CARGO SECURING MANUAL

ABS
MIRI
ABD SATTRUL
22 - APRIL - 2010

Vessel Name:	~~UFS ENAM~~ PRINCESS FATMA
IMO Number:	**9533385**
Official No.:	~~334016~~ 9252
Port of Registry:	~~PORT KLANG~~ PORT SAID
Vessel Type:	**ANCHOR HANDLING TUG & SUPPLY VESSEL**
Flag:	~~MALAYSIA~~ EGYPT
Built:	**2009**
Date:	**APRIL 2009**

APPROVED
on behalf of the government of the vessel's registry for compliance with SOLAS 1974 (as amended) subject to conditions of ABS letter
ABS

THIS MANUAL HAS BEEN EXAMINED FOR COMPLIANCE WITH THE INTERNATIONAL MARITIME ORGANIZATION'S CODE OF SAFE PRACTICE FOR CARGO STOWAGE AND SECURING (2003 Edition), AND FOUND TO BE SET OUT IN THE MANNER PRESCRIBED IN THE CODE AND PROVIDES THE NECESSARY GUIDANCE TO THE MASTER REGARDING ADEQUATE SECURING OF CARGO UNITS. THIS APPROVAL DOES NOT REMOVE THE MASTER'S RESPONSIBILITY FOR ENSURING THE SHIP IS STOWED SAFELY.

AS AMENDED
on pages: 9,10,27
only

TABLE OF CONTENTS & REVISION HISTORY

REVISION HISTORY:

Revision No.	Revision Summary	Date

LIST OF FIGURES

LIST OF TABLES

PREAMBLE

- In accordance with the International Convention for the Safety of Life at Sea, 1974 (SOLAS) Chapters VI, VII and the Code of Safe Practice for Cargo Stowage and Securing, cargo units, including containers shall be stowed and secured throughout the voyage in accordance with a Cargo Securing Manual, approved by the Administration.

- Cargo Securing Manuals are required to be carried on all ships to which the International Convention for the Safety of Life at Sea, 1974 (SOLAS), as amended, applies, and to cargo ships of less than 500 tons gross tonnage, except those engaged solely in the carriage of bulk cargoes, either solid or liquid (Solid bulk cargoes are to be stowed in accordance with the IMO Code of Safe Practice for Solid Bulk Cargoes.). The manual is also required on passenger ships which may also carry cargo, as well as on specialized vessels such as pipe and cable layers, and offshore supply vessels.

- It is important that securing devices meet acceptable functional and strength criteria applicable to the ship and its cargo. It is also important that the officers on board are aware of the magnitude and direction of the forces involved and the correct application and limitations of the cargo securing devices. The crew and other persons employed for the securing of cargoes should be instructed in the correct application and use of the cargo securing devices on board the ship.

- A copy of this Manual, approved by American Bureau Register of Shipping on behalf of the Government of the Malaysia is to be retained on board the vessel for examination and/or reference by American Bureau Register of Shipping Surveyors, Port/Flag State inspectors, and those involved with safe stowage and securing of cargoes carried.

- The information in this manual, including appendices as well as relevant reference documents should be reviewed and updated on a regular basis.

- In the event the provisions of this Cargo Securing Manual are revised, or the cargo securing devices described herein are significantly modified or altered, with the exception of the lists of portable cargo securing devices where devices are replaced with new devices of an identical type, this Manual should be resubmitted for review and approval by American Bureau Register of Shipping.

please comply with CSSC Annex 6, 8, 10 & Appendix 4A, 4B, 4C, 4D, 4E, 4F

MAIN PARTICULARS OF THE SHIP

Nam e of Ship	~~UFS ENAM~~ PRINCESS FATMA			
IM O Number	9533385			
Flag	~~M ALAYSIA~~ EGYPT			
Call Sign	~~9M II4~~ 6AGO	**~~Official Number~~**	334016	
Builder	BERJAYA DOCKYARD SDN BHD			
Hull No.	BJ-55	**Year Built**	2009	
Type of Ship	ANCHOR HANDLING TUG & SUPPLY VESSEL			
Class	ABS			
Length Overall	61.25 Meters			
Length B.P.	53.90 Meters			
Breadth Molded	16.0 Meters			
Depth Molded	6.0 Meters			
Design draft	5.1 Meters			
Tonnage (international)	**Gross**	1973 T	**Net**	592 T
Dead eight 1772.28	~~1790.85~~ Tons at summer draft			
Displacement	3346.59 M3			
Design Speed	13.5 knots			

Design Loads:

Location	Load (ton/m2)
M ain Deck	5

Guidance Note:
Where the design loading is not readily available, the following Rule reference loading may be used for guidance:

Location	*Rule Reference Uniform Loading (t/m 2)*
Exposed Deck on which Car o is carried	*2.636*

Typical GM Range

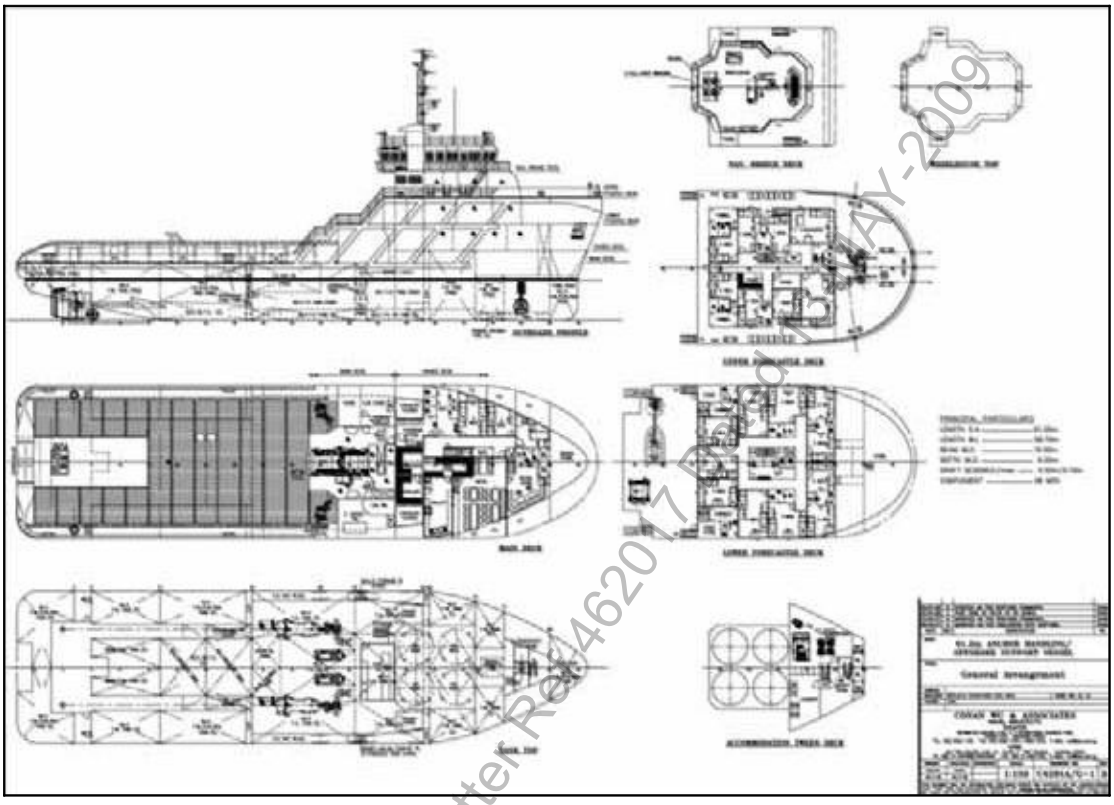
SHIP CONDITION		GM (m)	DRAFT (m)	DWT (tons)
Cndtn. 0	Lightship	2.841	2.830	0.0
Cndtn. 1	Departure at draft 5.1m Full Supplies with 150T Dry Bulk, Full Mud at Max. Draft. 52	2.969	5.146	1790.12
Cndtn. 2	Arrival of Condition # 1 with 10% consumables 161	3.061	4.185	1073.36
Cndtn. 3	Departure supplies with 500 ton deck cargo and supplies	2.639	5.040	1734.63
Cndtn. 4	Arrival Condition #3 with 10% consumables	2.804	4.002	966.23
Cndtn. 5	Departure with ballast without deck cargo	3.137	4.838	1567.29
Cndtn. 6	Arrival condition #5 with 10% consumables.	3.459	3.792	798.89
Cndtn. 7	Condition of #1 with 51 t bollard pull	2.996	5.147	1790.12
Cndtn. 8	Condition of #2 with 51 t bollard pull	3.053	4.185	1073.36

