SPECIAL SERVICE AND TYPE – ADDITIONAL CLASS

Naval Landing Craft

JULY 2004

This chapter has been amended since the main revision (July 2004), most recently in July 2011. See “Changes” on page 3.
FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

The Rules lay down technical and procedural requirements related to obtaining and retaining a Class Certificate. It is used as a contractual document and includes both requirements and acceptance criteria.

If any person suffers loss or damage which is proved to have been caused by any negligent act or omission of Det Norske Veritas, then Det Norske Veritas shall pay compensation to such person for his proved direct loss or damage. However, the compensation shall not exceed an amount equal to ten times the fee charged for the service in question, provided that the maximum compensation shall never exceed USD 2 million.

In this provision “Det Norske Veritas” shall mean the Foundation Det Norske Veritas as well as all its subsidiaries, directors, officers, employees, agents and any other acting on behalf of Det Norske Veritas.
CHANGES

General
The Executive Board approved this new chapter in June 2004. These rules come into force on 1 January 2005. Text affected by the main rule changes is highlighted in red colour in the electronic pdf version. However, where the changes involve a whole chapter, section or sub-section, only the title may be in red colour. This chapter is valid until superseded by a revised chapter.

Amendments July 2011

• General
  — The restricted use legal clause found in Pt.1 Ch.1 Sec.4 has been added also on the front page. In addition, the layout has been changed to one column in order to improve electronic readability.

Introduction
This new chapter introduces naval landing craft as a new ship type under the Rules for Classification of High Speed, Light Craft and Naval Surface Craft. The rules are aimed primarily at the traditional open type landing craft, but can also be applied for fast, enclosed types of landing craft.
Requirements typical for the design and operation of landing craft are covered, such as:
— open deck, stability and drainage
— deck loads for wheel loads and track vehicles
— beaching operations, hull reinforcement, water intakes and propulsion protection
— fendering for operations with a Landing Platform Dock (LPD) vessel.
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SECTION 1
GENERAL REGULATIONS

A. Classification

100 Application

101 The additional class notation for landing craft applies to purpose built craft intended to carry troops, vehicles and equipment combined with beach landing operations.

102 The rules do not apply to craft carrying ordinary passengers as defined in the class notation Passenger.

103 The rules apply to landing craft with a rule length (Lpp) less than 40 m.

104 It is assumed that landing operations are carried out in areas free of obstacles which may damage the vessel.

200 Definitions

201 Ro-Ro cargo spaces: are spaces not normally subdivided in any way and extending to either a substantial length or the entire length of the ship in which goods (packaged or in bulk, in or on rail or road cars, vehicles (including road or rail tankers), trailers, containers, pallets, demountable tanks or in or on similar stowage units or others receptacles) can be loaded and unloaded normally in a horizontal direction.

202 Open Ro-Ro cargo spaces: are Ro-Ro cargo spaces either open at both ends, or open at one end and provided with adequate natural ventilation effective over their entire length through permanent openings in the side plating or deckhead.

203 Closed Ro-Ro cargo spaces: are Ro-Ro cargo spaces which are neither open Ro-Ro cargo spaces nor weather decks.

204 Weather deck: is a deck which is completely exposed to the weather from above and from at least two sides.

300 Class notation

301 The following rule parts apply for the class notation Naval Landing Craft with the applicable modifications and additional requirements included in this chapter:

Pt.1, Pt.2, Pt.3 and Pt.4 except Ch.7.

302 High speed and light craft built in compliance with this chapter may be assigned the class notation:

 marginTop: 0px; ৺ 1A1 LC Naval Landing Craft

— when the displacement fully loaded is not more than: (0.16 L B) 1.5
— and when maximum fully loaded operational speed is less than 25 knots.

A landing craft may be assigned the class notation:

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— when 302 is complied with, and when the service speed is above 25 knots.

400 Service area restriction

401 The design of naval landing craft shall be based on one of the following service restrictions:

| Closed landing craft | R1, R2, R3, R4, R5 |
| Open landing craft    | R3, R4, R5         |

The maximum distances from nearest harbour or safe anchorage related to the different service restriction notations are given as guidance only.

