CLASS GUIDELINE

DNV-CG-0182 Edition July 2022

Allowable thickness diminution for hull structure

DNV AS

FOREWORD

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

Any comments may be sent by e-mail to *rules@dnv.com*

CHANGES – CURRENT

This document supersedes the July 2021 edition of DNV-CG-0182.

The numbering and/or title of items containing changes is highlighted in red.

Changes July 2022

Topic	*Reference*	*Description*
Introduction	Sec.1	Aligned the structure of Sec.1 with standard DNV format.
Hatch cover stoppers	Sec.3 [1.4], Sec.5 [1.4.3]	Introduced wear and tear requirements for hatch cover stoppers.
Container securing and lashing arrangement	Sec.11	New section detailing wear and tear acceptance criteria for container securing and lashing equipment.

Editorial corrections

In addition to the above stated changes, editorial corrections may have been made.

CONTENTS

Contents

SECTION 1 GENERAL

1 Introduction

A vessels scantlings and the allowable diminution are based on requirements according to the rules for classification in force at the 'date of contract for construction'.

During the life time of the vessel the structure will deteriorate due to corrosion. The corrosion will vary depending on a number of factors, such as material, environment, corrosion protection system and structural element type. The level of deterioration shall be evaluated during surveys with thickness measurements.

2 Objective

The objective of this class guideline is to provide the user with the acceptance criteria for the corrosion deterioration of hull structures.

3 Scope

This class guideline contains requirements for all types of vessels, built from steel or aluminium, for all relevant structural elements considering different kinds of corrosion types and are based on:

— date of contract for construction
— rule regime
— ship type
— class notations
— construction material.

4 Application

This class guideline is applicable to all vessels with a class certificate, issued by the Society.

The application of this guideline is detailed in Table 1.

Table 1 Application

Vessel characteristics	*Application*
Main class notation **1A**	Sec.1, Sec.2, Sec.8, Sec.9 and Sec.12
Main class notation **1A** with ship type notation **Container ship**	Sec.1, Sec.3, Sec.8, Sec.9 and Sec.12
Main class notation **1A1** [1)]	Sec.1, Sec.4, Sec.8, Sec.9 and Sec.12
Main class notation **100A5** [2)]	Sec.1, Sec.5, Sec.8, Sec.9 and Sec.12
Naval vessels	Sec.1, Sec.6, Sec.8, Sec.9 and Sec.12
High speed and light crafts, yachts and aluminum vessels	Sec.1, Sec.7, Sec.8, Sec.9 and Sec.12
Class notation **CSR**	Renewal thickness as given in applicable CSR rules. Acceptance criteria for pitting, groove and edge corrosion are given in Sec.10.
Construction symbol ✠ (Class entries)	Sec.8, Sec.9 and Sec.12, minimum thickness list from losing society.

Vessel characteristics	*Application*
[1] Ships built to Det Norske Veritas rules for classification of ships (**1A1**) [2] Ships built to Germanischer Lloyd rules for classification of ships (**100A5**)	

5 References

Table 2 lists DNV references used in this document.

Table 2 DNV references

Document code	*Title*
DNV-RU-HSLC	DNV rules for classification: High speed and light craft
DNV-RU-NAV	DNV rules for classification: Naval vessels
DNV_RU-SHIP	DNV rules for classification: Ships
DNV-RU-YACHT	DNV rules for classification: Yachts
DNV-CG-0131	Strength analysis of hull structure in container ships
DNV-CG-0137	Strength analysis of hull structure in RO/RO ships and car carriers
DNV-CG-0138	Direct strength analysis of hull structures in passenger ships
DNV-CG-0151	Strength analysis of general dry cargo and multi-purpose dry cargo ships
DNV-CG-0288	Corrosion protection of ships

6 Definitions and abbreviations

6.1 Definitions of verbal forms

The verbal forms defined in Table 3 are used in this document.

Table 3 Definition of verbal forms

Term	*Definition*
shall	verbal form used to indicate requirements strictly to be followed in order to conform to the document
should	verbal form used to indicate that among several possibilities one is recommended as particularly suitable, without mentioning or excluding others
may	verbal form used to indicate a course of action permissible within the limits of the document

6.2 Definitions of terms

Corrosion may be divided into the following categories, see Table 4.

Table 4 Corrosion types

Type	*Description*
edge corrosion	local material wastage at the free edges of plates and stiffeners Typically, if not renewed, repairs may be carried out by means of edge stiffener/doubler.
general corrosion	uniform reductions of material thickness, which may or may not affect global strength Criteria for minimum thickness of hull structural elements may be applied in order to determine average diminution values. Typically, repairs will include steel replacement to original scantlings and/or reinforcement upon special consideration.
groove corrosion	local line material loss normally adjacent to welding joints along abutting stiffeners and at stiffener or plate butts or seams Due to the complexity and effects of groove corrosion, diminution criteria are limited and special repair considerations are required.
grooving	see groove corrosion
pit corrosion	random scattered corrosion spots/areas with local material reductions The intensity of the pitting must first be estimated before applying depth. Typically, repairs will include renewal of plates, building up pits by welding or application of plastic filler compounds.
pitting	see pit corrosion

For each of the above corrosion categories, separate assumptions, criteria and typical repairs should be applied as given in relevant sections, and accepted by the Society.

For structural terminology applied in the specification of minimum thickness see DNV-RU-SHIP Pt.3 Ch.1 Sec.4.

6.3 Symbols

L = rule length, in m

$Z_{as\text{-}measured}$ = hull girder section modulus, in m^3, based on thickness measurements or conservative thickness estimates of hull girder plates and longitudinals, any owner's voluntary addition included

Z_{gr_off} = gross hull girder section modulus (in deck or bottom as applicable), in m^3, based on t_{gr_off}

t_{min} = minimum thickness, in mm, including a margin for further corrosion until next hull survey

t_c = corrosion addition, in mm

t_{as_built} = as-built thickness, in mm, taken as the actual thickness provided at newbuilding stage

t_{vol_add} = owner's voluntary addition, in mm

t_{gr_off} = gross offered, $t_{gr\_off} = t_{as\_built} - t_{vol\_add}$.

7 General requirements

Any minimum thickness, or list of minimum thickness, is only valid as long as the vessel has a valid DNV class certificate.

Owner's voluntary addition may be considered in calculation of t_{min} where the addition is included in the approved drawings.

SECTION 2 MAIN CLASS NOTATION 1A

1 General

1.1 Application

This section applies to vessels built to DNV rules for classification Ships (RU-SHIP), with main class notation **1A** except for:

— vessels with ship type notation **Container ship**
— Naval vessels (see Sec.6)
— High speed and light craft, yachts and aluminum vessels (see Sec.7)
— vessels with class notation **CSR**.

The following assumption applies:

— the construction material is steel
— the vessel has not undergone a major conversion.

2 Vessels with length, L < 90 m

Allowable diminution up to 20% for plates, and 25% for stiffeners may be accepted. The minimum thickness of plating shall not be less than:

weather and strength deck $t_{\min} = 4.5 + 0.02L\sqrt{k}$, mm

bottom and bilge $t_{\min} = 4.5 + 0.035L\sqrt{k}$, mm

where:

k = material factor, see DNV-RU-SHIP Pt.3 Ch.3 Sec.1 [2], (1.0 for mild steel)

Allowable diminution for plates and stiffeners made from stainless steel, or aluminium, is 10%.

3 Vessels with length, L ≥ 90 m

3.1 Structure within 0.4 L amidships

3.1.1 General

The method includes criteria for local strength, ultimate hull girder buckling strength and requirement for hull girder section modulus.

It may be relevant to carry out more detailed calculations in order to get more exact and differentiated results. The provisions for such calculations are given in Sec.1 [5].

3.1.2 Local strength control

The minimum thickness of plates, stiffener/girder webs or flanges at renewal survey may be determined from the following:

general corrosion criteria: $t_{min} = k\, t_{gr\_off}$

where:

t_{gr_off} = $(t_{as\_built} - t_{vol\_add})$,
Documented owner's voluntary addition is subtracted

k = diminution coefficient from Table 1 or Table 2.

Table 1 Longitudinal strength members

Structural component	*Diminution coefficient k*
Plating	0.80
Stiffeners	0.75
Girders and stringers	0.80
Side and longitudinal bulkhead plating	0.80
Corrugated bulkhead plating (flange and web)	0.80
Inner bottom plate in bulk carriers	0.75

Table 2 Transverse strength members

Structural component			*Diminution coefficient k*
Deck plating between hatches	Plate		0.80 [1)]
	Stiffener		0.75
Transverse bulkhead	Plane bulkhead		0.75 [2)]
	Corrugated bulkheads	Flange	0.80
		Web	
Frames/Stiffeners	Web		0.75
	Flange		0.75
Web frames/floors /girders and stringers	Web		0.80
	Flange		0.75
Cross ties			0.85

Notes:

1) To be specially considered if cross deck stiffened in longitudinal direction in way of vertically corrugated, transverse bulkhead.

2) Bulkheads designed with two plate flanges connected with vertical webs ('double skin bulkheads') should have a diminution coefficient, k = 0.80.