* PLEASE UPDATE AS PER STABILITY BOOKLET DETAILS.
" TO BE CORRELATED WITH THE APPROVED FINAL TRIM AND STABILITY BOOKLET ".

CARGO SPACE GENERAL ARRANGEMENT

(Refer to drawing)

Refer to General Arrangement Drawing: Hull BJ-55 / UFS ENAM attached.



1. GENERAL

1.1 Definitions

Definitions of terms used in this Manual:

1. *Cargo Securing Devices* are all fixed and portable devices used to secure and support cargo units.

2. *Maximum Securing Load (MSL)* is a term used to define the allowable load capacity for a device used to secure cargo to a ship. Safe Working Load (SWL) may be substituted for MSL for securing purposes, provided this is equal to or exceeds the strength defined by MSL.

   Note: Maximum securing load is to securing devices as safe working load is to lifting tackle.

3. *Standardized Cargo* means cargo for which the ship is provided with an approved securing system based upon cargo units of specific types. (For example, cargo which is secured in accordance with a set securing plan such as a lashing plan provided on container ships).

4. *Semi-standardized Cargo* means cargo for which the ship is provided with a securing system capable of accommodating a limited variety of cargo units, such as vehicles, trailers, etc.

5. *Non-standardized Cargo* means cargo which requires individual stowage and securing arrangements.

6. *Cargo Unit* means vehicle, container, flat, pallet, portable tank, packaged unit, or any other entity, etc. or loading equipment or any part thereof, which belongs to the ship but is not fixed to the ship.

7. *Unit load* means that a number of packages are either:

   - placed or stacked, and secured by strapping, shrink-wrapping or other suitable means, on to a load board such as a pallet; or
   - placed in a protective outer packaging such as a pallet box; or
   - permanently secured together in a sling.

8. *Intermediate Bulk container (IBC)* means a rigid, semi-rigid or flexible portable bulk container packaging of a capacity of not more than 3m3 (3,000 *l*), designed for mechanical handling and tested for its satisfactory resistance to handling and transport stresses.

9. *Portable Tank* means a tank which is not permanently secured on board a ship, and has a capacity of more than 450 litres and a shell fitted with external stabilizing members and items of service equipment and structural equipment necessary for the transport of gases, liquids or solids.

10. *Road tank-vehicle* means a vehicle with wheels and fitted with a tank or tanks intended for the transport of gases, liquids or solids by both road and sea modes of transport, the tank or tanks of which are rigidly and permanently attached to the vehicle during all normal operations of loading, transport and discharge and are neither filled nor emptied on board.

11. *Road vehicle* means a commercial vehicle, semi-trailer, road train, articulated road train or a combination of vehicles.

12. *Roll-trailer* means a low vehicle for the carriage of cargo with one or more wheel axles on the rear and a support on the front end, which is towed or pushed in the port to and from its stowage on board the ship by a special tow-vehicle.

13. *Ro-Ro ship* means a ship which has one or more decks either closed or open, not normally subdivided in any way and generally running the entire length of the ship, carrying goods which are loaded and unloaded normally in a horizontal manner.

1.2 General Information

1. The information contained in this Cargo Securing Manual is in an approved form in accordance with MSC/Circ.745 dated 13 June 1996 - "Guidelines for the Preparation of the Cargo Securing Manual".

2. The guidance given herein should by no means rule out the principles of good seamanship, neither can it replace experience in stowage and securing practice.

3. The information and requirements set forth in this Manual are consistent with the requirements of the vessel's Trim & Stability booklet, International Load Line Certificate (1966), the hull strength loading manual (if provided) and with the requirements of the International Maritime Dangerous Goods (IMDG) Code (if applicable).

4. This Cargo Securing Manual specifies the arrangements and cargo securing devices provided on board the ship for the correct application to, and the securing of, cargo units, containers, vehicles and other entities, based on transverse, longitudinal and vertical forces which may arise during adverse weather and sea conditions.

5. It is imperative to the safety of the ship and the protection of the cargo and personnel that the securing of the cargo be carried out properly and that only appropriate securing points or fittings should be used for cargo securing.

6. The cargo securing devices mentioned in this Manual should be applied so as to be suitable and adapted to the quantity, type of packaging, and physical properties of the cargo to be carried. When new or alternative types of cargo securing devices are introduced, the Cargo Securing Manual should be revised accordingly. Alternative cargo securing devices introduced should not have less strength than the device being replaced and which should be certified appropriately in accordance with National or International Standards.

7. There should be a sufficient quantity of reserve cargo securing devices on board the ship.

8. Information on the strength and instructions for the use and maintenance of each specific type of cargo securing device, where applicable, is provided in this Manual. The cargo securing devices should be maintained in a satisfactory condition. Items worn or damaged to such an extent that their quality is impaired should be replaced.

9. The purpose of this manual is to provide guidance to the Master and crew on board the vessel with respect to the proper stowage and securing of cargo units throughout the voyage.

10. The Masters should ensure that cargo carried in the vessel are at all times stowed and secured in an efficient manner, taking into account the prevailing conditions and the general principals of safe stowage.

1.3 Cargo Information

1. Prior to shipment the shipper should provide all necessary information about the cargo to enable the shipowner or ship operator to ensure that:

   - the different commodities to be carried are compatible with each other or suitably separated;
   - the cargo is suitable for the ship;
   - the ship is suitable for the cargo; and
   - the cargo can be safely stowed and secured on board the ship and transported under all expected conditions during the intended voyage.

2. The master should be provided with adequate information regarding cargo to be carried so that its stowage may be properly planned for handling and transport.

