> 40 bar > 32 DN	–	–	I	2.2	I	3.1[3]
Safety valves against pressure loss		I	2.2	I	2.2	I	2.2
Hydraulic hose lines		–	2.2	I	3.2[4]	I	3.2[4]
Hydraulic fittings		–	2.2	I	2.2	I	2.2
Ventilators/heat exchangers		–	2.2	I	3.1	Z	3.2
Sheaves		I	2.2	I	3.1	Z	3.2
Swell compensators		–	–	Z	3.2	Z	3.2
Damping devices		–	–	Z	3.2	Z	3.2

Explanations:

–The column "Loading gear in general" may also be applied to loose gear as and where relevant –"Z" means drawings and calculations

–"I" means documents for information

–The designation of the certificate types corresponds to EN 10204. The numbers mean the following certificates:

– 2.2 : test report (TL desination: C-type Certificate)

– 3.1 and 3.2 : inspection certificates (TL designation: B- and A-type Certificate)

1 At the manufacturer's at least 1 functional test is required, see H.2.2.2.4

2 Certificate of type 3.1, if the manufacturer is approved by TL

3 The certificate shall confirm the performance of a pressure test at 1.5 times the nominal pressure

4 Certificate of type 3.1, if the manufacturers of both, the hose as well as the hose line are approved by TL and proof is furnished of a pressure test at 2 times the nominal pressure

5 Includes offshore working cranes on wind energy plants

SECTION 10

ELECTRICAL EQUIPMENT

Page

A. General

1. This section contains generally applicable regulations for electrical equipment for lifting appliances and loose gear.

The scope of application depends on the range of parts covered by the **TL** approval (see Section 1, D.2. and E.2.).

Other, possibly more comprehensive, regulations if applicable are to be taken from the **TL** Rules, Part B - Chapter 5.

2. As regards supervision during construction and final test and examination at the manufacturers, the regulations in Section 13 apply.

3. Designs differing from the regulations which follow may be approved if examined by **TL** for their suitability and approval as being equivalent.

4. Electrical equipment developed on the basis of novel technical concepts but not yet sufficiently tried out, requires particular approval by **TL**. Such equipment may be subjected to more stringent supervision, if the prerequisites as per 3. are not given.

5. In the cases mentioned in 3. and 4., **TL** is entitled to demand presentation of additional documentation and performance of special trials.

6. **TL** reserves the right to impose additional requirements for all kinds of electrical equipment, should this be necessary on account of new findings or operational experience.

B. Special ship related provisions

1. The electrical control and switch gear as well as the motors must be so designed or arranged that necessary maintenance of contacts, contactors, collectors, slip rings, brakes etc. can be carried out with means available on board.

2. Switchgear, control cabinets and motors are to be provided with adequate heating for the standstill condition, if sufficient internal space is available.

3. When choosing the electrical equipment, the expected environmental conditions such as humidity, heat, cold and vibrations shall receive special consideration. In general, acceleration of 0.7 g in the frequency range from 13 to 100 Hz shall also be taken into account as regards design and mounting.

Plug-in cards with electronic controls may have to have extra fastenings.

4. Where special circuits for lighting, standstill heating, etc. are fed through separate powersupply switches in such a way that they can be operated also when main supply to the cargo-handling appliance is switched off, special measures shall be taken in the switchgear to prevent direct contact with live parts. Double feeding is to be indicated by special labels.

5. Power supply or control via contact lines or bus bars with collectors is not permitted on board ship or rather may on application be approved only for specially protected areas and with special protective measured being observed.

For supply lines to shipborne cargo-handling appliances, including the external fixed cabling, marine cable as per **TL**, Part B, Chapter 5, Electrical Installation is to be used.

C. Safety devices

1. General regulations

1.1 In general the operating voltage for motor drives should not exceed 500 volts and for controls, heating and lighting systems 250 volts. Insulation must be all-pole.

1.2 All equipment with a working voltage exceeding 50 volts, connected via movable cable, must be earthed via a protective conductor inside the cable.

For cable cross-sections up to 16 mm^2, its cross-section must match that of the main conductors; for those exceeding 16 mm^2, it must be at least half that of the main conductors.

If power is supplied via slip rings, the protective conductor must be provided with a separate slip ring.

1.3 Overload and short-circuit protection is to be provided in accordance with **TL**, Part B, Chapter 5, Electrical Installation.

For motors, monitoring of the winding temperatures is recommended as protection against inadmissible heating. If the admissible temperature or load is exceeded, power shall be switched off. Switching-off due to thermal overloading is to be indicated.

1.4 Switches, switchgear and control cabinets shall be so located that work on them and operational tests can be performed in safety. For arrangements inside the crane pedestals, gratings or platforms are to be provided.

The unobstructed service passage in front of switchgear and control cabinets must with 1,80 m headroom not be less than 0.5 m wide. If this headroom cannot be maintained, it may be reduced to 1.40 m if the passage is at least 0.7 m wide.

1.5 As a minimum, the following protective systems (contact, foreign body and water protection) shall be provided (see also Section 6, E.5.4):

1.5.1 For electrical installations below deck or in enclosed spaces of lifting appliances, the protective system must be at least IP 54.

1.5.2 For electrical installations on deck the protective system must be at least IP 56; under certain circumstances, e.g. where there is a heightened dust hazard, even IP 66.

2. Controls

2.1 Control handles are to be so constructed that the stop position at least engages unmistakably. In systems with pole-changing motors a separate notch must be allocated to each speed step.

2.2 When the control handles are released they must automatically move to the stop position.

2.2 Following failure of the electric power supply and when this is restored, or following operation of the emergency switch off button, restarting of the drives must be possible only via the stop position.

2.3 Where winch motors are provided with a speed step designed for light-hook operation only, the control mechanism must automatically prevent this step operating when there is a load on the hook. This may also apply to other part-load operating steps.

2.4 Programmed control mechanisms or micro-processor systems must have been type tested by **TL**, or else their operational safety must have been proved in another way.

3. Lighting

3.1 In addition to an adequate main lighting system for the working area of the lifting appliance, the cabin, the crane pedestal and at the switchgear and the machinery an emergency lighting system is to be provided for the cabin and the area of descent.

Emergency lighting systems should have about 30 min. assured endurance.

3.2 The emergency power supply chargers for these lamps shall be connected to a separate circuit not switched off by the load-circuit switch.

D. Drives and brakes

1. Driving power

1.1 All motors are to be dimensioned in accordance with their envisaged purpose and expected use.

1.2 In the case of shipborne cargo handling appliances the working speeds laid down for SWL shall be maintained also at the vessel's prescribed minimum inclinations (see Table 2-1).

1.3 The required power for winches is calculated from the rated pull and the rated rope speed of the first layer of rope on the drum, taking gearing efficiency into account.

2. Winch drives

For winch drives the following operating modes exist:

2.1 For drives up to about 5 t SWL started very frequently (about 160-400 starts per hour) with short load travel and lifting periods: operating mode S5, i.e. intermittent operation with the starting process and electrical braking influencing the heating-up of the motor.

2.2 For drives with long load travels and lifting periods and less frequent starts (up to about 160 starts per hour): operating mode S3, i.e. intermittent operation without the starting and braking processes having any noticeable effect on the heating- up of the motor.

2.3 For heavy loads with prolonged load handling and lengthy intervals: operating mode S2, i.e. short-term operation with an ensuing interval long enough for the driving motor to cool down approximately to the ambient temperature. Preferred duration of operation (short-time duty) 30 min.

2.4 In the case of hydraulic drives the electric motors driving the power units are to be matched to the given conditions. Possible operating modes are S1 (continuous operation) or S6 (continuous operation with intermittent loading). In the case of mode S6, particular regard has to be paid to the mode of operation of the hydraulic unit, e.g. the power required during idling.

2.5 In the case of drives designed for a pull exceeding 180 kN, the data in 2.2 and 2.3 respectively apply.

The driving motors are to be capable of running-up against at least 1.3 times the rated torque.

When designing the motors the moment of inertia of the gearing is to be taken into account. The moment of inertia of the driven masses shall be based on an inertia factor FJ of at least 1.2.

2.6 Operating modes S1 to S3, S5 and S6 are defined in DIN 57530 "Revolving electrical machinery, rating and characteristics".

When operating in mode S5, at least 160 starts per hour should be possible. This is based on the assumption that 50% of the starts will be without load.

Where the requirements are more stringent the drives should be designed for 240, 320 or 400 starts per hour.

The number of starts/operating modes mentioned in 2.1 to 2.3 likewise apply to all associated auxiliary winches, travelling and slewing drives.

2.7 For operating modes S5 and S3, differing duty times must be assumed depending on the service conditions. For the operating steps, a total operating period of 25 % of the overall total is to be considered. In the case of more stringent requirements (shorter intervals between the separate hoisting operations), duty times of 40 %, 60 % or 75 % should be chosen. In the case of polechanging motors, where all speed steps are designed for the rated load and where generally the top speed-step is reached by switching through the individual lower steps, the overall operating period is to be shared out between the individual switching steps.

If one of the speed steps is intended for light-hook operation only, the overall operating period applies only to the operating steps. However, the light- hook step shall be designed for at least 15 % of the overall operating period.

3. Brakes

3.1 The frequency of operation of the brake must correspond to that of the associated motor. It is assumed that when operating, braking will always be effected only from a low-speed step.

The braking arrangements must function automatically and arrest the load with the minimum possible impact.

3.2 Winches must as a matter of principle be equipped with safety brakes which if the power supply fails brake the load safely from any speed. Proof of this is to be presented to the **TL** Surveyor once, under test load (see also Section 13).

3.3 Load winch brakes must be so designed that in the event of a malfunction, e.g. a power failure, the suspended load can be set down safely. Suitable tools may be used to help with this. (See also Section 3, F.2.2.3 and Section 4, E.2.4.1.).

E. Cables and lines

1. General regulations

1.1 As a matter of principle power is to be supplied via suitable cables, possibly using cable trolleys or cable drums with integral slip rings. All cables and lines must be flame-resistant and self-extinguishing. Furthermore all cables must be approved by **TL**, possibly UV-radiation resistant and, where hydraulic systems are concerned, oil resistant.

1.2 Devices, e.g. cable drums, introduced to prevent the lines dragging on the floor during operation, must be so designed that wherever the cables are bent the inner bend diameter in the case of cables up to 21.5 mm external diameter is not less than 10 times the cable diameter; in the case of cables with an external diameter exceeding 21.5 mm, not less than 12.5 times.

1**.3** For internal cabling and the power supply to movable devices standardised and **TL** approved medium weight rubber hose cable of the following types may be used:

NSHÖU acc.	to VDE 0250/08.75	
NMHÖU acc.	to VDE 0250/08.75	
NSHTÖU	acc.	to VDE 0250/Part 814
NO7RN-F	acc.	to VDE 0282/Part 810

2. Wire cross-section

2.1 Dimensioning must take into account the loading, possibly giving consideration to a simultaneity factor and the expected ambient temperature.

2.2 For lifting appliances with only one driving motor, particularly with hydraulic-drive systems, the power supply is to be dimensioned as appropriate to the rated current at the maximum operating stage, for continuous operation.

2.3 For lifting appliances with several motors, for calculation of the amperage 100 % of the power of the hoisting unit motor plus 50 % of the power of all remaining drives may be used as a basis. The amperage resulting is to be applied as the continuous-operation value.

These values also apply to the dimensioning of slipring bodies and brushes.

3. Laying of cables

3.1 Notes

3.1.1 Fastening for cables must measure up to the vibration expected during lifting-appliance operation. Cables arranged suspended from cable trays or ones run vertically must, if secured by means of non-metal straps, as a matter of principle in this area and where they pass from one tray to the next, also be fastened with corrosion-resistant metal clips or metal straps at least at intervals of 1 m.

3.1.2 Penetrations through crane columns for passing-through cables shall be deburred and lined so that the cable sheathing cannot be damaged by sharp edges.

3.1.3 Leakage of hydraulic oil into control cabinets, switchgear and cable boxes is to be avoided; therefore wherever practicable cables are to be introduced into the boxes or cabinets from below. Where they are introduced from above, they may in areas exposed to the risk of oil leakage have to be additionally sealed using shrink-on sleeves.

3.2 Cable trays

3.2.1 Cables shall be laid on adequately rigid corrosion-resistant cable trays. Exceptions to this are possible when laying single cables, e.g. to lighting fittings.

3.2.2 Cable trays are to be arranged so that hydraulic oil from hydraulic systems cannot drip onto the cables. Where this is not possible, oil guards shall be provided.

3.3 Cable bundles

3.3.1 In slewing cranes with a limited slewing range, all circuits/supply lines may be led-in via flexible cable bundles suitably arranged in the centre of the crane column.

3.3.2 Suspended cable bundles must at both ends be appropriately led over curved cable trays with a radius of curvature not less than 10 times that of the thickest cable, and there fastened in such a way that the weight of the bundle is distributed as evenly as possible over all the cables, depending on their size.

3.3.3 The cable bundle must not strike or rub against anything during slewing and in the case of shipbome lifting appliances in a seaway.

4. Cable drums

4.1 Drum-wound cables are to be so dimensioned that even with the cable fully wound-on and under normal operating power load the cable does not heat up beyond its permitted limit.

4.2 For cable trolleys, minimum inside bend diameters related to cable outside diameters are as follows:

cable up to 8 mm, 6 times

cable up to 12,5 mm, 8 times, and

cable over 12,5 mm, 10 times.

4.3 In the case of flat cables, the thickness of the cable corresponds to the outside diameter of round cables.

F. Switches

1. Load circuit switches

1.1 Each lifting appliance must be fitted with a load-circuit switch capable of being locked in the "off" position, with which all movement can be stopped.

This switch must control all live conductors of the motion-drive main circuits.

1.2 A contactor also may be used as a load circuit switch, if it permits the maximum short-circuit power occurring to be switched off safely.

1.3 In the case of electro-hydraulic lifting appli-ances, the load circuit switch must also switch off power to the motor(s) of the hydraulic pump(s).

2. Limit switches

2.1 The control circuits of the safety limit switches must be designed on the closed-circuit current principle or must be self-regulating. Any failure of such a control circuit is to be indicated visibly and audibly.

2.2 In the case of automated motion processes or programme-controlled cargo handling appliances (including use of microprocessor systems) the continued secure functioning of means to provide movement limits is to be ensured even in the event of a fault or malfunction in the computer.

This may be achieved by using separate control elements or additional, main frame independent, electronic units insofar as these have been approved by **TL** and the switching has been qualified as "safe" by **TL** as regards its safety aspect (fault elimination assessment).

2.3 In programme-controlled movement proces-ses, safety-boundary limit switches may not be used for operational speed- or movement acquisition.

SECTION 11

MATERIALS

A. General

1. Materials for the manufacture of lifting appliances and loose gear must comply with the minimum requirements set out below. The manufacture and testing of these materials shall also conform to the **TL**'s Rules for Materials.

2. Rolled, forged and cast materials for lifting appliances and loose gear may be supplied only by manufacturers who have been approved by **TL** for that purpose. If no such approval exists, application for approval is to be made to the head office of **TL**.

3. Wherever possible, materials conforming to **TL**'s Rules for Materials, or to recognized International standards, shall be used. If other materials are to be used, the relevant material specifications, with all the details necessary for an evaluation, are to be submitted to **TL** for approval.

4. All materials must be so marked that they can, unequivocally, be related to the relevant acceptance test certificates. If this condition is not met, the material may be rejected, unless, with **TL**'s agreement, subsequent tests are able to provide firm proof of the properties of the material.

5. For use at ambient temperatures lower than -10°C, use is to be made of steels possessing sufficient toughness at these temperatures (to be proved by a notched-bar impact test at a prescribed temperature).

B. Selection of materials

1. Selection criteria

1.1 When selecting materials for the various components of lifting appliances or loose gear, the following criteria are to be applied:

- The effect of the components on the mechanical strength of the assembly,
- The type and magnitude of the load (static or dynamic loading, internal stresses in the component, stress concentrations, direction of the stress relative to the fibre structure of the material),
- The design temperature,
- Chemical composition and weldability,
- The mechanical properties of the material (dimensioning of components),
- The toughness of the material (resistance to brittle fracture at design temperature, as verified by the notched-bar impact test),
- The properties of the material perpendicular to the surface of the product (resistance to stepwise cracking),
- It may be appropriate to apply further criteria to the selection of materials.

1.2 Other materials, such as stainless steels, aluminium alloys, timber or plastics, are to be chosen and used in accordance with the selection criteria, as and when these are applicable. For instance, their mechanical properties, corrosion- resistance, etc. shall conform to the requirements laid down in **TL**'s Rules for Materials. Where necessary, special proof shall be furnished of their suitability for a given application.

2. Categorization of components

2.1 In consideration of their relevance to the overall safety of the structure, components are to be allocated to the following 3 categories:

2.1.1 Category 1 components

This category comprises components which are critical to the overall safety of the structure and its safe operation, and which, besides the design loads, may be subjected to additional stresses, e.g. multi-axial loads.

Such components include: crane booms, crane housings, crane columns, foundations, slewing rings, hydraulic cylinders for hoisting and luffing mechanisms, foot and pivot bearings, bolts for slewing rings, load-bearing parts of loose gear, etc.

2.1.2 Category 2 components

This category comprises components important to operational reliability and functional efficiency.

Such components include: hydraulic cylinders for slewing mechanisms, fittings, wind bracings, bolts, rope sheaves, eyeplates, etc.

2.1.3 Category 3 components

This category comprises components subjected to low loads or of secondary importance, which are not assignable to categories 1 or 2.

Such components include: cabins, stairways, platforms, stiffenings, consoles, etc.

2.2 The categorization of components according to the above mentioned criteria must take place at the design stage, and is to be submitted with the documents for approval.

2.3 For components not specifically mentioned in 2.1, separate categorization shall be undertaken in accordance with the loading conditions.

3. Strength categories

3.1 Steels for welded components are to be sub-divided into the following categories on the basis of their minimum yield strength, see also Table 11.5:

- Normal tensile steels with minimum yield strengths of up to 285 N/mm^2

- Higher tensile steels with minimum yield strengths over 285 N/mm^2 up to 390 N/mm^2

- High tensile steels with minimum yield strengths over 390 N/mm^2.

3.2 The strength category selected for the component concerned, or the steel grade conforming to this category, is to be indicated in the documents for approval. The same applies where the material is required to meet special conditions. When selecting materials, it should be borne in mind that a decline in the mechanical characteristics is to be expected as the product thickness increases.

3.3 Where a component is subject to multi-axial stresses, e.g. in the case of large material thicknesses and bulky connecting welds, steels with enhanced characteristics in the thickness direction are to be selected, see also C.6.

3.4 The use of high tensile steels for welded structures is permitted only if this has been agreed with **TL**, and the user is able to prove thorough competence in welding these steels.

3.5 High tensile, weldable steels for components of categories 1 and 2 must have been qualification-tested and approved by **TL**. With the agreement of **TL**, a special qualification test may be dispensed with in the case of steels to recognized standards which have given sufficient practical proof of their suitability.

4. Documentation of properties

4.1 The manufacturer must present certificates in proof of the mechanical properties of materials (see Table 11.1).

4.2 If the documentation of materials is insufficient or incomplete, or if identification of the materials or relating these to their respective certificates is open to doubt, repeat tests are to be carried out in accordance with **TL**'s Rules for Materials in the presence of a **TL** Surveyor.

4.3 In exceptional and justified cases, **TL** may, for certain components, agree to the use of materials tested in another way.

Table 11.1 Required documentation of materials

Component	Type of documentation (EN 10204)	Remarks
Category 1	Acceptance test certificate 3.2 issued by TL **(1)**	Acceptance test certificate 3.1 is also acceptable for hydraulic cylinders and pistons, if the manufacturer has been approved by TL. For slewing rings, see D.3.
Category 2	Acceptance test certificate 3.1	With the agreement of **TL**, test report 2.2 is also accepted for loose parts.
Category 3	Test report 2.2	—
(1) *Evidence of chemical composition, type of heat treatment, and - where required - the results of ultrasonic testing is to be provided in a 3.1 acceptance test certificate.*		

C. Requirements for steels for welded components

1. Manufacturing process

All steels are to be produced in electric or open- hearth furnaces by the oxygen blowing-process, or by another process approved by **TL**, and - unless otherwise specified for standard tensile steels - are to be cast in the killed condition.

High tensile steels must undergo grain refinement. This also applies to higher tensile steels, unless the standards, or **TL**'s Rules for Materials, allow unkilled steels for certain steel grades.

2. Chemical composition

The chemical composition of carbon and carbon-manganese steels must lie within the limits shown in Table 11.2. High tensile and alloy steels are subject to the provisions laid down in the material specifications approved by **TL**. In the case of the steels indicated in Table 11.5, the requirements are deemed to be satisfied.

In addition, the carbon equivalent, defined by the expression:

$$C_{eşd} = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}, \quad [\%]$$

shall not exceed a value of 0,45. For high tensile steels the value is to be agreed with **TL**.

3. Supply condition and heat treatment

High tensile steels are to be supplied in every case heat-treated or conditioned by a process approved by **TL** (e.g. thermo-mechanically processed). Normal and higher tensile steels are subject to the provisions laid down in the standards, or in **TL**'s Rules for Materials.

4. Mechanical properties

The requirements relating to tensile strength, yield strength or 0,2 % proof stress, and elongation at fracture laid down in the standards, **TL**'s Rules for Materials or the approved material specifications, as the case may be, are to be verified by tests. The mechanical properties of a number of weldable steels are indicated in Table 11.5.

5. Impact energy

Impact energy requirements are governed by the category of the component, the thickness of the material, the nominal yield strength of the material and the design temperature, and are to be determined in accordance with Tables 11.3 and 11.4. Materials are to be selected in such a way that these requirements can be met. Compliance with the requirements is to be verified by notched bar impact tests, as prescribed.

Table 11.2 Percentage limits for the chemical composition of weldable C and CMn steels (ladle analysis)

C	Si	Mn	P	S	Cr	Mo	Cu	Ni	Al	Others
0,22	0,55	1,60	0,04	0,04	0,30	0,08	0,30	0,40	0,08	**(1)**

(1) *Nb max. 0,05%, V max. 0,10%, Ti max. 0,02%, (Nb+V) max. 0,12%, (Nb+V+Ti) max. 0,12%*

Table 11.3 Impact energy requirements (1)

Nominal yield stress **(2)** [N/mm^2]		235	285	315	355	390 **(3)**
Minimum impact energy (Joules) (ISO V- notch test specimens)	longitudinal	27	29	31	34	41
	transverse	20	21	22	24	27

(1) *Mean value for 3 specimens. There may be one value below, but equal to not less than 70% of the mean value*

(2) *Intermediate values may be interpolated.*

(3) *Steels with nominal yield strengths above 390 N/mm^2 are to conform to the requirements laid down in approved specifications. However, proof is required of a value of at least 41 joules for longitudinal specimens, and of at least 27 joules for transverse specimens*

Table 11.4 Test temperatures for the notched bar impact test

Product thickness [mm]	Test temperatures T_p [°C] for steels for components belonging to categories **(1)**		
	Category 1	Category 2	Category 3
≤ 12,5	— **(2)**	— **(2)**	No special requirements **(2)**
> 12,5 ≤ 25	$T_p = T_E + 10$	— **(2)**	
> 25 ≤ 50	$T_p = T_E - 10$	$T_p = T_E + 10$	
> 50	$T_p = T_E - 30$ **(3)**	$T_p = T_E - 10$	

(1) *T_E = design temperature, If no lower temperatures are specified, a value of - 10°C is to be substituted for T_E.*

(2) *The requirements stated in the relevant standard or in **TL**'s Rules for Materials apply.*

(3) *Generally, test temperatures below - 60°C are not required.*

6. Characteristics in the thickness direction (Z steels)

Where plates and wide flats are required to have enhanced properties in the thickness direction, the following minimum values apply to the reduction of area (Z) measured as the mean value for 3 tensile test specimens whose longitudinal axis is perpendicular to the product surface.

$$Z_{min} = 25\%$$

One individual value may be less than 25%, though not lower than 20 %.

Where components are exposed to severe loads, a minimum value of 35 % (smallest individual value 25 %) may be prescribed, see also Stahl-Eisen-Lieferbedingungen SEL 096.

7. Absence of defects

With regard to any internal defects, plates and wide flats with enhanced properties in the thickness direction must at least meet the requirements of Test Class 2, laid down in the Stahl-Eisen-Liefer- bedingungen SEL 072, or requirements equivalent to these.

8. Proof of mechanical properties

The provisions stated in B.4 apply.

9. Weldable steels

Table 11.5 contains a selection of suitable steels for the fabrication of welded components. The actual choice shall be governed by the required yield strength and impact energy.

D. Forgings

1. General

These Rules apply to forgings, and to rolled or forged slewing rings. The rings must conform to a specification approved by **TL**. For the component tests on slewing rings, see Section 13, B.3.3.3.

2. Selection of materials

The criteria and provisions set out in B are applicable. Slewing rings are accordingly category 1 components.

3. Requirements

3.1 Chemical composition

This is subject to the requirements stated in the relevant standards, **TL**'s Rules for Materials, or, in the case of special steels and rings, those in the approved specifications, proof of which has to be supplied by the producer of the material.

Where forgings are to be used in welded structures, preference is to be given to carbon and carbon-manganese steels whose chemical composition meets the requirements stated in C.2.

In compliance with these conditions, the following grades of steel may, for instance, be used:

St 37-2, St 37-3, St 52-3 to DIN EN 10 025,
Ck 22 to DIN 17 200 or SEW 550.

3.2 Heat treatment

All forgings must be properly heat-treated. Such treatments comprise:

- Normalizing
- Normalizing and annealing
- Quenching and tempering

3.3 Mechanical properties

The requirements relating to tensile strength, yield strength or 0,2 % proof stress, and elongation at fracture laid down in the standards, **TL**'s Rules for Materials or the approved material specifications, as the case may be, are to be verified by tests.

Table 11.5 Selection of weldable steels

Strength category	Standard, Specification	Steel grade	Tensile strength [N/mm²]	Yield strength for thicknesses t [mm] t ≤ 16 [N/mm²] min.	Yield strength for thicknesses t [mm] 16 < t ≤ 40 [N/mm²] min.	Kopmadaki uzama (enine) A_5 [%] min.
Normal tensile		TL-A TL-B TL-D TL-E	400-490	235	235 **(1)**	22
	DIN EN 10 025	St 37-2 St 37-3	340-470	235	225	24
		St 44-2 St 44-3	410-540	275	265	20
	DIN 17 102	St E 255 T St E 255 E St E 255	360-480	255	255 **(3)**	25
		St E 285 T St E 285 E St E 285	390-510	285	275 **(3)**	24
Higher tensile steels	TL Rules for Materials	TL-A 32 TL-D 32 TL-E 32	440-590	315	315 **(2)**	22
		TL-A 36 TL-D 36 TL-E 36	490-630	355	355 **(2)**	21
		TL-A 40 TL-D 40 TL-E 40	510-650	390	390 **(2)**	20
	DIN EN 10 025	St 52-3	490-630	355	345	20
		St E 355 T St E 355 E St E 355	490-630	355	355 **(3)**	22
	DIN 17102	St E 380 T St E 380 E St E 380	500-650	380	375 **(3)**	20
Higher tensile steels Heat treated	**TL** Rules for Materials	TL-D 420 TL-E 420 TL-F 420	530-680	420	420 **(4)**	18
		TL-D 460 TL-E 460 TL-F 460	570-720	460	460 **(4)**	17
		TL-D 500 TL-E 500 TL-F 500	610-770	500	500 **(4)**	16
		TL-D 550 TL-E 550 TL-F 550	670-830	550	550 **(4)**	16
		TL-D 620 TL-E 620 TL-F 620	720-890	620	620 **(4)**	15
		TL-D 690 TL-E 690 TL-F 690	770-940	690	690 **(4)**	14

(1) *Further requirements are to be taken from the standards or Rules mentioned in column 2.*

(2) *Applicable up to a thickness of 50 mm.*

(3) *Applicable up to a thickness of 35 mm.*

(4) *Applicable up to a thickness of 70 mm.*

3.4 Impact energy

For design temperatures down to and including -10 C, the requirements applicable are those stated in the standards, TL's Rules for Materials or the approved specifications which are verifiable at room temperature.

Unless otherwise specified, the impact energy requirements for design temperatures below - 10 °C are shown in Table 11.6.

3.5 Proof of mechanical properties

The provisions of B. 4 apply, subject to the following:

Deviating from the indications in Table 11.1, the mechanical properties of the slewing rings of ship's cranes of types A and B may be attested by an acceptance test certificate 3.1 to EN 10204 issued by the forge or rolling mill producing the rings, provided that the test procedure has been approved by **TL**

Table 11.6 Impact energy requirements for forgings (except rings)

Component	Mean impact energy value **(1)** [J] min. ISO V- notch specimen		Test temperature T_p [°C]
	Longitudinal	Transverse	
Category 1	41	27	T_E - 10 **(2)**
Category 2	41	27	T_E - 10 **(2)**
Category 3	No special requirements		

(1) *One individual value may be below, but equal to not less than 70 % of, the mean value*
(2) *T_E = design temperature.*

E. Steel Castings

1. General

These Rules apply to steel castings for use in loose gear and welded structures.

2. Selection of materials

The criteria and provisions set out in B. are applicable

3. Requirements

3.1 Chemical composition

This shall meet the requirements stated in the standards, **TL**'s Rules for Materials, or, in the case of alloy steel castings, in the approved specifications, and proof of this shall be supplied by the steelmaker.

Where castings are to be used in welded structures, preference is to be given to carbon and carbon-manganese steels whose chemical composition meets the requirements stated in C.2.

Subject to these conditions, the following grades of steel castings may be used:

GS-38, GS-45 (and GS-52) **(1)** to DIN 1681

GS-16 Mn 5, GS-20 Mn N and GS-20 Mn 5 V to DIN 17 182

GS-C 25 to DIN 17 245

3.2 Heat treatment

All castings must be properly heat-treated. Such treatments comprise:

- Normalizing
- QNormalizing and annealing
- Quenching and tempering

(1) *Note: The weldability of GS-52 is subject to qualification.*

3.3 Mechanical properties

The requirements relating to tensile strength, yield strength or 0,2 % proof stress, and elongation at fracture laid down in the standards, **TL**'s Rules for Materials or the approved material specifications, as the case may be, are to be verified by tests.

3.4 Impact energy

For design temperatures down to and including - 10 °C, the requirements applicable are those stated in the standards, TL's Rules for Materials or the approved specifications which are verifiable at room temperature.

Unless otherwise specified, the impact energy requirements for design temperatures below - 10 C are shown in Table 11.7.

Table 11.7 Impact energy requirements for steel castings

Component	Mean impact energy value **(1)** [J] min. ISO V- notch specimens	Test temperature T_p [°C]
	Boyuna	
Category 1	27	T_E - 10 **(2)**
Category 2	27	T_E + 10 **(2)**
Category 3	no requirements	

(1) *One individual value may be less than the mean value, but not less than 19 joules.*
(2) *T_E = design temperature.*

3.5 Proof of mechanical properties

The regulations of B.4 apply.

F. Bolts and nuts

1. General

The following regulations apply to bolts and nuts, and to the non-alloyed and alloy steel rods used in their manufacture. The regulations apply to all bolts and nuts with nominal tensile strengths of > 600 N/mm^2 for which a quality certificate is required.

2. Manufacture

Bolts and nuts can be produced by hot or cold forming, or by machining. Cold-formed bolts are to undergo subsequent heat treatment. The same also applies to hot-formed bolts and nuts, with the exception of those made of non-alloyed steels, if they are to be used at normal ambient temperatures, and a uniform structure is brought about by the hot forming process.

3. Requirements

Bolts and nuts must meet the requirements of the relevant standards **(2)**, and, where this is called for by the application or steel grade in question, the conditions set out below

3.1 Chemical composition

The carbon content of the steels, as established by product analysis, shall not exceed 0,55 %. Free cutting steels with an increased S, P or Pb content dictated by production-engineering requirements shall not be used for bolts and nuts with low-temperature impact energy specifications.

3.2 Elongation at fracture

The elongation at fracture A_5 must conform to the values for the strength class or steel grade, and shall in any case not be less than 8 % for ferritic steels, or 30 % for austenitic steels.

(2) *Recognized standards include, for example, DIN ISO 898, DIN 267 and DIN 17240*

3.3 Impact energy

The impact energy in joules, determined with ISO V or U-notch longitudinal specimens must conform to the values for the steel grade, and shall, as a minimum requirement, attain the values stated in Table 11.8.

3.4 Expansion (of nuts)

The expansion of nuts of ferritic steels must be at least 4 % with chipless forming processes, and at least 5 % with machining methods. The expansion requirements for nuts of austenitic steels are to be specially specified.

Table 11.8 Impact energy requirements for bolts and nuts

Service or design temperature	Steel grade or nominal tensile strength	Impact energy		Test temperature
		V-notch [J] min.	U-notch [J] min.	
Ambient temperature -10°C up to +50°C	ferritic < 800 N/mm^2 ≥ 800 N/mm^2 ≥ 1000 N/mm^2 ≥ 1200 N/mm^2 austenic	 32 32 25 18 41	 30 30 25 20 (35)	+ 20°C
Over +50°C (heat resisting)	Alloyed and tempered Unalloyed	52 41	— —	+ 20°C
0°C up to-55°C (low temperature steel)	all steels	41	—	10 K below lowest desing temperature, but not higher than -20°C

SECTION 12

WELDING

A. General

1. This section contains generally applicable regulations for welding steel component parts, to the extent necessary for the Lifting Appliance Regulations. More comprehensive regulations and special details are to be taken from the **TL** Rules for Welding - Chapter 3.

2. Welded connections shall at the design stage be planned so as to be readily accessible during manufacture and capable **o**f being welded in the required quality in as favourable a position and sequence as possible.

3. Welded connections and the welding sequence shall be designed to minimise residual stresses and avoid excessive deformation. Welded connections shall not be overdimensioned.

4. All welded connections are to be configured to achieve as undisturbed a flow of forces as possible without major internal or external notches or rapid changes of rigidity, and without impeding expansion. The same applies analogously to the welding-on of subordinate components to main structural elements whose exposed plate- or flange edges should as far as possible be kept free from notch effects due to welded joints (see also D.1.1).

5. In designing the configuration of welded connections, care shall be taken to ensure that the proposed type and quality of weld, e.g. a fully fused root with single-bevel or double-bevel butt welds, can be satisfactorily executed under the existing manufacturing conditions. If not, welds simpler to perform as appropriate are to be used and their (possibly reduced) load bearing capacity be considered in the dimensioning (see also D.1.2).

6. Welded joints in girders and sections (especially site joints) should as far as possible not be located in areas subject to high bending stresses. Welded joints at cold formed bends of chords are to be avoided.

7. Welded connections which are highly stressed, and therefore generally subject to testing, shall be so designed as to facilitate the use of the most suitable fault-detection technique (radiographic, ultrasonic or surface-crack inspection) to make conclusive tests possible (see also D.1.3).

8. All the important details of the weld, e.g. the types of base material, configuration and dimensions of the welds, welding method, welding consumables, heat treatment, tests to be performed and special requirements laid down, must be indicated in the production documents (drawings, parts lists, etc.). In special cases **TL** may require submission of a welding schedule.

B. Qualification of workshops

1. Approval to weld

1.1 All works, including subcontracting firms, wishing to carry out welding operations on parts of lifting appliances and loose gear must have at their disposal the necessary equipment and qualified personnel, and be approved by **TL** for this work.

1.2 Approval is to be applied for from **TL** Head Office, with the appropriate documentation. Existing approval by other independent testing institutions may be taken into account if the relevant documents are submitted. Regarding this see the **TL** Rules for Welding Chapter 3.

1.3 The works must have at their disposal the necessary equipment according to up-to-date engineering practice for the manufacture and possibly testing of the welded connections, plus an adequate number of qualified welders holding valid test certificates and supervisory staff qualified for the welding tasks to be carried out.

1.4 The suitability of the welding method used in conjunction with the materials in question is to be proved to **TL** in an appropriate way. **TL** may to this end require **TL**-supervised method checks (test welds, non-destructive and mechanical-technological tests).

Welding consumables and auxiliary materials must be **TL**-approved.

1.5 For the (non-destructive) testing of the welded connections suitable test procedures and appropriately qualified test equipment shall be used. **TL** may demand a check, under its supervision, of ultrasonic test equipment. The scope of tests is to be indicated in the test documentation (see Section 1, E.2). The test reports are to be submitted to **TL**.

1.6 Careful works inspection shall be carried out to ensure professional, flawless and complete execution of the welds (see also F.7).

2. Supervision, welders

2.1 All works carrying out welding must employ its own welding supervisor; this supervisor must be suitably positioned and authorized in the welding shop. The welding supervisor shall be responsible for supervising the preparation and execution of the welds, and if applicable their testing.

2.2 According to the nature and scope of the welding work performed, the supervisory function may be exercised by a welding engineer (welding engineering specialist or comparably-trained engineer), a welding expert, or some other person with adequate specialist qualifications. The names of welding supervisors shall be made known to **TL** and proof of their technical qualifications furnished. Changes in the personnel responsible for supervising welding shall automatically be reported to **TL**.

2.3 Any welding work on parts of lifting appliances and loose gear may only be performed by welders qualified in the particular welding method concerned, holding valid test certificates. The provisions in the **TL** welding rules concerning repeat tests shall be complied with.

2.4 The execution of the welds must conform to current engineering practice and the generally accepted rules of welding technics (e.g. the **TL** welding rules or DIN 8563. "Quality assurance of welding operations").

The responsibility for this rests with the works welding supervisor. To allow the prescribed examinations to be carried out as required, the **TL** Surveyor shall at all times be allowed access to fabrication facilities as well as provision of required personnel- and material support. Regarding the inspection of parts no longer accessible later on (e.g. cavities, box girders, etc.), interim examinations shall be agreed with **TL**.

3. Welding methods, procedure tests

3.1 Only those welding methods may be employed of which suitability for the application in question has either been established by general practice or proved by a procedure test.

3.2 Procedure tests for the purpose of proving the satisfactory application of the procedure in the welding shop and adequate quality of the results obtained shall be performed under production conditions on the premises of the company using the method in all cases where materials other than ordinary-strength shipbuilding steels A to D or comparable structural steels, forging steels and types of casting steels are to be welded, or welding methods other than manual arc welding (E) or partly-mechanised inert gas shielded welding (MAG) are to be employed. Procedure tests shall also be performed where these processes are applied in a special manner, e.g. in single-side welding using a (ceramic) weld backing strip. For details regarding this see the **TL** welding rules.

3.3 The scope of the test, the samples, the test specimens and the requirements shall be determined from case to case depending on the proposed application in general accordance with the **TL** welding rules. In this connection account may be taken of procedure tests carried out elsewhere (on submission of the reports).

3.4 Welders engaged in procedure tests, are on successful completion of the tests, deemed qualified for the procedure employed or the materials concerned. If, in the event of subsequent extended use of the procedure, additional welders or operating teams are to be employed, these shall be appropriately trained and also tested.

4. Welding consumables, auxiliary materials

4.1 All welding consumables and auxiliary materials (e.g. rod electrodes, wire-gas combinations, etc.) must be approved by **TL**. The quality grade required depends on the base materials to be welded.

4.2 For highly stressed components and parts stressed at low temperatures, for higher-strength steels, steel castings and forgings and for low-temperature welding work, basic welding consumables materials are to be preferred, and wherever possible those giving a controlled, low hydrogen content in the weld metal (code letters H or HH).

4.3 Welding consumables and auxiliary materials for special materials may also be tested and approved together with the welding method. Such approvals are however restricted to the user works and remain valid for at most one year unless repeat tests are performed. Welding consumables and auxiliary materials jointly tested in this way may be replaced by other equivalent materials approved for the application in question by **TL**.

C. Weld geometry

1. Butt joints

1.1 Depending on plate thickness, welding procedure and -position, butt welds shall take the form of square, single- or double-V welds in conformity with the relevant DIN standard (e.g. DIN 1912, DIN 8551, DIN 8552 or DIN 8553). Where other forms of weld are envisaged, these are to be depicted specially in the drawings. Weld geometries for special welding processes such as single-side and electroslag welding must have been tested and approved as part of a procedure test.

1.2 Butt welds shall as a matter of principle be ground out or gouged on the root side and given at least one capping pass. Exceptions to this rule, e.g. in the case of submerged-arc welding or the processes referred to in 1.1 are required to be tested and approved as part of a procedure test. The theoretical throat shall be the thickness of the plate or, where the plates are of differing thickness, the lesser thickness. Where proof of fatigue strength is required, the notch case depends on the configuration (quality) of the weld.

1.3 If the above conditions cannot be fulfilled, e.g. where welds are accessible from one side only, open square-edge joints with back-up bars or permanent machined or integrally cast backing, as in Fig. 12-1, shall be used.

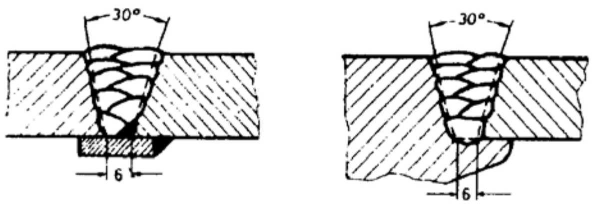


Fig. 12.1 Single-side welds on permanent weld pool support

The calculatory weld thickness may be taken as 90 % of the (lesser) plate thickness t, subject to a maximum (t-1) mm. Where proof of fatigue strength is required, these welds shall be placed in notch case K3 according to DIN 15018 or FEM Section 1.

2. Corner-, T- and double-T- (cross) welds

2.1 Full-penetration corner-, T- and double-T- (cross) welds shall take the form of single- or double-bevel joints with the minimum possible shoulder and an adequate gap, as shown in Fig. 12.2. The root should be grooved out and welded from the reverse side.

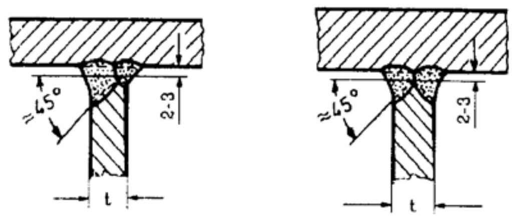


Fig. 12.2 Full-penetration single- and double-bevel joints

The theoretical weld thickness shall be the thickness of the abutting plate. Where proof of fatigue strength is required, the notch case depends on the configuration (quality) of the weld.

2.2 Corner-, T- and double-T- (cross) welds with a defined root defect f as shown in Fig. 12.3 shall take the form of single- or double-bevel welds as described in 2.1, with reverse-side welding but without grooving-out of the root.

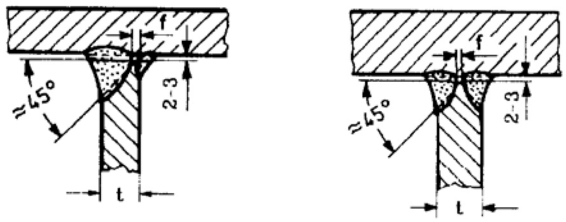


Fig. 12.3 Single- and double-bevel joints with defined root defect

The theoretical weld thickness may be taken as the thickness t of the abutting plate minus f, being equal to 0,2 t up to a maximum of 3 mm. Where proof of fatigue strength is required, these welds shall be placed in notch case K3 according to DIN 15018 of FEM Section 1.

2.3 Corner-, T- and double-T- (cross) welds with an unwelded shoulder c and a root defect f to be taken into consideration shall take the general form shown in Fig. 12.4.

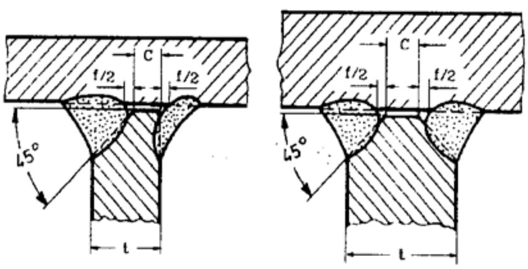


Fig. 12.4 Single- and double bevel joints with a shoulder

The theoretical weld thickness shall be the thickness t of the abutting plate minus (c + f), f being equal to 0,2 t up to a maximum of 3 mm. Where proof of fatigue strength is required, these welds shall be placed in notch case K4 according to DIN 15018 or FEM Section

2.4 Corner-, T- and double-T- (cross) welds accessible from one side only may as shown in Fig. 12.5 be made either as butt joints with a weld pool support analogously as described in 1.3 or as onesided single-bevel welds analogous to those in 2.2.