For strength members built of stainless steel or aluminium, k = 0.90

3.1.3 Hull girder section modulus

In order to comply with global longitudinal strength requirements for vessels with unrestricted service, the reduced section modulus of the vessel shall not be less than 90% of the required section modulus based on design bending moments.

In any case the reduced section modulus shall not be less than 90% of the minimum rule section modulus, see DNV-RU-SHIP Pt.3 Ch.5.

3.1.4 Ultimate strength

When the average reduction of deck or bottom structures is more that 5%, for vessels with L > 150 m and single deck, global longitudinal buckling strength check of vertical hull girder ultimate bending capacity shall be carried out.

This shall be carried out with thickness measurements or conservative thickness estimates of the hull girder plates and longitudinals, any owner's voluntary additions included.

The hull girder ultimate bending capacity, $M_{U\_as\_measured}$, shall be assessed by prescriptive method given in DNV-CG-0128 *Buckling* or by non-linear FE. The vessel shall have hull girder bending moment capacity to fulfil the requirement:

$$M \leq \frac{M_{U-as-measured}}{\gamma_R}$$

where:

M = vertical bending moment, in kNm, to be obtained as specified in DNV-CG-0128 or DNV-RU-SHIP Pt.3 Ch.5 Sec.4 [2.2]

$M_{U\text{-}as\text{-}measured}$ = vertical hull girder ultimate bending capacity, in kNm, to be obtained as specified for M_U in DNV-CG-0128 or DNV-RU-SHIP Pt.3 Ch.5 Sec.4 [2.3], based on thickness measurements or conservative thickness estimates of the hull girder plates and longitudinals, any owner's voluntary additions included, if the hull girder calculations are based on actual as-measured values then this shall be re-confirmed at subsequent renewal hull and intermediate surveys. The number of cross sections shall be determined on a case by case basis, and shall be dependent on condition of the vessel. See DNV-RU-SHIP Pt.7 Ch.1 Sec.4 [4].

3.1.5 Estimation of section modulus

The actual reduced (as measured) hull girder section modulus of the vessel may be calculated directly or estimated, see DNV-CG-0285 App.B. In the subject cross section, all structural elements contributing to longitudinal strength below 0.15 D or above 0.85 D should be included, see Figure 1.

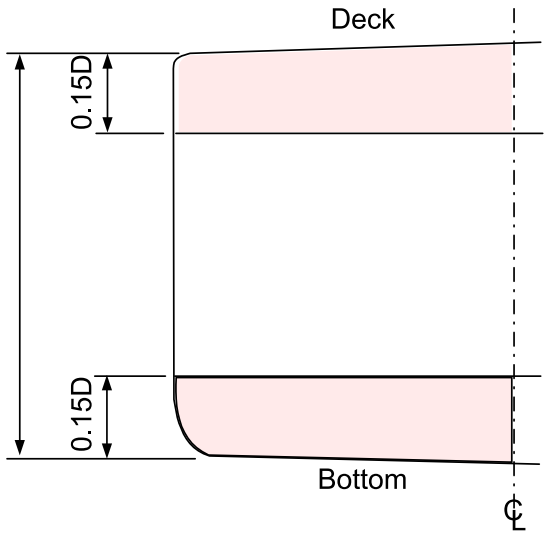

Figure 1 Structural elements contributing to longitudinal strength

3.2 Structure outside 0.4 L amidship

3.2.1 Transverse strength elements

Minimum thickness calculations of transverse strength members shall follow the procedures in [3.1.2].

3.2.2 Longitudinal strength elements

See Table 3 to be used in connection with [3.1.3] and [3.1.4].

Table 3 Criteria for global strength along the hull girder

Location (from aft)	*Acceptable average reduction in deck or bottom*
0.0 L - 0.1 L	10%
0.1 L - 0.2 L	Linear interpolation
0.2 L - 0.3 L	Use results from 3.1.3, or actual thickness measurements and recalculate
0.7 L - 0.8 L	Use results from 3.1.3, or actual thickness measurements and recalculate
0.8 L - 0.9 L	Linear interpolation
0.9 L - 1.0 L	10%

SECTION 3 MAIN CLASS NOTATION 1A, CONTAINER SHIPS

1 General

1.1 Application

This section applies to vessels built to DNV rules for classification: Ships (RU-SHIP), with main class notation **1A** and ship type notation **Container ship**.

This section provides allowable corrosion margins in accordance with the net scantlings approach in IACS UR S11A.

The renewal criteria may be specially considered provided it is demonstrated that the hull girder strength requirements in UR S11A are complied with.

1.2 Longitudinal strength

Maximum permissible reduction of gross midship section modulus: 10%.

1.3 General corrosion for local strength

The total corrosion margin, t_c, in mm, for both sides of the structural member is obtained by the following formula:

$$t_c = (t_{c1} + t_{c2}) + t_{res}$$

Where t_{c1} and t_{c2} are specified in Table 1.

For an internal member within a given compartment, the total corrosion addition, t_c is obtained from the following formula:

$$t_c = (2t_{c1}) + t_{res}$$

The corrosion addition of a stiffener shall be determined according to the location of its connection to the attached plating.

Table 1 Corrosion addition for one side of a structural member

Compartment type	*One side corrosion addition t_{c1} or t_{c2} [mm]*
Exposed to sea water	1.0
Exposed to atmosphere	1.0
Ballast water tank	1.0
Void and dry spaces	0.5
Fresh water, fuel oil and lube oil tank	0.5
Accommodation spaces	0.0
Container holds	1.0
Compartment types not mentioned above	0.5

1.4 Stoppers and support structure of cargo hatch covers

The wear and tear of stoppers and support structure of hatch covers as well as hatch cover guiding structure shall not exceed the corrosion addition as defined in DNV-RU-SHIP Pt.3 Ch.12 Sec.4 Table 2.

The allowable wear of the contact surface of the stopper to the hatch cover structure shall not exceed 10 mm.

Any cracks or deformations shall be repaired.

SECTION 4 MAIN CLASS NOTATION 1A1

1 General

1.1 Application

This section applies to vessels built to DNV rules with main class notation **1A1** except for :

— naval vessels
— high speed and light crafts, yacht and aluminium vessels
— vessels with class notation **CSR**.

The following assumptions apply:

— the criteria may be applied to vessels built of steel
— special considerations shall be applied if the vessel has undergone major conversions, e.g. has been lengthened.

2 Vessels with length, L < 100 m

In general, allowable diminution of plate thickness up to 20% and for profiles up to 25% on original values shall be accepted provided the thickness of plating is not be less than:

deck	t_{min} > 0.9 (5.5 + 0.02L)
side/bottom	t_{min} > 0.9 (5.0 + 0.04L).

For vessels with transverse framing in the bottom, inner bottom or upper deck, more thorough calculations may be required. The methods in [3] may be applied by the Society on a case-by-case basis.

For strength members built of stainless steel or aluminium, 10% diminution is acceptable.

3 Vessels with length, L ≥ 100 m

3.1 Structure within 0.4 L amidships

The method includes criteria for local strength, ultimate hull girder buckling strength and requirement for hull girder section modulus.

It may be relevant to carry out more detailed calculations in order to get more exact and differentiated results. Provisions for such calculations are given in Sec.1 [5].

3.1.1 Local strength control

The minimum thickness of plates, stiffener/girder webs or flanges at renewal survey may be determined from the following:

general corrosion criteria: $t_{min} = k\, t_{gr\_off}$

where:

t_{gr_off} = $(t_{as\_built} - t_{vol\_add})$,
documented owner's voluntary addition is subtracted

k = diminution coefficient from Table 1 or Table 2.

Table 1 Longitudinal strength members

Structural component	*Diminution coefficient k*
Plating	0.80
Stiffeners	0.75
Girders and stringers[1)]	0.80
Side and longitudinal bulkhead plating	0.80
Corrugated bulkhead plating (flange and web)	0.80
Inner bottom plate in bulk carriers	0.75
Notes: 1) Bottom girders: — for single skin bulk carriers with length L > 150 m carrying cargo with density of 1.78 t/m^3 or more, the shear strength of the girders in hold No.1 shall additionally be checked according to IACS UR S22, as applicable.	

Table 2 Transverse strength members

Structural component			*Diminution coefficient k*
Deck plating between hatches	Plate		0.80 [1)]
	Stiffener		0.75
Transverse bulkhead [2)]	Plane bulkhead		0.75 [4)]
	Corrugated bulkheads	Flange	0.80
		Web	
Frames/stiffeners	Web		0.75
	Flange		0.75
Web frames/floors [3)]/girders and stringers	Web		0.80
	Flange		0.75
Side frames in way of wing tank for container ships			
Upper part - the web frame plating above first stringer from second deck	Plating		0.7
Lower part - the web frame plating below first stringer from second deck	Plating		0.8
Cross ties			0.85

Structural component	*Diminution coefficient k*
Notes: 1) Shall be specially considered if cross deck stiffened in longitudinal direction in way of vertically corrugated, transverse bulkhead. 2) For single side skin bulk carriers with length L > 150 m carrying cargo with density of 1.78 t/m^3 or more, vertically corrugated transverse bulkhead between forward holds no.1 and 2 shall satisfy flooding requirements according to IACS UR S19, as applicable. 3) For single skin bulk carriers with length L >150 m carrying cargo with density of 1.78 t/m^3 or more, the shear strength of the floors in hold no.1 shall be checked according to IACS UR S22, as applicable. 4) Bulkheads designed with two plate flanges connected with vertical webs ('double skin bulkheads') shall have a diminution coefficient, *k* = 0.80.	

