CLASS GUIDELINE

DNVGL-CG-0156 Edition February 2016

Conversion of ships
FOREWORD

DNV GL class guidelines contain methods, technical requirements, principles and acceptance criteria related to classed objects as referred to from the rules.

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CHANGES – CURRENT

This is a new document.
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SECTION 1 INTRODUCTION

1 General

1.1 Objective
The objective of this class guideline is to describe the most common types of conversions and alterations of ships, and to specify requirements and recommendations related to the classification.

1.2 Scope

1.2.1 General
Scope of the class guideline includes changes to main functions, ship purpose and class notations of the vessel. This includes changes to main dimensions or equipment affecting structural strength, machinery, stability, and safety. Additionally, it covers installation of temporary equipment for multiple or single voyage.

1.2.2 Vibrations
Extensive conversions/alterations may have adverse effects on the natural frequencies of parts of the vessel. The plan approval does not include consideration of vibrations in the hull structural elements in relation to the requirements for scantling given in the rules.

1.2.3 Stability
Stability is a very important aspect to clarify when planning a conversion/alteration. In particular, it should be noted that for a dry cargo ship over 80 m in length where no damage stability requirements have previously been in force, new damage stability requirements given by SOLAS may become applicable. It may thus be necessary to submit damage stability index calculations to the flag administration or class, if delegated, to demonstrate that the level of subdivision is not less than before the conversion/alteration.

1.3 Application

1.3.1 General
This class guideline applies to all changes to the ship and its machinery systems or components which are covered by the scope of class according to the rules RU SHIP Pt.1 and subject to approval and survey. Conversions and alterations of offshore installations and conversions of ships into offshore installations are not covered by this class guideline.

It is the owner's responsibility to contact the Society in due time prior to undertaking alterations/conversions in order to allow for a well-planned approval and survey process.

1.3.2 Applicable rules
The applicable rule edition for which the vessel shall comply with, is defined in RU SHIP Pt.1 Ch.1 Sec.3 [2.6].

Note that the current rules will in general be applied when assigning a new class notation to a vessel. Current rules are taken as the rule edition in force at the date of signing of the conversion contract between class and client (designer, owner or shipyard), unless otherwise agreed. Deletion of optional class notations or imposing service restrictions may be accepted where rule requirements cannot otherwise be complied with. Changes to hull structure, machinery, systems or equipment shall be documented and approved in accordance with RU SHIP Pt.1 Ch.1 Sec.3 [2.6.2].
2 Definition of terms

2.1 Definitions and descriptions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>alteration</td>
<td>Change that does not affect the basic character or structure of the ship to which it is applied. This is typically a limited change to the ship's structure, equipment or functions, such as change of components, change of local structure, change of draught or change of class notations not affecting ship's purpose/type.</td>
</tr>
<tr>
<td>conversion</td>
<td>Change that substantially alters the main dimensions ($L$, $B$, $D$), watertight subdivision, carrying capacity, engine power or ship type. Increased draught is normally not regarded as a conversion. However, precaution should be taken if the increase in draught is major. See further information in Sec.2 [1].</td>
</tr>
</tbody>
</table>

3 Structural testing

Testing of new tanks and new equipment will be required. Please refer to relevant rules for details.

4 Documentation requirements

App.A contains documentation requirements for typical conversions. For general requirements to documentation and full definition of the documentation types, see RU SHIP Pt.1 Ch.3.

If relevant, information regarding change of flag administration in connection with the conversion shall be submitted to class.

5 Certification requirements

Requirements to certification of components and equipment will be the same as for newbuilding.

6 Statutory regulations

This class guideline neither enforces nor intends to provide complete references to statutory requirements such as SOLAS, MARPOL, IBC/BCH codes and IGC code. However, certain sections contain brief references to regulations which may have considerable consequences for conversions or alterations.

Note that certain requirements, e.g. SOLAS and MARPOL, may be linked to the contractual signing date between shipyard and owner, or the date of conversion commencement or completion.

Furthermore, in case a modification is defined as a “Major Conversion” by SOLAS or MARPOL, new statutory requirements may have to be complied with, e.g. requirements to double bottom height, position of fuel oil tanks, life-saving appliance, damage stability, NOx emissions etc. Similarly, conversions which alter the tonnage particulars or deadweight may imply that the ship has to comply with new requirements. It should be noted that lengthening of the vessel may result in new requirements. E.g., increasing the load line length from below 85 m to above 85 m will trigger requirements to lifeboats. If clarifications are needed, then the relevant sections of the Society should be contacted.

It is important to note that flag administrations may have additional requirements to those referenced in this class guideline.
SECTION 2 CONVERSIONS AND ALTERATIONS - STRUCTURAL STRENGTH

1 Increased draught

1.1 General
The following items are deemed important to the feasibility of the project and the amount of work required:
1) the current scantling draught of the vessel and earlier approved draughts
2) will there be any redefinition of the freeboard deck? If yes, may the vertical extent of watertight bulkheads interrupt the project (ro-ro ships, trawlers, general cargo ships)?
3) the freeboard has to be approved according to the load line regulations. Extensive calculations may be wasted if the questioned draught has to be reduced because it is not according to the load line regulations
4) global strength
5) bow height requirement
6) stern or bow doors and doors in the ship's side
7) position of side scuttles
8) position of valves and discharges
9) bottom of net bin for fishing vessels.

1.2 Application of the rules
Increased draught is normally not regarded as a conversion. This may however depend on the background for the deeper draught. A major change in load capacity or load type for a bulk carrier or a tanker could for instance be regarded as a conversion. Draught increase will be evaluated by the Society on a case-by-case basis. This may have an influence on the applicable rule edition.

1.3 Global strength
The distribution of still water bending moment \( M_{sw} \) and shear forces \( Q_{sw} \) is a function of distribution of buoyancy, lightweight, cargo and consumables over the ship's length. The type of vessel and the cargo distribution will therefore have an important impact on how an increase in a ship's draught will affect the longitudinal strength.

Wave bending moment and shear forces are very little influenced by the ship's draught. The block coefficient \( C_B \), increases with increasing draught, but this can in most cases be ignored, and design wave bending moments and shear forces are consequently unchanged.

Still water bending moment \( M_{sw} \) and shear force \( Q_{sw} \) for loading conditions with increased draught are often within values for existing loading conditions. However, \( M_{sw} \) and \( Q_{sw} \) can be critical, depending on the type of vessel, e.g. sagging moment amidships and shear force at the collision and forward engine room bulkheads for vessels with a large block coefficient, such as tankers for chemicals and bulk carriers.

The actual distribution of \( M_{sw} \) and \( Q_{sw} \) is seldom known at the time when an increased draught is requested. The evaluation is therefore normally based on previously approved loading conditions, or previously approved maximum still water bending moment and shear forces. In cases where the existing loading conditions are irrelevant, e.g. due to a conversion of the vessel, rule design values or design limits shall be applied.

The loading manual shall be updated and submitted for approval when applicable.
The cargo or loading instrument shall be adjusted accordingly.
1.4 Local strength

1.4.1 Ship’s sides and deck
Scantlings of structural elements shall be checked based on the new design sea-pressure.
1) frames, stringers and longitudinals, especially at the ends of the ship
2) forecastle structure
3) transverse strength of deck and ship side in way of cargo holds for open vessels (e.g. general cargo vessel with one large cargo hold opening)
4) main frames for bulk carriers and frames in empty holds
5) transverse strength of deck between cargo holds for bulk carriers the buckling capacity shall be appraised.

1.4.2 Girder system in bottom and sides
The girder system shall be checked based on the increased design sea pressure and increased cargo weight in tanks, holds or on deck, if relevant.
1) bottom structure in tankers (floors and longitudinal girders); a limitation on net pressure on the bottom may be given
2) double bottom and bulkheads strength for bulk carriers; double bottom analysis may be required.

1.4.3 Deck houses
Change of freeboard deck may lead to a substantial increase in the design pressure for deck house front bulkhead; e.g. 2nd tier becomes 1st tier if a new shelter deck is fitted.
Plating and stiffeners on front bulkheads shall be checked for strength.
Side and end bulkheads are to be checked for strength if the freeboard deck is changed or if the draught increase is substantial.

1.4.4 Bulkheads and decks acting as top/bottom of tanks
Watertight bulkheads shall be dimensioned for increased static pressure, due to new damage waterline or new freeboard deck (bulkhead deck).
Checking of bulkhead scantlings is normally only required if the freeboard deck is changed, since the increase in damaged water line must be considerable before it has any consequence for the bulkhead strength.
Tank bulkheads, bottom and top shall be checked if the height of the air pipes is increased, e.g. when a vessel's depth is increased. In such cases the Society shall be informed.
Cargo hold and tank bulkheads are to be checked if the total weight in hold or tank is increased beyond the previously approved limits (increased cargo density). In this case drawings showing the modification shall be submitted for approval.

1.4.5 The ice belt
The ice belt shall be especially considered. See Sec.2 [8].

1.4.6 Bow impact
Bow impact is only necessary to check for vessels with large flare, when the increase in draught is substantial.

1.5 Structural arrangement when the freeboard deck is redefined

1.5.1 Collision bulkhead
No openings are accepted below the freeboard deck.
The requirement for the longitudinal position of the bulkhead is normally not influenced. It should however be checked when the freeboard deck is redefined.
The vertical height of the collision bulkhead shall extend to the next deck above the freeboard deck for ships having complete or long forward superstructure. Openings or doors in the existing upper part shall be closed. Note that steps in the collision bulkhead can be accepted if all parts of the bulkhead are within the rule limits.

1.5.2 Fore engine room bulkhead
The bulkhead shall extend watertight to the freeboard deck. Doors in bulkheads acting as fore engine room bulkhead above the tween deck shall be watertight and fitted with signboards stating that the doors shall be kept closed at sea. Sill height shall be to the waterline or maximum 600 mm. Scuttles in tween deck bulkheads may be kept if fitted with deadlights.

1.5.3 After peak bulkhead
Three alternatives are accepted, see Figure 1.

a) Ships already fitted with a complete bulkhead from side to side between the aft perpendicular and the fore engine room bulkhead may use this as the after peak bulkhead. Strength shall be checked. The bulkhead shall extend to first watertight deck above the waterline. If the accommodation deck acts as a part of the bulkhead, the height of the deck from the bottom shall be at least equal to the height of the bottom floors. Inclined decks are acceptable.

b) A bulkhead is fitted between old and first watertight deck above the waterline. Doors shall be watertight with a sill height to the waterline or maximum 600 mm.

c) Entrance down to the aft accommodation below tween deck is closed by a steel casing with weathertight steel door and with a sill height to the waterline or maximum 600 mm. This arrangement is normally applied only for older vessels.

Note that the net bin bottom on fishing vessels is not to be below the new waterline.

Figure 1 a)

Figure 1 b)
Figure 1 c)

![Diagram](image)

**Figure 1 Three different arrangements of the aft peak bulkhead for a fishing vessel (old type)**

Approval of the above mentioned alternatives is based on that the entrance down to the engine room from tween deck below water line is closed by steel casing with weathertight steel doors with a sill to the waterline or maximum 600 mm.

Where parts of a deck form a part of the watertight bulkhead, the deck shall be dimensioned accordingly.

The rules state no requirement with respect to position of the after peak or fore engine room bulkheads, but:

- one may not define a bulkhead both as an after peak and a fore engine bulkhead
- the entrance down to the engine room shall be located between the bulkheads.

1.5.4 Doors and hatches

Coaming heights should be checked for possible redefinition from position 2 to position 1. In general the minimum required heights of coamings in way of hatches in the freeboard deck should be complied with.

Due to the operational aspects of some vessels reduced coaming heights are often preferred. In such cases written acceptance of dispensation from the flag administration will be required.

1.5.5 Bow height

The minimum bow height is calculated according to the load line regulations. Note the minimum longitudinal extension of the forecastle.

Acceptable solutions to obtain acceptable bow height, see **Figure 2**.

Figure 2 a)

![Diagram](image)

Figure 2 b)
Figure 2 c)

Figure 2 Examples of ways to increase the bow height

a) A new forecastle deck is built above the existing. Note that the space between the old and the new deck shall be arranged with access using a manhole or similar. This alternative may require that deck equipment (anchoring winches etc.) be removed and refitted on the new deck.

b) A new forecastle deck is built enclosing existing forecastle and the deck equipment. The new part shall be made watertight and the anchor chain pipes shall be arranged with closing arrangements at the upper end.

c) New forecastle (fulfilling the minimum criteria).

1.5.6 Ventilators, air pipes, scuppers and discharges
If the height of the air pipes is increased then the tanks shall be checked for the new design loads, the Society shall be informed.

1.5.7 Openings when freeboard deck is redefined
Old freeboard deck drains shall be closed. The minimum height between the waterline and the light valves is 500 mm.
If the rudder carrier is flooded, an additional sealing box shall be fitted.

1.6 Checklist for increased draught
1) watertight bulkheads:
   — vertical extent
   — strength
   — position of collision bulkhead.
2) minimum bow height
3) position of overboard discharges
4) position of side scuttles
5) doors in the ship’s side
6) position of rudder carrier
7) hatchway coamings and covers
8) ice belt:
   — strength and vertical extent
   — min. required engine power for ice class.
9) longitudinal strength (if applicable)
10) local strength:
    — weather deck
    — forecastle deck
    — ship’s sides
    — bottom
    — deckhouse front and sides.

2 Lengthening of vessels

2.1 Application of the rules
Reference is made to the introduction, for general information.
Lengthening of a vessel is always regarded as a conversion with regard to strength. This means that the current rules apply with respect to local and global strength.
The design process to determinate the required scantlings for the new section should be similar as for a new building. Scantlings of the new hull section must be in accordance with current rules i.e. the rule requirements for minimum thickness and minimum section modulus shall be complied with.
With respect to existing parts of the vessel, the minimum thickness requirements are normally not complied with if the vessel is lengthened. Usually, this can be dealt with as follows:
   — if the minimum thickness complies with the newbuilding stage rules, no further considerations are necessary, in this aspect
   — deletion of class notations, e.g. Fishing vessel, Supply vessel or Offshore service vessel(+), may reduce the minimum requirements
   — dinor discrepancies are, in general, acceptable, provided the strength is acceptable.
The design still water bending moments and design loads (sea pressure, bow impact, slamming, accelerations) are directly dependent on the length. This means that the complete vessel has to be reassessed for strength.
It should be noted that minor strength discrepancies may be accepted as reduced corrosion margins if requested by the owner. A memo to owner (MO) will be given in such cases.

2.2 Documentation requirements
The following drawings and documentation are required to be submitted for approval or information, in connection with lengthening of a vessel, see also App.A:
1) general arrangement
2) tank plan
3) midship section with material properties (new $C_B$, speed and design draught to be stated on the drawing)
4) shell expansion
5) profile and deck plan
6) new section
7) design loading conditions or loading manual, see the rules
8) reinforcement of existing structure
9) docking plan ($L > 100$ m)
10) new equipment number calculation and proposal of upgraded anchoring equipment as far as relevant
11) intended class notations.

2.3 Longitudinal strength

The coherence between a vessel's length and required longitudinal hull girder scantlings, with respect to bending moments and shear forces is discussed here. Lengthening of a vessel will have an influence on both still water and wave induced hull girder loads. Global design loads, and acceptance criteria for the hull girder, are given in RU SHIP Pt.3 Ch.5.

![Figure 3 Stillwater bending moments along the vessel length for $L=100$ m and $L=130$ m](image)

The actual still water bending moments and shear forces on a hull girder is dependent on both the vessel's length and type (hull shape and buoyancy, lightweight distribution and cargo distribution). The design still water bending moments, given by the rules, is a function of $L^3$, i.e. an increase in the length will lead to a rapid increase in the design bending moment, see Figure 3.

Still water bending moment less than the rule design still water bending moment can be used provided relevant and realistic loading conditions are submitted for approval. For some types of vessel e.g. cruise vessels, which often are pure hogging vessels, zero (0) or the minimum hogging condition as design "sagging condition" can be accepted.