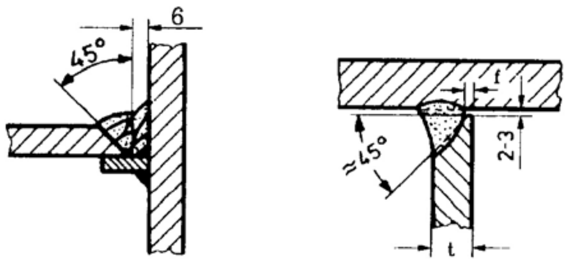


Fig. 12.5 T-welds accessible from one side only

The theoretical weld thickness shall similarly be determined in accordance with 1.3 or 2.2. Where proof of fatigue strength is required, use of these welds should be avoided if possible.

2.5 In the case of flush corner joints, i.e. where neither of the plates projects, joint configurations as shown in Fig. 12.6 should be used with bevelling of the plates shown as upright, to avoid the danger of lamellar rupture (stepwise cracking). In the case of flush T-joints (three-plate welds), an analogous procedure should be used if there is to be penetration by the plate shown upright.

2.6 Where in T-joints the main stress acts in the plane of the plates shown in the horizontal position in Fig. 12.7 (e.g. in plating) and the connection of the vertical (edge-on) plates is of secondary importance, then (except in the case of mainly dynamic stresses) three-plate welds as shown in Fig. 12.7 may be used.

Flush corner joints **Flush T-joints**

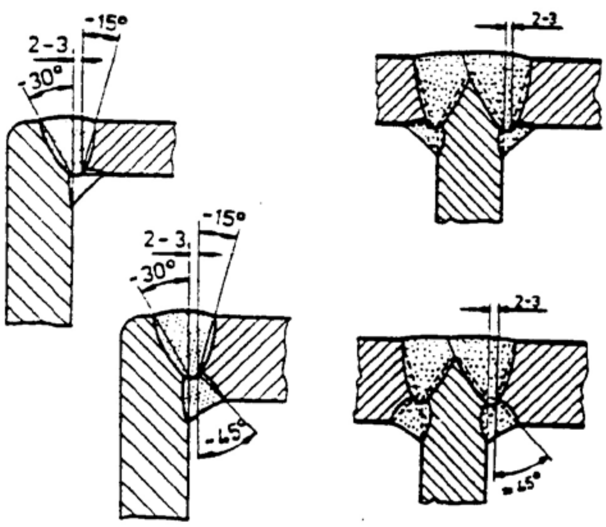


Fig. 12.6 Flush corner joints, Flush T-joints

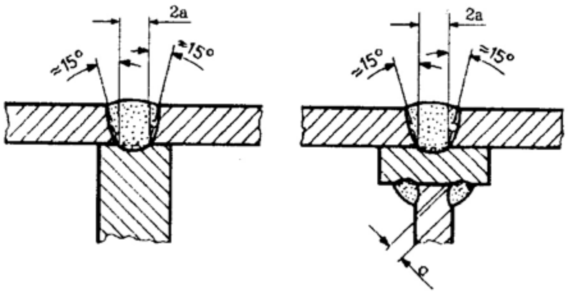


Fig. 12.7 Three-plate welds

The theoretical weld thickness of the joint uniting the horizontal plates shall be determined in accordance with 1.3. The requisite "a" dimension is determined by the joint connecting the vertical (edge- on) plate and shall where necessary be ascertained by calculation, as for fillet welds.

3. Fillet welds

3.1 Fillet welds shall as a matter of principle be made on both sides. Exceptions to this rule (e.g. in the case of closed box girders and in case of primary shear stress parallel to the weld) require approval in every instance. The thickness a (the height of the inscribed equilateral triangle) shall be determined by calculation.

3.2 The thickness of fillet welds should not exceed 0.7 times the lesser thickness of the parts to be welded (generally the web thickness). The minimum thickness is defined by:

$$a_{min} = \sqrt{\frac{t_1 + t_2}{3}}$$, [mm] , but not less than 3 mm.

t_1 = the lesser plate thickness (e.g. the web thickness) in [mm]

t_2 = the greater plate thickness (e.g. the chord thickness) in [mm]

3.3 The aim with fillet welds should be to have a flat, symmetrical cross-section with good transition to the base metal. Where proof of fatigue strength is required, it may be necessary to carry out machining (grinding-out the notch) depending on the notch case. The weld should extend at least to the immediate proximity of the theoretical root point.

3.4 Where mechanical welding processes are used which produce a deeper penetration going well beyond the theoretical root point and capable of being reliably and uniformly maintained under production conditions, it is permissible to take account of the deeper penetration when determining the fillet weld throat. The mathematical dimension.

$$a_{deep} = a + \frac{2 \min e}{3} \text{ , [mm]}$$

is to be determined by reference to the configuration shown in Fig. 12.8 and shall take into account the value of "min e" which is to be established for each welding procedure by a procedure test. The weld thickness shall in relation to the theoretical root point not be less than the minimum thickness for fillet welds specified in 3.2.

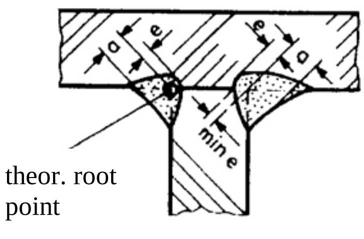


Fig. 12.8 Fillet welds with deeper penetration

3.5 Depending on the welding technique used, an increase of the "a" dimension of up to 1 mm may be stipulated when laying down welds over production coatings particularly liable to cause porosity. This particularly applies when using fillet welds of minimum thickness size. The extent of the increase shall be determined on a case to case basis according to the nature and magnitude of the stress based on the results of the production-coating tests according to the **TL** welding regulations. The same applies similarly to welding processes in which there is a likelihood of insufficient root penetration.

D. Design details

1. Configuration

1.1 All welded connections are to be configured to achieve as undisturbed a flow of forces as possible without major internal or external notches or rapid changes of rigidity, and without impeding expansion. The same applies analogously to the welding-on of subordinate components to main structural elements whose exposed plate- or flange edges should as far as possible be kept free from notch effects due to welded joints.

1.2 In designing the configuration of welded connections, care shall be taken to ensure that the proposed type and quality of weld, e.g. a fully fused root with single-bevel or double-bevel butt welds, can be satisfactorily executed under the existing manufacturing conditions. If not, welds simpler to perform as appropriate are to be used and their (possibly reduced) load bearing capacity be considered in the dimensioning.

1.3 Welded joints which are highly stressed, and therefore generally subject to testing, shall be so designed as to facilitate the use of the most suitable fault-detection technique (radiographic, ultrasonic or surface-crack inspection) to make conclusive tests possible.

2. Flow of forces, transition arrangements

2.1 All welded connections are to be configured to achieve as undisturbed a flow of forces as possible without major internal or external notches or rapid changes of rigidity, and without impeding expansion. The same applies analogously to the welding-on of subordinate components to main structural elements whose exposed plate- or flange edges should as far as possible be kept free from notch effects due to welded joints (see also D.1.1).

2.2 Structural members with differing dimensions are to be made to match gradually by means of gentle transitions. Where girders or sections have web plates of different heights, the chords or bulbs should be brought to the same height by tapering, or by slitting and splaying or reducing the height of the web plate. The transition length should be three times the difference in height.

2.3 Where the joint is between plates of differing thicknesses, thickness differences of more than 3 mm (see Fig. 12.9) must be equalized by bevelling the extending edge with a 1 : 3 slope or in accordance with the notch case. Thickness differences of less than 3 mm may be equalized within the weld.

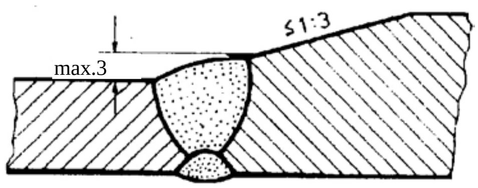


Fig. 12.9 Equalizing of different thicknesses

2.4 For connection to plates or other relatively thin-walled elements, steel castings and forgings shall, as shown in Fig. 12.10, be provided with matching tapered elements or cast resp. forged-on welding flanges.

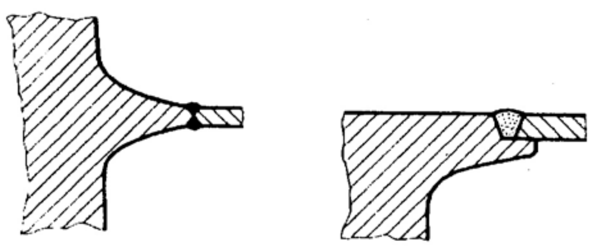


Fig. 12.10 Welding flange on steel castings or forgings

3. Close grouping of welds, minimum spacing

3.1 The local close grouping of welds and short distances between welds are to be avoided. Adjacent butt welds shall be separated by at least

50 mm + 4 x plate thickness

Fillet welds shall be separated from each other and from butt welds by at least

30 mm + 2 x plate thickness

The width of plate areas (strips) subject to replacement shall however be at least 300 mm or 10 x the plate thickness, whichever is the greater.

3.2 Reinforcing plates, welding flanges, hubs or similar components welded into plating shall have the following minimum dimensions:

$$D_{min} = 170 + 3\ (t - 10) \geq 170\ \text{mm}$$

D = diameter of round, or length of side of polygonal, weldments in [mm]

t = plating thickness in [mm].

The corner radii of polygonal weldments shall be at least 50 mm.

4. Through-welding holes

4.1 Through-welding holes for (subsequent) butt- or fillet welding following the fitting of transverse members shall as shown in Fig. 12.11 be rounded (minimum radius 25 mm or twice the plate thickness, whichever is the greater) and where the loading is mainly dynamic shall be provided with gentle runouts.

4.2 Where joints are fully welded prior to the fitting of transverse members, no through-welding holes are needed provided any weld reinforcement is machined away before fitting. **TL** may still deem necessary such reliefs at the plan approval stage according to the inspection requirements of the weld.

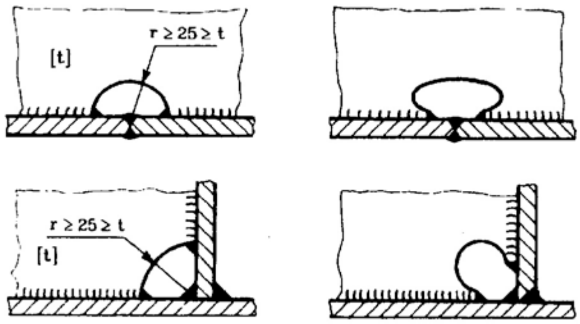


Fig. 12.11 Through-welding holes

5. Local reinforcements, doubling-plates

5.1 Where plating is subject to locally increased loading (e.g. girder- or pipe walls), thicker plates should wherever possible be used rather than doubling-plates. As a matter of principle, bearing bushes, hubs, etc. shall take the form of welded-in thicker plating; regarding this see also 3.2.

5.2 Where doubling plates cannot be avoided, they shall not be thicker than twice the plating thickness. Doubling plates wider than about 30 times their thickness shall be welded to the underlying plating by welding with cutouts, at intervals not exceeding 30 times the thickness of the doubling plate.

When welding with cutouts, these shall preferably take the form of elongated holes lying in the direction of the principal stress.

5.3 Doubling plates are to be welded along their (longitudinal) edges by continuous fillet welds with a thickness "a" equal to 0.3 times the thickness of the doubling plate. At the ends of doubling plates, as shown in Fig. 12.12, the thickness "a" along the terminal edges shall equal 0.5 times the thickness of the doubling plate though it shall not exceed the plating thickness. The weld transition angles between the terminal edge and the plating shall be 45° or less.

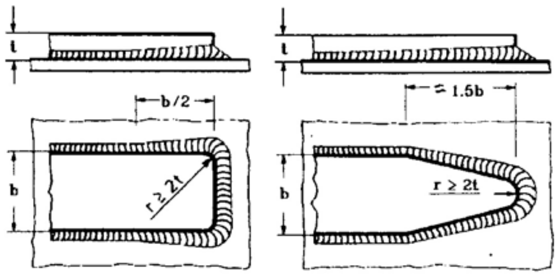


Fig. 12.12 Welds at the ends of doubling

Where proof of fatigue strength is required, the configuration of the end of the doubling plate must conform to the notch case selected.

6. Welding in cold-formed areas

6.1 Welding is permitted at and close to structural areas cold-formed from shipbuilding- and comparable structural steels provided that the minimum bending radii specified in Table 12.1 are adhered- to.

Table 12.1 Minimum Bending Radii

Plate thickness	Minimum bending radius (inside)
Up to 4 mm	1 x plate thickness
Up to 8 mm	1.5 x plate thickness
Up to 12 mm	2 x plate thickness
Up to 24 mm	3 x plate thickness
All thicknesses	10 x plate thickness

Edge bending operations may necessitate a larger bending radius.

6.2 For other steels, or other materials if applicable, the necessary minimum bending radius shall in case of doubt be determined by tests. In the case of steels with a minimum yield strength exceeding 355 N/mm^2 and plate thicknesses of 30 mm and over, where cold-forming with 3 % or more permanent elongation has been performed, proof of adequate toughness even after welding is required in the procedure test and by means of in-production tests. Regarding this see B.3 and F.9.

7. Reinforcement of bends (general)

7.1 Bent structural elements, e.g. the chords of girders, where the change of direction means that forces perpendicular to the bend are set up or have to be transmitted, shall be adequately supported at the line of bend. The conditions set out in 6.1 shall be complied with.

7.2 Where welded joints at lines of bend cannot be avoided, three-plate welds generally as in C.2.5 and, where the dynamic loading is low, as in *C2.6* may be used. However such connections require approval in every instance and are therefore to be depicted in detail on the drawings.

8. Nodes in tubular structures

8.1 Depending on tube wall thickness and angle of intersection, nodes linking relatively small tubes, e.g. in tubular-frame crane jibs, may take the form either of fillet welds or of single-bevel welds as in C.2.4. The weld configuration chosen and the effective weld thickness dimension shall be taken into account in the dimensioning (especially in the proof of fatigue strength) and shown in detail on the drawings. Where proof of fatigue strength is demanded, the quality of surface finish required shall also be specified on the drawings.

8.2 The nodes of relatively large tubes where the wall thickness of the branches exceeds about 8 mm shall take the form of full-penetration single bevel welds as shown in Fig. 12.13. Where the stress is lower, single-bevel welds with a backing strip as in C.2.4 may also be used.

E. Calculation

1. General

Regarding design calculations for welded connections, reference is made to the **TL** Rules for Welding - Chapter 3, or to DIN 15018 or FEM, Section 1.

The use of other bases for calculations requires TL agreement.

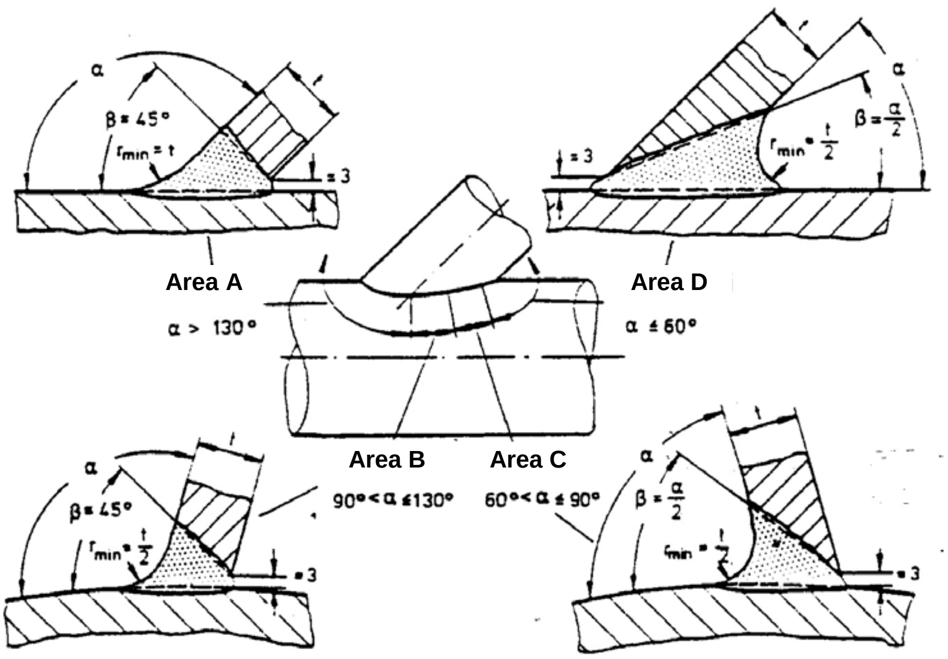


Fig. 12.13 Connections welded one-sidedly (tube connections not accessible from inside)

2. General stress analysis

Where in the case of mainly static stresses the thickness of butt welds does not equal the plate thickness or the weld thickness of fillet welds cannot be determined from standards, regulations or guidelines, proof by calculation of the adequacy of dimensioning (a general stress analysis) shall be furnished.

3. Proof of fatigue strength

For welded joints subjected mainly to dynamic stress, the permissible stress shall be determined on the basis of the range of stress cycles, the stress collective, the ratio of minimum to maximum stress and the notch condition. The notch condition is defined by the geometric configuration of the weld. Furthermore, to a certain degree, proof of the absence of any significant internal notches (welding defects) is linked to this.

F. Manufacturing and testing

The preparation and execution of welds, their inspection and any tests applied must conform to current engineering practice and the relevant rules of welding technology (**TL** welding rules, DIN 8563 etc.). The responsibility for this rests on the works welding supervisor and inspection department.

1. Weld preparation and assembly

1.1 When preparing and assembling structural members, care is to be taken to ensure compliance with the prescribed joint geometry and root face (air) gaps. Where the permissible root face gap is slightly exceeded, it may be reduced by build-up welding at the weld edges. Inserts or wires are not allowed to be welded into the gap.

1.2 Plates and profiles must be aligned accurately, especially where joints are interrupted by transverse members. The magnitude of the permissible misalignment of plate edges depends on the particular structural member, the plate thickness and the stress.

1.3 In the welding zone, structural members must be clean and dry. Scale, rust, slag, grease, paint (except for acceptable production coatings) and dirt shall be removed carefully prior to welding.

1.4 If plates, profiles or structural members are given a corrosion-inhibiting coating (of shop primer) before welding, this must not impair the quality of the welds.

2. Protection against the weather, preheating

The working area is to be protected against the effects of the weather during welding. In sub-zero temperatures (below 0°C), suitable measures (covering, heating the members) are to be taken to ensure that the welding work can proceed satisfactorily. If the temperature drops below -10 C, no further welding may be performed. Rapid cooling - especially of thick-walled components or readily hardenable steels - is to be avoided.

3. Welding position and sequence

3.1 Welding work should be performed in the most favourable welding position. Vertical downward welding is to be avoided if at all possible; it may not be used for uniting load-bearing members even if a (vertical downward) welding procedure test has been carried out and the welding consumables have been approved.

3.2 Undesirable effects of weld shrinkage is to be minimised by the choice of a suitable welding sequence.

4. Workmanship

4.1 Care shall be taken to achieve uniform penetration, thorough melt joints and a regular weld surface without excessive reinforcement. For the requirements to be met by welds see 8.2 (Table 12.2).

4.2 In multi-pass welding the slag from preceding passes is to be removed carefully. Cracks (including cracked tacks), large pores or visible slag inclusions etc. may not be welded over but shall be removed by machining.

5. Repair of defects

Repair of major defects of workmanship may only be undertaken after agreement with **TL**. This applies similarly to the repair by welding of worn, broken or otherwise damaged parts. Prior to repair work on important, load-bearing structural members, a sketch of the repair is to be submitted with the proposed procedure to **TL** for approval.

6. Heat treatment

6.1 The nature and scope of any heat treatment which may have to be applied to welded structural members depends on their residual stress situation (weld geometry and thickness, rigidity of member) and the character of the material concerned, i.e. on its behaviour or any change in characteristics to be expected when subjected to heat treatment. Generally, it is a matter of stress-relieving or annealing treatment. The steelmaker's directions and recommendations are to be followed.

6.2 Depending on the type of material concerned, flash butt welds are to be subjected to normalising or quenching and tempering treatment.

6.3 The way in which the mechanical properties of the weld are affected by subsequent heat treatment is one of the factors to be investigated in the weld-procedure test (see B.3). In addition to this, **TL** may call for in-production tests, see also 9.

6.4 Any non-destructive tests required shall be carried out after heat treatment.

7. Quality control by the manufacturer

7.1 Manufacturers have to ensure, by means of effective internal quality control, that manufacture and assembly are carried out in accordance with these lifting appliance regulations, the examined and approved documentation (drawings, specifications, etc.) or the requirements listed in the approval documents.

7.2 Compliance which these lifting appliance regulations, and observance of the conditions imposed during examination of the documentation, or of the stipulations in the approval documents, is the responsibility of the manufacturer. Tests or examinations carried out by **TL** do not relieve manufacturers of this responsibility.

7.3 It is furthermore the manufacturer's responsibility to ensure that the conditions of manufacture and the quality are identical to what they were on the occasion of the approval tests. **TL** does not guarantee that products examined in an approval test or at random during manufacture comply with these rules in all respects or throughout the entire manufacturing process.

7.4 **TL** may despite preceding satisfactory tests and examinations exclude products, processes, etc. proving inadequate in service from further use or require them to be improved and appropriate proofs to be furnished.

8. Non-destructive tests

8.1 The nature and scope of non-destructive tests depends on the importance and loading of the member concerned (its component class) and on the possible weld defects or effects on the base metal which may arise from the welding technique, position etc.

8**.2** By way of example, in Table 12-2 the tests required for the important parts of lifting appliances and loose gear have been compiled. Additionally, as a guide, requirements imposed on welded connections in the form of assessment categories according to DIN 8563 P.3 have been added. Where proof of fatigue strength is required, the test requirements in the notch condition table apply; regarding this see E.3. The manufacturing documents (drawings, welding diagram, test schedule) shall, for each structural member, contain comprehensive information concerning the nature and scope of the tests required.

8.3 Non-destructive tests shall be carried out by suitably qualified personnel.

8.4 The tests shall be carried out in accordance with accepted practice. The results shall be presented to the **TL** Surveyor not later than the acceptance testing of the components.

9. In-production tests

9.1 If the manufacturing process or any possibly necessary subsequent (heat) treatment leads to the expectation of a substantial change in, or indeed deterioration of, the properties of the material or the welded connection, **TL** may stipulate in-production tests to prove that the mechanical qualities remain adequate.

9.2 In-production tests during the course of manufacture shall as a matter of principle be performed when welding is carried out on cold-formed portions of masts, posts, etc. made from materials with a minimum yield strength of more than 355N/mm^2, with a wall thickness of 30 mm or more and with degrees of deformation of 3 % permanent elongation ε and over.

Elongation in the external tensile zone :

$$\varepsilon = \frac{100}{1 + 2.r/t} [\%]$$

r = Internal bending radius

t = Plate thickness

Table 12.2 Test specifications

<table>
<tr><th colspan="3">TEST SPECIFICATIONS FOR WELDED CONNECTIONS</th></tr>
<tr><th>Component *)</th><th>Category 1</th><th>Category 2</th></tr>
<tr><td>Notes</td><td>See Section 11, B.2.1.1</td><td>See Section 11, B.2.1.2</td></tr>
<tr><td rowspan="3">Nature and scope of tests to be applied</td><td>Butt welds perpendicular to direction of main stress including weld intersections:

radiographic and/or ultra-sonic inspection of 10 % of weld length; in special cases of 100 % of weld length. Where necessary, magnetic particle testing.</td><td>Butt welds perpendicular to direction of main stress including weld intersections

radiographic and/or ultra-sonic inspection randomly. Where necessary, magnetic particle testing.</td></tr>
<tr><td>Butt welds parallel to direction of main stress

radiographic and/or ultra-sonic inspection randomly. In special cases as above. Where necessary, magnetic particle testing.</td><td rowspan="2">Other welded connections and components, as above in cases of doubt

Recommended :

magnetic particle testing of single- or double bevel seams on thick-walled components.</td></tr>
<tr><td>Single- or double bevel seams - especially in thickish plates - perpendicular and parallel to the direction of the main stress:
ultra-sonic and magnetic particle testing of at least 10 %; in the case of thicker plates and rigid structural members as a rule of 100 % of the weld length</td></tr>
<tr><td>Requirements</td><td>.Assessment category BS/AK to DIN 8563 P.3</td><td>Assessment category
CS/CK (DS/CK) to DIN 8563 P.3</td></tr>
</table>

Remarks : *-With **TL** consent, dye penetrant testing may be used instead of magnetic particle testing.*

- *Departures from the recommended assessment categories - even in respect of individual criteria - may be agreed.*
- *As regards ultra-sonic tests, the assessment criterion will be specified by **TL** as part of the process of approving and authorising testing positions and inspectors.*
- *The **TL** Surveyor retains the right to determine or alter the position of random tests and to increase the scope of tests, particularly if there is an accumulation of defects*

**) For category 3 components (see Section 11, B.2.1.3) no tests are prescribed.*

SECTION 13

TESTING AND EXAMINATION OF LIFTING APPLIANCES

A. General

1. This Section contains regulations for the testing, examination and certification of lifting appliances.

2. Deviating/supplementary regulations apply to the following lifting appliances/means of transport:

- Lift units (Section 5,F)
- Rope and chain hoists (Section 6, E)
- Industrial cargo-handling vehicles (Section 6, F)
- Means for conveyance of persons (Section 6, G)
- Loose gear (Section 7,B).

3. Independent regulations apply to the testing, examination and certification of the following components:

- Interchangeable components (Section 7, C)
- Wire and fibre ropes (Section 8, E)

4. Definitions

Supplementing the definitions in Section 1, F, the following definitions are set out below:

4.1 Tests

4.1.1 Function test

The designation ’function test’ is applied to testing of all possible movements or functions and the control, limiting and safety equipment.

This test should generally be carried out with available weights.

For testing and if applicable for adjusting load - monitoring equipment, calibrated weights must be made available.

4.1.2 Load test

The designation ’load test’ is given to the test with the prescribed test load PL_{dyn}.

The purpose of the load test is to prove adequate strength, safety against hidden defects and - if applicable - adequate safety against overturning.

4.2 Examination

4.2.1 Thorough examination

A thorough examination means a detailed visual examination, supplemented if necessary by other suitable means or measures in order to arrive at a reliable conclusion as to safety.

If necessary, parts of the interchangeable components, the loose gear or the lifting appliances are to be dismantled.

4.2.2 Inspection

The term "inspection" means a visual inspection whereby - as far as is possible by this means - it shall be determined whether continued use can be permitted in safety.

(Inspection by the management of the ship, see G.3.2.3.)

5. The scope of application of the regulations that follow depends on the scope of the components covered by **TL** approval (regarding this see Section 1, D.2 and E.2-4.).

B. Supervision of Construction and Final Test and Examination at the Manufacturers

1. Prerequisites

1.1 Commencement of construction of a lifting appliance is to be advised to the respective **TL** Inspection Office in sufficient time for a **TL** Surveyor to attend the construction process from the very beginning.

1.2 The basis for the supervision of construction and final test and examination at the manufacturers of the lifting appliance is, the approved documentation according to Section 1, E., plus if applicable further documentation, certificates, reports and information from the manufacturer which the **TL** Surveyor needs for assessment of the parts to be examined or tested.

1.3 Components subject to supervision are to be advised to the **TL** Surveyor in good time for testing and examination.

The TL Surveyor checks the components supplied by subcontractors as to their condition, damage, marking, stamping and certification. He supervises assembly of the lifting appliances and checks workmanship as well as compliance with the approved documents and attends the trials and function tests as far as necessary or agreed.

1.4 The testing of the materials for production, modification or repair must be proven to the **TL** Surveyor in accordance with the **TL** Rules for Materials.

The certificates covering the materials used plus the proofs concerning the welding and non-destructive testing of the materials are to be submitted.

1.5 Certificates for parts supplied by subcontractors are to be submitted.

As far as practicable, components not type-tested but subject to test and examination are tested on the manufacturers test bed to the extent agreed or set out in these Lifting Appliance Regulations.

For series production, instead of the prescribed tests other test procedures may be agreed with **TL** if recognised by **TL** as equivalent.

1.6 In the case of novel machinery, equipment and electrical installations not yet proven in practice, **TL** may require type testing under more stringent conditions.

2. Requirements from the manufacturer

2.1 General requirements

2.1.1 The manufacturers workshops must have at their disposal suitable equipment and installations to make possible expert and impeccable handling of the materials concerned, the production processes, the components, etc. **TL** reserves the right to check workshops for this and to state requirements in this regard or to restrict the scope of manufacture in accordance with the potential of the workshops. (Regarding the required approval to weld and the prerequisites for this, see Section 12.)

2.1.2 The manufacturers works must have at their disposal professionally adequately qualified personnel. The supervisory and control personnel is to be nominated to **TL**, the areas of responsibility are to be defined. **TL** reserves the right to demand proof of qualification. (Regarding the welding-engineering and the test personnel, see Section 12.)

2.2 Quality control

2.2.1 The manufacturers works must ensure by effective internal quality control that manufacture and assembly are carried out in accordance with these Lifting Appliance Regulations, the approved documentation (drawings, specifications, etc.) or the conditions stated in the certificate of approval.

2.2.2 Compliance with these Regulations for Lifting Appliances, the remarks made when the documentation was approved or the conditions stated in the certificate of approval is the responsibility of the manufacturer's works. Tests and examinations carried out by **TL** do not relieve the works of this responsibility.

2.2.3 The manufacturer's works is furthermore responsible for ensuring that conditions of manufacture and quality correspond to those during the approval tests. **TL** provides no guarantee that products tested in an approval test or by random during production will later measure up to the stipulated demands in all parts or during the whole of the production process.

2.2.4 **TL** may exclude products, processes, etc. which have proved defective in service from further use in spite of a previous satisfactory test and examination, or call for their improvement including relevant proof.

2.3 Participation by manufacturers

2.3.1 As far as necessary and advisable, the works will have to check all components during and after manufacture for completeness, dimensional accuracy and proper workmanship.

2.3.2 Following checking and if need be repair by the works, the components are to be presented to the **TL** Surveyor for verification during appropriate phases of construction, normally in easily accessible and unpainted condition.

2.3.3 The **TL** Surveyor may reject components not adequately pre-checked and stipulate that they be presented again following checking by the works and if need be repair.

2.3.4 In order to enable the **TL** Surveyor to perform his/her duties, he/she is to be offered access to the workshops in which components subject to testing and examination are manufactured and assembled. Manufacturers are to make available to the Surveyor the personal and material support required to carry out the prescribed tests and examinations.

2.4 Workmanship

2.4.1 Details contained in manufacturing documents

2.4.1.1 The manufacturing documents (works drawings, etc.) shall contain all the details relevant to the quality and serviceability of the component concerned. Besides dimensional data, these details shall include, wherever necessary, information on tolerances, on surface finish (machining/finishing), special manufacturing methods plus tests and specifications.

2.4.1.2 Where the quality or serviceability of a component is not assured or in doubt, **TL** may demand appropriate improvements. This applies analogously to supplementary or additional components (e.g. reinforcements) even where these were not demanded when the drawings were examined, or could not then be demanded owing to insufficiently detailed presentation.

2.4.2 Cutouts, plate edges

2.4.2.1 Openings, penetrations and other cutouts are to be given an adequate radius.

2.4.2.2 The faces (cut edges) of cutouts are to be machined smooth and free from notches. Grooves caused by torches may not normally be repaired by welding but are to be ground out to form shallow depressions. The edges are to be chamfered or in cases of particularly severe stress rounded-off.

2.4.2.3 Exposed edges of plates and flange plates cut with torches or shears may not be left sharp and shall where necessary be machined as described under 2.4.2.2; the same applies to any torch grooves, etc. This also applies analogously to welded joints, changes in section or similar discontinuities.

2.4.3 Cold forming

2.4.3.1 When cold forming (bending, flanging, beading) plates the mean bend radius ought not to be less than 3 s (s = plate thickness), with 2 s as the absolute minimum. Regarding welding in cold- formed regions, see Section 12. These particulars apply only to shipbuilding- and comparable structural steels.

2.4.3.2 To prevent the initiation of cracks, edges left by torches or shears are to be removed before cold forming. After cold forming, the components, particularly the ends of bend zones (plate edges) are to be examined for cracks. Components with cracks - other than minor cracks at edges - are to be rejected. Repair by welding is not permitted.

2.4.4 Assembly, alignment

2.4.4.1 The excessive use of force when assembling individual component parts is to be avoided. As far as possible, major distortions of individual components shall be aligned before assembly proceeds further. (For details relating to the preparation of welds, the welding-on of assembly aids and tack welding, see Section 12).

2.4.4.2 Girders, reinforcements and suchlike interrupted by transverse members must be assembled in true alignment. Wherever necessary, important components shall be provided with check boreholes for this purpose, which can subsequently be welded-up again.

2.4.4.3 Aligning operations are to be carried out, once welding has been completed, in such a way as to avoid any significant deterioration in the properties of the materials. In case of doubt, **TL** may call for testing of the procedure or of workmanship.

2.5 Protection against corrosion

2.5.1 All components made of steel shall be provided with suitable protection against corrosion (as regards welding, see also Section 12, F.1.4).

2.5.2 Cavities, e.g box girders, tubular pillars and the like, which can be proved to be permanently airtight or are considered to be so from general experience need not be protected internally. At the time of assembly, the cavities must be clean and dry.

3. Testing and examination of components, marking and certification

3.1 Structural parts

3.1.1 Structural parts have to be supervised during manufacture as to their workmanship and compliance with the approved drawings. The **TL** Surveyor is therefore to be advised of commencement of production in sufficient time for him to be able to supervise the entire production process.

3.1.2 Expert, faultless and complete execution of the jointing process is to be ensured by careful controlling by the works.

Appropriately qualified personnel is to be employed to carry out the non-destructive testing. The tests shall be executed to current technical standards. The results are to be presented to the **TL** Surveyor.

3.1.3 If the production process or possibly necessary post-(heat-) treatment provides grounds to expect that the properties of the materials or of the welded connections will change substantially or indeed will deteriorate, the **TL** Surveyor may stipulate workmanship tests to prove the adequacy of the mechanical properties.

3.1.4 Workmanship tests of samples from current production are as a matter of principle to be performed when welding cold-formed cylindrical sheets of materials with minimum yield points exceeding 355 N/mm^2, wall thicknesses exceeding 30 mm and degrees of deformation of 3 % permanent set and over (see also Section 12, F.9.2).

3.1.5 If examination by **TL** has not given any cause for objection, the structural part is to be stamped with the stamp **TL** month and year of examination, No. of the certificate and distinguishing letter of the **TL** Inspection Office in charge.

3.1.6 For each structural part completed and examined by the **TL** Surveyor, the latter will issue a test certificate. This certificate contains the following information:

- Manufacturer's name
- Date and **TL** journal number of the approved drawing
- The stamp logo

If the structural parts are produced in the works of the lifting appliance manufacturer, these parts will not be separately stamped and certified on completion; this will then be effected for the completed lifting appliance within the scope of the final test and examination.

3.2 Interchangeable components

3.2.1 Interchangeable components such as hooks, blocks, shackles, swivels, chains, rings etc. must comply with the Tables in Appendix A or recognised standards. Where this is not the case, plan approval is required.

3.2.2 Manufacturers or dealers are obliged to present to the **TL** Surveyor, together with the certificates of the materials employed, all interchangeable components in unpainted and ungalvanised condition, for checking of dimensions and workmanship.

3.2.3 Prior to being fitted or put into service, interchangeable components, unpainted and ungalvanised, are to be subjected to load testing in the **TL** Surveyor's presence on a calibrated testing machine, to the test loads called for in Table 7.4.

3.2.4 As regards the certificate to be issued by the TL Surveyor, reference is made to Section 7, C.5.3.

3.3 Mechanical parts

3.3.1 Power units, hydraulic pumps

3.3.1.1 Power units (prime movers) are to undergo testing on the test bed. Works test certificates for this are to be presented.

3.3.1.2 Hydraulic pumps are to be subjected to a pressure- and performance test and if appropriate additional tests in accordance with the **TL** "Regulations for the Design, Construction and Testing of Pumps".

3.3.2 Winches

3.3.2.1 Following completion each winch is to be subjected to a final examination and function test to rated pull, with repeated raising and lowering of the rated load. During the function test, the braking- and safety equipment in particular is to be tested and/or adjusted.

3.3.2.2 In the case of winches with a holding power greater than the rated pull, the rated pull is to be tested dynamically and the holding force statically.

3.3.2.3 Winches with a constant pull device are to have the maintenance of the constant pull proved in accordance with the grading preset in the design. How the test is performed is to be agreed with the **TL** Surveyor.

3.3.2.4 The tests described in 3.3.2.1 to 3.3.2.3, including adjustment of the overload protection, may also be effected within the scope of the function test of the lifting appliance. In that case a function test with disposable load is to be carried out at the manufacturer's works.

The winches will be tested with the test load within the scope of the load test of the lifting appliance (see C.3.).

3.3.3 Slew rings

3.3.3.1 As regards slew rings, reference is made to Section 9, D.2.

The material properties of the rings are to be proven by tensile and notch impact tests in accordance with the **TL** Rules for Materials, and must meet the requirements listed in the approved specification. (This applies analogously also to the connecting screws.)

The manufacturer must additionally check the rings ultrasonically for internal defects and certify that the workpieces are free from defects which might impair their properties in service.

3.3.3.2 Rings must receive heat treatment appropriate to the material employed; the running surfaces are additionally to be hardened. Following hardening, the running surfaces of the rings are to be subjected to surface crack detection tests over the whole of their length. Cracks may be eliminated by gouging provided this does not impair the operability of the slew ring. There must not be any cracks left. The **TL** Surveyor may demand that the crack test be performed in his presence.

3.3.3.3 At a minimum of eight points distributed evenly around their circumference, the hardened running surfaces are to be hardness-tested. The hardness values must be within the limits indicated in the specification. If there are reasons to doubt proper hardening, proof thereof is to be obtained by way of test pieces which have been hardened under the same conditions as the ring concerned.

3.3.3.4 For the final test the slew ring is to be assembled and presented to the **TL** Surveyor. The operability (slewing without load), bearing clearance, accuracy of plane and true running are to be checked then; additionally random checks are to be made of the dimensions in accordance with the Surveyor's instructions.

3.3.4 Hydraulic cylinders

3.3.4.1 Hydraulic cylinders are to be manufactured in steel or cast steel and tested in accordance with the TL Rules for Materials.

3.3.4.2 Hydraulic cylinders are to be subjected to a function- and a pressure test in the presence of the **TL** Surveyor. The test pressure amounts to 1,5 times the maximum operating pressure but in the case of operating pressures above 200 bar need not be more than p_{max} + 100 bar.

3.3.5 Marking and certification

3.3.5.1 For the component test the manufacturer must present certificates of material tests and internal checks, and to set up a report. This report should contain the following details, as far as applicable:

- Type designation and nominal sizes
- Customer's- and order number
- Drawing number
- Results of internal checks
- Certificate numbers of materials- and non destructive tests
- any other necessary details.

3.3.5.2 Each mechanical part is to be suitably marked by the manufacturer. As far as applicable, the marking must at least comprise:

- Manufacturer's name
- Year of construction
- Type designation
- Order- or manufacturing number
- Characteristics such as rated load, rated pressure, rated voltage, etc.
- **TL** certificate number
- Month and year of final test and examination
- Any other necessary details.

3.3.5.3 Following the test and examination the **TL** Surveyor will issue a test certificate. The components are then to be stamped in an easily visible place. The stamp must contain the following details:

- The certificate number with distinguishing letters of the **TL** Inspection Office in charge
- The stamp with month and year of test.

For hydraulic cylinders additionally:

- The working pressure
- The test pressure.

For winches additionally:

- the rated pull in kN
- the holding force in kN.

For slew rings additionally:

- the symbol for the type of material
- the charge number
- the test specimen number.

3.4 Electrical machinery, switchgear

3.4.1 Electrical machinery, including integral brakes and associated switchgear, is to be tested in the presence of a **TL** Surveyor.

3.4.2 With at least one machine of each type including its brake, a heating-up run is to be carried out until the final temperature is reached, corresponding to the stipulated operating mode, starting frequency and duty time. The final temperatures must not exceed the permissible excess-temperature limits for electrical machinery at an ambient temperature of 45°C.

3.4.3 Where practicable, electric motors are to be tested under their operating conditions.

If a heating-up run under operating conditions is not possible, on application by the manufacturer a suggested substitute test recognized as equivalent may be agreed to. In the case of 3-phase A.C. drives with pole-changeable motors for the S 5 operating mode (units with more than 160 switchings-on per hour, i.e. more than 40 hoists per hour) the heating-up test may alternatively be performed with the motor unloaded, using a substitute centrifugal mass as an external moment of inertia.

Also possible is a test without a substitute centrifugal mass. In that case the effect of the external moment of inertia on heating-up is to be taken into consideration by a 10 % addition to the agreed frequency of starts.

3.4.4 The heating-up run may be terminated if the temperature of the motor has approached the condition of thermal inertia as nearly as 2 K. After stopping, a cooling-down curve is to be drawn.

3.4.5 In order to determine their heating-up, depending on their connection system motors are to be run up smoothly through the individual speed stages up to the highest service speed, and braking is to be effected generatively through the speed stages and mechanically with the aid of the attached brake.

3.4.6 Additional tests to be performed

3.4.6.1 Overload test with 1,6 times the rated torque for 15 sec.

3.4.6.2 Overspeed test, for motors with a wound rotor at 1,2 times the maximum no-load speed for 2 minutes, for motors with a series characteristic to at least 1,5 times the rated speed.

3.4.6.3 Winding test (high-voltage test) on motor and brake for a period of 1 minute, with a test voltage of 2 x rated voltage + 1000 Volts but not less than 1500 Volts.

3.4.6.4 Insulation measurement if possible with the motor and brake at operating temperature, with at least 500 Volts DC. The insulation resistance must be at least 1 MOhm.

3.4.7 Wherever practicable, switchgear is to be subjected to a function test plus a high-voltage test in accordance with 3.4.6.3 and insulation measurement in accordance with 3.4.6.4.

3.4.8 Following completion of the stipulated tests the TL Surveyor will issue a test certificate.

4. Final test and examination at the manufacturers

4.1 Notes

4.1.1 Normally the final test and examination of the completed lifting appliance is effected in two stages, i.e.

following completion at the manufacturers and prior to being put into service at the place of operation. There, apart from a function test and thorough examination the prescribed load test is to be performed so that the foundations and fastening arrangements are included in the test.

4.1.2 Final testing and examination at the manufacturers is required even if the lifting appliance is not assembled completely there.

4.2 Tests and examinations to be carried out

4.2.1 General test and examination

4.2.1.1 Checking of documentation

4.2.1.2 Checking of workmanship, for compliance with the approved documents and for completeness.

4.2.1.3 Checking of safety clearances and passive protection measures.

4.2.1.4 Checking of accesses, ladders, rails and platforms.

4.2.1.5 Checking of the cabin or the control platform and the control equipment.

4.2.1.6 Checking of the manufacturer's plate, on which should be durably stated:

- The manufacturer's name
- The year of construction
- The serial number and, where applicable,
- The type designation.

4.2.1.7 Checking of marking of SWL or lifting capacity (see C.7.).

4.2.2 Test run

4.2.2.1 New-design lifting appliances or the first appliances in every delivery must be test-run in the presence of the **TL** Surveyor according to a programme approved by **TL**. If possible this should take place at the manufacturers, but with **TL**'s consent it may also take place elsewhere or at the place of operation.

4.2.2.2 Lifting appliances subject to special operating conditions must undergo test runs under these conditions. At least one appliance of every different type must be so tested.

For shipborne lifting appliances, this for instance, means that the test run must be performed with the ship also at the stipulated inclination.

4.2.2.3 A test run may cover the following, insofar as applicable:

- Checking the concerted working of all movable parts and functions
- Function test under available load
- Braking test with dynamic test load according to Table 13-1 by releasing the operator's control
- One emergency braking test with dynamic test load according to Table 13-1 (see also C.3.2.4)
- Checking the emergency load release device
- Endurance tests of all power units under SWL, with heating-up measurement
- Noise measurement (also in the cabin)
- Measurement of power consumption and contractually agreed speeds under SWL
- Additional measurements, including electrical ones, if necessary
- Checking and adjustment of all valves and control equipment
- Pressure tests

- Testing and adjustment of all safety devices and limit stops

- Testing of lighting, ventilation, intercom, etc.

