1 Ship Lifts and Ro-Ro Ferry Ramps
The following Rules come into force on 11 November 2010.

Germanischer Lloyd SE

Head Office
Brooktorkai 18, 20457 Hamburg, Germany
Phone: +49 40 36149-0
Fax: +49 40 36149-200
headoffice@gl-group.com

www.gl-group.com

"General Terms and Conditions" of the respective latest edition will be applicable (see Rules for Classification and Construction, I - Ship Technology, Part 0 - Classification and Surveys).

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Section 1

General, Definitions

A. Application

1. Construction

This Rule applies to ship lifts and Ro-Ro-Ferry Ramps of following construction:

- Facility, to lift and to lower ships vertically out of and into the water using wire rope winches, hydraulic or other drives.
- Ship lift with movable carriages, normally rail guided with bearing blocks for the transfer of the ship to the shore and back.
- Steel bridge constructions to load and unload ships via truck, rail, forklift trucks or any other transport vehicles. These bridges are mounted flexible on shore and movable in vertical direction at sea, e.g. via hydraulic drives, rope winches, or other drives. The on-shore-bracket can also be a pontoon close to shore. A separate bridge is then the connection to shore.

2. Field of application

The Rule covers the waterside part of the facility with steel construction elements, connection and transfer elements to the shore, as well as the transfer carriages, the driving devices and the control systems.

An extension of the application to shore-site equipment belonging to it may be agreed.

Foundations and any concrete work are not subject to this Rule.

B. Definitions

1. Ship lift

1.1 Nominal lifting capacity (NLC)

The nominal lifting capacity \(NLC\) is the summary of all loads (weight of ship of the movable parts of the equipment, like carriages, ship bearing blocks, etc.), defined in metric tons \(\text{t}\).

1.2 Effective length \(L_{\text{eff}}\)

The effective length \(L_{\text{eff}}\) is the total length of the lifting platform, which serves to carry the loads for the nominal lifting capacity \(NLC\), defined in \(\text{m}\).

1.3 Lifting load for design (MDL)

The lifting load for design \(MDL\) (Maximum Distributed Load) is defined by the nominal lifting capacity \(NLC\) increased by a factor and equally distributed as a line load along the centre line of the platform, defined in \(\text{kN/m}\).

2. Ro-Ro-Ferry Ramps

2.1 Operational data

- Maximal loads from vehicles, maximal axle loads. Related axle-base and inflation surfaces of wheels.
- Maximal and minimal ramp inclination during operation. Maximum and minimum possible inclination.
- Headroom under lifting portal (if there is one) Maximal accepted height for vehicles.
- Achievable life cycle with corresponding load spectrum and underlying load cycle fatigue.
- Maximal and minimal water levels, at which operation is allowed.
- Water level and wave height used as de
Section 2

Classification

A. General

As far as applicable and not in contradiction to this Rule the GL Rules for Classification and Surveys (I-0) are in effect.

B. Admission to Class

1. The classification of a ship lift or a Ro-Ro-Ferry Ramp requires compliance with the Rules in relation to computation, design and inspection.

Different methods of computations or chosen design data may be accepted if GL is satisfied about their equivalence.

2. Existing facilities whose design and manufacturing had not been checked and tested as described in this Rule may obtain GL-Class under following conditions:
   - Conformity check by GL in proof of equivalence of the facility with this Rule. The existing documentation of the facility as drawings, calculations, operation handbooks has to be submitted to GL for checking.
   - Execution of a class (renewal) survey according to Section 15, C. In special cases additional load tests or overload tests may be required.

The scope of surveys and tests will be fixed by GL taking into consideration the available documentation and the actual condition of the facility.

3. Class designation

3.1 Ship lift

In proof of classification ship lifts obtain the class designation \( \text{G} \, 100 \, A5 \) appended the notation "SHIP LIFT" and the nominal lifting capacity NLC in [tons].

3.2 Ro-Ro-Ferry Ramps

Ro-Ro-Ramps classified by GL obtain the class designation \( \text{G} \, 100 \, A5 \) plus the notation "Ro-Ro-Ramp", showing the maximal accepted vehicle weight [in tons] and the corresponding load spreading.

4. Marking of the facility

4.1 Ship lift

Each facility has to be equipped with a plate at a good visible location containing at least the following data:
   - Max. LOAD NLC ..... tons
   - Further markings according to national regulations.

4.2 Ro-Ro-Ferry Ramp

Each facility has to be equipped at land- and seaside with a plate showing the following data:
   - Maximal accepted vehicle size [in tons]
   - Corresponding load spreading

4.3 Facilities and single machines installed in the European Union must additionally obtain the following data:
   - Name and address of the manufacturer
   - CE-Marking
   - Type and serial number
   - Year of construction

5. Operation documentation

To enable correct operation of the facility the operator must be in the possession of the following complete documentation:
   - Construction handbook with definition of the design parameters
   - Operating and maintenance instruction, including type and intervals of inspections and maintenance
   - Operation logbook, in which all lifting and lowering operations have to be noted, giving date, ship’s name and weight, location on the platform, load measurements during lifting/lowering operations and special events, etc.
   - Logging of all maintenance and repair works
   - Inspection plans and verifications for all checks to be done regularly.

Existence and updating of the operation documentation mentioned above is one of the conditions for the validity of class certificate of Germanischer Lloyd.
6. Changes to the facility

GL has to be informed immediately about all subsequent changes to the facility itself, of the operating conditions and of the operation documentation. If the class certificate shall continue to be valid, surveying and approval by GL will be necessary.

C. Non-classed Facilities

If there is no GL classification foreseen for the facility, because of e.g.:

– Periodical inspections by GL are not planned, or

– Only singular parts of the facility are to be checked by GL, or

– If the scope of checks and inspections defined in the Rules shall be reduced, or

– If the checks and inspections of GL should be executed on the basis of other regulations, which GL does not consider as equivalent to its own Rules.

GL will issue certificates, in which GL’s checks and their fundamentals are reported in detail.

Note

Such particulars are not necessary in a class certificate because of the reference to this Rule.
Section 3

Rules and Regulations

A. GL Rules

Additionally - and if applicable and not in contradiction to this Rule - instructions of the following GL Rules, in their latest edition have to be considered:

1. I - Ship Technology
   Part 0 - Classification and Surveys

2. I - Ship Technology
   Part 1 - Seagoing Ships
   Chapter 2 - Machinery Installations

3. II - Materials and Welding
   Part 1 - Metallic Materials
   Chapter 1 - Principles and Tests
   Chapter 2 - Steel and Iron Materials
   Chapter 3 - Non-Ferrous Metals
   Chapter 4 - Equipment
   Chapter 5 - Materials for Propeller Fabrication

4. III - Materials and Welding
   Part 3 - Welding
   Chapter 1 - General Requirements, Proof of Qualifications, Approvals
   Chapter 2 - Design, Fabrication and Inspection of Welded Joints
   Chapter 3 - Welding in the Various Fields of Application

5. VI - Additional Rules and Regulations
   Part 2 - Life Saving Appliances - Lifting Appliances - Towering Gears - Accesses
   Chapter 2 - Regulations for the Construction and Survey of Lifting Appliances

B. National Rules, Standards and Regulations

1. Regulations for safety and prevention of accidents

   The National Regulations for safety and prevention of accidents at the location of the facility have to be observed.
   Within the European Union in addition the "EC Regulation for Machines" - number 98/37/EWG in its latest, valid edition has to be considered.