Safe distances shall be determined by the responsible operating authority in each case based on the craft’s design limitations.

402 For the service restrictions R4 and R5, reduced requirements may be applied based on consideration in each case.

403 The distance from shore is based on the service restriction notation as given in the main rules.
A 500 Basis for structural design

501 A limitation of speed versus sea-state (significant wave-height) shall be calculated based on the design vertical acceleration at the longitudinal centre of gravity. This limitation is a basis for the structural design of the craft.

502 In addition to 501, it is a prerequisite for the class approval that limitations for safe operation of the craft are defined and given as operating procedures.

Guidance note:
The operating limitations normally consists of what is covered by the term “good seamanship” This may include:
- limitations to avoid excessive movements for cargo and personnel
- limitations to avoid loss of control of the craft such as broaching
- limitations to avoid water-filling of the craft
- limitations for the use of life saving appliances
- navigation speed limitations.

The operating limitations are normally given by the flag authorities

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A 600 Documentation

601 Details related to the additional notation Naval Landing Craft shall in general be included in the plans for the main class.
Additional requirements for documentation not covered by the main class, are specified in appropriate sections of this chapter.

602 Technical manual

The technical manual is normally at least to contain the following information:

- main particulars of the craft
- description of the craft and its equipment
- maximum number of persons onboard
- maximum baggage and store capacity
- cargo loading and lashing plan (if applicable)
- main drawings for the craft
- list of openings and doors to be kept closed at sea
- design speed versus wave height (sea state) and acceleration limits
- operating range as function of service speed
- description of the operation of systems (machinery, auxiliary, remote control, alarm, warning, electrical, fire protection, radio and communication, navigation)
- lifesaving appliances and their use.

603 Operating manual

The operation manual shall normally at least contain the following information related to the use of the craft for crew transportation:

- procedures for checking the integrity of buoyancy compartments
- damage control procedures
- operational speed limitations (speed and wave height limitations)
- emergency stations and procedures for evacuation
- procedures related to safety at high speeds
- instructions to order the crew seated
- use of safety belts
- use of light in crew accommodation during night operations
- restrictions to number of crew in wheelhouse underway
- use of survival suits if specified
- transfer operations in open sea
- recovery operations for man overboard
- sea state limitation for beaching.

B. Deviations from the Rules

B 100 General

101 The navy may decide that a naval surface craft shall deviate from the requirements put forward in the rules.
In case of deviation(s) from the assigned class notation and service restriction, the class notation on the certificate shall have letters of the nation of the navy, in accordance with ISO 3166 assigned in brackets, e.g. (nor) for Norway, (dnk) for Denmark, (deu) for Germany, etc.

Any deviations from the requirements for the assigned class notation shall be addressed in the class certificate and explained in the "Appendix to the classification certificate".
SECTION 2
ARRANGEMENTS

A. Arrangements

A 100 Cargo securing

101 The cargo and vehicle area shall be provided with means for securing of heavy items. In general, the securing points shall be designed for a horizontal acceleration of 0.5 g.

A 200 Personnel protection

201 If the craft shall operate at high accelerations, i.e. $a_{cg} > 1.0$ g, the navigation compartments shall have seats and or protection in order to ensure safe navigation and compartments for troops shall be arranged to prevent injury to the personnel.
SECTION 3
OPEN SEA OPERATIONS

A. Design Loads

A 100 Design accelerations

101 Design accelerations shall be determined as for main class based on the design acceleration factor $f_g$ defined in Table A1.

<table>
<thead>
<tr>
<th>Table A1</th>
<th>Design acceleration factor $f_g$ for class notation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naval Landing Craft</td>
<td>R1</td>
</tr>
<tr>
<td>$f_g$</td>
<td>3</td>
</tr>
</tbody>
</table>

A 200 Design loads

201 Hydrodynamic loads shall be calculated as for main class. Sea loads on front ramp structure shall be specially considered.

B. Structural Strength

B 100 Foundations

101 For all foundations of weapons and heavy equipment, weight and moments on the supporting structure shall be specified in the documentation for the foundation. All foundations shall be designed with smooth transitions and proper alignment with the hull structure elements.