- Testing of fire protection system

- Any other tests required.

4.2.2.4 Easing of testing requirements for repeated construction are to be agreed with **TL**.

4.2.3 Safety against overturning, drifting off by wind

4.2.3.1 For mobile lifting appliances or those not fastened to a foundation, in addition to proof of safety against overturning by calculation a practical proof thereof, using weights, is to be carried out.

This proof shall be conducted in accordance with DIN 15019. The application of other rules or standards may be agreed. (For lifting appliances mounted on rails or fork lift/trucks, see Section 2, F.3.2.).

4.2.3.2 The proof by calculation of safety against drifting off by wind is to be in accordance with DIN 15019. The application of other rules or standards may be agreed.

4.2.4 Examination

Following completion of the agreed trials and tests, lifting appliances are to be subjected to a thorough examination to determine whether any individual components have become damaged or distorted. The methods of examination to be used are within the discretion of the **TL** Surveyor. Lubricating- and hydraulic oil filters are to be examined for contamination.

4.2.5 Stamping

4.2.5.1 Prior to issuing of the comprehensive test certificate by **TL**, the lifting appliances shall be stamped as follows:

- the certificate number with distinguishing letters of the **TL** Inspection Office in charge

- the stamp **TL** with month and year of test.

4.2.5.2 An additional stamp covering the SWL is not applied until after the load test has been carried out.

4.2.5.3 Cranes are to be stamped at the bottom end of the left-hand jib member next to the point where that member joins the crane housing.

Derrick booms are to be stamped at the heel-fitting end of the tubular member (not on the heel fitting).
Lifting platforms and ramps are to be stamped in a prominent position.

The location of the stamp will be stated in the certificate.

4.2.5.4 If with the approval of **TL** Head Office a final test and examination was carried out without prior or intended plan approval, the lifting appliances tested receive the broad **TL** anchor stamp.

4.2.6 Test certificate

4.2.6.1 For every lifting appliance completed and tested, a test certificate is issued by the **TL** Surveyor.

4.2.6.2 Prior to this certificate being issued, the manufacturer shall hand over to the **TL** Surveyor all the **TL** certificates, and shall submit all other certificates and reports.

This includes certificates for:

- Materials

- Components

- Wire ropes

- Interchangeable components, plus

- Test reports, etc.

4.2.6.3 Apart from explanatory notes concerning the acceptance procedure, the test certificate contains a note regarding the available certificates, reports, etc. and the following details insofar as applicable:

- The manufacturer's name
- Type designation and manufacturers production number
- The SWL and if applicable the derrick boom inclination or the load radius
- Date and **TL** journal number of the plan approval
- The stamp
- The place of operation.

4.2.6.4 If not all tests are carried out at the manufacturers works, the test certificate may be in several parts (final test and examination at the manufacturers, test run, test for safety against overturning).

C. Initial test and examination

1. Notes

1.1 Prior to put being into use an initial test and examination at the place of operation is required.

In the case of mobile lifting appliances or ones not fixed to a foundation, this test and examination may also be carried out at the manufacturers or elsewhere.

1.2 If a test run in accordance with B.4.2.2 has been carried out, the on -site test consists of a function test plus a load test together with a thorough examination.

1.3 When testing lifting appliances dependent on an external power supply, care is to be taken to ensure that the test is carried out using the type of supply envisaged, e.g. shipbome lifting appliances must be fed with ship's power.

2. Function test

2.1 This test serves to provide proof of the working order of all components, installation systems and safety devices. The test procedure is left to the **TL** Surveyor's discretion. No certificate is issued for the test. (For the definition see A.4.1.1.).

2.2 In the case of permanently installed lifting appliances, e.g. shipborne ones, the function test furthermore serves to verify whether parts of the ship's structure or the ship's equipment restrict the working range or impede the working process.

2.3 The function test to be carried out for the **TL** Surveyor normally does not serve to check whether all the possible operations wanted by the operator can be effected. Proof of this is the responsibility of the manufacturer or supplier.

2.4 With the exception of the test of the overload protection devices, the function test may be carried out with any given load.

For certain purposes a function test with defined loads is to be performed (regarding this see A.4.1.1.).

2.5 A function test using the test load requires the manufacturers' consent.

3. Load test

3.1 Basis

3.1.1 Each lifting appliance with a defined SWL shall undergo a load test with weights prior to being put into use. If possible the test should be carried out at the place of operation. Shipborne- and fixed lifting appliances must be load-tested at the place of operation to include their respective foundations in the test.

For mobile lifting appliances without fixed foundations a load test at the manufacturers is sufficient.

3.1.2 Shipborne lifting appliances and dockside ones are to be subjected to a dynamic load test.

The size of the test load shall be taken from Table 13.1.

Lifting appliances ashore are to be subjected to a dynamic and a static load test.

3.1.3 The size of the test loads shall be taken from Table 13.1.

Table 13-1 Test loads

Shipborne lifting appliances and dockside ones *)	
SWL	**Test load (P_{dyn})**
Up to 20 t 20 up to 50 t Over 50 t	SWL + % 25 SWL + 5 + SWL + % 10
Lifting appliances ashore	
Any rated load	**Test load**
Dynamic test Static test	Rated load + % 20 Rated load + % 40
***)** *According to international ILO regulations*	

3.2 Performance

For the dynamic load test the test load is to be lifted slowly, slewed and if possible also luffed. In detail the following applies:

3.2.1 In the case of derrick booms the test is to be carried out using the appropriate winch, at the minimum inclination specified for the respective SWLs.

If the intention is to work with jointly-slewed pairs of derrick booms, this same test is to be carried out with the paired booms.

Derrick booms with two head fittings are to be tested at both fittings using the test load necessary in each case.

3.2.2 Cranes under test load are to run the full travelling distance or at maximum load radius cover the full swinging or slewing range. Additionally the minimum load radius is to be tested, and in the case of cranes with radius- dependent SWL also an intermediate value.

3.2.3 In the case of lifting platforms and ramps, the test load arrangement shall conform to the intended operating mode.

3.2.4 For lifting appliances generally, the test load is to be lowered rapidly and braked in various positions. Braking is to be effected by releasing the control lever. Additionally one emergency braking test with the test load, by operation of the emergency switch or button, is to be carried out either at the manufacturers or at the place of operation.

In the case of lifting platforms braking tests under test load are required

Ramps should if possible be moved under test load.

3.2.5 When carrying out the load test, care shall be taken to ensure that all parts are able to operate freely in all positions of the derrick boom or crane jib, all ropes are unobstructed by any other parts and the ropes can wind satisfactorily onto the winch drums.

3.3 Union purchase rigs

For union purchase rigs a test under test load is to be performed with at least two pairs of derrick booms to verify the satisfactory simultaneous operation of the two associated winches. Furthermore in the case of hydraulic cargo winches and preventers connected to guy winches it is required that each pair of booms be tested with the appropriate test load. The same applies where the SWT with coupled booms is more than half that with individually swinging booms.

3.4 Requirements for hoisting-winches

3.4.1 If the pull of the hoisting-winch is insufficient to lift the test load, a second winch or other lifting appliance may be brought in to assist with the hoist. Braking and holding the test load has, however, to be accomplished using solely the winch belonging to the lifting appliance.

3.4.2 Where hoisting-winches have not lifted the test load by themselves, proof is to be obtained by testing that with the maximum number of layers of rope on the winch drum the SWL is hoisted satisfactorily by the winches.

3.4.3 The ability of the winch to hold the test load with the drive to the winch switched off must be proved (regarding this see also F.6.2).

3.5 Hydraulic cranes

If hydraulic cranes are unable to lift a test load 25 % greater than the SWL because of the pressure limit, lifting the maximum possible load is sufficient. This should however exceed the SWL by at least 10 %.

3.6 Static testing

Static load testing of shore-based lifting appliances shall be carried out in calm wind conditions in the positions indicated by **TL** Head Office. Initially, the SWL is to be lifted slightly, the excess load then applied as gently as possible.

3.7 Exceptions

For shore-based lifting appliances test loads differing from those in Table 13-1 may be agreed.

4. Examination

4.1 Following performance of the load test, all parts of the lifting appliances, insofar as they are covered by the **TL** testing/survey order, shall be thoroughly examined (see A. 1.5).

4.2 The scope of the examination to be carried out corresponds to that stated under D.3.2 and lies within the discretion of the **TL** Surveyor.

4.3 For the examination, if necessary individual parts shall be unrigged and dismantled. All parts then found not to be in unobjectionable condition shall be repaired or replaced. The **TL** Surveyor is entitled to require a repetition of the load test if he/she considers this necessary.

5. Stamping

5.1 If the tests and examinations described above have not given rise to any objections, the lifting appliances are to be stamped before the relevant certificates are issued by the **TL** Surveyor.

5.2 Cranes are to be stamped at the bottom end of the right-hand jib member and next to the point where that member joints to the crane housing.

Derrick booms are stamped at the heel fitting.

Lifting platforms and ramps shall be stamped in a prominent position.

The location of the stamp is stated in the certificate.

5.3 The stamp must contain the following information:

a) the shipboard number of the lifting appliance,

b) the stamp **TL** with the month and year of test,

c) the SWL of the lifting appliance in (t) and the minimum permissible derrick boom inclination in degrees or the permissible minimum and maximum crane load radius in (m). Where the SWL varies with the load radius, the SWL and the corresponding load radius is to be stated for the maximum and minimum values,

d) the certificate number and distinguishing letters of the **TL** Inspection Office in charge.

5.4 Additional stamping of derrick booms in connection with the load test of pairs of booms for use as union purchase rigs is normally not necessary.

6. Certification

6.1 Following performance of the tests and examinations described above and stamping of the lifting appliances, the **TL** Surveyor issues the certificates required according to G, plus a Register Book.

On this occasion the **TL** Surveyor also hands over other certificates required for the Register Book, plus for shipbome lifting appliances the internationally required rigging plans.

6.2 The certificates to be issued in connection with the initial test and examination correspond to the model forms recommended by the ILO in the **TL** forms STLA2 and STLA2(U) and contain notes regarding the thorough examination plus details regarding the load test or such explanations as are still required.

Furthermore, the load radii/boom inclinations at which the load test was carried out are stated in the certificates.

7. Inscription (marking) of the lifting appliances

7.1 Numbering of shipborne lifting appliances

7.1.1 The consecutive numbering of shipborne lifting appliances must agree with the details in the rigging plans.

7.1.2 Adoption of the following rule for numbering is recommended:

a) first all lifting appliances for cargo-handling starting from forward and with arrangement in pairs progressing from port to starboard.

b) Next all lifting appliances needed for operating the ship, but not any appliances exclusively for launching life-saving equipment. (Regarding this see also E.).

7.2 Marking of shipborne lifting appliances

7.2.1 Lifting appliances are to be marked as follows:

a) number of the lifting appliance in arabic numerals preceded by the letters "Nr" on both sides of the derrick boom or crane jib,

b) Safe Working Load of the lifting appliance preceded by the letters "SWL" clearly distanced from the number. For derrick booms the minimum permissible boom inclination is to be added, for cranes always the minimum and maximum load radius. On derrick booms not arranged in pairs the SWL is to be marked on both sides; on identical ones arranged in pairs only on the outer side of each.

c) Safe Working Load when operating with derrick booms in Union Purchase preceded by the letters "SWL(U)"; on derrick booms arranged in pairs only on the inward side of the booms, on ones not arranged in pairs on the side towards the associated boom,

d) Safe Working Load when operating with lifting appliances slewed together preceded by the letters "SWL(P)"; for lifting appliances arranged in pairs only on the inward side of the derrick boom or crane jib and on the crane pedestal.

Lifting platforms and ramps shall be marked as follows: analogously to a) and b), the number and the Safe Working Load "SWL" is to be marked.

7.3 Marking of onshore lifting appliances

For onshore lifting appliances, instead of the abbreviation "SWL" the designation "lifting capacity" or whatever term is agreed shall be used, always followed by the allowed load in tonnes (t). Derrick booms should additionally be marked with the minimum inclination in degrees (°) and cranes with the load radius, resp. the extreme values of the load radius in metres (m). (Harbour cranes should, however, normally be marked like shipborne ones.)

7.4 Performance

The marking giving the details of the Safe Working Load or the lifting capacity shall be in writing at least 80 mm high, and that regarding boom inclination or load radius at least 50 mm high.

This marking is to be made with a centrepunch or durably applied by means of welding spots

The marking of the SWL and the permissible load radius of shipbome cranes are subject to the following guidelines

Marking General cargo cranes (hook operation)			Meaning
a)	SWL 5 t	4 - 14 m	With a load radius from 4 to 14 m, Safe Working Loads up to 5 t can be hoisted.
b)	SWL (P) 20 t	3 - 22 m	With two cranes slewed together and within a load radius from 3 to 22 m, Safe Working Loads up to 20 t can be hoisted. The special conditions for this operating mode are stated in the rigging plans.
c)	SWL 20 t SWL 4 t	2 - 8 m 2 - 18 m	With cranes whose variable Safe Working Load depends on the load radius, with a load radius of 2 to 8 m a Safe Working Load of 20 t may be hoisted with one of 2 to 18 m, a SWL of 4 t. Intermediate values are stated in the rigging plans.
Grab cranes			
	SWL (G) 20 t	2 - 25 m	With a load radius of the crane between 2 and 25 m, working with a grab the Safe Working Load is 20 t. The Safe Working Load comprises the pay- load plus the dead weight of the grab. If the crane is also convertible to hook operation, an additional marking for hook operation is to be applied. :

The marking of the SWL and the permissible inclination of shipbome derrick booms are subject to the following guidelines:

	Marking		Meaning
a)	SWL 2 t	15°	With the derrick boom inclined at an angle of 15 or more to the horizontal, loads of up to 2 t can be hoisted with a single-reeved cargo runner.
b)	SWL 3-5 t	15°	With the derrick boom inclined at an angle of 15° or more to the horizontal, loads of up to 3 t can be lifted with a single-reeved cargo runner; up to 5 t with one double-reeved.
c)	SWL 3 t	30°	With the derrick boom inclined at an angle of 30° or more to the horizontal, and a single-reeved cargo runner loads up to 3 t may be lifted. The (lower) Safe Working Load which can be lifted at an angle of 15° is stated in the rigging plans.
d)	SWL 3-5 t	45°	With the derrick boom inclined at an angle of 45° or more to the horizontal, loads up to 3 t may be hoisted with a single-reeved cargo runner, and up to 5 t with one double-reeved. The (lower) Safe Working Loads at angles of less than 45 are stated in the rigging plans
e)	SWL 3-5 t SWL 10 t	15° 30°	With the derrick boom inclined at an angle of 15° or more to the horizontal, loads up to 3 t may be hoisted with a single-reeved cargo runner and up to 5t with one double-reeved. Subject to special conditions stated in the rigging plans, at angles of inclination of 30° or more to the horizontal loads up to 10 t may be hoisted.
f)	SWL 3-5 t SWL 2 t	45° 13 m 15° 15 m	With an effective boom length of 13 m, the values applicable are those given under d); with one of 15 m, those given under a). (The clear distance between the two markings should be about 1 m.)
g)	SWL 80 t	30°	Subject to the conditions stated in the rigging plans, loads up to 80 t may be hoisted with the derrick boom inclined 30 or more to the horizontal
h)	SWL (A) 3 t		Irrespective of the angle of inclination Safe Working Loads up to 3 t may be hoisted when operating with union purchase rigs
i)	SWL (P) 20 t	30°	With two derrick booms slewed together, Safe Working Loads up to 20 t may be hoisted with angles of inclination of 30° or more. The special condition for this operating mode are stated in the rigging plans.

D. Periodic tests and examinations

1. Notes

1.1 Lifting appliances subject to continuous supervision by **TL** must at regular intervals be thoroughly examined by a **TL** Surveyor and subjected to load tests in his presence.

1.2 The expression "thorough examination", defined under A.4.2.1, derives from the international ILO regulations. For classified lifting appliances the expression "survey" is used instead; however this has the same definition.

1.3 The intervals between examinations, and between the load tests, described below are internationally accepted usual periods. National requirements going beyond these are to be taken into account if applicable.

1.4 In the case of testing of lifting appliances depending on an external power supply, care is to be taken to ensure that the tests are carried out with the power supply envisaged; e.g. shipbome lifting appliances must be tested with on-board power.

1.5 Tests and examinations carried out by officials or by officially authorised persons may be recognised by **TL**.

2. Due dates

2.1 Examinations

Lifting appliances, lifting platforms and ramps must be examined at 12-monthly intervals by **TL**, unless shorter intervals have been agreed upon or are required by national regulations, or **TL** regulations call for shorter intervals as, for example, for offshore supply cranes. The operator is as a matter of principle obliged to give **TL** due notice of the examination.

2.1.1 Shipborne and harbour lifting appliances

For shipbome and harbour lifting appliances the following examinations are stipulated:

- Annual thorough examination
- Quinquennial thorough examination
- Thorough examination after damage and/or repair

2.1.2 Offshore supply cranes

If no special agreements have been reached, offshore supply cranes are subject to half-yearly thorough examination.

The examination intervals may after the build-up phase of the offshore installation be increased to annual ones. Moreover the regulations according to 2.1.1 apply.

2.1.3 Lifting appliances with TL class

2.1.3.1 Lifting appliances with a **TL** class are subject to the following surveys:

- Annual class surveys
- Class renewal surveys
- Extraordinary surveys.

2.1.3.2 Class renewal surveys correspond, as regards scope and intervals, to the quinquennial thorough examinations as for shipbome lifting appliances.

2.1.3.3 Extraordinary surveys correspond to the thorough examinations after damage and/or repair of shipbome lifting appliances. Furthermore **TL** reserves the right to carry out extraordinary surveys in specially justified cases. Such surveys may be credited to the stipulated ones.

2.2 Load tests

No later than five years after the initial or the latest load test a further load test is required to be performed in a **TL** Surveyor’s presence.

For shipbome lifting appliances this test need not necessarily coincide with the quinquennial thorough examination.

For classified lifting appliances the load test need not coincide with class renewal survey.

2.3 Exceeding the due date

2.3.1 In the case of lifting appliances on offshore installations and ones subject to the regulations of the ILO, i.e. which are operated by dock workers on board ships and in harbour, the interval between examinations may not exceed 12 months and that between the load tests five years.

If these intervals are exceeded, the validity of entries in the Register Book about examinations carried out, plus the validity of test certificates, expires automatically.

2.3.2 In the case of lifting appliances not subject to the ILO regulations and not installed on offshore installations, the 12-month interval between examinations and the interval between the load tests may be exceeded by up to three months. This does not, however, postpone the due date of the next examination. The same applies inversely to tests performed before the due date.

2.3.3 In the case of classified lifting appliances the class lapses once the five year interval has been exceeded by more than three months.

3. Annual (semi-annual) examinations

3.1 In combination with the required thorough examination according to 3.2, a function test analogous to C.2. but possibly of reduced scope is also always required.

3.2 Normally lifting appliances need not be unrigged or dismantled for performance of the thorough examination. Substantially, the scope of the examination comprises:

- Checking for completeness and correct rigging resp. reeving, using the rigging plans
- Checking for damage, wear and deformation checking for proper marking function test using available load
- Random examination of the interchangeable components and correlation to the relevant certificates based on the stamps applied
- Verification of newly-fitted parts
- Checking documentation and certificates for completeness and validity
- Recording the examination carried out in the Register Book at the place of operation.

This list is by way of an example. The actual scope of tests and examinations is at the discretion of the **TL** Surveyor.

3.3 Parts which do not comply with the regulations or whose wear has reached its permitted limits must be replaced by new ones with the prescribed dimensions (see F.).

3.4 Use of steels liable to aging is not permitted as a matter of principle, for that they require heat treatment at regular intervals..

3.5 Any parts renewed since the last examination are to be submitted to the **TL** Surveyor together with the certificates required according to G.

4. Quinquennial examinations (class renewal surveys)

4.1 For lifting appliances in general, a quinquennial thorough examination is required at the latest five years after the initial examination and then at repeated intervals.

This examination should if possible coincide with the quinquennial load test according to 6.1.

4.2 No later than five years after the last class survey, instead of an annual survey a class renewal survey becomes due. For shipbome lifting appliances, where possible this survey should coincide with the vessel's class renewal.

4.3 Scope of survey and examination

4.3.1 Beyond the scope outlined in 3.2, the quinquennial thorough examination extends to additional components, so that the lifting appliances have to be unrigged and individual components also dismantled according to the instructions of the **TL** Surveyor. The scope of this examination/survey depends on age, condition and frequency of use and is left to the **TL** Surveyor's discretion.

4.3.2 In particular the following tests are also to be carried out as part of the quinquennial examination:

4.3.2.1 Crack tests

The comer connections of crane gantries, the connections between longitudinal- and transverse structural members of crane jibs, the kinked areas of crane columns plus similar joints of all kinds are as requested by the **TL** Surveyor to be checked for cracks, using the procedure appropriate to each case.

4.3.2.2 Hydraulic cylinders

Apart from a thorough visual examination, a function test of pipe burst safety valves with available load is required.

4.3.2.3 Slew rings

Because of its special significance as regards safety and continued operation of a lifting appliance, great importance attaches to the regular examination of the slew ring between lifting appliance and foundation. Slew rings of offshore supply cranes must therefore at certain intervals be removed and dismantled for internal inspection.

Slew rings are to be checked for lubrication and even running. Extruded grease is to be checked for abraded particles. The tight fit of the bolts is to be checked by hammer test.

For offshore supply cranes the following applies as regards removal and dismantling of the slew rings for internal inspection:

- slew rings constructed in accordance with these Lifting Appliance Regulations and accepted by **TL** are to be removed, dismantled and internally inspected in the course of the first quinquennial examination. (Non-destructive testing of the running surfaces.)

- Slew rings not complying with the above-mentioned conditions are to be inspected internally initially 30 months after commissioning.

Depending on the result of the examination, renewed dismantling may be dispensed with entirely or a new date is set.

5. Examinations after damage and/or repair (extraordinary surveys)

5.1 If modifications are intended to be made to lifting appliances or if repairs or renewals of structural elements (or installations of classified lifting appliances) are intended to be carried out, the operator has to inform **TL**.

5.2 With a view to maintenance or reassignment of the class, modifications of classified lifting appliances must be made under supervision of **TL**.

The modifications are subject to the same technical treatment as the initial manufacture.

5.3 Any repair or renewal of components as described in Section 1 under D.2.1 is to be carried out under supervision of **TL**. Where this is not possible in individual cases because of the circumstances, a resurvey is to be carried out on a suitable date.

5.4 **TL** reserves the right to carry out extraordinary surveys in specially justified cases. These may be credited to the stipulated regular surveys.

6. Load tests

6.1 As regards the due dates for these tests, 2.2 applies to lifting appliances, lifting platforms and ramps.

For lift units, the regulations according to Section 5, F. apply.

6.2 In general, for repeated load tests testing at maximum load radius or minimum derrick inclination will suffice. If possible the test is to be performed using weights. The weights must have certificates or be verifiable.

Lifting platforms and ramps shall be tested as described under C.3.2.3.

6.3 Repeated load test may also be effected using a calibrated load measuring instrument, whose measured value indication shall remain constant for five minutes.
The instrument is to have an accuracy of ± 2 %.

If the SWL of a lifting appliance exceeds 15 t, use of a load measuring instrument is in general to be avoided.

6.4 The value of the test load is to be obtained from Table 13-1.

6.5 Following modification, repair or renewal of load-bearing parts, load testing using weights in the presence of a **TL** Surveyor is required. This does not apply to interchangeable components since these are subject to component load tests.

6.6 Following replacement or repair of winches, a load test is required if the winch has not already been load-tested on a test bed. The scope of the test is at the discretion of the **TL** Surveyor.

6.7 Replacement of axles, shafts, pins, rope sheaves, ropes, etc. does not necessitate load-testing.

7. Certification

7.1 Following performance of the tests and examinations, the **TL** Surveyor will issue the certificates stipulated according to G.

7.2 The stamping required according to C.5 in connection with the issuing of certificates is in general not required for repeated load tests.

E. Lifting appliances not used for cargo-handling

1. Notes

1.1 Lifting appliances not used for cargo-handling are defined in Section 1 under F.3.3.

1.2 These lifting appliances are, as a matter of principle not subject to the regulations of the ILO Convention 152 since they are not used for handling cargo and are not normally operated by dock workers.

1.3 Lifting appliances not used for cargo-hand- ling are subject exclusively to national regulations, where these exist.

In the light of practical experience it is however re-commended that lifting appliances for provisions, equipment and for hose handling (possibly additionally) be treated like lifting appliances for cargohandling.

2. Foreign-flag ships

2.1 Where national regulations exist, these must be applied without reservations.

2.2 If the recommendation in 1.3 is followed, the lifting appliances named there are, possibly additionally, to be treated without reservations like cargo-handling lifting appliances.

F. Wear, damage, repair

1. Notes

1.1 The details which follow regarding tolerances, deflections, wear etc. are to be considered as reference values for judging the remaining margin of safety of damaged, corroded or worn components.
In cases of doubt, **TL** Head Office is to be consulted.

1.2 All components which have ceased to meet the requirements defined below must be either repaired or replaced.

(Regarding an alternative reduction of the SWL, see 8.).

1.3 Any damaged, worn or corroded part which is not discarded must, once the tolerances have been exceeded, be restored to the original dimensions and using equivalent materials.

1.4 Normally the rigging plans should contain details of nominal sizes, dimensions and materials of masts, posts, derrick booms, crane pedestals, loose gear, interchangeable components and ropes.

In this connection reference is made to the Tables in Appendix A.

1.5 Regarding loose gear, interchangeable components and ropes reference is also made to Section 7, E. and Section 8, E.

2. Acceptable reduction of plate thickness

2.1 For plates and profiles, the acceptable reduction of plate thickness is 10 %.

2.2 In cases of localised rusting or wear, a reduction of plate thickness of up to 20 % is acceptable provided this does not result in a reduction of the load-bearing capacity of the cross-section.

2.3 In cases of isolated pitting a reduction of plate thickness of up to 30 % is acceptable.

3. Acceptable cracks

3.1 In Category 1 components (see Section 11, B.2.1.1) there may not be any visible cracks.

3.2 In lateral wind bracing, latticework crosspieces and similar stiffeners or knee plates whose purpose is to reduce the slenderness ratio or stiffen load-bearing structures, subject to it being visible that they do not extend into the load-bearing structure cracks up to the following length are acceptable:

a) 10 % of the connection length

b) 3 x plate thickness

the lower of the two values applying.

In the case of pipes the connection length is the circumference.

In the case of rectangular sections or angle bars each flange width is to be considered separately as a connection length.

4. Compression- (tension-) bars, girders subject to bending

4.1 Acceptable indentations

4.1.1 In pipes, local indentations may have a depth of up to 10 % of the diameter (for compression bars, see 4.1.5).

4.1.2 In box girders, local indentations including corner indentations may have a depth of 8 % of the length of the shortest side (for compression bars, see 4.1.5).

4.1.3 Webs of girders may not have any indentations (for flange deformation, see 4.2).

4.1.4 Angle bars may not have any indentations at the corners (for flange deformation, see 4.2).

4.1.5 Compression bars

4.1.5.1 The indentations stated above are as a matter of principle only acceptable if diversion of forces is possible.

This presupposes smooth transitions. Folds and cracks in the indented region are not acceptable.

4.1.5.2 In the case of pipes and box girders, the longitudinal and transverse extent of indentations may not be more than:

- 30 % of the circumference
- 30 % of the length of the affected resp. the shortest adjoining side.

4.1.5.3 In each case the depth of indentation may not be more than **1/5** of the extent in %. For instance where the extent of the indentation is 30 %, the maximum depth allowed is 6 %.

4.1.5.4 In the case of derrick booms, indentations are permissible only in the bottom third since the maximum stress is in the upper portion.

Local indentations in the bottom part of the derrick boom need not be removed if the indentation diameter does not exceed a maximum of 0,33 x boom diameter and the depth is no more than 3 x wall thickness.

4.1.6 Tension bars

4.1.6.1 Assuming no folds, cracks or thin places have developed, indentations, deformations or war pings up to 5° are considered uncritical.

4.1.6.2 In view of the local increase of stress, the depth of indentations should not exceed 50 % of their length in the direction of the pull.

4.1.7 Girders subject to bending

4.1.7.1 Indentations are not acceptable at bearing- or load introduction points.

4.1.7.2 Elsewhere, the rule is, that indentations up to the dimensions in 4.1.5 are acceptable on the tension side; on the compression side ones of half that size only.

4.2 Acceptable deformation

4.2.1 The flanges of I-beams may individually or together be deformed by up to 20 %.

The deformation relates to the distance from web to outer edge.

4.2.2 The flanges of angle bars may be deformed by up to a maximum of 20 %. This figure relates to the flange width and applies to the individual flange or for the total deformation of both flanges.

4.3 Acceptable deflections

4.3.1 Compression bars

4.3.1.1 Under the maximum permissible loading, compression bars may not display deflection greater than the equivalent of the bar length divided by 250.

4.3.1.2 Unstressed compression bars, or ones stressed only by their own weight as for example derrick booms, may not display deflection greater than the equivalent of the bar length divided by 500.

4.3.2 Tension bars

Tension bars should when unstressed not display deflection greater than the equivalent of the bar length divided by 50.

5. Components

5.1 Interchangeable components

5.1.1 Interchangeable components are dealt with in Section 7, E.

5.1.2 Repeated testing of the components

Following repairs to forged components, proof that the heat treatment has been carried out is to be provided. Following repairs to components, the component load test shall be repeated. If in a sheave block only sheaves are renewed, a repeat of the load test is not required.

If in a sheave block, sheave pins or fork pins are renewed, the component load test shall be repeated if the TL Surveyor considers this necessary.

5.2 Individual parts

5.2.1 Rope sheaves

5.2.1.1 The thickness of rope sheaves made from normal-strength materials according to Table 27 to 33 in Appendix A must at the bottom of the groove meet the following condition:

$$t \geq \sqrt{0{,}85 \cdot S}$$

t = Thickness of material in [mm]

S = Static rope pull in [kN]

5.2.1.2 The details under 5.2.1.1 apply to disc- or spoked rope sheaves.

Rope sheaves of grey cast iron are not permitted.

5.2.1.3 The material thickness according to 5.2.1.1 may reduce in an outward direction to 1/3 at the outermost edge.

5.2.2 Gooseneck and gooseneck bearing

5.2.2.1 Worn gooseneck heads, gooseneck bearing bushes and heel fittings may be restored to working condition by insertion of a bush.

5.2.2.2 The wear may not amount to more than 100 % of the permissible bearing clearance which are indicated in Tables 9to12 and 14 in Appendix A.

5.2.2.3 The wear allowance for the gooseneck pin and the gooseneck itself is 10 % of the diameter.

5.2.3 Head fittings and slewing-guy eyes on the derrick boom

5.2.3.1 When wear of these parts exceeds 10 % of their diameter or 20 % of their load-bearing cross-sectional area they must be repaired.

5.2.3.2 In the case of head fittings the repair may follow the example in Fig. 13.1.

5.2.3.3 The worn areas may also be repaired by building-up using electric-arc welding, provided the following conditions are fulfilled:

a) the welding is done by a qualified welder.

b) The parts are preheated before welding. The temperature is to be selected in dependence on the base material and the material thick ness.

c) A welding consumable metal matching the base material (good deformation characteristics) is to be used.

d) Subsequent to welding the area is to be ground-out well.

e) Crack detection by the dye-penetration method is to be carried out.

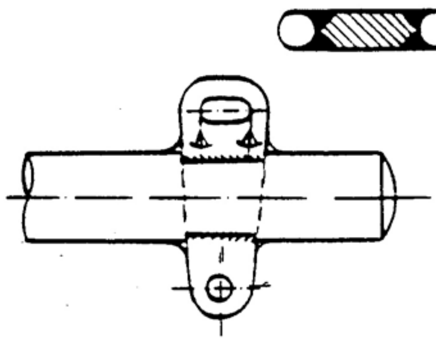


Fig. 13.1 Repair of head fittings

5.2.4 Pins

From the point of view of load-carrying capacity a reduction in diameter of 10 % is acceptable.
As regards fitting tolerances the following applies:

5.2.4.1 Rope sheave pins

The following tolerances are considered permissible:

- 1 mm in antifriction bearings
- 2 mm in sliding bearings

5.2.4.2 Foot bearing pins

For lifting appliance foot bearing pins a clearance of 4 mm is considered acceptable.

5.2.4.3 Pins in general

In general double the original clearance is considered the wear limit. Greater clearances are acceptable if load-carrying capacity and ability to function are not adversely affected.

6. Mechanical parts

6.1 Gearing

6.1.1 In the case of toothed racks and other "open" drives, the width of the teeth on the pitch circle (rolling circle) may not be less than **55** % of that at the root of the teeth.

6.1.2 In the case of "enclosed" gears, parts or the entire set of gearing must be renewed if the material on the pressure lines/working faces starts to break out (pitting).

6.1.3 Wedges or fitting keys must be renewed if there are visible signs of wear or damage.

6.2 Brakes

6.2.1 Wear on all types of brakes, in so far as visible, may only have reached the extent that in all probability they can be used for one more year.

In the case of band brakes with riveted-on linings the rivets may not make contact with the braking surface.

6.2.2 Electric or hydraulic winches with automatic standstill brakes may not have any slip, not even under test load.

6.2.3 Winches with manually-applied standstill brakes may not have any slip when the brake has been applied, not even under test load.

6.2.4 Hydraulic winches without standstill brakes may not under SWL show more slip per minute than one meter, or one full rotation of the drum. The lower of the two values applies.

7. Carriages

The acceptable tolerances for crane gantries, running gear and runways must correspond to ISO standard 8306. If necessary, **TL** Head Office is to be consulted.

8. Reduction of the SWL, repair

8.1 Reduction of the SWL

SWL-reductions because of damage, unacceptable wear or for other reasons are principally permissible as alternatives to putting out of service. In such cases a load test and certificate are required for the reduced SWL, plus a corresponding entry in the Register Book and a note in the survey report.

The marking of the derrick booms, cranes or loose gear must be correspondingly changed for the time of SWL-reduction.

8.2 Repairs

8.2.1 Bars or components bent, worn or damaged unacceptably shall be properly repaired. In the course of this care is to be taken that no adverse microstructure changes are produced, e.g. as a result of heating for straightening

8.2.2 If repairs to lifting appliances or loose gear have not been carried out to the satisfaction of the **TL** Surveyor or could not be carried out because of lack of time, the **TL** Surveyor must forbid working with the lifting appliance or loose gear until repairs have been completed, or reduce the SWL.

8.2.3 Repairs or other measures are entered into the Register Book and the survey report.

G. Documentation

1. Notes

1.1 The Register Books and certificates to be issued by **TL** are based on international plus national regulations in a form as interpreted by **TL**.

1.2 Secure storage throughout the entire working life of the lifting appliances and the presentation of Register Books, certificates, survey reports and forms to the **TL** Surveyor before the start of any test and/or examination is the responsibility of the ship management or the operator of the lifting appliances.

1.3 Completed examples of the rigging plans can be found in Appendix B.

Blank forms for rigging plans of cranes and derrick booms may be obtained from the Head Office.

1.4 Examples of certificates in the form used by **TL** plus the title pages of the Register Books to be issued by **TL** are shown in Appendix C.

2. Rigging plans

2.1 Rigging plans are required by the ILO for shipborne and harbour lifting appliances.

They contain information useful for operation and maintenance, and for the procurement of spare parts and repair.

2.2 Rigging plans for instance have information on SWLs and load radii, ropes, reeving of ropes, marking, arrangement of the lifting appliances on board the ship, working ranges, materials used, etc.

2.3 In the case of new constructions, rigging plans shall be drawn up by the building yard and presented for every ship (for repeats also) in their final form in sextuplicate to **TL** Head Office not later than a fortnight before the initial test and examination. It is recommended that these plans be submitted in a preliminary form already when the drawings are submitted for plan approval.

2.4 In the rigging plans

"Plan of Cargo-Lifting Gear"

"Crane Rig"

"Derrick Rig"

"Union Purchase"

"Derrick booms"

"Masts and Posts"

the necessary nominal sizes of the individual parts, the minimum breaking load of the ropes and the special conditions for operation of the lifting appliances shall be set out clearly.

2.5 In the case of ships in service, the existing rigging plans are to be used. If appropriate, the ship management or the operator shall have new rigging plans produced based on the existing documentation or on sketches of the installed lifting appliances.

3. Register Books

3.1 Explanatory notes

3.1.1 The purpose of Register Books for lifting appliances (and lift units) is, to provide information at any time about the actual situation as regards general data plus the test-, examination- and maintenance status.

3.1.2 On completion of successfully performed initial tests and examinations and after the stipulated entries have been made by Head Office resp. the **TL** Surveyor, the Register Books described below are handed over by the **TL** Surveyor to the shipyard or the ship management and/or the operator.

3.1.3 In the Register Books all test certificates, results of examinations, reports and other relevant data are collected. They are to be stored at the place of operation and submitted to the **TL** Surveyor or to inspectors on demand.

3.1.4 Register Books are normally unique and kept at the place of operation (exception: lift units).

3.1.5 If Register Books are lost, new ones can be produced on the basis of a test and thorough examination and with the help of **TL** Head Office (supply of Certified True Copies, etc.).

3.1.6 Special versions differing from the Register Books described below may be issued if this is sensible, required or desired and not in conflict with any valid regulations.

3.2 Register Book for cargo-handling appliances

3.2.1 **TL**'s "Register of Ship's Lifting Appliances and Cargo Handling Gear" is based on a model ILO Register Book and is issued by **TL** for ship- borne and harbour lifting appliances, and for ones on offshore installations; also for lifting appliances not used for cargo-handling on foreign-flag ships, in the absence of any special agreements.

3.2.2 The title page of the Register Book is shown on page C-3. Together with the certificates listed under 4.1.1, it is handed over in a plastic cover which also contains the rigging plans described under 2. and further serves to accommodate the survey reports.

3.2.3 Parts 1 and 2 of the Register Book are reserved for entries by the **TL** Surveyor, whereas the inspection of loose gear in part 3 and maintenance measures in part 4 are to be confirmed by the ship management.

3.2.4 A Register Book may cover several lifting appliances together, as is usual for instance on board ship. However if it makes sense Register Books may also be compiled separately for individual lifting appliances, interchangeable jib systems for floating cranes, loose gear, etc.

3.3 Register Book for classed lifting appliances

3.3.1 The "Register of classed Lifting Appliances" is made out in the form of a file.

3.3.2 Each classed lifting appliance gets its own Register Book. In the case of shipbome lifting appliances, only one such Register Book is made out per ship, possibly however in conjunction with the Register Book for cargo-handling appliances described under 3.2, if this is required by the ILO regulations.

3.3.3 The following is an example of what the Register Book contains:

- Title page
- Contents
- Data page
- Maintenance list for the operator
- Test certificates for the interchangeable components
- Rope test certificates
- Lifting appliance test certificates
- List of entries for the TL Surveyor
- Rigging plans
- Operating instructions
- If appropriate further pages as required.

4. Test certificates

A list of the **TL** test certificates for lifting appliances with comments where appropriate follows. Examples of certificates are shown in Appendix C.

4.1 Test certificates for lifting appliances subject to ILO regulations:

4.1.1 Certificate Forms

- **Form STLA2**

  Certificate of test and thorough examination of Lifting Appliances

- **Form STLA2(U)**

  Certificate of test and thorough examination of Derricks used in Union Purchase

- **Form SLA3**

  Certificate of test and thorough examination of Interchangeable Components and Loose Gear

- **Form STLA4**

  Certificate of test and thorough examination of Wire Ropes

4.1.2 The certificates on forms STLA 2, STLA2(U) or STLA3 plus STLA4 are issued by the **TL** Surveyor following the initial test and examination of the lifting appliance, resp. already available certificates STLA3 and STLA4 are embodied in the Register Book to be issued.

4.1.3 Following periodic load tests, the **TL** Surveyor again issues certificates on forms STLA 2/ STLA 2(U).

4.1.4 Following the replacement of components and ropes by spares, the relevant certificates shall be submitted to the **TL** Surveyor on the occasion of the next periodic examination. The **TL** Surveyor transfers these certificates onto the forms STLA3 and STLA4.

4.1.5 The numbers of all certificates issued on forms STLA2 to STLA3 are to be entered in the appropriate parts of the Register Book. This provides the connection between certificates and Register Book.

4.1.6 The certificates issued are to be glued into the Register Book.

4.2 Certificate of Class for Lifting Appliances

On completion of all tests and examinations and following receipt of the **TL** reports and certificates by Head Office, **TL** issues the class certificate and sends it to the operator. The latter adds it to the Register Book which the **TL** Surveyor has already handed over on completion of all tests and examinations.

5. Special forms

Below, the reports, lists or special certificates issued by **TL** are listed and where appropriate commented-on. These special forms are shown in Appendix C.

5.1 Survey report

5.1.1 The survey report is the standard form for all lifting appliances subject to the ILO regulations and one copy is in each case intended for the Register Book.

5.1.2 Similar or different report forms are at the discretion of **TL**.

5.2 Standard test certificates

Test certificate is issued by the **TL** Surveyor in conjunction with final tests and examinations of all kinds. It is also issued in conjunction with load tests of loose gear and interchangeable components, insofar as these are not put into use on ships.

5.3 Test certificates for fibre ropes

Certificate of test and examination of fibre ropes is issued by the **TL** Surveyor or by **TL**-approved firms following the stipulated tensile breaking test and examination.

5.4 Gear and tackle certificate

5.4.1 Gear and tackle certificate is based on the national regulations of various countries for ships more than 15 years old.

It is issued on application and after visual inspection of the lifting appliances by the **TL** Surveyor.

5.4.2 If desired by the ship management, the performed inspection may be accounted as the annual thorough examination.

5.5 ILO model certificates

Comparison of different ILO model certificates

5.5.2 Form 485, by presenting the differences and connections between the former and the new ILO certificates is intended to facilitate the transition to the newly-introduced regulations.

5.5.3 Form 485 is inserted in every ILO Register Book by the TL Surveyor.

5.6 Detailed parts list

List of interchangeable components, loose gear and wire ropes

5.6.2 Form 486 is intended to allow a tighter control of the interchangeable components, loose gear and wire ropes on board. It is recommended that the shipyard or the ship management fill it in at some suitable opportunity, e.g. within the framework of a quinquennial thorough examination, and it is then appended to the rigging plans in the Register Book.

6. Documentation for the operator

6.1 For shipborne lifting appliances (and for lift units) the documentation handed over by **TL** consists of the Register Books described under 3.

For information concerning the up-to-date situation regarding tests and examinations the operator receives one copy of each newly-issued certificate on Forms **TL** YD02 and TL YD02(U) plus every survey report.

6.2 For lifting appliances on offshore installations the operator receives the same documentation as described under 6.1, i.e. one or more Register Books as required.

In addition the operator receives a data folder. The scope of this depends on the documents to hand at **TL** and may for instance comprise the following:

a) Contents

b) Arrangement and consecutive numbering of the lifting appliances on the offshore installation

c) Separately for each lifting appliance, the following details:

- List of documents approved by **TL**
- General details such as for instance:
  - general arrangement
  - performance data
  - copy of rigging plans
  - safety diagrams
  - operating instructions
  - maintenance instructions
- List of **TL** component test certificates
- List of **TL** final test and examination certificates

6.3 For classified lifting appliances, the operator receives an individual classification document for every lifting appliance.

The scope of the documents in this clause depends on the documentation submitted to**TL** and may for instance comprise the following:

a) Contents

b) Copy of class certificate

c) List of documents approved by **TL**

d) General details such as for instance:

- general arrangement drawing
- performance data
- SWL and load radius
- rope reeving and rope data
- force diagrams
- safety diagrams
- operating instructions
- maintenance instructions

Copies of the certificates issued by, or on on behalf of, **TL** for:

- components
- interchangeable components
- wire ropes
- lifting appliances (final test and examinations/tests before being put into use)

Regarding the up to date information, what is stated in 6.1 applies.

6.4 Lifting appliances other than those listed under 6.1 to 6.3 receive such documentation as **TL** considers adequate, or as agreed.