2. Regulations for design and computation
   - DIN 1072
   - DIN EN 10025-1 & 2
   - DIN EN 10164, Steel products with improved deformation properties perpendicular to the surface of the product - Technical delivery conditions
   - DIN 18800-1 to 4 & 7
   - DIN 1090
   - DIN 18809
   - DIN 19704-1 to 3
   - DIN EN ISO 5817
   - EUROCODE 1
   - EUROCODE 3, DIN V ENV 1993 1-1/A2:2002-05
   - DIN EN 1993-2
   - EAU 2004
   - DS 804
   - ZTV-ING
   - BN 918002
   - Merkblatt Schwimmende Landebrücken BMV 1994 (only in German)
   - DIN-technical report 101
   - DIN-technical report 103

3. Application of various regulations

   A mixture of various different regulations is generally not permissible, except with prior approval of GL.
Section 4

Materials

A. General

1. The GL Rules for materials defined in Section 3, A.3. are in force.

2. Only steel material with attributes according to national and international standards is permitted for use.

3. Materials and products like steel plates, band steel, bar-iron and steel profiles have to be produced in steel-mills approved by GL. Otherwise an agreement with GL has to be reached.

Note

Normally GL-approvals are on hand of international well known mills for generally used materials..

B. Yield Strength

1. For steel constructions weldable construction steel with minimum yield strengths up to a maximum of 390 N/mm² has to be used.

2. The use of high strength steel with minimal yield strength above 390 N/mm² has to be approved by GL.

3. The limitation of the minimum yield strength for steel constructions does not apply for mechanical engineering.

C. Stainless Steel

Stainless steel for use in seawater or brackwater areas must have at least 2% molybdenum.

D. Quality Assurance

1. Source, type and specific characteristics (standards) of the steel material must be known and provable.

   Traceability from the source to the finished product has to be provable.

2. The quality of material for steel construction and engineering has to be proven by certificates according to Table 4.1.

Table 4.1 Material certificates

<table>
<thead>
<tr>
<th>Type</th>
<th>Type of component</th>
<th>Document (acc. DIN EN 10204)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.2</td>
<td>Components, which are critical to the overall safety of the structure as well as for safe operation. Components with special or higher demands on material quality, e.g. because of multi-axial stresses. E.g. main load-bearing parts of the platform, connection parts for load transfer, hydraulic cylinders, if they are involved as load bearing part of the platform.</td>
<td>Inspection Certificate 3.2 (with GL participation)</td>
</tr>
<tr>
<td>3.1</td>
<td>Components, which are decisive for safe operation and function. E.g. torque bearing components of winches, wind structures, stiffeners, eye plates, bolts, cylinders and pipes for a pressure above 25 bar. Elements built of stainless steel.</td>
<td>Inspection Certificate 3.1</td>
</tr>
<tr>
<td>2.2</td>
<td>Components of the construction with less importance, which cannot be classed to kind 3.2 and 3.1. e.g. local stiffeners, stairs, pedestals, consoles, machine casings, etc.</td>
<td>Test Report 2.2</td>
</tr>
</tbody>
</table>

1 For parts which are not mentioned in Table 4.1 categorization shall be undertaken analogously considering the local stress situation and the importance to safe operation.

2 Brief information concerning DIN EN 10204

Inspection Certificate 3.2: Material testing at manufacturer’s site with participation of GL inspector. Testing of parts actually to be delivered

Inspection Certificate 3.1: Manufacturer’s material testing at parts actually to be delivered

Test Report 2.2: Manufacturer’s or supplier’s report on conformity, e.g. based on manufacturing records, material specifications, technical rules
Section 5

Design Principles

A. General

1. Ship lift

1.1 Under loaded condition the speed of lifting and lowering is restricted to a maximum of 0.5 m per minute. For operations without load, higher speed is permissible.

1.2 For the transfer of the ship to the shore the platform has to be locked at the actual transfer side. Ship lifts, which are also used as a working platform (e.g. for ship repairs), have to be mechanically locked on both longitudinal sides for this working condition.

1.3 It is assumed, that wind and waves do not create vibrations of the ship lift loaded with a ship, which are not acceptable from safety point of view. Undue movement has to be prevented by guiding devices.

1.4 A horizontal alignment of the lifting platform has to be aspired. Inclinations and height differences between adjacent lifting equipment, which are not avoidable during operation have to be limited, that no exceeding of local stress, inadmissible load cycles and disturbances of functions appears.

1.5 The deflection of the girders for the travelling rails should not exceed 1/800 of the distance between two supports.

1.6 For bolted connections of platform girders preloaded high-tension bolt connections should be chosen.

2. Ro-Ro-Ferry Ramp

2.1 It must be possible to lock the movable ramp in the rest position. These lock are also used as bearing at replacements of drive components. The locks have to be designed to take the maximal working load according to the maximal lifting cylinder load or maximal hoisting winch load.

2.2 The movable ramp must have a lateral guidance with the piers.

2.3 The ramp has to be movable under full load at any time. The ramp has to be equipped with an automatic system to follow the ships movements.

2.4 The angle of inclination of the ramp has to be limited by end switches.

2.5 The synchronous run of the lifting cylinder or the hoisting winches has to be controlled. Allowed deviation and tolerances have to be defined in the specification. The control system of the synchronous run has to have a backup system.

2.6 Power Units, switchboards and control panels have to be placed in good accessible, isolated and heated machinery houses.

2.7 The overpass between pier and bridge shall be made with sliding plates. The sliding plates must comply with the requirements of the static calculation. The minimal thickness shall be at least 40 mm for heavy trucks. The sliding plates have to be designed in a way that they bear on good in each bridge position, allow a smooth crossing and cause only minimal driving noise.

2.8 The landside bridge bearings have to be designed according to the requirements of the static calculation and must allow all movements without restraint. The openings in the bearings have to be filled complete with seawater-resistant grease. Greasing has to be possible from the footway. Stainless lubrication lines shall be installed. The bearings have to have a potential equalization with a flexible band of at least 50 mm².

2.9 The use of the bridge has to be regulated by traffic lights and secured by barriers. At the shipside removable fences have to be provided.

2.10 The track plate must comply with the requirements of the static calculation but the minimal thickness is not less than 16 mm for trucks.

