Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

PORT STATE CONTROL COMMITTEE INSTRUCTION 45/2012/10

GUIDELINES ON CHECKING TANKER DAMAGE STABILITY

1. INTRODUCTION

1.1.General

Oil tankers, gas tankers and chemical tankers must comply with structural strength, intact stability and importantly with **damage stability**. Recent indications show that masters of tankers, whilst aware of intact stability requirements, are not always aware of damage stability requirements. This makes the ship vulnerable to pollution in the event of bottom or side damage due to collision, grounding, stranding etc

1.2.Goals and Purpose

The purpose of these Instructions is to give guidance to PSCOs on checking compliance with damage stability on tankers during a PSC inspection. It is not the intention of the Instructions to enable PSCOs to undertake damage stability calculations but for them to ensure that the master is aware of the requirement to comply with damage stability and show how it has been achieved.

1.3.Application

These instructions apply to convention size Oil Tankers, Gas Tankers and Chemical Tankers.

1.4.Relevant documentation

SOLAS
International Load Line Convention (ILLC)
MARPOL Annex I (Oil Tankers)
International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) (Gas Tankers)
International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) (Chemical Tankers)

1.5.Definitions and abbreviations

SIB: Approved Stability Information Booklet
KG: Distance from Centre of Gravity to Keel
GM: Distance between Centre of Gravity and Metacentre
RO: Recognised Organisation
Alternate Loading Condition: An approved loading condition, outwith the standard loading conditions as per the SIB, which meets damage stability requirements.

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Paris MoU
on Port State Control

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

2. INSPECTION OF SHIP

2.1 Initial Inspection

- Confirm that the ship has an approved Stability Information Book (SIB), sometimes referred to as Approved Loading Manual (see attached example), particularly on Gas and Chemical Tankers. The stability information must be approved by the flag State. This is commonly provided by one of the Classification Societies and should be stamped and dated with "Approved on behalf of [flag State]". In some cases the stability book may only have provisional approval, which may be because a ship has recently changed flag or is a new ship.
- Confirm the SIB is in the working language of the ship and can be understood by the master or officer responsible for stability.
- Confirm that the stability information covers damage conditions:

  Oil Tankers:

  In some cases the SIB will be simply be stamped as complying with MARPOL, which means that the standard loading conditions, as shown in the SIB, have been used to verify that in those standard loading conditions the ship complies with damage stability, following side or bottom damage, the actual calculations will **not** be shown.

  In other cases there will be a separate Damage Stability Book (DSB) showing approved damage calculations for each intact condition of loading from the SIB following side or bottom damage.

  The important criteria is that all the "standard" loading conditions in the approved stability information should have been verified for damage stability compliance.

  Note: separate approved damage calculations is **not** a mandatory requirement

  Gas and Chemical Tankers:

  For gas and chemical tankers the respective IGC and IBC Codes state that, ships subject to the Code "should survive the normal effects of flooding following assumed hull **damage** caused by some external force". This should be stated on the certificate.
- Confirm that the ship is loaded/loading to comply with damage stability requirements by asking the master to show procedures for complying with damage stability.

Note: PSCO's should be aware that cargo volumes may vary on passage, apart from the usual variations that may be expected through change in temperature of the cargo. Crude oil cargo may have a significant water content when it is being loaded on board, depending upon how it was handled and stored ashore. As the water settles out en-route the shipper may require that the crew transfer the settled water to slops or other tanks resulting in a change of cargo volume that may be up to 3% or 4%, resulting in final volumes less than 98%.

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Paris MoU
on Port State Control

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

2.2 Clear Grounds

- Lack of approved SIB
- SIB not in language understood by the master
- Ship not loaded as per approved SIB
- Damage stability not considered in stability information
- Ship not loaded according to damage requirements

2.3 More Detailed Inspection

- Request master to show information/calculations how it is ensured that the ship complies with intact and damage stability. This could be by loading to known conditions from the SIB or may be the result of a computer calculation. Either way the master should be able to prove compliance with damage stability.
- If a computer is used, is it clear that it covers damage requirements (Type 2 or 3 – see Annex 1)
- Has an Alternative Loading Condition been used
- If an Alternative Loading Condition has been used how has this been verified as being in compliance eg a statement from the flag State/RO/Classification Society, result of a Type 3 computer calculation