Appendix A

Tables

Contents

APPENDIX A

EXPLANATORY NOTES TO THE TABLES

1. Contents

1.1 The following Tables provide a general view of the dimensions of various structural members and Interchangeable Components

1.2 The permissible wall thicknesses and outside diameters of masts, posts and crane pillars can be determined by reference to Table 1.

1.3 The forces applicable to single span derricks can be determined by reference to the data listed in Tables 2÷ 5.

1.4 The forces in the running parts of tackle can be determined by reference to Table 6.

1.5 The permissible thrust in derrick booms with one span can be determined by reference to Table 7.

1.6 Tables 8 ÷ 46 contain the dimensions of various structural members and Interchangeable Components.

2. Load testing

2.1 For the purposes of these Regulations, Interchangeable Components are parts such as cargo hooks, shackles and blocks for which a component load test is prescribed. Where such components are replaced or repaired, no load test need to be performed of the related lifting appliance or loose gear

2.2 Parts such as goosenecks, heel and head fittings, span trunnion pieces, etc. are not Interchangeable Components. If such parts are replaced or repaired, a load test of the related derrick system is required (for exceptions, see Section 13, D.6)

3. Application

3.1 In order to facilitate interchangeability and the procurement of replacements it is recommended that the dimensions of all components shown in the Tables should be adhered to. Where it is impossible to comply with this recommendation, differences in the dimensions and materials of these components should be indicated in the Rigging Plans.

3.2 In the case of Interchangeable Components, with permissible loads up to 100 tonnes, the dimensions specified in the Tables shall be maintained even when the components are made from materials of greater strength.

3.3 The materials specified in the Tables represent the minimum requirements. With regard to the selection of materials for welded parts the provisions in Section 11 are to be observed.

3.4 The use of parts which differ in design or are made of other materials requires approval. Such parts may be approved as a works standard. Where reference is made to works standards in other drawings, the date and journal number of the approval shall also be stated

3.5 For welding the provisions contained in Section 12 shall be observed. Repair welding of worn parts is not permitted. In special cases **TL** reserves the right to sanction such repairs.

In this connection, reference should be made to Section 13, F. and to the notes to Tables 8, 13, 16 and 23.

3.6 The galvanizing of forged and cold formed parts is permitted only if the suitability of the material is proven.

Forged Interchangeable Components may be galvanized only after the parts have undergone the component load test.

3.7 Screw connections are to be secured.

In the case of screw connections exposed to seawater the use of spring washers is not permitted.

TABLE 1

Greatest Permissible Outer Diameter Of Steel Masts, Posts And Pedestals Dependent On The Wall Thickness 1)

Wall thickness s	Ratio of the greatest occurring stress to the permissible stress of the material **2)**										
	1,0	0,91	0,83	0,76	0,70	0,64	0,57 **3)**	0,5 **3)**	1,0	0,80	0,64
	Masts or posts completely closed or accessible for inside inspection								Open Masts or posts not accessible for inside inspection		
	Greatest admissible outer diameter D										
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
6	315	330	350	365	380	395	-	-	-	-	-
6,5	350	370	390	405	425	440	-	-	-	-	-
7	390	410	430	450	470	490	-	-	-	-	-
7,5	430	450	470	490	515	535	-	-	430	450	470
8	470	495	520	540	565	590	-	-	470	495	520
8,5	515	540	570	590	620	645	-	-	515	540	570
9	560	590	615	645	670	700	-	-	560	590	615
9,5	615	645	680	710	740	770	-	-	615	645	680
10	665	700	735	770	800	835	880	940	665	700	735
10,5	720	760	795	830	865	900	950	1020	720	760	795
11	785	825	860	900	940	980	1040	1110	785	825	860
11,5	850	890	935	975	1020	1060	1130	1200	850	890	935
12	920	965	1010	1060	1100	1150	1220	1300	920	965	1010
12,5	1000	1050	1100	1150	1200	1250	1330	1410	1000	1050	1100
13	1080	1130	1190	1240	1300	1350	1430	1530	1080	1130	1190
14	1270	1340	1400	1460	1530	1590	1680	1790	1270	1340	1400
15	1500	1575	1650	1725	1800	1875	2000	2110	1500	1575	1650
16	1700	1785	1870	1950	2030	2130	2240	2400			
17	1900	1990	2090	2180	2270	2360	2520	2550			
18	2100	2200	2310	2410	2510	2620	2700	2700			
19	2300	2410	2530	2650	2750	2850	2850	2850			
20	2500	2620	2730	2850	3000	3000	3000	3000			
22	2900	3030	3180	3300	3300	3300	3300	3300			
24	3300	3450	3600	3600	3600	3600	3600	3600			
26	3700	3870	3900	3900	3900	3900	3900	3900			
28	4100	4200	4200	4200	4200	4200	4200	4200			
30	4500	4500	4500	4500	4500	4500	4500	4500			
30 and more	150 · s	150 · s	150 · s	150 · s	150 · s	150 · s	150 · s	150 · s			

1) *Greater wall-thicknesses may be necessary in way of the outer forces and of the foundation.*

2) *Valid for materials up to a yield point of* R_{eH}*=355 N/mm*^{2}

3) *These values are not to be used if damages by handling of cargo (e. g. by grab discharge) are possible.*

TABLE 2

Loads P_B and H in single-span gears with derrick booms according to Figure A-1 ÷ A-3

Denomination of resultant loads	Number of sheaves in cargo purchase blocks	Inclination of derrick	Resultant loads for 1 t SWL of gear 1**)**						
			Ratio height of suspension: length of derrick = (1-a) :l_B						
			0,4	0,5	0,6	0,7	0,8	0,9	1,0
			kN	kN	kN	kN	kN	kN	kN
P_B	1		35,5	30,5	27,2	24,8	23,0	21,6	20,5
	1+1		30,4	25,4	22,1	19,7	17,8	16,5	15,4
	1+2		28,7	23,7	20,4	18,0	16,2	14,8	13,7
	2+2		27,8	22,8	19,5	17,1	15,3	13,9	12,8
	2+3		27,3	22,3	19,0	16,6	14,8	13,4	12,3
	3+3		27,0	22,0	18,7	16,2	14,4	13,1	12,0
	3+4		26,7	21,8	18,5	16,0	14,3	12,9	11,7
	4+4		26.6	21,6	18,3	15,8	14,1	12,7	11,5
H	Without influence	15°	24,4	19,9	17,1	15,2	13,9	12,9	12,2
		30°	21,8	17,3	14,5	12,7	11,5	10,6	10,0
		45°	19,3	14,7	11,9	10,1	8,92	8,15	7,66

Number of sheaves in cargo purchase blocks	Resultant loads for 1 t SWL **1)** of gear			
	Blocks with sliding bearings		Blocks with anti-friction bearings	
	L_s **3)**	L_b	L_s **3)**	L_b
	kN	kN	kN	kN
1	11,0	20,0	10,4	20,0
1+1	5,65	15,4	5,26	15,2
1+2	3,86	13,7	3,54	13,5
2+2	2,96	12,8	2,68	12,6
2+3	2,43	12,3	2,16	12,1
3+3	2,07	12,0	1,82	11,8
3+4	1,81	11,7	1,58	11,6
4+4	1,62	11,5	1,40	11,4

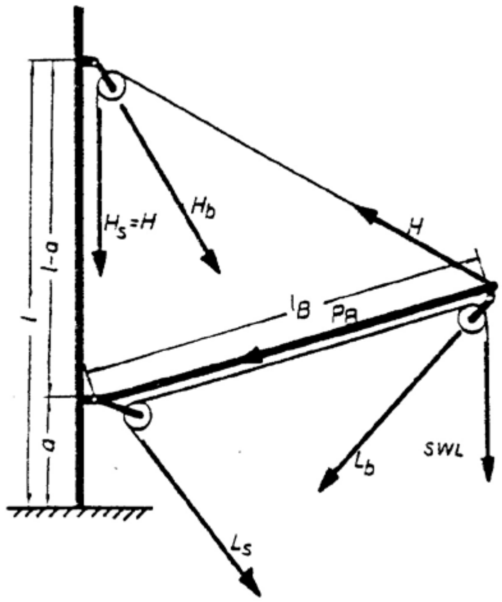


Figure A-1

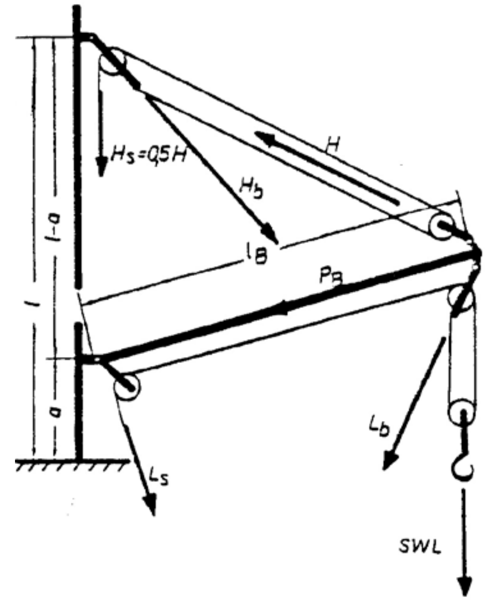


Figure A-2

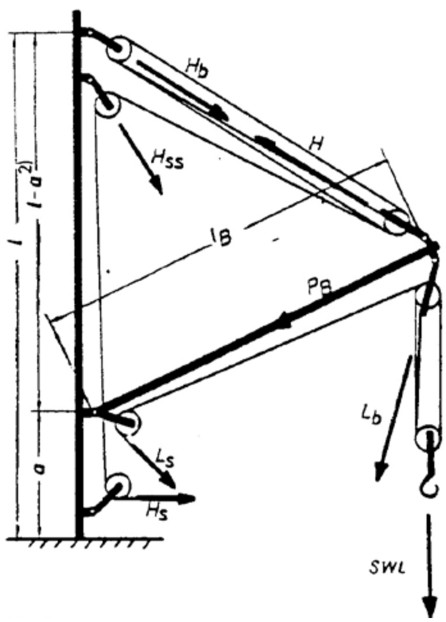


Figure A-3

Denomination of resultant loads

SWL : safe working load of gear

P_B : axial thrust on derrick boom

L_b : resultant load on head fitting of derrick head cargo block or cargo purchase block

L_s : tension in cargo runner or in cargo purchase runner (rope tension of winch)

H : load on span or resultant load on head fitting of derrick head span tackle block

H_b : resultant load on head fitting of mast head span block or span tackle block

H_{ss} = resultant load on head fitting of mast head lead block for span tackle

H_s : tension in span rope or in span tackle rope (rope tension of winch)

1) *All resultant loads and rope tensions refer to a SWL of gear of 1 t. The actual loads and tensions are to be determined by multiplying by the actual SWL.*

For loads H_b and H_s see Tables 3 or 4 respect. For load H_{ss} see Table 5. Examples see footnote to Table 5.

2) *If the upper span lead block according to fig. A-3 , is not arranged at the same level as the upper span tackle block, the ideal height (1-a) has to be especially determined. Intermediate values of the ratio (1-a): 1_B to be interpolated.*

3) *It has to be observed that with the usual gear 3 to 5 t SWL (3 t single-reeved and 5 t double-reeved) the cargo runner has to be dimensioned after the pull with 3 t SWL*

TABLE 3

Loads H_s and H_b, in single-span gears with derrick booms without span lead block according to fig. A-1 and fig. A-2. Blocks with sliding bearings and anti-friction bearings

	Rope tension H_s for a load on span H = 1 kN **1)**	
	Single reeeved span	Double reeeved span
	kN	kN
Span not to be adjusted under load	1,0	0,5
Span to be adjusted under load Blocks with sliding-bearings	1,05	0,538
Span to be adjusted under load Blocks with anti-friction bearings)	1,02	0,516

Span	Inclination of derrick	Resultant loads H_B for a load on span H = 1 kN **1)**						
		Ratio height of suspension:length of derrick= (l-a) / l_B						
		0,4	0,5	0,6	0,7	0,8	0,9	1,0
		kN	kN	kN	kN	kN	kN	kN
Single-reeved	15°	1,51	1,58	1,63	1,68	1,73	1,76	1,79
	30°	1,33	1,41	1,49	1,57	1,63	1,69	1,73
	45°	1,10	1,20	1,30	1,40	1,50	1,59	1,66
Double-reeved	15°	1,18	1,22	1,26	1,29	1,32	1,34	1,36
	30°	1,07	1,12	1,17	1,21	1,26	1,29	1,32
	45°	0,923	0,984	1,05	1,11	1,17	1,23	1,28

1) *All resultant loads and tensions refer to the span load of 1 kN. For different loads on span the loads and tensions are determined by multiplying by the the span load H according to Table 2.*

Intermediate values of the ratio (1-a): 1_B to be interpolated.
As for denomination of loads see Table 2.
For loads P_B, H, L_s and L_b see Table 2.
Examples see Table 5

TABLE 4

Loads H_s and H_b in single-span gears with derrick booms with span lead block according to fig. A-3.
Blocks with sliding and anti-friction bearings.

Number of sheaves in span tackle blocks	Resultant loads for a load on span H=1 kN **1)**			
	Blocks with sliding-bearings		Blocks with anti-friction bearings	
	H_s	H_b	H_s	H_b
	kN	kN	kN	kN
1	0,565	0,512	0,525	0,504
1+1	0,386	0,683	0,354	0,673
1+2	0,296	0,768	0,267	0,754
2+2	0,242	0,819	0,216	0,808
2+3	0,207	0,853	0,182	0,842
3+3	0,182	0,877	0,158	0,865
3+4	0,163	0,895	0,140	0,884
4+4	0,148	0,909	0,125	0,898
4+5	0,136	0,921	0,114	0,909
5+5	0,126	0,930	0,104	0,918
5+6	-	-	0,096	0,925
6+6	-	-	0,090	0,932
6+7	-	-	0,086	0,938

1) *See explanation, Table 3.*

For resultant loads P_B, H, L_s and L_b, see Table 2

For resultant loads L_{SS} and H_{SS}, see Table 5

Examples see footnote, Table 5

TABLE 5

Load H_{ss} in single-span gears with derrick booms. Resultant load on head fitting of upper lead block for span tackle rope according to fig. A-3.
Blocks with sliding and anti-friction bearings

Inclination of derrick	Resultant load H_{ss} for a tension in span tackle runner Hs = 1 kN *)						
	Ratio height of suspension: length of derrick = (l-a) / l_B						
	0,4	0,5	0,6	0,7	0,8	0,9	1,0
	kN	kN	kN	kN	kN	kN	kN
15°	1,47	1,53	1,58	1,63	1,67	1,71	1,74
30°	1,29	1,37	1,45	1,52	1,58	1,63	1,68
45°	1,06	1,16	1,26	1,36	1,46	1,54	1,61

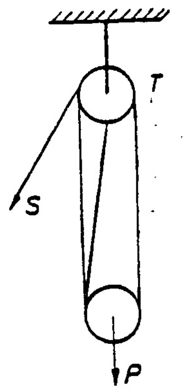
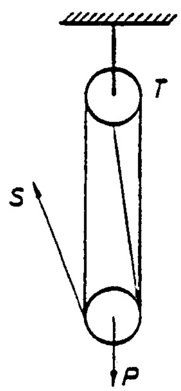
For resultant loads PB, H, L_s and L_B see Table 2. For resultant loads H_s and H_B see Table 3 or 4.
P_B, H, L_s ve L_B bileşke yükleri için Tablo 2'ye, H_s ve H_B bileşke yükleri için Tablo 3 ve 4'e bakınız.
*) *See Table 4.*

Examples :

Gear according to	Figure A-2	Figure A-3
SWL	3 - 5 t	20 t
Inclination of derrick	15°	45°
(l-a) / l_B	0,6	1,0
Number of sheaves in cargo purchase	1+1 anti-friction bearings	2+3 slinding bearings
in span tackle	1+1 sliding bearings span not to be adjusted under load	3+3 slinding bearings
From Table	2	2
P_B	22.1 kN x 5 = 110.5 kN	12.3 kN x 20 = 246.0 kN
H	17.1 kN x 5 = 85.5 kN	7.66 kN x 20 = 153.2 kN
L_s	10.4 kN x 3 = 31.2 kN	2.43 kN x 20 = 48.6 kN
L_b	15.2 kN x 5 = 76.0 kN	12.3 kN x 20 = 246.0 kN
From Table	3	4
H_s	85.5 kN x 0.5 = 42.8 kN	153.2 kN x 0.182 = 27.9 kN
H_b	85.5 kN x 1.26 = 107.7 kN	153.2 kN x 0.877 = 134.4 kN
From Table	-	5
H_{ss}	-	27.9 kN x 1.61 = 44.9 kN

TABLE 6

ROPE TENSIONS IN THE RUNNING PARTS OF TACKLES

	Number of sheaves in the tackle	Static load	Blocks with anti-friction bearings **1)**		Blocks with sliding bearings **2)**	
			Hoisting	Lowering	Hoisting	Lowering
Form A		η **3)**				
	1	1,000	1,020	0,981	1,050	0,952
	2	0,500	0,516	0,485	0,538	0,465
	3	0,333	0,347	0,320	0,367	0,302
	4	0,250	0,263	0,238	0,282	0,221
	5	0,200	0,212	0,188	0,231	0,172
	6	0,167	0,178	0,155	0,197	0,140
	7	0,143	0,155	0,132	0,173	0,117
	8	0,125	0,137	0,114	0,155	0,100
	9	0,111	0,123	0,100	0,141	0,086
	10	0,100	0,111	0,090	0,130	0,075
	11	0,091	0,102	0,081	0,120	0,067
	12	0,083	0,095	0,073	0,113	0,060
S = P · η	13	0,077	0,088	0,067	-	-
T = P + S	14	0,071	0,083	0,061	-	-
Form B		η **3)**				
	1	0,500	0,505	0,496	1	0,500
	2	0,333	0,340	0,327	2	0,333
	3	0,250	0,257	0,243	3	0,250
	4	0,200	0,208	0,192	4	0,200
	5	0,167	0,175	0,159	5	0,167
	6	0,143	0,152	0,135	6	0,143
	7	0,125	0,134	0,117	7	0,125
	8	0,111	0,120	0,102	8	0,111
	9	0,100	0,110	0,091	9	0,100
	10	0,091	0,100	0,082	10	0,091
	11	0,083	0,093	0,075	11	0,083
	12	0,077	0,087	0,068	12	0,077
S = P · η	13	0,071	0,081	0,063	13	0,071
T = P + S	14	0,067	0,076	0,058	14	0,067

1) *Blocks with anti-friction* bearings are calculated with a bending resistance and sheave friction of 2 % per sheave

2) *Blocks with sliding bearings are calculated with 5 per cent per sheave*

3) *For tackle Form A* *For tackle Form A*

Hoisting

$$\eta = \frac{K^n(K-1)}{K^n-1}$$

Lowering

$$\eta = \frac{K-1}{K(K^{n+1}-1)}$$

Hoisting

$$\eta = \frac{K^n(K-1)}{K^{n+1}-1}$$

Lowering

$$\eta = \frac{K-1}{K^{n+1}-1}$$

Where; K = *Friction allowance 1,02 or 1,05 resp. according to* **1)** and **2)**

n = *Number of sheaves in the tackle.*

TABLE 7

for single-span gears
with a ratio of height of suspension to length of derrick boom (l-a): l_B from 0,4 up to 0,8

Dia. of the calculated section	Permissible of wall-thickness S	Factor f_1 Factor K For the following lengths of derrick boom l_B in mm											
mm	mm	6,0	6,5	7,0	7,5	8,0	8,5	9,0	9,5	10,0	10,5	11,0	11,5
100	4,0-6,0	0,41 0,23	0,36 0,20	0,32 0,18	-	-							
150	4,5-6,5	1,18 0,35	1,06 0,32	0,96 0,29	0,87 0,26	0,78 0,24	0,72 0,21	0,65 0,19	0,60 0,18	0,55 0,16	0,51 0,15	-	-
200	5,0-7,0			1,90 0,41	1,73 0,37	1,60 0,34	1,48 0,32	1,37 0,29	1,26 0,27	1,17 0,25	1,09 0,23	1,02 0,22	0,95 0,20
250	5,5-7,5						2,53 0,40	2,38 0,37	2,21 0,35	2,06 0,32	1,94 0,30	1,81 0,28	1,69 0,27
300	6,0-8,0									3,11 0,41	2,96 0,39	2,78 0,36	2,62 0,34
350	6,5-9,0												3,81 0,41
400	7,0-10,0												
450	7,5-11,0												
500	8,0-12.0												
550	9,0-13.0												
600	9,5-14.0												
650	10,0-15,0												
700	10,5-16,0												

Note:

Extrapolation to longer derrick booms not given in the Table is not permitted as in this case the permissible degree of slenderness λ will be exceeded.

The factor f_1 takes into account the compressive and bending stresses on the basis of a yield point of the material of R_{eH} = 355 N/mm^2.

When using material with different yield point, the factor K is to be taken into account.

The diameter and thickness of the boom tube at its centre are to be maintained over a distance of not less than 0.8 of the length of the derrick boom l_B.

This Table applies to derrick booms with single- reeved cargo runners. In case of derrick booms with multiple-reeved cargo runners the permissible boom thrust can be determined on the basis of the provisions in Section 3.

Permissible thrust on derrick boom:

a) for the section at 0.5 of the length of the derrick boom $l_{B:}$

$$P_{B1} = f_1 \text{ x } s \left[1 - K \left(1 - \frac{R_{eH}}{355}\right) \right] x10 \qquad [kN]$$

b) Fort he section at the ends of the derrick boom:

$$P_{B2} = f_2 \text{ x } s \text{ x } \frac{R_{eH}}{355} \text{ x } 10 \qquad [kN]$$

c) for the complete derrick boom:

The permissible thrust on derrick boom P_{Bzul} is equal to the smaller one of the two values according to a) and b)

Where:

R_{eH} = the yieldpoint of the material in (N/mm^2).

FACTORS FOR THE DETERMINATION OF THE PERMISSIBLE THRUST ON DERRICK BOOMS

Factor f_1 Factor K For the following lenghts of derrick booms l_B in mm														Factor F_2
12,0	12,5	13,0	13,5	14,0	14,5	15,0	16,0	17,0	18,0	19,0	20,0	21,0	22,0	
														0,90
														1,61
0,88 0,19	0,82 0,18	0,77 0,17	0,72 0,16	0,68 0,15	-	-								2,22
1,60 0,25	1,50 0,23	1,40 0,22	1,33 0,21	1,25 0,20	1,18 0,19	1,13 0,18	1,00 0,16	0,91 0,14	-	-				2,96
2,47 0,32	2,35 0,31	2,22 0,29	2,10 0,27	2,00 0,26	1,90 0,25	1,80 0,24	1,63 0,21	1,47 0,19	1,35 0,18	1,23 0,16	1,13 0,15	1,03 0,14	-	3,54
3,62 0,39	3,44 0,37	3,28 0,35	3,12 0,33	2,97 0,32	2,79 0,30	2,67 0,28	2,43 0,26	2,22 0,24	2,04 0,22	1,87 0,20	1,72 0,18	1,59 0,17	1,47 0,16	4,30
		4,40 0,41	4,18 0,39	4,02 0,38	3,82 0,36	3,68 0,35	3,39 0,32	3,08 0,29	2,84 0,27	2,62 0,25	2,42 0,23	2,25 0,21	2,09 0,20	4,89
		5,51 0,44	5,37 0,43	5,27 0,42	5,09 0,41	4,89 0,39	4,48 0,36	4,15 0,33	3,86 0,31	3,54 0,28	3,30 0,26	3,08 0,25	2,85 0,23	5,65
				6,32 0,44	6,21 0,43	6,06 0,42	5,73 0,40	5,37 0,38	4,96 0,35	4,61 0,32	4,33 0,30	4,02 0,28	3,74 0,26	6,42
				7,39 0,46	7,25 0,45	7,15 0,44	6,91 0,43	6,60 0,41	6,21 0,38	5,82 0,36	5,44 0,34	5,11 0,32	4,80 0,30	7,19
						8,21 0,45	7,94 0,44	7,71 0,43	7,42 0,41	7,11 0,39	6,74 0,37	6,31 0,35	5,91 0,33	7,97
						9,32 0,47	9,03 0,45	8,79 0,44	8,56 0,43	8,24 0,41	8,01 0,40	7,57 0,38	7,17 0,36	8,75
										9,35 0,43	9,08 0,42	8,79 0,40	8,53 0,39	9,53

Examples:

1. Derrick boom 318 x 245 x 7,5, Length of derrick boom l_B =18,0 m., Material St35 DIN 1629, R_{eH} =235 N/mm^2

a) Section at l_B bumba boyunun 0,5'indeki kesitte; boru 318 x 7,5

f_1 (interpolated) = 1,60

K (interpolated) = 0,19

$$P_{B1} = 1{,}60 \text{ x } 7{,}5 \left[1 - 0{,}19 \left(1 - \frac{235}{355}\right)\right] \text{ x } 10 = 112{,}3 \text{ kN}$$

b) Section at the ends of the derrick boom : boru 245 x 7,5

f_2 (ınterpolated) = 2,88

$$P_{B2} = 2{,}88 \text{ x } 7.5 \text{ x } \frac{235}{355} \text{ x } 10 = 143{,}0 \text{ kN}$$

Permissible thrust on derrick boom = smaller one of the two values according to a) and b):

P_{Bzul} = 112,3 kN

Notes to Table 8:

Head fittings

1. The nominal sizes of the head fittings correspond to the forces L_b and H acc. to Table 2 which are to be determined without hoisting- and dead load coefficients.

2. Where two head fittings are to be fitted at different distances along the derrick boom, the second head fitting must also be provided with eyes for the span and the guys unless calculatory proof has been supplied that the dimensions of the derrick boom are sufficient even when the span and the guys do not act at the same point along the derrick boom as the load.

3. Long links and rings may not be welded into the eyes of the derrick head fittings.

4. Repair welds to worn head fittings are allowed subject to the provisions of Sections 13, F.

5. Where guy plates are used only to connect guys, their nominal size is to be determined in accordance with the provisions of Section 3. Where preventers are also to be connected to these plates, their dimensions shall be established with reference to the load exerted by the preventer. For the determination of the tension in preventers see Section 3, C.1.3.

6. If the preventer is to be looped over the boom head, a rope catch is to be fitted (see Figure 1-1).

TABLE 8

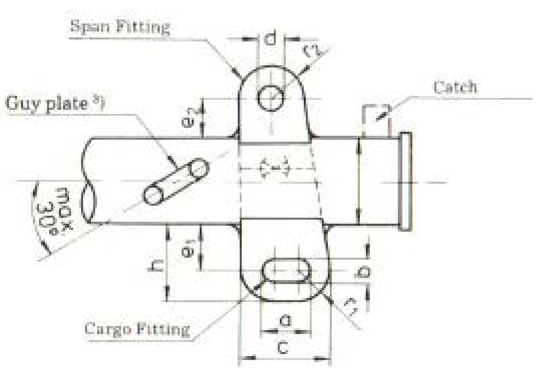
DERRICK HEAD FITTINGS

According to DIN/ISO 8/48, Oct. 86, St37-3 U, St37-3 N, DIN EN 10025

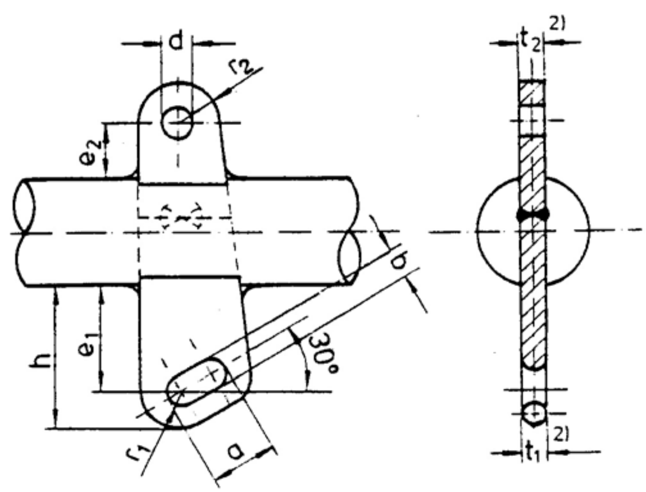
Material: Fe 360-B, Fe 360-C, Fe 360-D, ISO 630

Nominal size		Permissible load L_b, H	Cargo Fitting						Span Fitting			
Cargo fitting	Span fitting		a x b	c	e_1	h	r_1	t_1 **2)**	d	e_2	r_2	t_2 **2)**
		kN	mm x mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
2	2	20	50 x 27	100	49.5	88	38.5	25	25	40	25	22
2.5	2.5	25	55 x 29	105	53.5	93	39.5	25	27	40	28	25
3	3	32	66 x 33	126	56.5	103	46.5	30	30	45	30	28
4	4	40	77 x 36	147	65	118	53	35	33	50	33	30
5	**5**	50	87 x 41	167	70	130.5	60.5	40	39	55	38	35
6	6	63	91 x 45	171	75	137.5	62.5	40	42	60	43	40
8	**8**	80	101 x 51	201	80	155.5	75.5	50	48	70	48	45
10	10	100	117 x 56	217	90	168	78	50	52	75	55	50
12	**12**	125	128 x 61	248	100	190.5	90.5	60	56	80	60	55
16	16	160	145 x 67	265	115	208.5	93.5	60	65	85	65	60
20	**20**	200	157 x 73	297	125	231.5	106.5	70	74	95	70	65
25	25	250	170 x 80	331	135	255	120	80	78	100	75	70
32	**32**	320	194 x 88	374	150	284	134	90	86	110	85	80
40	40	400	220 x 98	420	170	319	149	100	96	120	95	90
-	50	500	-	-	-	-	-	-	106	135	105	100
-	63	630	-	-	-	-	-	-	116	150	115	110

Form A



Form B



Symbol :

According to nominal size of cargo fitting, nominal size of span fitting,

Form of derrick head fitting and No. of Table e.g.: derrick head fitting 10 x 12 - B - [8]

1) *The nominal sizes to be used preferably are printed in bold type.*

2) *If the derrick head fitting is to be made of one piece with same plate thickness, the greater of the two thickness, t_1 and t_2 has to be taken.*

3) *Guy plate acc. to Table 26, Form B.*

Notes to Table 9:

Heel fittings and cross bolts

1. For derrick booms individually slewed with guys, the nominal size of the heel fitting corresponds to the boom thrust P_B calculated without hoisting- and dead load coefficients.

2. Heel fittings for derricks used in union purchase are to be dimensioned for a nominal size corresponding to at least four times the Safe Working Load SWL (U) when the head fitting according to Table 8 is used, unless it can be proved by calculation that smaller dimensions are sufficient.

3. The nominal sizes required for the heel fittings of twin span gears shall be specially determined by reference to the torsional moments occuring in the derrick boom.

4. The cross bolts of heel fittings type B shall take the form of bolts with heads and crown nuts. When securely tightened, the crown nut shall be fastened with a split-pin

5. The bolts prescribed for use as cross bolts may be fitted with a flat head and a flat crown nut or nut. Their thread including the runout may only be so long that the smooth shank of the bolt extends over a length of at least 2/3 of the thickness of the lugs.

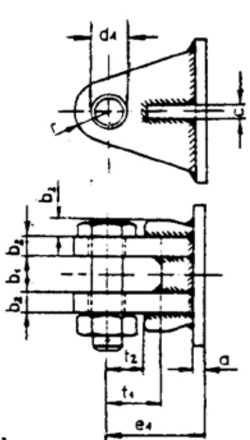
TABLE 9
HEEL FITTING
According to DIN/ISO 6044, October 86*)

Member:	Material:
Derrick heel fitting :	RSt37-2, St37-3 U, St37-3 N, DIN EN 10025, Fe 360-B, Fe 360-C, Fe 360-D, ISO 630
Cross-bolt :	St44-2, DIN EN 10025, Fe 430-B, ISO 630

Nominal size	P_B	Heel fitting								Cross-bolt for heel fitting	
		a	b_1	b_2	c	d_1	e_1	t_1	t_2	Screw	Ø of split pin
	kN	mm	mm	mm	mm	mm	mm	mm	mm		mm
1.6	16	8	28	16	16	24	95	32	25	M 22	5
2	20	8	30	16	16	26	105	35	28	M 24	6
2.5	25	10	32	22	16	29	122	45	32	M 27	6
3	32	10	35	22	16	32	127	50	35	M 30	6
4	40	12	38	25	22	35	135	50	38	M 33	8
5	50	15	42	25	22	41	150	55	42	M 39	8
6	63	15	47	32	22	44	160	60	45	M 42	8
8	80	18	53	32	22	47	175	65	50	M 45	8
10	100	18	60	40	25	54	195	70	60	M 52	10
12	125	22	67	40	25	58	210	75	65	M 56	10
16	160	22	76	45	25	67	230	85	70	M 64	10
20	200	25	85	50	32	75	260	95	75	M 72 x 6	10
25	250	25	95	60	32	79	285	100	80	M 76 x 6	13
32	320	25	105	70	40	83	295	105	85	M 80 x 6	13
40	400	25	115	70	40	93	325	115	95	M 90 x 6	13
50	500	25	127	80	50	104	350	125	100	M 100 x 6	13
63	630	25	144	80	50	114	365	135	105	M 110 x 6	13
80	800	30	154	100	70	129	380	160	125	M 125 x 6	16
100	1000	30	164	100	70	144	400	175	135	M 140 x 6	16
125	1250	35	184	120	80	164	450	200	150	M 160 x 6	16
160	1600	40	204	130	90	184	510	225	170	M 180 x 6	20
200	2000	45	230	140	100	205	565	250	190	M 200 x 6	20
250	2500	50	255	150	110	225	620	275	210	M 220 x 6	24

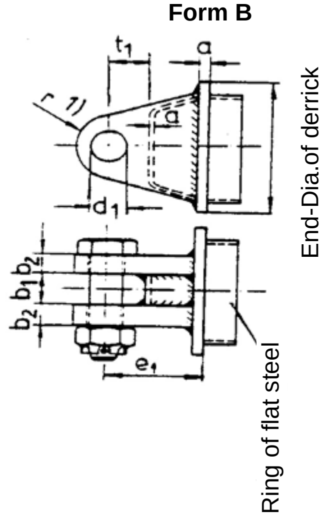
*) The dimensions a and c are not standardized.

Form A



1) $r = d_1$

Form B



Symbol :

According to nominalsize, Form and Table

e.g.: derrick heel fitting 25A - [9]

Notes to Tablo 10 ÷ 15:

Goosenecks, gooseneck bearings and accessories

1. In the case of single span gear, the nominal sizes of these parts correspond to the boom thrust P_B calculated without hoisting- and dead load coefficient. The nominal sizes of such parts for twin span derricks are to be determined by calculation based on the boom thrust and the torsion.

2. Goosenecks and gooseneck bearings for derricks used in union purchase are to be dimensioned for a nominal size corresponding to at least four times the Safe Working Load SWL (U) when the head fitting according to Table 8 is used, unless it can be proved by calculation that smaller dimensions are sufficient.

3. The width of the gooseneck bearing acc. to Table 14 must be chosen in such a way that the bearing collar plate encloses the mast or post over an extension corresponding to a sector angle of at least 2 · 40° . For the foot bearing plate, an extension corresponding to 2 · 30° is sufficient. The b_3 dimension shall not, however, be less than the value indicated. Where gooseneck bearings are fitted to masts or posts with specially small or large diameters, it may be necessary to depart from these requirements.

4. In the case of goosenecks of type GC to Table 12, the clear distance between the collar and foot bearing bushes must be equal to at least three times the gooseneck diameter in the collar bearing

5. Drainage holes are to be provided in foot bearings.

6. Goosenecks are to be made in one piece.

7. Lead block holders shall normally be made in one piece. On application **TL** may approve companies for the manufacture of welded lead block holders acc. to Table 13 provided that the following conditions are met:

a) The material used is suitable

b) The method used for welding the lead block holders has been approved by **TL**.

c) All lead block holders are subjected to a crack-detection test after manufacture.

d) The leadblock holders are clearly identified by an approval mark.

e) Before being fitted, every lead block holder is submitted to a load test with the test loads for components specified in Table 7-4.

The approval may be withdrawn from the company by **TL**.

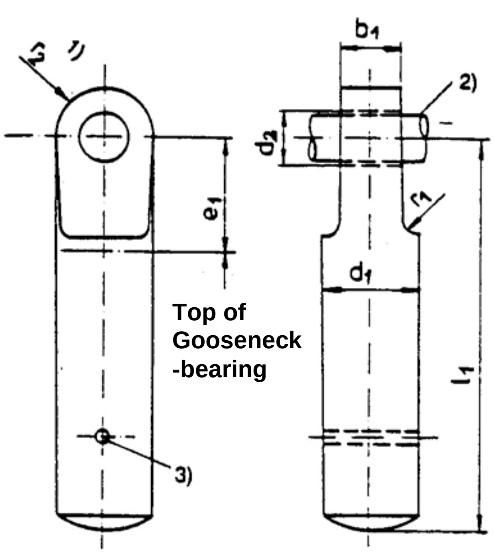
8. The stop lug may be welded on to lead block holders without restriction but the requirements acc. to Section 12 are to be observed.

TABLE 10

GOOSENECK FORM GA
According to DIN/ISO 6045, Febr. 88

Material: St44-2, DIN EN 10025, Fe 360-B, ISO 630

Nominal size	Permissible load	b_1	d_1	d_2	e_1	l_1	r_1
	kN	mm	mm	mm	mm	mm	mm
1.6	16	26	50	24	50	245	5
2	20	28	50	26	60	235	5
2.5	25	30	60	29	60	255	6
3	32	33	70	32	85	325	6
4	40	36	70	35	70	310	6
5	50	40	80	41	85	345	8
6	63	45	90	44	100	380	8
8	80	50	100	47	105	420	8
10	100	57	110	54	120	455	10
12	125	64	120	58	125	500	10
16	160	73	140	67	150	545	12



Symbol :
According to nominalsize Form and no. of Table

e.g.: Gooseneck 8GA - [10]

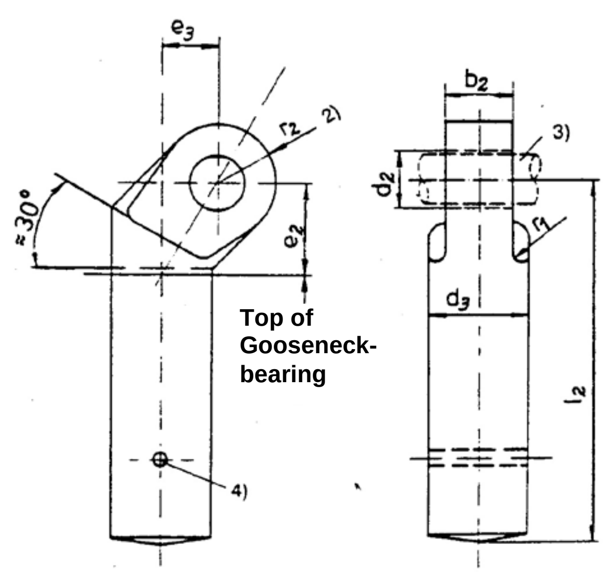
1) $r_2 \approx 0{,}5\ d_1$
2) *Cross-bolt for hell fitting according to Table 9*
3) *Drill hole for adjusting ring pin according to Table 13*

TABLE 11

GOOSENECK FORM GB
According to DIN/ISO 6045, Febr. 88

Material: St44-2, DIN EN 10025, Fe 430-B, ISO 630

Nominal size	Permissible load P_B **1)**	b_2	d_2	d_3	e_2	e_3	l_2	r_1
	kN	mm	mm	mm	mm	mm	mm	mm
2.5	25	30	29	55	60	35	245	6
3	32	33	32	60	65	38	260	6
4	40	36	35	65	70	40	290	6
5	50	40	41	70	80	46	320	8
6	63	45	44	80	85	49	345	8
8	80	50	47	90	90	52	370	8
10	100	57	54	100	100	58	415	10
12	125	64	58	110	105	61	440	10
16	160	73	67	120	110	64	485	12
20	200	82	75	130	115	67	510	12
25	250	92	79	140	125	72	520	15
32	320	102	93	155	135	78	575	15
40	400	112	93	170	150	85	590	20



Symbol :
According to nominal size, Form and No. of Table
e.g.: Gooseneck 10GB - [11]

1) *Permissible load through double luf fitting according to Tablo 9.***)**
2) $r_2 \approx 0,5\ d_1$
3) *Cross bolt for double luf fiiting according to Table 9*
4) *Bolt for adjusting ring pin according to Table 13*

TABLE 12

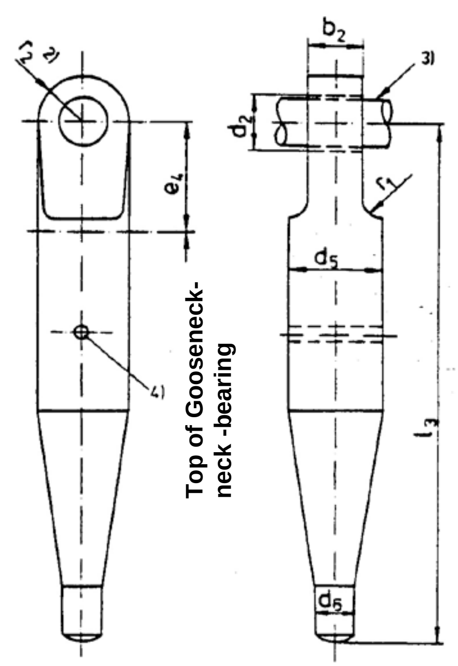
GOOSENECK FORM GC

According to DIN/ISO 6045, Febr. 88*)

Material: St44-2, DIN EN 10025, Fe 430-B, ISO 630

Nominal size	Permissible load **1)**	b_2	d_2	d_5	d_6	e_4	l_3	r_1
	kN	mm	mm	mm	mm	mm	mm	mm
20	200	82	75	155	90	170	820	12
25	250	92	79	180	90	200	910	15
32	315	102	83	190	100	210	950	15
40	400	112	93	190	100	220	960	15
50	500	124	103	200	110	220	1010	20
63	630	140	113	225	110	245	1120	20
80	800	150	129	250	120	275	1235	25
100	1000	160	144	275	120	290	1335	25
125	1250	180	165	320	140	340	1540	30
160	1600	200	185	360	160	385	1725	35
200	2000	225	205	400	190	425	1905	35
250	2500	250	225	440	220	465	2085	40

*) Only nominal sizes 20 to 100 standardized.