2.11 Bolted connections, which are subject to structural durability, have to be made as high-tension preloaded bolt connections.

2.12 Kerbs have to have an inclination of 1:10 at the side of the track and shall be rounded in breaks and end areas.

2.13 Walkways, 1000 mm wide and 250 mm above the track are required on both sides of the tracks, if there is more than one track. There shall be walkways from the landside up to the lifting piles. A Railing with at least 1100 mm height is required.

2.14 The control panels have to be easy and safe reachable. The operator must have a good sight over the complete bridge form the control panel.
2.15 All lifting devices must be reachable at all stages of operation with fixed ladders installed on lift frame, gangways and working platforms.

B. Welding

1. As far as applicable the GL Rules defined in Section 3, A.4. are in force.

2. For the fabrication in question the manufacturer must have suitable equipment and sufficient qualified staff at his disposal. The welding procedures to be used have to be tested and approved and the welders must be able to prove their qualification. GL may require test welds of welding details difficult to perform or if there are doubts regarding the skill of the welders.

3. For the steel construction of platform and carriages welding quality level B (high) according to GL Rule for Design, Fabrication and Inspection of Welded Joints (II-3-2), Annex A is required. There are limits fixed for imperfections in welded joints of steel.

For components dimensioned on the basis of a fatigue strength computation the additional limits given in Table 5.1 have to be applied.

C. Non-Destructive Testing

1. As far as applicable, the GL Rule for Design, Fabrication and Inspection of Welded Joints (II-3-2), Section 4 and 5 are in force.

2. High-tension, preloaded bolt connections are subject to a 100 % visual check and a random check of the bolt’s preloading in presence of GL.

3. Non-destructive testing of welds
– All full penetration welds at total butt joints of main girders of the platform are to be tested at 100 % in the tension are and at a minimum of 10 % in the compression area by radiographic or ultra-sonic examination.
– All site-welds of the load carrying girders of the platform are to be tested at 100 % with relevant methods in arrangement with GL.
– All load connecting points (eye plates and load transferring construction elements) are to be tested at 100% of their seam length. The method of testing has to be agreed with GL.

Table 5.1 Additional limits for imperfections in steel-welds of quality level B if component dimensions result from fatigue strength computation

<table>
<thead>
<tr>
<th>Ordinal-No. acc. ISO 6520-1</th>
<th>Imperfections</th>
<th>Limits for Imperfections</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011, 2012</td>
<td>Porosity and pores</td>
<td>Singular, little pores permissible</td>
</tr>
<tr>
<td>2013</td>
<td>Cluster of pores</td>
<td>Maximum sum: 2 %</td>
</tr>
<tr>
<td>2015, 2016</td>
<td>Gas pocket, worm pores</td>
<td>No big hose pores</td>
</tr>
<tr>
<td>300</td>
<td>Solid enclosures</td>
<td>Not permissible</td>
</tr>
<tr>
<td>617</td>
<td>Poor fit-up fillet welds</td>
<td>$h \leq 0,3 \text{ mm} + 0,1 \cdot a$, maximum 1 mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$h = \text{width of gap resp. relapse of root}$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>see sketch in GL Rules mentioned above</td>
</tr>
<tr>
<td>5011, 5012</td>
<td>Under cuts</td>
<td>a) Butt welds:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– locally and slightly permissible, $h \leq 0,5$ mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>b) fillet weld:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– vertical to direction of tensions not permissible</td>
</tr>
<tr>
<td></td>
<td></td>
<td>– locally present notches have to be ground flat</td>
</tr>
<tr>
<td>507</td>
<td>Misalignment of edges</td>
<td>Maximum 2 mm, abrupt transitions have to be corrected</td>
</tr>
<tr>
<td>601</td>
<td>Arc strikes</td>
<td>Not permissible outside of the welding seam</td>
</tr>
<tr>
<td>602</td>
<td>Welding spatters</td>
<td>The welding spatters have to be removed and the material surface influenced by the heat development has to be ground smooth.</td>
</tr>
<tr>
<td>None</td>
<td>Multiple imperfections in the section</td>
<td>Not permissible</td>
</tr>
</tbody>
</table>
Section 6

Design Loads

A. Dead Weight

In addition to the dead weight of the platform the weight of the layers for corrosion protection and mud, etc. on the steel construction have to be taken into account.

Note

Generally an addition of 3% of dead weight can be chosen.

B. Live Load

1. Ship lift

1.1 Nominal lifting capacity (NLC)

The nominal lifting capacity \( \text{NLC} \) is the sum of all loads (weight of ship and weight of the variable parts of the equipment, like carriages, ship bearing blocks, etc.). Usually it is defined in metric tons \([t]\).

1.2 Lifting load for design (MDL)

The lifting load for dimensioning \( \text{MDL} \) is created from the nominal lifting capacity \( \text{NLC} \) by increasing it with a certain factor and will be distributed equally as a line load along the centre line of the platform.

\[
\text{MDL} = \frac{10 \cdot \text{NLC}}{L_{\text{eff}}} \cdot \varphi \quad [\text{kN/m}]
\]

\( \text{NLC} \) = nominal lifting capacity \([t]\)

\( L_{\text{eff}} \) = effective length of the lifting platform in \([m]\), which serves to carry the loads of the nominal lifting capacity \( \text{NLC} \).

For \( L_{\text{eff}} \) the load carrying lengths of the platform ends are to be included in their full length, but not more than half the length between two pairs of lifting devices has to be added on each side.

\( \varphi \) = load distribution factor

The load distribution factor takes into consideration the unequal distribution of the ship’s weight at the platform axis as well as dynamic effects during docking and can be defined with \( \varphi = 1.33 \) for regular cases. The actual size of this factor has to be agreed with GL, taking into account the actual operating conditions.

1.3 Live load

Approachable platform areas not foreseen to be used by live loads have to be calculated using at least the following loads:

- An uniformly distributed load of 5 kN/m², (simultaneous action of this traffic load and the lifting load for design \( \text{MDL} \) must not be assumed for regular cases)

- A singular point load of 10 kN

For designing, the locally more disadvantageous load has to be chosen.

Platform areas foreseen to be used for working and transport have to be measured according to the expected maximum live load.

2. Ro-Ro-Ferry Ramps

2.1 Live load

- Road traffic classification acc. to DIN 1072, bridge capacity 60/30

- Harbour traffic in two-lanes without gap between the vehicles. It has to be considered that the vehicles are fully loaded on one track and empty on the other track (only dead weight). The type of vehicles must be defined in the specification.

- Loads of ship’s gate positioned on the Ro-Ro-Ramp including loads from traffic on the ships gate. The applicable dimensions have to be defined in the construction contract.

Friction force has to be considered with 1/7 of the total load pressure.

- A dynamic factor has to be defined, e.g. from DIN 1072 or agreed with the client.