For strength members built of stainless steel or aluminium, k = 0.90.

3.1.2 Hull girder section modulus

In order to comply with global longitudinal strength requirements for vessels with unrestricted service, the reduced section modulus of the vessel shall not be less than 90% of the required section modulus based on design bending moments.

In any case the reduced section modulus shall not be less than 90% of the minimum rule section modulus, see DNV-RU-SHIP Pt.3 Ch.5.

3.1.3 Ultimate strength

When the average reduction of deck or bottom structures is more that 5%, for vessels with L > 150 m and single deck, global longitudinal buckling strength check of vertical hull girder ultimate bending capacity shall be carried out.

This shall be carried out with thickness measurements or conservative thickness estimates of the hull girder plates and longitudinals, any owner's voluntary addition included.

The hull girder ultimate bending capacity, $M_{U\_as\_measured}$, shall be assessed by prescriptive method given in DNV-CG-0128 or by non-linear FE. The vessel shall have hull girder bending moment capacity to fulfill the requirement:

$$M \leq \frac{M_{U-as-measured}}{\gamma_R}$$

where:

M = longitudinal hull girder bending moment, in kNm, for hogging and sagging conditions respectively, at the hull transverse section considered, $M = M_{sw} + M_w$

$M_{U\text{-}as\text{-}measured}$ = vertical hull girder ultimate bending capacity, in kNm, to be obtained as specified in DNV-CG-0128 Sec.5 [6] based on thickness measurements or conservative thickness estimates of hull girder plates and longitudinals, any owners voluntary additions included. If the hull girder calculations are based on actual as-measured values then this shall be re-confirmed at subsequent renewal hull and intermediate surveys. The number of cross sections shall be determined on a case by case basis, and shall be dependent on condition of the vessel. See DNV-RU-SHIP Pt.7 Ch.1 Sec.4 [4]

γ_R = partial safety factor for the vertical hull girder ultimate bending capacity shall be taken as:

$\gamma_R = \gamma_M \gamma_{DB}$

γ_M = partial safety factor for the vertical hull girder ultimate bending capacity, covering material, geometric and strength prediction uncertainties; shall be taken as:

$\gamma_M = 1.1$

γ_{DB} = partial safety factor for the vertical hull girder ultimate bending capacity, covering the effect of double bottom bending, shall be taken as:

for hogging condition:

γ_{DB} = 1.25 for vessels with empty cargo holds and class notation **HC(A)** or **HC(B*)**, or **HC(M)** if alternate loading conditions are included in the loading manual

γ_{DB} = 1.1 for all other cases

for sagging condition:

γ_{DB} = 1.0

M_{sw} = Vertical still water bending moment in sea condition as given in DNV-RU-SHIP Pt.3 Ch.4 Sec.4 [2.2.1], in kNm

M_w = Vertical wave bending moment as given in DNV-RU-SHIP Pt.3 Ch.4 Sec.4 [3.1], in kNm.

3.1.4 Estimation of section modulus

The actual reduced (as measured) hull girder section modulus of the vessel may be calculated directly or estimated, see DNV-CG-0285 App.B. In the subject cross section all structural elements contributing to longitudinal strength below 0.15 D or above 0.85 D should be included, see Figure 1.

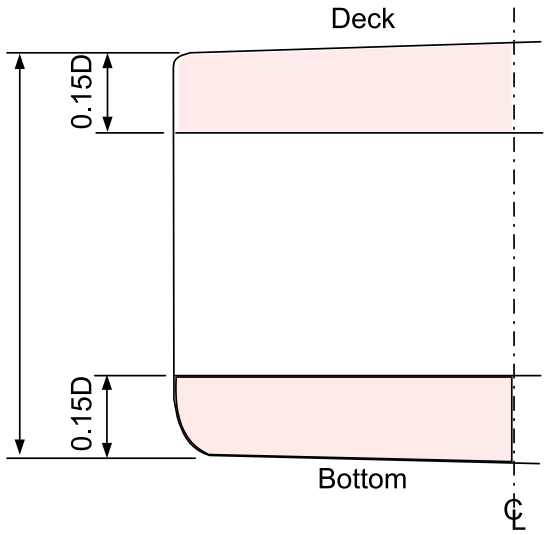

Figure 1 Structural elements contributing to longitudinal strength

3.2 Structure outside 0.4 L amidship

3.2.1 Transverse strength elements

Minimum thickness calculations of transverse strength members should follow the procedures of [3.1.1].

3.2.2 Longitudinal strength elements

See Table 3 to be used in connection with [3.1.2] and [3.1.3].

Table 3 Criteria for global strength along the hull girder

Location (from aft)	*Acceptable average reduction in deck or bottom*
0.0 L - 0.1 L	10%
0.1 L - 0.2 L	Linear interpolation
0.2 L - 0.3 L	Use results from [3.1.3], or actual thickness measurements and recalculate
0.7 L - 0.8 L	Use results from [3.1.3], or actual thickness measurements and recalculate
0.8 L - 0.9 L	Linear interpolation
0.9 L - 1.0 L	10%

3.3 Hatch covers and hatch coamings

3.3.1 Allowable corrosion margins for hatch covers and hatch coamings are given in Sec.8 for:

a) All ships except for bulk carriers, ore carriers and combination carriers as defined in IACS UR Z11 with date of contract for construction on or after 2012-07-01.
b) All ships with date of contract for construction on or after 1998-07-01 when the hatch covers and hatch coamings are located forward of 0.25 L.
c) Bulk carriers, ore carriers and combination carriers as defined in IACS UR Z11 with date of contract for construction on or after 2004-01-01.

3.3.2 The allowable corrosion margins for hatch covers and hatch coamings of ships with date of contract for construction prior to the ones given in [3.3.1] are defined in Table 4.

Table 4 Hatch covers and coamings

	Structural component	*Diminution coefficient k*
Hatch covers/ coamings	Plate	0.80
	Stiffener	0.75

SECTION 5 MAIN CLASS NOTATION 100A5

1 General

1.1 Application

This section applies to vessels built to GL rules, with main class notation **100A5**, except for:

— naval vessels
— high speed and light crafts, yachts, and aluminium vessels
— vessels with class notation **CSR**.

When reduced material thickness has been accepted for the new building (due to effective system of corrosion prevention), the permissible corrosion allowances shall be based on the unreduced rule thickness.

1.2 Longitudinal strength

Maximum permissible reduction of gross midship section modulus: 10%.

1.3 General corrosion for local strength

t_k: maximum permissible large-surface reduction of plate thickness and web thickness of profiles:

t_k = 1.5 mm for t ≤ 11.5 mm
t_k = 0.09 t + 0.45 mm, max 3.0 mm for t > 11.5 mm

t: plate and/or web thickness in [mm], as stipulated in **100A5** construction rules

In ballast tanks in way of 1.5 m below the weather deck, if the weather deck is the tank deck: $t_k = 2.5$ mm

In cargo oil tanks in way of 1.5 m below the weather deck, if the weather deck is the tank deck, and for horizontal structural elements in cargo oil and fuel tanks: $t_k = 2.0$ mm

In dry cells, such as fore-to-aft passageways of container ships and comparable spaces:

t_k = 1.0 mm for t ≤ 11.5 mm
t_k = 0.09 t, max 2.5 mm for t > 11.5 mm

Maximum permissible surface reduction of the side shell in way of the ice belt:

$t_k = 2.0$ mm.

1.4 Hatch covers and hatch coamings

1.4.1 Vessels with 'date of contract for construction' on or after 2012-07-01

See Sec.8.

1.4.2 Vessels with 'date of contract for construction' construction prior to 2012-07-01

t_k: maximum permissible large-surface reduction of plate thickness and web thickness of profiles:

t_k = 1.5 mm for t ≤ 11.5 mm

t_k = 0.09 t + 0.45 mm, max 3.0 mm for t > 11.5 mm.

For hatch covers of dry cargo holds:

t_k = 1.0 mm.

1.4.3 Stoppers and support structure of cargo hatch covers

The wear and tear of stoppers and support structure of hatch covers as well as hatch cover guiding structure shall not exceed the corrosion addition as defined in DNV-RU-SHIP Pt.3 Ch.12 Sec.4 Table 2.

The allowable wear of the contact surface of the stopper to the hatch cover structure shall not exceed 10 mm.

Any cracks or deformations shall be repaired.

SECTION 6 NAVAL VESSELS

1 General

1.1 Application

This section applies to steel vessels built to one of the following rule sets:

— DNV-RU-NAVAL, with main class notation **1A**
— DNV rules for ships, Ch. 14 Naval and Naval Support Vessels, with main class notation **1A1**
— GL rules and guidelines, Naval Ship technology III-1-1, with main class notation **100A5**.