2.4 Reporting

- No approved stability information – Code 02103
- SIB not in a language understood by the master – Code 01326
- Ship not loaded in compliance with SIB – Code 02103
- Stability information does not cover damage stability requirements – Code 01326
- Ship not loaded in accordance with damage stability requirements – Code 01326

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Paris MoU
on Port State Control

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

Annex 1

TANKER DAMAGE STABILITY BACKGROUND INFORMATION

All ships must comply with longitudinal strength, intact stability and damage stability requirements. For tankers (oil, gas, chemical) they must comply with the following mandatory instruments:

Longitudinal Strength – Load Line (ICLL) 1988 Protocol / ANNEX I / Chapter II / Reg. 10

Intact Stability - SOLAS 1988 Amend / Chapter II-1 / Reg. 22

Damage Stability – Oil Tankers MARPOL Annex I Reg 28
Gas Tankers IGC Code Chap 2
Chemical Tankers IBC Code Chap 2

Basic pre-departure checks should ensure compliance with the above.

Typical stability approval at build comprises intact and **damage stability**:

Approved Intact Stability Information Book (SIB)

- Contains sample intact loading conditions
- On approval, these intact loading conditions are themselves deemed to be "approved" for use
- Normally this will only demonstrate that the approved **intact** loading conditions will survive the extent of **damage** required by the applicable Convention (MARPOL) or Code (IGC, IBC) and achieve the minimum residual stability standard.
- Occasionally the damage stability submission will take the form of critical KG or GM data which are intended to permit any condition of loading (including those in the SIB) to be assessed against pre-determined tables. Where such data is provided it is essential that their correct usage should be explained, particularly in relation to any assumptions used in their preparation which must also be met when loading the vessel. Minimum tank fillings for example.

Every tanker should have approved stability information on-board which details intact loading conditions and **damage** calculations for different conditions of loading and should have relevant certification:

Oil Tankers – IOPP Certificate and Form B

Marpol Annex 1, reg 28(1) states:

"Every oil tanker delivered after 31 December 1979, as defined in regulation 1.28.2, of 150 gross tonnage and above, shall comply with the subdivision and **damage stability criteria** as specified in paragraph 3 of this regulation, after the assumed side or bottom damage as specified in paragraph 2 of this regulation, **for any operating draught reflecting actual partial or full load conditions consistent with trim and strength of the ship as well as relative densities of the cargo**."

With regard to the term ''any operating draught reflecting actual partial or full load conditions'', the information required should enable the damage stability to be assessed under conditions the same as or similar to those under which the ship is expected to operate.

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Paris MoU
on Port State Control

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

MARPOL Annex I, Reg 28(5) states:
The master of every oil tanker to which this regulation applies and the person in charge of a non-self-propelled oil tanker to which this regulation applies shall be supplied in a approved form with:

.1 information relative to loading and distribution of cargo necessary to ensure compliance with the provisions of this regulation; and

.2 data on the ability of the ship to comply with **damage stability** criteria as determined by this regulation, including the effect of relaxations that may have been allowed under subparagraph 1.3 of this regulation.

Gas Tankers – Certificate of Fitness

Chemical Tankers – Certificate of Fitness

IGC and IBC Certificates of Fitness states:

"That the ship must be loaded:

.1 in accordance with the loading conditions provided in the **approved loading manual**, stamped and dated ..... and signed by a responsible officer of the Administration, or of an organization recognized by the Administration(RO); or

.2 in accordance with the loading limitations appended to this Certificate.

Where it is required to load the ship <u>other</u> than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions should be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition.

In the majority of cases this approach is therefore conditional upon the assumption there is <u>no significant variation</u> in the following parameters in the loaded vessel, otherwise damage results may be adversely affected and a full check of the loading condition would be required for damage stability:

- Cargo SG
- Draught and or Trim
- Slack/Empty Cargo Tanks
- Cargo or Ballast Distribution
- Use of Deck Tanks

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Paris MoU
on Port State Control

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

Variation in Loading

This may be of little significance on a VLCC fulfilling a long term charter where it usually carries a full cargo with the same SG in every tank, but it could prove problematic for a small coastal parcel tanker where tanks are loaded to different levels with cargoes of different SG.

