BULK CARRIER SAFETY

Retroactive Requirements for existing bulk carriers

July 2003

ClassNK
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**Bulk Carrier Safety**

Introduction

Retroactive upgraded requirements for existing Bulk Carriers, so called Bulk Carrier Safety consisting structural and stability requirements against flooding of foremost cargo hold: NK Rule Part C Chapter C31B, IACS UR-S19, 22 & 23 which have been implemented since July 1998, as well as other retroactive requirements for Loading Computer and Loading/Unloading Sequence Booklet which have already been settled. In addition to the above, it has been concluded to introduce the following retroactive requirements for existing Bulk Carriers, as the result of measures announced by IACS in March 2002 so called 8 initiatives and subsequent discussions at IMO/IACS.

1. Early implementation of structural and stability requirements against flooding of foremost cargo hold
2. Amendment of ESP requirements
3. Installation of water level detection and alarm system for cargo holds, forward spaces & ballast tanks
4. Installation of dewatering arrangements for dry spaces & ballast tanks
5. Requirements to increase the integrity of fore deck fitting
6. Improving of Cargo Hatch cover stopper and securing arrangements
7. Upgraded renewal criteria of hold frames

<table>
<thead>
<tr>
<th>No</th>
<th>Implementation Scheme</th>
<th>03.01</th>
<th>03.07</th>
<th>04.01</th>
<th>04.07</th>
<th>05.01</th>
<th>05.07</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Early implementation of structural and stability requirements against flooding of foremost cargo hold (L_f \geq 100m)</td>
<td></td>
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<td>2</td>
<td>Amendment of ESP requirements</td>
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<td>3</td>
<td>Installation of water level detection and alarm system for cargo holds, forward spaces &amp; ballast tanks</td>
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<td>4</td>
<td>Installation of dewatering arrangements for dry spaces &amp; ballast tanks</td>
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<td>5</td>
<td>Requirements to increase the integrity of fore deck fitting (L_s \geq 100m)</td>
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<td>6</td>
<td>Improving of Cargo Hatch cover stopper and securing arrangements</td>
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<td>7</td>
<td>Upgraded renewal criteria of hold frames</td>
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</tr>
</tbody>
</table>

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A. Bulk Carrier

B. Bulk Carrier (Double Hull)

C. Ore Carrier

D. Dry Cargo other than the above (Except for RO/RO, PCC, Chip)
Chapter 1 Early implementation of structural and stability requirements against flooding of foremost cargo hold

1-1 Application

1-1-1 Scope
Single Hull Bulk Carriers of which freeboard length Lf ≥ 150m or over, carrying bulk cargoes having density of 1.78t/m³ and above

1-1-2 Implementation

<table>
<thead>
<tr>
<th>Ship’s Age on 1 July 1998 (A)</th>
<th>Implementation Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 years ≤ A&lt;15years</td>
<td>By the due date of the next first Intermediate Survey or Special Survey after the date on which the ship reaches 15 years of age, but not later than the date on which the ship reaches 17 years of age</td>
</tr>
<tr>
<td>5 years ≤ A&lt;10years</td>
<td>By the due date of the first Intermediate Survey or Special Survey after 1 July 2003</td>
</tr>
<tr>
<td>A &lt; 5 years</td>
<td>By the date on which the ship reaches 10 years of age</td>
</tr>
</tbody>
</table>

Status of the application of the requirements for each ship is shown in the Survey Status

Sample of Survey Status:
1) **NOTE:** Where the ship carries bulk cargoes having density of 1.78t/m³ and above the ship should comply with structural and stability requirements against flooding of foremost cargo hold by dd/mm/yy.
   **Apply to** ships that have not verified for compliance with these requirements yet.

2) **NOTE:** Verifications of compliance with structural requirements for aft bulkhead of foremost cargo hold to be conducted at subsequent Special Surveys according to preliminary assessment for IACS UR S19.
   **Apply to** ships that passed initial verification but required continuous verifications since the bulkhead plates between No.1 and No.2 cargo hold are corrugated.

3) **NOTE:** Thickness measurements to be carried out for aft bulkhead of foremost cargo hold at Annual Survey.
   **Apply to** ships that passed initial verification but required annual thickness gauging because of insufficient margin against required thickness \( t_{sec} \).

4) **NOTE:** For foremost cargo hold, survey items for cargo hold required at Intermediate Survey to be carried out at Annual Survey.
   **Apply to** ships adopted alternative measures specified in SOLAS Chapter XII, since damage stability requirements specified in UR-S23 can not be complied with.

5) **NOTE:** Density of solid bulk cargoes restricted to less than 1.78t/m³.
   **Apply to** ships that did not pass initial verification by the due date.

6) **INFORMATION:** Verification of compliance with structural requirements for aft bulkhead of foremost cargo hold not required due to plane bulkhead.
   **Apply to** ships that once passed initial verification, and not required continuous verification since the bulkhead plates between No.1 and No.2 cargo holds are not corrugated.
7) **NOTE:** Structural and stability requirements against flooding of all cargo holds complied. **Apply to** ships the building contract date of which is after 1 July 1998. The retroactive requirements are not applicable to.

8) **INFORMATION:** Bulk Carrier Safety requirements not applied due to double hull construction. **Apply to** ships that have double hull construction. The retroactive requirements are not applicable to.

**1-2 Specific requirements**

Structural (Strength of transverse bulkhead between No.1 and No.2 cargo holds and double bottom in way of No.1 cargo hold) and stability requirements against flooding of No.1 cargo hold have been prescribed.

**1-3 Survey**

1-3-1 Structural Requirements for Transverse Bulkhead Between No.1 and No.2 Cargo Hold

Necessity and extent of reinforcements or steel renewal are concluded by comparing result of thickness measurements for transverse bulkhead and required net thickness shown in The Result of Preliminary Assessment.

1-3-2 Structural Requirements for Double Bottom Construction in Way Of No.1 Cargo Hold

It is stated in The Result of Preliminary Assessment if any reinforcements are required or not. Where any reinforcements are required, please contact ClassNK Survey Department for reinforcing measures.

1-3-3 Stability Requirements

Upon receiving application from the ship’s owner, Head Office examine and issue Statement of Compliance or Non-Compliance. Bulk Carriers with reduced freeboard are exempted from verifications for damage stability requirements.

1-3-4 Bilge Alarm/Water Ingress Detector/Flooding Scenario

In order to enable the ship, who failed to comply with the stability requirements, to carry bulk cargoes having density of 1.78t/m³ and above after the implementation date prescribed in the above 1-1-2, bilge alarms and water ingress detectors are to be installed and flooding scenario showing abandon procedure is to be provided in line with the requirements specified in NK Guidance C31B.2.1. Plan examinations at Head Office for the bilge alarms, water ingress detectors and flooding scenario are not required.

**1-4 Others**

**Attachments**

1-4-1 Flowchart for Application of the Rules to Existing Bulk Carriers

1-4-2 The Result of Preliminary Assessment

1-4-3 Guidance for Steel Renewal and Reinforcement on Aft. Bulkhead of Foremost Cargo Hold.

1-4-4 (Sample) Statement of Compliance (damage stability requirements UR-S23)

1-4-5 (Sample) Statement of Non-Compliance (damage stability requirements UR-S23)

In general Bulk Carriers having 4 cargo holds are hard to comply with the damage stability requirements. Bulk Carriers having 5 cargo holds seldom fail to comply with the requirements.

1-4-6 SC154 and a sample of flooding scenario
Attachment: 1-4-1 Flowchart for Application of the Rules to Existing Bulk Carriers (IACS UR S1A, S19, S22 and S23.2)

START - Existing Bulk Carriers

Length Lf 150m and above?

NO → Not Applicable

YES → Installation of Loading Computer (UR S1A)

(SOLAS XII/10)
Prior to loading of bulk cargo, density of cargo is declared. If the density is within 1.25 - 1.78 t/m³, density is to be tested and verified.

Single Side Skin Construction?

NO → Not Applicable

YES → Provision of Loading Sequence into Approved Loading Manual (UR S1A)

(To be provided by 1 July '99)

Carrying solid bulk cargoes having density of 1.78 t/m³ and above?

NO → Not Applicable

YES → Ship’s freeboard be assigned as B-60 or B-100 type?

YES → SOLAS XII/8

Booklet required by SOLAS VI/7.2 (hereinafter referred to as ‘booklet’) be endorsed in order to indicate that ship has complied with SOLAS Reg.XII/4.2.

SOLAS XII/9 and UR S24

The following requirements for exemption from Reg.4.2 & 6 to be met;
1. Extent of IS in ESP be done at AS for No.1 Cargo hold
2. Bilge well high water level alarms in all cargo holds be installed.
3. Detailed information of flooding scenarios is provided, which is accompanied by instruction based on ISM code.
4. Water ingress alarms in all cargo holds be installed.

Implementation scheme is differed due to ship’s ages.

Not Applicable

Verification to comply with requirements of damaged stability for foremost hold (UR S23.2/ SOLAS Reg.XII/4.2)

No → Not Complied

Complied → SOLAS XII/8

Booklet is endorsed in order to indicate that ship has complied with SOLAS Reg.XII/4.2.

OR

Cease to carry solid bulk cargoes having density of 1.78 t/m³ and above

SOLAS XII/8

NO restriction for loading

YES

Single Side Skin Construction?

NO → Not Applicable

YES

Implementation scheme is differed due to ship’s ages.

Length Lf 150m and above?