1.2 Surface vessels

These vessels are generally built with small or no corrosion allowance and are handled on a case-by-case basis. For the current construction rules, see DNV-RU-NAVAL Pt.3 Ch.1 Sec.4 [2.3].

Guidance note:

Navy vessels have additional design criteria like explosions, local pressure due to explosions, etc., which may have required special strength steel or locally increased thicknesses as compared to typical merchant vessels.

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

In lieu of other information, for local corrosion Sec.9 may be applied.

SECTION 7 HIGH SPEED AND LIGHT CRAFTS, YACHTS AND ALUMINUM VESSELS

1 General

1.1 Application

This section applies to vessels built to one of the following rules sets:

— DNV **1A** RU-HSLC
— DNV **1A** RU-YACHT
— GL **100A5** I-3-1, I-3-2
— DNV **1A1** rules for classification of high speed and light craft.

1.2 Longitudinal strength

Maximum permissible reduction of midship section modulus: 10%.

1.3 Vessels built according to DNV 1A RU-HSLC, 100A5 I-3-1, I-3-2 or 1A1 rules for classification of high speed and light craft

Local strength:

Maximum permissible large-surface reduction t_k of plate thickness and web thickness of profiles is:

$t_k = 0.5$ mm for $t \leq 10.5$ mm

$t_k = 0.03\ t + 0.2$ mm, max 1.0 mm for $t > 10.5$ mm

For tank bottoms:

$t_k = 1.0$ mm

Maximum permissible locally limited reduction of thickness: $0.1\ t$

For aluminum and stainless steel, to allow for milling tolerances and rounding of calculation results, the corrosion allowance may be taken as 0.5 mm unless a higher value is documented by approved drawings.

1.4 Vessels built according to DNV-RU-YACHT

See corrosion additions in DNV-RU-YACHT Pt.3 Ch.4.

SECTION 8 HATCH COVERS AND HATCH COAMINGS

1 Corrosion addition for hatch covers and coamings

The requirements follow IACS UR S21 and S21A as shown in Table 1.

Table 1 Corrosion addition t_c as per IACS UR S21, S21A

Application	*Structure*	*t_c [mm]*
Weather deck hatches of container ships, car carriers, paper carriers, passenger vessels [1)]	Hatch covers	1.0
	Hatch coamings	See applicable section: Sec.2, Sec.3, Sec.4, Sec.5, Sec.6 or Sec.7
Weather deck hatches of all other ship types except bulk carriers, ore carriers and combination carriers, as defines in IACS UR Z11 [1)]	Hatch covers in general	2.0
	Weather deck exposed plating and bottom plating of double skin hatch covers	1.5
	Internal structure of double skin hatch covers and closed box girders	1.0
	Hatch coamings not part of the longitudinal hull structure	1.5
	Hatch coamings part of the longitudinal hull structure	See longitudinal strength members in section as applicable: Sec.2, Sec.3, Sec.4, Sec.5, Sec.6 or Sec.7
	Coaming stays and stiffeners	1.5
Bulk carriers, ore carriers and combination carriers [2)]	Single skin hatch covers, all structure	2.0
	Double skin hatch covers, top and bottom plating	2.0
	Double skin hatch covers, internal structure	1.5
	Hatch coaming and coaming stays	1.5

[1)] IACS UR S21A, applies to vessels with 'date of contract for construction' on or after 2012-07-01. For vessels built prior to this date see section 3-7 as applicable: Sec.2, Sec.3, Sec.4, Sec.5, Sec.6 or Sec.7.

[2)] IACS UR S21, applies to vessels with 'date of contract for construction' on or after 2004-01-01, and also for hatch cover forward of 0.25 L with 'date of contract for construction' on or after 1998-07-01. For vessels built prior to this date, see Sec.4 or Sec.5 as applicable.

2 Steel renewal

t_{net} = $t_{gr\text{-}off} - t_c$, in mm

t_c = given in Table 1.

For single skin hatch covers, the plating of double skin hatch covers and coaming structures the corrosion additions are provided in Table 1. Steel renewal is required where the gauged thickness is less than $t_{net} + 0.5$ mm.

Where the gauged thickness is within the range $t_{net} + 0.5$ mm and $t_{net} + 1.0$ mm, steel renewal is required. Alternatively, coating (applied in accordance with the coating manufacturer's requirements) or annual gauging may be adopted.

Coating shall be maintained in good condition, as defined in DNV-RU-SHIP Pt.7 Ch.1 Sec.1 Table 1.

For the internal structure of double skin hatch covers, thickness gauging is required when hatch cover top or bottom plating renewal shall be carried out or when this is deemed necessary, at the discretion of the surveyor, on the basis of the plating corrosion or deformation condition. In these cases, steel renewal for the internal structures is required where the gauged thickness is less than t_{net}.

For corrosion addition $t_c = 1.0$ mm the thickness for steel renewal is t_{net}, and the thickness for coating or annual gauging is when gauged thickness is between t_{net} and $t_{net} + 0.5$ mm.

SECTION 9 PITTING, GROOVE AND EDGE CORROSION

1 Pit corrosion

1.1 General

The following assumptions apply:

— pitting repair by plastic compound filler material is only considered as a method to prevent further corrosion and does not contribute to the strength.
— hard coating should be applied after repair.

1.2 Minimum acceptable remaining thickness without repair

a) For plates with pitting intensity less than 10%, the minimum remaining thickness in pitting shall be at least:

t_{min}= 0.6 t_{as_built}

but, not less than 6 mm.

b) For plates with '100% pitting intensity' (i.e. general corrosion) the average remaining thickness, in the worst cross section through the pitting in a plate field should not be less than minimum thickness for general corrosion given in Sec.2, Sec.3, Sec.4, Sec.5, Sec.6 or Sec.7.

c) For intermediate pitting intensities, acceptance of average remaining thickness may be decided based on linear interpolation between a) and b) above.

d) Pitting intensity above 50% is shall be regarded as 100% (general corrosion).

e) Single hull bulk carriers subject to ESP, see DNV-RU-SHIP Pt.7 Ch.1 Sec.3 [2.3.4].

1.3 Average remaining thickness for pitted areas

As a guide for estimating the average remaining thickness for pitted areas the following may be applied:

t_{act} = t_{plate} $(1\text{-}Int/100)$ + t_{pit} $Int/100$

t_{act} = corrected average remaining thickness

t_{plate} = average remaining thickness outside pitting

t_{pit} = average remaining thickness in pitting

Int = estimated pitting intensity in %.

Further, in order to assist in the assessment of estimated pitting intensity, see Figure 1.

1.4 Repair

a) For widely scattered pitting, i.e. intensity < 5%, see Figure 1 and where the remaining thickness in pitting is not less than 6 mm, the following applies:

   i) The use of filler material/plastic compound of a suitable elastic type according to the manufacturer's instructions may be acceptable provided:

      — the pitting shall be thoroughly cleaned (sand/grit blasted) and dried prior to application
      — the pitting shall be completely filled
      — a top layer of coating shall be applied.

      When the depth and/or intensity of the pits are outside of acceptance criteria in [1.2]

      then filling of the pits with a filler material/compound only, is not considered a permanent repair.

   ii) Welding, may be carried out afloat, in accordance with the following:

      — the pitting shall be thoroughly cleaned, ground and dried prior to welding
      — low hydrogen electrodes approved for the material in question shall be used. The weld shall start outside the pitting and the welding direction shall be reversed for each layer.

b) Unless otherwise is agreed on a case by case basis, for high intensity pitting and/or where the remaining thickness is below the acceptable limits, plates and stiffeners shall be renewed by inserts.