- Loads of rail vehicles are to be considered as stated in DS 804 or DIN-technical report 101.

C. Wind Loads

The effect of wind loads can be defined with

\[
F_{KW} = q \cdot c_f \cdot A \quad [\text{kW}]
\]

\( A \) = Area attached by wind forces

for ship lifts incl. ship \([\text{m}^2]\)

for Ro-Ro-Ferry Ramps acc. to DIN 1072
\( q = \) Impact pressure [KN/m²]

- for ship lifts 0.25 KN/m² for the condition "ship lift in operation with ship" and 1.5 KN/m² for the condition "ship on ship lift, locked position, no operation"
- for Ro-Ro-Ferry Ramps 0.7 KN/m² for the condition "with traffic" and 1.5 KN/M² for the condition "without traffic"

\( C_f = \) aerodynamic, form depending coefficient

**Note**

Generally the aerodynamic coefficient may be assumed for rectangular areas with \( C_f = 1.3 \).

### D. Horizontal Loads

1. For computation the horizontal loads created by wind have to be considered, but at least 1/100 of the vertical loads.

2. For moving the ship on the platform horizontal loads created by friction in the bearings of the wheels of the carriages have to be considered.

   **Note**

   For slide bearings 4 % for roller bearings 2 % of the vertical load on the wheels may be chosen for horizontal loads.

3. Loads of deceleration and acceleration

   According to DIN 1072

### E. Ice and Snow Loads

1. Ice loads

   Loads from ice and snow – the more unfavourable load has to be selected – have to be considered as vertical load. Load values defined by local Authorities or by the operator of the facility have to be taken into account.

   **Note**

   In Germany a vertical area load created by ice may be assumed with 0.9 kN/m², by snow with 0.75 kN/m². Changes according to the local ratio are possible.

   - 250 kN/m² as horizontal load
   - 400 kN/m² as thermal ice pressure for local stresses in narrow spaces
   - The ice pressure on piers has to be set acc. to EUA.

### F. Wave Load

The wave height has to be given by the client. The wave pressure has to be ascertained acc. to EAU acc. to SAINFLOU.

### G. Exceptional Actions

Exceptional actions have to be confirmed by an analysis. Exceptional actions are stated in Table 7.1.

### H. Loads due to Ship Impact

The condition "impact of a ship" has to be defined in the specification.

Reference values can be taken from the standards "EAU" and "DIN 19704".
Section 7

Calculation of Steel Construction

A. General

Stresses (e.g. internal forces and moments) as well as resistances (e.g. limit stresses, limit internal forces and moments) have to be calculated according to elastic theory. Plastic capacities in cross section and system are not taken into account.

Note

It is recommended to execute the analysis according to EUROCODE 3, DIN V ENV 1993-1-1: "Design of Steel Structures" or the German series of standards DIN 18 800 "Structural Steelwork" using the latest, valid edition. If the analysis is according to Eurocode 3, then also DIN-technical report No. 103 has to be considered. Other standards will be accepted by GL if they are proven to be equivalent.

B. Ultimate Limit State Analysis

1. The analysis has to be executed for the following combinations of actions

   – Action case 1 (AC 1): All permanent actions together with each in turn of the unfavourable variable actions

   – Action case 2 (AC 2): All permanent actions and more than one unfavourable variable actions

   – Action case 3 (AC 3): All permanent action and all unfavourable variable actions and one accidental action

2. For the evaluation of the stresses for the members (sectional forces and stresses) the actions have to be multiplied by the relevant partial safety factor γF and in addition for creating the action cases defined in B.1. to be multiplied by the relevant combination factor Ψ. The values for the partial safety factor and the combination factor are defined in Table 7.1.

3. For the evaluation of the resistances of the members the value of material resistance (yield strength $f_{y,k}$ for materials according to Section 4, B.) has to be divided by the partial safety factor $\gamma_M = 1,1$.

C. Analysis of Fatigue Strength

1. An analysis of fatigue strength is not necessary if one of the following conditions is met:

   - $\Delta\sigma < 26 \text{ N/mm}^2$
   - $N < 5 \cdot 10^6 (26/\Delta\sigma)^3$

   with stress amplitude:

   $$\Delta\sigma = \text{max. } \sigma - \text{min. } \sigma.$$  

2. The analysis of fatigue strength has to be executed according to the GL Rules for Hull Structures (I-1-1), Section 20. A verification according to other regulations will be accepted by GL, if it is equivalent.

The stress range spectrum and the service life have to be defined by the owner of the facility.

Note

If no other value is given, a service life of 50 years may be chosen.

D. Pontoon

This paragraph applies to pontoons that are used as floating bearing for Ro-Ro-Ramps.

Pontoons have to be designed according to the applicable GL Rule for Hull Structures (I-1-1).

In addition the loads stated in DIN 1072 and of any special vehicles have to be considered in the analysis for the decks.

The pontoon has to be fixed longitudinal and cross in its position with an appropriate construction. Possible are e.g. piles and dolphin locks or mooring systems.
Table 7.1  Partial safety factor $\gamma_F$ and combination factor $\Psi$

<table>
<thead>
<tr>
<th>Type of action</th>
<th>Action</th>
<th>Combination of actions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Basic</td>
</tr>
<tr>
<td></td>
<td>Action case 1</td>
<td>Action case 2</td>
</tr>
<tr>
<td>Permanent</td>
<td>Dead weight of platform</td>
<td>$\gamma_F = 1,35$</td>
</tr>
<tr>
<td></td>
<td>$\Psi = 1,0$</td>
<td>$\Psi = 1,0$</td>
</tr>
<tr>
<td></td>
<td>Dimensioning load ship</td>
<td>$\gamma_F = 1,5$</td>
</tr>
<tr>
<td></td>
<td>$\Psi = 1,0$</td>
<td>$\Psi = 0,9$</td>
</tr>
<tr>
<td></td>
<td>Live loads</td>
<td>$\gamma_F = 1,35$</td>
</tr>
<tr>
<td></td>
<td>$\Psi = 1,0$</td>
<td>$\Psi = 0,9$</td>
</tr>
<tr>
<td>Variable (waves, friction by a vessel, impact of a vessel)</td>
<td>Weight of carriages/ship bearing blocks</td>
<td>$\gamma_F = 1,35$</td>
</tr>
<tr>
<td></td>
<td>Wind loads</td>
<td>$\Psi = 1,0$</td>
</tr>
<tr>
<td></td>
<td>Ice</td>
<td>$\Psi = 1,0$</td>
</tr>
<tr>
<td></td>
<td>Snow</td>
<td>$\Psi = 1,0$</td>
</tr>
<tr>
<td></td>
<td>Influence of temperature</td>
<td>$\Psi = 1,0$</td>
</tr>
<tr>
<td></td>
<td>Acceleration/deceleration</td>
<td>$\Psi = 1,0$</td>
</tr>
<tr>
<td>Exceptional</td>
<td>Installation</td>
<td>$\gamma_F = 1,35$</td>
</tr>
<tr>
<td></td>
<td>Repairs</td>
<td>$\gamma_F = 1,35$</td>
</tr>
<tr>
<td></td>
<td>Failure of lifting devices, etc.</td>
<td>$\gamma_F = 1,35$</td>
</tr>
</tbody>
</table>

**Note**

The values of this table are not valid for the analysis of fatigue stress according to Section 7.C.
Section 8

Calculation of Mechanical Parts

A. General
As far as applicable and not in contradiction with these Rules, the GL Rules defined in Section 3, A.2. and A.5. are valid.