NO → Not Applicable

YES

Installation of Loading Computer (UR S1A)

(SOLAS XII/10)
Prior to loading of bulk cargo, density of cargo is declared. If the density is within 1.25 - 1.78 t/m³, density is to be tested and verified.

Prohibition to load cargo having density of 1.78 t/m³ and above, be described in the Approved Loading Manual.

Carrying solid bulk cargoes having density of 1.78 t/m³ and above?

NO → Not Applicable

YES

Ship’s freeboard be assigned as B-60 or B-100 type?

YES

Implementation scheme is differed due to ship’s ages.

Not Applicable

Verification to comply with requirements of damaged stability for foremost hold (UR S23.2/ SOLAS Reg.XII/4.2)

No → Not Complied

Complied → SOLAS XII/8

Booklet is endorsed in order to indicate that ship has complied with SOLAS Reg.XII/4.2.

OR

Cease to carry solid bulk cargoes having density of 1.78 t/m³ and above

SOLAS XII/8

NO restriction for loading

YES

Prohibition to load cargo having density of 1.78 t/m³ and above, be described in the Approved Loading Manual.

Carrying solid bulk cargoes having density of 1.78 t/m³ and above?

NO → Not Applicable

YES

Implementation scheme is differed due to ship’s ages.

Not Applicable

Verification to comply with requirements of damaged stability for foremost hold (UR S23.2/ SOLAS Reg.XII/4.2)

No → Not Complied

Complied → SOLAS XII/8

Booklet is endorsed in order to indicate that ship has complied with SOLAS Reg.XII/4.2.

OR

Cease to carry solid bulk cargoes having density of 1.78 t/m³ and above

SOLAS XII/8

NO restriction for loading

YES

Prohibition to load cargo having density of 1.78 t/m³ and above, be described in the Approved Loading Manual.

Carrying solid bulk cargoes having density of 1.78 t/m³ and above?

NO → Not Applicable

YES

Implementation scheme is differed due to ship’s ages.

Not Applicable

Verification to comply with requirements of damaged stability for foremost hold (UR S23.2/ SOLAS Reg.XII/4.2)

No → Not Complied

Complied → SOLAS XII/8

Booklet is endorsed in order to indicate that ship has complied with SOLAS Reg.XII/4.2.

OR

Cease to carry solid bulk cargoes having density of 1.78 t/m³ and above

SOLAS XII/8

NO restriction for loading

YES

Prohibition to load cargo having density of 1.78 t/m³ and above, be described in the Approved Loading Manual.
1. Thickness measurement

Verification to comply with the structural requirements for aft. W.T.Bhd and double bottom of foremost hold. (IACS UR S19 & S22 / SOLAS Reg.XII/6)

- **SOLAS XII/8**
  - Booklet be endorsed in order to indicate that ship has complied with SOLAS Reg.XII/6

  **Complied**
  - No restriction for loading

  **Not complied**
  - Steel renewal/reinforcement chosen for complying with requirements?

  **YES**
  - Completion of steel renewal/reinforcement works for Bhd. and/or double bottom

  **NO**
  - Restriction on Loading Distribution? (Non-homo → Homo)

    **YES**
    - Re-verification to comply with structural requirements (IACS UR S19 & S22)
    - Not complied
    - Re-approval of Loading Manual

    **Complied**
    - Steel renewal/reinforcement under the restriction

    **NO**
    - Restriction on Max. DWT?

      **YES**
      - Re-verification to comply with structural requirements (IACS UR S19 & S22)
      - Not complied
      - Re-approval of Loading Manual

      **Complied**
      - Steel renewal/reinforcement under restriction

      **NO**
      - Cease to carry solid bulk cargoes having density of 1.78 t/m³ and above

2. Thickness measurement

3. Not complied
The Result of Preliminary Assessment

M.V. “NK BULKER”, CNo.999999

1. Strength of Corrugated Bulkhead in Flooding Condition (IACS UR S19)

1.1 Required Net Thickness (t<sub>net</sub>)(mm)

<table>
<thead>
<tr>
<th>Structural elements</th>
<th>Homo. Loading</th>
<th>Non-homo. Loading</th>
<th>Original Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>t&lt;sub&gt;net&lt;/sub&gt; · 1</td>
<td>t&lt;sub&gt;net&lt;/sub&gt; · 2</td>
<td>t&lt;sub&gt;net&lt;/sub&gt; · 1</td>
</tr>
<tr>
<td>Lower part*1</td>
<td>16.50</td>
<td>14.50</td>
<td>16.50</td>
</tr>
<tr>
<td>Web*2</td>
<td>15.50</td>
<td>13.50</td>
<td>15.50</td>
</tr>
<tr>
<td>Middle part*3</td>
<td>16.50</td>
<td>14.50</td>
<td>16.50</td>
</tr>
<tr>
<td>Web*4</td>
<td>15.50</td>
<td>13.50</td>
<td>15.50</td>
</tr>
<tr>
<td>Shedder plates</td>
<td>-</td>
<td>-</td>
<td>16.50</td>
</tr>
<tr>
<td>Gusset plates</td>
<td>-</td>
<td>-</td>
<td>16.50</td>
</tr>
</tbody>
</table>

*1 : 0.15·l above the top of the lower stool or the inner bottom (if no lower stool fitted)(see Fig.2)
*2 : 0.55·l above the upper end of Lower part (see Fig.2)

l : the span of the corrugated bulkhead as illustrated in Fig.1.

*3,*4 :

\[ t_{net} : t_{net} \cdot 1 \text{ or } t_{net} \cdot 2, \text{ whichever is greater.} \]

\( t_{net} \cdot 1 \) : Required net thickness for bending strength
\( t_{net} \cdot 2 \) : Required net thickness for shear, shear buckling and local bending strength

1.2 Renewal or reinforcement required depending on the gauged thickness (g/t)

<table>
<thead>
<tr>
<th>g/t</th>
<th>t&lt;sub&gt;net&lt;/sub&gt;+0.5 mm</th>
<th>t&lt;sub&gt;net&lt;/sub&gt;+1.0 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>g/t</td>
<td>renewal work is required</td>
<td>coating* or annual gauging may be adopted as an alternative to steel renewal</td>
</tr>
</tbody>
</table>

*: Coating is to be according to the manufacturer’s requirements.

1.2.1 Corrugated Bulkhead

.1 Notwithstanding the above scale, as an ordinary requirement of class survey, steel renewal is required if gauged thickness is found less than 75% of the original thickness.

.2 Steel renewal is required with a minimum thickness of t<sub>net</sub>+2.5 mm, but not less than the original thickness.

.3 For web and flange plates, the alternative reinforcement by doubling strip to replenish the sectional area
corresponding to the required renewal thickness of the above (see the attached guidance) may be accepted providing the gauged thickness is not less than \( t_{\text{net}} - 0.2 + 0.5 \) mm and 75% of the original thickness.

1.2.2 Reinforcement for Lower Stool Slant Plate/ Double Bottom Floor*

Gussets with shedder plates, extending from the lower end of corrugation up to 0.1\( \cdot L \), or reinforcing doubling strips (on bulkhead corrugation and stool slant plate/floor*) are to be fitted where as built thickness of the lower stool slant plate/ double bottom floor* \( (t_a) \) is not more than the required thickness \( (t_{\text{req}}) \) depending on the gauged thickness of the corrugation flange \( (g/t) \) for the lower part of bulkhead as shown in the following table (see the attached guidance for reinforcement work):

<table>
<thead>
<tr>
<th>Thickness of corrugation flange for lower part of Bhd.</th>
<th>( t_{\text{req}} ) (mm)</th>
<th>( t_{\text{st}} ) (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Homo. Loading</td>
<td>Non-homo. Loading</td>
</tr>
<tr>
<td>( g/t &lt; t_{\text{net}} - 0.05 ) mm</td>
<td>16.67</td>
<td>18.23</td>
</tr>
<tr>
<td>( g/t \geq t_{\text{net}} - 0.05 ) mm</td>
<td>13.59</td>
<td>15.86</td>
</tr>
</tbody>
</table>

When \( t_{\text{st}} < t_{\text{req}} \), reinforcement is required.

\( t_{\text{req}} \): Required thickness of the lower stool slant plate/double bottom floor*

\( t_{\text{st}} \): Original thickness of the lower stool slant plate/double bottom floor*

*1: Fore side of the lower stool slant plate/double bottom floor*

*2: Aft side of the lower stool slant plate/double bottom floor*

(∗: if no lower stool fitted)

1.3 Others

.1 For the purpose of thickness measurement and steel renewal or reinforcement, please refer to guidance as attached hereto.

.2 The drawings regarding renewal and/or reinforcement work are required prior to work commencement.

.3 At subsequent special surveys, verification of continuing compliance with IACS UR S19 is required in the same manner as the first verification survey.

2. Strength of Double Bottom Construction (IACS UR S22)

The original design of double bottom construction beneath No.1 Cargo Hold satisfies/does not satisfy (∗) the requirements. (∗) Reinforcement is required for floors and/or girders as follows.

(* delete as appropriate

Appendix: Guidance
Note: For the definition of $l$, the internal end of the upper stool is not to be taken more than a distance from the deck at the center line equal to:
- 3 times the depth of corrugations, in general
- 2 times the depth of corrugations, for rectangular stool

* Fig.1 Corrugated Bulkhead Span($l$)

* Fig.2 Lower Part and Middle Part of Corrugated Bulkhead
1. General
   (1) The extent and specification of steel renewal and/or reinforcement should be shown clearly in plans.
   (2) Renewed or reinforced parts should be applied with an efficient protective coating.