Wave induced loads on the hull girder are also a function of the ship length. The rule design wave bending moments is a function of $L^3$ i.e. increasing the length will imply a rapid increase in the wave bending moment, see Figure 4.
Figure 4 Wave bending moment along the vessel length for $L=100$ m and $L=130$ m

From Figure 3 and Figure 4, it may be seen that a 30% increase in length will lead to approximately 90% increase in both the rule still water and wave bending moment. In other words, the requirement to section modulus will increase with 90% for a lengthening of 30%. The minimum requirement to the section modulus about the horizontal neutral axis, which must be fulfilled for all vessels irrespective of loading conditions, will increase similarly.

2.3.1 Longitudinal strength evaluation
Scantlings of the new hull section must be in accordance with the current rules.

The existing vessel must be reassessed according to the current rules, based on the new length, and hence the new design bending and shear forces. Such evaluation should include checking of the relevant cross sections, with respect to fulfilment of the rule requirements for section modulus, buckling control of longitudinal structural elements and shear strength control. In addition, it shall be checked that the plate thickness is according to the rule minimum.

Minimum requirements for thickness are a function of the ship’s length. However, deficiencies of up to 10% can be accepted upon application from the Owners. Larger deviations, however thickness not to be taken less than minimum scantlings for steel renewal, may be accepted for limited areas based on case-by-case consideration of the type of structure and stress level, the corrosive environment and the applied coating. The steel renewal corrosion margin in the sailing phase will in such cases be reduced correspondingly, which will be reflected in a MO.

Example of MO:
“As a result of the lengthening of the vessel in 2012, the following structures no longer satisfy minimum thickness requirements, and therefore have a reduced corrosion margin:

— Longitudinal bulkhead 5600 mm from CL in compartment No. XX (rule minimum thickness = 10 mm, actual thickness = 9.5 mm)
— Longitudinal double bottom girder 8200 mm from CL, from #25 to #84 (rule minimum thickness = 11 mm, actual thickness = 10 mm).”

It should be noted that this type of deficiency cannot be accepted for ships covered by IACS common structural rules (CSR) or hatch cover structures covered by rules.

The allowable stress in longitudinal strength members, when checking for lateral loads, is dependent on the longitudinal hull girder stress. Members, which were acceptable before the lengthening, may fail to fulfil the rule requirements after the lengthening, due to reduced allowable stresses.
2.3.2 Shear strength
The rule wave shear forces will increase when a ship’s length is increased, see Figure 5.

![Wave shear force distribution along the vessel length for L=180 m and L=210 m](chart.png)

**Figure 5** Wave shear force distribution along the vessel length for \( L=180 \text{ m} \) and \( L=210 \text{ m} \)

Evaluation of global shear strength is especially important for vessels with large or many openings in the side shell, in way of the quarter length fore and aft. It is important to check both vertical and horizontal shear for passenger and cruise vessels, which have many windows with a small distance between them. The allowable shear stress, shear buckling and secondary bending of shell plating between the windows shall be controlled.

For vessels with a relatively simple longitudinal structure (single skin vessel or vessel with continuous longitudinal bulkhead(s)), rule values or the nauticus hull section scantlings shear flow analysis may be used. For more complex vessels, it may be required to carry out FEM analysis in order to achieve a satisfactory shear stress level.

2.3.3 Racking analysis
For vessels with large deck areas over several decks, without any transverse bulkhead in the cargo area, such as ro-ro vessels and seismic research, racking analyses may be required. How the lengthening effects the vessel’s racking capacity has to be considered before racking analysis is required and the extension of such.

2.3.4 Torsion
For ships with large deck openings (total width of hatch openings in one transverse section exceeding 65% of the ship breadth or length of hatch opening exceeding 75% of hold length) the longitudinal strength including torsion may be required to be considered. This is normally only applicable for bulk carriers and container carriers.

Please see the following references:

- DNV GL rules RU SHIP Pt.5 Ch.2 - Container Ships
- DNVGL CG 0131 - Strength Analysis of Hull Structures in Container Ships
- DNV GL rules RU SHIP Pt.5 Ch.1 - Bulk Carriers and Dry Cargo Ships
- DNVGL CG 0151 - Strength Analysis of Multi-purpose dry cargo ships.

2.3.5 Reinforcement of existing structure
For a newbuilding or a new section, it is normally not a problem e.g. to increase the plate thickness or the size of the longitudinals in order to achieve satisfactory section modulus or buckling capacity. Such proposals
will in most cases be unrealistic for existing parts of a ship, due to the cost involved in first removing the old structure and then inserting a new structure, with the required scantlings.

Reinforcement of existing ships must therefore be based on what is possible to achieve bearing in mind the conversion cost involved. However, proposed reinforcement shall always comply with the rule requirement. Problems, which frequently occur for the existing structure, are:

1) Section modulus for the existing structure does not fulfil the rule minimum or the required section modulus based on the new design bending moments and shear forces.
2) Buckling of longitudinal strength elements, such as bottom plating, strength deck plating, side shell plating etc. Transversely stiffened plating shall be especially considered.
3) The rule minimum thickness is not fulfilled for all structural elements.
4) Torsion strength of vessel with large deck openings, i.e. a general cargo vessel with one large hatch opening, open hatch container vessel. The longitudinal strength, including torsion may be required to be considered.
5) Shear strength in way of quarter length from AE and FE for vessel with many or large openings in the side shell, e.g. cruise vessels.

   The following reinforcements can be applied:
6) Fitting of doubler plates/straps on bottom, strength deck or at shear strake in order to increase the section modulus, and hence reduce the longitudinal hull girder stress.
7) Increase breadth by fitting of sponsons, in order to increase the section modulus.
8) Fitting intermediate stiffeners or longitudinals in order to increase both section modulus and buckling capacity.
9) Fitting buckling stiffeners.
10) Doublers/straps on side shell in order to increase shear capacity or closing of windows or openings.

Acceptable ways to increase the section modulus by fitting doublers/straps, are described in [2.10].

2.4 Local strength general
The following areas shall be considered with respect to strength:

— ship's side, especially fore and aft ship
— bow impact affected area
— slamming affected area
— bottom
— ice belt
— weather decks, especially fore and aft ship
— hatches
— superstructures, especially front bulkhead.

2.5 Local strength - New section
The new section shall be checked with respect to requirements stated in the current rules.

2.6 Local strength - Existing parts of the ship

2.6.1 Structures exposed to sea loads
The ship length is included in both the minimum sea pressure and the rule sea pressure. Increased length will however not result in a major change in the sea pressure.

E.g. given a ship with the particulars:

\[ L = 50 \text{ m}, B = 12 \text{ m}, D = 10 \text{ m}, T = 6 \text{ m}, C_B = 0.6, V = 15, \]
an increase of the length of 40% will only lead to a sea pressure increase of approximately 15% in way of FE at the base line. The pressure alteration will increase if the draught is less than given above. Larger ships will generally experience a smaller pressure increase than smaller ships when the length is altered. Considering that $C_B$ increases with the length, one may experience that the sea pressure will remain unchanged when the ship is lengthened. The percentage increase of sea pressure should be checked before detailed calculations are carried out. If the sea pressure increases by less than:

- 5%, then frames need not be checked
- 10%, then plating need not be checked.

For increased draughts of less than 10% above the scantling draught, frames and plating need normally only be checked in the fore and the aft ship.

It is however important to take rule changes into consideration. Old ships may have to be checked even for small sea pressure alterations, as the current rules are applied for conversions.

2.6.2 Superstructures
The front bulkhead shall be checked as the length of the vessel has major influence on the design pressure. The superstructure sides should also be checked on the lower tiers, especially if the draught is increased.

2.6.3 Ship sides for bulk carriers or general cargo carriers with large hatch openings in deck
The ship side is carried by deep web frames or stringers or deck strips. If the latter carries the side and the cargo space is altered, these stringers or deck strips shall be checked according to the new span and sea pressure. The most conservative load case shall be applied i.e. empty hold and maximum sea pressure (if applicable).
When applying a beam element model one should note that the hatch coaming will be the upper deck strip flange.

2.6.4 Hatches
Hatches that previously were located within position 2 may after the ship lengthening be located within position 1. Thus the requirement for hatch coaming height and strength increases. It is also to be noted that the minimum load on the hatches according to the load line convention rules increases with the ship length.

2.6.5 Slamming
The area affected by slamming is always to be checked when the length is increased. The rule slamming pressure increases rapidly (over proportional) and almost linear with the ship length. The extension of the area affected by slamming will also increase, see Figure 6.

E.g. for a ship which is lengthened from 80 m to 100 m (25%) with a forward minimum ballast draught of 3 m, the slamming pressure will increase by approximately 75%.
Discrepancies may be handled in the following ways:

a) Plating: intermediate stiffeners are fitted or plating is renewed.
b) Stiffeners: intermediate stiffeners are fitted or existing stiffeners are strengthened with brackets, additional flanges or struts.
c) Shear area of bottom floors or girders: manholes are closed, floors or girders are fitted with doublers, additional floors or girders are fitted.
d) Weight of ballast may be deducted. New load conditions apply.
Figure 6 Slamming pressure for different ballast conditions as a function of the vessel length

In ships with large holds in the foreship, one may often find a shear area deficiency in bottom floors or girders according to the rule formula. As additional steel in the bottom may become costly for the shipowner, it is important to know that it is possible to carry out a direct stress analysis of the bottom structure based on the slamming pressure.

The shear area summation formula is based on the fact that the slamming pressure is very local. The mean allowable shear stress is set to 100 N/mm² and the slamming pressure is reduced as a function of the affected area.

- for an area \((\ell \times b) \geq (L \times B/20)\) a minimum pressure of \(p = p_{sl}/4\) is applied
- \((L \times B/60) \leq (\ell \times b) \leq (L \times B/80)\) => \(p = p_{sl}/2\)

High bending stresses according to this model may be neglected as the slamming pressure is assumed to be peaky.

2.6.6 Bow impact

The foreship need only be checked according to the bow impact pressure for ships with well-rounded bow lines and/or flare. The bow impact pressure increases significantly less (in %) than the slamming pressure when the ship length is increased.

For direct calculations of girder or frame arrangements, the following parameters may be used:

- as the bow impact pressure is peaky, \(p_{sl}/2\) is applied on the model
- allowable shear stress: \(\tau = 110\) N/mm²
- allowable bending stress: \(\sigma = 235\) N/mm²
- the girders are assumed simply supported at both ends.

2.6.7 Ice belt

The ice belt shall be especially considered. See [8].
2.7 Checklist for lengthening – strength

1) documentation requirements (See App.A)
2) watertight bulkheads
   — number
   — position
   — collision bulkhead.
3) minimum bow height
4) anchoring equipment
   — new equipment number
   — upgrading.
5) longitudinal strength (if applicable)
   — new midship section, \( Z_0 \)
   — new midship section, buckling
   — existing parts amidships, \( Z_0 \)
   — existing parts, buckling
   — shear strength
   — shear strength existing parts.
6) local Strength
   — new midship section
   — existing ship sides
   — ice belt
   — existing bottom
   — forecastle deck
   — slamming
   — bow impact
   — hatchway coamings and covers
   — deck house front and sides.
7) minimum engine power requirements for ice class if applicable.
3 Increased breadth

3.1 General
Increasing a vessel’s breadth is performed by fitting sponsons to the ship’s side. It may be carried out to reduce draught or to increase deadweight.

3.2 Documentation requirements
The following documentation shall be submitted for approval, see also App.A:
1) new shell expansion and framing plan
2) steel structural details and welding details
3) proposal for new equipment number and updated anchoring equipment
4) new loading manual, if applicable.
For information:
1) general arrangement
2) tank plan.

3.3 The following shall be considered
1) Minimum thickness requirement for sponsons sides will be as for side shell. Similar for frames.
2) It is of outmost importance that the sponson framing is aligned with the existing frames, see Figure 7.
3) When the sponsons are tapered at the ends, slot welding of the shell plating to the frames will be accepted where access is not possible, unless the vessel has assigned ice class notation, see below. The slot weld throat thickness is normally to be \(0.6 t\), see Figure 8 and Figure 9. See the rules with regard to the required arrangement of the slots in the plating. Closed spaces shall be conserved.
4) Ice belt and minimum engine power requirement. Sponsons in the ice belt shall be strengthened according to the assigned ice class notation and the minimum requirements to engine power shall be checked accordingly. See [8].
5) The equipment number may change due to the increased displacement and wind area (factors of the rules’ requirement to equipment number), and hence proposal for new number shall be submitted for approval. See [5].
4 Increased depth

4.1 General
Increasing the depth of a vessel is normally done by fitting of a new shelter deck, e.g. in connection with an increased draught where freeboard deck is redefined. The most important structural consequences may be that the new deck will be a strength deck (and freeboard deck) and that the equipment number increases due to the increased wind area. In addition, the minimum power requirements with regard to ice class will change and must be considered accordingly.

4.2 Documentation requirements
The following documentation shall be submitted for approval, see also App.A:
1) deck plan with applicable deck load
2) shell expansion or framing plan of new part
3) new loading manual if applicable
4) proposal for new equipment number and updated anchoring equipment.

For information:
1) general arrangement
2) updated tank plan if air pipe heights are increased.

4.3 The following shall be considered
1) If the new deck shall be regarded as a strength deck, then all scantlings (minimum, allowable stress level, sheer strake) shall be considered consequently. If not, scantlings may be as for superstructure weather decks.
2) If the distance between effective transverse bulkheads is large, racking analysis should be considered.
3) The enclosed deck shall be fitted with drainage arrangement according to the rules.
4) If the old weather deck (main deck) shall be used as cargo deck after alteration, new load (t/m²) and possible strengthening thereof shall be submitted for approval.
5) Extension of collision bulkhead.
6) The equipment number may change due to the increased wind area and hence a proposal for a new number shall be submitted for approval. Please refer to [5].
7) Tank bulkheads to be checked for new design pressure if air pipe heights of tanks are increased.
8) Fishing vessels: The minimum requirement for hatch coaming heights on freeboard decks, within L/4 from FE is 600 mm. Upon application, the Society or the flag administration may accept a coaming height of hatches or door sill of 300 mm, on doors or hatches leading below this deck. The minimum freeboard is presupposed to be increased to the same level as the hatch coaming is reduced, or 50% of the reduced door sill height. The minimum requirement for hatch coaming heights on position 2 decks, within L/4 from FE is 450 mm. Upon application as described in 5), 225 mm may be accepted.

5 Anchoring equipment

5.1 General
Being a function of the vessel’s displacement and the area of vessel profile above the waterline, the equipment number and letter will normally increase in connection with a conversion. Deficiencies with regard to anchoring equipment may however be accepted upon special considerations.

5.2 Documentation requirements
New equipment number calculations shall always be submitted for approval when considering;
— increased length L, breadth B or depth D
— additional superstructures or other new structures that considerably increase the wind exposed area.

Guidance note:
Note that an increased draught does not normally alter the vessel’s equipment number as the decreased wind exposed area compensates for the increased displacement. However, the Society may require calculations in these cases.
See also the rule guidance in regard to mooring and towing lines.

---e-n-d---o-f---g-u-i-d-a-n-c-e---n-o-t-e---

5.3 Acceptance criteria for equipment deficiency
A principle of equivalence with the rules is normally used. After conversion/alteration of the vessel, the anchoring equipment shall have the required holding power and the required level of safety according to the new letter.
1) chain diameter: a reduction of 12% according to new letter for wear and corrosion is allowed
2) chain length: no reduction is accepted
3) anchor weight: a deficiency of 25% is accepted. The deficiency shall be compensated with additional lengths of chain of same weight as the anchor weight deficiency +50%. The last 50% shall compensate for reduced holding power of smaller anchors. Minimum compensation will always be one additional length.