B. Ultimate Limit State Analysis
For the evaluation of the stresses for the elements (Sectional forces and stresses) the actions have to be multiplied with the relevant partial safety factor $\gamma_F$ defined in Table 8.1.

For the evaluation of the resistances of the elements the value of material resistance/yield strength $f_{y,k}$ (resp. 0.2 % proof stress) has to be divided by the partial safety factor $\gamma_M$ defined in Table 8.1.

C. Analysis for Fatigue Strength

1. An analysis of fatigue strength his not necessary if one of the following conditions is met:
   - The number of stress cycles to be endured is $N \leq 10^4$.
   - or
   - If the analysis of the applied stress amplitude shows
   - $\Delta\sigma \leq \frac{26}{\gamma_{Mf}}$ [N/mm²] and

   $\Delta\tau \leq \frac{36}{\gamma_{Mf}}$ [N/mm²] or

   the number of stress cycles is:

   $N \leq 5 \cdot 10^6 \left[ \frac{26}{\gamma_{Mf} \cdot \Delta\sigma} \right]^3$ bzw.

   $N \leq 5 \cdot 10^8 \left[ \frac{36}{\gamma_{Mf} \cdot \Delta\sigma} \right]^5$

   The values for $\Delta\sigma$ and $\Delta\tau$ have to be inserted in N/mm².

   $\gamma_{Mf} = 1.35$ partial safety factor for fatigue strength

   2. The analysis of fatigue stress has to be executed according to generally acknowledged rules.

   Note
   General principles are defined by:

   3. The stress range spectrum and the service life have to be defined on the basis of the operating conditions given by the owner.

   Note
   If no other value is given, a service life of 35 years may be chosen.

Table 8.1 Partial safety factors $\gamma_F$ and $\gamma_M$

<table>
<thead>
<tr>
<th>Mechanical elements</th>
<th>$\gamma_F$</th>
<th>$\gamma_M$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Directly drive related, e.g. couplings, shafts, etc.</td>
<td>$\gamma_F = 1.35$</td>
<td>$\gamma_M = 1.5$</td>
</tr>
<tr>
<td>Single actions (with no load combination):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Partial safety factor $\gamma_F$ for actions, load limited e.g. by auxiliary devices:</td>
<td>$\gamma_F = 1.35$</td>
<td></td>
</tr>
<tr>
<td>Accidental loads (e.g. breakdown, emergency stop):</td>
<td>$\gamma_F = 1.1$</td>
<td></td>
</tr>
<tr>
<td>Partial safety factor $\gamma_M$ for material resistance values ($f_{y,k}$ resp. 0.2 % proof stress):</td>
<td>$\gamma_M = 1.5$</td>
<td></td>
</tr>
</tbody>
</table>

For calculations yield strength $f_{y,k}$ and 0.2 % proof stress are limited to a value not greater than 70 % of the tensile strength $F_{u,k}$. Exception: Design of high strength bolts.
Section 9

Lifting Winches

A. General

As far as applicable and not in contradiction to this Rule the following GL Rules are valid:

– Rules for Machinery Installations (I-1-2), Section 5, E.

– Guidelines for the Construction and Survey of Lifting Appliances (VI-2-2)

B. Materials

1. Material selection

Shafts, pinions, wheels and wheel rims of gears for the main drive should be preferably manufactured of forged steel. For flangeless shafts also rolled steel bars may be used. Gear wheel bodies may be made of grey cast iron or nodular cast iron or may be fabricated from welded steel plates with steel or cast steel hubs.

2. Material quality

Material of parts principally involved in torque transmission has to be proved by an inspection certificate 3.1, see Table 4.1.

C. Brakes and Couplings

1. The brakes and couplings applied need approval by GL. Manufacturer’s data sheets of these parts have to be submitted to GL.

2. Two independent safety devices/brakes have to be provided for the winches. In case of a breakdown of energy the brakes must become effective.

Adjustment and wear and tear of brakes must be easily checkable.

3. Couplings

Between the rope drum and the safety devices/brakes only non-switchable couplings which are safe against snapping through have to be installed.

If the elastic elements of elastic couplings fail, full torque transmission must be maintained.

D. Gears

1. Analysis

The gears have to be calculated according to generally acknowledged rules and the calculation has to be presented to GL for checking.

Note

The stresses for flank and foot of the toothing may be proved according to international Standard ISO 6336 or according to German Standard DIN 3990.

2. Basis for analysis

The following minimum requirements are valid:

– Duration of use: 35 years, if there is no other requirement from the operator

– Application factor: $K_A = 1.25$

– Safety factor against tooth breaking: $S_F \geq 2.0$

– Safety factor against build up of pittings: $S_H \geq 1.1$

Instead of the analysis with stresses at the foot of the tooth and pressure on the tooth flanks using the application factor $K_A$, it is possible to perform the analysis of fatigue strength according to generally accepted methods considering the operation hours during life time and the stress spectrum.

A suitable toothing quality has to be selected.

Note

For milled or pushed teeth, toothing quality 8 according to DIN 3967 or toothing quality 7 according to ISO 1328 may be selected.

E. Wire Rope and Rope Accessories

1. Requirements for wire ropes

1.1 As far as applicable the GL Guidelines for the Construction and Survey of Lifting Appliances (VI-2-2) are valid.

1.2 The wire ropes have to fulfil the following minimum requirements:
Galvanized rolled single wires

Number of single wires at least 216

Wire rope with steel core

Nominal tensile grade of the wires less or equal to 1770 N/mm². Before the use of wire ropes with higher tensile grade, approval by GL has to be obtained.

Note

Because of danger of corrosion use of wire ropes with plastic layer is recommended.

2. Dimensioning of wire ropes

2.1 The load for dimensioning of the ropes $F_d$ is the biggest value resulting from the combinations of the basic loads defined in Table 7.1, considering a load increase for turning around the rope sheaves and friction.