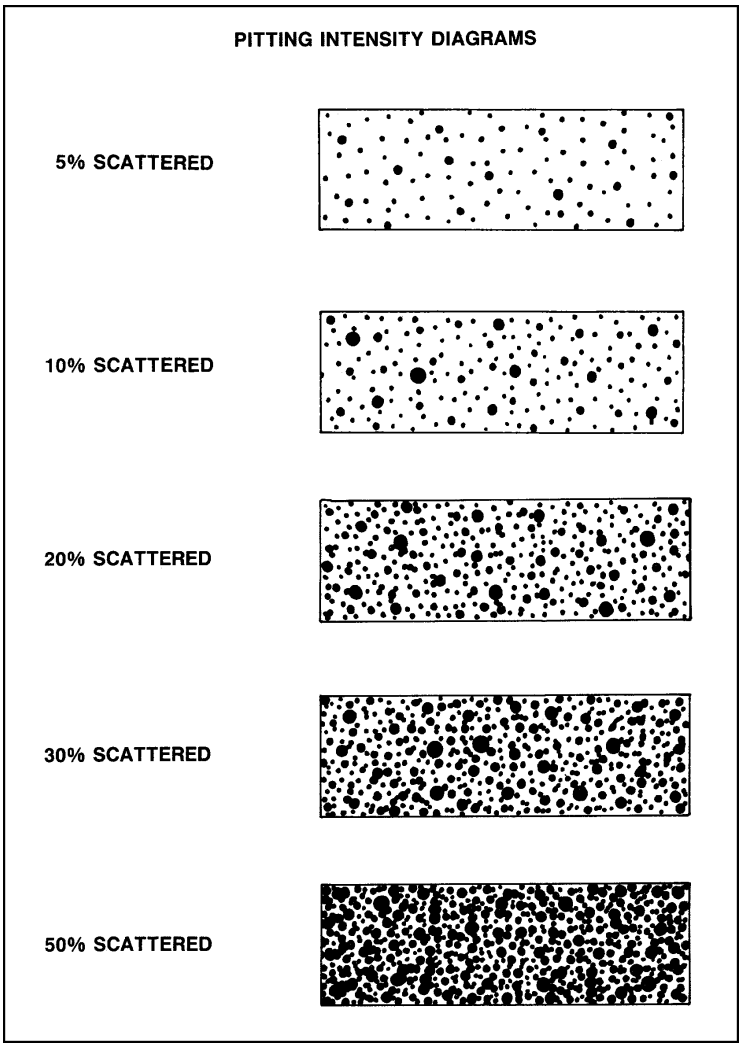

Figure 1 Pitting intensity

2 Groove corrosion

2.1 General

Groove corrosion normally takes place in the heat affected zone adjacent to welds and is of particular concern for the connection of side frames to (shell) plate in single skin bulk carriers, see DNV-RU-SHIP Pt.7 Ch.1 Sec.3 [2.3.4]. However, grooving may be a problem for various ship types. Other commonly affected areas are:

— web frame connections to deck/stiffeners (ballast tanks)
— webs of side/deck longitudinals (ballast tanks)
— external shell plates in the forward part of the vessel.

Edge corrosion is mainly found around cutouts in web structures and at the free edges of flat bar deck longitudinals.

2.2 Assumptions

The following assumptions apply:

— grooves and edges are smooth and without sharp edges or notches
— welding is intact and with acceptable remaining throat thickness
— 'accumulated transverse grooves' means the total length of all grooves at each structural member in deck, bottom, longitudinal bulkhead or side plating within the cargo area of the ship.

Limits are given in the below subsections.

2.3 Groove corrosion of internal structures

The maximum extent of grooving and the acceptable minimum thickness of stiffeners and plates may be taken as follows:

Where the groove breadth is a maximum of 15% of the web height, but not more than 100 mm, the remaining allowable thickness in the grooved area may be taken as, see Figure 2:

$t_{min} = 0.7 \cdot t_{as\_built}$

$t_{min} = 0.75 \cdot t_{as\_built}$ for L-profiles,

but not less than 6.0 mm.

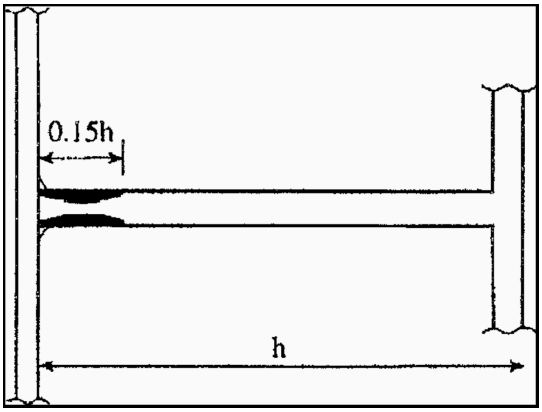

Figure 2 Groove corrosion

Accumulated transverse grooves in deck, bottom, longitudinal bulkhead or side plating within the cargo area is shall be limited to 20% of the breadth respective height of the ship. For ships with large deck openings, such as container ships, the accumulated length of transverse grooves in the passageway shall be limited to 10% of the breadth.

2.4 Corroded welded seams in shell plating

Minimum thickness at the weld or plate:

$t_{min} = 0.7 \cdot t_{as\_built}$

Accumulated transverse grooves in bottom and side plating within the cargo area shall be limited to 20% of the breadth respective height of the ship.

3 Edge corrosion

3.1 General

3.1.1 Introduction

Exposed edges of stiffeners and openings are prone to edge corrosion.

3.1.2 Flat bar deck longitudinals

For acceptable extent of corrosion of the free edge of the longitudinals the following may be applied:

a) the overall height of the corroded part of the edge is less than 25% of the stiffener web height

b) the edge thickness is not less than 1/3 t_{as_built} and well rounded, see Figure 3

c) the thickness of the remaining part of the longitudinal is above the minimum allowable as per Sec.2, Sec.3, Sec.4, Sec.5, Sec.6 or Sec.7.

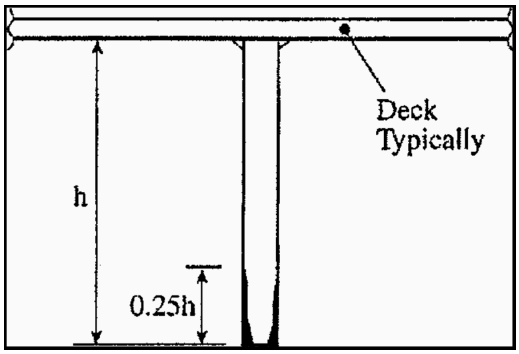

Figure 3 Extent of free edge corrosion

3.1.3 Manholes, lightening holes, etc.

Plate edges at openings for manholes, lightening holes, etc. may be reduced below the minimum thickness as described below:

a) The maximum extent of the reduced plate thickness, below the minimum given in Sec.2, Sec.3, Sec.4, Sec.5, Sec.6 or Sec.7 as applicable, from the opening edge shall not be more than 20% of the smallest dimension of the opening but should not exceed 100 mm, see Figure 4.

b) Rough or uneven edges may be cropped-back provided the maximum dimension of the opening is not increased by more than 10%. Special care shall be taken in areas with high shear stresses, including areas with adjacent cut-outs.

3.2 Repair

Where excessive edge corrosion is found the standard repair is to crop and renew with inserts of original scantling. However, alternative repairs may be considered as follows:

a) edges of openings may be reinforced by:

   i) compensation reinforcement ring with lap joint, see Figure 4

   ii) additional flanges

   iii) possible closing of openings by collar plates around stiffener and at corner cutouts adjacent to the affected areas shall be considered.

b) re-welding of grooves and corroded butts or seams:

i) the surfaces shall be cleaned, ground and dried before welding
ii) low hydrogen electrodes shall be used.

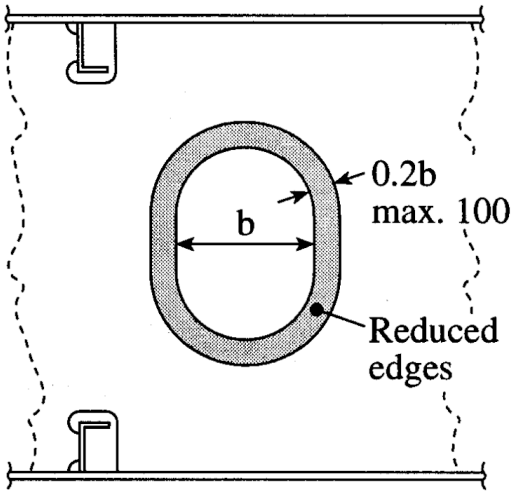

Figure 4 Extent of corrosion in way of manholes, etc.

SECTION 10 CSR - PITTING, GROOVE, AND EDGE CORROSION

1 General

1.1 Application

This section applies to local corrosion on oil tankers and bulk carriers built under IACS common structural rules (CSR).

1.2 Symbols

t_{ren} = renewal thickness: minimum allowable thickness, in mm, below which renewal of structural members shall be carried out

t_C = total corrosion addition, in mm, defined in IACS CSR.

2 Pit corrosion

2.1 General

The following assumptions apply:

— pitting repair by plastic compound filler material is only considered as a method to prevent further corrosion and does not contribute to the strength
— hard coating should be applied after repair.

2.2 Side structures of bulk carriers

2.2.1 Application

Applicable for bulk carriers where coating is required.

2.2.2 Pitting intensity

If pitting intensity in an area where coating is required, according to IACS CSR, as applicable, is higher than 15%, see Figure 1, thickness measurements shall be performed to check the extent of pitting corrosion. The 15% is based on pitting or grooving on only one side of a plate.

In cases where pitting is exceeding 15%, as defined above, an area of 300 mm diameter or more, at the most pitted part of the plate, shall be cleaned to bare metal and the thickness measured in way of the five deepest pits within the cleaned area. The least thickness measured in way of any of these pits shall be taken as the thickness to be recorded.

The minimum remaining thickness in pits, grooves or other local areas shall be greater than the following without being greater than the renewal thickness (t_{ren}):

— 75% of the as-built thickness, in the frame and end brackets webs and flanges (applicable for single side CSR bulk carriers)
— 70% of the as-built thickness, in the side shell, hopper tank and topside tank plating attached to each side frame, over a width up to 30 mm from each side of it.