Equipment deficiency, compensated for by additional lengths of chain, shall be according to the new equipment letter at times of possible renewal after the conversion/alteration. Wear and tear limits shall be calculated according to the new equipment letter. A reference to this will be noted as a MO and in the appendix to the classification certificate.

Table 1 Equipment compensation requirements

<table>
<thead>
<tr>
<th>Letter increment</th>
<th>Letter increment</th>
<th>Letter increment</th>
<th>Letter increment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 step</td>
<td>2 steps</td>
<td>3 steps</td>
<td>4 steps or more</td>
</tr>
<tr>
<td>Anchor weight and chain length deficiency according to the new letter can be compensated with adding additional lengths of chain.</td>
<td>New anchors are required when the new letter is ≤ j. New chain is required when:</td>
<td>New anchors are required when new letter is ≤ p. New chain is required when:</td>
<td>New anchors and new chain according to the new letter are required.</td>
</tr>
<tr>
<td></td>
<td>— new letter ≤ j and existing chain is of K1 quality</td>
<td>— new letter ≤ s and existing chain is of K1 quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— new letter ≤ l and existing chain is of K2 quality</td>
<td>— new letter ≤ v and existing chain is of K2 quality</td>
<td></td>
</tr>
<tr>
<td></td>
<td>— new letter ≤ n and existing chain is of K3 quality.</td>
<td>— new letter ≤ w and existing chain is of K3 quality.</td>
<td></td>
</tr>
<tr>
<td>Exempted for chain: K2, letter (e and f)</td>
<td>Exempted for chain: K2, letter (o, p and q)</td>
<td>K3, letter (q)</td>
<td></td>
</tr>
</tbody>
</table>

Note:
Note that the above stated "letter" limits and exempted "letters" have no or a marginal corrosion margin.

---e-n-d---o-f---n-o-t-e---

5.4 Important consequences
1) Chain lockers may have to be converted.
2) Anchor pockets may have to be converted. Note the possibility to change to high holding power anchors, allowing a weight reduction of 25%.
3) Cable lifters may have to be renewed according to new chain diameter. Note that increased chain material quality will reduce upgrading requirement.
4) Hoisting speed of windlass shall maintain 9 m/min after upgrading of equipment.
5) Upgrading of windlass, chain stoppers and chain securing may have to be considered for increased breaking strength of chain.

5.5 Example 1
Existing equipment on board according to letter ‘j’ i.e. 2 × 900 kg anchors + 357.5 m 30 mm VL K1 chain. New required equipment according to letter ‘l’: 2 × 1140 kg anchors + 385.0 m 34 mm VL K1 chain.
Existing chain may be kept: 34 mm – 12% = 29.9 mm.

Equipment deficiency will be as follows:

<table>
<thead>
<tr>
<th>Chain length deficiency</th>
<th>Weight deficiency of anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>385 m – 357.5 m = 27.5 m</td>
<td>( (2 \times 900 \text{ kg} - 2 \times 1140 \text{ kg}) \times 1.5 = 720 \text{ kg} )</td>
</tr>
<tr>
<td></td>
<td>Weight compensation: 720 \text{ kg} : 25.1 \text{ kg/m} = 29 m</td>
</tr>
</tbody>
</table>

=> Required: 27.5 m + 29 m = 2 additional lengths of 27.5 m 34 mm VL K1 chain; one on each side. Existing anchors remain.

A MO will be issued e.g.: "Due to lengthening of the vessel, the equipment number has been increased corresponding to letter 'l'. To compensate the shortage in weight of anchor and length of chain cable, one length of chain cable has been added on each side. Wear and tear limits will be calculated according to the new equipment letter. Renewals are as far as practicable to be in accordance with letter 'l'."

A similar reference will be given in the Appendix to the classification certificate.

### 5.6 Example 2

Existing equipment on board according to letter 'A' i.e. 2 × 4 050 kg anchors + 522.5 m 56 mm VL K2 chain.

New required equipment according to letter 'D': 2 × 4 890 kg anchors + 550 m 62 mm VL K2 chain.

Existing chain may be kept: 62 mm – 12% = 54.6 mm. The owner wishes however to renew the chain in order to increase the corrosion margin. Cable lifters cannot take 62 mm chain and the owner therefore decides to use VL K3 chain.

Equipment after conversion/alteration will be as follows:

<table>
<thead>
<tr>
<th>Chain</th>
<th>Anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement according to letter: 550 m, 54 mm VL K3</td>
<td>Weight deficiency: ( (2 \times 4 890 \text{ kg} - 2 \times 4 050 \text{ kg}) \times 1.5 = 2621 \text{ kg} )</td>
</tr>
<tr>
<td></td>
<td>Weight compensation: 2 621 \text{ kg} : 63 \text{ kg/m} = 42 m</td>
</tr>
</tbody>
</table>

=> Required: 550 m + 42 m = 22 lengths of 54 mm VL K3 chain; 11 lengths on each side. Existing anchors remain.

A MO will be issued similar as in example 1.

### 5.7 Example 3

Similar as example 2 but owner wishes to change to high holding power anchors due to lack of space in the anchor pockets. Equipment after conversion/alteration will be as follows:

<table>
<thead>
<tr>
<th>Chain</th>
<th>Anchors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Requirement according to letter: 550 m, 54 mm VL K3</td>
<td>HHP anchors – weight requirement: 4 890 kg – 25% = 3 668 kg</td>
</tr>
</tbody>
</table>

=> Required: 550 m = 20 lengths of 54 mm VL K3 chain; 10 lengths on each side and 2 × 3 668 HHP anchors.

No MO will be issued.
6 Steering arrangement

Any change in the ship’s main parameters, such as the rudder, propulsion or power supply systems, may have impact on the steering capability of the ship. The rules state no requirements with regard to rudder area only a guidance note in the rules for stern frames, rudders and steering gears. The owners will have to decide whether the steering capabilities are considered adequate for the vessel after conversion/alteration. If, however, the rudder has been altered, or if an alteration of the ship could otherwise affect the ship’s steering capability, then a new sea trial for testing of the rudder and the steering gear, including documenting the steering capability of the ship, shall be carried out.

If the rule requirement to the rudder stock in way of the tiller exceeds 230 mm after the conversion/alteration, then an alternative power supply to the steering gear will be required, assuming that the new rules apply.

Any modification to the rudder, increased vessel speed, repositioning of the rudder or modification of and or the steering gear will be subject to approval and survey. Azimuth thrusters are subject to approval, survey and testing to the same degree as conventional propulsion and steering arrangements.

Increased vessel speed and or the installation of propeller nozzles will give greater requirements for the rudder, rudder stock, sole piece and steering gear.

Note that a repositioning of the rudder stock will affect the ships length. The Society and the flag administration shall be informed accordingly to determine new correct freeboard values.

The following documentation shall be submitted for approval:

1) updated or new arrangement drawings of rudder, steering gear and steering compartment
2) drawings and particulars of all changes to azimuth thrusters, rudder, stock, bearing and steering gear inclusive all relevant piping and control and monitoring. systems. Material data and ratings shall be specified
3) updated operating instructions (posters in wheel house and in steering gear compartment).

All new parts and relevant components shall be delivered with a DNV GL certificate.

The sea trial of the rudder and steering gear shall be carried out at full speed, i.e. the same conditions that are required for a new ship.

7 Mounting of bottom equipment

Documentation, arrangement and strength of foundations for bottom equipment shall satisfy requirements given in RU SHIP Pt.3 Ch.10 Sec.6.

Due attention should be paid to the location of docking supports, to avoid damage to bottom equipment and its foundations.

8 Ice belt

8.1 Generally

Longitudinal extension of forward, midship and aft ice region is dependent upon the vessel’s length, its breadth and the given ice class notation. The vertical extension is dependent upon the ice class notation. The extension and strength of the ice belt is very often utilised with regard to the initial draught. This means that the ice strengthening often fails to meet the requirement given by a possible new draught or a conversion, e.g. lengthening. Changes in displacement or in main dimensions L, B or T will require appraisal of machinery power, shafting, propeller, in addition to structural strength, etc. Attention shall be paid to the extension of the ice belt, in both directions.

The Society accepts that the class notation Ice(C) is valid to a maximum specified draught, which is less than the new draught. If such an arrangement is chosen, a reference to this will be given in the appendix to the classification certificate and as a MO. This procedure is not acceptable for the Baltic ice class notations.
8.2 Baltic ice class notations

The ice pressure is dependent on the vessel's displacement and its propulsion power. It is important to find the total ice pressure increase and consider the amount of checkpoints according to this.

— ordinary and intermediate frames are generally to be checked if the ice pressure increases more than 5%  
— the ice belt plating is generally to be checked if the ice pressure increases with more than 10%.

Design ice-pressure, increase with increasing displacement. In most cases this can be ignored. Only a considerable increase in draught will require the adjustment of the ice-pressure.

8.3 Strengthening in the ice belt

If the owner does not intend to carry out the required strengthening, the ice class notation will be deleted.

8.3.1 Shell plating

Doublers/straps are normally accepted in connection with conversions/alterations or increased draught of vessels, in order to fulfil the ice class requirements with respect to shell thickness. Where doublers/straps are to be used for increasing the shell thickness, the guidance below should be followed:

1) Minimum thickness of doublers is 10.0 mm.
2) The breadth of doublers should not exceed 250 mm in the foreship and 325 mm elsewhere. Where slot welds are accepted, the vertical distance should not exceed 325 mm.
3) Adjacent doublers shall be connected with full penetration welding, see Figure 11.
4) Welds along the doublers sides shall be at least: \( a = 0.5 \ t_{db} \), see Figure 11. Slot welds shall not be used in the foreship for Ice(1B) and Ice(1C) and shall not be used in the fore- and midship for ice class Ice(1A*F), Ice(1A*), and Ice(1A). Where accepted, slot welds shall be completely filled with welding in the ice belt.
5) Thickness of doublers shall be determined by the following formula:

\[
t_{db} = \sqrt{t_{ice}^2 - t_{ex}^2 + t_c}
\]

where

- \( t_{ice} \) = required shell thickness for the given ice class, in mm (without \( t_c \))
- \( t_{ex} \) = existing shell thickness, in mm
- \( t_{db} \) = required thickness of doubler, in mm
- \( t_c \) = increment for abrasion and corrosion, in mm, (normally 2 mm)

Figure 10 Section A-A: Extending the ice belt vertical with doublers. Welding detail
8.3.2 Side frames in the ice belt
Ice frames may be strengthened with additional flanges, new intermediate stiffeners, fitting of brackets or supported by stringers (must be specially considered). Intermediate framing may have to be extended.

9 Strengthening for increased local loads
When increased environmental loading due to increased main dimensions or increased draught necessitates strengthening of the existing steel structure, some arrangements must be approved which are usually not approved during a newbuilding phase.

9.1 Strengthening of plating
Increased sea pressure will seldom necessitate strengthening of plating. Such are usually required due to increased:

1) slamming pressure
2) bow impact pressure
3) design load for decks
4) tank loading
5) ice belt extension or pressure
6) longitudinal stress level.

In the four first cases, fitting of intermediate stiffening is often used. Refitting of plating may be necessary in extreme cases or when increased local loading is combined with increased longitudinal stresses. It may be necessary to strengthen existing stiffeners as well as adding intermediate.

SPS sandwich panels may be used as an alternative strengthening of plate areas, see DNVGL CG 0154. The arrangement will be subject to case-by-case acceptance.

For areas where it may be accepted to use doubler plates to strengthen for lateral pressure, the arrangement should in general comply with the following guidance. The plate thickness for a doubler should not be taken less than:

\[ t_{db} = \sqrt{t_R^2 - t_{ex}^2} \]

where

- \( t_{db} \) = thickness of doubler plate
- \( t_R \) = rule required thickness
- \( t_{ex} \) = existing plate thickness.

In regard to the ice belt, see [8]. With respect to the increased longitudinal stress level, this is usually handled by fitting doublers, see [11].

**9.2 Strengthening of stiffeners**

The strengthening of stiffeners due to increased environmental loads or loads from new equipment is usually handled in one of the three following ways:

1) The stiffeners' end brackets are increased or new larger brackets are fitted. The alignment of supporting structures shall be specially considered.

2) The stiffeners' sections are increased by fitting of doublers or additional sections. The thickness of doublers should not be less than 6.5 mm. The additional flanges shall extend beyond the existing end brackets. Where the sections are considerably increased, new brackets should be fitted.

3) The stiffeners are supported by girders, stringers or struts. Note that when girders are fitted on the outside of a bulkhead, typical strengthening on the superstructure front connection area shall be applied, with brackets.

   See also Figure 13 and Figure 14.
9.3 Strengthening of girders

Girders may be strengthened with regard to bending strength and shear strength, see Figure 15 to Figure 17.

1) When strengthening girders in order to reduce bending stresses, the sections shall be increased in the same way as for stiffeners. Doublers shall be extended beyond brackets. This may be done by slotting the doubler in way of the bracket or by making the section unsymmetrical. The latter will require additional tripping brackets.
2) To reduce shear stresses in girders, two solutions are normally acceptable:
   a) increase girder height
   b) increase shear area by fitting a doubler. The doubler shall be located in way of the shear centre of the girder. Doublers outside the shear centre will not be accepted.

Figure 16 Strengthening of girders for shear strength
Doublers for shear shall extend fully to the girders ends and shall be tapered inboard. When the doubler height is equal to the girder height, the doubler shall be welded with full penetration welds.

Figure 17 Fitting of shear doubler
10 Application of doublers/straps for longitudinal strength

Where the stress level in existing structures is increased above the maximum allowable, either according to buckling criteria or according to longitudinal strength criteria, fitting of doublers may be an acceptable solution. Doublers may be fitted at deck or bottom for insufficient bending strength or at sides for insufficient shear strength.

Increased area in deck and/or bottom due to longitudinal strength, may be obtained from the formula:

$$\Delta A \geq \frac{\Delta Z}{Z/A + Y_T}$$

where

- $\Delta A$ = required increase in deck/bottom area, in cm$^2$
- $\Delta Z$ = required increase in deck/bottom section modulus, in cm$^3$
- $Z$ = actual section modulus, in cm$^3$
- $A$ = actual total area in the cross section, in cm$^2$
- $Y_T$ = distance from deck or bottom to neutral axis, in cm

It is assumed that the doubler material is of the same quality as the existing deck or bottom plating.

Minimum thickness of the doublers shall be as follows:
- Deck plating: $t_{\text{min}} = 6.5$ mm or $t_{\text{existing deck plate}}$
- Sides and bottom: $t_{\text{min}} = 10.0$ mm or $t_{\text{existing side/bottom plate}}$ whichever is less.

10.1 Welding of doublers/straps

Doublers shall be welded to plating contributing to longitudinal strength with continuous welding along the edges. The thickness of doublers should not be less than 6.5 mm.

Throat thickness of the welds to the deck or bottom plating for tapered terminations is normally to be:

$$a_t \geq 0.4 \times t \text{ (mm) } > \text{ (at tapered terminations)}$$

and

$$a_t \geq 3 + 0.1 \times t \text{ (mm) } \text{ (in general),}$$

assuming the breadth of the doublers $b < 100 + 30 \times t$, where $t$ is the thickness of the doubler (mm).

Where doubler plates are tapered within $0.2L$ and $0.25L$, fore and aft of amidships, the weld area surrounding the taper of each doubler should not be less than $1.75 \times$ the doubler area. Where several doublers are terminated in the same region, the sectional area $A^*$ of the strengthened part, see Figure 18, should not be less than:

$$A^* \geq 1.75 \left( \sum_{i=1}^{n} A_i + A_0 \right)$$

where

- $A_0$ = original shell plate area in way of doublers
\[ A_i = \text{area of doubler/strap no. } i \]
\[ \text{i.e. } A_1, A_2 \text{ and } A_3 \text{ as shown in Figure 18.} \]
\[ A_i = b_{\text{doubler},i} \cdot t_{\text{doubler},i} \]

**Figure 18 Weld area in doubler ends**

For doublers plates with breadth, \( b \), exceeding:

\[ b = 100 + 30 \cdot t, \text{ maximum } 850 \text{ mm} \]

welding through evenly distributed slots will be required.