Note

For load increase may be assumed:

- 5 % load increase for each turning around with plain bearings for the rope sheaves
- 2 % load increase for each turning around with roller bearings for the rope sheaves

2.2 The wire ropes have to be chosen, that

$$\nu \cdot F_d \leq F_{W, Seil}$$

$F_{W, Seil} = "Actual breaking load" \ or \ "Proven breaking load" \ of \ the \ wire \ rope$

$\nu \geq 5,0 \quad operation \ coefficient \ for \ basic \ load \ cases \ 1 \ and \ 2 \ of Table \ 7.1$

$\nu \geq 3,0 \quad operation \ coefficient \ for \ exceptional \ load \ cases \ 3 \ of Table \ 7.1$

The operation coefficient can be reduced to a minimum value of $\nu = 3,0$ for the basic load cases 1 and 2 under the following conditions:

- If it can be proven, that in case of a breaking of the rope at one winch the platform will be held by the adjacent winches and therefore a fall of the platform can be avoided. The verification for this has to be performed as an "exceptional load case" with coefficients defined in Table 7.1, or
- If additional mechanical devices to prevent falling of the platform are provided.

3. Rope sheaves

The keep diameter of the rope sheaves must at least be equivalent to 20 times the diameter of the relevant wire rope. If nominal tensile grades of the wires above 1960 N/mm² are used, the diameter of the sheaves has to be agreed with GL. The rope has to be secured against jumping out of the sheaves.

4. Rope drums

The keep diameter of the rope drum must be equivalent to 18 times the diameter of the relevant wire rope. If nominal tensile grades of the wires above 1960 N/mm² are used, the diameter of the rope drum has to be agreed with GL.

By suitable measures a good guiding and a continuous winding up of the rope must be guaranteed.

Rope drums with a groove for the rope and only one layer of rope are to be preferred. In case of multilayer rope drums a suitable winding system has to be provided and the homogeneous load transmission has to be proven.

During operation at least three safety winding must remain on the drum.

5. Rope end attachments

As rope-end attachments only rope sockets, where the ends of the rope are casted in, have to be used. Only methods, materials and cast metals which are approved by GL can be used. Casting has to be done only by companies approved by GL.

Rope sockets must be permanently marked with the code letter of the socket manufacturer and of the company executing the casting.
Section 10

Hydraulic Equipment

A. General

As far as applicable and not in contradiction to this Rule the following GL Rules are valid:

- Rules for Machinery Installations (I-1-2), Section 14, F.
- Guidelines for the Construction and Survey of Lifting Appliances (VI-2-2)

B. Materials

1. Pipes

If stainless steel is used, materials with a specified molybdenum content of 2.0 – 2.5% have to be chosen. The material quality has to be verified by an inspection certificate 3.1.B, see Table 4.1.

Note

E.g. material with number 1.4571 according to DIN EN 10088 (AISI-type 316)

2. Hydraulic cylinders

For main drive hydraulic cylinders the material of cylinder pipe, piston rod, load transmitting cylinder end parts and exe plates has to be verified by an inspection certificate 3.2 according to DIN EN 10204.

The material quality of hydraulic cylinders for auxiliary systems has to be verified by an inspection certificate 3.1.

C. Calculations

For dimensioning of pressure loaded parts reference is made to GL Rules for Machinery Installations (I-1-2), Section 8. For the dimensioning of pressure pipes and hoses Section 11 of that Rule can be used.

D. Design

1. Hydraulic system

The following requirements have to be fulfilled at least:

- Pressure relief valves have to be provided in sufficient number. At least one relief valve has to be located adjacent to each pump and to each cylinder resp. hydraulic motor.
- It must be possible to check the hydraulic pressure at points important for the system.
- It must be possible to vent the hydraulic system effectively.
- The lifting device must not start if only the hydraulic pumps are powered up.
- For power drives at least two independent pump units have to be provided.
- Hydraulic cylinders must be connected in such a way that no bending moments can affect the piston rod.

2. Pipe system

The following requirements have to be fulfilled at least:

- At least one pipe-burst safety valve has to be provided adjacent to the cylinder or to the hydro motor.
- Pipes have to be installed in a way that they are protected against damage and are checkable.
- The routing of the pipes has to be chosen in such a way that leaking oil caused by damage or repair works will be collected and water pollution will be avoided.
- High pressure hoses should be used only where this is unavoidable and only at locations where sufficient protection against damage exists. Requirements for high pressure hoses are defined in the GL Rules for Machinery Installations (I-1-2), Section 11, U.
- Manually operated stop valves have to be provided in sufficient number
Section 11

Electrical Equipment

A. General

1. Limit for the requirements defined in this Section is the energy feeding connector at the main energy distribution of the mechanical lift dock.

2. Relevant Regulations

Relevant Regulations are:
- DIN IEC 60364: "Electrical installation of buildings"
- DIN EN 60204: "Safety of machinery - Electrical equipment of machines"
- DIN EN 60204-32: "Requirements for hoisting machines" (as far as applicable)
- In Addition: National regulations

B. Switchgears

1. IEC-Publications

The switchgear has to meet the requirements of IEC Publications
- DIN EN 60947: "Low-voltage switchgear and control gear"
- DIN EN 60694: "Common specification for high-voltage switchgear and control gear standards"
as well as further applicable DIN IEC resp. DIN EN Series.

2. Degree of protection

Switchgear, control desks and distribution cabinets must have at least the following degrees if protection according to IEC Series 60529: "Degree of protection provided by enclosures (IP-Code)":
- IP 20: for closed, dry operation rooms
- IP 22: for wet spaces
- IP 55: for outside locations

If the environmental conditions require, higher degrees of protection may be necessary.

C. Motors

Driving motors according to DIN EN 60034 "Rotating electrical machines" have to be used.

If the environmental conditions require, the motors have to be equipped with standstill heating.

A protection against overload has to be provided.

Motors for outside locations must have at least degree of protection IP 56.

D. Installation

1. The installation must be appropriate to the regulations of DIN IEC Series 60364: "Electrical installation of buildings".

2. If IT-systems are applied a leakage detector has to be provided.

3. Suitable cables and installation materials have to be used and have to be protected against environmental and other influences. 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.

Cable trays are to be arranged so that hydraulic oil from hydraulic systems cannot drip on the cables. Where this is not possible, oil guards shall be provided.

4. Electric and electronic systems and devices have to be protected against influences like electromagnetic fields, overload, etc. A relevant protection concept has to be set up.

If electric power cables and control cables are positioned side by side a reciprocative influence has to be prevented by shielding or sufficient distance from each other.

5. A main equipotential bonding compensation and other additional equipotential bondings compensators have to be guaranteed.

E. Fire Protection

1. The electrical and mechanical equipment has to be designed and manufactured in such a way, that the danger of fire and overheating by these devices will be avoided.

2. In rooms with electrical switchgear, suitable portable fire extinguishers have to be easy accessible situated.

3. National Regulations for fire protection have to be observed.
Section 12

Monitoring and Control System

A. General

1. For the automation of the facility only standardized and well proven components shall be used.

2. For the man-machine interface reference is made to the operation principles of the standard DIN EN 60447: "Man-machine interface (MMI) - Actuating principles".