2. Steel renewal for corrugation plate
   (1) Steel renewal with a minimum thickness of \( t_{\text{net}} + 2.5 \text{mm} \), but not less than the original thickness, is required.
      In general, the vertical distance of each renewal zone should be not less than 15% of the vertical distance
      between the upper and lower end of the corrugation measured at the ship’s centerline.
      \( t_{\text{net}} \): Required net thickness for flange or web plates.
   (2) The renewed bulkhead connections to the side shell plating and the lower stool shelf plate or inner bottom
      plate (if no stool is fitted) should be at least made by deep penetration welds (see Fig.1.4.3.1).

3. Steel renewal for shedder plates
   (1) Steel renewal with a minimum thickness of \( t_{\text{net}} + 2.5 \text{mm} \), but not less than the original thickness is required.
      \( t_{\text{net}} \): Required net thickness for shedder plates.
   (2) Shedder plates should be fitted with a minimum slope of 45°.
   (3) Shedder plates should be attached by one side full penetration welds onto backing bars.

4. Steel renewal for gusset plates
   (1) Steel renewal with a minimum thickness of \( t_{\text{net}} + 2.5 \text{mm} \), but not less than the original thickness, is required.
      \( t_{\text{net}} \): Required net thickness for gusset plates.
   (2) The material of gusset plates should be the same as that of the corrugation plating.
   (3) Their connection with the corrugations and the lower stool shelf plate/inner bottom* should be at least made
      by deep penetration welds (see Fig.1.4.3.1).
   (4) Gusset plates should be welded to the lower stool shelf plate/inner bottom in line with the flange of
      corrugation, to reduce the stress concentrations at the corrugation corners.
   (5) Ensure good alignment between gusset plate, corrugation flange and lower stool slant plate/double bottom
      floor*.
   (6) Ensure start and stop of welding is as faraway as practically possible from corners of corrugation.

5. Reinforcing doubling strips for corrugation plate
   (1) The length of the reinforcing strips should be sufficient to allow extending over the whole depth of the
      diminished plating.
   (2) The width and thickness of strips should be sufficient so that the total sectional area of strips on each flange
      or web plates is not less than the value given by the following formula, however, maximum width, minimum
      thickness and maximum thickness should be 200mm, 7mm and \( g/t \) respectively.
      (a) where flange and/or web plates are reinforced:
      \[
      A = \left( t_{\text{net}} + 2.5 \right) - g/t \times b \quad \text{(mm}^2\text{)}
      \]
      \( b \): width of corrugation flange or web
      (b) where only flange plates are reinforced, though reinforcement is required for both flange and web plates:
A = \{(t_{net}+5.0)-g/t\} \times b \ (\text{mm}^2)

b: width of corrugation flange

In this case, where mean value of the gauged web thickness \((g/t)\) is within \(t_{net}-2+0.5\text{mm}\) and \(t_{net}-2+1.0\text{mm}\), coating or annual gauging should be required for corrugation web plates.

(3) The material of the strips should be the same as that of the corrugation plating.

(4) The strips should be attached to the existing bulkhead plating which has adequate grounding by continuous fillet welds at spacing of 30mm and above.

(5) The upper end of the strips and the lower end of the strips with gusset plates should be suitably tapered. The lower end of the strips without gusset plates should be connected to the lower stool shelf plate or inner bottom plate (if no stool is fitted). (see Fig.1.4.3.2)

(6) Where reinforcing strips are connected to the lower stool shelf plate or inner bottom plate (if no stool is fitted), one side full penetration welding should be used. When reinforcing strips are fitted to the corrugation flange and are connected to the lower stool shelf plate or inner bottom plate (if no stool is fitted), they should be aligned with strips of the same scantlings welded to the stool slant plating or double bottom floor and having a minimum length equal to the width of the corrugation flange. (see Fig.1.4.3.2)

6. Lower stool slant plate/double bottom floor*

(1) Reinforcement by doubling strips

(a) The minimum length of the reinforcing strips on bulkhead corrugation and lower stool slant plate or doubling bottom floor (if no lower stool is fitted) should be 15% span of corrugation plate \((0.15 \cdot l)\) and the width of the corrugation flange respectively.

(b) The width and thickness of strips should be sufficient so that the total sectional area of strips on each flange is not less than the value given by the following formula, however, maximum width, minimum thickness and maximum thickness should be 200mm, 7mm and \(g/t\) respectively.

\[
A = (t_{reg}-t_a) \times b \ (\text{mm}^2)
\]

\(t_{reg}\): required thickness which is given in the attachment of the letter (mm)

\(t_a\): original thickness of the lower stool slant plate /double bottom floor*(mm)

b: width of corrugation flange

(c) The material of the strips should be the same as that of the corrugation plating, the lower stool slant plate / double bottom floor*.

(d) Welding and fitting of the strips should be referred to the above 5. (4) to (6).

(2) Reinforcement by gussets with shedder plates

(a) Gussets with shedder plates should be extended from the lower end of corrugation up to 10% span of corrugation plate \((0.1 \cdot l)\).

(b) Shedder and gusset plates should have a thickness equal to or greater than the original bulkhead thickness.

(c) The material of the gusset plates should be the same as that of the corrugation plating.

(d) Shedder plates should be fitted with a minimum slope of 45°.

(e) If gusset plates are to be fitted or renewed, their connections should be as follows:
(i) Their connection with the corrugations and the lower stool shelf plate/inner bottom* should be at least made by deep penetration welds (see Fig.1.4.3.1).

(ii) Gussets plate should be welded to the lower stool shelf plate/inner bottom in line with the flange of corrugation, to reduce the stress concentrations at the corrugation corners.

(iii) Ensure good alignment between gusset plate, corrugation flange and lower stool slant plate/double bottom floor*.

(iv) Ensure start and stop of welding is as far away as practically possible from corners of corrugation.

(v) Shedder plates should be attached by one side full penetration welds onto backing bars.

(*: if no lower stool is fitted)
Fig.1.4.3.2
NIPPON KAIJI KYOKAI

No. 03HE****BCS Date: ** June 2003

Statement of Compliance

THIS IS TO CERTIFY that a damage stability calculation has been carried out, at the request of Messrs. NK SHIP MANAGEMENT Co., Ltd. by the Society for

M/V “NK BULKER”

Flag : ******
Official Number : ******
Distinctive Letters : ******
IMO Number : 99999999
Class Number : 999999

and the compliance to IACS UR S23.2 Requirements has been examined in accordance with

74 SOLAS Convention as amended,
Chapter XII
“Additional Safety Measures for Bulk Carriers”,
Regulation 4
“Damage Stability Requirements Applicable to Bulk Carriers”

to find that, when loaded to the summer loadline, the vessel is able to withstand flooding of the foremost hold and remains afloat in a satisfactory condition of equilibrium as specified in Regulation XII/4.2 – 4.6.

NIPPON KAIJI KYOKAI

Y. Nakamura
Manager, HE Section
Hull Department

Ref. : C.No.999999 M/V “NK BULKER", DAMAGE STABILITY CALCULATION BOOKLET,
This Report is issued subject to the condition that it is understood and agreed that neither the Society nor any of its Committees is under any circumstances whatsoever to be held responsible for any inaccuracy in any report or certificate issued by this Society or its Surveyors or in any entry in the Record or other publication of the Society or for any error of judgment, default or negligence of its Officers, Surveyors or Agents.

97. 11. 100000 (K)

1-12
Statement of Non-Compliance

THIS IS TO STATE that a damaged stability calculation referred hereunder for

M/V "NK BULKER"
Flag : ******
Official Number : ******
Distinctive Letters : ******
IMO Number : 9999999
Class Number : 999999

at the request of Messrs. NK SHIP MANAGEMENT Co., Ltd. has been carried out to evaluate the compliance with

74 SOLAS Convention as amended
Chapter XII
“Additional Safety Measures for Bulk Carriers”
Regulation 4
“Damage Stability Requirements Applicable to Bulk Carriers”

to find that, when loaded to the summer loadline, the vessel is unable to withstand flooding of the foremost hold and cannot remain afloat in a satisfactory condition of equilibrium specified in Regulation XII/4.2 – 4.6.

NIPPON KAIJI KYOKAI

Y. Nakamura
Manager, HE Section
Hull Department


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SC154 Provision of Detailed Information on Specific Cargo Hold Flooding Scenarios (SOLAS XII/9.3)  
(Mar. 2000)

This Unified Interpretation is applicable only to bulk carriers which are constructed before 1 July 1999 but not capable of complying with SOLAS XII/4.2.

Where bulk carriers are shown to be not capable of complying with SOLAS XII/4.2 due to the design configuration of their cargo holds, SOLAS XII/9 permits relaxation from the application of regulations 4.2 and 6 on the basis of compliance with certain other requirements, including provision of detailed information on specific cargo hold flooding scenarios.

1. General – The information should comprise at least the following:
   1.1 Specific cargo hold flooding scenarios.
   1.2 Instructions for evacuation preparedness.
   1.3 Details of the ship’s means for leakage detection

2. Specific cargo hold flooding scenarios
   2.1 Flooding assumptions:
      2.1.1 The flooding of the foremost cargo hold is to be used as the starting point for any respective flooding scenario. Subsequent flooding of other spaces can only occur due to progressive flooding.
      2.1.2 The permeability of a loaded hold shall be assumed as 0.9 and the permeability of an empty hold shall be assumed as 0.95, unless a permeability relevant to a particular cargo is assumed for the volume of a flooded hold occupied by cargo and a permeability of 0.95 is assumed for the remaining empty volume of the hold. The permeability of a hold loaded with packaged cargo shall be assumed as 0.7.
   2.2 Loading conditions to be considered:
      2.2.1 Flooding scenarios should be developed for loading conditions loaded down to the summer load line even if not in compliance with the requirements of Regulation 4.2. The scope to be covered should include at least the following:
         • A homogenous and, if applicable, an alternate hold loading condition are to be considered.
         • In case one or more loading conditions meet the requirements of regulation 4.2, this should be noted.
A packaged cargo condition, if applicable.