B 200 Deck structure

201 Wheel loads

The deck structure shall be dimensioned for wheel loads as defined in Pt.5 Ch.2 Sec.3

202 Track loads

The distributed pressure load on a flat deck structure shall be calculated as:

$$p_{\text{track}} = \frac{\text{weight of vehicle}}{\text{footprint area of tracks}}.$$  
Local deck loads at uneven surfaces shall be considered based on the characteristics of the vehicle’s undercarriage.

Guidance note:
The above load formula does not cover local point-loads or abrasion from direct steel against steel. It is assumed that the deck is protected against steel/steel contact either by rubber pads on the tracks, deck planking or similar.

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203 For closed landing craft, the deck shall also be dimensioned for water on deck as defined in C301. This shall be taken in addition to the ordinary deck load. Design acceleration for this case shall be taken as $0.3g_0$.

C. Stability, Watertight and Weathertight Integrity

C 100 General

101 Position of heavy load items such as trucks, tanks etc. shall be specified. If not, it must be assumed that the load can be positioned anywhere on the deck, and the most unfavourable positions shall be used for the stability calculations.

C 200 Drainage capacity on exposed deck for open landing crafts

201 The freeing port area shall be in accordance with Pt.5 Ch.14 Sec.5 B900.

C 300 Accumulated water on deck of closed landing craft

301 For closed crafts arranged with a single bow ramp the consequence of water entering into the craft shall be investigated by assuming an amount of water corresponding to the level of $0.5$ m above the deck. In this
condition, the craft shall have a GM of not less than 0.05 m and the GZ curve shall have a range of at least 10
degrees in combination with a minimum height of 0.05 m. A permeability of 0.95 shall be used in the
calculation. In cases where this value is unrealistic due to cargo on deck, a calculated value may be used. Sill
heights and hatch coamings to spaces leading below shall be minimum 600 mm.

302 The effect of alternative arrangements, such as installation of high-efficiency drainage system may be
considered in each separate case.

C 400 Minimum reserve buoyancy

401 Minimum reserve buoyancy for closed landing craft shall be 100%. The reserve buoyancy shall only
include volumes up to the cargo deck and buoyant volumes separated from the exposed deck by watertight
subdivision.

C 500 Weathertight and watertight integrity

501 For weathertightness and watertight integrity, the requirements of Pt.5 Ch.14 Sec.5 B and Sec.5 D100
apply to landing craft.

C 600 Intact stability

601 The intact stability requirements for the main class, found in Pt.3 Ch.6, apply to landing craft as well.

C 700 Damage stability

701 Extent of bottom damage

The vessel is assumed to be subjected to a bottom damage any-
where in the bottom area forward of 0.5 L of the vessel:

<table>
<thead>
<tr>
<th>Length</th>
<th>2 + 0.03 L m</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transverse extent</td>
<td>2 m</td>
</tr>
<tr>
<td>Penetration</td>
<td>0.5 m</td>
</tr>
</tbody>
</table>

702 Extent of side damage

The side damage is assumed to occur between watertight bulkheads, i.e. single compartments damage. Where
bulkheads are spaced closer than 2 + 0.03L m, one of the bulkheads should be considered as non-existent.

<table>
<thead>
<tr>
<th>Inboard penetration</th>
<th>B/5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vertical extent of damage</td>
<td>From the baseline and upwards without limits</td>
</tr>
</tbody>
</table>

C 800 Survival criteria

801 The final waterline shall be below any opening through which progressive flooding can occur. Such
openings include weathertight doors, air pipes and ventilators with weathertight closing, but may exclude
watertight doors kept closed at sea and bolted manhole covers.

802 The maximum angle of heel after damage shall not exceed 15 degrees.

803 The range of the GZ-curve shall be at least 10 degrees in combination with a minimum height of 0.05 m.

D. Piping Systems

D 100 Fuel capacity

101 The fuel capacity of the craft shall be sufficient for 2.5 times the maximum restriction in tropical season
for the relevant service restriction.