**10.2 Buckling check of doublers/straps**

All doublers/straps are to be checked against relevant buckling criteria in accordance with RU SHIP Pt.3 Ch.8.
11 Ladder access by means of cut-outs in ships side

Occasionally, but mainly on fishing vessels, access ladders are arranged by cutting holes in the ships side. Even though longitudinal stresses may be relatively low cracks may arise unless adequate reinforcing is arranged. A suitable and acceptable method is shown in Figure 19.

![Figure 19 Shell insert in way of ladder holes](image)

It is strongly recommended that such openings are positioned outside $0.4 \times L$ amidships, if possible.
12 Ballast keels made from slabs

Figure 20 Ballast keels made of slabs

Fitting of new a new keel is subject to class approval. To achieve required stability, a ballast keel built up by slabs is often used for ships with $L < 100$ m. The following requirements must be satisfied:

1) Ballast keel built up by slabs is not accepted as an integral part of the bottom structure, and is not to be included in the calculation of section modulus, $Z_B$.

2) Internal stiffening must be provided to ensure the load distribution between the ballast keel and the bottom structure with respect to docking. Internal brackets or intercostals in line with the longitudinal welding seam shall be fitted.

3) The keel plate thickness for connections of the ballast keel is not to be less than twice the normal rule thickness. Steel grades in accordance with class III shall be provided.

4) The slab material shall have good weldability with carbon content normally not exceeding 0.18%. Preheating to 75 to 100°C is recommended. Special attention should be paid to weather conditions and air temperature.

5) Butt welded joints of the slabs are not accepted within sections which may be subjected to local tensile stress, such as just below or near to transverse bulkheads.

6) Butt welded joints and the seams along the keel plate shall be built up after 45° edge preparation with depth minimum 20 mm to 25 mm.

7) The welds shall be carefully checked with respect to cracks by MPI or equivalent methods.

8) For $Z_B/Z_R$ less than 2, ballast keel built up by slabs will normally not be accepted. ($Z_B/Z_R$ will normally be less than 2 for ships exceeding 90 m).

9) The slabs shall be delivered in normalised condition if:
   a) The ballast keel serve as a sole piece, or in any other way is subject to higher local tensile stresses.
   b) If $Z_B/Z_R$ is less than 3. ($Z_B/Z_R$ is normally to be checked for all vessels with length exceeding 60 m).

10) For vessels with length less than 50 m and with docking weight less than 30 t/m, the stress concentration in the supporting structures found to be low (120 to 160 N/mm²). Brackets or intercostals in line with the welded seam between frames may therefore normally be omitted.

11) The strength of the supporting structure of the keel will be subject to special consideration.

$Z_R$ = rule section modulus requirement

$Z_B$ = section modulus of ship as built.

13 Installation of special fixed ballast materials

13.1 General

The following is based on USCG’s Circular from 1982:
When fixed ballast is installed, the following MO shall be given:

“Tank(s)........ have been filled with ........ tons (m$^3$) of fixed ballast of the type ........, with a specific gravity of ........ t/m$^3$.

The ballast shall be removed for the survey of the tanks on request from the Society.”

13.2 Fixed ballast, general

Fixed ballast may be installed to increase stability on new or existing vessels. If fixed ballast is to be used aboard vessels requiring inclining tests, it should be installed prior to conducting the test. On existing vessels, addition or removal of fixed ballast may require that a new inclining test is performed on the vessel. The mass and location of fixed ballast on such vessels should be included in the stability calculations.

The use of high density materials for fixed ballast installations may cause excessive structural loading on a vessel. Therefore, the following plans and calculations may be required to be submitted for approval:

1) An arrangement plan showing proposed types, locations and quantities of fixed ballast.
2) A capacity plan showing the original capacity of each space in which fixed ballast will be installed.
3) A structural evaluation of each fixed ballast compartment for the mass and location of the proposed ballast installation.

Special arrangements may be necessary to provide proper ventilation and to facilitate the installation and inspection of the ballast material. The following guidance applies to all fixed ballast installations:

1) Each ballast tank should be fitted with vents to the weather deck. Flame screens should be installed if organic decay is possible.
2) Fixed ballast should not be installed in tanks containing piping systems that require inspection. If fixed ballast must be installed in such tanks, a pipe tunnel or other suitable arrangement should be made to permit inspection of the piping.
3) The ballast material should be properly secured to prevent shifting in severe weather.
4) Inspection openings should be provided in each corner of the ballast space for detection of shifting or settling of the material or seepage of water into the ballast space. Manholes may be provided for this purpose in double bottom tanks. If concrete caps are used to secure the ballast, ullage pipes at least 200 mm in diameter should be fitted in the concrete to permit inspection of the ballast material.
5) An expansion trunk should be provided which is adequate for the maximum volumetric expansion of liquid ballast.
6) Plans showing ventilation of the fixed ballast space, the securing arrangement of the ballast material, and all closure plate installations for openings cut in the vessel structure may be required to be submitted for approval.

Fixed ballast is often installed in compartments or tanks that would normally be examined for deterioration during periodic inspections. The following procedures may be followed in lieu of emptying fixed ballast tanks at each inspection period:

1) The atmosphere in each tank should be sampled and analysed by a certified marine chemist who should follow the provisions of NFPA 306 to determine if gas evolution is present.
2) All fixed ballast installations should be accessed through the ullage openings provided. The ballast material should be inspected for shifting, settling and excessive moisture. Visible change to the ballast material may be cause for removal and additional inspection.
3) If a bacteriostatic agent is required, a sample of ballast fluid from the mid-depth of each tank should be removed for analysis to determine the bacteriostatic agent residual and the presence of any methane gas or gas producing bacterin. If there is evidence that the bacteriostatic agent residual is inadequate to prevent bacterin growth, the fluid should be pumped out and supplied with a bacteriostatic agent.
4) If installed, the tank material test pieces should be examined to determine the apparent type and rate of corrosion. If there is indication that extensive or accelerated corrosion is taking place the ballast material should be pumped out and the tank cleaned for internal examination.
Plans, calculations and procedures for approval of fixed ballast installations should be submitted in one co-ordinated package. The Society’s approval of the package should be obtained prior to installation of the ballast material.

13.3 Fixed mud ballast

Special drilling mud type fluids (Baryte) may be used as fixed ballast, under the following provisions:

1) Bacteriostatic agent; a bacteriostatic agent effective against aerobic as well as anaerobic bacteria should be thoroughly mixed with the fluid in accordance with the manufacturer’s specifications.

2) Anticorrosivity; the pH factor of the fluid should be adjusted to a value which minimise corrosion for the particular metals involved. Corrosion inhibitors may be added to the fluid, but they should not interfere with the action of the bacteriostatic agent or affect the physical properties of the fluid such as suspension, viscosity, etc.

3) Settling; fluids should have sufficient viscosity and gel strength to minimise settling of solids.

4) Thermal expansion; volumetric expansion should not be greater than four tenths of one percent (0.4%) over a temperature range from -2°C to 30°C.

5) Freezing; the fluid should withstand a low temperature ambient of -2°C without freezing. Unless adjacent to high temperature spaces, the expected maximum temperature of the ballast should be taken as 30°C.

6) Proposed ballast; a sample of proposed ballast fluid should be prepared by the manufacturer and subjected to at least a thirty day test to insure that all of the above requirements are fulfilled. A report of the test should be made available to the surveyor prior to installation of the fluid.

7) Corrosion test plates; corrosion test specimens, in the form of two 100 × 500 mm plates 10 mm thick and of the same material as the internal structure of the ballast tanks and welded together to form a plate 200 mm wide, should be attached to the underside of the manhole cover on each expansion trunk for the ballast tanks in such a way that the corrosion test specimens hang down to the mid-depth of the ballast tanks. A permanent record of the date of installation, thickness and weight of each corrosion test specimen should be kept on aboard the vessel. Specimen thickness, weight and date of inspection should be placed in this record after each inspection.

8) Air pockets; when pumping the fluid into the ballast tanks, care should be taken to eliminate all air pockets. Permanently installed ship’s pumps or piping should not be used for handling the fluid.
SECTION 3 MOBILISATION WITH TEMPORARY INSTALLATIONS

1 General
A vessel classed with the Society shall comply with the Society's relevant rules and statutory requirements as required by the flag administration in order to maintain the validity of the class certificate. If the Society's involvement is required due to modifications to a vessel in connection with a mobilization, it is the owner's responsibility to contact the Society with the necessary information and request for approval/survey.

When installing temporary equipment on deck, it should be evaluated if the loads on the supporting vessel structure are within or outside approved capacity, i.e., whether the installation is an operation within approved vessel limits or constitutes an alteration requiring class approval, see [4].

When assessing whether an installation requires approval, it should be noted that in general, as part of the deck approval, the deck is approved for evenly distributed loads acting downwards. Hence, temporary installations that give rise to unevenly distributed deck loads (such as point or line loads) or tensile reaction loads (typically introduced by winches/pulling accessories or heavy objects/equipment with high centre of gravity) may trigger the need for approval.

For more flexible use of the deck for temporary installations, it is recommended to have a detailed load plan approved for specific loads and fastening arrangements. This load plan could include e.g. point loads/line loads, uplift, typical connection details and welds.

This section gives guidelines and examples of what should be considered when mobilizing with temporary installations for a limited time period.

2 Temporary installations subject to class approval
The temporary installations listed below are subject to class approval.

2.1 Units/equipment/systems/arrangements
The following structures and units are subject to class approval:

a) equipment/systems/arrangements covered by main functions as defined in RU SHIP Pt.1 Ch.1 Sec.1 or applicable class notations
b) superstructure units manned or operated independent of weather conditions
c) superstructures units, storage units and offshore service containers containing equipment covered by main functions or class notations
d) mezzanine decks or other structures being used by the crew as work deck, cargo deck or supporting items listed in this subsection
e) any equipment installed for temporary alteration of the hull girder strength or buoyancy, e.g. additional buoyancy elements or similar
f) mobilisation with special equipment introducing new operational work tasks for the vessel is subject to case-by-case evaluation if the equipment and foundations are subject to class plan review; e.g. mobilisation with equipment to operate as well stimulation vessels will introduce class requirements to plan approval.

2.2 Foundation for units or equipment
Foundations for the following types of equipment are subject to class approval:

a) man-riding equipment, such as work boat davits, life boat davits or similar
b) diving support systems
c) heavy objects where the local support foundation forces are exceeding the approved vessel deck capacity
d) machinery equipment, winches, lifting equipment as defined in RU SHIP Pt.3 Ch.11 Sec.2 and not exempted in [4]
2.3 Use of Offshore Service Containers

Offshore service containers of type ship service container which have been certified by the Society to DNVGL ST E272 - Offshore Service Modules may comply with the classification and statutory requirements described in this class guideline, but installation and connections must be approved in each case. The certificate for the service container will include information on conditions for temporary installation on ships.

It is recommended that also temporarily installed service containers which are not subject to class approval should be certified to DNVGL ST E272 - Offshore Service Modules. This ensures that the containers are fit for use on ships, and the certificates provide information on conditions for temporary installation.

2.4 Tanks and storage units

Tanks and storage units, including relevant systems and equipment used for carriage of low flashpoint liquids, dangerous goods or chemicals, are subject to class approval.

Tank containers for dangerous goods that are certified according to the IMDG Code are considered to comply with class requirements and can be used as storage tanks, but installation and connections must be approved in each case, see [16].

Foundations for storage units are subject to class review if the local support foundation forces exceed the approved deck capacity. Uncertified purpose-built tanks and storage units used for carriage of dangerous liquids are subject to class appraisal before being installed.

General notes:

1) certificates of temporary equipment, life-saving appliances and or man-riding equipment are requested as for permanent equipment
2) mobilisation with temporary installations covered by the rules shall be carried out by qualified personnel and in compliance with applicable rules, with good engineering practice and under the supervision of a surveyor
3) independent of the above-mentioned categories, class can be contacted for an evaluation of relevant applicable requirements of unconventional temporary installations.

3 Plans and documentation

Plans and documentation of temporary installations covered by [2] shall be submitted for approval. The documentation requirements are the same as for permanent installations and are listed in relevant parts of the rules.

4 Temporary installation of small deck-mounted equipment and heavy objects exempted from class review

Sections [4.1] and [4.2] provide guidelines for the evaluation whether equipment and heavy objects are within approved deck capacity and hence not required to be submitted for class approval.

4.1 General criteria

In order for a foundation to be exempted from approval, the following general criteria should be fulfilled.

1) The deck on which the unit is mounted shall be approved for a uniform load of 5 t/m² or more.
2) The SWL and static overturning moment of the equipment must not exceed 6 t and 10 tm, respectively, unless a detailed load plan has been approved covering specific loading conditions.
3) Support brackets and welding of the foundation directly onto deck shall be arranged such that no part of the foundation is terminated on unsupported deck plating.
4.2 Special criteria

This subsection provides examples of typical items which may be exempted from class approval, along with associated special criteria which should be fulfilled in addition to those given in subsection [4.1].

a) Fixed support points in way of pad eyes or similar may be exempted from approval provided that the foundation of the support point is directly aligned with underlying primary deck structures, such as deep girders or bulkheads, or supported by at least two secondary structures, such as stiffeners or carlings/brackets.

b) Deck-mounted winches or other pulling accessories, such as that exemplified in Figure 1, may be exempted from approval provided that the distance \( h \) from the foundation base to the acting SWL versus the horizontal foundation extent \( b \) does not exceed the figures given in Table 1. Linear interpolation may be used to establish acceptable arrangements for operational design load limits between those listed in the table. The foundation should, as a minimum, be securely fastened in four corners.

Table 1 Maximum moment arm for SWL of 6t versus size of foundation

<table>
<thead>
<tr>
<th>Deck load (ton/m²)</th>
<th>Maximum moment arm for SWL of 6t versus size of foundation.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 t/m²</td>
<td>( h \leq 0.50 \cdot b )</td>
</tr>
<tr>
<td>6.0 t/m²</td>
<td>( h \leq 0.65 \cdot b )</td>
</tr>
<tr>
<td>8.0 t/m²</td>
<td>( h \leq 0.85 \cdot b )</td>
</tr>
<tr>
<td>10.0 t/m²</td>
<td>( h \leq 1.05 \cdot b )</td>
</tr>
<tr>
<td>12.0 t/m²</td>
<td>( h \leq 1.30 \cdot b )</td>
</tr>
<tr>
<td>15.0 t/m²</td>
<td>( h \leq 1.60 \cdot b )</td>
</tr>
<tr>
<td>20.0 t/m²</td>
<td>( h \leq 2.10 \cdot b )</td>
</tr>
</tbody>
</table>

Figure 1 Foundation for typical pulling appliance
c) Deck stiffener capacity to support single footprint load from pulling accessories and other deck-mounted units:

Table 2 gives the minimum deck capacity for a single footprint load, $F_C$ (kN) or (t), supported by one deck stiffener.

**Table 2 Deck stiffener capacity, $F_C$ for single load (dynamic amplification included)**

<table>
<thead>
<tr>
<th>Deck load capacity (ton/m²)</th>
<th>Deck capacity to take single load, $F_C$ per stiffener versus deck design load capacity (ton/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 t/m²</td>
<td>$F_C = 35$ kN (or 3.5t)</td>
</tr>
<tr>
<td>6.0 t/m²</td>
<td>$F_C = 40$ kN (or 4.2t)</td>
</tr>
<tr>
<td>8.0 t/m²</td>
<td>$F_C = 55$ kN (or 5.6t)</td>
</tr>
<tr>
<td>10.0 t/m²</td>
<td>$F_C = 70$ kN (or 7.0t)</td>
</tr>
<tr>
<td>12.0 t/m²</td>
<td>$F_C = 80$ kN (or 8.4t)</td>
</tr>
<tr>
<td>15.0 t/m²</td>
<td>$F_C = 100$ kN (or 10.5t)</td>
</tr>
<tr>
<td>20.0 t/m²</td>
<td>$F_C = 140$ kN (or 14.0t)</td>
</tr>
</tbody>
</table>

Table 2 is based on stiffener minimum span and spacing of 1.8 m and 0.6 m, respectively. I.e., with reference to below formula, the capacity, $F_C$, will increase for larger span and spacing.