Symbol :

According to nominal size, Form and No. of Table

e.g.: Gooseneck 25GC - [12]

1) *Permissible load through double lug fitting according to Table 9.*

2) $r_2 \approx 0{,}5\ d_5$

3) *Cross bolt for double lug fitting, according to Table 9*

4) *Bolt for adjusting ring pin according to Table 13*

TABLE 13

LEAD BLOCK HOLDERS AND ADJUSTING RINGS

According to DIN/ISO 6045, Febr. 88*)

Member:	Material:
Lead block holder }	RSt37-2, DIN EN 10025
Adjusting ring }	Fe 360-B, ISO 630
Adjusting ring pin :	St42-2, DIN EN 10025, Fe 430-B, ISO 630

Dia.of gooseneck	d_1	d_2	d_3	h_1	h_2
mm	mm	mm	mm	mm	mm
50	52	75	12	40	50
55	57	85	12	40	50
60	62	90	12	40	50
65	68	95	12	50	65
70	73	100	16	50	65
80	83	110	16	50	85
90	93	120	16	50	85
100	103	140	20	60	110
110	113	150	20	60	110
120	123	170	20	80	130
130	134	180	20	80	130
140	144	190	20	80	130
160	164	210	25	80	150
180	184	230	25	80	150
190	194	240	25	80	
200	204	250	25	80	
225	230	280	25	80	
250	255	300	30	80	
280	285	335	30	80	
320	325	380	35	100	
360	365	420	35	100	
400	405	470	40	100	
440	445	510	40	100	

***)** *Standardized only for dia. of gooseneck 50 to 275*

Symbol :

For lead block holder

According to nominalsize , Form, diameter of the gooseneck and No. of Table

e.g: Adjusting ring room 10F x 140-[13]

For adjusting ring

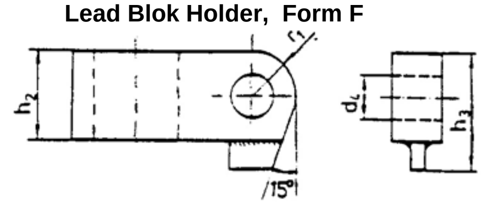
Accoring to diameter of the gooseneck, form and No. of Table

e.g.: Adjusting ring room 190J - [13]

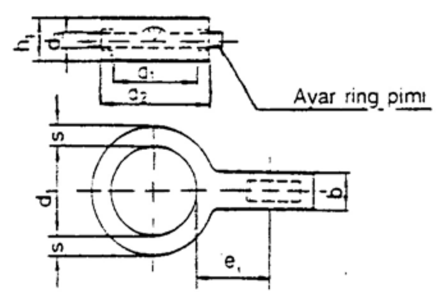
Nominal size	Permissible load	b_1	d_4	h_3	r_1	s	b_2	b_3	e_1
	kN	mm	mm	mm	mm	mm	mm	mm	mm
2	20	22	24	75	25	14	26	12	49
4	40	30	33	100	32	16	35	15	61
6	63	40	42	130	43	18	45	20	78
10	100	50	52	165	55	22	58	26	98
12 **1)**	125	55	56	180	60	25	64	28	108
16	160	60	66	195	65	28	70	30	118

1) *Nominal size 12 not standardized.*

Lead Blok Holder, Form F



Adjusting Ring, Form J



Lead Block Holder, Form H

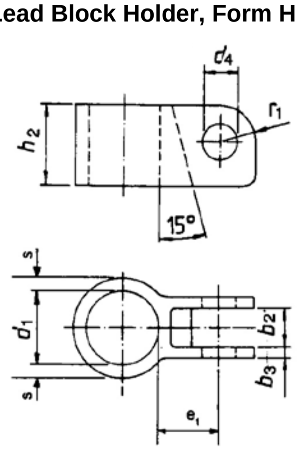


TABLE 14

GOOSENECK BEARINGS

For goosenecks according to Table 10 ve 11

Malterial: RSt37-2, St37-3 U, St37-3 N, DIN EN 10025, Fe 360-B, Fe 360-C, Fe 360-D, ISO 630

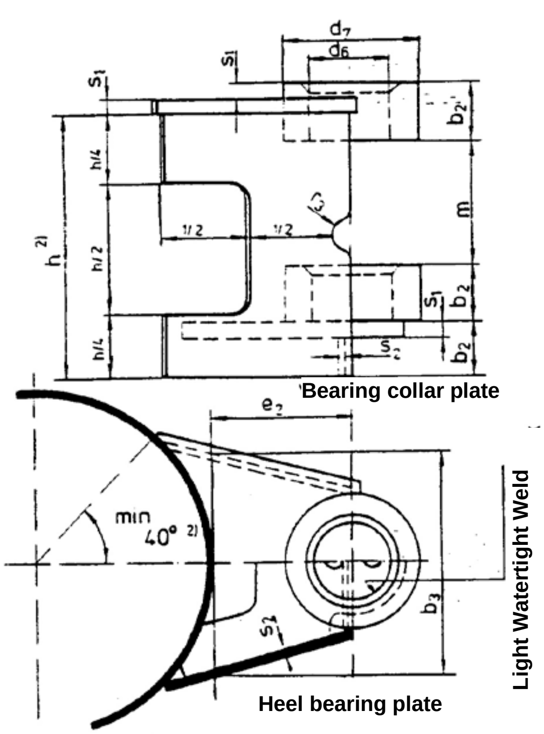
Dia.of gooseneck **1)**	b_2	b_3	d_6	d_7	e_2	m	r_3	s_1	s_2
mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
50	45	150	52	85	70	95	20	8	8
55	45	170	57	90	80	95	20	8	8
60	50	180	62	100	90	95	20	8	8
65	50	200	68	110	100	120	20	10	8
70	60	210	73	120	115	120	25	10	8
80	60	230	83	130	130	140	25	12	10
90	70	250	93	140	145	140	25	12	10
100	70	270	103	160	160	175	30	16	10
110	80	290	113	170	175	175	30	18	10
120	80	320	123	190	190	215	30	20	12
130	90	350	134	200	205	215	30	22	12
140	90	370	144	210	220	215	30	25	12
155	100	400	159	230	240	235	40	30	16
170	100	450	174	250	270	235	40	30	16

Symbol :
According to the diameter of the gooseneck, form and No. of Table
e.g.: Gooseneck 110A - [14]

1) *Diameter of gooseneck is equal to the dimension d_1 or d_3 in Table 10 and 11.*

2) $h = 3 \cdot b_2 + m - 2 \cdot s_1$

Form A



Form B

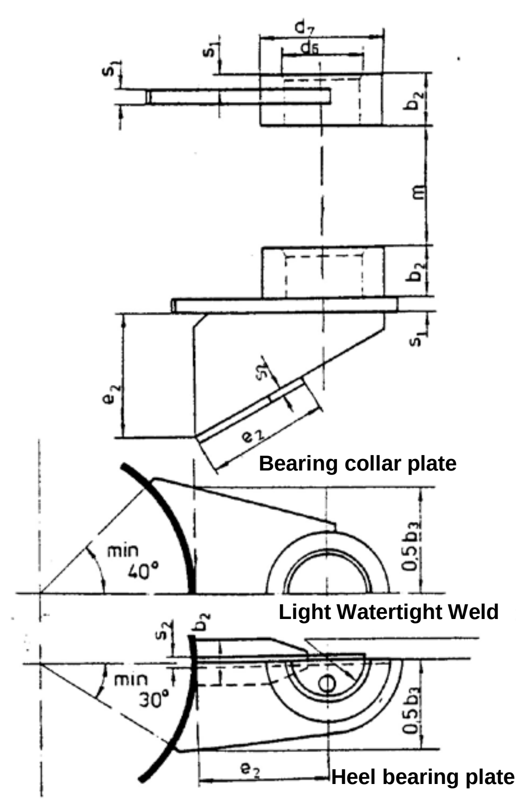


TABLE 15

BSHES FOR NECK AND FOOT BEARING

According to DIN/ISO 6045, Febr. 88*)

For goosenecks acc. to Table 12

Material: St37-3 N, DIN EN 10025, Fe 430-D, ISO 630

Form A	Neck bearing		
Dia.of gooseneck d_5 **1)**	b_1	d_7	d_8
mm	mm	mm	mm
155	100	164	235
170	100	184	260
190	100	194	270
200	110	204	285
225	120	230	315
250	130	255	350
275	140	285	390
320	150	325	445
360	160	365	500
400	170	405	555
440	180	445	610

Form B	Step bearing			
Dia of lower and of gooseneck d_6 **2)**	b_2	c	d_9	d_{10}
	mm	mm	mm	mm
90	70	85	93	140
100	70	85	103	160
110	80	100	113	170
120	80	100	123	190
140	90	115	144	210
160	100	125	164	235
190	110	140	194	270
220	120	150	224	310

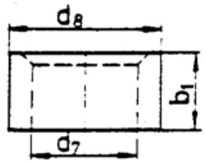
***)** *Only for gooseneck dia. up to 275 mm. standardized.*

Symbol :

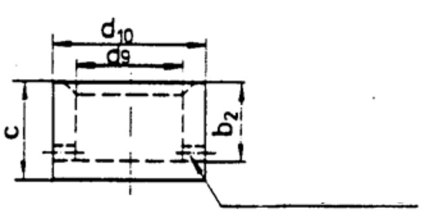
According to Form and dia.of gooseneck, and No. of Table

e.g.: Foot bearing 100A - [15]

Neck bearing Form A



Foot bearing, Form B



1) *Diameter of gooseneck equal to dimension d_5 in Table 12.*

2) *Diameter of lower end of gooseneck equal to dimension d_6 Table 12.*

Notes to Table 16 and 17:

Span trunnion pieces and span bearings

1. The direction of the resultant tension in span (force on the eye) at the minimum permissible derrick boom angle shall not intersect the axis of the trunnion bolt below mid-height between the two bearings. Consequently, with multiply rope spans and especially with tackle blocks having no downward running part, the trunnion piece must be made to the design shown in Table 16 with the eye at mid-height

2. The ratio height: derrick boom length = (1 - a) : l_B shall not exceed 1.0, as the load on the trunnion bolt may otherwise be excessive.

3. The nominal size of span trunnion pieces is determined by the calculated force H_b or H_{ss} shown in Tables 2 - 5 .

4. Span trunnion pieces must normally be made in one piece. On application, **TL** may approve companies for the manufacture of welded trunnion pieces acc. to Table 17 provided that the following conditions are met.

a) The material used is suitable

b) The method used for welding the trunnion pieces has been approved by **TL**.

.

c) All trunnion pieces are subjected to a crack-detection test after manufacture.

d) The trunnion pieces are clearly identified by an approval mark.

e) Before being fitted, every trunnion piece is submitted to a load test with the test loads for components specified in Table 7-4

The approval may be withdrawn from the company by **TL**.

5. The width of the upper span bearing plate on the mast or post in accordance with Table 17 must be chosen in such a way that this plate encloses the mast or post over an extension corresponding to a sector angle of at least 2 · 40°. for the lower span bearing plate an extension corresponding to 2 · 30° is sufficient. The b_2 and b_3 dimensions shall not, however, be less than the value indicated. Where span bearings are fitted to masts orposts with specially small or large outside diameters, it may be necessary to depart from these requirements.

6. In all other cases where the e_2 dimension specified in Table 17 cannot be adhered to for structural reasons, drawings of the span bearings shall be submitted for approval.

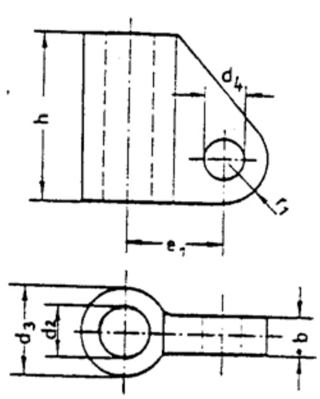
TABLE 16
SPAN TRUNNION PIECE
According to DIN/ISO 8314, Febr. 88*)

Member:	Material:
Trunnion piece :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Trinnion bolt :	St44-2, DIN EN 10025, Fe 430-B, ISO 630

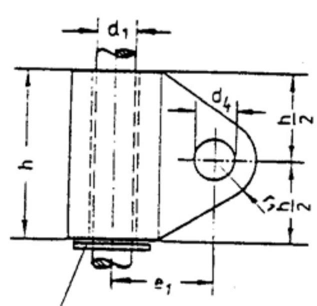
Nominal size	Permiss. load H_b/H_{ss}	Bolt dia. d_1	d_2	d_3	e_1	h	Form A and Form B: b	Form A and Form B: d_4	Form A and Form B: r_1	Form C: Perm. load d_4	Form C: Perm. load d_5	Form C: b	Form C: d_4	Form C: d_3	Form C: r_1	Form C: r_3
	kN	mm	mm	mm	mm	mm	mm	mm	mm	t	t					
2	20	32	34	65	75	90	22	25	25							
4	40	40	42	80	95	110	30	33	32							
6	63	45	47	90	110	130	40	42	43							
8	80	50	52	100	120	150	45	48	48							
10	100	55	57	110	130	170	50	52	55							
12	125	60	62	120	140	190	55	56	60							
16	160	65	68	130	150	215	60	65	65	10	6,3	50	52	42	55	43
20	200	75	78	150	170	240	65	74	70	12,5	8	55	56	48	60	48
25	250	80	83	160	180	270	70	78	75	16	10	60	65	52	65	55
32	320	90	93	180	190	300	80	86	85	20	12	65	74	56	70	60
40	400	100	103	200	210	330	90	96	95							
50	500	110	113	220	235	370	100	106	105							
63	630	120	123	240	260	410	110	116	115							
80	800	130	134	260	295	460	125	131	135							
100	1000	140	144	280	330	520	140	146	148							
125	1250	150	155	300	370	590	160	168	168							
160	1600	165	170	330	415	670	180	188	190							
200	2000	180	185	360	460	760	200	208	210							

*) Only up to nominal size 40 standardized.

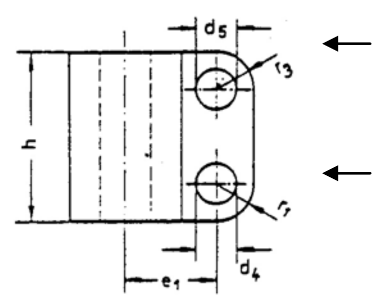
Form A



Form B



Form C



Fitting for rope end shackle

Fitting for span block according to Table 32 however with double lug head fitting according to Table 41.

Symbol :

According ton om. Size Form and No. of Table

e.g.: span trunnion piece 80 A- [16]

TABLO 17

SPAN BEARINGS

Material: RSt37-2, St37-3 U, St37-3 N, DIN EN 10025, Fe 360-B, Fe 360-C, Fe 360-D, ISO 630

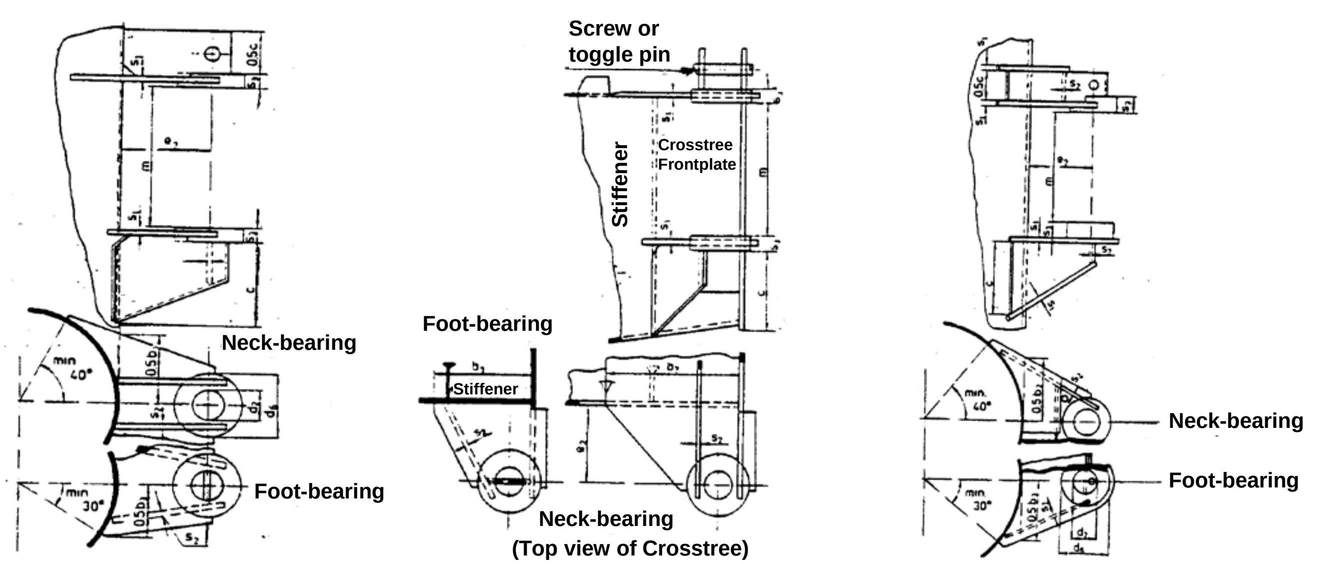
Nominal size	Perm. load **1)**	b_2	b_3	c	d_2	d_6	e_2	m	s_1	s_2	s_3
	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
2	20	140	100	75	34	70	75	95	8	8	16
4	40	160	120	95	42	85	95	115	10	8	20
6	63	180	135	115	47	95	115	138	12	10	25
8	80	200	150	140	52	110	140	158	16	10	25
10	100	230	180	160	57	120	160	178	16	10	30
12	125	260	195	175	62	130	175	200	16	10	30
16	160	290	215	190	68	140	190	225	20	12	35
20	200	320	240	205	78	160	205	250	20	16	40
25	250	370	270	220	83	170	220	280	20	16	40
32	320	370	270	170	93	190	220	320	20	16	45
40	400	410	300	190	103	210	245	350	20	16	50
50	500	450	330	210	113	230	270	390	25	16	55
63	630	500	370	230	123	250	300	430	25	16	60
80	800	560	410	260	134	270	335	480	30	16	65
100	1000	630	460	300	144	290	375	540	30	16	70
125	1250	700	510	340	155	310	420	610	35	18	80
160	1600	780	570	380	170	340	470	700	40	20	90
200	2000	860	630	420	185	370	530	790	50	25	100

Symbol :

According to nominal size, form and No. of Table

e.g.: Span bearing 80A - [17]

Form A 2) **Form B 3)** **Form C 3)**



1) *Permissible load through span trunnion piece according to Table 16.*

2) *for nominal size 2 - 25*

3) *for nominal size 32 - 200*

TABLE 18

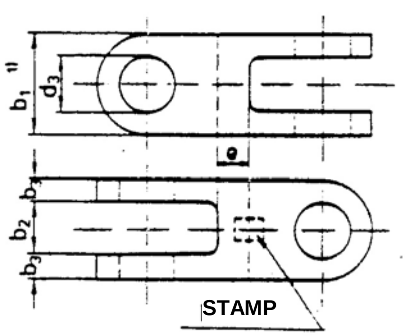
DOUBLE YOKE PIECES FOR SPAN TRUNNION
According to DIN/ISO 82048, Aug. 90

Material : RSt37-2 N, DIN EN 10025, Fe 360-B, ISO 630

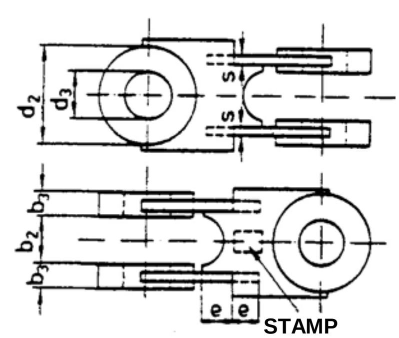
Nominal size	Working load limit "WLL"	b_1	b_2	b_3	b_4	d_1	d_2	e	l	r_1	r_2	t	Bolt ∅
	t	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
12	125	120	64	28	55	54	56	35	175	60	10	70	52
16	160	130	70	30	60	62	66	40	190	65	10	75	50
20	200	140	74	33	65	70	74	45	205	70	10	80	68
25	250	150	80	35	70	74	78	50	224	75	12	87	72
32	315	170	90	40	80	82	86	50	244	85	12	97	80
40	400	190	100	45	90	93	96	60	282	95	16	111	90
50	500	210	110	50	100	104	107	60	302	105	16	121	100
63	630	230	120	55	110	114	117	70	332	115	16	131	110
80	800	270	140	65	125	129	132	80	390	135	20	155	125
100	1000	296	156	70	140	144	147	90	426	148	20	168	140
125	1250	336	176	80	160	165	168	100	476	168	20	188	160
160	1600	380	200	90	180	185	188	110	530	190	20	210	180
200	2000	420	220	100	200	205	208	125	585	210	20	230	200
250	2500	460	240	110	220	225	230	140	640	230	20	250	220

Symbol :
According to Form, nominal size and No. of Table
e.g.: yoke piece A32 - [18]

Form A



Form B



1) $b_1 = d_2$

Notes to Table 19:

Cargo hooks

1. This cargo hook is to be used for all gear irrespective of its Safe Working Load if the load is suspended by a single sling placed over the hook.

2. Hooks conforming to a Standard may be permitted. If necessary, drawings of the hooks shall be submitted to **TL** for approval.

3. Hooks of other designs (e.g. single hooks to DIN 15 401 with a mobile rope safety catch) are only permitted for lifting appliances not serving cargo handling below deck.

TABLE 19

CARGO HOOK

According to DIN 82017, May 91

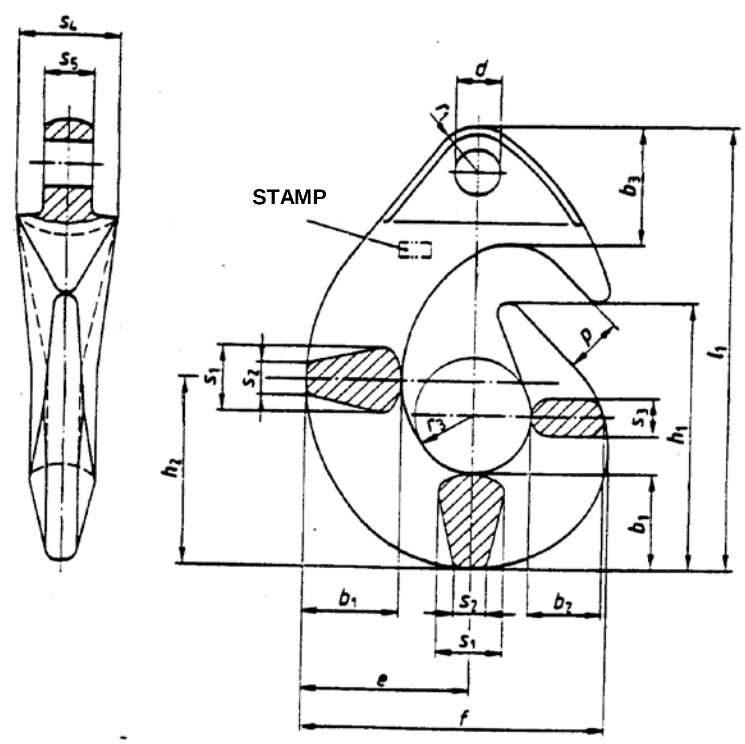
Material: St E 355, DIN 17103, 34 Cr Mo 4, DIN 17200, Gs 45.3, DIN 1681

Nominal size	Working load limit "WLL"	b_1	b_2	b_3	d	e	f	h_1	h_2	l_1	p	r_1	r_3	s_1	s_2	s_3	s_4	s_5 Form A	s_5 Form B
	t	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	42	33	50	17,5	74	134	117	82	192	25	18	25	28	14	16	40	19	16
2	2	54	42	69	24	94	170	150	105	251	32	25	32	36	18	20	58	27	22
3	3.2	68	53	82	30	118	214	188	132	310	40	30	40	46	23	26	72	35	28
5	5	84	66	103	39	148	268	234	164	387	50	38	50	56	28	32	92	44	35
6	6.3	94	73	114	42	167	300	262	184	432	56	43	56	64	32	36	102	50	40
8	8	106	83	129	48	188	338	295	207	487	63	48	63	72	36	40	115	56	45
10	10	118	92	150	52	208	376	328	230	548	70	55	70	80	40	45	125	61	50
12	12.5	135	105	172	56	234	425	375	263	627	80	60	80	91	46	51	138	68	55
16	16	152	114	190	66	258	470	422	296	702	90	65	90	103	52	58	155	75	60
20	20	170	133	202	74	298	540	470	330	772	100	70	100	115	57	64	172	84	65
25	25	190	153	220	78	332	603	522	366	852	110	75	110	128	64	72	192	94	70
32	32	203	167	246	86	354	648	562	395	928	120	85	120	137	69	77	204	102	80
40	40	225	189	272	96	392	718	618	433	1020	130	95	130	152	76	85	225	117	90

Symbol :

According to Form, nominal size and No. Table

e.g.: Cargo hook B5 - [19]



1) ***Form A*** *for shackle-connection (shackle Form B according to Table [22])*

2) ***Form B*** *for fork-connection (double lug head fitting according to Table [41])*

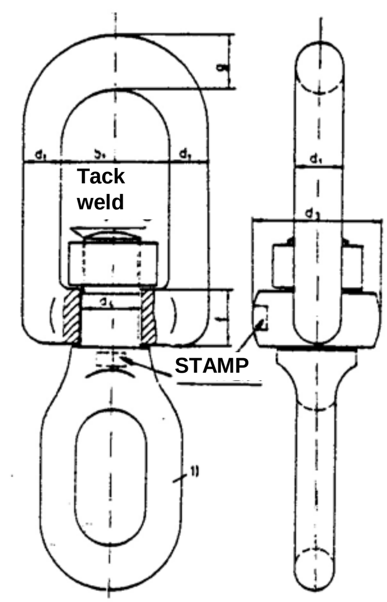
TABLE 20

SVIWEL
According to DIN 82018, August 90

Material: RSt 37-2, DIN EN 10025, Fe 360-B, ISO 630

Nominal size	Working load limit "WLL"	b_1	d_1	d_3	d_4	g_1	f
		mm	mm	mm	mm	mm	mm
1	1	32	12	35	18	16	18
2	2	45	16	50	24	20	22
3	3.2	55	21	60	30	26	28
5	5	70	26	75	36	32	36
8	8	87	32	95	45	40	45
10	10	96	36	105	52	45	50

Symbol :
According to nominal size and No. of Table
e.g.: Sviwel 5 - [20]



1) *Oval eye head fitting according to Table [39].*

Notes to Table 21:

Ramshorn hooks

1. This hook may be used for gear with Safe Working Loads over 20 t. The hook may only be symmetrically loaded. The enclosed angle of the sling attached to the hook may not exceed 90°.

2. Round threads to DIN 15 403 may also be used instead of the specified metric threads.

On hooks of sizes 20 - 40, the round nuts are to be secured by tack welding at the top end.

3. On hooks of sizes 50 - 500, the nut must be secured by slot and key according to DIN 15 411 or similar.

TABLE 21

RAMSHORN HOOK

According to DIN 82019, Nov. 90*)

Member : Material:

Hook : StE355, DIN 17103, 34CrMo4, DIN 17200, GS-45.3, DIN 1681

Round nut : RSt37-2, DIN 10025, Fe 360-B, ISO 630

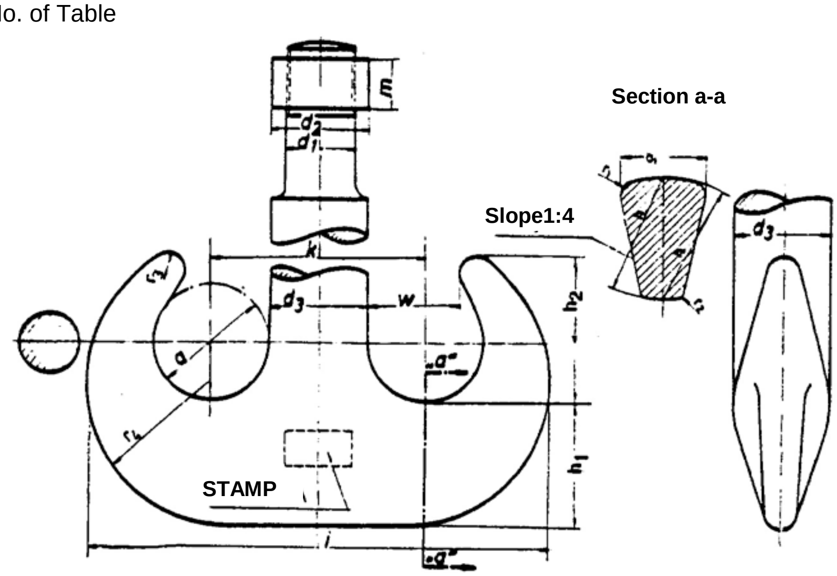
Nominal size	Working load limit "WLL"	a	b_1	Thread d_1	d_3	h_1	h_2	i	r_1	r_2	r_3	r_4	w	Round nut **2)** d_2	Round nut **2)** m	No. of blank of hook according to DIN 15402
	t	mm	mm		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	**1)**
20	20			M72 X 6										105	55	
25	25	112	95	M76 X 6	95	118	146	471	14	11	11	132	90	110	60	16
32	32	125	106	M80 X 6	106	132	163	531	16	12,5	12,5	150	100	115	62	20
40	40	140	118	M90 X 6	118	150	182	598	18	14	14	170	112	130	70	25
50	50			M100 X 6	132	170	205	672	20	16	16	190	125	145	78	32
63	63	160	132	M110 X 6										155	85	
80	80	180	150	M120 X 6	150	190	230	754	22	18	18	212	140	170	95	40
100	100	200	170	M130 X 6	170	212	260	842	25	20	20	236	160	185	102	50
125	125	224	190	M140 X 6	190	236	292	944	28	22	22	265	180	200	110	63
160	160	250	212	M160 X 6	212	265	325	1062	32	25	25	300	200	225	125	80
200	200	280	236	M180 X 6	236	300	364	1186	36	28	28	335	224	255	140	100
250	250	315	265	M200 X 6	265	335	408	1330	40	32	32	375	250	280	155	125
320	320	355	300	M220 X 6	300	375	458	1505	45	36	36	425	280	310	175	160
400	400	400	335	M250 X 6	335	425	515	1685	50	40	40	475	315	350	200	200
500	500	450	375	M280 x 6	375	475	580	1885	56	45	45	530	355	400	225	250

Symbol :

According to nominal size and No. of Table

e.g.: Ramshorn hook 40 - [21]

*) Only up to nominal size 250 standardized.



1) *The no. of blank of hook is to be deleted This No. does not correspond with the SWL of the hook..*

2) *Round nut according to DIN 82013.*

Notes to Table 22:

Shackles

1. Shackles may be subjected only to tensile loads.

2. Wherever possible, shackles should be so connected that the bolt side is attached to a round eye and the strap side to an elongated eye or chain link.

3. Type A shackles may only be used for connecting of lower guy blocks, preventers and snatch blocks on deck.

Furthermore, for loose gear if the shackles are used for the connection of loads.

4. Shackles for cargo hooks to Table 19, cargo chains, cargo hook swivels and loose gear must have slotted bolts (type B). The bolts must be secured

5. Type C shackles are to be used for fastening cargo and span blocks, for attaching upper guy blocks, span runners and guy pendants to the head fitting and for ropes to the beckets of blocks

TABLE 22

SHACKLES

According to DIN 82101, Febr.76

Member:	Material:
Bow :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630

Nominal size	Working load limit"WLL"	b_1	d_1	d_3	Bolt	
					∅	Diş
	t	mm	mm	mm	mm	
1	1	21	13	32	16	M 16
1,6	1,6	27	17	40	20	M 20
2	2	30	19	44	22	M 22
2.5	2,5	33	21	48	24	M 24
3	3,2	38	24	54	27	M 27
4	4	42	27	60	30	M 30
5	5	47	30	72	36	M 36
6	6,3	53	34	78	39	M 39
8	8	60	38	90	45	M 45
10	10	66	42	96	48	M 48
12	12.5	73	47	104	52	M 52
16	16	81	52	120	60	M 60
20	20	90	58	136	68	M 68
25	25	100	63	144	72	M 72 X 6
32	32	110	70	160	80	M 80 X 6
40	40	125	79	180	90	M 90 X 6
50	50	140	88	200	100	M 100 X 6
63	63	155	96	220	110	M 110 X 6
80	80	175	110	250	125	M 125 X 6
100	100	200	125	280	140	M 140 X 6

Symbol :

According to Form nonimal size and No. of Table

e.g.: Shackle A16 - [22]

Nominal size	**Form A**	**Form B**	**Form C**	
	1 ÷ 20	1 ÷ 20	1 ÷ 20	25 ÷ 100

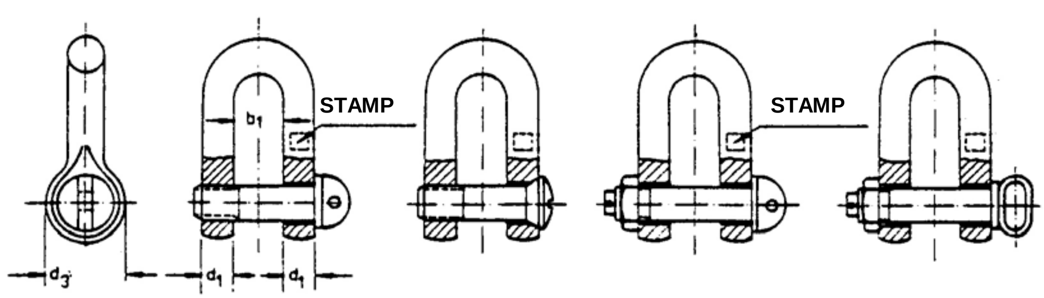


Table 23 için notlar:

Round steel chains with B type transition link

1. Only short-link chains with the appropriate end links may be used for cargo chains.

Span chains must be of the long-link type.

2. Arc and gas welding may not be used in the manufacture of chain links, rings and similar parts. These parts may not be repaired by welding.

3. Provided they have been approved by **TL**, manufacturers may join together round steel bars or unite them to other parts having the same joint section by means of flash butt welding. The butt welding of round bars to other components is not permitted.

4. Flash butt welds shall be normalized.

TABLE 23

CHAINS WITH TRANSITION LINK FORM B

Material: RSt 35-2, DIN 17115

Working load limit WLL"	Cargo chains (short link chains) according to E DIN 32891, Sept. 90			Egg link B for span chains (short link chains) according to DIN 695, Juli 86		
	Nominal size **1)** d	b	t	d_1	b_1	t_1
t	mm	mm	mm	mm	mm	mm
1	10	36	30	13	51	54
1.6	13	47	39	16	66	70
2.5	16	58	48	20	80	85
3.2	18	65	54	23	96	115
4	20	72	60	23	96	115
5	23	83	69	26	117	140
6.3	26	84	78	32	134	150
10	32	115	96	40	160	170
12.5	36	130	108	45	180	180
16	40	144	120	50	200	200
20	45	162	135	56	227	230

Span chains (Long link) according to DIN 82056, Nov. 78			
Working load limit "WLL"	Nominal size d	b	t
t	mm	mm	mm
1	13	44	78
1.6	16	54	96
2	18	60	108
2.5	20	67	120
3.2	23	77	138
4	26	87	156
5	28	94	168
6.3	33	112	198
8	36	122	216
10	39	132	234
12.5	45	152	270

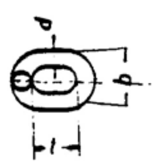
Symbol :

According to nominal dimension and No. of Table

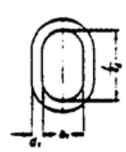
e.g.: Cargo chain 20 with connecting link

Form B - [23]

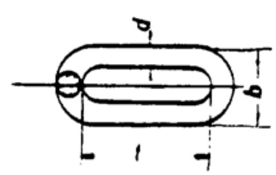
Span chain 26 - [23]



Short link chain
(Cargo chain)



Connecting link
B for cargo chain



Span chain
(long link)

1) *The nominal dimension of argo chain is equal ton om.dimension for link B.*

Notes to Table 24:

Round eyes with double lugs for tensile loads

1. The bolts shall take the form either of headed bolts with nut and split-pin or of smooth pins with a groove and retaining piece at both ends. Where bolts are used, the thread including the runout may only be so long that the smooth shank of the bolt extends over a length of at least 2/3 of the thickness of the fork lugs.

2. Bolts for round eyes with double lugs of sizes 63 - 250 may also, where appropriate, be secured by cotter pins (e.g. for heavy-duty traverses).

The cotter pin must conform to the dimension d_3 shown in Table 13 and must be fastened by a chain. The fork bolt must be sucured to prevent twisting.

TABLE 24

EYES AND DOUBLE-LUGS FOR TENSILE LOAD

According to ISO 6043

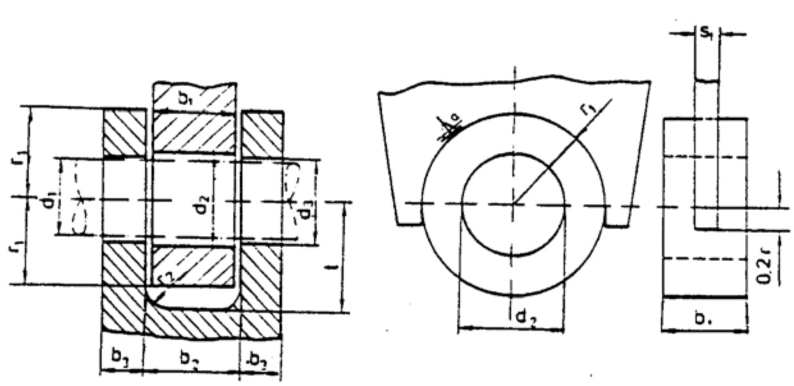
Member :	Material :
Cross bolt:	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Eyes and double lugs :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Bushing and plates of welded eyes:	RSt37-2, St37-3U, St37-3N, DIN EN 10025, Fe 360-B, Fe 360-C, Fe 360-D ISO 630

Nominal size	Permissible load	d_1	b_2	b_3	d_2	d_3	r_1	r_2	t	Bolt d_1	Bolt diş	s_1	Fillet weld a
	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm		mm	mm
1	10	16	19	8	18	17	17.5	5	23	16	M 12	-	-
1,6	16	20	23	11	22	21	22.5	5	28	20	M 16	6	4
2	20	22	26	12	24	23	25	6	31	22	M 20	6	4
2,5	25	25	29	13	26	25	27.5	6	34	24	M 20	8	5
3	32	28	32	14	30	28	30	6	36	27	M 22	8	5
4	40	30	35	15	33	31	32.5	6	39	30	M 24	8	5
5	50	35	39	18	39	37	37.5	8	46	36	M 27	10	6
6	63	40	45	20	42	40	42.5	8	51	39	M 30	10	6
8	80	45	49	23	48	46	47.5	8	56	45	M 36	12	7
10	100	50	58	26	52	50	55	8	63	48	M 39	14	7
12	125	55	64	28	56	54	60	10	70	52	M 42	14	8
16	160	60	70	30	66	62	65	10	75	60	M 48	16	8
20	200	65	74	33	74	70	70	10	80	68	M 56	20	9
25	250	70	80	35	78	74	75	12	87	72	M 60	20	10
32	320	80	90	40	86	82	85	12	97	80	M 64	20	11
40	400	90	100	45	96	93	95	16	111	90	M 72 x 6	25	13
50	500	100	110	50	107	104	105	16	121	100	M 80 x 6	25	14
63	630	110	120	55	117	114	115	16	131	110	M 90 x 6	30	15
80	800	125	140	65	132	129	135	20	155	125	M 100 x 6	35	18
100	1000	140	156	70	147	144	148	20	168	140	M 115 x 6	35	18
125	1250	160	176	80	168	165	168	20	188	160	M 130 x 6	40	20
160	1600	180	200	90	188	185	190	20	210	180	M 145 x 6	40	20
200	2000	200	220	100	208	205	210	20	230	200	M 160 x 6	50	25
250	2500	220	240	110	230	225	230	20	250	220	M 180 x 6	60	30

Symbol :

According to nominal size and No. of Table

e.g. : Stud eye 40-[24]



Notes to Tablo 25:

Round eye plates

1. These eye plates are suitable for tensile loads acting at an angle α = 40 - 90 to the horizontal. Tensile loading angles of less than 40° are not covered by the Table. These conditions produce mainly tilting moments over the long edge of the inclined plate which necessitate a special transverse bracket at the rear end of the eye plate and special attention to the stiffening at the back of the plate to which the eye is welded.

2. Where stiffeners are required to strengthen the connecting plate, these must be arranged in the longitudinal direction of the round eye plate.

The clearance between the shackle bolt diameter and the eye hole - subject to compliance with the specified eye width b - is allowed for as a permitted diagonal load. The same applies to the eccentric point of application of the force caused by possible movement from the central to the lateral or any intermediate position of contact.

TABLE 25

ROUND EYE PLATES

According to DIN 82024, Aug. 90

Material : St37-2, St37-3U, DIN EN 10025, Fe 360-B, Fe 360-C, Fe 360-D, ISO 630

Nominal size	Permissible load	e	h	l	Min. im size. s_2	Welding seam a_1	a_2	b	d_1	d_2	r_1	s_1
	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	10	28	32	85	4	3	-	16	18	-	17.5	-
1,6	16	36	40	110	4	3	-	20	22	-	22.5	-
2	20	40	44	120	6	4	-	22	24	-	25	-
2,5	25	44	48	130	4	3	5	25	26	55	-	8
3	32	48	54	145	4	3	5	28	30	60	-	8
4	40	52	60	155	4	3	5	30	33	65	-	8
5	50	60	72	180	5	3.5	6	35	39	75	-	10
6	63	68	78	200	5	3.5	6	40	42	85	-	10
8	80	76	90	230	6	4	7	45	48	95	-	12
10	100	88	96	260	7	5	7	50	52	110	-	14
12	125	96	104	290	7	5	8	55	56	120	-	14
16	160	104	120	310	8	6	8	60	66	130	-	16
20	200	112	136	340	10	7	9	65	74	140	-	20
25	250	120	144	360	10	7	10	70	78	150	-	20
32	320	136	160	410	10	7	11	80	86	170	-	20
40	400	152	180	460	12.5	9	13	90	96	190	-	25
50	500	168	200	500	12.5	9	14	100	107	210	-	25
63	630	184	230	570	15	10.5	15	110	117	230	-	30
80	800	216	260	650	17.5	12	18	125	132	270	-	35
100	1000	237	300	750	17.5	12	18	140	147	296	-	35

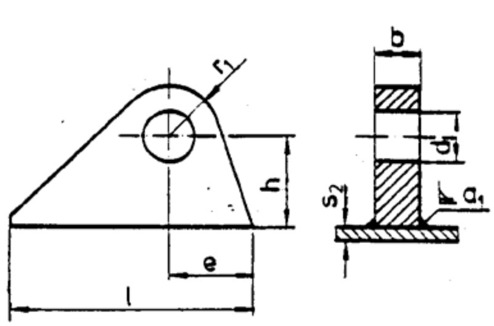
Symbol :

According to nominal size, Form and No. of Table

e.g.: Round eye plate 10 B-[25]

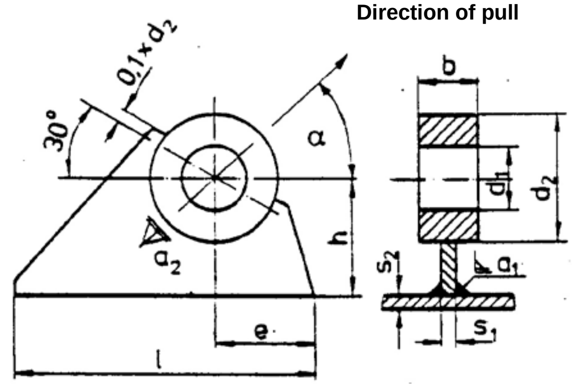
Nominal size1 ÷ 2

Form A



Nominal size 2,5 ÷ 50

Form B



Notes to Table 26:

Oval eye plates

1. These oval eye plates are used to attach shackles acc. to Table 22, the shackle bow being located in the oval eye.

2. The oval eye plates are designed for the tensile load specified, and the tensile force may act at any angle.

3. The oval eye plates are to be attached with the specified fillet weld a. Their bottom edges may not be chamfered. The thickness of the plate to which the oval eye plate is welded may not be less than the dimensions shown in the Table. Where stiffeners are required to support the connecting plate, these must be arranged in the longitudinal direction of the elongated eye plate.

TABLE 26

OVAL EYE PLATES

According to ISO 8146,-1985*)

Material : RSt37-2, St37-3U, St37-3N, DIN EN 10025, Fe 360-B, Fe 360-C, Fe 360-D, ISO 630

Nominal size	Working load limit "WLL"	a	b	d	e	l	s	Filet weld a
	kN	mm	mm	mm	mm	mm	mm	mm
1	10	35	22	16	25	95	6	4
1,6	16	42	24	20	33	120	7	4
2	20	50	27	25	35	132	9	6
2,5	25	55	29	25	39	140	9	6
3	32	66	33	30	42	180	10	6
4	40	77	36	35	48	210	12	7
5	50	87	41	40	57	225	14	9
6	63	91	45	40	66	240	14	9
8	80	101	51	50	73	270	17	10
10	100	117	56	50	80	300	17	11
12	125	128	61	60	87	335	20	12
16	160	145	67	60	95	370	20	13
20	200	157	73	70	105	420	25	14
25	250	170	80	80	120	470	30	16
32	320	194	88	90	130	530	30	18
40	400	220	98	100	145	570	35	20
50	500	240	108	110	155	630	35	22
63	630	260	120	120	165	700	40	24
80	800	300	135	135	180	780	45	27
100	1000	330	150	150	200	870	50	30

*) Only nominal sizes up to 50 standardized.