2.2.2 In case the vessel is able to withstand flooding of the foremost hold at a lower draught, guidance in the form of limiting KG/GM curves, based on the flooding assumptions in 2.1, should be provided. Curves should indicate the assumed trim and whether the foremost hold is homogeneously loaded, loaded with high density cargo (alternate hold loading), loaded with packaged cargo or empty.

2.3 Presentation of results

The results should clearly indicate the reasons for non-compliance with the survival criteria given in Reg. XII/4.3 and explain the implications regarding the need to abandon ship. e.g. immersion of a weathertight closing appliance if the stability characteristics are otherwise satisfactory may indicate that there is no immediate danger of foundering, provided the bulkhead strength is adequate, particularly if the weather conditions are favorable and bilge pumping can cope with any progressive flooding.

3. Guidance for evacuation

The following guidance in this IACS Interpretation with regard to preparation for evacuation is in the most general terms. Responsibility for the preparation of detailed information rests with the operator of the ship.

3.1 In any case of detection of severe flooding (made in accordance with UR S 24), preparations for abandoning the vessel shall be envisaged in accordance with the applicable rules and procedures, such as SOLAS III, STCW and the ISM Code.

3.2 In the context of severe weather conditions the weather itself may have substantial influence on the development of the flooding and consequently the time remaining to execute the abandoning of the ship could be much shorter than estimated in any pre-assessed flooding scenario.

Note: This UI SC 154 is to be uniformly implemented by IACS Members and Associates from 1 January 2001.
DETAILED INFORMATION ON SPECIFIC CARGO HOLD FLOODING SCENARIOS

The damage scenarios that were considered were based on the following assumptions:

- Damaged compartment: Cargo Hold No.1
- The permeability of a loaded hold was assumed as 0.9 and the permeability of an empty hold was assumed as 0.95.

The loading conditions that were examined and a summary of the results are shown in the following table.

Note: Detailed results of all flooding scenarios considered can be found in Appendix 00. Also, Mar. VCG vs. Displacement curves/or various values of trim can be found in Appendix 000.

<table>
<thead>
<tr>
<th>Case</th>
<th>Loading Condition</th>
<th>Draft (m)</th>
<th>Trim (m)</th>
<th>Condition of equilibrium / Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>SOLAS XII / 4.2</td>
<td><strong>.</strong></td>
<td><strong>.</strong></td>
<td>In the final condition, the openings through which progressive flooding occurs, come below the waterline.</td>
</tr>
<tr>
<td>2</td>
<td>Homogeneous</td>
<td><strong>.</strong></td>
<td><strong>.</strong></td>
<td>In the final condition ....</td>
</tr>
<tr>
<td>3</td>
<td>Alternate</td>
<td><strong>.</strong></td>
<td><strong>.</strong></td>
<td>In the final condition ....</td>
</tr>
</tbody>
</table>
EVACUATION PROCEDURES

ABANDON SHIP

The order to abandon ship is the final decision to be taken by the Master when, according to his judgment, there is no other way to save the lives of the passengers and the crew.

All officers and crew should be well trained in the quick and safe launching of the ship's life saving equipment (lifeboats, life rafts etc.) by means of frequent evacuation drills (per SOLAS, Chap.III, Reg. 19).

Apart from launching and operating the life saving equipment, the Officers and the crew should be familiar with matters of protection and survival after abandoning ship.

If possible, members of the crew who care to be exposed to cold, (e.g. by swimming), should be wearing appropriate clothing to protect themselves from the cold (immersion suits), since immersion, especially in cold climates may prove lethal.

For the same reasons, all survivors on open life boats should - if possible - be equipped either with immersion suits or with thermal protective aids.

If the ship is fitted with a marine evaluation system, it shall. be provided with on-board training aids in the use of the system.

Detailed guidelines on abandoning ship are provided in the Safety Training Manual (per SOLAS, Chap.III, Reg. 35), that shall be provided in each crew mess room and recreation room or in each crew cabin.
ABANDON SHIP DRILL

The following procedure should be applied for the Emergency training in abandon ship drill.

1. summoning of passengers and crew to muster stations with the alarm followed by drill announcement on the communication system and ensuring that they are made aware of the order to abandon ship.
2. reporting to stations and preparing for the duties described in the muster list;
3. checking that passengers and crew are suitably dressed;
4. checking that lifejackets are correctly donned;
5. lowering of least one lifeboat after any necessary preparation for launching. The lifeboat shall be lowered, as far as practicable;
6. starting and operating the lifeboat engine;
7. operation of davits used for launching life rafts;
8. a mock search and rescue of passengers trapped in their staterooms;

Except otherwise stated in relevant lifeboat and rescue boat launching drills, each lifeboat shall be launched with its assigned operating crew aboard and maneuvered in the water at least once every 3 months during an abandon ship drill.

Emergency lighting for mustering and abandonment should be tested at each abandon ship drill.
C. No. 999999

M/V "NK BULKER"

SOLAS Chapter XII, Reg. 4

DAMAGED STABILITY CALCULATION

Client : NK SHIP MANAGEMENT Co., Ltd.

Charged by : *******

Approved by : ____________________________
  Y. Nakamura
  Manager, HE Section
  Hull Department

** June 2003

Nippon Kaiji Kyokai
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2) Criteria.......................... 2
3) Conclusion....................... 2
4) Calculation sheets
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   2. Damage stability calculation .... 5
   3. Residual stability calculation .... 6
   4. Summary table of damaged stability .... 7
1) Principal Particulars of the vessel

Lpp : 150.00m
B : 24.40m
D molded : 13.60m
Summer load draft ds : 9.90m
Shipyards : *** Shipbuilding Co., Ltd. Sno.999
No. of Cargo Holds : 4

2) Criteria

The following criteria are required to be met:

a) the final water line after flooding is below the lower edge of any opening through which progressive flooding may take place,
b) the metacentric height in the flooded condition is positive,
c) the righting lever curve has a minimum range of 20° beyond the position of equilibrium with a maximum righting lever of at least 0.1m within this range.

3) Conclusion

Not satisfactory. Openings come below the final water line after flooding.
For details, see Page 4 of the calculation sheets.
(CASE 1)

DETAIL OF DRAFT AT UPRIGHT CONDITION OF EQUILIBRIUM AFTER FLOODING

<table>
<thead>
<tr>
<th>STATION</th>
<th>DRAFT (M) (HEIGHT OF C.L.)</th>
<th>VERT HEIGHT OF UPP.DK.S.L. ABOVE W.L. (MLD) (M)</th>
<th>UPP.DK.BREADTH OF SINK UNDER THE WATER (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-.310</td>
<td>6.828</td>
<td>6.994</td>
<td>.000</td>
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<tr>
<td>-.300</td>
<td>6.837</td>
<td>6.986</td>
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</tr>
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<td>-.150</td>
<td>6.966</td>
<td>6.825</td>
<td>.000</td>
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<tr>
<td>.000</td>
<td>7.096</td>
<td>6.667</td>
<td>.000</td>
</tr>
<tr>
<td>.250</td>
<td>7.312</td>
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<tr>
<td>.750</td>
<td>7.744</td>
<td>5.906</td>
<td>.000</td>
</tr>
<tr>
<td>1.000</td>
<td>7.960</td>
<td>5.674</td>
<td>.000</td>
</tr>
<tr>
<td>1.500</td>
<td>8.392</td>
<td>5.212</td>
<td>.000</td>
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<tr>
<td>2.000</td>
<td>8.824</td>
<td>4.770</td>
<td>.000</td>
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<td>2.500</td>
<td>9.256</td>
<td>4.337</td>
<td>.000</td>
</tr>
<tr>
<td>3.000</td>
<td>9.688</td>
<td>3.905</td>
<td>.000</td>
</tr>
<tr>
<td>4.000</td>
<td>10.552</td>
<td>3.043</td>
<td>.000</td>
</tr>
<tr>
<td>5.000</td>
<td>11.416</td>
<td>2.180</td>
<td>.000</td>
</tr>
<tr>
<td>6.000</td>
<td>12.280</td>
<td>1.318</td>
<td>.000</td>
</tr>
<tr>
<td>7.000</td>
<td>13.144</td>
<td>.455</td>
<td>.000</td>
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<td>13.576</td>
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<td>8.000</td>
<td>14.008</td>
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<td>23.868</td>
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<td>9.000</td>
<td>14.872</td>
<td>-1.198</td>
<td>19.474</td>
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<tr>
<td>9.250</td>
<td>15.088</td>
<td>-1.378</td>
<td>17.072</td>
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<tr>
<td>9.500</td>
<td>15.304</td>
<td>-1.548</td>
<td>13.914</td>
</tr>
<tr>
<td>9.750</td>
<td>15.520</td>
<td>-1.705</td>
<td>9.928</td>
</tr>
<tr>
<td>10.000</td>
<td>15.736</td>
<td>-1.848</td>
<td>4.984</td>
</tr>
</tbody>
</table>
(CASE 1)