E. Fire Safety

E 100 General

101 Vessels with service restriction area R1, R2 or R3 shall comply with the requirements of Pt.4 Ch.10 and
Pt.5 Ch.2 Sec.4.

102 Vessels with service restriction R4 and R5 shall comply with the requirements of Pt.4 Ch.10 with the
additional requirements and exceptions defined in E200 through E800.
103 If sleeping berths for crew are provided, they shall comply with Pt 5 Ch 3 Sec 4 B.
104 Vessels carrying dangerous goods shall comply with Pt.5 Ch.8.

E 200 Means of escape
201 All spaces or combination of spaces exceeding 25 m² shall be provided with at least two independent escape routes.
202 The primary escape way shall be provided by corridors, stairways and other spaces independent of the space considered, all with a minimum free opening of 700 mm in all directions. The secondary means of escape can be provided by a permanent ladder and hatch arrangement with a free opening of minimum 500 mm in all directions. Doors and hatches not capable of being unlocked from both sides shall not be regarded as an escape way.
203 Main propulsion machinery spaces and Ro-Ro spaces shall be provided with two means of escape leading to a position outside the spaces from which a safe route to the evacuation stations is available. One means of escape from the main propulsion machinery spaces shall avoid direct access to any Ro-Ro cargo space. Main propulsion machinery spaces having a length of less than 5 m and not being routinely entered or continuously manned, may be provided with a single means of escape.

E 300 Classification of space, use and structural fire protection
(Vessels with service restriction R4 and R5)
301 The requirements of Pt.4 Ch.10 apply as amended and modified below.
302 Machinery spaces of major fire hazard shall be protected to 30 minutes structural fire protection time if aluminium or FRP (Fibre Reinforced Plastic) are used. If steel is used, then A0 may be accepted.
303 Special consideration shall be given to other areas of major fire hazard such as galleys and ammunition store.
304 No structural fire protection requirements are applicable to other areas than mentioned above.

E 400 Material requirements and arrangements
(Vessels with service restriction R4 and R5)
401 Requirements for restricted use of combustible materials in Pt.4 Ch.10 Sec.3 A100 do not apply.

E 500 Ventilation
(Vessels with service restriction R4 and R5)
501 The requirements of Pt.4 Ch.10 apply as amended and modified below.
502 No remote or automatic operation of closure of main inlets and outlets, ventilation fans or fire and smoke dampers are required.
503 Closed Ro-Ro cargo spaces shall be treated as areas of major fire hazard. No requirements for ventilation apply to open Ro-Ro cargo spaces.

E 600 Fire detection systems
(Vessels with service restriction R4 and R5)
601 The requirements of Pt.4 Ch.10 apply as amended and modified below.
602 An approved automatic fire detection and alarm system according to Pt 4 Ch 10 shall be installed in all enclosed spaces, except void spaces, including closed Ro-Ro cargo spaces and those areas of open Ro-Ro cargo spaces not completely open from above, to indicate, at the craft's control station, the location of outbreak of a fire. In the event that the control station is unmanned, an audible alarm shall be automatically sounded throughout the crew compartments.
603 Areas of no fire risk and limited areas of minor fire risk such as void spaces and bathrooms of limited area within cabins need not to be provided with fire detectors. Rooms with floor area below 4 m² and ceiling area below 6 m² are in this context considered to be rooms of limited area.
604 For open Ro-Ro cargo spaces not completely open from above, a continuous fire patrol may replace the fire detection and alarm system.
605 The vessels need not to be fitted with TV cameras in the main propulsion machinery room.

E 700 Fire extinguishing system
(Vessels with service restriction R4 and R5)
701 The requirements of Pt.4 Ch.10 apply as amended and modified below.
Machinery spaces of major fire hazard shall be protected by a fixed fire extinguishing system according to Pt.4 Ch.10 Sec.6.

In aluminium or FRP vessels of service restriction area R4, closed Ro-Ro cargo spaces and those areas of open Ro-Ro cargo spaces not completely open from above, shall be protected by an approved fixed pressure water-spraying system for manual operation. Other equivalent systems may be accepted.