Linear interpolation may be used to establish acceptable arrangements for operational design load limits not listed in the above table.

If the foundation arrangement exceeds the deck capacity as listed in Table 2 (or Table 1), then the deck stiffener capacity, $F_C$, to take a single vertical footprint force per stiffener (incl. dynamic factor) can be estimated as:

$$F_C = 0.05 \cdot (g_0 + 0.5 a_v) \cdot p_c \cdot s \cdot l \quad (kN)$$

where

- $p_c$ = design load for deck\(^1\) (t/m\(^2\))
- $s$ = deck stiffener spacing (m)
- $l$ = deck stiffener span (m)
- $g_0 = 9.81$ (m/s\(^2\))
- $a_v$ = vertical accelerations\(^2\) (m/s\(^2\))

Footprint loads for pulling accessories and other deck-mounted units should be based on the loads given in subsection [7].

Uneven loading caused by the wire’s extreme positions on the drum can normally be distributed with 80% and 20% of the load onto each side of the winch.

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\(^1\) Maximum operational static deck loads as specified in the appendix to classification certificate.

\(^2\) The design accelerations for deck cargo ($g_0 + 0.5a_v$) can be simplified as $1.3 \cdot g_0$ or based on calculations/values from relevant part of the rules.
If there is any doubt about the fastening arrangement or deck capacity, then class can be contacted for an appraisal of the securing and supporting structure.

Limitations to use of doubler plates:
Doubler plates are normally not accepted as part of the support arrangement for tensile foundation forces. For equipment delivered with "mounting pads" in way of thick doubler plates; it is required to arrange for underlying deck structure being aligned with the welding of the "mounting pads", see [5] for all support points being subject to tensile force. The local support of the foundation pads shall be evaluated for both maximum compression and tensile forces. However, no mounting pads being subject to uplift forces shall be arranged with less than two (2) of the edges being supported. Structural support arrangement of such equipment including doubler plates is subject to class appraisal for case-by-case acceptance.

Shimming plates introduced only to take compression loads may be allowed provided that they are arranged in a way that minimises load transfer from shimming plate corner onto unstiffened plate. I.e. this will normally require a minimum of two supporting structures below the shimming.

5 Guidance to structural arrangement, welding and material grades for deck structure subject to uplift force
a) supporting deck plates thicker than 15 mm shall comply with RU SHIP Pt.3 Ch.11 Sec.2 [4.3.3]
b) ultrasonic lamination testing shall be carried out if the imposed load results in tensile stress exceeding 100 N/mm², unless the steel is of Z quality
c) underlying supporting structures aligned with tensile part of the support foundation shall, as a minimum, have a double continuous welding equivalent to the required welding of the foundation
d) the foundation's welding shall be aligned with welding of underlying structure.

6 Temporary installations of additional buoyancy units or units being mounted on the outside of the vessel hull
Any temporary equipment being mounted onto the ship side or deck equipment extending outside of the vessel hull shall be evaluated for buoyancy, rule sea pressure or slamming pressure acting on the bottom and sides of the equipment.

7 Applicable loads for temporary installations
a) For pulling accessories, the design loads should be applied as per RU SHIP Pt.3 Ch.11 Sec.3.
b) Acceleration loads on offshore service containers, stowed heavy equipment or deck cargo should be calculated according to relevant parts of the rules. It is recommended that positive and negative vertical accelerations in combination with horizontal accelerations be considered for possible uplift in the foundations.
c) Any temporary deckhouse, manned unit or service container which is subject to class approval according to [2.1] should be evaluated for a minimum longitudinal acceleration of 0.5g₀ in the forward direction and 0.25g₀ in the aft direction, to accommodate for safe securing in case of accidental collision, grounding or similar.
d) Temporary superstructure units, including offshore service containers which are subject to class approval, positioned on exposed weather decks should be evaluated for green-sea pressure according to rules for deckhouse/superstructure.
e) Units positioned on weather decks shall be evaluated for buoyancy loads when relevant.
f) Temporary deckhouses, storage units and offshore service containers which are protected from green sea pressure by way of high cargo rails, bulwarks, protection bulkheads etc. can be evaluated for a reduced rule sea pressure. For the protected area of the units, the sea pressure need not be taken greater than the calculated sea pressure value at the top of the protection bulkhead. The sea pressure
should, however, not be taken less than 50% of the rule sea pressure for unprotected side/aft bulkhead of the units, to take into account possible washing of trapped sea water on weather deck.

g) For temporary units which are protected from green sea by means of a forward permanent superstructure as well as side protection by means of cargo rails or similar, buoyancy-induced uplift loads need only be evaluated for a water level up to 2.3 m above weather deck or hatch top.

8 Operational limitations

Ship motion design loads caused by accelerations and sea pressure can be reduced according to the rules for restricted service area RE, R4, R3, R2 or R1 if the mobilisation with temporary equipment is limited to be used within the restricted service area. Similarly, the design accelerations and sea pressures can be reduced according to operational limitations in terms of sea state condition with maximum significant wave height $H_s^3$.

The reduced design loads shall then be established by direct sea-keeping analysis of the vessel performance in the limited sea condition.

Accommodation units, other manned units and service containers which are subject to class approval according to [2.1] and without restriction to use in heavy weather shall, however, be evaluated for full rule loads according to the vessel’s class notations, and may only be reduced if the vessel is assigned a service restriction notation. The design load values shall, however, not be taken less than the minimum rule value corresponding to a 50% reduction in $C_w$ factor as given for the highest service restriction RE. See RU SHIP Pt.3.

Restriction to operational conditions will be issued as a MO.

For mobilisations with temporary equipment limited to a maximum of 12 months’ operational period, the local scantlings may be calculated based on measured scantlings or actual corrosion margins, $t_k$. The hull scantlings condition shall be confirmed by a surveyor if the scantlings evaluations are to be based on reduced corrosion margins.

For offshore service containers that are certified according to DNVGL ST E272 - Offshore Service Modules, the allowable loads are specified in their certificates. Each temporary installation of such containers shall be evaluated based on these allowable loads.

9 Fastening arrangement

9.1 Welded connections

All welded connections of temporary equipment subject to class acceptance shall comply with the rules applicable to permanent installations. Corrosion margins, $t_k$ can however be neglected (or based on surveyed status) if the mobilisation is intended for a restricted mobilisation not exceeding 12 months. Use of single-sided welding of temporary equipment in areas exposed to sea water is subject to case-by-case acceptance for a time period normally not exceeding 12 months. Such limitations to corrosion allowance, $t_k$ for a restricted period will be reflected in a MO stating that survey shall be carried out to confirm the condition of the weld at next annual survey.

9.2 Twistlocks

All fastening of temporary equipment subject to class acceptance by means of twistlocks shall comply with the following:

a) The calculated footprint forces acting on the twistlock units shall be kept within the units’ allowable limits. Resulting forces in the twistlock calculated at normal load level ($10^{-4}$ probability level) shall not exceed the twistlock’s approved Safe Working Load (SWL).

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[3] It is recommended to evaluate the design wave height ($H_s$) according to OS-H101 - Offshore Standard for Marine Operations depending on the operational period, the distance to safe harbour and/or possibility to shut down the operation.
b) Twistlocks shall be certified by the Society or recognised body according to CSS code Annex 13 (IMO Requirements to Cargo Stowage and Securing).

c) Only manually operated twistlocks can be used, not semi-automatic or fully automatic twistlocks.

d) The twistlocks shall be secured in locked positions by means of a welded flatbar or equivalent measures.

e) If twistlocks are used as fastening for temporary equipment for a time period exceeding 12 months, then class will normally require that the twistlocks be included in the vessel's annual survey. A MO shall then be issued stating that "Twistlocks used for fastening of temporary equipment (list of units) shall be included in the annual survey. This mobilisation with temporary installations is scheduled to be demobilised within (date). Any extension of the mobilisation period shall be agreed with class and application for extension shall be submitted no later than 3 weeks prior to termination day."

9.3 Bolted connections

Use of bolted connection is accepted as a means of fastening temporary equipment to the vessel main structure. The capacity of the bolt group connection can be evaluated based upon relevant recognized steel standards. Due attention shall be paid to load application versus the capacity of the bolted connection. I.e., the capacity of the bolt group shall not be taken less than that of an equivalent welded fastening arrangement independent of the probability level of the applied loads.

Shear stoppers shall normally be arranged in addition to the bolted connection used to secure temporary equipment to the vessel main structure.

9.4 Padeyes and securing points

Padeyes or other permanently fixed securing points may be used as part of the arrangement to fasten temporary installations.

It should be noted that the main pad eyes used for offshore lifting of offshore containers are normally not suited for use as securing points.

9.5 Loose securing equipment

Loose securing equipment/lashing equipment, such as cables, wires, chains or other lashing equipment, is in general not accepted as primary securing of the equipment listed under [2], excluding units used for storage only.

All loose securing equipment shall have a certificate issued by a recognized classification society.

9.6 Use of T-bars to secure temporary installations

T-bars located on top of the deck can be used as part of main supporting structure for temporary equipment provided that they have been fully documented and surveyed by the classification; i.e. with respect to arrangement, material certification, scantlings and welding. Normally this is not the case as the T-bar arrangement is not part of the standard class scope during newbuilding, and then the following restrictions apply.

Fastening of temporary equipment to T-bars

The use of T-bars to support equipment foundations with compression forces or horizontal forces acting in the parallel direction of the T-bars is found acceptable provided that the T-bar scantlings and welding are surveyed by class.

Use of T-bars to support fastening of equipment with significant tensile foundation forces for temporary equipment listed in [2] will normally require survey and documentation of material quality.

If material and welding have not been fully documented, samples of the T-bars can be sent for testing to a recognized laboratory and the welding can be surveyed by spot checks by the Society's attending surveyor.
The DNV GL surveyor should witness when these samples are cut from the vessel. The number of test samples and extent and type of weld inspection is to be agreed with the DNV GL attending surveyor, depending on the condition of the T-bars and welding.

For double-web T-bars (TT-bars) which form closed spaces, it is recommended that means for leakage testing and visual inspection be arranged. In case a surveyor should have concerns about the condition of such an inaccessible structure, and it is impossible to assess its condition by non-destructive means, the surveyor may require that the TT-bar be removed or opened to allow for inspection. Due attention shall be paid to the limited capacity of the T-bars unless they are directly aligned with under-deck structure.

9.7 Survey scope

Depending on the type and function of temporary installation or offshore service container, the Society will evaluate the need to survey the temporary fastening on case-by-case basis. A MO shall be issued if the temporary securing/fastening arrangements shall be included in the regular class surveys.

10 Temporary accommodation units and other manned superstructure units

10.1 Application of the Rules

All temporary accommodation units, other manned units and service containers which are subject to class approval according to [2.1] and which are used without weather restrictions shall be in compliance with applicable rule requirements as if it was a permanent deckhouse on the vessel. Relevant plans showing documentation of the unit and its fastening to the vessel hull shall be submitted for class plan approval.

In addition to the above, documentation for compliance with Flag State requirements should be submitted, see [15].

10.2 Minimum thickness and buckling control of thin-plated structures

Any deviation from rule minimum thickness of plates and stiffeners is subject to case-by-case acceptance, on the condition that the structural arrangement satisfies rule strength requirements. The minimum thickness should, however, normally not be taken less than 4 mm.

Special attention should be paid to compliance with rule requirements to buckling control of thin-plated structures subjected to compression stress in the face plate caused by local bending.

10.3 Foundation and fastening

The fastening and supporting structure of the units should be evaluated for ship accelerations and sea pressure as specified in the Rules for Classification of Ships. For additional applicable loads, please refer to [7].

The fastening shall be of secured type, i.e. welded to the vessel hull by means of brackets or similar. If twistlocks are used as part of the sea fastening solution, then the twistlocks shall be of approved type and secured in locked position.

10.4 Opening and closing appliances

Temporary superstructure units which do not have access to openings to under-deck spaces or enclosed superstructures may, on case-by-case basis, be exempted from Load Line requirements. Arrangement of superstructure units being exempted from Load Line requirements shall, however, normally comply with the following:
1) all opening and closing appliances in way of doors or hatches shall be of weathertight type and have sufficient strength to comply with the rule sea pressure for deckhouses
2) all windows glass thickness shall comply with strength requirement according to Pt.3 Ch.12 Sec.6 [4]
3) arrangement of door sill height and position of ventilation shall as far as practical be in compliance with the Load Line requirement and arranged to minimise the risk of water ingress to the unit; it is recommended to arrange the door sill at minimum 380 mm above the weather deck
4) any arrangements of windows/side scuttles on first tier superstructure units are subject to case-by-case acceptance.

10.5 Loads
Fastening to the vessel main hull and strength of the unit itself shall be evaluated for ship acceleration and sea pressure as if it was a permanent deckhouse. Reference is also made to [7] for additional applicable loads.
Special attention shall be paid to strength and support of the fastening details for any units which are exposed to direct green sea, or when units are raised above the deck.
The total sea pressure acting simultaneously on the whole superstructure unit (giving maximum reaction in the sea-fastening), may be calculated at the bottom of the unit and tapered off towards zero at the top of the unit.

11 Temporary deckhouse units being unmanned in heavy weather
Under the assumption that the temporary unit in question is not to be manned during heavy weather with possibilities for large amounts of green sea on deck, the unit itself is not subject to class approval.
Foundations for temporary units which are not manned during heavy weather are subject to class review if the local support foundation forces exceed the approved deck capacity.
The fastening and supporting structure of the units shall be evaluated in the same manner as for manned temporary superstructure units as stated in [10]. Reduction of rule loads may however be applied according to operational limitations as described in subsection [8].
The limitation of class scope and use shall be stated in a MO, e.g.: “The (unit list) is/are approved for fastening to the hull only and should not be manned in heavy weather with possibility of being exposed to green sea”.
It is assumed that the owner will take appropriate measures to ensure that the units are unmanned in heavy weather, e.g. by means of signboards, procedures or similar.
Recommendation:
Although class does not require compliance with the rules for temporary units with restricted use, we still recommend that the units’ strength be designed according to the guideline for “temporary accommodation units and other manned superstructure units” as given in [9.7], or that they be certified according to DNVGL ST E272 - Offshore Service Modules.

12 Diving support units
Diving support system (DSS) and their foundations shall be in compliance with RU SHIP Pt.5 Ch.10 Sec.6.
Special requirements to applicable loads and allowable stress levels for DSS are given in RU SHIP Pt.5 Ch.10 Sec.6.
It should be noted that a DSS installed on a vessel is required to hold a class certificate. The DSS does, however, not need be classed by the Society even though the DSS is installed on a vessel classed by the Society.
13 Class survey and mobilisation period for temporary installation

A MO stating the date when the temporary installation is intended to be demobilised will be issued for all temporary installations which are subject to class approval according to [2.1].

The class is to be contacted no later than 3 weeks prior to the termination of the mobilisation period for a class acceptance and reissuing of an updated MO if the captain intends to extend the accepted period of mobilisation with temporary equipment.

Temporary equipment being mobilised for more than 12 months is subject to case-by-case evaluation if the installation and its foundations shall be included in annual or other regular class surveys.

Class survey of certified offshore service containers:

The suitability and condition of any offshore service containers which are subject to class approval according to [2.1] should be assessed before they are installed on a ship. The offshore service container certificate shall be provided to the surveyor.