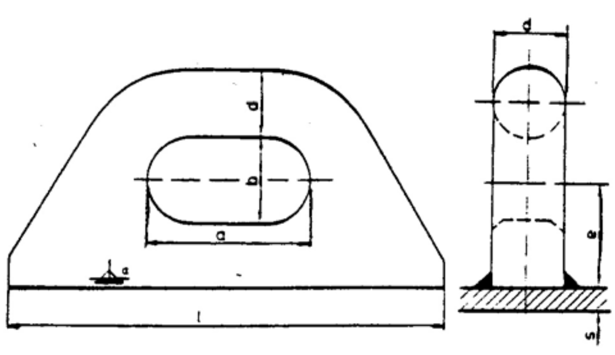
Symbol :

According to nominal size, Form and No. of Table

e.g.: Oval eye plate 2,5 A-[26]

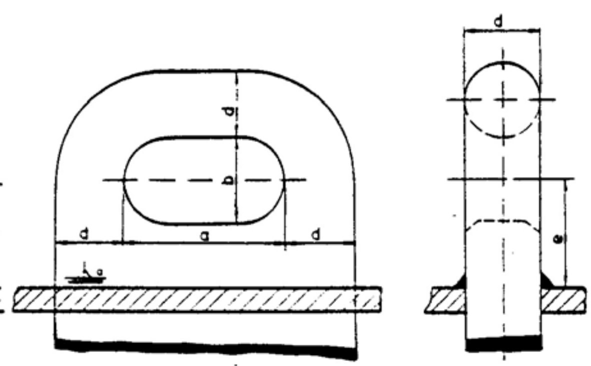
Form A

Construction at the hull



Form B

Construction at the derrick



Notes to Tables 27-38
Blocks

1. Wherever possible, the blocks used in gears should conform to this Table.

Other designs require special **TL** approval.

2. The Tables for blocks indicate the permissible load on the eye R_{max} and the permissible load "WLL", which corresponds to the rope pull S in case of single sheave blocks and without frictional influences. See sketch below.

3. Block frames should be so designed that wire ropes cannot lodge themselves between the block and the sheave. For the cargo and lead blocks of light cargo gear, it is recommended that the inside of the block frame should be provided with a moulding or contour projecting over the edge of the sheave to guide the rope.

4. Sheave pins used in blocks shall take the form either of smooth, grooved pins with retaining pieces at both ends or of headed bolts with nut and split-pin.

Where bolts are used as sheave pins, their smooth shank must be long enough to ensure that the side plates or bars of the block cannot be drawn together.

5. Where use is made of a multiple-sheave block in which the running part could cause the block to turn, suitable measures must be taken to prevent this.

6. Cargo blocks, span blocks and guy blocks shall be attached to head fittings, span- and guy eyes in such a way that no bending stress can be exerted on the eyes of the blocks.

7. Blocks with hook-type head fittings may not be used for cargo gear.

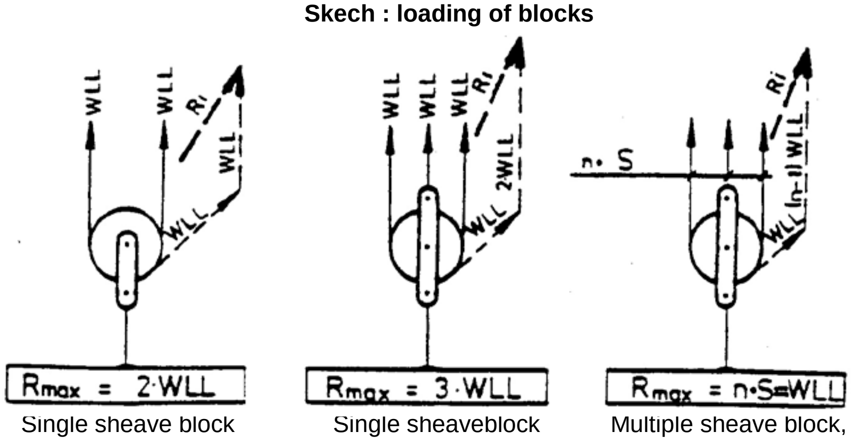
8. The dimensions of snatch blocks are shown in Table 38. These blocks are permitted for use only as lead blocks for single and double-reeved spans not worked under load and for derrick toppers. They may also be used as lead blocks for guy falls where the angle of deflection is not greater than about 90°.

9. The necessary rope sheave diameters and the maximum nominal diameters of the commonest ropes are indicated in the Tables (see also Sect. 8).

10. The dimensions of the beckets are shown in Table 29.

.

Skech : loading of blocks



Single sheave block without becket | Single sheaveblock with becket | Multiple sheave block, n : number of ropes

where :

R_{max} : Permissible load on eye

R_i : Load on eye according to the force diagram

WLL : Permissible load on block =
Permissible rope pull S in case of single sheave blocks or permissible load at the suspension in case of multiple sheave blocks

TABLE 27

CARGO BLOCKS WITHOUT BECKET AND LEAD BLOCKS

Member : Material:

Axle pin : St44-2, DIN EN 10025, Fe 430-B, ISO 630

Supporting stranps, traverse, housing : RSt37-2, DIN EN 10025, Fe 360-B, ISO 630

Rope sheave : GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size	Permiss.load "WLL" permiss.rope tension SZ	Permiss. load on the head fitting R_{max}	Largest nom. Dia.of rope	Rope sheave Groove bottom dia d_1		Rope sheave Axle pin dia. d_2	Sheave housing	Supporting straps		Traverse		Head Fitting
				boyut 2*)	boyut 3**)		s_1	b_2	s_2	f	pim çapı d_4 **2)**	d_3
	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	20	12	168	240	22	3**1)**	50	6	22	16	24
2	2	40	16	224	320	32	4**1)**	65	10	32	23	33
3	3,2	63	18	252	360	40	5	80	10	40	28	42
4	4	80	20	280	400	45	5					
5	5	100	22	308	440	50	6	100	13	50	36	52
6	6,3	125	24	336	480	55	6					
8	8	160	28	392	560	65	7	130	16	60	45	64

Symbol :

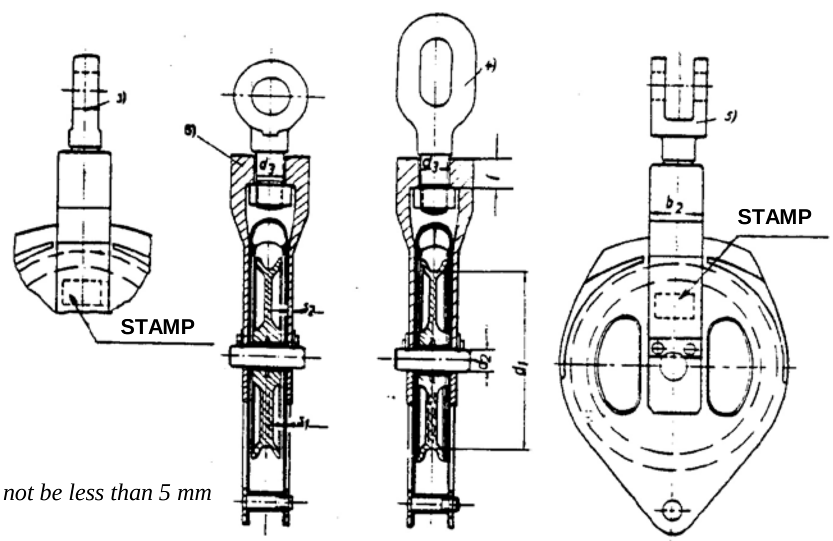
According to form, nominal size, size of the rope sheave and No. of Table

e.g.: Cargo block A 3/2 - [27]

	Form A	**Form B**	**Form C**
***)** Size 2 :	upper and lower	lower cargo block	leadblock
Groove bottom dia. = 14xNom.dia of rope	cargo block		

****)** Size 3 :

Groove bottom dia. = 20xNom. Dia.of rope



1) *The wall thickness of cast sheave housings is not be less than 5 mm*

2) *Only for traverses riveted, Table 28*

3) *Round eye head fitting, Table 40*

4) *Oval eye head fitting, Table 39*

5) *Double lug head fitting, Table 41*

6) *Other types of double lugs for sheave housings, Table 28*

TABLE 28

CARGO BLOCKS WITH BECKET

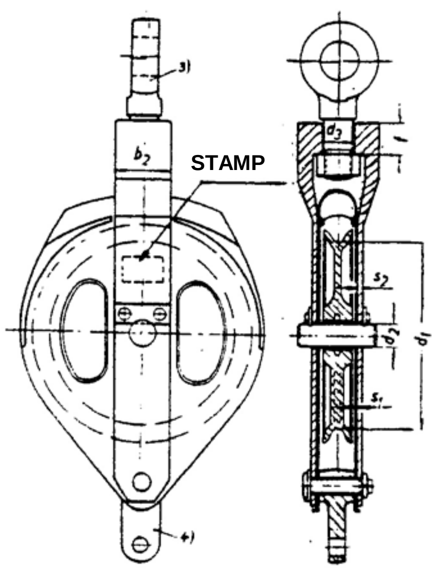
Member:	Material:
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Supporting straps, traverse, housing :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Rope sheave :	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size	Permiss. load "WLL" permiss.rope tension SZ	Permiss. load on the head fitting R_{max}	Largest nom.dia. of rope	Rope sheaves: Groove bottom dia. d_1, Size 2*)	Rope sheaves: Groove bottom dia. d_1, Size 3**)	Rope sheaves: Axle pin dia. d_2	Sheave housing s_1	Supporting straps b_2	Supporting straps s_2	Traverse f	Traverse Rivet dia. d_4 **2)**	Stud eye head-fitting d **3)**
	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	30	12	168	240	22	3**1)**	60	10	28	20	30
2	2	60	16	224	320	32	4**1)**	80	13	40	28	42
3a	3,2	80	18	252	360	40	5	100	13	45	32	45
3b	3,2	95	18	252	360	40	5	100	16	50	36	52
4	4	120	20	280	400	45	6	110	18	55	40	56
5	5	150	22	308	440	50	6	130	20	60	45	64
6	6,3	200	24	336	480	55	7	140	20	65	50	72
8	8	240	28	392	560	65	7	150	20	70	55	76

Symbol :

According to nominal size, size of rope sheave and No. of Table

e.g.: Cargoblock 3a/2-[28]

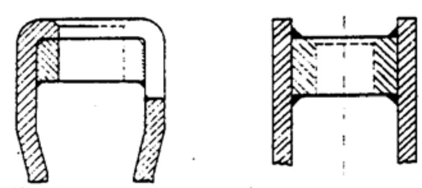


***)** Size 2 : Groove bottom dia. = 14xNom.dia of rope

****)** Size 3 : Groove bottom dia. = 20xNom.dia.of rope

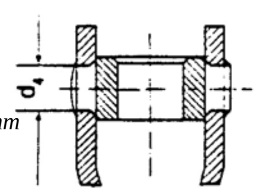
Further types of double lugs for sheave housings

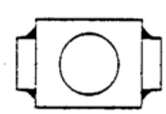
Filler piece



Transverse without shoulder

Transverse without shoulder





1) *The wall thickness of cast sheave housings is not to be less than 5 mm*

2) *Only for transverses riveted.*

3) *Round eye head fitting, Table 40*

4) *Becket according to Table 29*

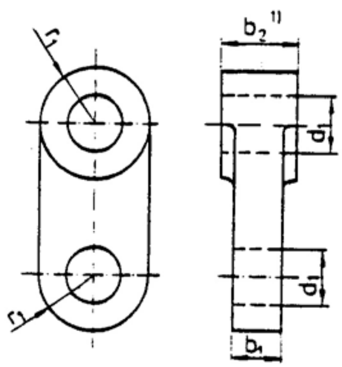
TABLE 29

BECKETS
According to DIN 82241, May 63

Material : RSt37-2, DIN EN 10025, Fe 360-B, ISO 630

Nominal size	Permiss. load "WLL"= permissible rope tension SZ	d_1	r_1	b_1	b_2 **1)**
	t	mm	mm	mm	mm
1	1	18	17,5	16	29
2	2	25	25	22	36
3	3,2	30	30	28	44
4	4	33	32,5	30	50
5	5	39	37,5	35	56
6	6,3	42	42,5	40	63
8	8	48	47,5	45	70
10	10	52	55	50	78
12	12,5	56	60	55	86

Symbol :
According to nominal size and No. of Table
e.ge. : Becket 5 - [29]



1) *For heavy-lift blocks the beadth b_2 of the eye is to be dimensioned according to the width of nave of the sheave.*

TABLE 30

SPAN BLOCKS FOR SINGLE-REEVED SPAN

Member : Material :

Axle pin : St44-2, DIN EN 10025, Fe 430-B, ISO 630

Supporting straps, transverse,housing: RSt37-2, DIN EN 10025, Fe 360-B, ISO 630

Rope sheave : GS-38, DIN 1681, GGG-40, DIN 1693

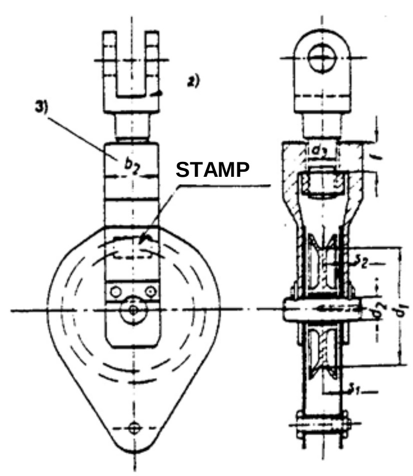
Nominal size	Permiss. load "WLL" permiss. rope tension SZ	Permiss. load on the head fitting R_{max}	Largest nom. Dia.of rope	Rope sheaves Groove bottom dia d_1	Rope sheaves Axle pin dia. d_2	Sheave housing	Supporting straps		Traverse		Double lug head fitting
				boyut 1*****)		s_1	b_2	s_2	f	Rivet **1) dia.**d_4	d_3
	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	20	12	108	22	3	50	6	22	16	24
2	2	40	16	144	32	4	65	10	32	23	33
3	3,2	63	18	162	40	5	80	10	40	28	42
4	4	80	20	180	45	5	90	10	45	32	45
5	5	100	22	198	50	6	100	13	50	36	52
6	6,3	125	24	216	55	6	110	13	55	40	56
8	8	160	28	252	65	7	130	16	60	45	64
10	10	200	32	288	72	7	140	16	65	50	72
12	12,5	250	36	324	80	8	150	20	70	55	76

Symbol :

According to nominal size, size of rope sheave and No. of Table

e.g.: Span block 8/1-[30]

***)** Size 1: Groove bottom dia = 9xNom. dia of rope



1) *Only for traverses riveted, Table 28*

2) *Double lug head fitting according to Table 41*

3) *Other types of double lugs for sheave housings, Table 28*

TABLE 31

LOWER SPAN TACKLE BLOCKS FOR DOUBLE-REEVED SPAN

Member:	Material :
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Supporting straps, traverse, housing :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Rope sheave:	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size	Permiss. load "WLL" permiss. rope tension SZ	Permiss. load on the head fitting $R_{max.}$	Largest nom. Dia of rope	Rope sheaves: Groove bottom dia d_1 size 1*)	Rope sheaves: Groove bottom dia d_1 size 2**)	Rope sheaves: Axle pin dia. d_2	Sheave housing s_1	Supporting straps b_2	Supporting straps s_2	Traverse f	Traverse Pin.dia. **1)**	Oval eye head fitting d_3
	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	20	12	168	240	22	3	50	6	22	16	24
2	2	40	16	224	320	32	4	65	10	32	23	33
3	3.2	63	18	252	360	40	5	80	10	40	28	42
4	4	80	20	280	400	45	5	90	10	45	32	45
5	5	100	22	308	440	50	6	100	13	50	36	52
6	6.3	125	24	336	480	55	6	110	13	55	40	56
8	8	160	28	392	560	65	7	130	16	60	45	64

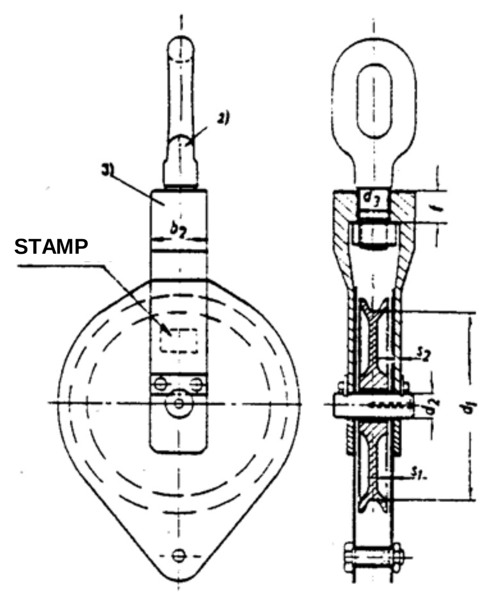
Symbol :

According to nominal size, size of the rope and no. of Table

e.g.: Span tackles block 4/1-[31]

***)** Size 1: Groove bottom dia. = 14xNom. dia.of rope

****)** Size 2: Groove bottom dia. = 20xNom. dia of rope



1) *Only for traverses riveted, Table 28*

2) *Oval eye head fitting Table 39*

3) *Other types of double lugs for sheave housings, Table 28*

TABLE 32

UPPER SPAN TACKLE BLOCKS FOR DOUBLE-REEVED SPAN

Member:	Material :
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Supporting straps, traverse, housing :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Rope sheace:	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size	Permiss. load "WLL" permiss. rope tension SZ	Permiss. load on the head fitting R_{max}	Largest nom. Dia. of rope	Groove bottom dia. d_1 Size 2*)	Groove bottom dia. d_1 Size 3**)	Axle pin. dia. d_2	Sheave housing s_1	Supporting straps b_2	Supporting straps s_2	Traverse f	Traverse Rivet **1)** dia. d_4	Double lug head fitting d_3
	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	30	12	168	240	22	3	60	10	28	20	30
2	2	60	16	224	320	32	4	80	13	40	28	42
3	3.2	95	18	252	360	40	5	100	16	50	36	52
4	4	120	20	280	400	45	5	115	20	55	40	56
5	5	150	22	308	440	50	6	130	20	60	45	64
6	6.3	190	24	336	480	55	6	140	20	65	50	72
8	8	240	28	392	560	65	7	150	20	70	55	76

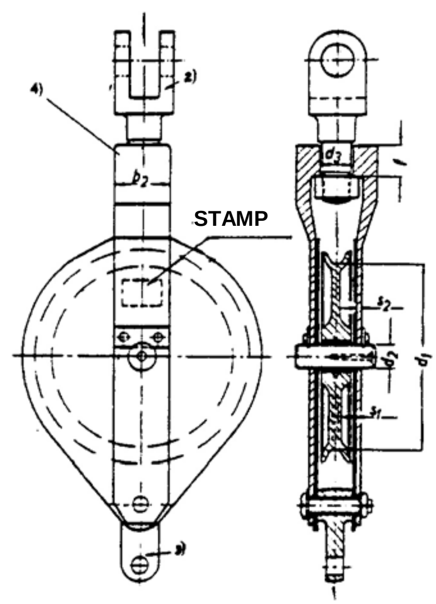
Symbol :

According to nominal size, size of the rope sheave and No. of Table

e.g.: Span tackle block 6/3-[32]

***)** Size 2 : Groove bottom dia. = 14xNom.dia.of rope

****)** Size 3 : Groove bottom dia. = 20xNom. dia. of rope



1) *Only for traverses riveted, Table 28*

2) *Double lug head fitting, Table 41*

3) *Becket, Table 40*

4) *Other types of double lugs for sheave housings, Table 28*

TABLE 33

MULTI SHEAVE BLOCKS FOR CARGO AND SPAN TACKLE BLOCKS 1)

Member:	Malzeme :
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Side plates cross head :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Sheave :	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal pull of winch	Nominal dia.of rope	Sheave				Side plates			Crosshead through bolt	Cross head
		Groove bottom dia d_1 Form B*)	Form C**)	Axle pin dia. d_2 **4)**	Width of nave b_1 **4)**	r_1	s_1	s_2	d_3 **5)**	r_2 **1)**
kN	t	mm	mm	mm	mm	mm	mm	mm	mm	mm
30	18	252	360	40	42	90	8	13	40	45
40	20	280	400	45	48	100	9	15	45	55
50	22	308	440	50	54	110	10	17	50	60
63	24	336	480	55	60	120	11	18	55	65
80	28	392	560	65	67	130	12	20	60	70
100	32	448	640	72	74	140	13	22	65	75
125	36	504	720	80	82	150	15	24	70	80

***)** Form B : Groove bottom dia. = 14xNom. dia. of rope

****)** Form C : Groove bottom dia. = 20xNom. dia. of rope

Symbol :

according to nominal pull of the winch in (kN),

nominal diameter of rope in mm, permiss. load "WLL" on head fitting (t), number of sheaves, and type with or without becket, and No. of Table, e. g.: Tackle block 50 x 22 x 50 - 5 sh. w. B. - [33] - (5 sheaves with becket)

1) *The crosshead's eye is to be dimensioned in accordance with Table 24 and dependent on the occurring resultant load (SWL of gear. L_b, H and H_b in accordance with Tables 2, 3 and 4).*

2) *The becket has to .be dimensioned in accordance with Table 29.*

3) *In case of blocks with beckets the centreline of the cross-head's eye for suspension of the block has to be displaced by the distance "c" from the centreline of the block to ensure that the loaded block is hanging straight in the direction of the tackle.*

Number of sheaves of the block	*2*	*3*	*4*	*5*	*6*
c	*0,10xa*	*0,14xa*	*0,17xa*	*0,18xa*	*0,19xa*

4) *The dimension d_2 is only applicable to blocks with sliding bearings For these blocks the product d_2 x b_1 in mm^2 has tobe at least 50 times the nominal pull of the winch. (Surface pressure must not exceed 40 N/mm^2.)*

5) *For blocks with anti-friction bearings the diameter d_2 of the sheave pin may be dimensioned as the diameter d_3 of the crosshead through bolt.*

6) *When welding the crosshead in altered construction to the partition and side plates, the through bolt may be deleted.*

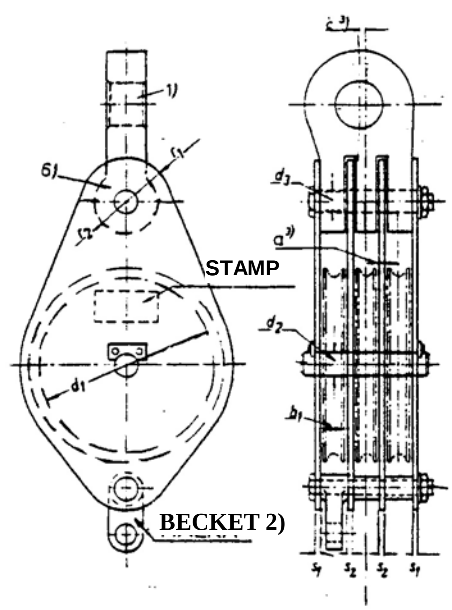


TABLE 34

WOODEN TACKLE BLOCKS FOR MANILA AND POLYPROPYLENE ROPES

Nominal size	Largest nom. Dia. of rope	Permissible load						
		Permiss. load "WLL" = permiss. rope tension	Number of sheaves of the block					
			1		2		3	
			Without (Becket)	With (Becket)	Without (Becket)	With (Becket)	Without (Becket)	With (Becket)
			Permiss. load on the head fitting R_{max}		SWL = Permiss. load on the head fitting R_{max}			
	mm	t	kN	kN	kN	kN	kN	kN
7	18	0,22	4,4	6,6	8,8	11	13	15
8	20	0,26	5,2	7,8	10	13	15	18
9	22	0,30	6,0	9,0	12	15	18	21
10	24	0,36	7,2	11	14	18	21	25
11	26	0,40	8,0	12	16	20	24	28
12	28	0,50	10	15	20	25	30	35

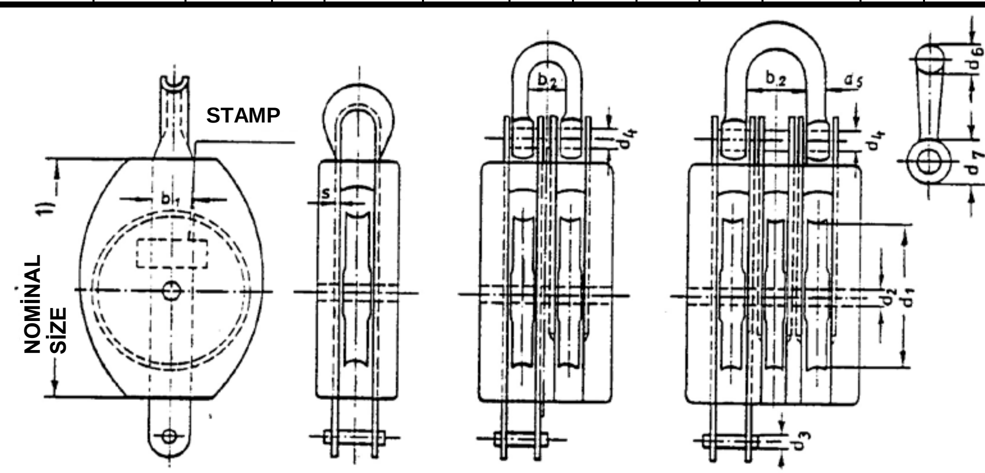
Member: Material :

Axle pin : St44-2, DIN EN 10025, Fe 430-B, ISO 630

Supporting straps shackle RSt37-2, DIN EN 10025, Fe 360-B, ISO 630

Sheaves : GS-38, DIN 1681, GGG-40, DIN 1693

Nominal boyut	Sheave		Supporting straps		Becket bolt dia. d_3	Shackle for blocks with two sheaves					Shackle for blocks with three sheaves				
	Gro.bot. dia d_1	Axle pin. dia. d_2	b_1	s		Bolt dia d_4	b_2	d_5	d_8	d_7	Bolt dia. d_4	b_2	d_5	d_6	d_7
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
7	100	16	30	6	14	16	40	15	19	32	16	63	17	25	32
8	110	16	35	6,5	16	16	46	16	21	32	16	71	20	28	32
9	121	18	35	8	16	18	51	17	22	36	18	79	21	30	36
10	132	20	40	8	16	20	51	19	24	42	20	81	22	33	42
11	143	20	45	8	20	20	55	20	26	42	20	84	24	34	42
12	154	22	50	8	20	25	58	22	28	50	25	89	26	38	50



Symbol :

According to nominal size, permiss. load "WLL", number of sheaves, and type with or without becket and No. of Table

e.g.: Tackle block 9x2,1 - 3, sh. W. B. [34]

1) *The nominal size is equal to the length of the housing (in inch).*

TABLE 35

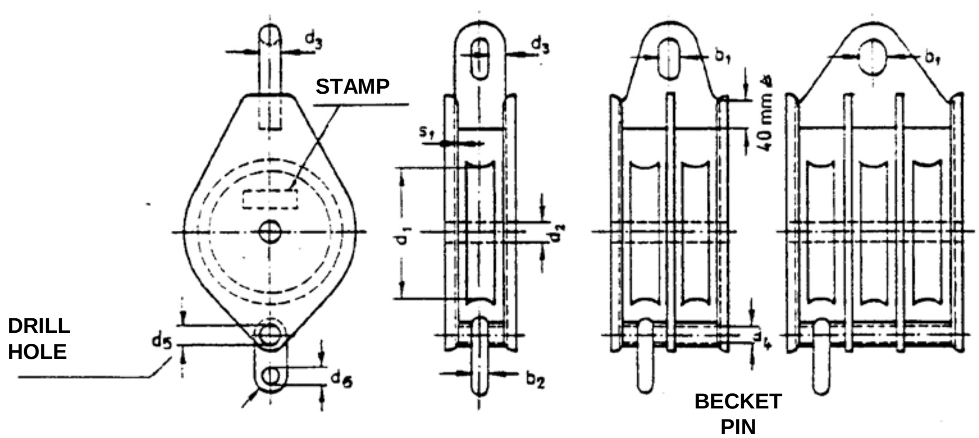
STEEL BLOCKS FOR MANILA-AND POLYPROPYLENE ROPES

Member:	Material :
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Side plates, becket :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Sheaves :	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size **1)**	Largest nom. dia. of rope	Sheave			Permissible load						
		Groove bottom dia.	Axle pin		Permiss. load "WLL" = permiss.rope tension SZ	Number of sheaves of the block					
						1		2		3	
						Without rope	With rope	Without rope	With rope	Without rope	With rope
						Permiss.load on the head fitting R_{max}		SWL = permiss. load on the head fitting R_{max}			
		d_1	d_2	S_1							
	mm	mm	mm	mm	t	kN	kN	kN	kN	kN	kN
7	18	100	14	5	0,37	7,4	11	15	18	22	26
8	20	110	16	5	0,50	10	15	20	25	30	35
9	22	121	18	5	0,59	12	18	24	29	35	41
10	24	132	20	5	0,70	14	21	28	35	42	49
11	26	143	20	5	0,82	16	25	33	41	49	57
12	28	154	22	5	0,92	18	28	37	46	56	65

Nominal size **1)**	Head fitting Number of sheaves of the block						Becket bolt dia.	Becket			
	1		2		3						
	b_1	d_3	b_1	d_3	b_1	d_3	d_4	b_2	d_5	d_6	r
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
7	26	18	26	18	32	23	16	16	18	18	17.5
8	26	18	32	23	40	28	16	16	18	18	17.5
9	26	18	32	23	40	28	18	16	20	18	20
10	26	18	40	28	40	28	21	16	23	18	20
11	32	23	40	28	45	32	21	16	23	18	22.5
12	32	23	40	28	45	32	22	18	24	18	22.5

1) *The nominal size is equal to the length of the housing of the wooden tackle block according to Table [34] (in ınch)*



Symbol :

According to nominal size, permissible load "WLL", number of sheaves and with or without becket and No. of Table

e.g.: Tackle block 10x1,4-1 sh. w.o. B.- [35]

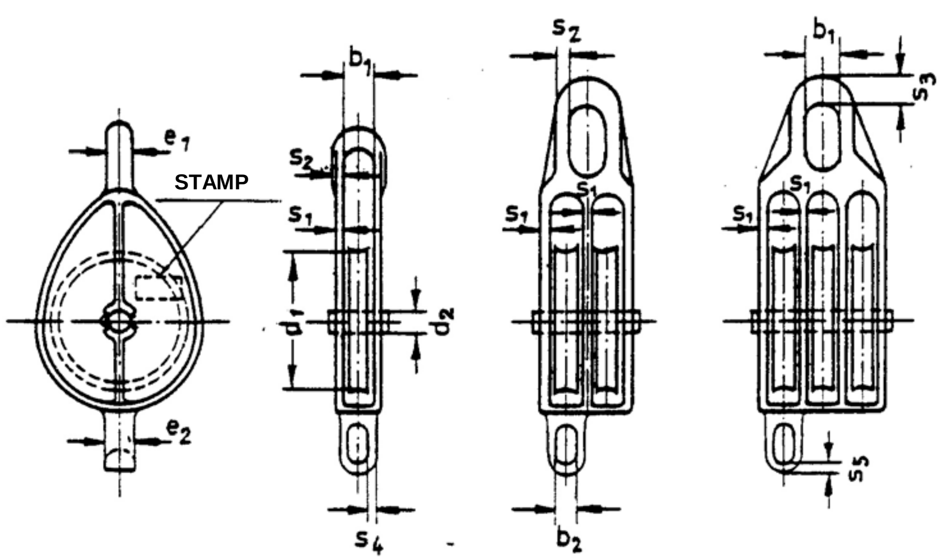
TABLE 36

BLOCKS WITH CAST HOUSING FOR MANILA- AN POLYPROPYLENE ROPES

Member:	Material :
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Housing :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Sheaves :	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size **1)**	Largest nom. dia. of rope	Rope sheaves: Groove bottom dia. d_1	Rope sheaves: Axle pin. dia. d_2	S_1	Permissible load: Permiss. load "WLL" permiss.rope tension SZ	1 sheave: Without rope (Permiss.load on the head fitting R_{max})	1 sheave: With rope (Permiss.load on the head fitting R_{max})	2 sheaves: Without rope (SWL = permiss. load on the head fitting R_{max})	2 sheaves: With rope (SWL = permiss. load on the head fitting R_{max})	3 sheaves: Without rope (SWL = permiss. load on the head fitting R_{max})	3 sheaves: With rope (SWL = permiss. load on the head fitting R_{max})
		Mm	mm	mm	t	kN	kN	kN	kN	kN	kN
7	18	100	14	5	0,37	7.4	11	15	18	22	26
9	22	121	18	5	0,59	12	18	24	29	35	41
11	26	143	20	5	0,82	16	25	33	41	49	57

Nominal size	Head fitting, number of sheaves of the block: 1				2				3				Becket			
	b_1	e_1	s_2	s_3	b_1	e_1	s_2	s_3	b_1	e_1	s_2	s_3	b_2	e_2	s_1	s_5
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
7	27	18	6	18	27	23	6	23	27	28	8	28	24	18	5	10
9	33	23	6	23	33	28	8	28	33	30	12	30	28	20	5	12
11	43	28	8	28	43	30	12	30	43	35	15	35	32	22	5	14



Symbol :

According to nominal size, permissible load "WLL", number of sheaves and with or without becket and No. of Table

e.g.: Tackle block 11x4-1 -2sh. w. B.- [36]

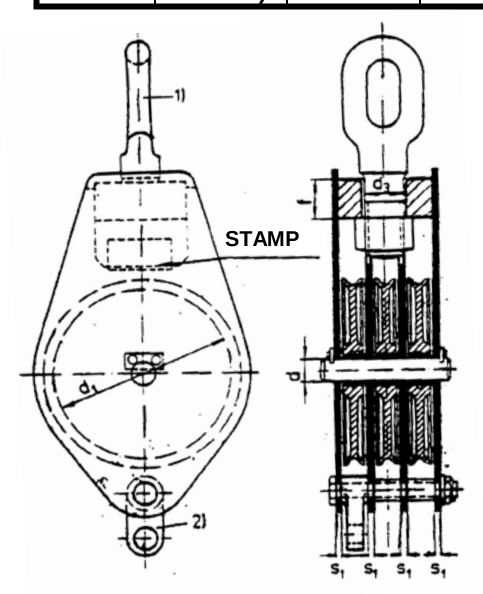
TABLE 37

GUY BLOCKS FOR WIRE ROPES

Member:	Material :
Axle pin :	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Housing :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Dil :	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size	Number of sheaves	Permiss. load "WLL" permiss. rope tension SZ	Permiss. load on the head fitting R_{max}	Largest nom. dia. of rope	Rope shaver		Side plates	Traverse	Oval eye head fitting
					Groove bottom dia d_1	Axle pin. dia. d_2			
		t	kN	mm	mm	mm	mm	mm	mm
1 2 3	1	1 2 3,2	20 40 63	12 16 18	168 224 252	22 32 40	6 8 10	22 32 40	24 33 42
1 2 3	1 with becket **2)**	1 2 3,2	30 60 95	12 16 18	168 224 252	22 32 40	6 8 10	28 40 50	30 42 52

Nominal size	Number of sheaves	Permiss. rope tension	Permiss. load "WLL" permiss.load on the head fitting	Largest nom. dia.of rope	Rope sheaves		Side plates	Traverse	Oval eye head fitting
					Groove bottom dia d_1	Axle pin dia d_2			
		t	kN	mm	mm	mm	mm	mm	mm
1 2 3	2	10 20 32	3.7 7.5 11.7	12 16 18	168 224 252	22 32 40	6 8 10	32 45 55	33 45 56
1 2 3	2 with becket**2)**	10 20 32	4.5 9.1 14	12 16 18	168 224 252	22 32 40	6 8 10	35 50 60	36 52 64
1 2 3	3	10 20 32	5.4 10.7 17	12 16 18	168 224 252	22 32 40	6 8 10	40 55 60	42 56 64
1 2 3	3 with becket**2)**	10 20 32	6.1 12.2 19	12 16 18	168 224 252	22 32 40	6 8 10	40 55 65	42 56 72



Symbol :

According to nominal size, number of sheaves and with or without becket and No. of Table

e.g.: Guy block 3-2sh. w. B.- [37]

1) *Oval eye head fitting according to Table 39*

2) *Becket according to Table 29*

TABLE 38

SNATCH BLOCKS

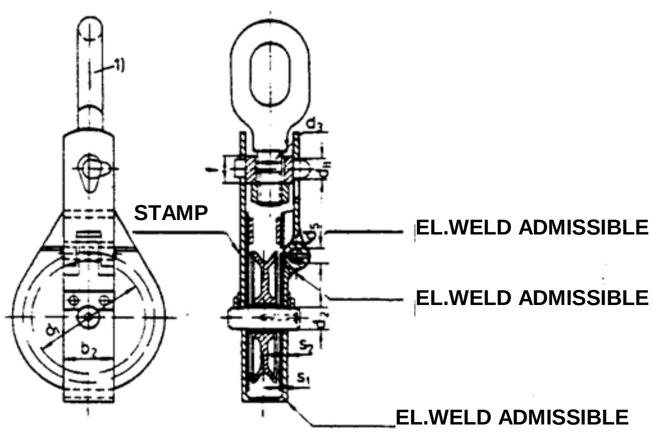
Member :	Material :
Axle pin:	St44-2, DIN EN 10025, Fe 430-B, ISO 630
Side plates, supporting straps, hinge eye, hinge plate and traverse :	RSt37-2, DIN EN 10025, Fe 360-B, ISO 630
Rope sheave :	GS-38, DIN 1681, GGG-40, DIN 1693

Nominal size	Permiss. load "WLL" permiss. rope tension SZ	Permiss. load on the head fitting	Largest nom. dia. of rope	Rope sheaves		Sheave housing	Supporting straps and hingle plate		Traverse		Oval eye head fitting	Hinge bolt dia.
				Groove bottom dia d_1	Axle pin. dia. d_2	s_1	b_2	s_2	f	d_{11}	d_3	d_5
	t	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm	Mm
1	1	20	12	108	22	3	50	6	22	16	24	16
2	2	40	16	144	32	4	65	10	32	23	33	22
3	3,2	63	18	162	40	5	80	10	40	28	42	25
4	4	80	20	180	45	5	90	10	45	32	45	28
5	5	100	22	198	50	6	100	13	50	36	52	32
6	6	125	24	216	55	6	110	13	55	40	56	36
8	8	160	28	252	65	7	130	16	60	45	64	40

Symbol :

According to nominal size and No. of Table

e.g.: Snatch block 5-[38]



1) *Oval eye head fitting according to Table 39.*

TABLE 39

OVAL EYE HEAD FITTINGS
For blocks, swivels and rigging-screws according to
DIN 82006, April 71

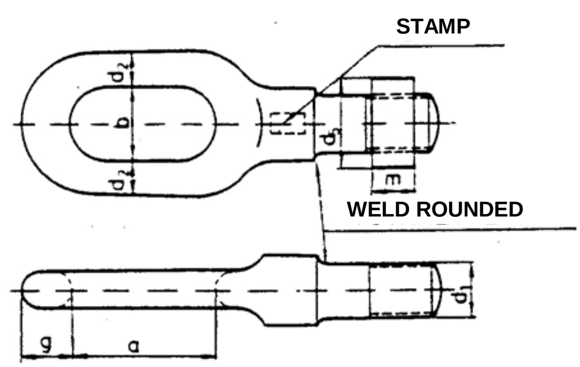
Member :	Material :
Oval eye head fitting :	RSt37-2, DIN EN 10025
Round nut :	Fe 360-B, ISO 630

Nominal size	Working load limit "WLL"	a	b	Thread d_1	d_2	g	Round nut **1)** d_5	Round nut **1)** m
	t	mm	mm		mm	mm	mm	mm
1	1	48	21	M 18	12	14	27	15
1,6	1,6	58	26	M 22	16	18	32	17
2	2	58	26	M 24	16	18	36	18
2,5	2,5	72	32	M 27	21	23	40	20
3	3,2	72	32	M 30	21	23	45	22
4	4	94	40	M 33	26	28	50	25
5	5	94	40	M 36	26	28	55	28
6	6.3	108	45	M 42	29	32	65	32
8	8	115	49	M 45	32	35	70	35
10	10	125	54	M 52	36	39	80	40
12	12,5	144	60	M 56	41	44	85	44
16	16	163	66	M 64	46	49	95	50
20	20	173	72	M 72x6	51	54	105	55
25	25	192	80	M 76x6	56	59	110	60
32	32	216	90	M 80x6	60	64	115	62
40	40	240	100	M 90x6	66	70	130	70
50	50	264	110	M 100x6	74	78	145	78
63	63	290	120	M 110x6	84	89	155	85
80	80	325	135	M 120x6	94	99	170	95
100	100	360	150	M 130x6	105	111	185	102
125	125	400	165	M 140x6	117	123	200	110
160	160	440	185	M 160X6	133	140	225	125
200	200	500	210	M 180x6	149	157	255	140
250	250	560	235	M 200x6	167	175	280	155

Symbol :

according to nominal size, and No. of Table

e.g.: Oval eye head fitting 32 - [39]



1) *According to DIN 82013*

TABLE 40

ROUND EYE HEAD FITTINGS

For blocks and rigging –screws

According to DIN 82010, April 71

Member: Material :

Stud eye head fitting : RSt37-2, DIN EN 10025

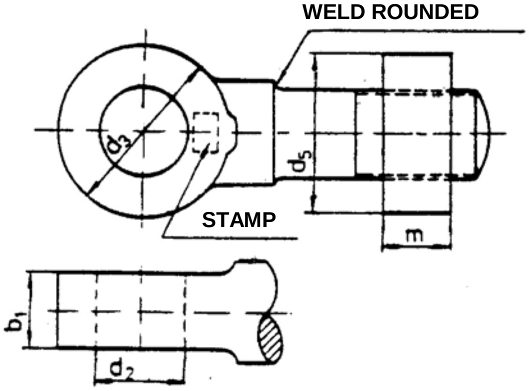
Round nut : Fe 360-B, ISO 630

Nominal size	Working load limit "WLL"	b_1	Thread d_1	d_2	d_3	Round nut **1)** d_5	m	Stud eye through bolt ∅
	t	mm		mm	mm	mm	mm	mm
1	1	16	M 18	18	35	27	15	16
2	2	22	M 24	25	50	36	18	22
2,5	2,5	25	M 27	27	55	40	20	24
3	3,2	28	M 30	30	60	45	22	27
4	4	30	M 33	33	65	50	25	30
5	5	35	M 36	39	75	55	28	36
6	6,3	40	M 42	42	85	65	32	39
8	8	45	M 45	48	95	70	35	45
10	10	50	M 52	52	110	80	40	48
12	12,5	55	M 56	56	120	85	44	52
16	16	60	M 64	65	130	95	50	60
20	20	65	M 72x6	74	140	105	55	68
25	25	70	M 76x6	78	150	110	60	72
32	32	80	M 80x6	86	170	115	62	80
40	40	90	M 90x6	96	190	130	70	90
50	50	100	M 100x6	106	210	145	78	100
63	63	110	M 110x6	116	230	155	85	110
80	80	125	M 120x6	131	270	170	95	125
100	100	140	M 130x6	146	296	185	102	140

Symbol :

According to nominal size and No. of Table

e.g.: Round eye head fitting 16 - [40]



1) *According to DIN 82013*

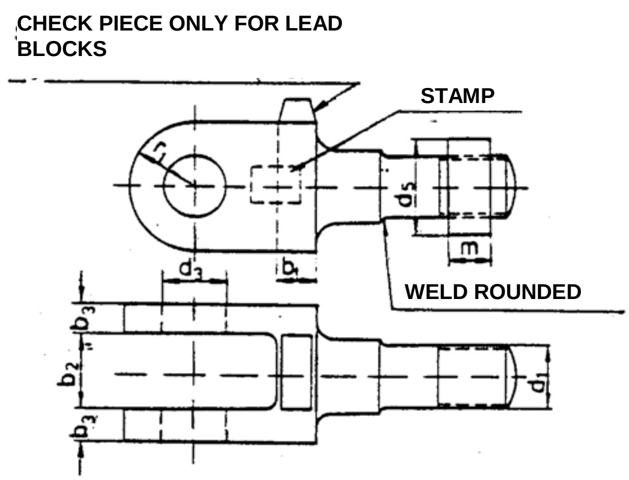
TABLE 41

DOUBLE LUG HEAD FITTINGS
For blocks and rigging –screws
According to DIN 82008, April 71

Member :	Material :
Stud eye head fitting:	RSt37-2, DIN EN 10025
Round nut:	Fe 360-B, ISO 630

Nominal size	Working load limit "WLL"	b_1	b_2	b_3	Thread d_1	d_3	r_1	Round nut **1)**		Double lug through bolt dia.
								d_5	m	
	t	mm	mm	mm		mm	mm	mm	mm	mm
1	1	10	19	8	M 18	17	17.5	27	15	16
2	2	13	26	12	M 24	23	25	36	18	22
2,5	2,5	14	29	13	M 27	25	27,5	40	20	24
3	3.2	17	32	14	M 30	28	30	45	22	27
4	4	18	35	15	M 33	31	32,5	50	25	30
5	5	22	39	18	M 36	37	37,5	55	28	36
6	6,3	24	45	20	M 42	40	42,5	65	32	39
8	8	28	49	23	M 45	46	47,5	70	35	45
10	10	31	58	26	M 52	50	55	80	40	48
12	12,5	34	64	28	M 56	54	60	85	44	52
16	16	36	70	30	M 64	62	65	95	50	60
20	20	40	74	33	M 72x6	70	70	105	55	68
25	25	42	80	35	M 76x6	74	75	110	60	72
32	32	48	90	40	M 80x6	82	85	115	62	80

Symbol :
According to nominal size and No. of Table
e.g.: Double lug head fitting 20-[41]



1) *According to DIN 82013*

Remark: if in spezial cases a rope shall be directly fitted to these head fittings by means of a closed socket or thimble, the length of the double lug (dimension t according to Table [24]) is to be enlarged.