Portable fire extinguishers shall be installed according to Pt.4 Ch.10.

In addition, each Ro-Ro cargo space shall be provided with:

1) One portable foam applicator unit consisting of an air-foam nozzle of an inductor type capable of being connected to the fire main by a fire hose, together with a portable tank containing 20 l of foam-making liquid and one spare tank. The nozzle shall be capable of producing effective foam suitable for extinguishing an oil fire of at least 1.5 m³/minute. At least two portable foam applicator units shall be available in the craft for use in such space; and

2) Portable extinguishers shall be provided at each deck level in each compartment spaced not more than 20 m apart on each side of the craft. Fire extinguishers in special-category spaces should be suitable for A and B class fires. The extinguishers should have a capacity of 12 kg dry powder or equivalent.

Fire pumps and fire main
(Vessels with service restriction R4 and R5)

The requirements of Pt.4 Ch.10 apply as amended and modified below.

If installed in an area protected by a fixed fire extinguishing system, only one fire pump of minimum capacity 25 m³/h is required.

Miscellaneous
(Vessels with service restriction R4 and R5)

A duplicate set of the Fire Control Plan is not required to be stored outside the deckhouse.

Fire doors need not be remotely operated or self-closing. A fire door bounding area of major fire hazard shall normally be shut and clearly marked showing that it shall be kept shut when the engines are running. Alternatively it shall be fitted with an indicator giving warning to the control station.

Naval landing craft need not carry fire-fighter’s outfits.

If petrol or vehicles with petrol in their tanks shall be transported in closed Ro-Ro cargo spaces the requirements for precautions against ignition of flammable vapours in Pt 5 Ch 2 Sec 4 B700 apply.

F. Safe Evacuation

General

Unless the lifesaving equipment is accepted by the national authority or the naval authority, in the case of naval vessels, the requirements specified in this sub-section apply as class requirements.

Lifesaving equipment covered by this sub-section shall be approved by the Society or a national authority in accordance with SOLAS Ch.III, LSA code and IMO Res. MSC.81 (70) or equivalent naval and national standard.

Emergency radio equipment covered by this sub-section shall be approved by the society or a national authority in accordance with IMO Res. A.802(19) or A.809(19) or equivalent naval and national standard.

Landing craft are assumed to be relatively small and manoeuvrable, and do not need to carry a separate rescue boat.

Safety equipment

The craft shall be fitted with the following safety equipment:

1) 1 line-throwing appliance with 4 rockets and lines shall be provided.

2) One lifebuoy shall be provided on every open deck and in connection with every normal exit, subject to a minimum of two (2) being installed. Of those 50% shall be fitted with a buoyant line of at least 30 m length and 50% with a self-igniting light. Of the latter, one shall be located in immediate proximity of the bridge and fitted with a self-activating smoke signal.
3) One radar transponder shall be provided.
4) 2 two-way VHF radio telephone apparatus shall be provided.
5) 12 rocket parachute flares shall be provided.
6) 1 daylight signalling lamp shall be provided, not dependent on the main source of electrical power.

F 300 Personal lifesaving equipment
301 The following personal lifesaving equipment shall be provided:
   — a lifejacket with a light and whistle for every person onboard
   — an immersion suit or anti exposure suit for all crew members.

F 400 Survival craft
401 Survival craft of sufficient capacity as will accommodate 100% of the number of persons onboard, even in the event that any one survival craft is lost or rendered unavailable, shall be provided.
402 Open reversible life rafts, complying with annex 11 to the HSC Code, is acceptable for accommodating troops.
403 Minimum one canopied liferaft shall be provided for accommodating all crew members.
404 Each liferaft shall be stowed with a float-free arrangement complying with the requirements of paragraph 4.1.6 of the LSA Code, so that it floats free and inflates automatically if the craft sinks.

F 500 Operational readiness, maintenance and inspection
501 Operational readiness, maintenance and inspection of safety equipment shall be in compliance with SOLAS Ch.III or the HSC Code.

F 600 Alarm system
601 A general emergency alarm system shall be provided.