14 Temporary installations being in non-compliance with optional class notations

Temporary installations shall comply with mandatory class notations applicable for the vessel. If temporary equipment is installed, which results in non-compliance with optional class notations, e.g. Offshore service vessel(+), a MO will be issued stating the restrictions upon which the acceptance of the temporary equipment has been based.

15 Statutory and non-structural requirements to temporary installations

15.1 Fire Safety

“Fire control and safety plan” for mobilisations with temporary manned units or accommodation units shall be updated for the actual situation. The updated plans shall be endorsed by local surveyor or alternatively submitted for approval/information.

Information for issues to be addressed:

— arrangement and layout of equipment on deck with details of equipment:
— access and escape ways to be maintained, and access to vessel's fire hydrant and safety equipment.
  Additional fire appliances and or lifesaving equipment will be based on type of equipment / container provided. A fire control and safety plan for the mobilization area may be approved as an appendix to the vessel’s original fire control and safety plan, and shall in such cases be stored together with all copies of the original plan
— specification of liquids with low flash point (< 60°C) or substances contaminated by them:
— if such liquids are used, fixed or portable fire protection may be required to protect the vessel from possible fires and or project protection (cooling) of containers containing these liquids. See [17]
— specification of units containing internal combustion machinery:
— power packs that generates more than 375kW shall be arranged with fixed fire detection connected to the vessels fire detection and alarm system
— fire extinguishing in accordance with SOLAS and FSS Code shall be provided / documented. For other units with less power-output, portable fire extinguishing will be accepted. Close down of ventilation and shut down of fuel to be documented for any power packs regardless of size
— manned work spaces / control station
— these shall be equipped with fire alarm connected to the vessels fire detection and alarm system. Life jackets shall be arranged within such work-spaces for those on work / watch.

Rules and regulations to be applied:
15.2 Internal Communication Systems
Temporary deckhouse units shall be arranged with public address and general alarm systems according to the LSA code as if it was a permanent installation.

15.3 Stability
a) It is the master’s responsibility to ensure that the vessel is operated within the approved stability limits when mobilising with temporary equipment. If in doubt, the class may be contacted for an evaluation of whether a new loading condition is subject to class/administration review.
b) If loading conditions with mobilisation of temporary equipment exceed the assumptions in the approved stability conditions for the vessel (e.g. amount of deck cargo), an updated trim and stability booklet or an addendum to the trim and stability booklet shall be submitted for class or administration approval.

15.4 Load Line
For mobilisations giving alterations to exposed decks; Relevant plans showing protection of crew according to RU SHIP Pt.3 Ch.11 Sec.3 to be submitted for class and/or flag administration appraisal or endorsed by the local surveyor.

15.5 SOLAS
Mobilisations with changes to number of crew or non-marine personnel shall be reported to class and/or flag administration for evaluation of compliance with SOLAS.

15.6 Electrical Systems
a) power supply for temporary units connected to the vessels socket outlets are not subject to class acceptance
b) power supply for temporary units with low-power consumables connected to the existing electrical distribution board can be endorsed by the local surveyor
c) temporary units with high-power consumables exceeding 5% of the capacity for the existing electrical distribution board are normally subject to class appraisal including review of load balance and single line diagrams
d) acceptance of independent power supply to the temporary units in way of temporary electrical generators can be endorsed by the local surveyor
e) class requirements to electrical cables:
   — cables for temporary equipment connected by sockets are not subject to class approval
   — all cables used for temporary equipment and terminated in a distribution board shall be either be type approved by the Society or subject to case by case approval
   — cables on skids or installed in container units are not subject to class approval.
f) if the ship has hazardous area or if the modification creates hazardous area, and installation will be modified or new consumers added in this area, updated documentation for Installation in hazardous areas requested in RU SHIP Pt.4 Ch.8 Sec.1 Table 1 shall be submitted for approval. See also [17].
16 Mobilization with chemicals acc. IMO resolution A.673(16)

16.1 General
Temporary mobilisations involving chemicals which require modifications of the ship’s P&A manual and short term certificate of fitness (CoF) are to be approved in accordance with IMO Resolution A.673(16).
This sub-section is based on the assumption that portable tanks, pumps and piping system on main deck are utilized. If the vessel’s integral tanks or piping system shall be connected, special considerations must be made (segregation etc.).
It is further assumed that the vessel shall not be engage in other operations as long as the equipment is on board.
It is important to note that other requirements in A.673(16), other than those listed here, may also be relevant.

16.2 Scope
These guidelines have been developed for the design, construction and operation of offshore support vessels which transport limited amounts of hazardous and noxious liquid substances in bulk for the servicing and re-supplying of offshore platforms, mobile offshore drilling units and other offshore installations, including those employed in the search for and recovery of hydrocarbons from the sea-bed.
The provisions of these guidelines have been developed so that limited quantities of cargoes regulated under these guidelines may be carried in bulk with minimum risk to the offshore support vessel, its crew, and to the environment.
Products which may be carried on the vessel are:
— hazardous and noxious liquids listed in Table 3 and other products which may be assigned to Table 3 based on the following criteria:
  — products which for safety reasons may be assigned for carriage on a type 3 ship as defined by the International Bulk Chemical Code and which are not required to meet the requirements for toxic products in section 15.12 of that Code
  — Noxious liquid substances which would be permitted for carriage on a type 3 ship
— flammable liquids

Table 3 Table of permitted products

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Flammability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oil-based mud containing mixtures of products listed in chapters 17 and 18 of the IBC Code and the MEPC.2/Circular and permitted to be carried under paragraph 1.2 of A.673(16)</td>
<td>No</td>
</tr>
<tr>
<td>Water-based mud containing mixtures of products listed in chapters 17 and 18 of the IBC Code and the MEPC.2/Circular and permitted to be carried under paragraph 1.2 of A.673(16)</td>
<td>No</td>
</tr>
<tr>
<td>Drilling Brines, including:</td>
<td></td>
</tr>
<tr>
<td>Sodium Chloride Solution</td>
<td>No</td>
</tr>
<tr>
<td>Calcium Bromide Solution</td>
<td>No</td>
</tr>
<tr>
<td>Calcium Chloride Solution</td>
<td>No</td>
</tr>
<tr>
<td>Calcium nitrate/Magnesium nitrate/Potassium chloride solution</td>
<td>No</td>
</tr>
<tr>
<td>Calcium Nitrate Solution (50% or less)</td>
<td>No</td>
</tr>
<tr>
<td>Drilling brines (containing zinc salts)</td>
<td>No</td>
</tr>
</tbody>
</table>
### Conversion of ships

<table>
<thead>
<tr>
<th>Substance</th>
<th>Flammability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potassium Formate Solution</td>
<td>No</td>
</tr>
<tr>
<td>Potassium Chloride Solution</td>
<td>No</td>
</tr>
<tr>
<td>Ethyl Alcohol</td>
<td>Yes</td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>No</td>
</tr>
<tr>
<td>Ethylene Glycol monoalkyl ether</td>
<td>Yes</td>
</tr>
<tr>
<td>Methyl Alcohol</td>
<td>Yes</td>
</tr>
<tr>
<td>Acetic acid</td>
<td>Yes</td>
</tr>
<tr>
<td>Formic acid</td>
<td>Yes</td>
</tr>
<tr>
<td>Hydrochloric Acid</td>
<td>No</td>
</tr>
<tr>
<td>Hydrochloric-hydrofluoric mixtures containing 3% or less Hydrofluoric acid</td>
<td>No</td>
</tr>
<tr>
<td>Sodium Silicate Solution</td>
<td>No</td>
</tr>
<tr>
<td>Sulphuric Acid</td>
<td>No</td>
</tr>
<tr>
<td>Triethylene Glycol</td>
<td>Yes</td>
</tr>
<tr>
<td>Toluene</td>
<td>Yes</td>
</tr>
<tr>
<td>Xylene</td>
<td>Yes</td>
</tr>
<tr>
<td>Liquid carbon dioxide</td>
<td>No</td>
</tr>
<tr>
<td>Liquid nitrogen</td>
<td>No</td>
</tr>
<tr>
<td>Noxious liquid, NF, (7) n.o.s.</td>
<td>No</td>
</tr>
<tr>
<td>(trade name ..., contains ...) ST3, Cat. Y</td>
<td></td>
</tr>
<tr>
<td>Noxious liquid, F, (8) n.o.s.</td>
<td>Yes</td>
</tr>
<tr>
<td>(trade name .., contains ...) ST3, Cat. Y</td>
<td></td>
</tr>
<tr>
<td>Noxious liquid, NF, (9) n.o.s.</td>
<td>No</td>
</tr>
<tr>
<td>(trade name ,, contains .) ST3, Cat. Z</td>
<td></td>
</tr>
<tr>
<td>Noxious liquid, F, (10) n.o.s.</td>
<td>Yes</td>
</tr>
<tr>
<td>(trade name ,, contains .) ST3, Cat. Z</td>
<td></td>
</tr>
<tr>
<td>Noxious liquid, (11) n.o.s.</td>
<td>No</td>
</tr>
<tr>
<td>(trade name ,, contains .) Cat. Z</td>
<td></td>
</tr>
<tr>
<td>Non-noxious liquid, (12) n.o.s.</td>
<td>No</td>
</tr>
<tr>
<td>(trade name ,, contains .) Cat. OS</td>
<td></td>
</tr>
</tbody>
</table>

Additives which are considered to fall outside the scope of products in Table 3 may be carried in limited amounts in accordance with requirements acceptable to the flag administration. The aggregate amount of such additives which may be transported shall not exceed 10% of the vessel’s maximum authorized quantity of products subject to these guidelines. An individual tank shall contain no more than 10 m³ of these additives. The discharge of these additives into the sea from offshore service vessels is prohibited.

### 16.3 Cargo tank construction

Cargo tanks shall be at least of the type required for the cargo by the International Bulk Chemical Code or the International Gas Carrier Code, as applicable.
Instead of the use of permanently attached deck-tanks, portable tanks meeting the requirements of the International Maritime Dangerous Goods Code or other portable tanks specifically approved by the Administration may be used provided that the tanks are properly located and secured to the vessel. Independent gravity tanks shall be constructed and tested according to standards of the Administration taking into account the carriage temperature and relative density of cargo.

16.4 Materials of construction

Materials of construction for tanks, piping, fittings and pumps shall be in accordance with chapter 6 of the International Bulk Chemical Code, or chapter 6 of the International Gas Carrier Code, as applicable. Steel is assumed to be the normal material of construction.

16.5 Cargo transfer

The cargo transfer system shall comply with the requirements of chapter 5 of the International Bulk Chemical Code or chapter 5 of the International Gas Carrier Code.

Pipes are normally to be fully welded with a minimum of flanges.

Hoses used for chemical transfer are to be type approved for their intended use.

Shutdown devices for all cargo pumps and similar equipment are to be installed, and shall be capable of being activated from a dedicated control location which is permanently manned at the time of transfer.

16.6 Acid spill protection

Flanges or other detachable pipe connections shall be covered by spray shields.

Portable shield covers for connecting the flanges of the loading manifold shall be provided. Drip trays of corrosion-resistant material shall be provided under loading manifolds for acids.

Deck spills shall be kept away from accommodation and service areas by means of deck coamings of suitable height and extension.

16.7 Special requirements for the carriage of liquefied gases

Each size and type of valve intended to be used at a working temperature below -55°C is to be approved through design assessment and prototype testing. Prototype testing for all valves to the minimum design temperature or lower and to a pressure not lower than the maximum design pressure foreseen for the valves is to be witnessed in the presence of the Society’s representative. Prototype testing is to include hydrostatic test of the valve body at a pressure equal to 1.5 times the design pressure, and cryogenic testing consisting of valve operation or safety valve set pressure, and leakage verification. In addition, for valves other than safety valves, a seat and stem leakage test at a pressure equal to 1.1 times the design pressure.

This testing and documenting is normally to be performed by the valve manufacturer.

For valves intended to be used at a working temperature above -55°C, prototype testing is not required.

Expansion bellows intended to be used at a working temperature below -55°C are to be delivered with test reports or certificates proving compliance with International Gas Carrier Code. This is normally to be delivered by the bellow manufacturer.

Each enclosed space used for handling or storage of a liquefied gas shall be fitted with a sensor continuously monitoring the oxygen content of the space and an alarm indicating low oxygen concentration. For semi-enclosed spaces portable equipment may also be acceptable.

Drip trays resistant to cryogenic temperatures shall be provided at all leakage points such as; manifolds transferring liquefied gases or at other flanged connections in the liquefied gas system. The tank shell itself is not considered a leakage point.
Emergency shutoff valves shall be provided in liquid outlet lines from each liquefied gas tank. The controls for the emergency shutoff valves shall be remotely operated. The control may be manual if a dedicated operator is located on a pedestal or similar at the valve with a prolonged spindle during transfer operation.

16.8 Vapour detection

Vapour detection for the cargoes carried shall be provided in accordance with the requirements contained in the International Bulk Chemical Code.

Enclosed and semi-enclosed spaces containing installations for acid shall be fitted with fixed vapour detection and alarm systems which provide visual and audible indication. The vapour detection systems shall be capable of detecting hydrogen except that, in the case where only hydrochloric acid is carried, a hydrogen chloride vapour detection system shall be provided.

At least two portable instruments for detecting flammable vapour concentrations should be provided when cargoes subject to these Guidelines with a flashpoint not exceeding 60°C (closed cup test) are carried.

At least two portable instruments suitable for measuring the concentration of oxygen in atmospheric air should be provided.

16.9 Gauging and level detection

Each cargo tank shall have a level gauging system acceptable to the flag administration.

16.10 Emergency remote shutdown

In the case of transfer operations involving pressures in excess of 5 MPa, arrangements for emergency depressurizing and disconnection of the transfer hose shall be provided. The controls for activating emergency depressurization and disconnection of the transfer hose shall be available at a location permanently manned during transfer operation.

17 DNV GL Class rules

If the vessel shall be arranged and equipped for stimulation of wells for production of oil and/or gas, RU SHIP Pt.5 Ch.10 Sec.8 applies in addition to A.673(16).

Most of the requirements in these rules are also incorporated in A.673(16), but some additional will be applicable.

17.1 Operation manual

Operation manual for well stimulation procedures shall be submitted for approval. The manual shall give instructions and information on safety aspects related to well stimulation processing. The operation manual shall give particulars on:

— protective equipment
— storage and handling of fluids and dry additives
— transfer operations
— emergency shut-down and disconnection.

17.2 Documentation

Documentation for the control and monitoring system for the following shall be approved:

— cargo tank level measurement system
— cargo tank overflow protection system (if tank is filled on board)
— emergency shut-down system
— hydrogen indication equipment
— hydrogen chloride indication equipment
— oxygen indication equipment.

For requirements to documentation types, see RU SHIP Pt.4 Ch.9.
The following control and monitoring system shall have been certified according to RU SHIP Pt.4 Ch.9:
— cargo tank level measurement system
— cargo tank overflow protection system (if applicable)
— emergency shut-down system.

17.3 Cargo piping system
Piping system for cargoes with flashpoint above 60°C shall comply with RU SHIP Pt.4 Ch.6.
Piping system for cargoes with flashpoint below 60°C shall comply with RU SHIP Pt.5 Ch.6.

17.4 Special considerations
Requirements for tanks and pumping arrangements for chemicals other than acids or nitrogen, will be considered in each case with due regard to the properties of the chemicals and applicable requirements of RU SHIP Pt.5 Ch.6.

17.5 Emergency shutdown.
Emergency stop of all pumps in the oil well stimulation system shall be arranged from one or more positions located outside the area accommodating the system.

17.6 Personnel protection
a) Decontamination showers and eye washes shall be fitted in convenient locations.
b) Protective equipment shall be kept on board in suitable locations as required by the IMO "International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk" (IBC Code) Res. MSC.4(48) as amended, for carriage of hydrochloric acid

17.7 Mobilizations involving carriage of Methanol and other chemicals with flashpoint below 60°C

17.7.1 Methanol as cargo will, in addition to A.673(16) and RU SHIP Pt.5 Ch.10 Sec.8 (if applicable, depending on operation), render requirements in RU SHIP Pt.6 Ch.5 Sec.9 applicable.