B. Safety Equipment

1. Safety circuits

1.1 The safety circuits have to be executed according to DIN EN 60204-32: "Requirements for hoisting machines".

1.2 Faults in the circuits must be recognizable. Recognition of faults can be established by independent fault registration and reporting, by operation stop or by periodical checks.

1.3 Safety circuits recording inadmissible exceeding limits of travel, speed and/or load, which may produce a dangerous situation or damage to the ship lift or hoist load, have to cause a stop function, if they are responding. The execution of the safety circuits has to be based on endangerment assessment.

1.4 Safety circuits have to be provided for:

   – Recording of the end positions, lifting speed as well as inclination of the platform
   – Recording of loads
   – Stopping orders
   – Slackness of wire ropes or chains
   – Pipe-burst supervision for hydraulic drives

2. Limit switches

2.1 For the registration of the end positions at least two independent limit switch devices (operational end position and emergency position) have to be provided.

2.2 For automatized movement procedures it has to be ensured, that in case of emergency the limit switches will stay in function even if disturbances or faults in the computer occur. This can be established by means of separate switching elements or by additional electronic units independent from the main computer.

C. Control Stand

1. The control stand has to be positioned in a way that from there the steps of operation are kept under observation as far as possible. This does not substitute other measures for safeguarding of riskless and failure-free operation.

   Movement of platform and carriages has to be signalized and accomplished during operation by acoustical and optical signals.

2. It must be ensured, that the facility and its complete operation can only be started by authorized personnel.

3. A convenient dead man’s handle has to be provided.

4. At the control stand – and also at good accessible areas of the facility – easily recognizable emergency push buttons (stop category 0) have to be provided in sufficient number.

D. Operation Signals and Fault Messages

1. General

1.1 For all indicators, like signalling lamps, analogue and digital displays, acoustic signals, etc. a possibility to check their functioning has to be provided. All indicators must be clearly visible and glare-free.

1.2 It must be possible to acknowledge all faults. Faults, which have been acknowledged, but not solved must look different from actual alarms, e.g. by different flashing frequencies.

1.3 The analogous transmission of measured signals should be done by standardized 4 to 20 mA signals. Reports on condition and fault messages have to be provided as self monitored circuit.
2. **Measured values**

At least the following values have to be registered and reported:

- The position of the platform/lifting height
- Load on each lifting device
- Deviations of lifting heights between the single lifting devices

3. **Status messages**

At least the following condition messages have to be registered and reported:

- Facility in operation
- Locking devices, pawls, etc. active/not active
- Chosen direction of movement
- Upper/lower end position reached

4. **Fault messages**

At least the following fault messages have to be registered and reported:

- Summary fault
- Overload message operating end position overrun
- Upper/lower operating end position overrun
- Inadmissible deviations of lifting heights between lifting devices
- Operation fault at each lifting device
Section 13

Surveys prior and during Manufacturing

A. General
All components which are important for operational safety and proper function have to be inspected by GL. The extent of the survey depends on the potential of danger for man and facility as well as on the importance of the components to the function of the facility.

B. Approval of Documents
1. Principles
As a basis for inspection and evaluation the following documents have to be submitted in one copy to GL:
- Technical part of contract documents between the orderer and the supplier/manufacturer, like design basics manual, performance listing etc.
- Reference to local Regulations, Limitations for the construction on site, safety conditions and regulations for environmental protection.

2. Obligatory documents for approval
The documents named below will be examined by GL. They have to be submitted at least in triplicate in perusable condition for examination.
GL may ask for additional documents or calculations, if needed for approval.

2.1 Steel construction
- Shop drawings for the lifting platforms, ramps, piers, lifting portals, trolleys, bolting and crossing constructions
- Static calculations of these parts
- Welding plans
- Test plans regarding non-destructive testing of welding
- Test plans for other tests foreseen by the manufacturer.

2.2 Lifting devices
- Sectional drawings and assembly drawings including parts list for lifting winches, hydraulic cylinders with the associated drive bearings
- Design calculation for the winches or the hydraulic cylinders
- Design calculations for the gears and drives
- Hydraulic plans with parts list
- Data sheets concerning standard construction components, switch gear elements and equipment like e.g. motors, wire ropes and rope accessories, hydraulic hoses and fittings, etc.

2.3 Electrical equipment
- Description of functions with general wiring diagrams and control programs
- Current chart with parts list
- Cable listing
- Verification of cable design
- Verification of selectivity in the system

C. Survey of Construction Components
1. Steel construction
1.1 The manufacturing in the workshop and the installation on site will be supervised by GL by regularly recurring inspections.
Subject of the survey will be the steel construction of the lifting platforms, ramps, piers, lifting portals, trolleys, bolting and crossing constructions to the shore.

1.2 The manufacturer has to furnish proof of:
- Manufacturer's qualification, compare Section 5, B.2.
- Proof of quality for the materials, compare Section 4, C.
- Reports of tests and quality checks executed by the manufacturer like non-destructive testing of welding seams, trials, etc.

2. Lifting devices
2.1 Winches
2.1.1 Each winch has to be finally tested by the manufacturer at least with checks as defined in 2.3. The tests have to be proven by a test report.

2.1.2 10 % of the total number of winches, but at least two pieces, have to be tested in the presence of GL. On this occasion the manufacturer’s documentation according to 2.1.1 has to be presented for all winches.
2.2 Hydraulic cylinder

2.2.1 Each hydraulic cylinder has to pass a FAT witnessed by GL including the tests stated in C.2.3.2. The test results have to be recorded.

2.3 Scope of testing

2.3.1 Winches
At least the following final inspections have to be carried out at the finished winches:

- Visual inspection
- Idle running tests
- Functional test, as far as possible with nominal load or partial load
- Test and adjustment of brakes and safety devices
- Random test of tooth clearance and load distribution at toothed wheels
- Overload test at manufacturer’s shop. Regarding the test load see Table 14.1. For the tabular value \( F \) the nominal pull of the winch has to be inserted.

If an overload test is not possible at manufacturer’s shop the winches will be tested within the scope of final tests of the platform according to Section 14, B.3. The rope tension at the drum resulting from the test load \( F_T \) of the platform, see Table 14.1, has to be calculated taking into consideration the rope turns round the sheaves, rope friction and speed-up load. The maximum rope tension at the drum due to the test load of the platform has to be stated in the test report.

2.3.2 Hydraulic cylinder
At minimum the following final inspections have to be carried out at the finished hydraulic cylinder:

- Visual inspection
- Dimensional inspection
- Functional test, as far as possible under load
- Functional test of the pressure control valve, current regulation valve, position measuring system and the end switches
- Design pressure \( 1.5 \times \) operating pressure
- Density control

3. Wire ropes

Reference is made to the GL Rules for Classification and Construction concerning Lifting Appliances.