F 700 Instructions and muster lists
701 Clear instructions to be followed in the event of an emergency shall be provided for every person onboard.
702 Muster list shall be exhibited in conspicuous places onboard.
703 Illustrations and instructions for troops about assembly stations, essential actions in an emergency and donning of lifejackets shall be available.
704 Operational readiness, maintenance and inspections shall be in compliance with SOLAS and the HSC Code.
SECTION 4
BEACHING OPERATIONS

A. Special Considerations for Beaching Operations

A 100 General
101 The safety aspect of beaching from a classification point of view is mainly relying on operational limitations with respect to wave-height and surf in the beaching area.

102 Beaching operations for a landing craft is considered mainly as an operational question. The design formula covering beaching operations shall be based on a “middle” design level. It is therefore possible for the owner to specify higher or lower level as long as it does not have implications on the safety of the craft.

B. Structural Strength

B 100 General
101 The requirements are applied to hull bottom structure where the possibility of loads from landing operations (grounding) exists. The extent of application of the following Rule requirements shall be agreed between client and DNV.

102 Strengthening requirements for beaching operations cover craft made of steel or aluminium. Strengthening of FRP craft will have to be evaluated in each case.

103 Determination of the hull scantlings by more sophisticated methods than the formulae and values given in this section may be permitted. Such analysis, methods and criteria are subject to special approval.

104 The beaching protection length shall extend from front of the craft and to extend 0.3 Lpp aft from the forward perpendicular.

Fig. 1
Beaching protection length

B 200 Plating
201 Bottom plating within the beaching protection length shall be increased by 20%.

B 300 Bottom stiffeners
301 Bottom stiffening within the beaching protection length shall be designed in accordance with the requirements of main class and increased by 20%. For impact areas the spacing of longitudinals not to be greater than 500 mm.

B 400 Structural strength - girders and web frames
401 In additions to the ordinary loads as given in the Pt.3 Ch.1, girders and webframes within the beach protection length shall be dimensioned for an average beaching pressure:

\[ p_{\text{beach}} = 3.2 \frac{\Delta}{b_{\text{contact}}} \quad (\text{kN/m}^2) \]

where:

\[ b_{\text{contact}} = \text{average breadth of hull bottom within beaching length (see Fig.2)} \]
\[ \Delta = \text{full load displacement (tons)} \]
Fig. 2
Width of bottom contact area

402 The stiffening and support of girders shall be increased within the beaching protection length. Stiffening of the girder web is required at half the web height as given by the main rules. Stiffening spacing given in main rules shall be halved.

B 500 Weld connections

501 For bottom structure in way of the beaching protection length, the following requirements shall apply:
— double continuous welding
— stiffener webs shall be connected to web frames
— rubbing strakes shall be continuously welded.

B 600 Rubbing strakes

601 Rubbing strakes shall be fitted to the bottom shell in way of areas subject to grounding loads.
602 Rubbing strakes shall be aligned with internal structure and structural discontinuities shall be avoided. The ends of rubbing strakes shall be tapered at an angle of not less than 1 in 3.
603 The connection of rubber strakes to the hull shall be so designed that in the event of a rubbing strake being ripped off the risk of damage to the hull is minimised.
604 Alternative protection arrangement of bottom contact area for special beaching conditions may be separately agreed.
605 Rubbing strakes for FRP craft shall preferably be arranged so that the bottom plating structure does not get in contact with the beach.

B 700 Ramp structure

701 The ramp structure shall be dimensioned for wheel loads as defined in Pt.5 Ch.2 Sec.3.
702 The ramp carrying structure shall be calculated for the most unfavourable positions of wheel point loads.
703 In order to cover unevenness at the beach, the ramp shall be designed for a support point from the beach located along the forward end positioned 1/3 from the side.
704 The ramp opening and closing mechanisms shall be dimensioned for:
— opening and closing loads
— wheel loads, if they are carried by the opening and closing mechanisms. This can be ignored if the ramp is resting fully on the beach.
705 The loading ramps shall have mechanical closing mechanism for the closed position.