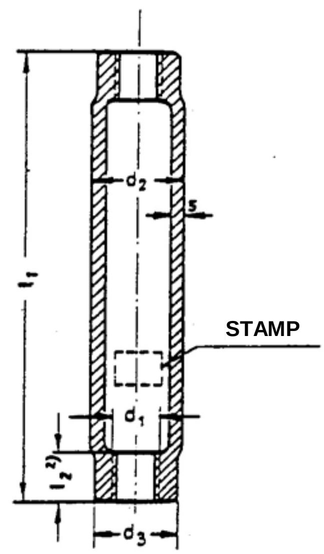
TABLE 42

TUBULAR BODIES FOR RIGGING SCREWS

According to DIN 82004, Jan 72*)

Material : RSt35-2, DIN 17115

Nominal size	Working load limit "WLL"	$d_2$xs **1)**	d_3	l_1	Thread d_1
	t	mm	mm	mm	
1	1	31,8 x 4,5	25	220	M 18
1,6	1,6	38 x 5,6	30	240	M 22
2	2	42,4 x 5,6	33	260	M 24
2,5	2,5	44,5 x 6,3	37	280	M 27
3	3,2	51 x 6,3	41	300	M 30
4	4	57 x 8	46	320	M 33
5	5	63,5 x 8	50	340	M 36
6	6,3	70 x 8,8	57	380	M 42
8	8	76,1 x 10	63	420	M 45
10	10	88,9 x 10	72	460	M 52
12	12,5	88,9 x 11	78	500	M 56
16	16	108 x 12,5	90	540	M 65
20	20	127 x 12,5	100	580	M 72x6
25	25	152,4 x 14,2	104	620	M 76x6
32	32	152,4 x 16	112	680	M 80x6
40	40	152,4 x 20	125	740	M 90x6
50	50	152,4 x 22	140	800	M 100x6
63	63	165 x 22	155	900	M 110x6



*****) Only up to nominal size 32 standardized.

Symbol for a complete rigging screw :

According to nominal size and No. of Table of both head fittings

e.g. : for a rigging screw of the nominal size 6, with one oval eye head fitting an done double lug head fitting :
head fitting 6 - [39+42+41]

for a a rigging screw of the nominal size 4, with stud eye head fitting at both ends:
head fitting 4 - [40+42+40]

1) *Tube according to DIN 2448*

2) $l_2 = d_1$

TABLE 43

MANILA AND POLYPROPYLENE ROPES

According to DIN 83322, Dec 84

Nominal dia. of rope	Manila halat ISO-Tip 1 DIN 83322	Polypopylene rope ISO-Tip 2 DIN 83322
	Breaking load of rope Form A **1)** and Form B **1)**	Breaking load of rope Form A **1)** and Form B **1)**
Mm	daN	daN
12	1050	2170
14	1430	2990
16	1990	3700
18	2400	4720
20	3190	5690
22	3790	6820
24	4480	7970
26	5230	9220
28	5980	10490
30	6730	11980
32	7720	13280
36	9460	16590
40	11800	-
44	14000	-
48	16500	-

Symbol :

According to Form, DIN-Standard and nominal dia. of rope.

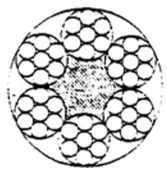
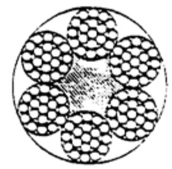
e.g.: rope DIN 83322-A24

1) *Form A = 3-stranded, hawser lay*

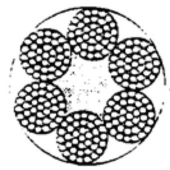
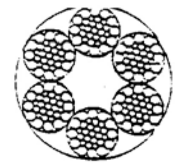
2) *Form B = 4- stranded, hawser lay*

TABLE 44

WIRE ROPES

Nominal strength	1570 N/mm^2	1570 N/mm^2	1770 N/mm^2
Nominal dia. of rope	Accord. to DIN 3055  Round rope 6x7 Constr. 6(6+1)+FE	Accord. to DIN 3060  Round rope standard 6x19 Constr. 6(12+6+1)+FE	
	Nominal breaking load **1)**		
mm	kN	kN	kN
8	33,4	30,9	34,8
10	52,2	48,2	54i4
12	75,1	69,5	78,3
14	102	94,6	107
16	134	124	139
18	169	156	176
20	209	193	218
22	252	234	263
24	300	278	315
26	353	326	368
28	409	378	426
32	534	494	557
36	676	625	705
40	835	722	870
44	-	934	1050
48	-	1110	1250
52	-	1300	1470
56	-	1510	1710
Approved for Shrouds Stays, Guy pendants		Shrouds, Stays, Guy pendants, Preventers, fastened by shackles or rope-sockets to the hull, Ropes for single-reeved span, not to be topped under load	Guy pendant, Guy tackle, Preventer

1) *The values of the Table are valid for ropes with core of natural or man made fibre material. The nominal breaking loads are to be increased for 8% if ropes of same construction are used with core of steel wire rope.*

Nominal strength	$1570\ N/mm^2$	$1770\ N/mm^2$	$1570\ N/mm^2$	$1770\ N/mm^2$
Nominal dia. of rope	DIN 3066  Round rope standard 6x37 Constr. 6(18+12+6+1)+FE		DIN 3064  Round rope Warrington-seal 6x36 Constr. 6(14+7/7+7+1)+FE	
	Nominal breaking load **1)**			
mm	kN	kN	kN	kN
8	29,6	33,4	-	-
10	46,3	52,2	51,3	58,4
12	66,6	75,1	74,6	84,1
14	90,7	102	102	114
16	118	134	133	149
18	150	169	168	189
20	185	209	207	234
22	224	253	251	283
24	267	301	298	336
26	313	353	350	395
28	363	409	406	458
32	474	534	530	598
36	600	676	671	757
40	741	835	829	934
44	896	1010	1000	1130
48	1070	1200	1190	1350
52	1250	1410	1400	1580
56	1450	1640	1620	1830
60	1670	1880	1860	2100
64	1900	2140	-	-
Approved for gears :	Cargo runners (hoisting ropes) span ropes (luffing ropes) guy tackles, preventer, lifting ropes			

Denomination of a rope made of round strands :

According to nominal diameter of rope, DIN-standard, type of core, surface of wires, nominal strength of wires, kind and direction of impact

e.g.: Rope 20 DIN 3066 - FE zn k 1570 sZ

According to DIN 3051 Sheet 4

The meaning of the following abbreviations is : : FE = Fibre core

zn k = wires drawn zinced

1570= nominal strength

sZ = rigth handed cross lay

TABLE 45

ROPE SOCKETS

According to DIN 83313, Oct.63

Material : GS-45.3, DIN 1681

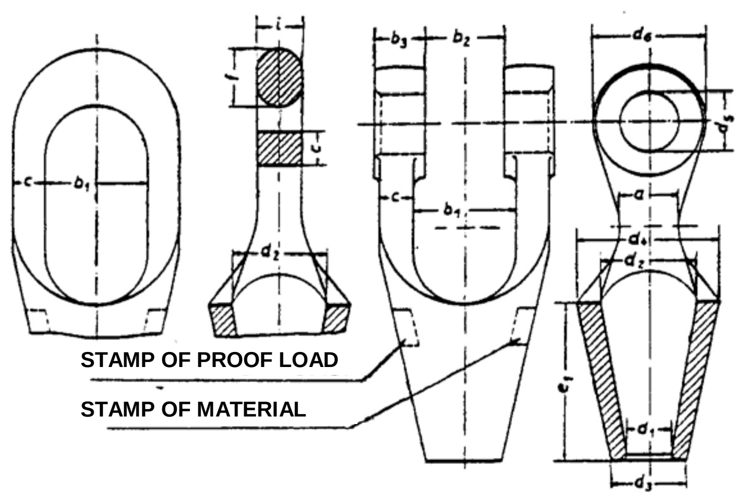
Nominal size	Working load limit "WLL"	Dia. of rope **1)**								Closed socket Form A		Open socket Form B					
			b_1	c	d_1	d_2	d_3	d_4	e_1	i	f	a	b_2	b_3	d_5	d_6	Bolt ∅
	t	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	10-12	30	8	14	30	26	45	50	12	15	15	21	13	17	35	16
1,6	1,6	12-14	37	12	17	36	30	55	60	15	19	19	27	17	21	45	20
2,5	2,5	14-18	45	14	20	42	33	62	69	19	24	25	33	21	25	55	24
3	3.2	16-20	50	16	22	47	36	69	78	21	26	28	38	24	28	60	27
4	4	18-22	54	18	24	51	40	76	84	24	30	32	42	27	31	65	30
5	5	20-24	60	20	27	57	44	85	94	27	34	36	47	30	37	75	36
6	6.3	22-28	67	23	30	64	49	94	106	30	38	40	53	34	40	85	39
8	8	26-30	73	26	33	70	54	103	115	33	42	44	60	38	46	95	45
10	10	28-34	80	29	36	76	60	112	125	36	45	48	66	42	50	110	48
12	12.5	32-38	89	32	40	85	67	125	140	41	51	54	73	47	54	120	52
16	16	36-44	100	35	45	96	75	140	159	46	56	61	81	52	62	130	60
20	20	40-50	110	40	50	106	84	156	174	50	62	66	90	58	70	140	68
25	25	44-54	120	43	55	116	93	173	190	55	69	73	100	63	74	150	72
32	32	50-62	132	48	60	127	104	188	209	61	76	80	110	70	82	170	80
40	40	58-72	150	54	68	144	117	212	237	68	85	91	125	79	93	190	90
50	50	62-76	165	60	75	159	130	235	262	75	94	100	140	88	104	210	100

Symbol :

According to Form, nominal size and No. of Table

e.g.: Closed socket A10-[45]

Closed socket Form A **Open socket Form B**



1) *Boring of the lower end to the sockets is necessary, except when used for ropes with the smallest nom. dia..*

TABLE 46

PREVENTER GRIBS

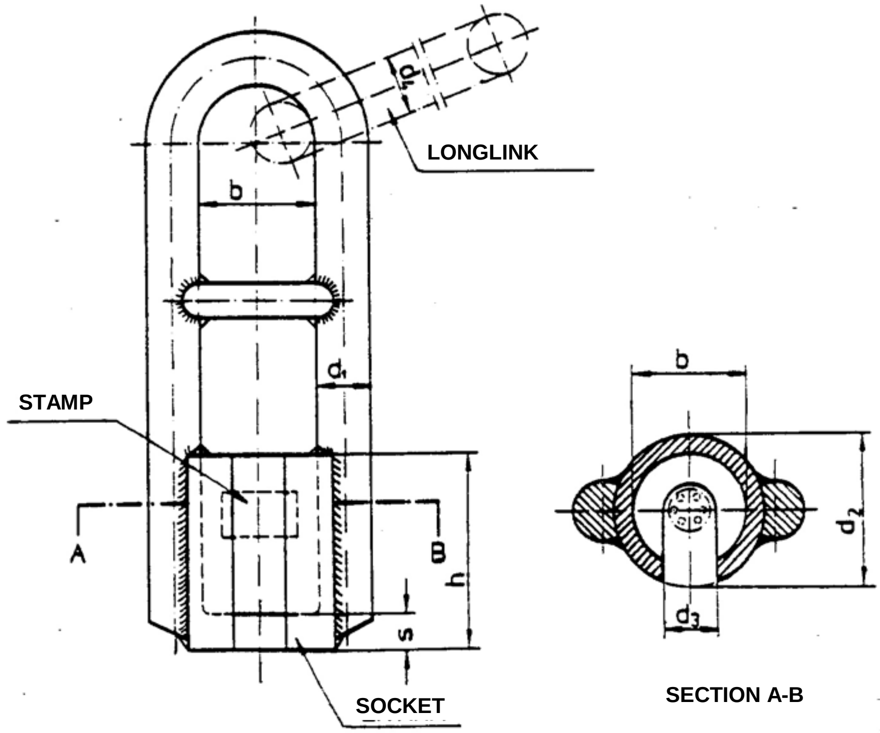
Member :	Material :
Grib :	RSt37-2, according to DIN EN 10025, Fe 360-B, ISO 630
Long link :	RSt35-2, according to DIN 17115

Nominal size	Working load limit "WLL"	Dia. of the corres-ponding wire rope	Shore							Long link	
			b	d_1	d_2	d_3	h	s	Fillet weld	d_4	Inside dimensions
	t	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
4	4	18	45	26	65	22	100	18	4	26	35 x 150
4,5	4,5	20	50	28	70	24	100	18	4	28	40 x 160
5,5	5,5	22	55	30	75	26	100	18	5	30	45 x 160
7	7	24	60	34	80	28	110	23	5	33	50 x 180
8	8	26	60	36	80	30	110	23	5	36	50 x 180
9	9	28	65	39	85	32	110	23	5	39	55 x 200
10	10.5	30	65	42	90	32	110	23	5	42	55 x 200
12	12.5	32	70	45	100	38	130	30	5	45	60 x 200
16	16	34	70	50	100	38	130	30	5	50	68 x 200

Symbol :

According to nominal size and No. of Table

e.g.: 4.5-[46]



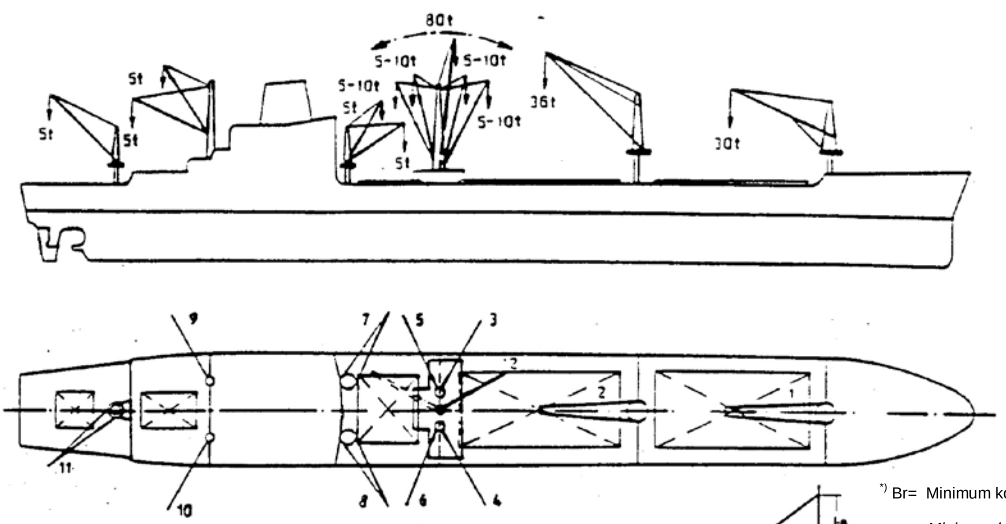
Appendix B

Rigging Plans

EXEMPLARILY THE FOLLOWING SAMPLES OF RIGGING PLANS ARE CONTAINED

Contents

TWIN SPAN TACKLE GEAR



*) Br= Minimum kopma yükü

Minimum breaking load

1t=1000 kg.

YÜK KALDIRMA DONANIMI PLANI
PLAN OF CARGO LIFTING GEAR

Bumba *Derrick* No:	SWL t	Bumba açısı *Angle of derrick*	Açavela *Outreach* m	Bumba boyu *Lenght of der.* m	$\frac{l-a}{l_B}$	Bumba çekme kuv. *Thrust of der.*	Gerilme *Tensile*: Yük halatı *Cargo runner* kN	Gerilme *Tensile*: Mant. halatı *Span rope* kN	Makara adedi *No of sheaves*: Yük palan. *Cargo purch.*	Makara adedi *No of sheaves*: Mant. palan. *Span tackle*	Bumba başı mak. Der. Head sheave	Mant. Klavuz mak. Span lead block	Yük halatı *Cargo runner*: Ø mm	Yük halatı *Cargo runner*: Br.*) kN	Mant. halatı *Span rope*: Ø mm	Mant. halatı *Span rope*: Br.*) kN	Markalama *Mark*: SWL	Markalama *Mark*: SWL (U)	Yük sınırı Load limitation: Bumba *Derrick*	Yük sınırı Load limitation: Yük mom. *Load mo.* tm	Alavera donanımı *Union purchase*: Bumba *Derrick*	Alavera donanımı *Union purchase*: SWL (U) t	Kamçı *Preventer*	
1	30	-	2.5 - 15	18.2	-	-	160	-	1 + 1	Hid.	-	-	34	735	-	-	30t 25-15m						Ø mm	Br.*) kN
2	36	-	3 - 22	23.0	-	-	204	194	1 + 1	2 + 2	-	-	38	916	36	871	36t 3-22m				3 + 4	5.0		
3 ÷ 6	5-10	15	-	16.9	0.65	20.8	52	80	1 + 1	1 + 1	-	-	22	260	28	400	5-10t 15°	5t			5 + 6	5.0		
7 ÷ 8	5	-	2.5 - 18	20.0	-	-	53	-	1	Hid.	-	x	22	265	-	-	5t 2.5-18m				9 + 10	3.0		
9 ÷ 10	3 - 5	15	-	16.9	0.69	12.0	31	77	1 + 1	1	-	-	18	155	26	385	3-5t 15°	3t						
11	5	-	1.5 - 18	19.8	-	-	56	22	1	2 + 1	-	x	24	280	16	110	5t 19-18m							
12	80	25	-	24.5	0.7	136.0	120	120	4 + 2	5 + 5	x	x	27	458	27	458	80t 25°							

Ağır yük için döndürme ablisi/*Slewing guy for heavy lift*

Bumba *Derrick*	Askı/*Pendant*: Ø mm	Askı/*Pendant*: Br.*) kN	Makara/*Tackle*: Dil adedi *No of sheaves*	Makara/*Tackle*: Ø mm	Makara/*Tackle*: Br.*) kN

ÖZEL ŞARTLAR
SPECIAL CONDITIONS

KREYN ÇALIŞMASINDA MAKSİMUM MEYİL 5°
WORKING WITH CRANES MAX. LIST 5°
12 NO'LU BUMBA ÇALIŞMASINDA MAKSİMUM MEYİL 13°, MAKSİMUM TRİM 1/2°
WORKING WITH DERRICK NO 12 MAX. LIST 13°, MAX. TRIM 1/2°

SERTİFİKALAR/*CERTIFICATES*

	Adet	İmalatçı *Manufacturer*	Sertifika No. *Certificate No*	Nominal Ölçü *Nominal size*	Tahrik Şekli *Type of drive*	Notlar *Notes*
Mantilya Vinci *Span winches*	6			25/125	Elektrik	
Yük Vinci *Cargo winches*	2			30	Elektrik	
	4			30/50		
Direkli Dikmeler *Mast & Posts*	3					
Bumbalar *Derricks*	6					
	1					
Kreynler *Cranes*	1				Hidro	
	1				"	
	2				Elektrik	
	1				"	

RESİM KONTROLLERİ/*CHECKING OF DRAWINGS*

Jurnal *Ju. No.*	Tarih *Date*	Madde *Item*	Önceki Onay

GEMİ SAHİBİ *OWNER OF THE SHIP*
GEMİ ADI *NAME OF SHIP*
TERSANE *YARD*
TL KAYIT NO: *TL REG. NO*
KOD NO: *CODE*
SİCİL LİMANI: *PORT OF REG.*
KLAS / *CLASS*
YENİ İNŞ. NO: *YARD NO.*
SAYFA / *SHEET*

KREYN İMALATÇISI : İsim *MANUFACTURER OF CRANE*					**KREYN DONANIMI** *CRANE RIG*	
TİP : *TYPE*					**GEMİ ADI** : İsim *NAME OF SHIP*	
YÜK HALATI *CARGO RUNNER*		**MANTİLYA HALATI** *SPAN RUNNER*			**KREYN NO** : 1 *CRANE NO*	
Ø mm	**MİNİMUM KOPMA YÜKÜ** *MINIMUM BREAKING LOAD kN*	**Ø mm**	**MİNİMUM KOPMA YÜKÜ** *MINIMUM BREAKING LOAD kN*		**TERSANE** : İsim *YARD.*	
34	735	-	-		**İNŞA NO** : Numara *YARD. NO*	
SERTİFİKALAR *CERTIFICATES*				**RESİMLERİN KONTROLÜ** *CHECKING OF DRAWINGS*		
PARÇA *PART*	**İMALATÇI** *MANUFACTURER*	**SERTİFİKA NO** *CERTIFICATE NO*	**NOTLAR** *NOTES*	**JURNAL NO** *JOURNAL NO*	**TARİH** *DATE*	**MADDE** *ITEM*
KREYN	İsim	Numara				KREYN

1 t = 1000 kg

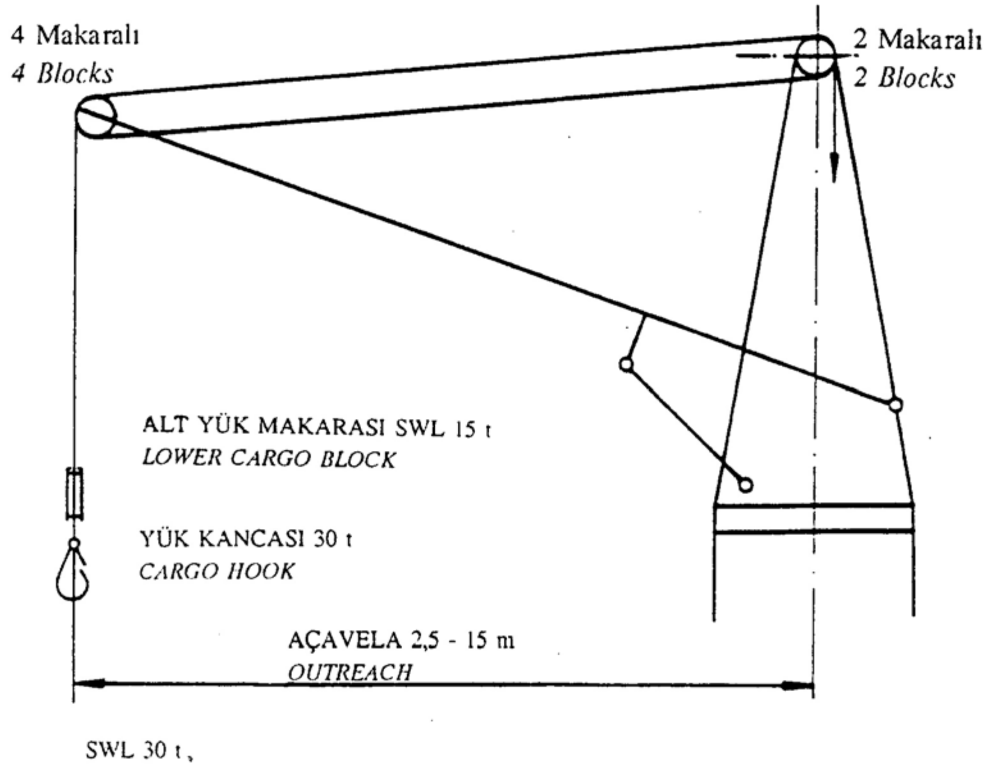
JİB BOYU = 18.2 m
JIB LENGTH

RULMANLI, TEL HALAT PALANGALARI
SHEAVES FOR WIRE ROPES WITH ANTI-FRICTION BEARINGS

HİDROLİK ORSA SİLİNDİRİ
HYDR.LUFFING CYLINDER

STATİK YÜKÜ = 610
STATICAL LOAD

ÇALIŞMA BASINCI = 230 BAR
OPERATING PRESSURE



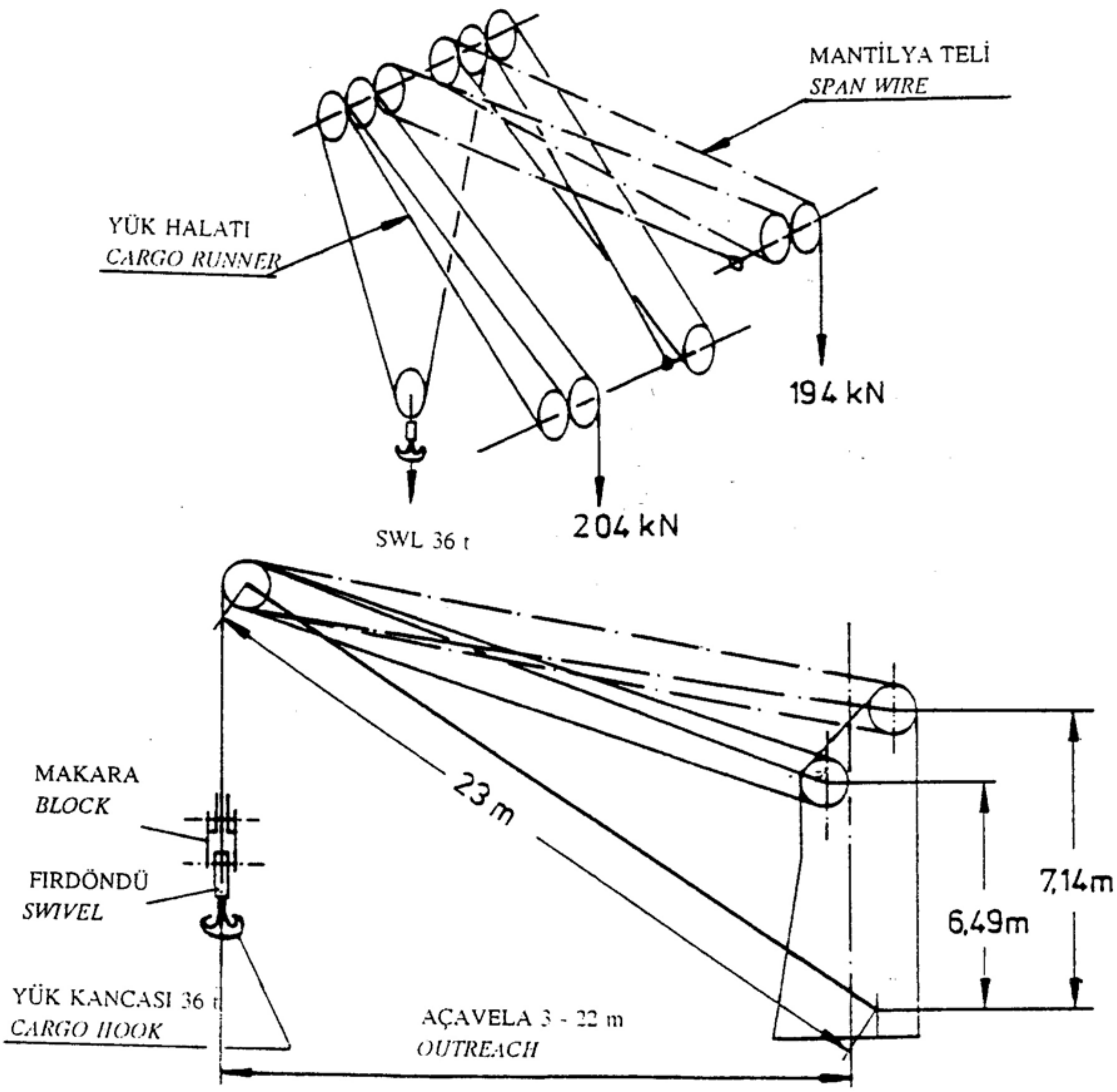
SAYFA NO......
SHEET NO

KREYN İMALATÇISI *MANUFACTURER OF CRANE*	: İsim	**KREYN DONANIMI** *CRANE RIG*
TİP : *TYPE*		**GEMİ ADI** *NAME OF SHIP* : İsim

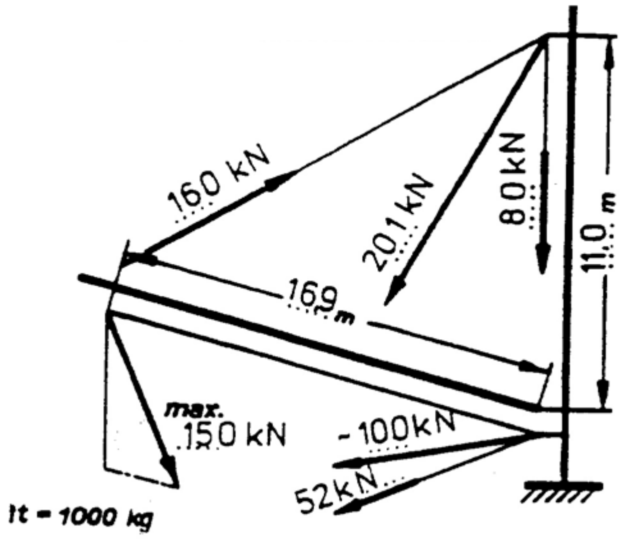
YÜK HALATI *CARGO RUNNER*		**MANTİLYA HALATI** *SPAN RUNNER*		**KREYN NO** *CRANE NO* : 2
Ø mm	**MİNİMUM KOPMA YÜKÜ** *MINIMUM BREAKING LOAD kN*	**Ø mm**	**MİNİMUM KOPMA YÜKÜ** *MINIMUM BREAKING LOAD kN*	**TERSANE** *YARD.* : İsim
38	916	36	871	**İNŞA NO** *YARD. NO* : Numara

SERTİFİKALAR *CERTIFICATES*				**RESİMLERİN KONTROLÜ** *CHECKING OF DRAWINGS*		
PARÇA *PART*	**İMALATÇI** *MANUFACTURER*	**SERTİFİKA NO** *CERTIFICATE NO*	**NOTLAR** *NOTES*	**JURNAL NO** *JOURNAL NO*	**TARİH** *DATE*	**MADDE** *ITEM*
KREYN	İsim	Numara				KREYN

1 t = 1000 kg.

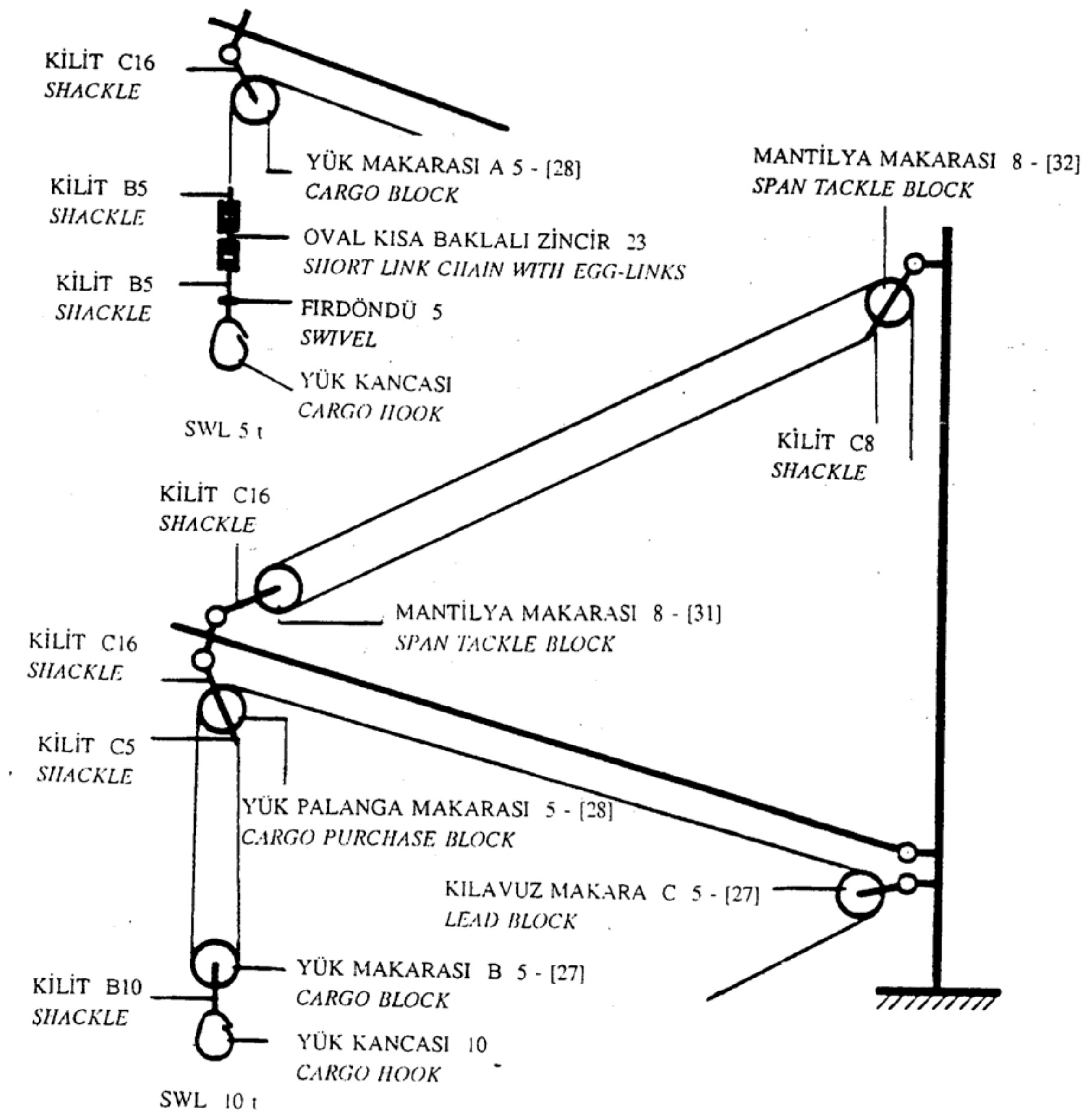


HALAT GERİLMELERİ VE BİLEŞKE YÜKLERİ
ROPE TENSIONS AND RESULTANT LOADS



BUMBA DONANIMI *DERRICK RIG*	
GEMİ ADI *NAME OF SHIP*	**:** İsim
BUMBA NO *DERRICK NO*	**:** 3-6
TERSANE *YARD.*	**:** İsim
YENİ İNŞA NO *YARD. NO*	**:** Numara

RULMANLI TEL HALAT MAKARALARI
SHEAVES FOR WIRE ROPES WITH ANTI-FRICTION BEARINGS



KREYN İMALATÇISI : İsim *MANUFACTURER OF CRANE*					**KREYN DONANIMI** *CRANE RIG*	
TİP : *TYPE*					**GEMİ ADI** : İsim *NAME OF SHIP*	
YÜK HALATI *CARGO RUNNER*		**MANTİLYA HALATI** *SPAN RUNNER*			**KREYN NO** : 7+8 *CRANE NO*	
Ø mm	**MİNİMUM KOPMA YÜKÜ** *MINIMUM BREAKING LOAD kN*	**Ø mm**	**MİNİMUM KOPMA YÜKÜ** *MINIMUM BREAKING LOAD kN*		**TERSANE** : İsim *YARD.*	
22	265	-	Hidrolik		**İNŞA NO** : Numara *YARD. NO*	

SERTİFİKALAR *CERTIFICATES*				**RESİMLERİN KONTROLÜ** *CHECKING OF DRAWINGS*		
PARÇA *PART*	**İMALATÇI** *MANUFACTURER*	**SERTİFİKA NO** *CERTIFICATE NO*	**NOTLAR** *NOTES*	**JURNAL NO** *JOURNAL NO*	**TARİH** *DATE*	**MADDE** *ITEM*
KREYN	İsim	Numara		Numara	Tarih	KREYN

1 t = 1000 kg

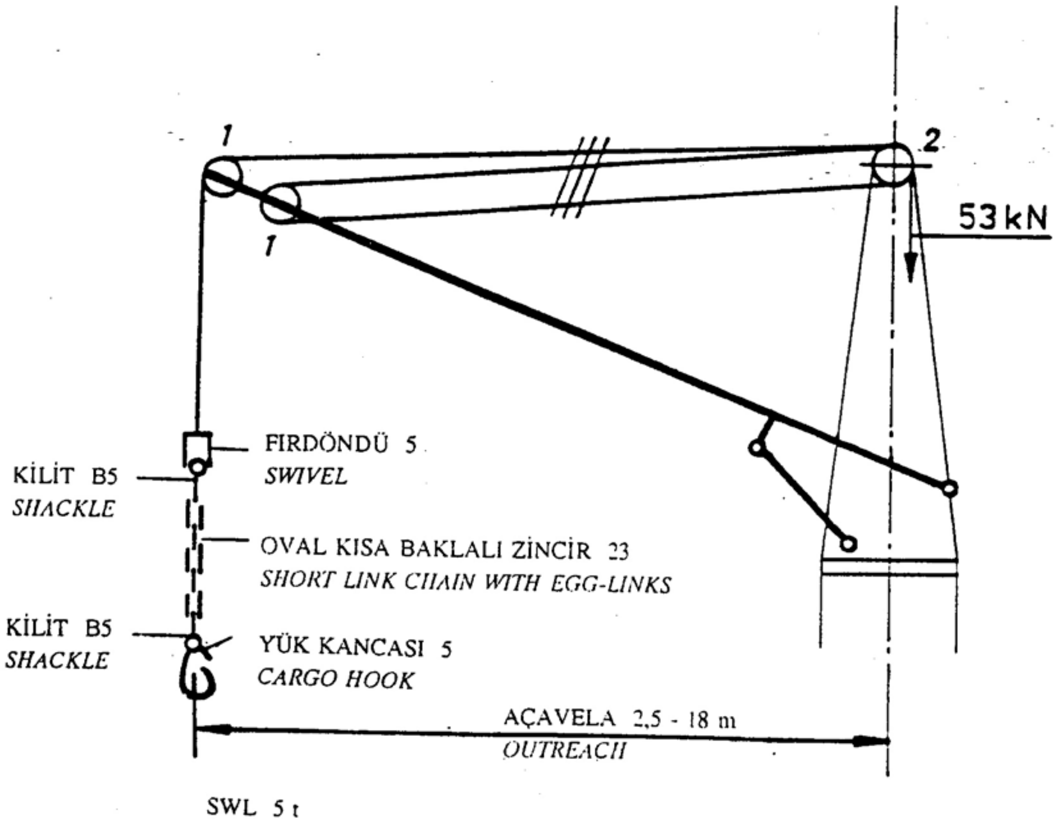
JİB BOYU = 20 m
JIB LENGTH

RULMANLI, TEL HALAT PALANGALARI
SHEAVES FOR WIRE ROPES WITH ANTI-FRICTION BEARINGS

HİDROLİK ORSA SİLİNDİRİ
HYDR. LUFFING CYLINDER

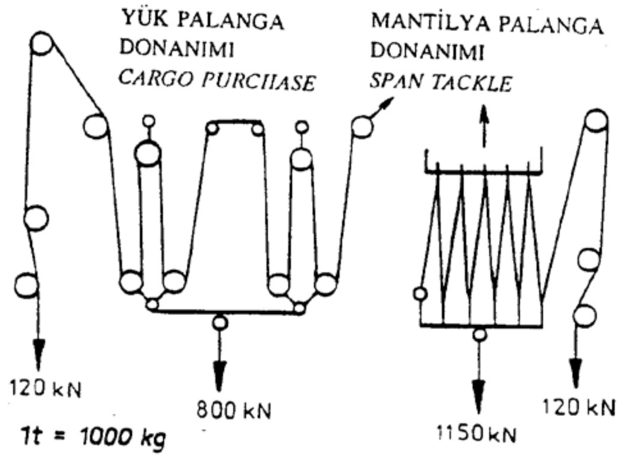
STATİK YÜKÜ = 220 kN
STATICAL LOAD

ÇALIŞMA BASINCI = 180 BAR
OPERATING PRESSURE



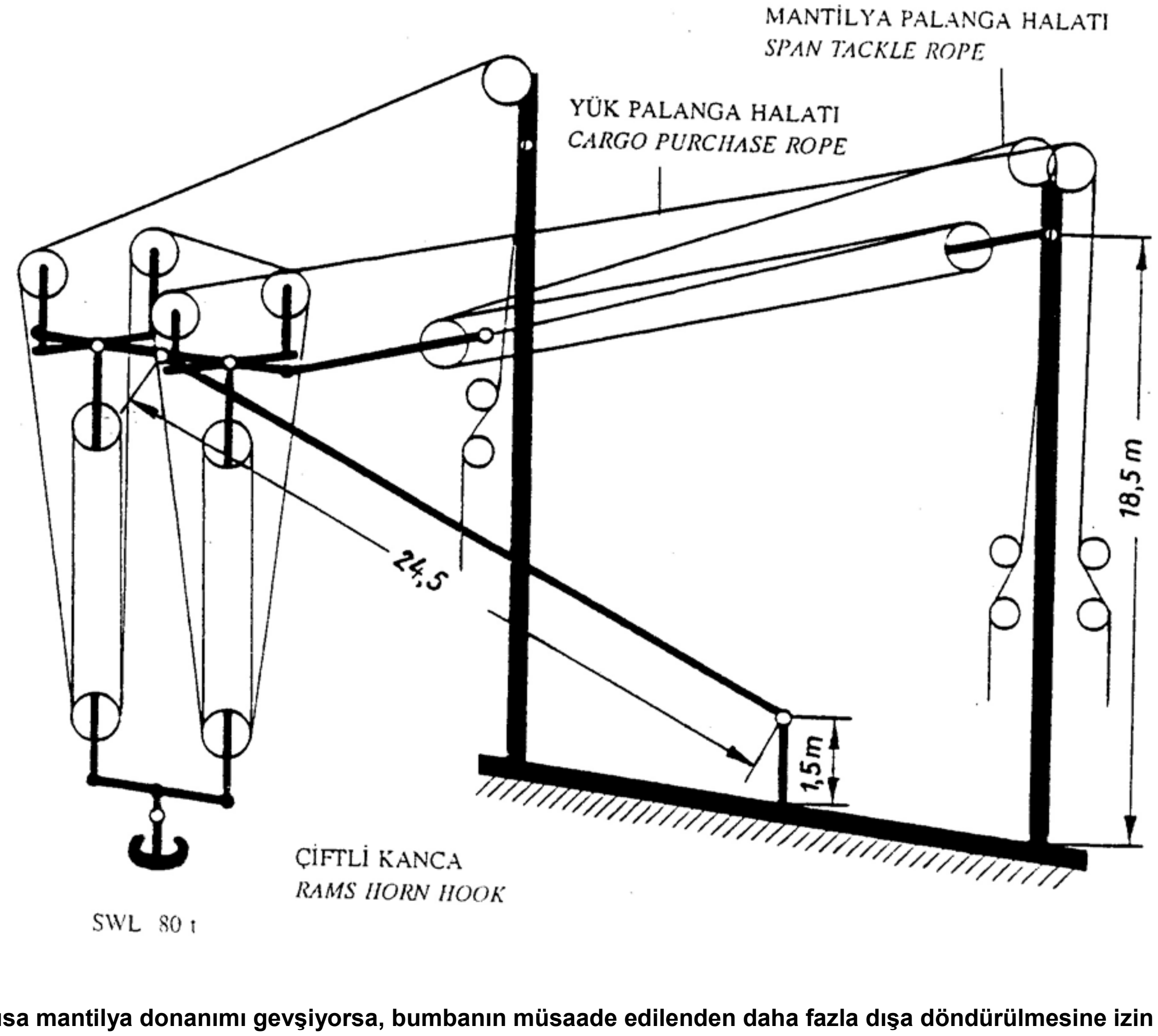
SAYFA NO......
SHEET NO

HALAT GERİLMELERİ VE BİLEŞKE YÜKLERİ
ROPE TENSIONS AND RESULTANT LOADS



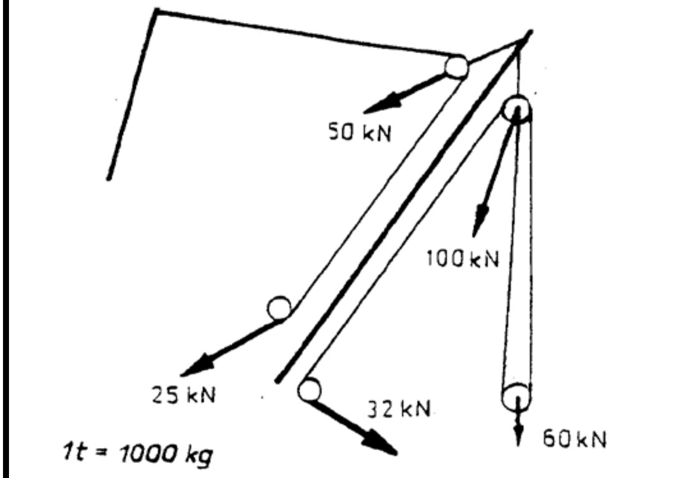
BUMBA DONANIMI *DERRICK RIG*		
GEMİ ADI *NAME OF SHIP*	:	İsim
BUMBA NO *DERRICK NO*	:	12 SWL 80 t
TERSANE *YARD.*	:	İsim
YENİ İNŞA NO *YARD. NO.*	:	Numara

RULMANLI TEL HALAT MAKARALARI
SHEAVES FOR WIRE ROPES WITH ANTI-FRICTIONS BEARINGS
Sadece 1 mantilya gösterilmiştir.
Only one span shown



Eğer kısa mantilya donanımı gevşiyorsa, bumbanın müsaade edilenden daha fazla dışa döndürülmesine izin verilmez.
Bu gevşeme, dönmeye ve bükülmeye başlayan alt mantilya palanga makarasından açıkça görülebilir. Gevşemiş kısa mantilya donanımı vira edilmemelidir.
If the short span tackle is falling slack, no further slewing out of the derrick is permissible. This slackness can be clearly seen from the lower span tackle block beginning turning and sagging away. The slack short span tackle must not be hauled in
SAYFA NO.....
SHEET NO

HALAT GERİLMELERİ VE BİLEŞKE YÜKLERİ
ROPE TENSIONS AND RESULTANT LOADS



ABLİ DONANIMLARI
GUY UNIT RIG

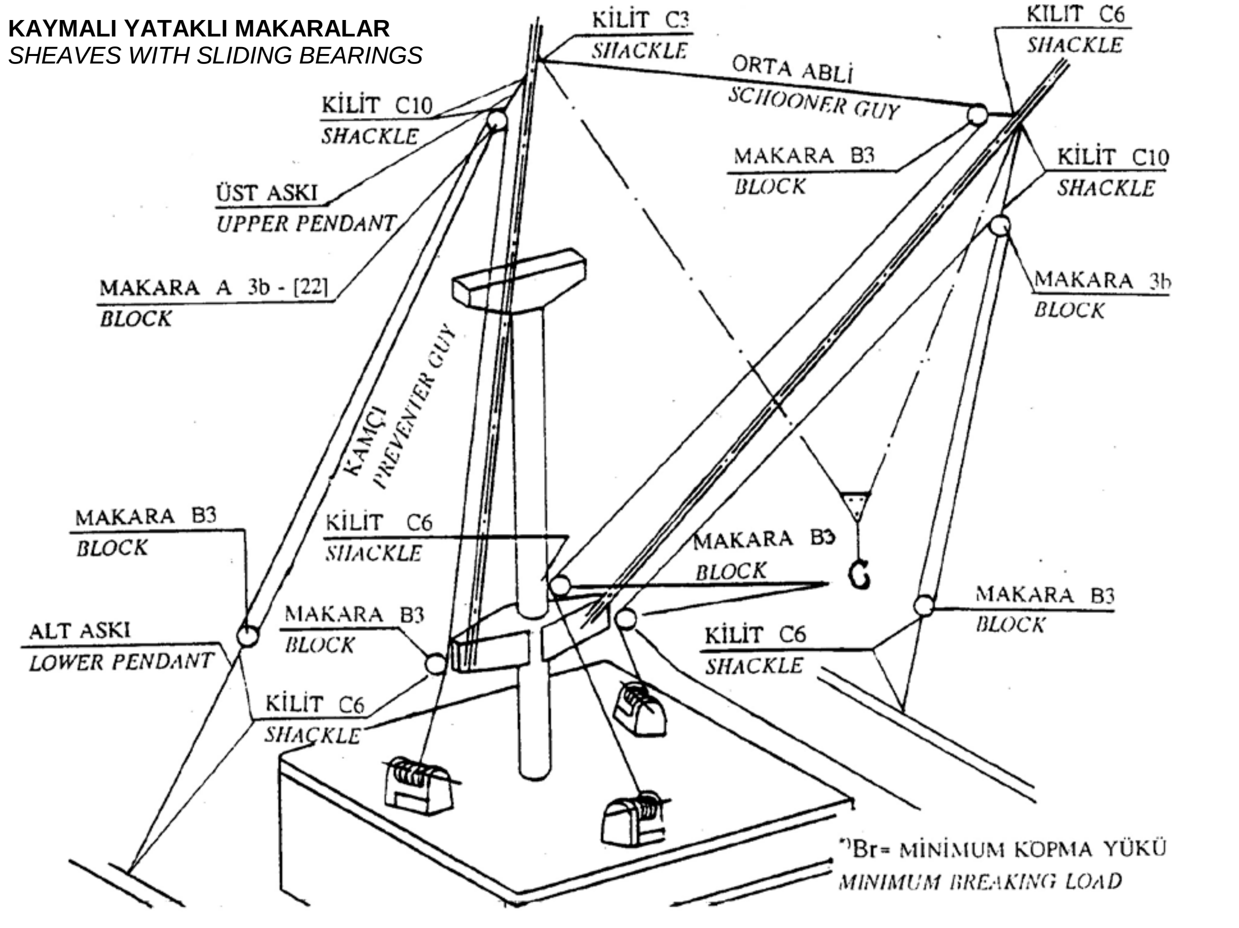
BUMBA NO : 9+10
DERRICK PAIR

TERSANE : İsim
YARD.