Wire ropes are subject to individual inspection by GL in the workshop of the manufacturer.

Manufacturers of wire ropes approved by GL are allowed to carry out the tests in own responsibility. The test has to be verified by an inspection certificate 3.2 according to DIN EN 10204.

4. Electrical motors

The motors have to be tested according IEC DIN EN 60034-1.

Data sheets and test certificates concerning the type tests as well as the individual tests have to be submitted to GL.

5. Electrical systems

The electrical equipment and the switch gear will be visually checked and tested within final function testing of the facility ready for operation according to Section 14.

6. Hydraulic pumps and motors

For hydraulic pumps and hydraulic motors the Guidelines for the Design, Construction and Testing of Pumps (VI-5-1) of GL have to be applied in analogous form. For drive performances of 50 kW and above the test has to be performed in presence of a GL surveyor.

7. Load measuring equipment

The measuring equipment for monitoring of platform loading will be inspected by GL at manufacturer’s site. Load cells will be tested with 1.5-fold the maximum nominal load and the calibration will be verified.
Section 14

Final Test of the Construction ready for Operation

A. General

1. The tests described in this Section have to be carried out by the manufacturer of the facility in presence of GL.

2. The programme for the surveys and tests of the complete facility has to be submitted to GL for approval. Operation manual and description of the functions have to be included.

3. Prior to the final test of the facility attended by GL the manufacturer has to test the electrical equipment according to DIN VDE 0100-600 (VDE 0100-600). The test has to be proved by a test report.

B. Functional and Overload Tests

1. Visual check

Before and after the functional and overload tests described in the following, the complete facility has to undergo a visual check. Besides of the general condition of the facility special checks have to be made for:

- Load connection points
- Wheels of the transfer carriages
- Wire ropes, opening of ropes and rope-end attachments
- Tightness of the hydraulic system

2. Functional tests

2.1 Lifting platform

2.1.1 The functional tests have to be carried out preferably with nominal lifting capacity NLC. In accordance with GL the tests can be performed with partial load, partially also without load.

2.1.2 All operational functions have to be tested over the full range. All possible operations, like lifting and lowering of the platform, transfer of the load on the platform and transport of the load from the platform to the shore and back have to be carried out.

2.1.3 Within the tests all safety functions have to be checked by simulation of relevant situations, like overload protection, emergency stop, limit switches, etc. All steering and control possibilities and their control indicators have to be tested.

2.2 Ro-Ro-Ramps

2.2.1 The functional test has to be carried out with working load. The type of vehicles and load for testing has to be agreed with GL.

2.2.2 The functional test shall prove the following:

- Check of the electrical installation, the hydraulic system and the functioning of the safety system
- Check of the main dimensions, including geometrical data like maximum up and down position
- Lifting and lowering speed
- Check of synchronous correction
- Check of oil pressure and current consumption under the above mentioned working load
- Functional check of alarm system, traffic lights, screws, navigation lights, delivery locks in the end position, sliding plates and the slip and motion control equipment

2.2.3 After successful testing the manufacturer has to prepare, complete, and hand over a documentation including the test results and protocols to the customer and to GL.

3. Overload test

3.1 Lifting platform

3.1.1 Test loads

The test loads for the overload test of the complete facility have to be chosen according to Table 14.1.

Table 14.1 Test loads

<table>
<thead>
<tr>
<th>F</th>
<th>Test load $F_T$ [t]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to and inclusive 20 t</td>
<td>$1,25 \cdot F$</td>
</tr>
<tr>
<td>Above 20 t up to and inclusive 50 t</td>
<td>$F + 5$ t</td>
</tr>
<tr>
<td>Above 50 t</td>
<td>$1,1 \cdot F$</td>
</tr>
</tbody>
</table>

$F = \text{Load at the connection point of the lifting device at the platform resulting from the lifting load for dimensioning MDL according to Section 6}$
3.1.2 The lifting and lowering of the platform as well as the locking procedures have to be tested with overload.

3.1.3 If relevant test loads are not available, parts of the platform may be tested in segments.

3.2 Ro-Ro-Ramps

3.2.1 Test loads
In general the test loads have to be chosen according to Table 14.1.
Other test loads have to be agreed with the customer and GL and can be in accordance with the available vehicles for testing.

3.2.2 The test loads have to be measured locally and the required weights have to be ascertained. The weight of vehicles used has to be verified by an official weighing.

3.2.3 Load maps have to be issued and the related static calculations have to be made.

3.2.4 Deflections, oil pressures and current consumptions have to be measured.

3.2.5 The actual deflections have to be compared with the results of the calculation made in 3.2.3.

4. Date of tests

4.1 If for functional tests and/or overload tests sufficient test loading is not available and first tests are carried out with reduced test load, after such a successful test GL will issue on operation for a load lower than the nominal lifting capacity \(NLC\).
This reduced operation load will comply in general with the actual test load, but may be lower under special circumstances.

4.2 The class certificate becomes valid if all tests have been carried out successfully with the required test load.
The complete testing should be finished within one year.
Section 15

Periodical Surveys

A. General

1. Maintenance of class

Periodical surveys of the facility are required for maintenance of class.

2. Extraordinary surveys

Additional, extraordinary surveys of the facility by GL may become necessary, if - in GL’s opinion - substantial changes and repairs of the facility have been performed or if the operation conditions have changed. It is the owner's obligation to inform GL about extraordinary occurrences.

B. Annual Surveys

1. Survey period

A visual check and a functional test of the facility will be carried out. Normally disassembly of components or the use of costly auxiliary devices for tests will not be required.

The following tests will be carried out:

   - review of the operation documentation according to Section 2, B.5.
   - survey of the status of the complete facility regarding safety of operation and prevention of accidents, damages, wear and corrosion
   - visual check of all ropes and load connection points. Random measurement of the rope diameters.

Note

Guidance for testing and criteria for renewal of wire ropes are contained in DIN 15020-2 (DIN 15020, Blatt 2).

   - functional test of the facility with checks of all safety devices

GL may ask for further checks if - from GL’s point of view - there exist some doubts on sufficient conditions.

C. Class Renewal Surveys

1. Survey period

Class renewal surveys are to be carried out at the intervals indicated by the class designation for the facility. Normally intervals of 5 years are fixed.

In justified cases and upon application GL may accept an Extension of the class period of maximum 3 months.

2. Scope of survey

2.1 The class renewal survey is an annual survey as described in B., but with extended and more intensive scope of inspection.

The survey covers all components of the facility, also parts under water and areas, where special measures and disassembling of components where necessary, to get access for inspection.

2.2 GL may demand additional surveys and inspection of components if this is - from the point of view of GL - necessary for a doubtless judgement or if there is suspicion on deficiencies. Such inspections are e.g. induction tests of wire ropes, crack tests, measurement of wall thickness in case of corrosion, etc.