17.7.2 The most relevant additional requirements are as described in this section, please note that other requirements in RU SHIP Pt.6 Ch.5 Sec.9 still may be applicable.

17.7.3 It is assumed that no dry cargo is handled simultaneously.
17.8 Definitions
A hazardous area is an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

17.9 Vessel arrangement
No accommodation, service spaces, control stations or machinery spaces shall be located within the hazardous area.

Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations are, in general, not to face the hazardous area. They may however be accepted provided they are situated at least 10 m from the nearest area.

The following provisions apply for such boundaries:

a) doors shall be kept closed during loading/discharge operations
b) port lights or windows shall be of a non-opening type. Inside covers of steel or equivalent material shall be fitted in the first tier on main deck
c) ventilation inlets shall be fitted as far as practicable from the nearest hazardous area (in no case less than 10 m)

Documented operational procedures may be used in order to accommodate b) and c)

Exhaust outlets from combustion equipment shall have spark arrestors according to recognized standard.

Surface temperatures of equipment and piping in hazardous area shall not exceed 220°C.

Deck spills shall be kept away from accommodation and service areas through suitable precautionary means, such as a permanent coaming of suitable height extending from side to side or around loading and discharge points. Portable coaming arrangements will also be accepted.

Means shall be provided for stopping the pumps from the bridge or a similar position facing the hazardous area.

The connecting coupling for the transfer hose shall be of a type which automatically closes at disconnection (self-sealing type).

Means of quick-release of the transfer hose shall be provided, e.g. by installation of a weak link assembly or by installation of a remotely controlled coupling.

The remote operation shall be capable of being effectuated from the bridge or a designated permanently manned control station.

17.10 Electrical Installations in Hazardous Areas
Electrical installations in hazardous areas shall comply with the requirements given in RU SHIP Pt.5 Ch.6 Sec.12. and RU SHIP Pt.4 Ch.8 Sec.11

In hazardous areas only electrical equipment suitable for the relevant zone shall be installed. Electrical equipment not suitable for the relevant zone with arrangements for disconnection during operation will in some cases be accepted as long as it does not affect the safety of the ship.

17.11 Hazardous area classification

17.11.1 Definitions

Hazardous areas zone 0

The interiors of cargo tanks, slop tanks, any pipework of pressure-relief or other venting systems for cargo and slop tanks, pipes and equipment containing the cargo or developing flammable gases or vapours.

Hazardous areas zone 1
1) hold spaces containing independent cargo tanks
2) areas on open deck, or semi-enclosed spaces on deck, within 3 m of any cargo tank outlet, gas or vapour outlet, cargo manifold valve, cargo valve, cargo pipe flange, and cargo tank openings for pressure release provided to permit the flow of small volumes of gas or vapour mixtures caused by thermal variation
3) areas on open deck, or semi-enclosed spaces on open deck above and in the vicinity of any cargo gas outlet intended for the passage of large volumes of gas or vapour mixture during cargo loading, within a vertical cylinder of unlimited height and 6 m radius cantered upon the centre of the outlet, and within a hemisphere of 6 m radius below the outlet (this paragraph will only be applicable when tanks are filled on board the vessel)
4) areas on the open deck within spillage coamings surrounding tank valves and 3 m beyond these, up to a height of 2.4 m above the deck
5) enclosed or semi-enclosed spaces in which pipes containing cargoes are located.

**Hazardous areas zone 2**

1) Areas within 1.5 m surrounding open or semi-enclosed spaces of zone 1 as specified above
2) Spaces 4 m beyond the cylinder and 4 m beyond the sphere defined in item 3) for hazardous areas zone 1.

Spaces with access or opening located in hazardous area shall have the same zone classification as the hazardous area.

### 17.12 Fire Protection and Extinction

#### 17.12.1 Fire protection

Vessel should in general comply with the current requirements of the International Convention for the Safety of Life at Sea (SOLAS) for tankers. In connection with mobilization, fire protection of cargo tanks on deck, cargo piping, cargo tank ventilation and equipment (pumps, blenders and Launch And Recovery Systems (LARS/Umbilical) used for liquids with flash point not exceeding 60°C shall be considered based on the hazardous area to be defined. Bunding / coaming to prevent possible spread of liquids from the installation shall be taken into account.

Hazardous area shall be arranged with minimum distance of 10 m of superstructure, otherwise additional measures to protect superstructure shall be taken. Other class notations such as **OILREC** and **LFL*** may be required suspended during mobilization.

#### 17.12.2 Fire extinction

1) The vessel shall have a fixed foam fire extinguishing system for protection of the cargo tank area with equipment equivalent to the area defined as hazardous zone. This area shall be protected by a deck foam system designed in accordance with the principles laid down in Res. A673(16) 3.9, The system shall be arranged with start / operation of the system in a readily available position(s) outside the protected area.

2) Application rate shall be not less than 10 l/min/m² of the horizontal projection of the hazardous area as defined. For cargo tanks / system limited to the use for contaminated return MEG with minor content of hydrocarbons, the application rate may be reduced to 5 l/min/m² upon special consideration.

The required application rate shall be for not less than 30 min (20 min may be considered for return MEG).

Water supply to the fixed foam fire extinguishing system shall be in addition to the water supply required for the vessels fire main.

The foam concentrates shall be compatible with the cargo carried.

3) In addition, the vessel should carry in a readily available position at cargo deck level, two portable foam applicator units with at least 4 portable 20 litre containers with foam concentrate, for use with water supplied by the vessels fire main.

4) Two fire fighter's outfits shall be provided in addition to those required by SOLAS Reg. II-2/10.10.
SECTION 4 MOBILISATION FOR SINGLE VOYAGE

1 General

Mobilisation for single voyage is normally associated with a specific transportation of cargo or equipment from one specific area of departure to a specific arrival destination. The voyage may, however, be taken in several steps including possible transportation by heavy-lifter or similar. Class is in this respect only covering phases of the voyage when the vessel is operated in normal sea-going condition with the cargo/equipment securely fastened to the hull.

Class appraisal of single voyage is normally limited to hull strength requirements. Other requirements will be handled case by case depending on the flag administration.

Design loads such as hull girder wave moment, hull girder wave shear, ship accelerations and sea pressure can be reduced according to limitation in operational sea state condition with maximum significant wave height, \( H_s^4 \). The reduced wave-induced hull girder design loads can be established through direct sea-keeping analysis of the vessel performance in limited sea condition. The design load values shall, however, not be taken less than the minimum rule value equivalent to a 50% reduction in \( C_w \) factor (equivalent to RE notation).

Restriction to operational conditions will be issued as a MO.

For single voyages carried out within 12 months after the mobilisation, the local scantlings may be calculated based on measured scantlings or actual corrosion margins, \( t_k \). The hull scantling condition shall be confirmed by a surveyor if the scantlings evaluations shall be based on reduced corrosion margins.

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\(^4\) It is recommended to evaluate the design wave height \( (H_s) \) according to DNV GL Offshore Standard for Marine Operations DNVGL OS H101 depending on the operational period, the distance to safe harbour and/or possibility to shut down the operation.
SECTION 5 STABILITY

1 Involvement by the Society

Stability requirements as defined in the rules RU SHIP Pt.3 Ch.15 and in class notations will be covered by the Society accordingly. Damage stability will be covered by the Society when authorized by the flag administration or if required by class notations, e.g. SF.

When stability is a class matter, but the Society is not authorised to approve stability on behalf of the flag administration, the Society will base the class approval on the approval by the flag administration, if possible. The final stability documentation carrying the approval stamp of the flag administration shall then be submitted for class approval and for class records together with the flag administration’s approval letter. Preliminary documentation need not be submitted, nor will it be necessary to submit an inclining test/lightweight survey procedure or report or to attend at the test.

Note that some class notations such as Tug, Offshore service vessel, SF, Crane vessel and Crane contain intact or damage stability requirements that may not have been covered by the flag state approval. See RU SHIP Ships Pt.3 Ch.15 Sec.1 Table 3 for a full list. In these cases it will be necessary for the Society to be involved from the preliminary stage.

2 Increased draught

2.1 General

Increased draught is normally not regarded as a conversion, see Sec.2 [1.2]. Thus, the converted ship must continue complying with the same intact and damage stability requirements, previously applied to the ship at new summer load line draught (and timber draught, if relevant). For a dry cargo ship over 80 m in length where no damage stability requirements have previously been in force, it may be necessary to submit damage stability index calculations demonstrating that the level of subdivision is not less than before the conversion. This shall be decided by the flag administration.

2.2 Documentation requirements

The following documentation will be required for all ships:

— stability booklet or loading manual including loading conditions, hydrostatic data, cross curves and limiting stability data covering the new maximum draught.

Where damage stability requirements are applicable:

— damage stability calculations covering the loading conditions in the stability booklet or loading manual or damage KG/GM limiting curves for the full draught range.

For passenger ships:

— floodable length calculations.

For dry cargo ships over 80 m in length where no damage stability requirements have previously been in force, when required by the flag administration:

— calculation of A/R ratio for the ship before and after the conversion as required by MSC.1/Circ.1246.

For ships carrying grain cargo:

— grain stability booklet including loading conditions and maximum allowable heeling moments covering the new maximum draught.

For ships with a loading instrument approved with respect to stability:

— test loading condition at new maximum draught
— stored characteristic data for the increased draught range.
When strengthening and/or other conversion work changes the light ship particulars (see also [5.5]):
- inclining test procedure
- inclining test report.
In the latter case, preliminary versions of the stability booklet or loading manual and damage stability calculations will also be required.

2.3 Survey points
To meet damage stability requirements for the increased draught, it may be necessary to increase air pipe heights, install weathertight or watertight doors, etc. In these cases it is very important that the position of openings with type of closing appliances assumed in the damage stability calculations, are verified by the surveyor.

3 Major conversions
“Major conversions” as used below refers to IMO definitions.

3.1 General
This covers change in main dimensions (see also Sec.1 [4]). The ship shall comply with the rules and statutory requirements currently in force for new ships. The exception is existing dry cargo ships over 80 m in length where no damage stability requirements have previously been in force, where it may be sufficient to prove that the level of subdivision is not less than before the conversion. This shall be accepted by the flag administration.
Change of ship type is regarded as a major conversion according to SOLAS. The ship shall comply with the rules and statutory requirements currently in force for new ships (no exceptions). As an example, a cargo ship converted to a passenger ship shall comply with the regulations in force for new passenger ships regardless of the date of construction.

3.2 Documentation requirements
The following will be required for all ships:
- preliminary and final stability booklet or loading manual
- inclining test procedure
- inclining test report.
Where damage stability requirements are applicable:
- preliminary and final damage stability calculations
- internal watertight integrity plan.
For passenger ships:
- floodable length calculations.
For dry cargo ships built from 1992-02-01 and onward and for passenger ships:
- damage control plan
- damage control manual.
For change in main dimensions of a dry cargo ship over 80 m in length where no damage stability requirements have previously been in force:
- calculation of A/R ratio for the ship before and after the conversion as required by MSC.1/Circ.1246.
For ships carrying grain cargo:
— preliminary and final grain stability booklet
— grain loading plan.
For ships with a loading instrument approved with respect to stability:
— test loading conditions
— stored characteristic data.

3.3 Survey points
1) Verification onboard of internal watertight integrity plan or damage control plan will be required.
2) Existing cross-flooding valves, spindle extensions and cross-flooding pipes in older ships are susceptible to corrosion and should be examined and tested in connection with the verification of the damage control plan.

4 Internal modifications

4.1 General
The converted ship must continue to comply with the same intact and damage stability requirements, at least to the same extent as before the modification. Modifications to tanks and cargo spaces may make it necessary to revise loading conditions and tank or hold data. Similarly, the damage stability may be influenced by internal modifications and therefore need revision.
Note that for a dry cargo ship over 80 m in length where no damage stability requirements have previously been in force, it may be necessary to submit damage stability index calculations demonstrating that the level of subdivision is not less than before the conversion.

4.2 Documentation requirements
The following will be required for all ships:
— stability booklet or loading manual including updated loading conditions and tank or cargo space data.
Where damage stability requirements are applicable:
— damage stability calculations covering the loading conditions in the stability booklet or loading manual or damage KG/GM limiting curves.
For passenger ships:
— revised floodable length calculations.
For dry cargo ships over 80 m in length where no damage stability requirements have previously been in force:
— calculation of A/R ratio for the ship before and after the conversion as required by MSC.1/Circ.1246.
For ships carrying grain cargo:
— grain stability booklet including updated loading conditions and cargo hold volumetric heeling moments
— revised grain loading plan.
For ships with a loading instrument approved with respect to stability:
— new test loading conditions
— revised stored characteristic data.
When the conversion changes the lightship particulars (see also [5]):
— inclining test procedure
— inclining test report.
In the latter case, preliminary versions of the stability booklet or loading manual and damage stability calculations will also be required.

4.3 Survey points

1) Even a minor modification of a bulkhead between two dry compartments could have an effect on the damage stability. In such cases the Society should be contacted to determine if new stability documentation would be required.
2) Modifications to existing cross-flooding arrangements will usually have significant effect on the damage stability. Any modification or discrepancies found in comparison with the damage control plan must be reported to the Society.

5 Change in lightship particulars, additional comments

5.1 General

The effect of the conversion on the lightship particulars must always be considered. This is not only the case for extensive conversion work such as a lengthening, but also minor changes such as strengthening of deck structure or installation or replacement of equipment (cranes, winches, etc.).

5.2 Inclining test

As a general guideline, the new lightship particulars shall be found by an inclining test if the estimated change in lightship mass is more than 2%.

5.3 Lightship particulars found by calculation

Subject to acceptance by the Society, lightship particulars may be found by calculations, provided that the estimated mass change is less than 2% and that the surveyor is able to verify the mass and position of the changes. Following survey onboard the calculations listing the mass changes shall be endorsed by the surveyor and submitted for approval. (See also [7.2].) Note that the 2% guideline is not the net change; the total of added and removed masses as well as their positions shall be considered.

In the case where the lightship particulars have originally been based on the inclining test results of a sister ship, the modification may invalidate previous dispensation from an inclining test.

5.4 Documentation requirements

This will vary depending on the conversion and must be clarified with the Society.

6 Conversions that may have an effect on stability

6.1 Change of tank contents

When the types of liquid in tanks are changed, it will normally be necessary to revise the loading conditions as well as the tank plan or tables and submit an updated stability booklet or loading manual. Typical examples are an increase in fuel capacity by converting fresh water or ballast tanks, conversion of combined fuel or ballast tanks to exclusive fuel tanks, and conversion of tanks in supply vessels to high density cargo tanks.

Where the damage stability calculations are direct calculations based on actual loading conditions, or otherwise assume a specified tank content in intact condition, revised damage stability calculations may also be necessary.
6.2 Increase of load on deck
Additional loading conditions covering the new maximum deck load shall be calculated and submitted as part of a revised stability booklet or loading manual.

6.3 Increase in windage areas
New loading conditions including weather criteria calculations may have to be submitted as part of a revised stability booklet or loading manual. A typical example is increase of stack height on container ships.

6.4 Tugs and supply vessels, increase of bollard pull
For vessels with the class notations Tug or Offshore service vessel (in the latter case: only if engaged in towing), where the bollard pull is increased, calculations according to RU SHIP Pt.5 Ch.10 Sec.11 [5] shall be submitted for approval.

6.5 Fire fighters, increase in monitor heeling moment
For vessels with the class notation Fire fighter where the monitor heeling moment is increased, calculations according to RU SHIP Pt.5 Ch.10 Sec.9 [9] shall be submitted for approval.