DETAIL OF DRAFT AT UPRIGHT CONDITION OF EQUILIBRIUM AFTER FLOODING

<table>
<thead>
<tr>
<th>NAME</th>
<th>DRAFT (M)</th>
<th>VERT. HEIGHT OF SEA WATER ENTRANCE POSITION ABOVE WATER LINE (MLD)</th>
<th>* MARK</th>
<th>PROTECTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>F,CLE END DOOR</td>
<td>15.132</td>
<td>- .681</td>
<td>*</td>
<td>WEATHER TIGHT</td>
</tr>
<tr>
<td>NOITST AIR PIPE1</td>
<td>15.109</td>
<td>- .628</td>
<td>*</td>
<td>WEATHER TIGHT</td>
</tr>
<tr>
<td>NOITST AIR PIPE2</td>
<td>13.865</td>
<td>.654</td>
<td>*</td>
<td>WEATHER TIGHT</td>
</tr>
</tbody>
</table>
1) INITIAL CONDITION

<table>
<thead>
<tr>
<th>DRAFT (MLD)</th>
<th>9.898 M</th>
</tr>
</thead>
<tbody>
<tr>
<td>DISPLACEMENT (FULL)</td>
<td>29213.7 MT</td>
</tr>
<tr>
<td>VERTICAL CENTER OF GRAVITY</td>
<td>8.070 M</td>
</tr>
</tbody>
</table>

2) FLOODED SPACES AND WEIGHT

<table>
<thead>
<tr>
<th>FLOODED COMPARTMENT</th>
<th>FLOODED PERMEABILITY</th>
<th>WEIGHT (X, Y, Z FROM MS CL KEEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO.1 CARGO HOLD</td>
<td>.90</td>
<td>4897.5 (-53.464, .000, 7.777)</td>
</tr>
<tr>
<td>FLOODED SUM</td>
<td></td>
<td>4897.5 (-53.464, .000, 7.777)</td>
</tr>
</tbody>
</table>

3) UPRIGHT CONDITION OF EQUILIBRIUM AFTER FLOODING

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DISPLACEMENT (MT)</th>
<th>CENTER OF GRAVITY (M)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HULL UNDER UPPER DECK</td>
<td>33741.3 (-9.253, .000, 6.047)</td>
<td></td>
</tr>
<tr>
<td>SUM OF RESERVE BUOYANCY</td>
<td>370.0 (-65.070, .000, 14.510)</td>
<td></td>
</tr>
<tr>
<td>FLOODED SUM</td>
<td>(-) 4897.5 (-53.464, .000, 7.777)</td>
<td></td>
</tr>
<tr>
<td>RESULTANT TOTAL</td>
<td>29213.8 (-2.549, .000, 5.864)</td>
<td></td>
</tr>
<tr>
<td>C.L. FORE</td>
<td>15.74</td>
<td>CORRECTED VCG (M) 8.070</td>
</tr>
<tr>
<td>DRAFT AFT (M) MEAN</td>
<td>7.10</td>
<td>TRANSVERSE GM (M) 1.899</td>
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<tr>
<td>TRIM (AFT) (M)</td>
<td>-8.64</td>
<td>LONGITUDINAL GM (M) 104.673</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HEEL (DEGREE) .000</td>
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<tr>
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<td></td>
<td>HEEL (TANGENT) .0000</td>
</tr>
</tbody>
</table>

1-24
# Residual Stability Calculation (Case 1)

**Trim Free**

## Applied Rule

**IMO Res. A.320 (A.514)**

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Minimum</th>
<th>Attained</th>
<th>Judge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong> - Final Angle of Heel</td>
<td>15.00°</td>
<td>.00°</td>
<td>GOOD</td>
</tr>
<tr>
<td><strong>B</strong> - Range of Positive GZ</td>
<td>20.00°</td>
<td>.529°</td>
<td>GOOD</td>
</tr>
<tr>
<td><strong>C</strong> - Max. GZ within 20° Deg. Range</td>
<td>.100 m</td>
<td>.413 m</td>
<td>GOOD</td>
</tr>
<tr>
<td><strong>D</strong> - Area within 20° Deg. Range</td>
<td>.0175 m-RAD</td>
<td>.0906 m-RAD</td>
<td>GOOD</td>
</tr>
<tr>
<td><strong>E</strong> - Transverse GM</td>
<td>.000 m</td>
<td>1.899 m</td>
<td>GOOD</td>
</tr>
</tbody>
</table>

## Angle of Righting Lever (GZ) in Meter

<table>
<thead>
<tr>
<th>Inclination Deg.</th>
<th>Righting Lever</th>
<th>Righting Lever (GZ) in Meter</th>
<th>Area (m-RAD)</th>
<th>F.S.E. Corr.</th>
<th>Trim (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>.00</td>
<td>I</td>
<td>.000</td>
<td>.000</td>
<td>-8.640</td>
</tr>
<tr>
<td>2</td>
<td>.07</td>
<td>I***</td>
<td>.0011</td>
<td>.000</td>
<td>-8.669</td>
</tr>
<tr>
<td>4</td>
<td>.13</td>
<td>I*****</td>
<td>.0045</td>
<td>.000</td>
<td>-8.747</td>
</tr>
<tr>
<td>6</td>
<td>.19</td>
<td>I*********</td>
<td>.0100</td>
<td>.000</td>
<td>-8.875</td>
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<td>8</td>
<td>.24</td>
<td>I*****************</td>
<td>.0174</td>
<td>.000</td>
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<td>10</td>
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<td>.0267</td>
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<td>.42</td>
<td>I**</td>
<td>.1087</td>
<td>.000</td>
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<td>I**</td>
<td>.1774</td>
<td>.000</td>
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<td>50</td>
<td>.28</td>
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<td>.1921</td>
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<td>.25</td>
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<td>I**</td>
<td>.2169</td>
<td>.000</td>
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<td>.2267</td>
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<td>-.04</td>
<td>I**</td>
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<td>.2457</td>
<td>.000</td>
<td>-28.419</td>
</tr>
</tbody>
</table>

20.00            |                |                               | .0906        |              |          |
SUMMARY TABLE OF DAMAGED STABILITY

1) APPLIED SHIP

SHIP NAME
L * B * D 150.000 M * 24.400 M * 13.600 M
DESIGNED DRAFT 9.898 M
TRIM .000 M
VERTICAL CENTER OF GRAVITY 8.070 M

2) DAMAGE STABILITY

INITIAL ........ DRAFT ...... TRANS.
CASE DRAFT  FORE AFT MEAN HEEL GM NO. (M) (M) (M) (M) (DEG.) (M)
1 9.898 15.74 7.10 11.42 .00 1.899

3) RESIDUAL STABILITY

APPLIED RULE IMO RES.A.3204/A.514

CRITERIA (MIN.)
A - FINAL ANGLE OF HEEL 15.00 DEG.
- INCREASE OF NO DECK IMMERSION 17.00 DEG.
B - RANGE OF POSITIVE GZ 20.00 DEG.
C - MAX. GZ WITHIN 20 DEG. RANGE .100 M
D - AREA WITHIN 20 DEG. RANGE .0175 M-RAD
E - TRANSVERSE GM .000 M

CASE JUDGE A B C D E D.I. M.C.
1 GOOD .00 52.90 .413 .0906 1.899 *

D.I. * : DECK IMMERSON AT EQUILIBRIUM CONDITION
M.C. * : TWO OR MORE COMPARTMENTS FLOODING

(Note)

CASE FLOODED COMPARTMENTS NO.

1 NO.1 CARGO HOLD
Chapter 2 Amendment of ESP requirements

2-1 Application
2-1-1 Scope
Bulk Carriers defined in NK Rule Part B. (Bulk Carriers and Ore Carriers with a class notation of ESP)
2-1-2 Implementation
The amended requirements are applicable to surveys concerned, which were/will carried out after 1 January 2003.

2-2 Specific requirements:
2-2-1 Intermediate Survey:
Enhanced thickness gauging and close up surveys at Special Survey No.2
2-2-2 Special Survey:
Thickness gauging and close up survey at Intermediate Survey for ships exceeding 10 years old are to be carried out at same extent of last Special Survey. The Intermediate Survey is to be carried out concurrently with Docking Survey.

2-3 Survey
The amendments have already been incorporated to NK Rule Part B and “Guidance for undergoing class maintenance surveys” which has been shown in NK Home Page.
Chapter 3  Installation of water level detection and alarm system for cargo holds, forward spaces & ballast tanks

At the seventy-seventh session of Maritime Safety Committee (MSC 77), Performance Standards for Water Level Detection and Alarm System on Bulk Carriers, which should be installed by first periodical survey (Annual, Intermediate or Special Survey) after 1 July 2004 as specified in Regulation 12 of SOLAS Chapter XII, was adopted. The Performance Standard had been drafted to be applicable to water level detection and alarm systems installed to ships after MSC 77, but this application date was eliminated.

NK is going to develop RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIP to incorporate the Performance Standard (scheduled on 1 July 2004). In the meantime, we examine the water level detection and alarm system on bulk carriers installed to ships classed by NK before amendment of the above Rule, on the basis of the requirements specified in Regulation 12 of SOLAS Chapter XII.

The followings show the provisional survey procedure till the performance standard is incorporated to NK Rule.

3-1 Application
3-1-1 Scope
Bulk Carriers defined in NK Rule Part B (bulk carriers and ore carriers with a class notation of ESP) of which keel were laid before 1 July 2004. Ships during construction, of which keel were/will be laid before 1 July 2004 are included.