2.3 Other structures

For plates with pitting intensity less than 20%, see Figure 1, the measured thickness, t_m of any individual measurement shall meet the lesser of the following criteria:

$t_m \geq 0.7\ (t_{as\text{-}built} - t_{vol\ add})$

$t_m \geq t_{ren} - 1.$

The average thickness across any section in the plating shall not be less than the renewal criteria for general corrosion given in IACS CSR.

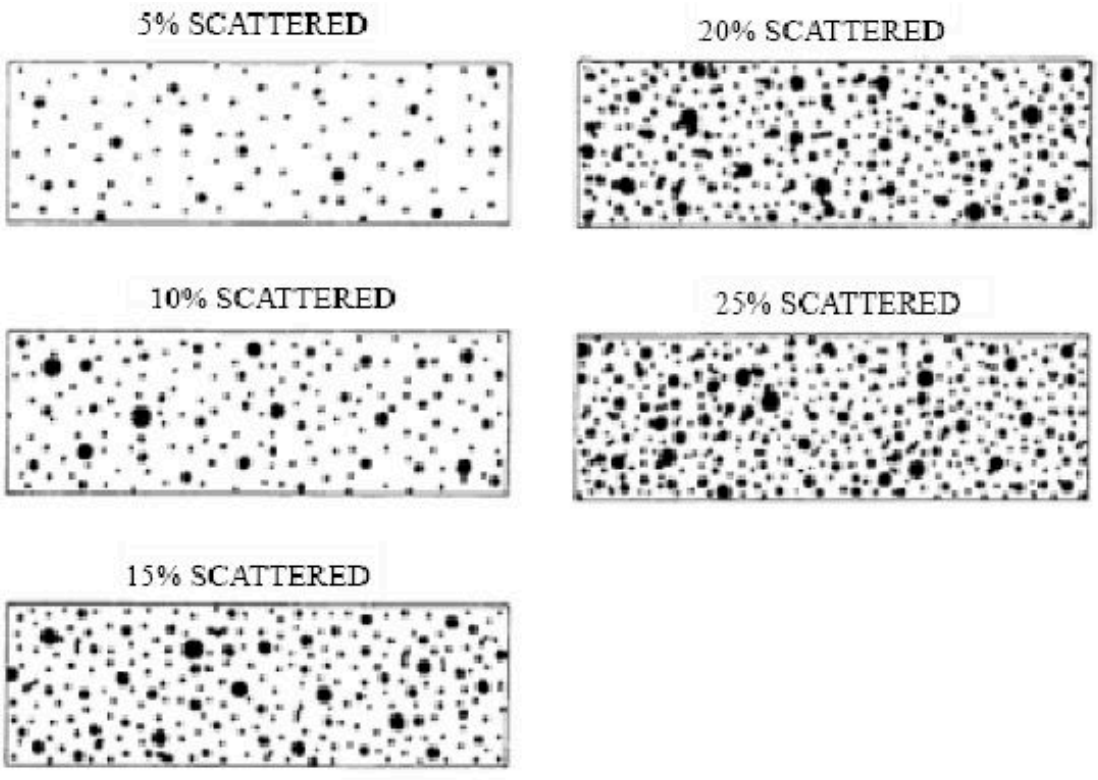

Figure 1 Pitting intensity diagrams

3 Edge corrosion

3.1 General

Provided that the overall corroded height of the edge corrosion of the flange, or web in the case of flat bar stiffeners, is less than 25%, see Figure 2, of the stiffener flange breadth or web height, as applicable, the measured thickness, t_m, shall meet the lesser of the following criteria:

$t_m \geq 0.7\ (t_{as\text{-}built} - t_{vol\ add})$

$t_m \geq t_{ren} - 1.$

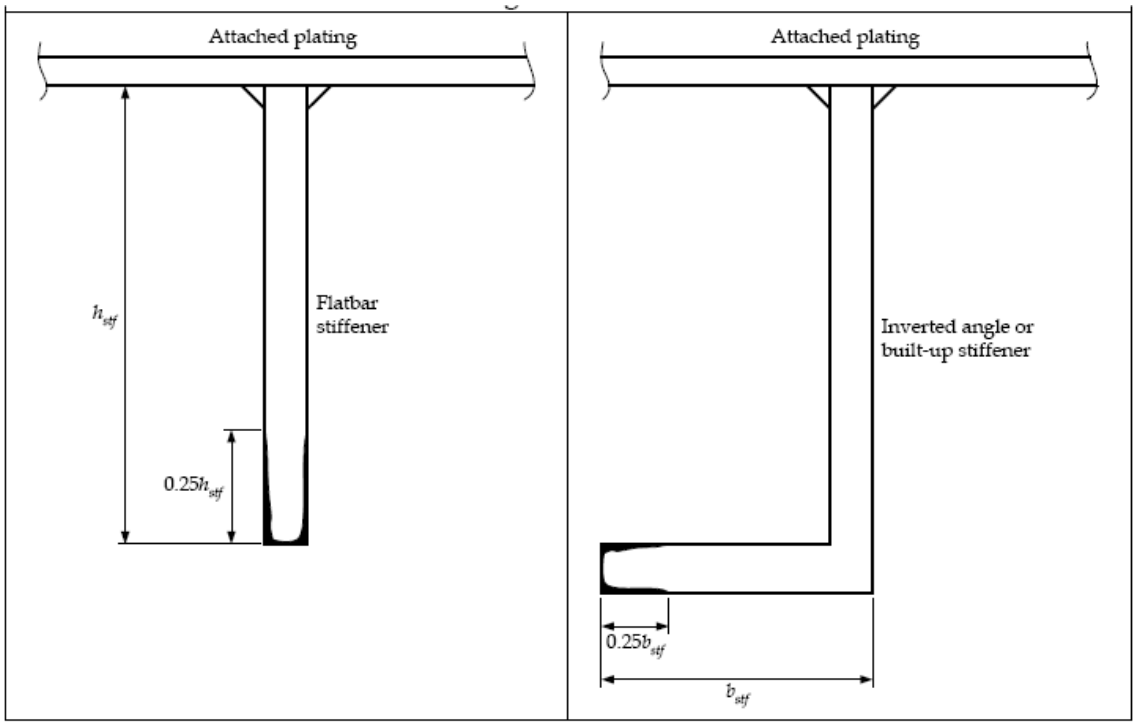

Figure 2 Edge corrosion

3.2 Average thickness

The average measured thickness across the breadth or height of the stiffener shall be less than what it is defined in IACS CSR (and this is usually shown on the approved drawing).

3.3 Edges at openings

Plate edges at openings for manholes, lightening holes, etc., may be below the minimum thickness given in IACS CSR provided that:

1) the maximum extent of the reduced plate thickness, below the minimum given in IACS CSR, from the opening edge is not more than 20% of the smallest dimension of the opening and does not exceed 100 mm
2) rough or uneven edges may be cropped back provided that the maximum dimension of the opening is not increased by more than 10% and the remaining thickness of the new edge is not less than t_{ren} - 1 mm.

4 Groove corrosion

4.1 General

Where the groove breadth is a maximum of 15% of the web height, but not more than 30 mm, see Figure 3, the measured thickness, t_m, in the grooved area shall meet the lesser of the following criteria:

$t_m \geq 0.75\ (t_{as\text{-}built} - t_{vol\ add})$
$t_m \geq t_{ren} - 0.5$
but is not to be less than
$t_m = 6$.

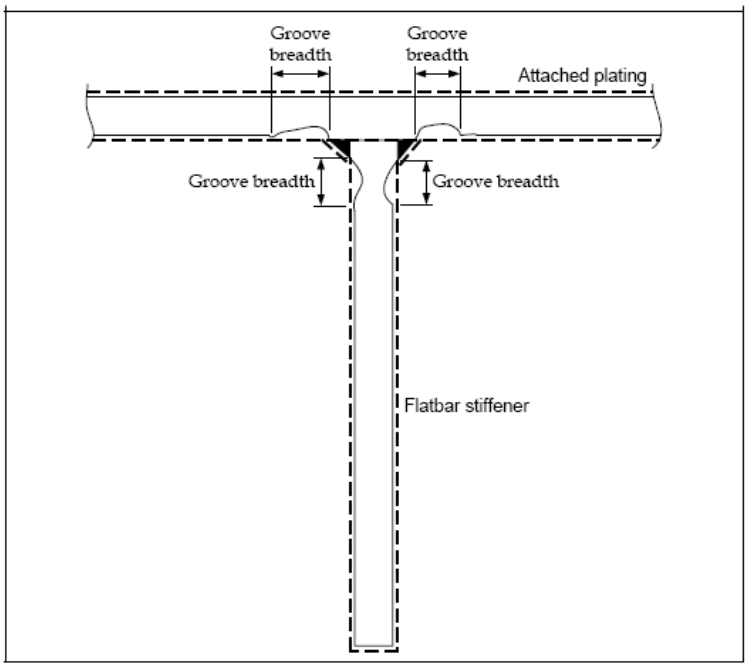

Figure 3 Groove corrosion

4.2 Structural members

Structural members with areas of grooving greater than those in [4.1] shall be assessed based on the criteria for general corrosion as defined in IACS CSR, using the average measured thickness across the plating and stiffener.