It is often considered that **alternate loading conditions** are **acceptable** where these do not vary **'significantly'** from the **approved intact loading** conditions, but there is **no** safe basis for this conclusion unless such variation is controlled. (Note "significant variation" is deemed to be **IF** the filling of each cargo and ballast tank lies within 1% of the weight in the approved condition **AND** GMf lies within 2 cm of the approved condition GMf)

Depending on the shipyard the loading conditions for damage stability may or may not be comprehensive, it may be a brief document with only a few loading conditions or it may be a comprehensive document with many permutations of loading conditions.

Thus, there are specific approved loading conditions, as documented in the Stability Information Book (SIB), and if the ship is loaded outside these conditions then:

- the alternate loading condition must be authorised by the certifying Administration, **or**
- the alternate loading condition must be assessed against critical damage KG data included in the approved stability information, **or**
- the alternate loading condition must be assessed using an on-board damage stability program

In reality the first two bullets above would be unlikely in practice and the third bullet offers the most reliable way of ensuring compliance with damage stability if the ship is loaded **outside** the **approved** loading conditions,

Documentation

The documentation required to demonstrate adequacy of damage stability verification on tankers could be any one of the following options:

Option 1. Permanent record that an alternate loading condition has been assessed against critical damage KG/GM data included in the approved stability information, ie a record of the checks made using a standard calculation sheet or a copy of the critical KG/GM data with the operational conditions spotted on, or

Option 2. Written authorisation stating that the that an alternate loading condition is authorised by the certifying Administration (or an appointed certifying authority acting on its behalf), ie an endorsement that the proposed sailing condition (which is not included in the SIB) has been separately assessed and found to comply, or

Option 3. Permanent record that the vessel is loaded in accordance with an approved loading condition, to fulfil this option there would a requirement for limits set by the company or the Administration within which the actual condition should lie relative to the standard condition, or

Option 4. Permanent record that an alternate loading condition has been verified using an on-board damage stability program. ie A printout retained on board which shows that the condition has been assessed and complies. This option requires that the program in use is

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

approved, noting that the program may calculate stability directly (by applying all statutory damages) or use critical KG/GM curves stored within the program.

4.1 There is no flag State requirement for approval of any form of stability computer program, the use of onboard computers is not a requirement. The same applies to class, the use of computers is not a requirement. However, a stability software installed onboard shall cover all stability requirements applicable to the type of ship, thus for tankers it should include damage stability.

4.2 For Classification Societies that are IACS members they should comply with IACS Unified Requirement (UR) L5 “Onboard Computers for Stability Calculations”. UR L5 requires only software approval, not hardware approval. UR L5 includes: calculation systems; types of stability software (Types 1,2 or 3); functional requirements; acceptable tolerances; approval procedure; operation manual; installation testing; and importantly periodical testing. It is the responsibility of the master to check the accuracy of the system at each annual survey by applying at least one approved test condition.

4.3 There are 3 types of stability program under UR L5:

Type 1: Software calculating intact stability only (for vessels not required to meet a damage stability criterion)

Type 2: Software calculating intact stability and checking damage stability on basis of a limit curve (typically for vessels applicable to SOLAS Part B-1 damage stability calculations, etc.) or previously approved loading conditions and,

Type 3: Software calculating intact stability and damage stability by direct application of pre-programmed damage cases for each loading condition (for some tankers etc.)

Only Type 2 and Type 3 programs can be used for ensuring compliance with damage stability for each condition of loading, but Type 3 programs are more suited to verification of tankers.

4.4 It is common for programs to be approved for only some of the operations they perform. So it is not unusual to find a program which assesses damage to be approved only for intact stability, or for a program which verifies intact stability to be approved for longitudinal strength only.

These are the only four options available to demonstrate compliance with any form of damage stability requirement. The generally accepted method for demonstrating stability compliance on SOLAS ships is Option 1, noting that this can be used to show both intact and/or damage stability compliance.

These are the only four options available to demonstrate compliance with any form of damage stability requirement. The generally accepted method for demonstrating stability compliance on SOLAS ships is Option 1, noting that this can be used to show both intact and/or damage stability compliance.

The general rule is that any vessel operating under Marpol, IBC or IGC certification must be able to meet the damage requirement that applies to it and it is up to the loading officer and master to demonstrate, through one of the four options above, that this has been duly verified.