B 800 Sea loads on aft structure

801 Transverse aft structure shall be dimensioned for breaking waves that may occur in the surf zone of a beach.
802 Surf slamming shall be considered when the vertical angle is between 0° and 105° and the horizontal angle is between 0° and 30°.
803 The structural calculations of surf slamming shall be as for bottom slamming defined in Pt.3.
The slamming pressures (KN/m²) to be used on stern panels exposed to surf slamming:

Above waterline: \( p = 51 - 0.67 \, h_o \)

Below waterline: \( p = 51 + 10 \, h_o \)

where:

\( h_o \) = distance (m) above or below waterline.

**B 900 Push-out and pull-out strength**

901 If the craft shall be pushed out from the beach, the front ramp (or other structure) shall be dimensioned for push-out loads from tractors or bulldozers.

902 Unless specific loads are given, the push out area shall be dimensioned for a load of:

\[ F_{\text{push}} = 0.5 \Delta_{\text{light}} \quad (\text{kN}) \]

where:

\( \Delta_{\text{light}} \) = displacement (tons) of landing craft when leaving beach.

903 If the craft shall be equipped with pull-out anchors or similar, winches shall be dimensioned based on the pull out force \( F_{\text{push}} \).

Fairleads and the foundation for winches shall be dimensioned for the capacity of the winch.

**B 1000 Air intakes**

1001 Air intakes shall be protected from water ingress from breaking waves in the surf zone. Air intakes and ventilation openings are generally not to be placed in the shaded area in Fig.4.

**C. Piping Systems**

**C 100 General**

101 Piping systems should in general comply with Pt.4 Ch.6. In addition, the requirements found below shall be complied with.
C 200  Sea cooling water and sea inlets
201  Machinery for propulsion and power generation shall be connected to at least two seawater inlets.
202  The cooling water system shall be arranged with redundant strainers. It should be possible to clean each
strainer without stopping the seawater supply to the machinery.

C 300  Fuel tanks
301  Fuel tanks located within the beaching protection length shall be separated from the outer hull plate.

D. Machinery

D 100  Protection of propellers, waterjets and rudders
101  Any protruding parts of propeller and rudder shall be protected from contact with sea bottom. Protection
of the propellers and rudders may be in the form of skeg, extended keel, or special arrangement of the hull.
102  Waterjet intakes shall be equipped with suitable grating or similar to avoid rocks being sucked into the
jets.
SECTION 5
LPD OPERATIONS

A. Special Considerations for LPD Operations

A 100  Fendering arrangement

101  Landing craft intended for open sea operations with a Landing Platform Dock (LPD) or similar, shall have fendering systems as described below.

102  Longitudinal fenders are normally to be fitted on the ship's side. The fenders shall extend along the full length of the craft.

103  Corner areas and other natural contact points for open sea docking operations shall be protected by fenders.

104  If the landing craft is dedicated for one specific LPD, the height and positioning of the fenders shall be adapted to the geometry of the dock.

Fig. 1
Fendering zones for open sea docking operations

105  Fender lists are normally to be supported by underlying stiffeners or similar structure. If the fenders are supported by the ordinary longitudinal stiffeners, the section modulus and shear area of these longitudinals shall be increased by a factor of 1.5.

A 200  Dry docking

201  Landing craft intended for open sea drydocking shall have a flat footprint with sufficient area for stability and low nominal contact pressure.

202  The footprint shall be free from protruding elements.

203  Propellers, rudders and stabiliser fins shall be protected either by a recessed position or fending.

204  If the craft is docked directly on the hull bottom, the bottom plating thickness in way of the footprint shall be increased by a factor of 1.3. The plate stiffener’s modulus and shear area in way of the footprint shall be increased by a factor of 1.3.

205  If dedicated bottom docking elements such as skids, strakes etc. are used, the plating and stiffeners need not be increased. In this case the support structure such as frames and longitudinal shall be specially considered.

206  Proper securing arrangement shall be provided to hold the craft in position in the dock. This may be in the form of lashing gears or mooring bollards. For a monohull LDP, the total lashing force shall be taken as 25% of the landing craft’s weight, unless more specific data for the LPD is known.