1.4 Stowage and Securing

1. General principles of cargo securing:

   - All cargoes should be stowed and secured in such a way that the ship and persons on board are not put at risk.
   - The safe stowage and securing of cargoes depends on proper planning, execution and supervision.
   - Personnel commissioned to tasks of cargo stowage and securing should be properly qualified and experienced.
   - Personnel planning and supervising the stowage and securing of cargo should have a sound practical knowledge of the application and content of this Cargo Securing Manual.
   - In all cases, improper stowage and securing of cargo will be potentially hazardous to the securing of other cargoes and to the ship itself.
   - Decisions taken for measures of stowage and securing cargo should be based on the most severe weather conditions which may be expected by experience for the intended voyage.
   - Ship-handling decisions taken by the master, especially in bad weather conditions, should take into account the type and stowage position of the cargo and the securing arrangements.

2. Cargo carried in a cargo unit shall be packed and secured within the unit so as to prevent, throughout the voyage, damage or hazard to the ship, to the persons on board and to the marine environment.

3. Appropriate precautions shall be taken during loading and transport of heavy cargoes or cargoes with abnormal physical dimensions to ensure that no structural damage to the ship occurs and to maintain adequate stability throughout the voyage.

4. Cargo should be stowed such that the design loads for main deck, 'tween deck, hatchcovers and inner bottom, indicated under ship's particulars at the beginning of this manual, are not exceeded.

2. SECURING DEVICES AND ARRANGEMENTS

2.1 Specification for Fixed Securing Devices

This sub-chapter indicates and illustrates the number, locations, type and MSL of the fixed devices used to secure cargo.

1. The fixed cargo securing devices are shown in the following Appendices, indicating their number, location, type and maximum securing loads as well as longitudinal and transverse distances between securing points.

- Location of Fixed Securing Devices on Deck. See Appendix 1A
- Details of Fixed Securing Devices on Deck. See Appendix 1B
- Sketches/Drawings of Fixed Securing Devices on Deck. See Appendix 1C

2. Existing securing arrangements which have proven satisfactory in service are not subject to examinations providing they are properly maintained and used for the purpose for which they are intended.

3. If and when a new fixed securing device is to be fitted on an existing vessel, structural details and calculations, demonstrating structural adequacy of the supporting structure, are to be submitted for review by ABS and the appropriate certification should be retained with this Manual.

4. For existing fixed fittings where there is any doubt over the capability of existing fixed securing arrangements, including supporting structure, the fixed fitting should be Prooftested at loads equal to the maximum specified securing load +50%. The proof loading is to be applied at both the mean and extreme angles of operation.

5. Loads exerted on the ship's structure, by cargo securing devices and associated attachments, are not to exceed the loads indicated under Ship's particulars/Design loads at the beginning of this manual.

2.2 Portable Securing Devices

This sub-chapter describes the number of, and the functional and design characteristics of the portable cargo securing devices carried on board the ship.

1. The following appendices give the details of the portable securing devices used on board the ship, and are supplemented by appropriate drawings and sketches.

- Table of portable securing devices including Item, Model/Type, Strength (MSL/SWL), Quantity, Storage Location. See Appendix 2A
- Sketches of portable securing devices. See Appendix 2B

2. All portable securing devices shall be certified in accordance with an appropriate national or international standard. The certificates for these devices are (included in Appendix 2A to this Manual OR available on board).

2.3 Inspection & Maintenance Schemes

This sub-chapter of the manual describes the inspection and maintenance schemes for the cargo securing devices on board the ship.

2.3.1 Regular Inspections And Maintenance Are Carried Out Under The Responsibility Of The Master. Cargo Securing Device Inspections As A Minimum Should Include:

1. Routine visual examinations of components being utilized. (Refer to the latest revision of the Planned Maintenance System Manual, PMSM-07-4D which is located on the wheel house.)

2. Periodic examinations/re-testing as required by the Administration. When required, the cargo securing devices concerned should be subjected to inspections by the Administration.

2.3.2 This Sub-Chapter Documents Actions To Inspect The Ships Cargo Securing Devices. Entries Are Made In A Record Book.

1. All cargo securing devices shall be regularly examined for wear and tear and their operational and functional integrity maintained. The proper maintenance of all cargo securing devices rests upon the owner/operator. Where applicable, manufacturer's recommended maintenance procedure is to be adhered to.

2. Damaged or otherwise unfit cargo securing devices shall be appropriately identified and kept isolated to prevent from being inadvertently used.

3. In the event of any damage or deterioration to the ship's structure in way of fixed cargo securing devices, including container corner fitting pockets, are to be brought to the attention of ABS at the first opportunity.

4. A record is to be kept on board the vessel which is to show particulars of all inspections, overhauls, repairs and replacements carried out. Certificates for devices, as required in Sections 2.1 and 2.2 above, are to be retained in ship's record. These are to be kept together with the cargo securing manual. (Refer to the latest revision of the Planned Maintenance System Manual, PMSM-07-4D which is located on the wheel house.)

2.3.3 This Sub-Chapter Of The Manual Contains Information For The Master Regarding Inspections And Adjustments Of Securing Arrangements During The Voyage.

1. The integrity of the securing arrangements should be maintained throughout the voyage.

2. Particular attention should be paid to the need for tight lashings, grips and clips to prevent weakening through chafing. Wire clips should be adequately greased, and tightened so that the dead end of the wire is visibly compressed. Timber cradles, bedding and shoring should be checked, in so far as practicable and accessible.

3. Lashings should be regularly checked and re-tightened.

   It is of paramount importance that all lashings be carefully examined at regular intervals during the voyage and tightened, as the vibration and working of the ship may cause the cargo to settle and compact. Lashings may also become slack due to deformation of cargo and temperature differential.

4. Greasing the thread of clips and turnbuckles increases working life and prevents corrosion.

5. Action which may be taken in heavy weather:

General

The purpose of this section is not to usurp the responsibilities of the master, but rather to offer some advice on how stresses induced by excessive accelerations caused by bad weather conditions could be avoided.

Excessive accelerations

Measures to avoid excessive accelerations are:

1. alteration of course or speed, or a combination of both;

2. heaving to;

3. early avoidance of areas of adverse weather and sea conditions; and

4. timely ballasting or deballasting to improve the behaviour of the ship, taking into account the actual stability conditions (see also 6 below)

Voyage planning

One way of reducing excessive accelerations is for the master, as far as possible and practicable, to plan the voyage of the ship carefully so as to avoid areas with severe weather and sea conditions. The master should always consult the latest available weather information.

6. Actions which may be taken once cargo has shifted

The following actions may be considered:

1. alterations of course to reduce accelerations;

2. reductions of speed to reduce accelerations and vibration;

3. monitoring the integrity of the ship;

4. restowing or resecuring the cargo and, where possible, increasing the friction; and

5. diversion of route in order to seek shelter or improved weather and sea conditions

Tank ballasting or deballasting operations should be considered only if the ship has adequate stability.

3. STOWAGE AND SECURING OF NON-STANDARDIZED AND SEMISTANDARDIZED CARGO

3.1 Handling & Safety Instructions

This sub-chapter contains instructions on:

- the proper handling of the securing devices,
- safety instructions related to handling of securing devices and to securing and unsecuring of units by ship or shore personnel.