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

Coding matrix

Deficiencies supporting the Guidance on checking Tanker Damage Stability. For the sake of completeness this includes all convention references for all ships, not just tankers, in 01326.

Code	Defective item	Nature of defect	Delay action taken	Base Code	Convention reference	Equipment Y/N	Det. Y/N	ROs Y/N
01326	Stability Information Booklet	Not as required, Missing, Not Approved, Incomplete, Not in working language,	Rectified, At the next port, Within 14 days, Before departure, As in the agreed flag State condition, Master instructed to ...	01021 13010 13020 13090	SOLAS 1988 Amend / Chapter II-1 / Reg. 22 SOLAS 2006 Amend / Chapter II-1 / Reg. 5-1 IGC 83/90 Amend 2.2 IBC 1983 Chapter 2 Para 2.2 IBC 2004 Amend Chapter 2 Para 2.2 IS Code / Chapter 2 (2.1~2.6)	N	Y	Y
02103	Stability/Strength/Loading Information and Instruments	Missing, Incomplete, Not as Required, Insufficient, Not Available, Documentation Missing,	Rectified, At the next port, Within 14 days, Before departure, As in the agreed Class condition, As in the agreed flag State condition, Master instructed to ...	01021 02000 13010 13020 04010	ICLL 1988 Protocol / ANNEX B / Chapter II / Reg. 10 SOLAS 1989/1990 Amend / Chapter II-1 / Reg. 25-8 MARPOL 2004 Amend (Oct.) / Annex I / Chapter IV / Reg. 28 IGC 83/90 Amend / Annex/ Chapter 2 Para 2.4 IBC 2004 Amend / Annex / Chapter 2 Para 2.4	N	Y	Y

Nieuwe Uitleg 1
P.O. Box 90653
2509 LR The Hague
The Netherlands

Telephone: +31 70 456 1508
Telefax: +31 70 456 1599
E-mail: secretariat@parismou.org
Internet : www.parismou.org

02134	Loading/Ballast condition	Not as required, Insufficient stability, limits exceeded	Rectified, At the next port, Within 14 days, Before departure, As in the agreed Class condition, As in the agreed flag State condition, Master instructed to ...	13010 04010 13020 13090	IGC 83/90 AmendCh. 2 2.2.2 IGC 83/90 AmendCh. 2 2.2.3 IGC 83/90 AmendCh. 2 2.2.4 MARPOL 2004 Amend / Annex I / Chapter IV / Reg. 28 IBC 2004 Amend / AnnexChapter 2 / 2.2 IS Code / Chapter 2 (2.1~2.6) IS Code / Chapter 3/3.5	N	Y	Y

TECHNICAL REPORT

LOADING MANUAL

IMO NO.

REPORT NO. 2006-

REVISION NO. 0

DET NORSKE VERITAS

DET NORSKE VERITAS

TECHNICAL REPORT

Date of first issue:	Project No.:
2006-08-10	3615053
Approved by:	Organisational unit:
Liv Hovem Head of Section	Hydrodynamics, Structures and Stability
Client:	Client ref.:
V.Ships Norway AS	

DET NORSKE VERITAS AS
Maritime Technology and Production Centre
Maritime Technical Consultancy
Veritasveien 1
1322 Høvik
Norway
Tel: +47 67 57 99 00
Fax: +47 67 57 99 11
http://www.dnv.com
Org. No: NO 945 748 931 MVA

Summary:
This is the Trim and Stability Manual for the vessel DNV ID 25878.

A total of 8 different loading conditions are presented, in both departure and arrival condition, in addition to the ballast conditions and the lightship condition.

For damage stability of the 8 loading conditions, please see DNV Report no 2006-0109.

Report No.:	Subject Group:
2006-0108	
Report title:	
Loading Manual –	
Work carried out by:	
Work verified by:	

Date of this revision:	Rev. No.:	Number of pages:
06-08-10	0	349

Indexing terms

Key words	Service Area
Trim and Stability Oil and Chemical Products Tanker	Market Sector

☒ No distribution without permission from the client or responsible organisational unit (however, free distribution for internal use within DNV after 3 years)
☐ No distribution without permission from the client or responsible organisational unit.
☐ Strictly confidential
☐ Unrestricted distribution

TABLE OF CONTENTS

1 GENERAL PARTICULARS

General information

This booklet is prepared to enable the trim and stability and longitudinal strength calculations to be easily performed. The longitudinal strength calculations are made to check that the bending moments and hull girder shear force are within the permissible limits.