3-1-2 Implementation
First periodical survey (Annual, Intermediate or Special Survey) after 1 July 2004.

3-2 Specific requirements
Water level detection and alarm system is to be located on the navigation bridge and be capable of detecting water ingress at all cargo holds and spaces and ballast tank forward of collision bulk head. In general, FPT, Bosn’s Store, F’cle Space excluding chain lockers are considered as these spaces.

3-3 Surveys
Plan examination at Head Office is not required.
Surveyors are to examine water level detection and alarm systems in line with the attached check list.

3-4 Others: Attachment (Sample of water level detection and alarm system arrangement)
Water Level Detection and Alarm System Check List

Cargo Holds
☐ In each cargo hold, the systems are to give alarms when the water level reaches the following (a) and (b) at the aft end of the cargo hold.
   (a) a height of 0.5m above the inner bottom.
   (b) a height not less than 15% of the depth of the cargo hold but not more than 2.0m.
☐ Detectors, electrical cables and any associated equipment installed in cargo holds are to be protected from damage by cargoes or cargo handling equipment.
☐ Water levels are to be detected at as close to the center line (within B/6m from center line), or at both the port and starboard sides of the cargo hold. B : Breadth of Ship
☐ Bilge alarms and water ingress detectors had already been provided in accordance with SOLAS Regulation 9 Chapter XII. In this case, the above water level detection system are not required.

Other Spaces
☐ In any ballast tank forward of the collision bulk head, the system is to give an alarm when the liquid in the tank reaches a level not exceeding 10% of the tank capacity.
☐ In any dry or void space other than chain locker, any part of which extends forward of the foremost cargo hold and the volume of which exceeds 0.1% of the ship’s maximum displacement volume, the system is to give an alarm at a water level of 0.1m above the deck.

General
☐ The installation of the system is not to inhibit the use of any other sounding devices such as sounding pipe or other water level gauging device.
☐ The installation of the system is not to inhibit the water-tightness nor strength of hull structure.
☐ In case electric cables are not protected by steel pipes, cable penetration of bulkheads and deck is made by means of cable gland or boxes.
☐ Visible and audible alarms given by the water level detection and alarm systems are to be capable of identifying at the navigation bridge.
☐ The systems are to be installed at the location where they are accessible for survey, maintenance and repair. Any filtration arrangement, if fitted to the detectors, are to be capable of being cleaned before loading.
☐ Electric facilities in way of cargo holds are to be of certified intrinsically safe type. In case the ship does not carry flammable cargoes, intrinsically safe type is not required.
☐ Electric cables for water ingress alarm of intrinsically safe circuits are to be installed separately from cables for general circuits.
☐ Override system for ballast tanks forward of the collision bulkhead and water ballast holds: The alarm for each tank/hold is to be capable of stopping, and an override visual indication is to be given to the navigation bridge throughout deactivation of the water level detectors for the tanks/holds.
☐ Electric cables on weather decks are adequately protected from mechanical damages.
☐ Performance Test
FIG 3-4-2 (1)
C/H F.P.T. & BOS’N STORE WATER INGRESS ALARM SYSTEM
(CAPACITANCE TYPE LEVEL SWITCH)
FIG 3–4–2 (2)
C/H F.P.T. & BOS’N STORE WATER INGRESS ALARM SYSTEM
(VERTICAL FLOAT TYPE LEVEL SWITCH)
FIG 3-4-2 (3)
C/H F.P.T. & BOS’N STORE WATER INGRESS ALARM SYSTEM
(HORIZONTAL FLOAT TYPE LEVEL SWITCH)
FIG 3–4–2 (4)
C/H F.P.T. & BOS’N STORE WATER INGRESS ALARM SYSTEM
(PRESSURE TYPE LIQUID SENSOR LEVEL SWITCH)
Chapter 4    Dewatering arrangements for forward dry spaces & ballast tanks

4-1    Application
4-1-1 Scope
Bulk Carriers defined in NK Rule Part B (bulk carriers and ore carriers with a class notation of ESP) of which keel were laid before 1 July 2004. Ships during construction, of which keel were/will be laid before 1 July 2004 are included.

4-1-2 Implementation
First Intermediate or Special Survey which comes earlier after 1 July 2004.

4-2    Specific Requirements
4-2-1 Dewatering arrangements
Bilge or ballast systems capable of being brought into operation from a readily accessible enclosed space**, the location of which is accessible from the navigation bridge or continuously manned propulsion machinery space without traversing exposed decks, are to be provided for draining and pumping the spaces specified in the following (1) and (2).

**e.q. Ballast Control Room, Engine Control Room
(1) Ballast tanks forward of the collision bulkhead: Fore Peak Tank
(2) Dry or void spaces other than chain lockers, any part which extends forward of the foremost cargo hold: Bosn’s Store, F’cle Space

4-2-2 Remote control
With respect to the provisions of the above 4-2-1, the following components in bilge and ballast systems are to be capable being brought operation from the readily accessible enclosed space.

(1) Eductors and pumps for dewatering the spaces specified in the above 4-2-1, which include driving water pumps for the eductors.

(2) All valves in piping systems served for the devices specified in 4-2-2 (1), except those controlled kept in open/close position appropriately with locking devices at sea.

Where the dewatering piping from a space/tank is connected to that from other spaces/tanks, each piping is to be provided with screw down check valves are nearby the suction header of the pump or the suction wells for the eductor and all such valves are also to be capable of being brought operation independently.

See the attached sample.

4-2-3 Capacity of the dewatering arrangements is not to be less than the value obtained by the following formula.

\[ Q = 320A (\text{m}^3/\text{h}) \]

A: Cross-sectional are of the largest air pipe or ventilator duct served for the space/tank

This requirement may not applicable to the existing ships, i.e. it is enough to modify existing water ballast system for FPT and eductors for forward spaces enable being operated from Navigation Bridge or Engine Control Room.*

* pending until the final decision by IACS
4-3 **Survey**
Plan examinations at Head Office are not required. Surveyor is to confirm that the components which should be capable of being brought into operation from Engine Control Room, Navigation Bridge or Ballast Control Room etc., are to be modified adequately.

4-4 **Others:**
Attachment (Sample of dewatering arrangement with remote control)
Sample of dewartering arrangements with remote control.

Deck Stand

BOS’N STORE

C.L.

F.P.T.

Butterfly Valve

Elect. hydraulic power unit remote controled from navigation bridge or engine room.

FIG 4-4 (1)
Remote pump control system in F.P.T.
FIG 4-4 (2)
Remote pump control system in BOS’N STORE
Chapter 5  Requirements to increase the integrity of fore deck fitting

5-1  Application
5-1-1  Scope: Dry Cargo Ships (bulk carriers and general dry cargo ships excluding Container Carrier, Vehicles Carrier Ro-Ro ship) of which length L1 defined in NK Rule Part C15.2.1-1 is 100m or over. The ships these requirements are applicable to will be identified by NOTE in Survey Status.
5-1-2  Implementation

<table>
<thead>
<tr>
<th>Ship’s Age on 1 January 2004</th>
<th>Implementation Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 years</td>
<td>By the due date of the next first Intermediate Survey or Special Survey after 1 January 2004.</td>
</tr>
<tr>
<td>10 years ≤ A &lt; 15years</td>
<td>By the due date of the first Special Survey after 1 January 2004, but not later than first Intermediate Survey after the ship’s age reaches 15 years.</td>
</tr>
<tr>
<td>A &lt; 10 years</td>
<td>By the date on which the ship reaches 10 years of age. Where the due date of the first intermediate or special survey does not fall between 1 January 2004 and the date when the ship reached 10 years of age, the implementation may be by the due date of the first intermediate or special survey after the ship reaches 10 years of age.</td>
</tr>
</tbody>
</table>

5-2  Specific Requirements
Reinforcing requirements for small hatch covers, air escape pipes and ventilators located at forward parts are prescribed. The attached Guidance is to be referred to.

5-3  Survey
Plan examinations at Head Office are not required. Surveyors are to confirm reinforce of small hatches, air escape pipe and ventilators in line with the attached Guidance.

5-4  Others: Guidance enclosed
Guidance of retroactive requirements for Fore Deck Fitting

A. Application
This guidance is applicable to Small Hatches, air pipes and ventilator pipes located on the exposed fore deck*1 of bulk carriers, general dry cargo ships (excluding container vessels, vehicle carriers, Ro-Ro ships and woodchip carriers), and Combination Carriers (e.g. OBO ships, Ore/Oil Carriers, etc.) of L1*2 100m or more.

*1 exposed fore deck see Fig 5.4.1.
*2 L1 see NK Rule Part C Chapter 15.2.1-1.

B. Implementation

<table>
<thead>
<tr>
<th>Ship’s Age on 1 January 2004</th>
<th>Implementation Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 years</td>
<td>By the due date of the next first Intermediate Survey or Special Survey after 1 January 2004.</td>
</tr>
<tr>
<td>10 years &lt; A &lt; 15 years</td>
<td>By the due date of the first Special Survey after 1 January 2004, but not later than first Intermediate Survey after the ship’s age reaches 15 years.</td>
</tr>
<tr>
<td>A &lt; 10 years</td>
<td>By the date on which the ship reaches 10 years of age. Where the due date of the first intermediate or special survey does not fall between 1 January 2004 and the date when the ship reached 10 years of age, the implementation may be by the due date of the first intermediate or special survey after the ship reaches 10 years of age.</td>
</tr>
</tbody>
</table>

C. Small Hatches
-1 Strength
1. Small hatch covers are to be renewed and / or stiffened to meet requirements shown in Table 5.4.1 and Fig 5.4.2 Stiffeners, where fitted are to be aligned with the metal-to-metal contact points, see Fig 5.4.2. All stiffeners are to be welded to inner edge stiffener, See Fig 5.4.3.
2. The upper edge of the hatchway coaming is to be suitably reinforced by a horizontal stiffener, normally not more than 170 to 190mm from the upper edge of the coaming See Fig 5.4.4.
3. Small hatch covers of circular or similar shape of which the top plate is greater than 8mm and diameters are less than 630mm, are exempted from these requirements.