1. In handling ship's cargo securing devices, following shall be considered:

- The cargo securing devices and arrangements should be appropriate for the quantity and properties of the cargo to be secured.
- All cargo securing devices should be used and maintained as per manufacturers' recommendations and as described in their respective operational manuals.
- Securing devices should be assembled so that each component is of equal strength.
- Connecting elements and tightening devices should be used in the correct way. Consideration should be given to any reduction of the strength of the lashings during the voyage through corrosion, fatigue or mechanical deterioration and should be compensated by using stronger securing material.
- Particular attention should be paid to the correct use of wire, grips and clips. The saddle portion of the clip should be applied to the live load segment and the U-bolt to the dead or shortened end segment.
- Securing devices should be arranged in such a way that each device takes its share of load according to its strength.
- Mixed securing arrangements of devices with different strength and elongation characteristics should be avoided.

2. Generally, the following safety instructions related to handling of securing devices and to securing and unsecuring of units by ship or shore personnel shall be observed:

- The ship's cargo securing equipment should be suitable for its intended purpose, of adequate strength and available in sufficient quantity together with sufficient quantity of reserve cargo securing gear on board the ship.
- Cargo securing arrangements and equipment should have sufficient residual strength to allow for normal wear and tear during their lifetime.
- Lashings should be kept as short as possible because long lashings are difficult to tighten and, therefore, difficult to keep taut.
- The principal means of preventing the improper stowage and securing of cargoes is through proper supervision of the loading operation and inspection of the stow. It is of utmost importance that the master takes great care in planning and supervising the stowage and securing of cargoes in order to prevent cargo sliding, tipping, racking, collapsing, etc.

- As far as practicable, cargo spaces should be regularly inspected throughout the voyage to ensure that the cargo, vehicles and cargo transport units remain safely secured. The master should ensure that it is safe to enter any enclosed space as the atmosphere may be incapable of supporting human life through lack of oxygen or it may contain flammable or toxic gases.

- Particular care should be taken to distribute forces as evenly as practicable between the cargo securing devices. If this is not feasible, the arrangements should be upgraded accordingly.

- Some cargoes have a tendency to deform or to compact themselves during the voyage, which will result in a slackening of their securing gear.

- For cargoes with low friction coefficients, suitable material such as soft boards dunnage or other anti-skid material shall be used, as far as practicable, to increase friction and prevent sliding or slipping of cargo (See paragraph 7.2.1 of the CSS Code).

- Timber shoring should not exceed 2 m in length and contact surface should be at least 100cm2.

- The following criteria should be taken into account when selecting suitable securing methods and whenever reviewing the forces to be absorbed by the securing equipment:

  ♦ dimensional and physical properties of the cargo;
  ♦ location of the cargo and its stowage on board;
  ♦ suitability of the ship for the particular cargo;
  ♦ suitability of the securing arrangements for the particular cargo;
  ♦ expected seasonal weather and sea conditions;
  ♦ expected ship behavior during the intended voyage;
  ♦ stability of the ship;
  ♦ geographical area of the voyage; and
  ♦ duration of the voyage.

- Having evaluated the risk of cargo-shifting, the master should ensure, prior to loading/securing of any cargo, cargo transport unit or vehicle that:

  1. the cargo, cargo transport unit or vehicle appears to be in suitable condition for transport, and can be effectively secured;
  2. all necessary cargo securing equipment is on board and in good working condition; and
  3. cargo in or on cargo transport units and vehicles is, to the extent practicable, properly stowed and secured on to the unit or vehicle.

- If, due to the complex structure of a securing arrangement or other circumstances, the person in charge is unable to assess the suitability of the arrangement from experience and knowledge of good seamanship, the arrangement should be verified by using an acceptable calculation method.

3.2 Evaluation of Forces Acting on Cargo Units

This sub-chapter contains the following information:

1. tables/diagrams giving a broad outline of the accelerations which can be expected in various positions on board the ship in adverse sea conditions and with a range of applicable metacentric height (GM) values;

2. examples of the forces acting on typical cargo units when subjected to the accelerations referred to in paragraph 1 above and angles of roll and metacentric height (GM) values above which the forces acting on the cargo units exceed the permissible limit for the specified securing arrangements as far as practicable;

3. examples of how to calculate number and strength of portable securing devices required to counteract the forces referred to in 2 above as well as safety factors to be used for different types of portable cargo securing devices.

3.2.1 Scope Of Application

1. The methods described in this sub-chapter should be applied to non-standardized cargoes.

2. Nothing in this sub-chapter should be read to exclude the use of computer software, provided the output achieves design parameters which meet the minimum safety factors applied in this section.

3. The application of the methods described in this sub-chapter is supplementary to the principles of good seamanship and shall not replace experience in stowage and securing practice.

3.2.2 Calculation Of Efficiency Of The Securing Arrangement

Calculations may be carried out in accordance with the procedure outlined in Annex 13 of the Code of Safe Practice for Cargo Stowage and Securing, Annex 8 in this manual, or other methods accepted by the Administration.

a) Calculation of Accelerations :

The procedure to calculate the acceleration at any point on the ship, in accordance with Annex 13 to CSS Code, consists of the following steps:

1. Determine vertical position (on deck - high, on deck - low, 'tween deck or lower hold)

2. Determine the longitudinal position with respect to the aft perpendicular or A.P. (within the range 0 to 1.0 L, where L is the LBP of the ship)

3. Determine the basic accelerations in transverse, longitudinal and vertical directions using CSSC Annex 13, or Table A8.2 in Annex 8 of this manual.

4. Apply correction to the basic acceleration, determined in step 3 above, for the length and speed of the specific vessel, using CSSC Annex 13, or Table A8.3 in Annex 8 of this manual.

5. If the B/GM ratio is less than 13, the transverse accelerations, as corrected in step 4, are to be corrected using Table A8.4 in Annex 8 of this manual.

b) Balance of forces and moments:

The balance calculation should preferably be carried out for:

- transverse sliding in port and starboard directions;
- transverse tipping in port and starboard directions;
- longitudinal sliding under conditions of reduced friction in forward and aft directions.

In the case of symmetrical securing arrangements, one appropriate calculation is sufficient.

Appendix 3A to this manual contains an example for hand calculations, using the 'Advanced Calculation Method' as per Annex 13 to the Code of Safe Practice for Cargo Stowage and Securing. Appendix 3B contains the calculation sheet which may be used for a specific vessel.

3.3 Application of Portable Securing Devices on Various Cargo Units, ehicles and Stowage Blocks

For the definition of various items, reference should be made to Chapter 1 of this manual.

3.3.1 Correct Application of Portable Cargo Securing Devices

The following factors should be taken into account when selecting suitable stowage and securing methods using portable securing devices and whenever reviewing the forces to be absorbed by the securing equipment.

1. Prior to the loading and securing of any cargo, all the factors listed under Section 3.1 of this manual, should be carefully considered. The factors to be taken into account include:

    - duration of the voyage;
    - geographical area of the voyage;
    - expected seasonal weather and sea conditions;
    - dimension, design and characteristics of the ship;
    - expected static and dynamic forces during the voyage;
    - type and packaging of cargo units including vehicles;
    - location of the cargo and its stowage on board;
    - intended stowage pattern of the cargo units including vehicles; and
    - mass and dimensions of cargo units and vehicles.

2. Decision taken for measures of stowage and securing cargo should be based on the most severe weather conditions which may be expected by experience for the intended voyage.

3. Minimum safe operational temperatures of all portable securing devices should be taken into consideration when operating in cold climates, especially those intended for use in exposed location, to ensure that their strength is not impaired.