YENİ İNŞA NO : Numara
YARD

TEKİL DÖNMELİ BUMBALARLA ÇALIŞMADA HER İKİ BUMBA DA AYNI MEYİLDE OLMALIDIR.
WHEN WORKING WITH SINGLE SLEWED DERRICKS BOTH DERRICKS MUST HAVE THE SAME INCLINATION.

KAYMALI YATAKLI MAKARALAR
SHEAVES WITH SLIDING BEARINGS



Kamçı Ünitesi *Preventer Guy-Unit*							**Orta Abli Ünitesi** *Schooner Guy-Unit*		
Üst Askı *Upper Pendant*		**Alt Askı** *Lower Pendant*		**Makara Donanımı** *Tackle*			**Makara Donanıma** *Tackle*		
Ø	**Br.kN*)**	**Ø**	Br.kN*)	**Dil Adedi** *No of sheaves*	**Ø**	**Br.kN*)**	**Dil Adedi** *No of Sheaves*	**Ø**	**Br.kN*)**
22	240	28	400	1+1	18	160	1	16	125

	No	**İmalatçı** *Manufacturer*	**Sertifika No** *Certificate No*	**Nominal ölçü** *Nominal Size*	**Tahrik şekli** *Type of Drive*	**Notlar** *Notes*	
Kamçı vinci *Preventer Guy Winch*	2			15/40	Elektr.		**Sayfa No**: *Sheet No*
Orta Abli Vinci *Schooner Guy Winch*	1			10/25	Elektr.		

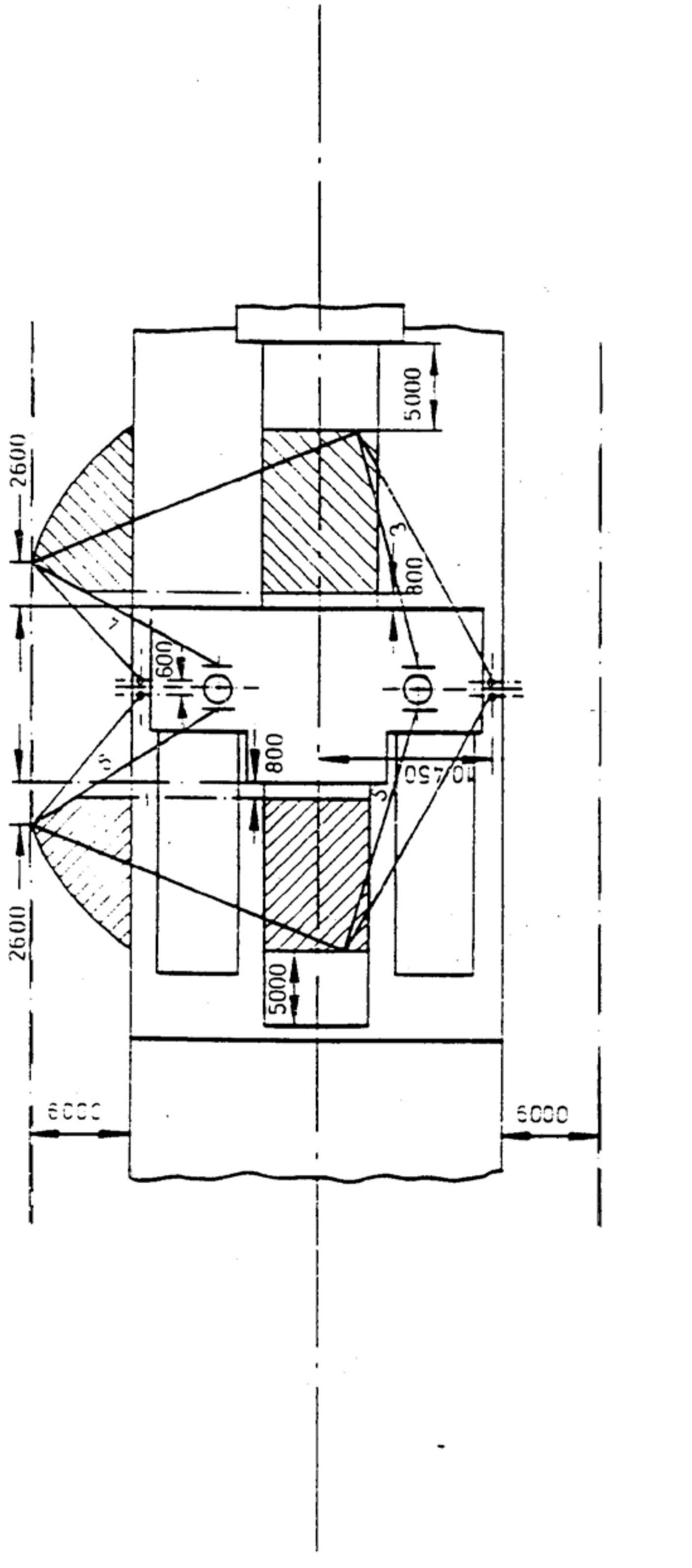
ALAVERE DONANIMI

ALAVERE DONANIMI ÇALIŞMA ALANI VE DIŞ BUMBADAKİ KAMÇILAR İÇİN GÜVERTE BAĞLANTI ELEMANLARI

UNION PURCHASE

WORKING RANGE FOR UNIION PURCHASE AND THE POSITION OF DECK ATTACHMENTS FOR PREVENTERS ON OUTHER DERRICKS

GEMİ ADI *NAME OF SHIP*	**:**	İsim
BUMBALAR *DERRICKS*	**:**	3 + 4 ; 5 + 6
TERSANE *YARD.*	**:**	İsim
YENİ İNŞA NO *YARD. NO*	**:**	Numara

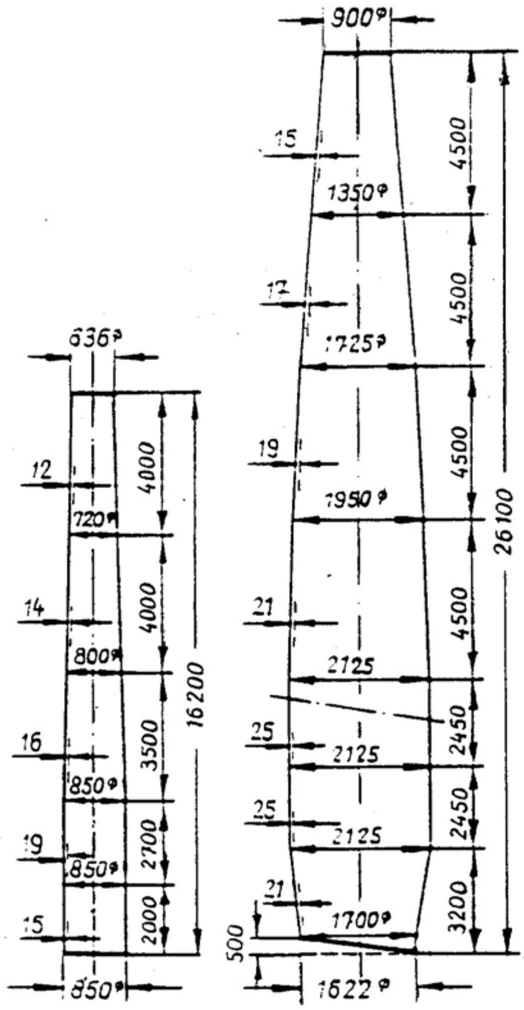


AMBARLARIN KIÇ TARAFINDA YER ALAN BUMBALARIN ÇALIŞMA SINIRLARI
WORKING RANGE OF DERRICKS SITUATED ABAFT THE HATCHES

AMBARLARIN BAŞ TARAFINDA YER ALAN BUMBALARIN ÇALIŞMA SINIRLARI
WORKING RANGE OF DERRICKS SITUATED ABEAM THE HATCHES

DIŞ BUMBADAKİ KAMÇILAR İÇİN GÜVERTE BAĞLANTI ELEMANLARI YERLEŞİMİ
KAMÇI ÖLÇÜLERİ VE SWL İÇİN, BAKINIZ: F 250
POSITION OF DECK ATTACMENTS FOR PREVENTERS ON OUTHER DERRICKS
DIMENSIONS OF PREVENTERS AND S.W.L SEE F.250

DİREKLER VE DİKMELER **KREYN (ALT YAPILARI)** *MASTS AND POSTS* *CRANE-SUBSTRUCTURES*	**GEMİ ADI** : İsim *NAME OF SHIP* **TERSANE** : İsim *YARD.* **YENİ İNŞA NO** : Numara *YARD. NO*



		DİKMELER *POSTS*	**DİKMELER** *POSTS*
BUMBA NO	**:**	**9+10**	**3-6**
DERRICK NO	:		12
MALZEME	**:**	**41-50 kg/mm^2**	**St 52-3, DIN 17100**
MATERIAL			
		GEMİ YAPIM ÇELİĞİ *SHIPBUILDING STEEL*	

KREYN DİKMESİ :
CRANE-POSTS

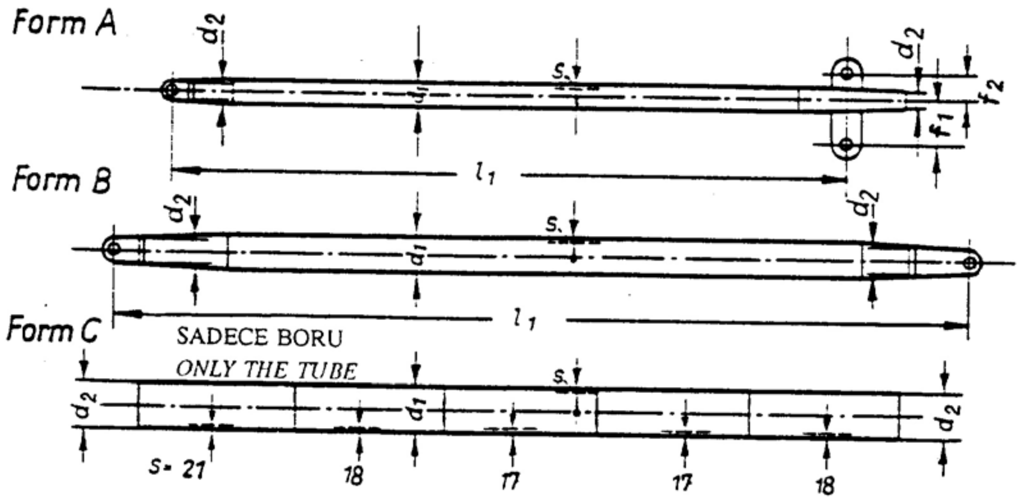
KREYN NO : SİLİNDİRİK BORU
CRANE NO CYLINDRICAL TUBE

	865	X	20
7+8	950	X	17
11	1000	X	17 / 12
1	2680	X	20
2	1800	X	40

MALZEME 41-50 kg/mm
MATERIAL
GEMİ YAPIM ÇELİĞİ
SHIPBUILDING STEEL

SAYFA NO.....
SHEET NO

BUMBALAR *DERRICK BOOMS*	**GEMİ ADI** : İsim *NAME OF SHIP* **TERSANE** : İsim *YARD.* **YENİ İNŞA NO** : Numara *YARD. NO*



BUMBA *DERRICK*	**BUMBA BOYU** *LENGTH OF DERRICK* l_1	**FORM**	d_1	d_2	**s**	f_1	f_2	**TOPUK FİTİNGİ NOMİNAL ÖLÇÜSÜ** *NOM.SİZE OF HEEL FITTING*	**BUMBA BORUSU MALZEMESİ** *MATERIAL OF DERRICK TUBE*
NO	**m**	**-**	**mm**	**mm**	**mm**	**mm**	**mm**	**-**	**-**
3-6 9+10 12	16.5 16.5 24.5	A A C	457.2 355.6 650	355.6 298.5 650	8 7.1 **Şekile bakınız** *s. fig.*	420 255 -	340 230 -	32 12 -	GEMİ YAPIM ÇELİĞİ SHIPBUILDING STEEL St 52-3 DIN 17100

SAYFA NO.....
SHEET NO

Appendix C

Documentation

DOCUMENTATION

Contents

Form No. STLA1

TÜRK LOYDU

Gemi ismi
Name of ship ....

Çağrı işareti
Code letters ....

Kayıt numarası
Offical number ....

Sicil Limanı
Port of Registry ....

TL-Sicil No.
TL-Register No. ....

Armatör
Owner ....

Düzenleme tarihi
Date of issue

Damga ve imzası
Stamp and signature

Not:
Bu sicil, merkezi Cenevre olan Uluslararası Çalışma Örgütü tarafından tavsiye edilen Uluslararası standart forma uygun olarak, 152 numaralı ILO anlaşması hükümlerine göre düzenlenmiştir.

Note:
This register is based on the Standard international form as recommended by the International Labour Office in Geneva In accordance with ILO Convention No.152.

GEMİ YÜKLEME DONANIMI SİCİL KİTAPÇIĞI

REGISTER OF SHIP'S LIFTING APPLIANCES AND CARGO HANDLING GEAR

Form No. STLA1R

TÜRK LOYDU

Kaldırma Donanımlarının Tescili
Register of Lifts

1. Gemi Bilgileri
Data of Ship

Gemi Adı :
Name of Ship

Çağrı İşareti :
Code Letters

Sicil Limanı :
Port of Registry

Armatör :
Owner

TL Kayıt Numarası :
TL-Register No.

Kaldırma Donanımı Numarası :
Lift No.

2. Kaldırma Donanımı Bilgileri
Data of Lift

Tipi :
Type

Kapasitesi :
Capacity

Adet
No of

- **Durak Pozisyonları** :
  Landing Positions
- **Erişimler** :
  Acceseses

Toplam Seyir Mesafesi :
Total Travel

Operasyon Hızı :
Operation Speed

İmalatçı :
Maker

Seri Numarası :
Serial No

Üretim Yılı :
Year Built

This Register is to be carefully kept and must be produced whenever required by a TL-Surveyor or authorized person.
İşbu sicil belgesi özenle muhafaza edilmeli ve gerektiği takdirde TL Sörveyörü veya yetkili bir kişi tarafından hazırlanmalıdır.

TÜRK LOYDU

Form No. STLA2

Not :
Bu sertifika, Uluslararası Çalışma Örgütü (ILO) tarafından önerilen ILO Konvansiyoneli No.152'ye uygun uluslararası standart forma göre düzenlenmiştir.

Note :
This certificate is based on the standard international form as recommended by the international Labour Office in accordance with ILO Convention No.152.

Sertifika No.
Certificate No. ....

Gemi Adı
Name of ship ....

TL Kayıt No.
TL-Reg. No. ....

Yükleme donanımlarının test ve ayrıntılı göz muayenesi sertifikası
Certificate of tests and thorough examination of Lifting Appliances

(1) Test edilen ve ayrıntılı göz muayenesi yapılan yükleme donanımlarının yeri ve tarifi (varsa tanıtma numarası) *Situation and description of lifting appliances (with distinguishing numbers or marks, if any) which have been tested and thoroughly examined*	**(2)** Test yükü uygulanan yarıçap ya da yatayla olan açı *Angle to the horizontal or radius at which test load applied*	**(3)** Test yükü [Ton] *Test load* *[Tonnes]*	**(4)** Sütun 2'de gösterilen yarıçapta ya da açıdaki emniyetli çalışma yükü [Ton] *SWL at angle or radius shown in col.2* *[Tonnes]*

Yükleme donanımının pozisyonu ve kullanımdaki özel durumlar için Yük Donanımı planlarına bakınız.
Position of Lifting Appliances and special conditions for the use see Rigging plans.

Türk Loydu tarafından .... kayıt nosuyla ....tarihinde onaylanmıştır.
Approved by .... Türk Loydu on...with Journal No..................................

Ayrıntılı göz muayenesi yapan ve testi gözlemleyen yetkili kişi/firma isim/adres
Name/address of the firm or competent person who witnessed testing and carried out thorough examination
: TURK LOYDU
Tersaneler Cad. No: 26
34944 Tuzla/İstanbul

Aşağıda imzaladığım tarihte, (1) No.lu sütunda gösterilen donanımın test edildiğini ve ayrıntılı göz muayenesinin yapıldığını ve hiçbir kusur ya da kalıcı deformasyon bulunmadığını ve emniyetli çalışma yükünün belirtildiği gibi olduğunu onaylarım.
I certify that on the date to which I have appended my signature, the gear shown in col.(1) was tested and thoroughly examined and no defects or permanent deformation was found; and that the safe working load is as shown.

______________________ ______________________ ______________________

(*Place*/Yer) (*Date*/Tarih) *Surveyor to TL*

Açıklamalar için arka sayfaya bakınız / *For instructions see reverse side*

AÇIKLAMALAR

1. Her yükleme donanımı; Emniyetli Çalışma Yükünden SWL fazla olarak aşağıda belirtilen test yükü ile test edilecektir :

SWL	Test yükü
20 tona kadar 20-50 ton arası 50 tondan fazla	+ %25 + 5 ton + %10

2. Bumba sistemlerinde test yükü, geminin normal donanımı ile ve bumba, bumba sisteminin dizayn edildiği yatayla en düşük açıdayken (genelde 15 derece) ya da kabul edilebilen daha büyük açıdayken kaldırılır. Test yapılan açı test sertifikasında belirtilmelidir. Test yükü kaldırıldıktan sonra bumba mümkün olduğunca her iki yönde döndürülmelidir.

2.1. Belirtilen SWL sadece tek bumbalı sistemlerde uygulanabilir. Alevera donanımlı sistemler kullanıldığında SWL (U), STLA02 (U) da gösterildiği gibi olmalıdır.

2.2. Ağır yük bumbalarında bağlantıların düzgün donandığına dikkat edilmelidir.

3. Kreynlerde, test yükü düşük hızda kaldırılmalı, döndürülmeli ve diklenmelidir. Büyük ve hareketli kreynler mümkünse hareketli taşıyıcıları ile birlikte tüm ray boyunca hareket ettirilmeli ve öne arkaya çevrilmelidir.

3.1. Değişebilen yük-çaplı kreynlerde, testler genellikle en büyük, en küçük ve ara çaplardaki uygun test yüküyle yapılmalıdır.

3.2. Emniyetli çalışma yükünün yüzde 25 fazlasının test yükü olarak kaldırılmasını basınç sınırlamalarının olanaksız hale getirdiği hidrolik kreynlerde, mümkün olan en yüksek yükü kaldırmak yeterli olacaktır. Ama bu, emniyetli çalışma yükünün yüzde 10 fazlasından az olmamalıdır.

4. Genel bir kural olarak, testler ağırlık kullanılarak yapılmalıdır ve ilk testlerde istisna yapılmasına izin verilmemelidir. Tamirlerde, değişimlerde veya periyodik muayenelerde tekrarlanması zorunlu testler için, kaldırma donanımının 15 tonu geçmemesi durumunda yaylı ya da hidrolik cihazların kullanılmasına müsaade edilebilir. Yaylı ya da hidrolik cihaz kullanıldığında, cihaz kalibre edilmeli ve yüzde ± 2 doğrulukla olmalıdır. İndikatör 5 dakika sabit olarak kalmalıdır.

4.1. Test ağırlığı kullanılmadıysa bu sütun (3) de belirtilmelidir.

5. "Ton" ifadesi 1000 kg. dır.

6. "Yetkili kişi", "Ayrıntılı göz muayenesi" ve "Kaldırma donanımı" ifadeleri Form No.STLA1'de açıklanmıştır.

Not : Test yöntemlerindeki öneriler için ILO'nun "Safety and Health in Dock Work" yayını referans verilebilir.

INSTRUCTIONS

1. *Every lifting appliance shall be tested with a test load which shall exceed the Safe Working Load SWL as follows :*

SWL	*Test load*
Up to 20 tonnes *20 to 50 tonnes* *Over 50 tonnes*	*25 percent in excess* *5 tonnes in excess* *10 percent in excess*

2. *In the case of derrick systems the test load shall be lifted with the ship's normal tackle with the derrick at the minimum angle to the horizontal for which the derrick system was designed (generally 15 degrees), or at such greater angle as may be agreed. The angle at which the test was made should be stated in the certificate of test. After the test load has been lifted it should be swung as far as possible in both directions.*

2.1. *The SWL shown is applicable to swinging derrick system only. When derricks are used in union purchase the SWL (U) is to be as shown on Form STLA02 (U).*

2.2. *In the case of heavy derricks, care should be taken to ensure that the appropriate stays are correctly rigged.*

3. *In the case of cranes, the test load is to be hoisted, slewed and luffed at slow speed. Gantry and travelling cranes together with their trolleys, where appropriate, are to be traversed and travelled over the full length of their track.*

3.1. *In the case of variable load-radius cranes, the tests are generally to be carried out with the appropriate test load at max. and min. and at an intermediate radius.*

3.2. *In the case of hydraulic cranes where limitations of pressure make it impossible to lift a test load 25 per cent in excess of the Safe Working Load, it will be sufficient to lift the greatest possible load, but in general this should not be less than 10 per cent in excess of the Safe Working Load.*

4. *As a general rule, tests should be carried out using test loads and no exception should be allowed in the case of initial tests. In the case of repairs, replacement or when the periodic examination calls retest consideration may be given to the use of spring or hydraulic balances provided the SWL of the lifting appliance does not exceed 15 tonnes. Where a spring or hydraulic balance is used it shall be calibrated and accurate to within ± 2 per cent and the indicator should remain constant for five minutes.*

4.1. *If the test weights are not used this is to be indicated in col.(3).*

5.*The expression "Tonne" shall mean a tonne of 1.000 kg.*

6. *The terms "Competent Person", "Thorough Examination" and "Lifting Appliance" are defined in Form No.STLA1.*

Note : *For Recommendations on test procedure reference may be made to the ILO document "Safety and Healt h in Dock Work".*

TÜRK LOYDU

Form No. STLA3

Not :
Bu sertifika, Uluslararası Çalışma Örgütü (ILO) tarafından önerilen ILO Konvansiyoneli No.152'ye uygun uluslararası standart forma göre düzenlenmiştir.
Note :
This certificate is based on the standard international form as recommended by the international Labour Office in accordance with ILO Convention No.152.

Sertifika No.
Certificate No. ....

Gemi Adı
Name of ship ....

TL Kayıt No.
TL-Reg. No. ....

Değiştirilebilen elemanların ve serbest yük teçhizatının test ve ayrıntılı göz muayenesi

Certificate of test and thorough examination of Interchangeable components and Loose Gear

(1) Tanıtma numarası ya da markası *Distinguishing number or mark*	**(2)** Değiştirilebilen elemanların ve serbest yük teçhizatının tarifi *Description of interchangeable components and loose gear*	**(3)** Test adedi *Number tested*	**(4)** Test tarihi *Date of test*	**(5)** Test yükü [Ton] *Test load [Tonnes]*	**(6)** Emniyetli çalışma yükü SWL [Ton] *Safe working load SWL [Tonnes]*

İmalatçı ya da satıcının isim/adres :
Name and address of makers and suppliers ....

....

Ayrıntılı göz muayenesi yapan ve testi gözlemleyen yetkili kişi/firma isim/adres
Name/address of the firm or competent person who witnessed testing and carried out thorough examination
: TURK LOYDU
Tersaneler Cad. No:26
34944 Tuzla/İstanbul

Yukarda belirtilen değiştirilebilen elemanların ve serbest yük teçhizatının test edildiğini ve ayrıntılı göz muayenesinin yapıldığını ve emniyetli çalışma yükünü etkileyecek hiç bir kusurun bulunmadığını onaylarım.
I certify that the above items of interchangeable components and loose gear were tested and thoroughly examined and no defects affecting their SWL were found.

______________________ ______________________ ______________________

(*Place*/Yer) (*Date*/Tarih) *Surveyor to TL*

Açıklamalar için arka sayfaya bakınız / *For instructions see reverse side*

AÇIKLAMALAR

1. Değiştirilebilen elemanların ya da serbest yük donanımının her parçası ilk kullanıma alınmadan önce ve emniyetini etkileyebilecek herhangi bir kısmının önemli değişiminden ya da tamirinden sonra, test edilmeli ve ayrıntılı göz muayenesi yapılmalıdır.

Değiştirilebilen elemanlar	Çalışma yükü limiti "WLL" *	Test yükü "PL stat"
Zincirler, halkalar, kancalar, kilitler, fırdöndüler v.b.	25 tona kadar 25 tondan fazla	2xWLL (1.22xWLL)+20t
Çok dilli makara	25 tona kadar 25 tondan 160 tona kadar 160 tondan fazla	2xWLL (0.933xWLL)+27t 1.1xWLL
Bülbülsüz tek dilli makara	12.5 tona kadar 12.5 tondan fazla	4xWLL (2.44xWLL)+20t
Bülbüllü tek dilli makara	8.0 tona kadar 8.0 tondan fazla	6xWLL (3.66xWLL)+20t
Yük ve konteyner kantarmaları ve benzeri tertibatlar gibi olan serbest yük donanımı	10 tona kadar 10 tondan 160 tona kadar 160 tondan fazla	2xWLL (1.04xWLL)+9.6t 1.1xWLL

*) Çok dilli makaralar için çalışma yükü limiti WLL, makara arasındaki müsaade edilen yüke eşittir.
Bülbülsüz tek dilli makaralar için, çalışma yükü limiti WLL askıdaki müsaade edilen yükün yarısına eşittir. Eğer telin her iki kısmı da paralel olarak çalışıyorsa, çalışma yükü limiti WLL tel gerilmesine eşittir.
Bülbüllü tel dilli makaralar için, çalışma yükü limiti WLL askıdaki müsaade edilen yükün üçte birine eşittir. Eğer telin üç kısmı paralel olarak çalışıyorsa, çalışma yükü limiti WLL tel gerilmesine eşittir.

2. Aynı yükleme donanımında kullanılacak değiştirilebilen elemanlardan çalışma yükü limitleri 100 tonu geçerek farklılık gösterenler ve çalışma yükü limitleri 10 tonu geçen gemideki serbest yük donanımı yükleme donanımının yük testinde dinamik olarak beraber test edilebilir. Aşağıdaki test yükleri uygulanır :

Donanım (SWL)'si	Test yükü "PLdyn"
20 tona kadar 20 tondan 50 tona kadar 50 tondan fazla	SWL + %25 SWL + %5t SWL + %10

"PLdyn" test yükü uygulanan elemanlar değiştirilemezler. Türk Loydu onaylı kabulü ile diğer yükleme donanımlarında da kullanılabilir. Her bir eleman için kendi STLA3 formu düzenlenmelidir.

3. Ton ifadesi 1000 kg. dır.

4. "Yetkili kişi", "Ayrıntılı Göz Muayenesi" ve "Kaldırma Donanımı" ifadeleri Form No.STLA1 de açıklanmıştır.

Not :
Test yöntemlerindeki öneriler için ILO'nun "Safety and Health in Dock Word" yayını referans verilebilir.

INSTRUCTIONS

1. *Every item of interchangeable component and loose gear is to be tested and thoroughly examined before being put into use for the first time and after any substantial alteration or repair to any part liable to affect its safety. The test loads to be applied shall be in accordance with the following table :*

Interchangeable components	***Working load limit "WLL")****	***Proof load "PL stat"***
Chains, rings, hooks, shackles, swivels, etc.	*Up to 25t* *Over 25t*	*2xWLL* *(1.22xWLL)+20t*
Multiple sheave blocks.	*Up to 25t* *Over 25t to 160t* *Over 160t*	*2xWLL* *(0.933xWLL)+27t* *1.1xWLL*
Single sheave blocks without becket	*Up to 12.5t* *Over 12.5t*	*4xWLL* *(2.44xWLL)+20t*
Single sheave blocks with becket	*Up to 8.0t* *Over 8.0t*	*6xWLL* *(3.66xWLL)+20t*
Loose gear like lifting beams, spreaders and similar devices.	*Up to 10t* *Over 10t to 160t* *Over 160t*	*2xWLL* *(1.04xWLL)+9.6t* *1.1xWLL*

**) For multiple sheave block, the working load limit WLL is equal to the permissible load at the suspension of the blocks. For single sheave blocks without backed, the working load limit WLL is equal to one half of the permissible load at the suspension. If both parts of the rope are running in parallel the working load limit WLL is equal to the rope tension.*
For single sheave blocks with backed, the working load limit WLL is equal to one third of the permissible load at the suspension. If the three parts of the rope are running parallely the working load limit WLL is equal to the rope tension.

2. *Deviating from this components with Working Load Limits exceeding 100 t and shipborne loose gear with Working Load limits exceeding 10 t intended for identical lifting appliances may during load testing of the lifting appliance be tested dynamical together with it, applying the following test loads :*

SWL of gear	***Test load "PLdyn"***
Up to 20t *From 20t to 50t* *Over 50t*	*SWL + 25%* *SWL + 5t%* *SWL + 10%*

Components subjected to test load "PLdyn" are not interchangeable, they can be used with written consent of Türk Loydu for other lifting appliances also. For each of these components must be issued an own certificate form STLA3

3. *The expression "tonne" shall mean a tonne of 1000 kg.*

4. *The terms "competent person", "thorough examination" and "loose gear" are defined in form No. STLA1*

Note :
For recommendations on test procedures reference may be made to the ILO doc. "Safety and Health in Dock Work."

Form No. STLA2 (U)

TÜRK LOYDU

Not :
Bu sertifika, Uluslararası Çalışma Örgütü (ILO) tarafından önerilen ILO Konvansiyoneli No.152'ye uygun uluslararası standart forma göre düzenlenmiştir.
Note :
This certificate is based on the standard international form as recommended by the international Labour Office in accordance with ILO Convention No.152.

Sertifika No.
Certificate No. ....

Gemi Adı
Name of ship ....

TL Kayıt No.
TL-Reg. No. ....

Alavera donanımlı sistemlerin test ve ayrıntılı göz muayenesi sertifikası
Certificate of test and thorough examination of Derricks used in union purchase

(1) Test edilen ve ayrıntılı göz muayenesi yapılan alevera donanımlı sistemlerin yeri ve tarifi (varsa tanıtma numarası ya da markası) *Situation and description of derricks used in union purchase (with distinguishing numbers or marks, if any) which have been tested and thoroughly examined.*	**(2)** Kanca üçgeni terazisinin ambar mezarnasından max. yük. [m] ya da kanca halatları arasındaki açı *Max. height of triangle plate above hatch coaming [m] or max. angle btw. runners.*	**(3)** Test yükü [Ton] *Test load [Tonnes]*	**(4)** Alevera donanımlı sistemdeki emniyetli çalışma yükü SWL (U) *Safe working load SWL (U) when operating in union purchase [Tonnes]*

Diş abli bağlantılarının yeri :
Position of outboard preventer guy attachments

(a) direğin önünde/arkasında,
forward/aft of mast,* .... *[m]*
(b) gemi merkez hattından,
from ship's centre line,.. *[m]*

İç abli bağlantılarının yeri :
Position of inboard preventer guy attachment

(a) direğin önünde/arkasında,
forward/aft of mast,* .... *[m]*
(b) gemi merkez hattından,
from ship's centre line,.. *[m]*

*) Uygun şekilde iptal ediniz / *Delete as appropriate.*

Ayrıntılı göz muayenesi yapan ve testi gözlemleyen yetkili kişi/firma isim/adres
Name/address of the firm or competent person who witnessed testing and carried out thorough examination
: TURK LOYDU
Tersaneler Cad. No:26
34944 Tuzla/İstanbul

Aşağıda imzaladığım tarihte, (1) no'lu sütunda gösterilen donanımın test edildiğini ve ayrıntılı göz muayenesinin yapıldığını ve hiçbir kusur ya da kalıcı deformasyon bulunmadığını ve emniyetli çalışma yükünün belirtildiği gibi olduğunu onaylarım.
I certify that on the date to which I have appended my signature, the gear shown in col.(1) was tested and thoroughly examined and no defects or permanent deformation was found; and that the safe working load is as shown.

______________________ ______________________ ______________________
(*Place*/Yer) (*Date*/Tarih) *Surveyor to TL*

Açıklamalar için arka sayfaya bakınız / *For instructions see reverse side*

AÇIKLAMALAR

1. Kullanıma alınmadan önce, alevera donanımlı sistemler Emniyetli Çalışma Yükünden SWL (U) fazla olarak aşağıda belirtilen test yükü ile test edilir :

SWL	Test Yükü
20 tona kadar	+ % 25
20-50 ton arası	+ 5 ton
50 tondan fazla	+ % 10

2. Testler, kanca üçgen terazinin ambar mezarnasından max. yüksekliğinde ya da kanca halatları arasındaki max. açıda ve bumbaların çalışır durumlarında, mapaların ve alevera donanımlı sistemin mukavemetini onaylama için yapılır. Bu yükseklikler ve açılar yük donanımı planlarında belirtilen değerleri aşmamalıdır.

3. Testler, ağırlık kullanılarak yapılır.

4. "Ton" ifadesi 1000 kg. dır.

5. "Yetkili kişi", "Ayrıntılı Göz Muayenesi" ve "Kaldırma Donanımı" ifadeleri Form No. STLA01'de açıklanmıştır.

Not :

Test yöntemlerindeki öneriler için ILO'nun "Safety and Health in Dock Work" yayını referans verilebilir.

INSTRUCTIONS

1. *Before being taken into use, the derricks rigged in union purchase shall be tested with a test load which shall exceed the Safe Working Load SWL (U) as follows:*

SWL	*Test Load*
Up to 20 tonnes	*25 per cent in excess*
20 to 50 tonnes	*5 tonnes in excess*
Over 50 tonnes	*10 per cent in excess*

2. *Tests are to be carried out at the approved max. height of the triangle plate above the hatch coaming or at the angle btw. the cargo runners and with the derrick booms in their working positions, to prove the strength of deck eyeplates and the union purchase system. These heights or angles must not exceed the values shown on the rigging plan.*

3. *Tests should be carried out using test loads.*

4. *The expression "Tonne" means a tonne of 1.000 kg.*

5. *The terms "Competent Person", "Thorough Examination" and "Lifting Appliance" are defined in Form No.STLA01.*

Note :

For recommendations on test procedure reference may be made to the ILO document "Safety and Health in Dock Work".

TÜRK LOYDU

Form No. STLA4

Gemi ismi
Name of ship ....

Çağrı işareti
Code letters ....

Kayıt numarası
Offical number ....

Sicil Limanı
Port of Registry ....

TL-Sicil No.
TL-Register No. ....

Armatör
Owner ....

Bu sertifika Türk Loydu veya TL'nin yetkilendirdiği firmalar tarafından düzenlenecektir. Bu firmalar tarafından hazırlanan belge, sonraki sayfada belirtilen şartları sağladığı takdirde TL tarafından onaylanacaktır.
This certificate is to be issued by Türk Loydu or by firm authorised by TL. The issuance by these firms will be acknowledge by TL provided conditions stated on reverse side are complied with.

Not :
Bu sertifika, Uluslararası Çalışma Örgütü (ILO) tarafından önerilen ILO Konvansiyoneli No.152'ye uygun uluslararası standart forma göre düzenlenmiştir.
Note :
This certificate is based on the standard international form as recommended by the international Labour Office in accordance with ILO Convention No.152.

Tel halatların test ve ayrıntılı göz muayenesi sertifikası
Certificate of test and thorough examination of wire ropes

İmalatçı/tedarikçi ismi ve adresi:
Name and address of maker or supplier --

Halat anma çapı(mm):
Nominal diameter of rope (mm) --

Kol sayısı:
Number of strands --

Her bir koldaki tel sayısı:
Number of wires per strand --

Öz Tipi:
Core --

Sarım tipi :
Lay --

Halat kalitesi (N/mm^2):
Quality of wire (N/mm^2) --

Numunenin test tarihi:
Date of test of sample --

Halat kopma yükü (ton):
Load at which sample broke (tonnes) --

Emniyetli çalışma yükü (ton):
Safe working load of rope (tonnes) --

Kullanım amacı:
Intended use: --

Test ve ayrıntılı göz muayenesini yapan firma yetkilisinin ismi ve firma adresi --
Name and address of the firm of competent person who witnessed testing and carried out thorough examination --

Yukarıdaki bölümlerin doğru olduğunu, halatın test ve ayrıntılı göz muayenesinin gerçekleştirildiğini ve emniyetli çalışma yükünü etkileyecek bir kusur bulunmadığını onaylarım.
I certify that the above particulars are correct, and that the rope was tested and thoroughly examined and no defects affecting its SWL were found.

(*Place*/Yer) (*Date*/Tarih) *Surveyor to TL*

AÇIKLAMALAR

1. Tel halata ait bir parça test numunesi, koparılmak suretiyle test edilecektir.

2. Test prosedürü Uluslarası veya kabul gören ulusal standarta gore olacaktır.

3. Emniyetli çalışma yükü (SWL), test numunesi halatın kopma yükünün aşağıda verilen şekilde belirlenen kullanım katsayısına bölünmesi ile belirlenecektir:

Madde	**Katsayı**
Sapana ait bir tel halat için Sapan SWL'si:	
SWL≤10 ton	5
10 ton<SWL≤160 ton	$\frac{10^4}{(8.85\text{xSWL})+1910}$
SWL≥160 ton	3
Halatın kaldırma ekipmanının bir parçası olması durumu için Kaldırma donanımının SWL'si:	
SWL≤160 ton	$\frac{10^4}{(8.85\text{xSWL})+1910}$
SWL>160 ton	3

4. "Ton" ifadesi 1000 kg. dır.

Not :

Test yöntemlerindeki öneriler için ILO'nun "Safety and Health in Dock Work" yayını referans verilebilir.

INSTRUCTIONS

1. *Wire rope shall be tested by sample, a piece being tested to destruction.*

2. *The test procedure should be in accordance with an international or recognised national standard.*

3. *The SWL of the rope is to be determined by dividing the load at which the sample broke, by a coefficient of utilisation, determined as follows:*

Item	***Coefficient***
Wire rope forming part of a sling *SWL of the sling:*	
SWL≤10 tonnes	*5*
10 tonnes<SWL≤160 tonnes	$\frac{10^4}{(8.85xSWL)+1910}$
SWL≥160 tonnes	*3*
Wire rope as integral part of lifting appliance *SWL of the lifting appliance:*	
SWL≤160 tonnes	$\frac{10^4}{(8.85xSWL)+1910}$
SWL>160 tonnes	*3*

4. *The expression "tone" shall mean a tonne of 1,000 kg*

Note :

For recommendations on test procedure reference may be made to the ILO document "Safety and Health in Dock Work".