6.6 Crane vessels, modification of crane arrangement
For vessels with the class notation Crane vessel or Crane, where the maximum hook load is increased or other changes are made to the crane arrangement that could adversely affect the stability, calculations according to RU SHIP Pt.5 Ch.10 Sec.2 [4] shall be submitted for approval.

6.7 Upgrade of ice class
Upgrade from class notation Ice to PC or Icebreaker will require damage stability calculations in accordance with the relevant part of Rules RU SHIP Pt.6 Ch.6.

6.8 Increase of number of passengers
For passenger vessels where the number of passengers is increased, it may be necessary to require new floodable length calculations, new damage stability calculations and a revised stability booklet or loading manual.

7 Stability documentation and other formal matters

7.1 Preliminary stability documentation
Preliminary documentation must be submitted for approval at least 6 weeks prior to the completion of the conversion.

7.2 Dispensation from an inclining test
In order to allow time for preparations in case a dispensation from an inclining test cannot be granted, the application for a dispensation together with lightship particulars found by calculations (see [5.3]), must be submitted together with the preliminary stability documentation.
7.3 Inclining test procedure
This shall be received for approval at least 1 week prior to the test. This is only required when the use of the “Yard's checklist for planning and execution of lightweight survey and inclining test” is not appropriate. See DNVGL CG 0157.

7.4 Inclining test report
The inclining test report shall be endorsed by the surveyor and submitted for approval.

7.5 Departure of converted and inclined ship
In general, preliminary documentation shall be on board in approved order and the inclining test shall be approved before the ship departs.
SECTION 6 LOAD LINE

1 Increased draught – freeboard deck not redefined

1.1 Important aspects with respect to load line conditions of assignment
   a) Sanitary discharges
      the requirements for number of, type and position of closing of valves are determined by the height of
      the lowest inboard opening for each system above the new summer water line. See RU SHIP Pt.3 Ch.12
      Sec.9.
   b) Side scuttles in the ship’s sides and windows
      for side scuttles in the ship’s sides, the distance from lowest sill of the lowest scuttle to the new summer
      water line is not to less than the largest of either 0.025 $B$ or 500 mm.
      Increased glass thickness for side scuttles and windows may be required. See RU SHIP Pt.3 Ch.12 Sec.6.
   c) Minimum bow height. See RU SHIP Pt.3 Ch.2 Sec.2 [3].
   d) Exemption from the load line convention
      possible previous exemption with respect to load line may have been granted for a specific draught.

1.2 Required load line documentation
   Form no. 44.401a, “Initial Load Line Survey” and Freeboard plan shall be updated for possible changes made.

2 Increased draught – freeboard deck redefined

2.1 Important aspects with respect to load line conditions of assignment
   1) requirements listed under [1.1].
   2) stricter position 1 requirements, according to ICLL 66, may be required for closing appliances with
      respect to sills, coamings, scantlings of hatch covers, freeing arrangement etc.

2.2 Required load line documentation
   1) updated form no. 44.401a, ”Initial Load Line Survey”
   2) updated freeboard plan
   3) new form no. 44.402a, “Report on Measurements for Load Line”.


3 Alteration of main dimensions

Existing ships with one or more conversions affecting one or more of the main dimensions shall be in accordance with prevailing load line convention regulations.

3.1 Important aspects with respect to load line conditions of assignment and freeboard assignment

1) new freeboard calculation to be carried out based on new form no. 44.402a, “Report on Measurements for Load Line”. Note:
   — lesser draught may be expected for lengthening of vessels that was previously assigned maximum geometrical draught
   — minimum bow height requirement increases with increase of $L$
   — length of forecastle, from FE, is required to minimum cover 7% of the new $L$ after lengthening in order to be included in the available bow height.
2) requirements listed under [1.1].

3.2 Required load line documentation

1) updated form no. 44.401a, ”Initial Load Line Survey”
2) updated freeboard plan
3) new form no. 44.402a, ”Report on Measurements for Load Line”.

4 Alteration of - or new superstructure

4.1 Important aspects with respect to load line conditions of assignment and freeboard assignment

1) New freeboard calculation shall be carried out. Note:
   — lesser draught may be expected for reduction of superstructure.
   — for modification of forecastle the mean covered length, from FE, is required to be minimum 7% of the new $L$ in order to be included in the available bow height.

4.2 Required load line documentation

1) updated form no. 44.401a, ”Initial Load Line Survey”
2) updated freeboard plan
3) updated or new form no. 44.402a, ”Report on Measurements for Load Line”.
SECTION 7 LIFE-SAVING APPLIANCES AND COLREG AND ILO CREW ACCOMMODATION

1 Life-saving appliances
If the life-saving appliances or arrangements are changed due to the conversion, alteration or modification, then drawings showing the new arrangement shall be submitted to the Society for approval. The following should be noted in this respect:

When life-saving appliances or arrangements of the ship is replaced or the ship undergo repairs, alterations or modifications of a major character which involve replacement of, or any addition to, their existing life-saving appliances or arrangements, such life-saving appliances or arrangements, in so far as is reasonable and practicable, shall comply with the requirements which are applicable under chapter III of the SOLAS convention in force.

However, if a survival craft other than an inflatable liferaft is replaced without replacing its launching appliance, or vice versa, the survival craft or launching appliances may be of the same type as that replaced.

2 COLREG
If the conversion, alteration or modification involves that the navigation light arrangements and/or sound signal appliances are changed, then drawings showing the new arrangement shall be submitted to the Society for approval.

3 ILO Crew accommodation and MLC
If the superstructure (crew accommodation) is replaced, modified or additional accommodation units are added, then drawings showing the new arrangement shall be submitted to the Society for approval.
SECTION 8 ELECTRICAL INSTALLATION

1 Documentation

1.1 General
All changes in the electrical system shall be specified and modifications shall be indicated in the documentation. This applies to changes to the already existing system, new electrical installations and changes or additions of a class notation.

1.2 Documentation requirements
For changes in the electrical installation the following documentation should be submitted to the Society:
— description of the extent of the conversion/alteration
— updated single line diagram.

For changes in generator capacity or installed power (e.g. changes in motor load or installed generator power):
— power consumption balance covering the following operational modes: normal at sea, manoeuvring, special operations and emergency
— discrimination analysis
— short circuit calculations (if the short circuit current changes).

For changes in the switchboard or installation of new switchboard:
— drawings of the switchboard
— discrimination analysis (only if the change of breakers affects the selectivity in the system).

For generators powered by the main propulsion system, e.g. power take off (PTO):
— section of shaft generators with bearing arrangement and details of lubrication.

2 New class notations
New rules will apply to the vessel if the following changes are done:

1) If the size of the vessel is changed from below 500 gross tonnage to above 500 gross tonnage there will be a requirement to installation of emergency power according to RU SHIP Pt.4 Ch.8.

2) Conversion of a Passenger craft from a Category A to a Category B vessel according to the HSC2000 Code: Stricter requirements will apply according to RU HSLC Pt.5 Ch.1 Sec.1 [1.2.3].

3 Certification
New electrical equipment shall be certified according to RU SHIP Pt.4 Ch.8.

4 Testing
New electrical equipment shall be tested according to RU SHIP Pt.4 Ch.8.
SECTION 9 FIRE SAFETY

1 General
DNV GL rules RU SHIP Pt.4 Ch.11 will apply to all ships assigned main class. Note that new fire and safety plans shall be submitted for conversions/alterations in the form of change of ship type. For vessels changing class notation or obtaining additional class notations after the conversion/alterations, special requirements will be applicable as referred to the applicable parts of the rules.

2 Documentation requirements
Required drawings are given in App.A. See RU SHIP Pt.4 Ch.11 Sec.1
The drawings submitted should show all fire safety details as for newbuildings. Equipment used should be type approved when required by the rules. Special attention should be paid to equipment placed on board an EU and EFTA vessel, where equipment mentioned in the Marine Equipment Directive is required to be CE marked (wheel marking).
MSC/Circ.847 “Interpretations of vague expressions and other vague wording in SOLAS Chapter II-2” will apply.

3 Special arrangement
For vessels fitted with a helicopter deck the following should be noted:
When additional class notations HELDK with supplementary qualifiers is given, RU SHIP Pt.6 Ch.5 Sec.5 will apply.
For vessels with the class notation Cable laying vessel spaces containing cables are regarded as cargo spaces, and should be fitted with a fixed fire extinguishing system approved by the Society.
SECTION 10 MACHINERY

1 Documentation

1.1 General
All changes in the machinery systems, or components, which are covered by the scope of class are subject to approval and survey. Installation of new equipment, which becomes under ditto scope, e.g. a side thruster, is subject to approval with respect to equipment design and installation on board and shall be delivered with a certificate.

All changes in the machinery systems shall be specified. This applies to changes to the already existing system, new installations and change or addition of class notations.

1.2 Documentation requirements
For changes in the machinery systems and/or components the following documentation shall be submitted:

For changes in the propulsion system:
— updated or new arrangement drawing(s)
— drawings and particulars of all changes in shafting system inclusive propeller and gear, main engine and all relevant piping, control and monitoring systems. Material data and power rating shall be specified
— torsional vibration calculations if the mass-elastic system is effected by changes (e.g. new propeller, new type elastic coupling, new engine type, etc.) and $P > 300$ kW
— calculation of natural frequencies of resiliently mounted engines
— shaft alignment calculations, axial vibration calculations upon request.

For changes in installed power, or class notations (e.g. new or higher ice class):
— new power rating and/or class notation.

For change and/or installation of generator set:
— updated or new arrangement drawing
— torsional vibration calculations if $P > 300$ kW
— calculation of natural frequencies of resiliently mounted engines
— relevant piping, control and monitoring system diagrams.

For change and/or installation of thruster:
— arrangement drawings in thruster room and thruster itself
— drawings of connections to the ship's hull
— torsional vibration calculations if $P > 300$ kW
— engine mounting (fixing to foundation) arrangement (note that resilient mounting of diesel engine requires that vibration calculations shall be submitted)
— piping systems: lubrication oil, hydraulic oil, cooling, fuel, starting air and exhaust (insulation)
— control and monitoring systems.

2 Certification
Machinery systems and components shall be certified according to the requirements in the relevant rule chapters for the systems and components.
3 Testing

Function and load testing of machinery including verification of any running or load restrictions and setting safety valves, etc. shall be carried out. Proper function and performance of the propulsion system after any modification shall be verified at sea trial. Quay test may be accepted for minor changes, provided that function testing can be properly carried out. If the alteration may effect the ship's manoeuvrability, a new sea trial for testing and documenting stopping time and manoeuvrability shall be carried out.
SECTION 11 PIPING SYSTEMS

1 Documentation

1.1 General
All changes in machinery and ship piping systems or components, which are covered by the scope of class, are subject to approval and survey. All changes in machinery and ship piping systems shall be specified. This applies to changes to the already existing system, new installations and change or addition of class notations.

1.2 Documentation requirements
For changes in the machinery and ship piping systems and/or components the following documentation shall be submitted:
— updated engine room arrangement (if applicable)
— schematic drawings of piping systems with clear identification of modifications. In case of lengthening, schematic drawings simply showing extension of piping systems need not be submitted for approval, but the modifications shall be reflected in as carried out drawings
— if a new class notation is assigned, document requirements as specified in the rules shall be submitted.

2 Application of rules

2.1 General
In case of a new class notation being assigned, the latest edition of the relevant rules shall be applied.
The latest edition of the rules shall be applied on the part of the piping system subject to modification. New components in a piping system shall be certified in accordance with the requirements in the latest edition of the rules.

3 Testing
For new and modified piping systems the requirements for manufacture, workmanship, inspection and testing as specified in the latest edition of the rules apply.
## APPENDIX A  CONVERSION/ALTERATION DOCUMENTATION REQUIREMENTS

<table>
<thead>
<tr>
<th>Hull and Equipment Drawings</th>
<th>Change of main dimensions, increased L, B or D</th>
<th>New tank contents, heightened air pipes</th>
<th>New super-structure</th>
<th>Machinery and ship piping systems</th>
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</thead>
<tbody>
<tr>
<td>Strengthening of existing structures is always to be considered and submitted for approval</td>
<td>updated general arrangement</td>
<td>new profile and deck plans</td>
<td>air pipe heights</td>
<td>general arrangement</td>
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<tr>
<td>updated tank plan with air pipe heights</td>
<td>new midship section with material properties</td>
<td>proposal for strengthening of tank structures</td>
<td>new deckhouse steel drawings</td>
<td>new engine room arrangement</td>
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<td>deck equipment foundations with applicable loads</td>
<td>new shell expansion</td>
<td>proposal for new equipment number</td>
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<tr>
<td>bottom equipment foundations with applicable loads</td>
<td>proposal for upgraded anchoring equipment</td>
<td>proposal for new equipment number</td>
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<tr>
<td>engine and generator foundations</td>
<td>new loading manual or loading conditions</td>
<td>proposal for new equipment number</td>
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<tr>
<td>propeller nozzles with supports</td>
<td>reinforcement of existing structures</td>
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<td>hatch covers</td>
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<td>doors in ship sides and ends</td>
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<td>openings and closing appliances</td>
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<td>welding dimensions</td>
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<td>rudder and steering gear</td>
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## Stability and load line

<p>| updated freeboard plan |
| updated record of conditions of assignment |
| loading manual and loading computer to be updated when relevant. |
| stability documentation or copy of such if approved by Authorities |
| inclining test procedure and report |
| report on measurement for load line |
| updated freeboard plan |
| updated record of conditions of assignment |
| updated freeboard plan |
| updated record of conditions of assignment |
| updated or new report on measurements for load line |</p>
<table>
<thead>
<tr>
<th>General</th>
<th>Change of main dimensions, increased $L$, $B$ or $D$</th>
<th>New tank contents, heightened air pipes</th>
<th>New super-structure</th>
<th>Machinery and ship piping systems</th>
</tr>
</thead>
</table>
| **Life-saving and fire safety** | Life-saving if changed:  
- updated safety plan  
- updated lifeboat or rescue boat arrangement drawing  
- updated liferaft arrangement drawing  
- updated navigation lights arrangement drawing  
- pilot ladder arrangement | Life-saving and COLREG:  
- updated lifeboat or rescue boat arrangement drawing if relevant  
- updated navigation lights arrangement drawing if relevant  
- pilot ladder arrangement if relevant | Life-saving and COLREG:  
- updated lifeboat or rescue boat arrangement drawing if relevant  
- updated navigation lights arrangement drawing if changed  
- ILO Crew accommodation arrangement drawings |
| **Electrical installations and instrumentation** | — updated single line diagram  
— new load balance  
— new selectivity analysis  
— new short circuit calculations  
— new/updated switchboard drawings | | | |
<table>
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<tr>
<th><strong>General</strong></th>
<th><strong>Change of main dimensions, increased ( L, B ) or ( D )</strong></th>
<th><strong>New tank contents, heightened air pipes</strong></th>
<th><strong>New super-structure</strong></th>
<th><strong>Machinery and ship piping systems</strong></th>
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<tbody>
<tr>
<td><strong>Machinery and piping</strong></td>
<td>Updated drawings for:</td>
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<td>Schematic piping diagrams with alterations clearly marked. In case of lengthening only, schematic diagrams of extended piping systems need only be submitted through as carried out drawings. Schematic diagrams of bilge, air, sounding and overflow systems are always to be submitted for approval.</td>
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<td>— machinery arrangement</td>
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<td>— torsional vibration calculations ( P &gt; 300 \text{ kW} )</td>
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<td>— chocking calculations</td>
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<td>— other calculations (upon request)</td>
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<td>— foundation plan for propulsion</td>
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<td>— plans and calculations for resiliently mounted engines</td>
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<td>— thrusters including driving engine and torsional vibrations calculations if ( P &gt; 300 \text{ kW} )</td>
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<td>— piping and system diagrams</td>
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<td></td>
<td>— engine room arrangement</td>
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CHANGES – HISTORIC

There are currently no historical changes for this document.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.