Identification and background:

Ship name	Ievoli Gold
IMO number	8916504
Signal Letter	MFMR8
Port of Registry	London
Name of Newbuilding Shipyard	Societa Esercizio Cantieri S.P.A.
Yard Hull Number	769
Year of Build	1993
Classification society	DNV
DNV ID Number	25878
Ship Type	Chemical Tanker, IBC type II

Reference dimensions:

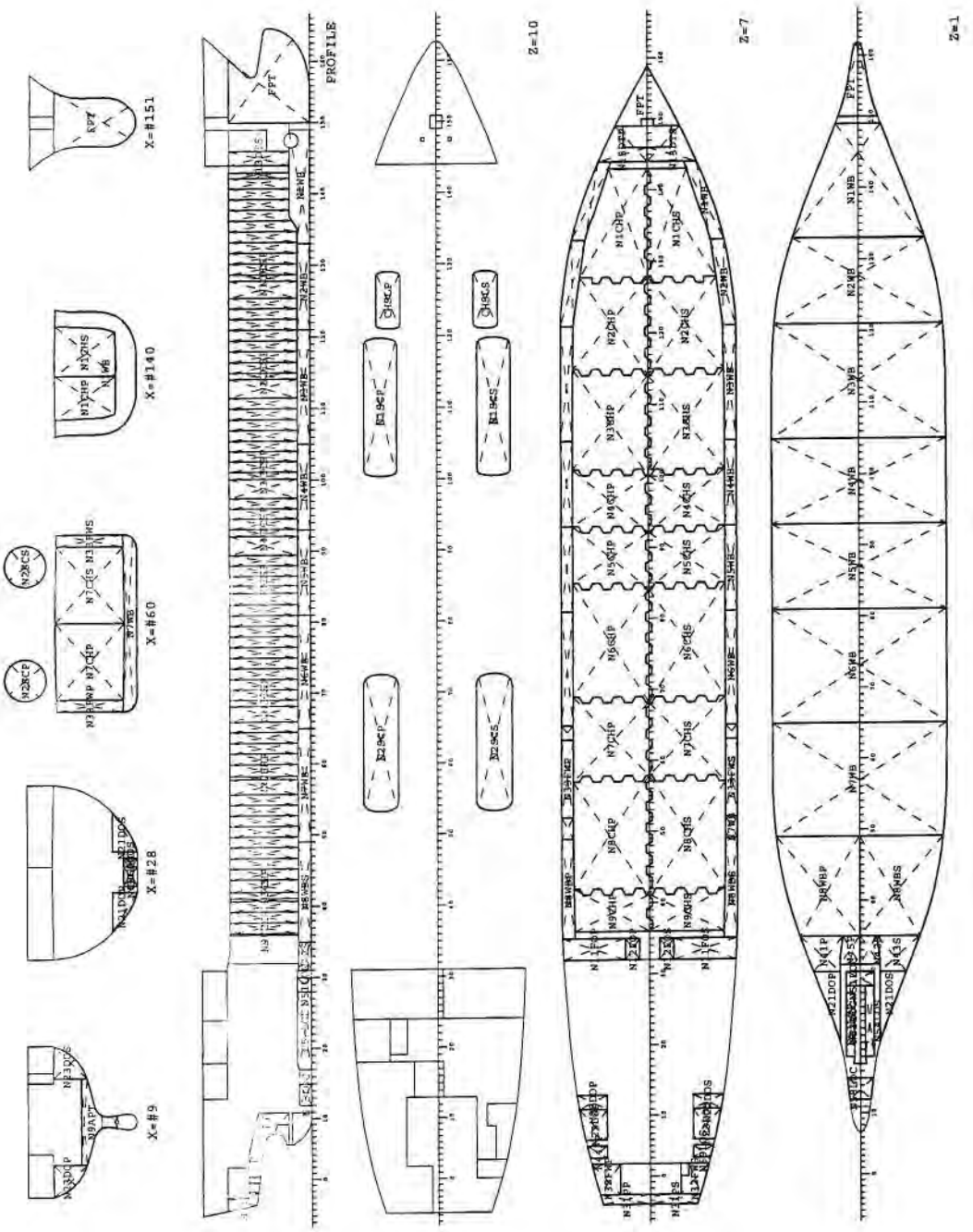
Length over all (LOA)	117.07 m
Reference length (LBP)	108.50 m
Breadth moulded	17.50 m
Moulded depth (1 st deck)	8.00 m
Maximum draught (midship moulded)	6.39 m
Aft perpendicular	0.000 m
Fore perpendicular	108.50 m
Shell thickness	0.010 m
Keel thickness	0.012 m