4. Wire clips should be adequately greased and tightened so that the dead end of the wire is visibly compressed. The saddle portion of the clip should be applied to the live load segment and the U-bolt to the dead or shortened end segment.

Note: Regarding the following three items, refer to Appendix 2 for details on Portable Securing Devices.

5. As far as practical, thimbles shall be used when forming eyes. The size of the thimble shall be determined by the size of the wire to be used.

6. Tensioners such as turnbuckles or bottle-screws shall always be used in securing arrangements in order that lashings can be maintained in a taut condition.

7. Ships mobile cargo handling equipment not fixed to the ship should be adequately secured, when not in proper use.

3.3.2 Application of Lashings

This sub-chapter describes the application of portable cargo securing devices as to number of lashings and allowable lashing angles.

For a correct understanding and proper application of the lashings for various types of cargo and cargo units, reference is made to the sketches shown in Annex 1 through Annex 5, of this manual. The following factors should be considered:

1. Bearing in mind the characteristics of the ship and the weather conditions expected on the intended voyage, the master should decide on the number of securing points and lashings to be used for each voyage.

2. Lashings should be kept, when possible, under equal tension.

3. Lashings may become slack when cargoes are loaded and secured in conditions of low ambient temperature and the vessel then proceeds to areas of significantly higher ambient temperature.

4. The securing devices should be arranged in a way to withstand transverse and longitudinal forces which may give rise to sliding or tipping.

5. The optimum lashing angle against sliding is about 25°, while the optimum lashing angle against tipping is generally found between 45° and 60°.

6. If a heavy cargo item has been dragged into position on greased skid boards or other means to reduce friction, the number of lashings used to prevent sliding should be increased accordingly.

7. If, owing to circumstances, lashings can be set at large angles only, sliding must be prevented by timber shoring, welded fittings or other appropriate means. Any welding should be carried out in accordance with accepted hot work procedures.

8. Lashing eyes shall be connected to fixed securing points using shackles, tensioners or other suitable devices.

9. After first tightening of the lashing the nuts of wire clips should be re-tightened. Wire lashings should be applied in a way that chafing at sharp corners is avoided.

Assembling Conventional Wire Lashing

When assembling and applying conventional wire lashings, the following principles should be observed:

1. Lashings should preferably consist of wire ropes or chains or material with equivalent strength and elongation characteristics.

2. Ends of cut-off lengths of wire ropes should be secured by suitable adhesive tape.

3. The number of wire clips should be four per wire loop, when forming an eye (see Figure 3.1).

4. The size of wire clip should be matching the diameter of the wire rope.

5. Wire clips should be spaced at intervals about six times the wire diameter.

6. The U-bolt of wire clips should preferably be applied to the dead end of the wire rope.

7. Threads of wire clips should be greased and nuts tightened until the dead end of the wire rope is visibly dented. Without greasing a sufficient tightening will be impossible.

8. Turn sticks may be used for wires of 12mm diameter or less. They should be secured against reverse turning after tightening the lashing.

9. Doubling a wire rope does not necessarily mean a doubling in MSL, due to loss of strength at the bend on top side. However, MSL would be doubled if the top bend has a radius of at least three times the wire diameter.

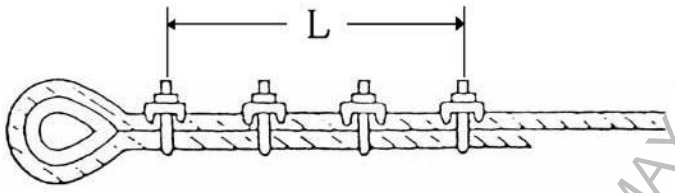


FIGURE 3.1
Forming an Eye

3.3.3 Guidance as to Recommended Location and Method of Stowage and Securing of Cargoes.

This sub-chapter contains guidance as to the recommended location and method of stowing and securing of containers, trailers and other cargo carrying vehicles, palletised cargoes, unit loads and single cargo items (e.g. wood pulp, paper rolls, etc.), heavy weight cargoes, cars and other vehicles.

Listed below are Annexes, which provide guidance with respect to stowage and securing of each type of cargo have been included in this Manual and are denoted below. The Annexes have been extracted from the IMO's "Code of Safe Practice for Cargo Stowage and Securing".

1.	Containers when carried on deck of ships which are not specially designed and fitted for the purpose of carrying containers	Annex 1
2.	Portable tanks(tank containers)	Annex 2
3.	Portable receptacles	Annex 3
4.	Special wheel based (rolling) cargoes	Annex 4
5.	Heavy cargo items such as locomotives, transformers, etc.	Annex 5
6.	Heavy metal products	Annex 6
7.	Anchor chains	Annex 7

3.4 Offshore Supply Vessels

This sub-chapter includes extracts from the OSV Code, MSC 66/24/Add.2 Resolution A. 863(20) for cargo stowage onboard Offshore Supply Vessels.

Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels (OSV Code)

3.4.1 Definitions (OSV Code, MSC 66/24/Add.2, Annex 18, para 1.1)

1. *Offshore Installation* means a structure which is, or is to be, or has been used, while standing or stationed in water or on the foreshore or other land intermittently covered with water.

2. *Offshore Supply Vessel (OSV)* means a vessel which is used for the transportation of stores, materials, equipment or personnel to, from and between offshore installations.

3. *Operator* means the party who contracts an offshore supply vessel.

4. *Cargo handler* means a member of the ship or offshore installation handling the cargo on board the OSV at the offshore installation.

3.4.2 Stowage and Securing of Cargo

1. Cargoes should be properly stowed and secured during sea transport. Regular visual checks of the securing arrangements should be carried out.

2. The master should ensure that the vessel has a sufficient quantity and types of lashing and securing material for the safe operation of the vessel, as described in Section 3.1 of this manual.

The lashing and securing materials should be:

.1 suitable for their intended purpose

.2 of adequate strength

.3 easy to use

.4 well maintained; and

.5 periodically inspected,

and a record should be kept of the inspections.

3. The number of cargo handlers should be sufficient for safe and effective cargo operations and reflected in the pre-planning.

4. During deck cargo handling operations other activities should be avoided on the cargo deck of the vessel.

5. Operator should ensure that as much cargo as possible is containerized to allow safer stowage and securing on deck. Where different container sizes are used, the need for safe securing should be considered when planning the stowage.

6. The operator should ensure that cargoes within containers are adequately stowed and secured for sea transport. The master has the authority to carry out random inspections. If inspection of any container reveals inadequate stowing, lashing or securing arrangements, inadequate marking or labeling of dangerous goods, or if he is in doubt as to the safety status of the container, he should refuse this container for sea transport.

7. Before loading the master should be provided with details on dangerous cargoes, nonstandardized cargoes and cargoes which are heavy, difficult to stow, secure, or unload.

8. The master should not accept the loading of any cargo which is not safe for cargo handling. not adequately packed, not properly marked or not properly documented.

The responsibility for ensuring that cargoes are properly prepared for carriage on board OSVs rests with the operator, shipper and/or owner of the items concerned

9. Both during sea transport and operations at the offshore installation, OSVs with an open stern, under certain conditions (e.g. certain weather- and sea conditions, deeply laden) are troubled with incoming water on the exposed cargo deck. This can lead to dangerous situations, especially if cargoes with a tendency to and/or with low friction coefficients are stowed on the exposed deck of the vessel. Adequate measure are to be taken to counter these dangers.