SECTION 11 CONTAINER SECURING EQUIPMENT

1 General

1.1 Scope

This section provides requirements and guidance on allowable wear and tear of container supporting structures, approved according to DNV-RU-SHIP Pt.5 Ch.2 Sec.8 and container securing equipment certified according to DNV-CP-0068.

1.2 Application

The requirements of this section apply to ships with the class notations **Container ship** or **Container** and to fixed and loose container securing devices with a product certificate issued by the Society according to DNV-CP-0068.

1.3 Thickness measurements

Thickness measurements on container securing equipment shall be carried out with appropriate measurement devices.

Areas for measuring may need to be prepared or cleaned by metal brush to prevent false measurement from significant corrosion and paint.

2 Container supporting structures

2.1 General

Cracks and deformed structural elements shall be repaired.

Guidance note:

Acceptable deformations may be based on IACS Rec.47.

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

The width of the aperture (ISO-hole) shall not exceed 66.0 mm. The length of the aperture shall not exceed 127.0 mm (not applicable to longhole-foundations).

2.2 Cell guides

Cell guide rails and cell guides heads shall not exceed a diminution of 20% in thickness due to corrosion and wear.

Support brackets of cell guides to bulkheads shall not exceed the corrosion allowance t_k:

t_k = 1.5 mm for t ≤ 11.5 mm

t_k = 0.09 t + 0.45 mm, max. 3.0 mm for t > 11.5 mm.

2.3 Container stanchions

Container stanchion plating shall not exceed the corrosion allowance t_k:

t_k = 1.5 mm for t ≤ 11.5 mm

t_k = 0.09 t + 0.45 mm, max. 3.0 mm for t > 11.5 mm.

2.4 Lashing bridges

Main structural members of lashing bridges, such as:

— pillars
— diagonal bracings
— shear plates
— platform top and
— face plates

shall not exceed the corrosion t_k:

t_k = 1.5 mm for t ≤ 11.5 mm

t_k = 0.09 t + 0.45 mm, max. 3.0 mm for t > 11.5 mm.

3 Fixed container securing devices

3.1 Container foundations

3.1.1 Top plates

The minimum top plate thickness of container foundations shall be not less less than 26.0 mm, see Figure 1. The thickness of top plate shall be measured in the aperture in way of the twistlock contact area.

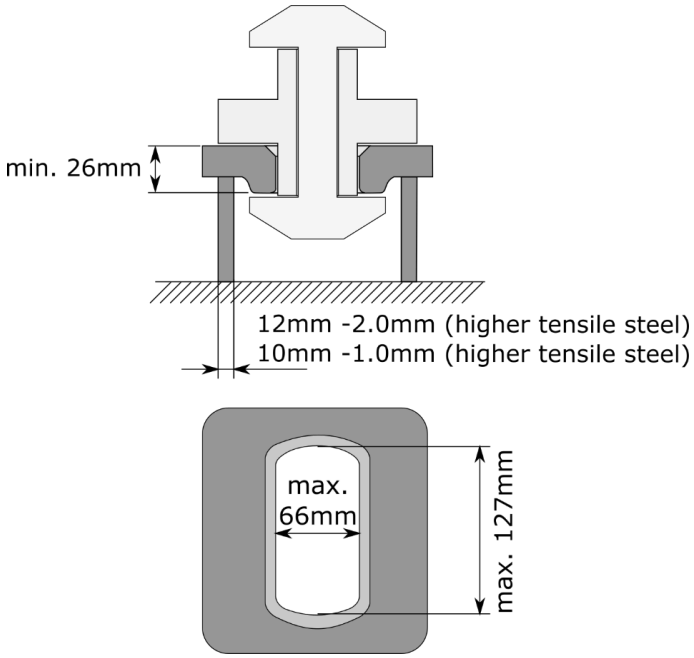

Figure 1 Raised container foundation

3.1.2 Raised container foundations

The allowable minimum thickness of raised container socket side plates including wear and tear is given in Table 1. The values are applicable for raised container sockets made of high strength steel.

Table 1 Minimum thickness of side plates of container foundation

Nominal side pate thickness t according to drawing	*Minimum thickness*
t = 10.0 mm	9.0 mm
t = 12.0 mm	10.0 mm

For raised foundations made of mild steel the minimum acceptable thickness of side plates shall be determined by proof load tests.

3.1.3 Dovetail foundations

Dovetail fondations as shown in Figure 2 and sliding foundation shall be checked with regard to wear or upward bending of the supporting wedges. The increase of clearance between supporting wedges of dovetail or sliding twistlock shall not exceed 2 mm. Corrosion diminution shall not exceed 3 mm for the supporting wedges.

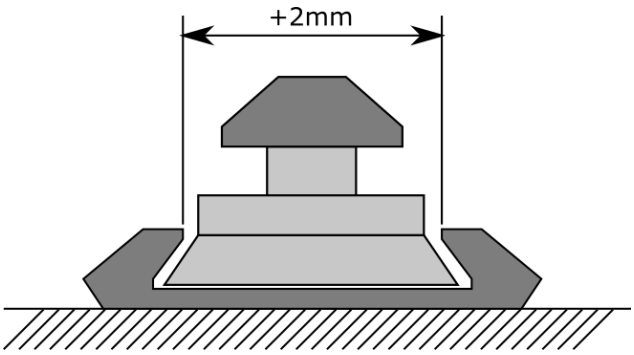

Figure 2 Dovetail foundation

3.2 Lashing eyes

The corrosion margin for plate thickness of lashing eye plates, see Figure 3, made of higher strength steel grade shall not exceed 20%. The diameter of the aperture may increase by maximum 10%. The diameter shall be measured at an angle of 45° and 90° and then the average of the measurements shall be used for evaluation, see Figure 3.

For lashing eye plates made of mild steel the above margins are 10% and 5% respectively.

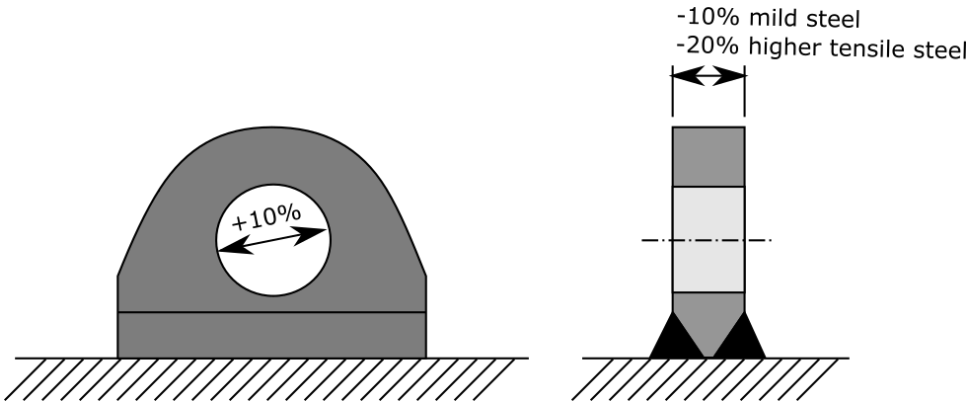

Figure 3 Lashing eye plate

For lashing D-rings the clamp and D-ring a corrosion diminution limit of 10% is acceptable, see Figure 4.

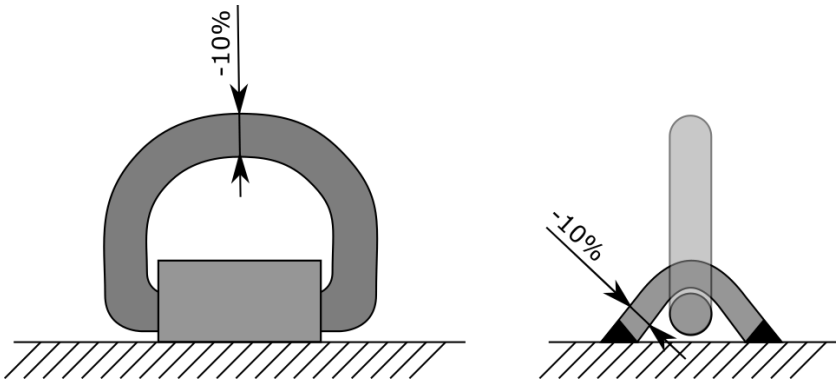

Figure 4 D-ring

Deformed or cracked lashing eyes, D-rings, and clamps shall be replaced.

3.3 Welded cones

Corrosion diminution of welded cones, see Figure 5, shall not exceed 20% of the maximum width or length measured between the flanks of the cone which are in contact with the aperture of container corner fittings. Cracks or significant, permanent deformations are not permitted. Such damaged cones shall be replaced.

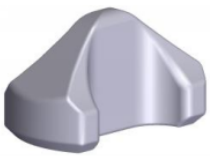

Figure 5 Weld-on cone

3.4 Guide fittings

Corrosion diminution of guide fittings, see Figure 6, shall not exceed 20% of the width for full metal guide fittings or 20% plate thickness of guide fittings constructed by welded steel plates or made of cast steel. Cracks or significant permanent deformations are not permitted. Such damaged cones shall be replaced.