Main hydrostatic particulars referred to summer load line (maximum draught):

Summer Load Displacement	9808.6 tonnes
Light Ship Weight	2717.8 tonnes
Summer Load Deadweight	7090.8 tonnes
Longitudinal centre of buoyancy	56.060 m
Vertical centre of buoyancy	3.346 m
Transverse metacentre	7.334 m
Block coefficient	0.789

2 TANK ARRANGEMENT

2.1 Tank Plan



TECHNICAL REPORT

DAMAGE STABILITY CALCULATIONS

IMO NC

REPORT NO. 2006

REVISION NO. 0

DET NORSKE VERITAS

TECHNICAL REPORT

Date of first issue: 2006-08-08	Project No.: 3615053
Approved by: Liv Hovem Head of Section	Organisational unit: Hydrodynamics, Structures and Stability
Client: V.Ships Norway AS	Client ref.:

DET NORSKE VERITAS AS
Maritime Technology and Production Centre
Maritime Technical Consultancy
Veritasveien 1
1322 Høvik
Norway
Tel: +47 67 57 99 00
Fax: +47 67 57 99 11
http://www.dnv.com
Org. No: NO 945 748 931 MVA

Summary:
This report presents the damage stability calculations for the vessel

A total of 8 different loading conditions have been tested, in both departure and arrival condition. Side and bottom damage are investigated for each condition.

For intact stability analyses of the equivalent loading conditions, please see DNV Report no 2006-0108.

Report No.: 2006-0109	Subject Group:
Report title: Damage Stability Calculations – Ievoli Gold	
Work carried out by:	
Work verified by:	

Date of this revision:	Rev. No.:	Number of pages:
06-08-08	0	119

Indexing terms

Key words	Service Area
Damage Stability Calculations Oil and Chemical Products Tanker	Market Sector

☒ No distribution without permission from the client or responsible organisational unit (however, free distribution for internal use within DNV after 3 years)
☐ No distribution without permission from the client or responsible organisational unit.
☐ Strictly confidential
☐ Unrestricted distribution

TABLE OF CONTENTS

1 INTRODUCTION

1.1 General

This analysis is carried out on behalf of V. SHIPS NORWAY AS for . , DNV Id No 25878. The purpose of the analysis is to investigate the damage stability of the given loading conditions acc. to the IMO Chemical Code for a type II vessel of less than 150 m in length.

Intact stability calculations for the loading conditions are found in:

DNV Report No. : 2006-0108, Ievoli Gold - DNV ID 25878

1.2 Main Particulars

Length between perpendiculars.....108.500 m
Breadth moulded..... 17.500 m
Depth moulded..... 8.000 m
Summer draught moulded..... 6.387 m
Length (L) acc. to IMO Chem Code...108.820 m

1.3 Loading Conditions

The following loading conditions are analysed:

L01	Hmg Cargo excl Deck Tanks, Dens=0.9345, Dep
L02	Hmg Cargo excl Deck Tanks, Dens=0.9345, Arr
L03	Departure, Dens=1.0155 (DT empty)
L04	Arrival, Dens=1.0155 (DT empty)
L05	Departure, Dens=1.144 (DT, 4 & 7 empty)
L06	Arrival, Dens=1.144 (DT, 4 & 7 empty)
L07	Departure, Dens=1.443 (DT, 2 & 5 empty)
L08	Arrival, Dens=1.443 (DT, 2 & 5 empty)
L09	Departure, Dens=1.661 (DT, 2, 5 & 7 empty)
L10	Arrival, Dens=1.661 (DT, 2, 5 & 7 empty)
L11	Departure, Dens=1.913 (DT, 2, 5 & 7 empty)
L12	Arrival, Dens=1.913 (DT, 2, 5 & 7 empty)
L13	Hmg Cargo incl Deck Tanks, Dens=0.841, Dep
L14	Hmg Cargo incl Deck Tanks, Dens=0.841, Arr
L19	Mixed Cargo, Dens=0.844 & 1.45, Dep
L20	Mixed Cargo, Dens=0.844 & 1.45, Arr

1.4 Conclusions

The calculation shows that the vessel meets the damage stability criteria of the IMO Chemical Code for all the loading conditions.