10. The crew of OSVs should be adequately trained.

ANNEX 1

Safe Stowage and Securing of Containers on Deck of Ships Which are Not Specially Designed and Fitted for the Purpose of Carrying Containers

1 Stowage

1.1 Containers carried on deck or on hatches of such ships should preferably be stowed in the fore-and-aft direction.

1.2 Containers should not extend over the ship's sides. Adequate supports should be provided when containers overhang hatches or deck structures.

1.3 Containers should be stowed and secured so as to permit safe access for personnel in the necessary operation of the ship.

1.4 Containers should at no time overstress the deck or hatches on which they are stowed.

1.5 Bottom-tier containers, when not resting on stacking devices, should be stowed on timber of sufficient thickness, arranged in such a way as to transfer the stack load evenly on to the structure of the stowage area.

1.6 When stacking containers, use should be made of locking devices, cones, or similar stacking aids, as appropriate, between them.

1.7 When stowing containers on deck or hatches, the position and strength of the securing points should be taken into consideration.

2 Securing

2.1 All containers should be effectively secured in such a way as to protect them from sliding and tipping. Hatch covers carrying containers should be adequately secured to the ship.

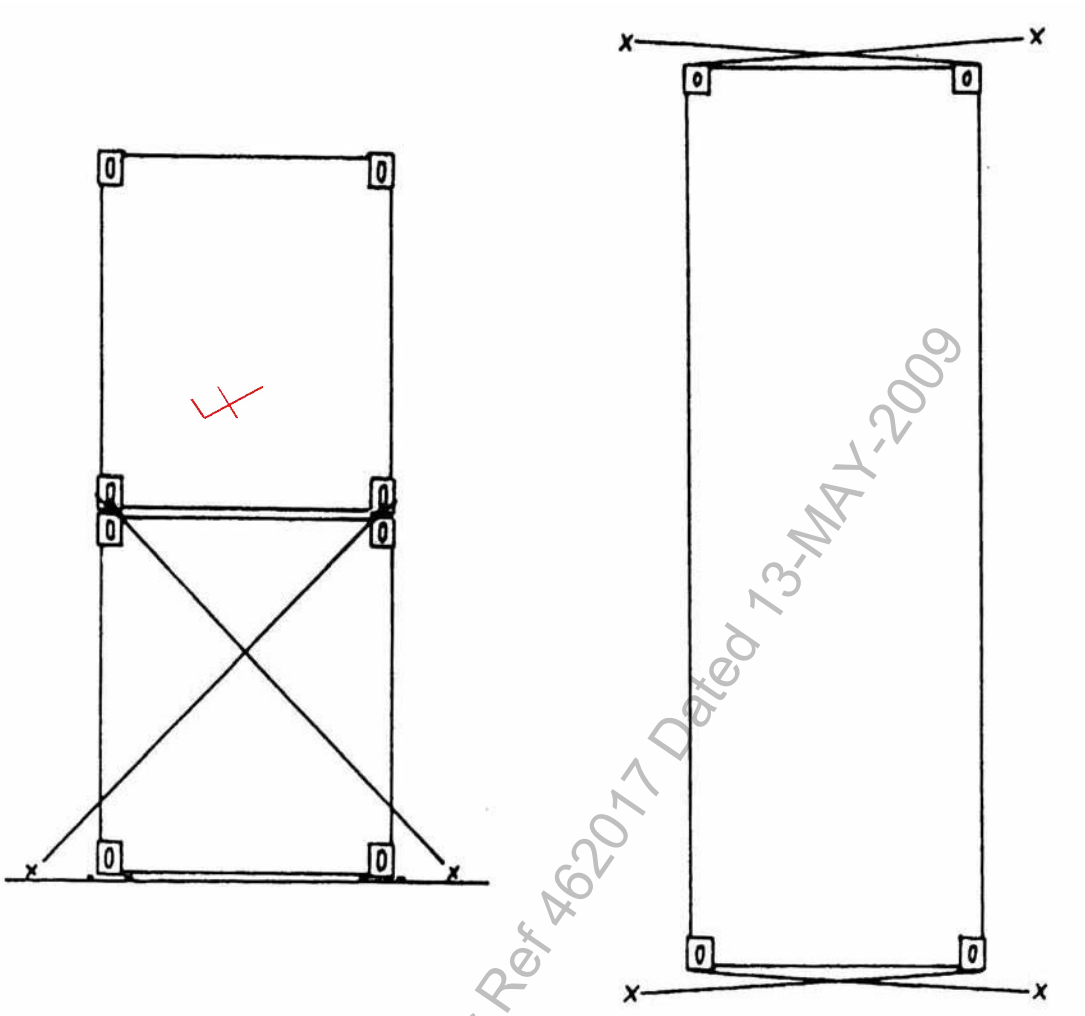
2.2 Containers should be secured using one of the three methods recommended in Figure A1.1 or methods equivalent thereto.

2.3 Lashings should preferably consist of wire ropes or chains or material with equivalent strength and elongation characteristics.

2.4 Timber shoring should not exceed 2 m in length.

2.5 Wire clips should be adequately greased and tightened so that the dead end of the wire is visibly compressed (Figure A1.2).

2.6 Lashings should be kept, when possible, under equal tension.



Method A – *Medium-weight containers: weight of top container not more than 70% of that of bottom container*

FIGURE A1.1 (Part 1)
Recommended Methods of Non-standardized Securing of Containers

SEE ABS LETTER FOR COMMENT.