Figure 6 Guide fitting

4 Loose container securing devices

4.1 General

The maintenance of loose container securing devices shall be filed in the maintenance record document. A separate storage shall be assigned for devices to be repaired or scrapped.

The type of the loose equipment shall comply with the equipment described in the approved cargo securing manual on board. Replacement of loose lashing equipment with another type of equipment shall be described in the modification page of the cargo securing manual. Related product certificates, drawings and maintenance instructions shall be filed on board.

Guidance note:

The update of and the amendment to the cargo securing manual may be approved during the devices exchange process.

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

4.2 Twistlocks and other cone type locking devices

The requirements of this subsection apply to twistlocks, such as fully automatic locks, midlocks and hanging stackers.

Twistlocks, see Figure 7, and other device types shall be randomly checked for overall condition, deformations and cracks. The function and loose housing and function of lever-actuated cones shall be checked for manual twistlocks or pull-wire operation for semi-automatic twistlocks.

The flange thickness of the housing of bottom of cone type devices shall not be reduced by more than 2 mm.

Cone type devices in non-acceptable conditions shall either be scrapped and replaced or kept separate until be repaired.

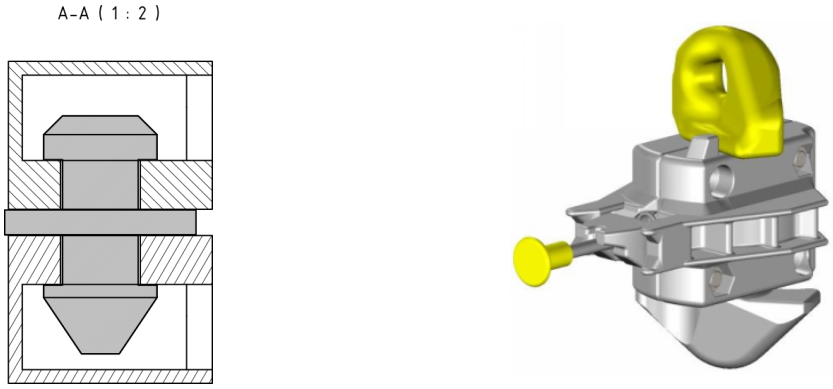

Figure 7 Schematic twistlock, semi-automatic twistlock

4.3 Lashing rods

Lashing rods, see Figure 8, shall randomly checked for overall condition with regard to deformations, cracks and corrosion. Reduction of diameter of lashing rods due to corrosion or shafing shall not exceed 1.5 mm.

The knobs of the lashing rod shall not be deformed more than 1mm in way of the load transfer to the turnbuckle.

Bent or cracked lashing rods shall be scrapped and replaced.

Figure 8 Lashing rod and extension rod

4.4 Turnbuckles

Turnbuckles, see Figure 9, shall be randomly checked for overall condition with regard to deformations, cracks and corrosion. Reduction of diameter for round bars or reduction of thickness of square profiles of turnbuckles shall not exceed 1.5 mm. For lashings using knob-type lashing rods, the contact surface between lashing rod knob and turnbuckle shall not be reduced by corrosion or wear.

The shackle fork of the turnbuckle shall not be deformed.

Bent or cracked turnbuckles shall be replaced.

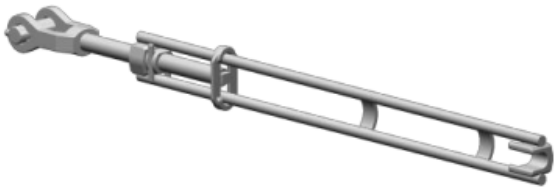

Figure 9 Turnbuckle

SECTION 12 REPAIR

1 General

See IACS Rec. no.47 *Shipbuilding and Repair Quality Standard*, Part B.

Areas found with diminution in excess of acceptable limits shall be repaired with inserted material of same grade and scantlings as the original. Alternative dimensions materials and repair methods may, however, be accepted provided they are approved by the Society. See DNV-RU-SHIP Pt.1 Ch.1 Sec.3 [2.5].

Regarding procedures for damage assessment, commencement and acceptance of repairs, see DNV-RU-SHIP Pt.1 Ch.1 Sec.3 [2.5].

Where inserts are arranged for repairs, the remaining thickness for existing areas, adjacent to replacement areas should normally be at least 1 mm in excess of the minimum thickness.

CHANGES – HISTORIC

July 2021 edition

Changes July 2021

Topic	*Reference*	*Description*
Hatch covers for cargo holds forward of 0.25 L	Sec.4 [3.3]	Section 8 applies to hatch covers forward of 0.25 L for bulk carriers, ore carriers and combination carriers with 'date of contract for construction' on or after 1998-07-01.
	Sec.8 Table 1	Sec.8 Table 1 Note 2) has been updated accordingly: IACS UR S21, applies to vessels with 'date of contract for construction' on or after 2004-01-01, and also to hatch cover forward of 0.25L for 'date of contract for construction' on or after 1998-07-01. For vessels built prior to this date, see Sec.4 or Sec.5 as applicable.
Repair of pits	Sec.9 [1.4]	When the depth and/or intensity of the pits are outside of acceptance criteria in [1.2] then filling of the pits with a filler material/compound only, is not considered a permanent repair. Unless otherwise is agreed on a case by case basis, for high intensity pitting, and/or where the remaining thickness is below the acceptable limits, plates and stiffeners shall be renewed by inserts.
Minimum thickness for pitting, groove and edge corrosion	Sec.10	New section, local corrosion criteria as defined in IACS UR Z10.2, Z10.4, Z10.5 and IMO ESP code.
Rebranding to DNV	All	This document has been revised due to the rebranding of DNV GL to DNV. The following have been updated: the company name, material and certificate designations, and references to other documents in the DNV portfolio. Some of the documents referred to may not yet have been rebranded. If so, please see the relevant DNV GL document.

August 2020 edition

Changes August 2020

Topic	*Reference*	*Description*
General	The whole document	The class guideline has been re-structured according to main class and rule set (DNVGL-RU-SHIP, DNVGL-RU-HSLC, DNVGL-RU-YACHT and DNVGL-RU-NAVAL).
100A5 anchor and anchor chain	Sec.4 [1.4]	Requirements to anchor and chain are deleted here because they are stated in DNVGL-RU-SHIP Pt.7 Ch.1 Sec.4 [2.1.5].
1A1	Sec.4 [3.1.1]	Corrosion allowance for strength elements of stainless steel and aluminum included.

Topic	*Reference*	*Description*
	Sec.4 Table 1	Allowance for inner bottom on bulk carriers increased from 20% to 25%.
	Sec.4 [3.1.3]	Calculation procedure for hull girder ultimate global strength make use of new calculation tools developed for **1A** rules. Ultimate strength check only required for single deck vessels > 150 m. These changes are simplifying calculations in connection with check of global strength.
1A1 hatch covers and coamings	Sec.4 [3.3]	Alignments of requirements for hatch covers and hatch coamings governed by IACS UR S21 / S21A - latest edition.
1A Container ship	Sec.5 [1.4]	Requirements to anchor and chain have been deleted, since these are stated in the rules.
	Sec.8 Table 1	Minimum thickness for hatch cover and coamings moved to separate subsection.
Naval vessels	Sec.6	Only local corrosion criteria applies.
High speed craft, yachts and aluminum vessels	Sec.7	Yachts and aluminum vessels included. For aluminum and stainless steel, to allow for milling tolerances and rounding of calculation results, the corrosion allowance may be taken as 0.5 mm unless a higher value is documented by approved drawings.
Hatch cover and hatch coamings	Sec.8	IACS UR S21 / S21A requirements will eventually affect all ships, these requirements have been put in a common section.
100A5 hatch covers and hatch coamings	Sec.8	Alignments of requirements for hatch covers and hatch coamings governed by IACS UR S21 / S21A - latest edition.
Pit corrosion	Sec.9 [1.2]	Allowance for depth of single pit increased from 30% to 40%. Pit corrosion with an extent of more than 50% shall be regarded as general corrosion.
Pitting, groove and edge corrosion	Sec.9 [3]	Edge corrosion. Content has been moved into separate subsection.
Repair	Sec.10	Some guidance for repair and rules for ships included.
General guidance for survey of voyage repair	App. A deleted	Outdated and therefore deleted.
Early introduction to CSR	App. B deleted	Outdated and therefore deleted.

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This is a new document.

About DNV

DNV is the independent expert in risk management and assurance, operating in more than 100 countries. Through its broad experience and deep expertise DNV advances safety and sustainable performance, sets industry benchmarks, and inspires and invents solutions.

Whether assessing a new ship design, optimizing the performance of a wind farm, analyzing sensor data from a gas pipeline or certifying a food company's supply chain, DNV enables its customers and their stakeholders to make critical decisions with confidence.

Driven by its purpose, to safeguard life, property, and the environment, DNV helps tackle the challenges and global transformations facing its customers and the world today and is a trusted voice for many of the world's most successful and forward-thinking companies.

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