-2 Primary Securing Devices
1. Dogs (twist tightening handles) with wedges type securing devices see (Fig 5.4.5) are not acceptable. They have to be replaced by i) Butterfly nuts tightening onto forks (clamps), ii) Quick acting cleats, or iii) Central locking device.
2. A gasket of small hatch cover is to allow a metal to metal contact to prevent over compression of the gasket by green sea forces that may cause the securing devices to be loosened or dislodged. The metal-to-metal contacts are to be arranged closed to each securing device in accordance with Fig 5.4.2.
3. The securing device should be able to be tightened sufficiently by one person without any tools.
4. A primary securing method using butterfly nuts, the forks (clamps) are to be arranged in accordance with
5. Hinges are to be located on the fore edge. If not, hatches are to be replaced or cut and turned to meet this requirement. (See Fig 5.4.6)

3. Secondary Securing Device
Small hatches on the exposed fore deck are to be fitted with an independent secondary securing device e.g. by means of a sliding bolt, a hasp or a backing bar of slak fit, which is capable of keeping the hatch cover in place, even in the event that primary securing device became loosened or dislodged. It is to be fitted on the side opposite to the hatch cover hinges.

D. Air Pipes
Air Pipes on the exposed fore deck are to be reinforced in accordance with Table 5.4.2 and Fig 5.4.7.

E. Ventilator
-1 Gooseneck Type ventilators are on the exposed fore deck are to be reinforced in accordance with Table 5.4.3 and Fig 5.4.8.
-2 Rotation type mushroom type heads (Fig 5.4.9) are to be replaced by another type (Fig 5.4.10)
Table 5.4.1 Scantling for Small Steel Hatch Covers on the Fore Deck

<table>
<thead>
<tr>
<th>Nominal size (mm x mm)</th>
<th>Cover plate thickness (mm)</th>
<th>Primary stiffeners</th>
<th>Secondary stiffeners</th>
</tr>
</thead>
<tbody>
<tr>
<td>630 x 630</td>
<td>8</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>630 x 830</td>
<td>8</td>
<td>100 x 8 ; 1</td>
<td>-</td>
</tr>
<tr>
<td>830 x 630</td>
<td>8</td>
<td>100 x 8 ; 1</td>
<td>-</td>
</tr>
<tr>
<td>830 x 830</td>
<td>8</td>
<td>100 x 10 ; 1</td>
<td>-</td>
</tr>
<tr>
<td>1030 x 1030</td>
<td>8</td>
<td>120 x 12 ; 1</td>
<td>80 x 8 ; 2</td>
</tr>
<tr>
<td>1330 x 1330</td>
<td>8</td>
<td>150 x 12 ; 2</td>
<td>100 x 10 ; 2</td>
</tr>
</tbody>
</table>
Fig 5.4.2  Arrangement of stiffeners
1. butterfly nut
2. bolt
3. pin
4. center of pin
5. fork (clamp) plate
6. hatch cover
7. gasket
8. hatch coaming
9. bearing pad welded on the bracket of a toggle bolt for metal to metal contact
10. stiffener
11. inner edge stiffener

(Note: Dimensions in millimeters)

Fig 5.4.3  Example of a Primary Securing Method
Fig 5.4.4  Reinforcement of the hatchway coaming

**NOT ACCEPTABLE**

Fig 5.4.5  Dogs with wedges
**Table 5.4.2-1 760mm Air Pipe on Freeboard deck Bracket Standards**

<table>
<thead>
<tr>
<th>Nom. Dia.(mm)</th>
<th>80</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>200</th>
<th>250 over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Brackets (mm)</td>
<td>Sch 40</td>
<td>Not Acceptable</td>
<td></td>
<td></td>
<td></td>
<td>No reinforce</td>
</tr>
<tr>
<td>Sch 80</td>
<td>460</td>
<td>380</td>
<td>300</td>
<td>300</td>
<td>No reinforce</td>
<td>No reinforce</td>
</tr>
</tbody>
</table>

**Table 5.4.2-2 450mm Air Pipe on Superstructure deck Bracket Standards**

<table>
<thead>
<tr>
<th>Nom. Dia. (mm)</th>
<th>80</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>200</th>
<th>250 over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Brackets (mm)</td>
<td>Sch 40</td>
<td>Not Acceptable</td>
<td></td>
<td></td>
<td></td>
<td>No reinforce</td>
</tr>
<tr>
<td>Sch 80</td>
<td>300</td>
<td>300</td>
<td>300</td>
<td>No reinforce</td>
<td>No reinforce</td>
<td>No reinforce</td>
</tr>
</tbody>
</table>

Thickness 8 mm  
At least 3 Brackets  

Fig 5.4.6  Hinge to be located on the fore edge

Fig 5.4.7  Reinforcement by bracket of Air pipe  
and

Fig 5.4.8  Reinforcement by bracket of Ventilator
Table 5.4.3 Gooseneck type Ventilator Bracket Standards

Circle type

<table>
<thead>
<tr>
<th>Nom. Dia. (mm)</th>
<th>80</th>
<th>100</th>
<th>150 over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Bracket (mm)</td>
<td>460</td>
<td>380</td>
<td>No reinforce</td>
</tr>
</tbody>
</table>

Oval type

<table>
<thead>
<tr>
<th>Section Scantling (mm)</th>
<th>120 x 80</th>
<th>200 x 100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height of Bracket (mm)</td>
<td>300</td>
<td>300</td>
</tr>
</tbody>
</table>

Fig 5.4.9 Rotation type Mushroom head

Fig 5.4.10 Another type

NOT ACCEPTABLE

ACCEPTABLE
Chapter 6  Improving of Cargo Hatch cover stopper and securing arrangements

6-1 Application

6-1-1 Scope

Single deck bulk carriers with bilge hopper and top side tanks (bulk carriers with a class notation ESP. Ore carriers are excluded.)

Requirements for stopper are applicable to all existing Bulk Carriers. The ships of which Application of Classification Survey during Construction were submitted after 1 September 1988 originally comply with the requirements for securing arrangements. The ships these requirements are applicable to will be identified by NOTE in Survey Status.

6-1-2 Implementation

<table>
<thead>
<tr>
<th>Ship’s Age on 1 January 2004</th>
<th>Implementation Scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 years</td>
<td>By the due date of the next first Intermediate Survey or Special Survey after 1 January 2004.</td>
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<tr>
<td>10 years ≤ A &lt; 15 years</td>
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<td>By the date on which the ship reaches 10 years of age. Where the due date of the first intermediate or special survey does not fall between 1 January 2004 and the date when the ship reached 10 years of age, the implementation may be by the due date of the first intermediate or special survey after the ship reaches 10 years of age.</td>
</tr>
</tbody>
</table>

6-2 Specific requirements

Guidance showing specific requirements is being prepared.

6-3 Surveys

Instruction will be made when the above Guidance is completed.
Chapter 7  Upgraded renewal criteria of hold frames

7-1  Application
7-1-1  Scope
Single hull bulk carriers with a class notation ESP, of which date of building contract is before 1 July 1998. These requirements are not applicable to ships of which date of building contract is after 1 July 1998. The ships these requirements are applicable to will be identified by NOTE in Survey Status.

7-1-2  Implementation

<table>
<thead>
<tr>
<th>Ship’s Age on 1 January 2004</th>
<th>Implementation Scheme</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

7-2  Specific requirements
7-2-1  Renewal criteria
Head Office prepares Preliminary Assessment of IACS Unified Requirements showing renewal criteria and reinforces criteria such as \( t_{\text{REN}} \) and \( t_{\text{COAT}} \) etc., and distributes them to each managing company. At IACS Council meeting held on June 2003, the relevant requirements UR S-31 is partially amended. Head Office is reassessing the renewal criteria for all the bulk carrier in line with the amended UR-S31 and planning to distribute Preliminary Assessment of IACS Unified Requirements S-31 with a target date end of August 2003. A sample of Preliminary Assessment of IACS Unified Requirements S-31 and plans showing extents and measures of renewal/reinforcements (Fig.7-1) are enclosed.

7-2-2  Renewal
Partial renewal of hold frame web plates are not accepted. (See Fig.7-2)

7-2-3  Reinforce
Reinforcing measures are constituted by tripping brackets, located at the lower part and midspan of side frames. Tripping brackets may be located at every two frames, but lower and midspan brackets are to be fitted in line between alternative pairs of frames. The thickness of the tripping brackets is to be not less than the as-built thickness of the side frame webs to which they are connected. Double continuous welding is to be adopted for connections of tripping brackets to the side shell frames and shell plating.

7-2-4  Coating
a) The part to be coated includes:
- the web and the face plate of the side frames,
- the hold surface of side shell, hopper tank and top side tank plating, as applicable, over a width
not less than 100mm from the web of the side frame.

b) Epoxy coating or equivalent is to be applied.