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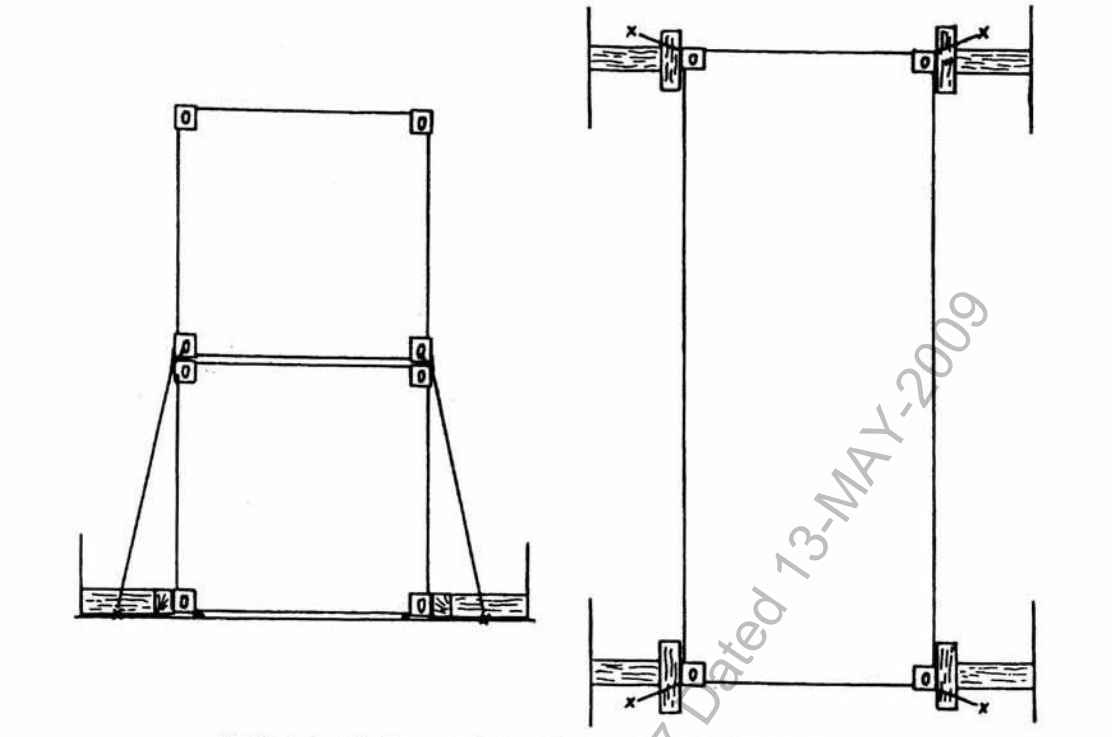
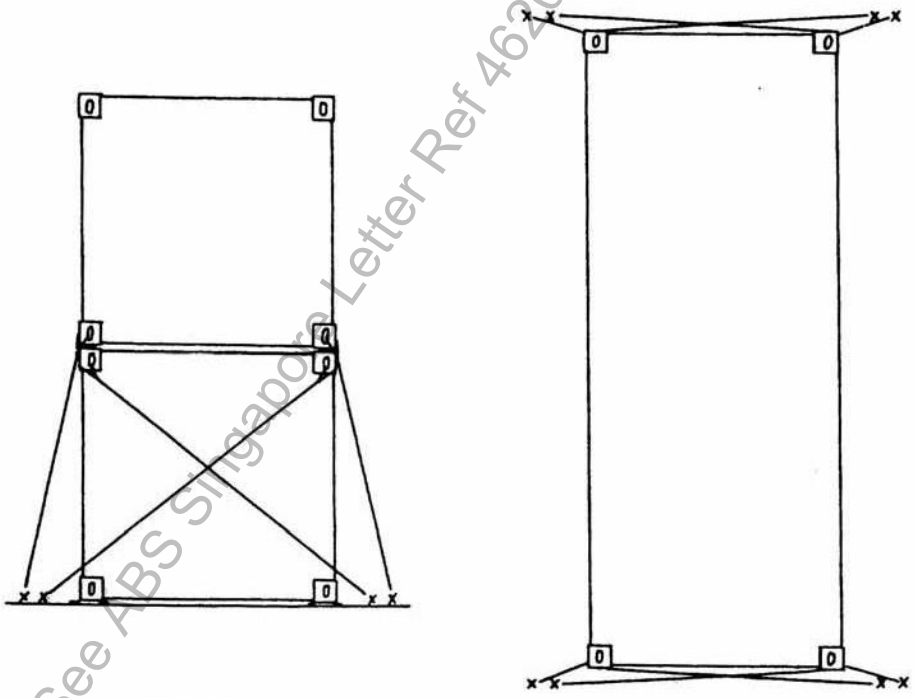


Method B – *Medium-weight containers: weight of top container may be more than 70% of that of bottom container*



Method C – *Heavyweight containers: weight of top container may be more than 70% of that of bottom container*

FIGURE A1.1 (Part 2)
Recommended Methods of Non-standardized Securing of Containers

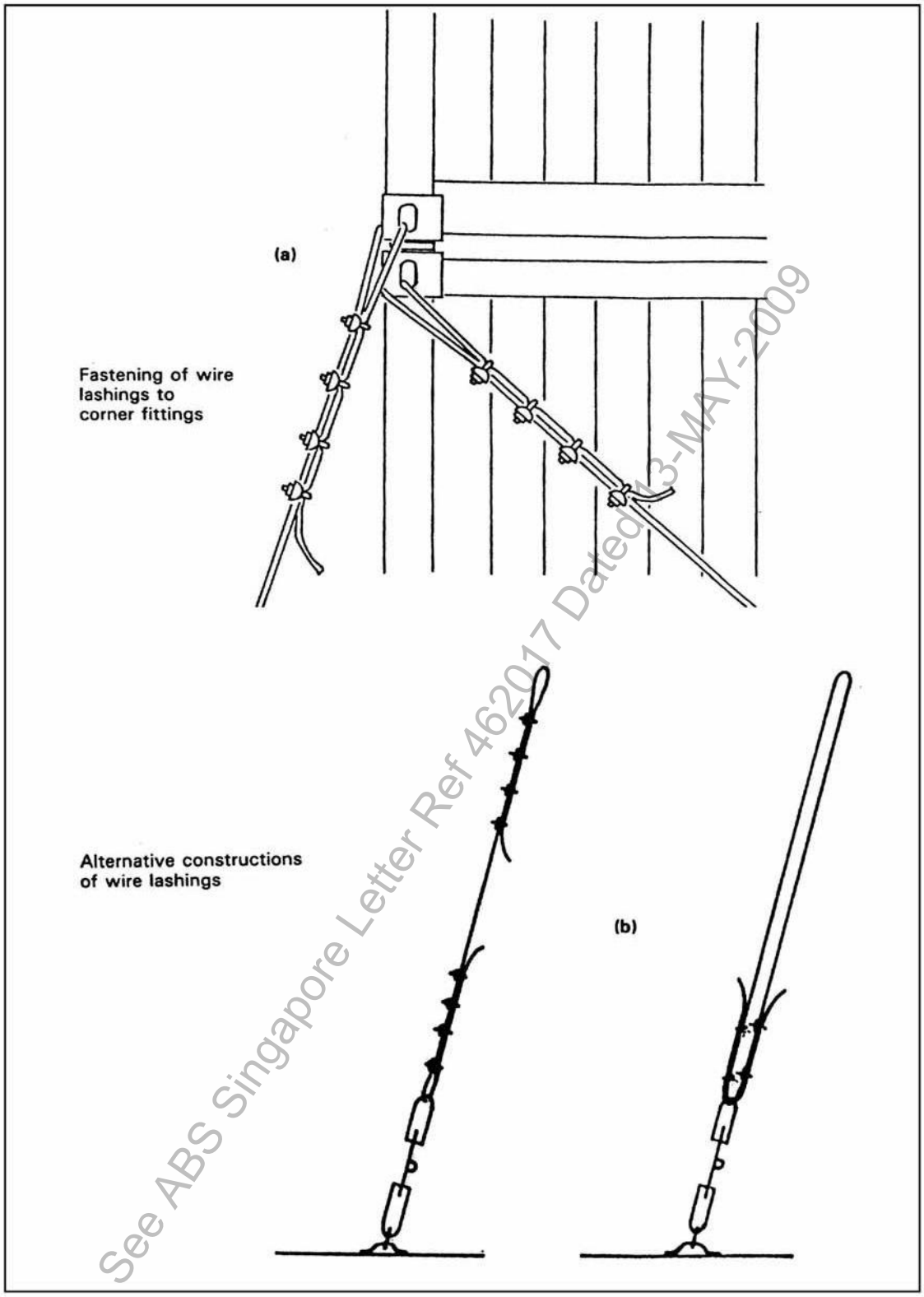


FIGURE A1.2
Detail of Wire Lashings

ANNEX 2

Safe Stowage And Securing Of Portable Tanks

1 Introduction

1.1 The provisions of this annex apply to a portable tank, which in the context of this annex, means a tank which is not permanently secured on board the vessel and has a capacity of more than 450 l and a shell fitted with external stabilizing members and items of service equipment and structural equipment necessary for the transport of liquids, solids or gases.