The results of the calculation are found in chapter 4.

2 DAMAGE STABILTY ACC. TO MARPOL

2.1 Extent of Damage

a) Side damage

i) Longitudinal extent:	7.598 m, anywhere in the ship's length
ii) Transverse extent:	3.500 m
iii) Vertical extent:	Upwards without limit

b) Bottom damage	For 0.3L from the forward perpendicular of the ship	Any other part of the ship
i) Longitudinal extent:	7.598 m,	5.000 m
ii) Transverse extent:	2.917 m,	2.917 m
iii) Vertical extent:	1.167 m,	1.167 m

2.2 Downflooding Points and Margin Line

Positions of the entrance doors are taken from the General Arrangement, drawing no 769.00.1. Information regarding the positions of the water ballast tank ventilation heads are provided by the vessel's master.

2.3 Damage cases

Side and bottom damage and lesser extent damages are investigated.

The figure on the next page shows the arrangement of the damaged compartments.

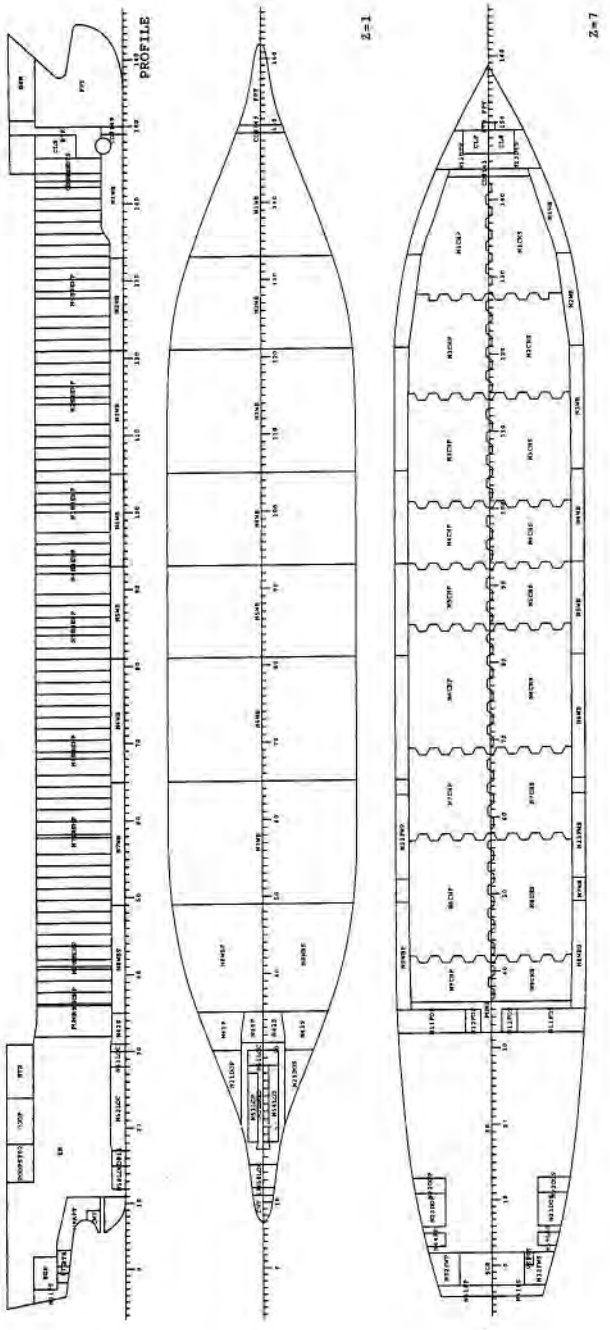


Figure: Arrangement of Damhull