In all cases, all the surfaces to be coated are to be sand blasted prior to coating application.

7-2-5 Thickness measurements

Thickness measurement points are shown in the attached sheets (Fig 7-3). Numbers of side frames to be measured are equivalent to those of Special Survey/Intermediate Survey corresponding to the ship’s age. Where gauging reading close to the criteria $t_{\text{EN}}$ and/or $t_{\text{COAT}}$ etc., are observed or the ship’s owner want to conclude measures one by one hold frame basis, number of hold frames to be measured may be increased.

7-2-6 Pitting and grooving

If pitting intensity is higher than 15% in area (see Fig 7-4), thickness measurement is to be taken to check pitting corrosion.

The minimum acceptable remaining thickness in pits or grooves is equal to

- 75% of the as built thickness, for pitting and grooving in the frame webs and faces
- 70% of the as built thickness, for pitting or grooving in the side shell, hopper tank and top side tank plating attached to the side frame, over a width up to 30mm from each side of it.

7-3 Surveys

7-3-1 Thickness measurements for hold frame webs are to be carried out in the presence of NK Surveyors. By comparing thickness gauging results with the Results of Preliminary Assessment of IACS Unified Requirements UR-S31, extents of renewal and/or reinforcements and blasting/coating are concluded by attending surveyors.

7-3-2 Continuous verifications are to be carried out at subsequent Special Survey/Intermediate Survey in the same manner with the initial verification.

7-4 Others

Attachments:

Sample of Preliminary Assessment of IACS Unified Requirement S-31

Fig 7-1 Extent and measures of renewal, reinforcement and coating
Fig 7-2 Example for inadequate replacement
Fig 7-3 Standards for measuring points
Fig 7-4 Pitting and grooving
The result of preliminary assessment of IACS Unified Requirement S-31

ClassNK
NIPPON KAIJI KYOKAI Survey Department
FAX: +81-3-5226-2029 TEL: +81-3-5226-2027
E-Mail: svd@classnk.or.jp

FAX MESSAGE

To: NK BULKER Management
Fax: Date: 30 June, 2003
FM: Survey Department
Staff in Charge: A. Miura

Subject: MV NK BULKER CNO.999999

Dear sirs,

We have advised you regarding Bulk Carrier Safety Up-graded requirements in ClassNK Technical Information No.TEC-0507. The following retroactive requirements are applicable to the subject bulk carrier.

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Implementation Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>-To increase the integrity of fore-deck fitting</td>
<td>(The implementation date may vary depending of the ship's date of delivery and Survey Status )</td>
</tr>
<tr>
<td>-Improving of Cargo Hatch cover securing arrangements</td>
<td></td>
</tr>
<tr>
<td>-Up graded renewal criteria of hold frames</td>
<td>First periodical survey after 1 July 2004</td>
</tr>
<tr>
<td>-water level detection and alarm system</td>
<td>First Special Survey or Intermediate Survey after 1 July 2004</td>
</tr>
<tr>
<td>-remote pumping systems</td>
<td></td>
</tr>
</tbody>
</table>

As for up graded renewal criteria of hold frames, we hereby inform you of the result of preliminary assessment in the attached sheets. You are kindly invited to refer to the sheets as an information for the arrangement of fitness confirmation survey and renewal/reinforcement work.

You are requested to submit a copy of the attachment together with the Survey Program to the attending surveyor of the Society in advance.

For your reference, as the attached calculation sheet is based on the information in so-called Key plan (Midship, Construction Profile, Shell Expansion and General Arrangement). When you find any differences between detailed construction plans filed in your office and the Preliminary Assessment, please do not hesitate to contact us.

Best regards,

T.Matusi
General Manager
of Survey Department
### Preliminary Assessment of IACS Unified Requirement S31

#### M.V. NK BULKER  Class No. 999999

<table>
<thead>
<tr>
<th>Hold</th>
<th>Fr. No.</th>
<th>Position</th>
<th>Type</th>
<th>$t_{WEB}$</th>
<th>$t_{AS}$</th>
<th>$t_{CUT}$</th>
<th>$t_{RUN}$</th>
<th>$t_{RUN,\infty}$</th>
<th>$t_{NEW,1}$</th>
<th>$t_{NEW,2}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>212</td>
<td></td>
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<td>9.00</td>
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<td>10.89</td>
<td>9.72</td>
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</tr>
</tbody>
</table>

The calculation is based on the information in Midship, Construction Profile, Shell Expansion and General Arrangement. If any discrepancy in the scantlings exists, indication to Survey Department is preferable.
IACS Unified Requirement S31

1. Countermeasure

1.1 When \( t_{\text{con}} < t_{\text{gaged}} < t_{\text{dr}} \) at each zone A to D (see Figure 1 & 2)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Tripping brackets are to be fitted on the lower bracket plate so as not to buckle.</td>
<td>( t_{\text{con}} )</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>B</td>
<td>Frames are to be reinforced by tripping brackets, then A &amp; B is to be sand-blasted &amp; coated.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>C</td>
<td>Frames are to be reinforced by tripping brackets, then A is to be sand-blasted &amp; coated.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>D</td>
<td>Frames are to be reinforced by tripping brackets, then B, C &amp; D is to be sand-blasted &amp; coated.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

1.2 When \( t_{\text{con}} < t_{\text{gaged}} < t_{\text{con}} \) at each zone A to D (see Figure 1 & 2)

<table>
<thead>
<tr>
<th>Integral type</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Frames are to be reinforced by tripping brackets, then A &amp; B is to be sand-blasted &amp; coated.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>C</td>
<td>Frames are to be reinforced by tripping brackets, then A is to be sand-blasted &amp; coated.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>D</td>
<td>Frames are to be reinforced by tripping brackets, then B, C &amp; D is to be sand-blasted &amp; coated.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

1.3 When \( t_{\text{gaged}} < t_{\text{con}} \) at each zone A to D (see Figure 2)

<table>
<thead>
<tr>
<th>Integral type</th>
<th>A &amp; B are to be replaced with ( t_{\text{new}} ).</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>B</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>

1.4 When \( t_{\text{gaged}} < t_{\text{con}} \) at each zone A to D (see Figure 2)

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Face plate at zone A &amp; B are also to be reinforced by doubling strips.</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>B</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>C</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
<tr>
<td>D</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
</tr>
</tbody>
</table>
2. Pitting and grooving
If pitting intensity is higher than 15% in area (see Figure 3), thickness measurement is to be taken to check pitting corrosion. The minimum acceptable remaining thickness in pits or grooves is equal to:
- 75% of the as built thickness, for pitting or grooving in the frame webs and flanges
- 70% of the as built thickness, for pitting or grooving in the side shell, hopper tank and topside tank plating attached to the side frame, over a width up to 30 mm from each side of it.

![5% SCATTERED](5% SCATTERED)
![20% SCATTERED](20% SCATTERED)
![10% SCATTERED](10% SCATTERED)
![25% SCATTERED](25% SCATTERED)
![15% SCATTERED](15% SCATTERED)

Figure 3

3. Others
3.1 At subsequent Special Surveys and Intermediate Surveys, verification of continuing compliance with IACS UR S31 is required in the same manner as the first verification survey.
3.2 The reinforcing measures shown in the above 1.2 may be deferred to next occasion of continuous verification if the structure and coating are in "as-new" condition.

4. Symbols
$t_{d1}$ : Criterion of web depth/thickness ratio for anti-buckling.
$t_{coat}$ : Criterion of coating requirement.
$t_{ren}$ : Criterion of renewal requirement.
$t_{ren,m}$ : Criterion of anti-yielding by bending moment.
**Fig 7-1** Extent and measures of renewal, reinforcement and coating

**Definition of position**

*Integral type*

- 0.25 fr. span

*Separate type*

- 0.25 fr. span

Both types

- Tripping bracket
- Stiffener

$t_{gauged}$ at $A$ is in the range

**Fig 7-1 (1)** When $t_{coat} < t_{gaged} < T_{d/t}$
Fig 7-1 (2)  When  \( t_{\text{ren}} < t_{\text{gaged}} < t_{\text{coat}} \)
**Integral type**

$t_{\text{gauged}}$ at $A$ and/or $B$ in the range

**Separate type**

$t_{\text{gauged}}$ at $C$ is in the range  
$t_{\text{gauged}}$ at $D$ is in the range

*Fig 7-1 (3) When $t_{\text{gauged}} < t_{\text{ren}}$*
Both types

11. \( t_{\text{gaged}} \) at A or B is in the range

The width of Fitted doubling strips is more than 80% of the face plate width.

The thickness of fitted doubling strips is more than the same thickness of the face plate.

**Fig 7-1 (4) When** \( t_{\text{ren}} < t_{\text{gaged}} < t_{\text{ren,m}} \)
Fig 7-2  Partial renewal of hold frame web plate

Both types

B & C are replaced

Both types

A is replaced

Fig 7-2 Example for inadequate replacement

Fig 7-3  Position of thickness measurements

Integral type

Separate type

Fig 7-3 Standards for measuring points
Pitting and Grooving

If pitting intensity is higher than 15% in area (see Figure 7-4), thickness measurement is to be taken to check pitting corrosion. The minimum acceptable remaining thickness in pits or grooves is equal to:

- 75% of the as built thickness, for pitting or grooving in the frame webs and flanges
- 70% of the as built thickness, for pitting or grooving in the side shell, hopper tank and topside tank plating attached to the side frame, over a width up to 30 mm from each side of it.

---

*Fig 7-4 Pitting intensity diagrams (from 5% to 25% intensity)*