1.2 These provisions do not apply to tanks intended for the transport of liquids, solids or gases having a capacity of 450 l or less.

Note: The capacity for portable tanks for gases is 1000 l or more.

2 General Provisions For Portable Tanks

2.1 Portable tanks should be capable of being loaded and discharged without the need of removal of their structural equipment and be capable of being lifted onto and off the ship when loaded.

2.2 The applicable requirements of the International Convention for Safe Containers, 1972, as amended, should be fulfilled by any tankcontainer which meets the definition of a container within the terms of that Convention. Additionally, the provisions of section 13 of the General Introduction to the IMDG Code should be met when the tank will be used for the transport of dangerous goods.

2.3 Portable tanks should not be offered for shipment in an ullage condition liable to produce an unacceptable hydraulic force due to surge within the tank.

2.4 Portable tanks for the transport of dangerous goods should be certified in accordance with the provisions of the IMDG Code by the competent approval authority or a body authorized by that authority.

3 Portable Tank Arrangements

3.1 The external stabilizing members of a portable tank may consist of skids or cradles and, in addition, the tank may be secured to a platform-based container. Alternatively, a tank may be fixed within a framework of ISO or non-ISO frame dimensions.

3.2 Portable tank arrangements should include fittings for lifting and securing on board.

Note: All types of the aforementioned portable tanks may be carried on multipurpose ships but need special attention for lashing and securing on board.

4 Cargo information

4.1 The master should be provided with at least the following information:

4.1.1 dimensions of the portable tank and commodity if non-dangerous and, if dangerous, the information required in accordance with the IMDG Code;

4.1.2 the gross mass of the portable tank; and

4.1.3 whether the portable tank is permanently secured onto a platform-based container or in a frame and whether securing points are provided.

5 Stowage

5.1 The typical distribution of accelerations of the ship should be borne in mind in deciding whether the portable tank will be stowed on or under deck.

Guidance Note :
Lower accelerations occur in the midship sections and below the weather deck; while higher accelerations occur in the end sections and above the weather deck.

5.2 Tanks should be stowed in the fore-and-aft direction on or under deck.

5.3 Tanks should be stowed so that they do not extend over the ship's side.

5.4 Tanks should be stowed so as to permit safe access for personnel in the necessary operation of the ship.

5.5 At no time should the tanks overstress the deck or hatches; the hatchcovers should be so secured to the ship that tipping of the entire hatchcover is prevented.

6 Securing Against Sliding And Tipping

6.1 Non-standardized portable tanks

6.1.1 The securing devices on non-standardized portable tanks and on the ship should be arranged in such a way as to withstand the transverse and longitudinal forces, which may give rise to sliding and tipping. The lashing angles against sliding should not be higher than 25° and against tipping not lower than 45° to 60° (Figure A2.1).

6.1.2 Whenever necessary, timber should be used between the deck surface and the bottom structure of the portable tank in order to increase friction. This does not apply to tanks on wooden units or with similar bottom material having a high coefficient of friction.

6.1.3 If stowage under deck is permitted, the stowage should be such that the portable non-standardized tank can be landed directly on its place and bedding.

6.1.4 Securing points on the tank should be of adequate strength and clearly marked.

Note: Securing points designed for road and rail transport may not be suitable for transport by sea.

6.1.5 Lashings attached to tanks without securing points should pass around the tank and both ends of the lashing should be secured to the same side of the tank (Figure A2.2).

6.1.6 Sufficient securing devices should be arranged in such a way that each device takes its share of the load with an adequate factor of safety.

6.1.7 The structural strength of the deck or hatch components should be taken into consideration when tanks are carried thereon and when locating and affixing the securing devices.

6.1.8 Portable tanks should be secured in such a manner that no load is imposed on the tank or fittings in excess of those for which they have been designed.

6.2 Standardized portable tanks (tank-containers)

6.2.1 Standardized portable tanks with ISO frame dimensions should be secured according to the system of lashing with which the ship is equipped, taking into consideration the height of the tank above the deck and the ullage in the tank.

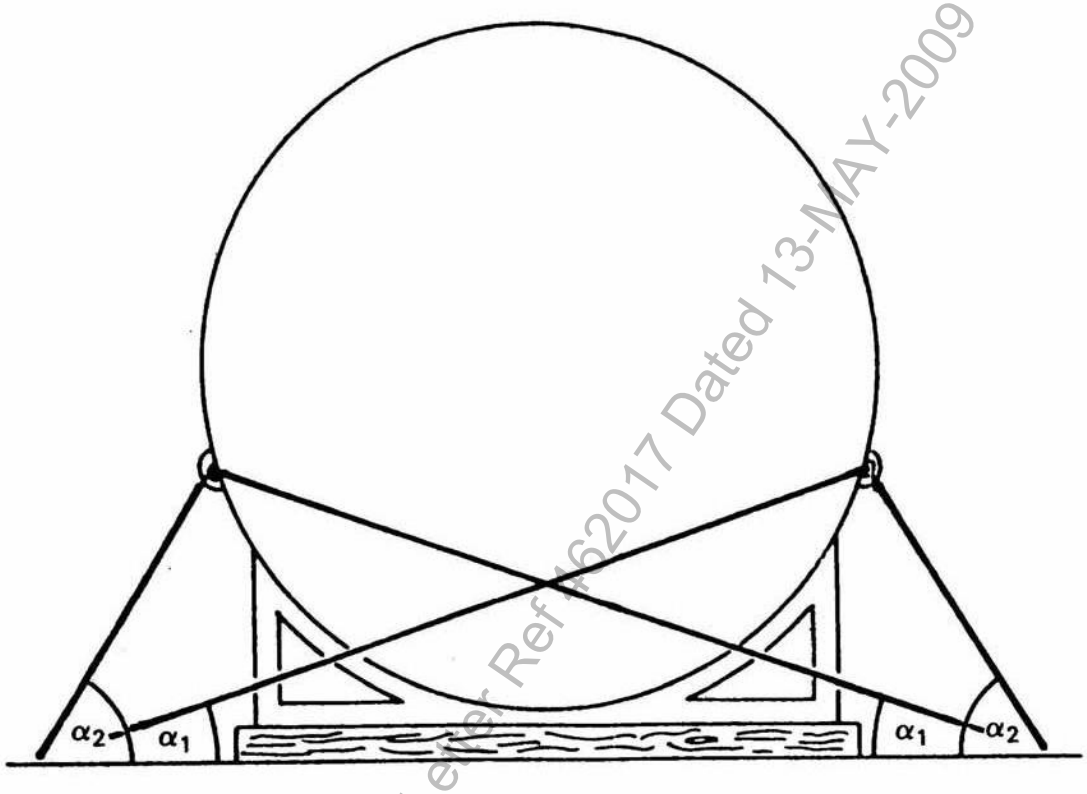


FIGURE A2.1
Securing of Portable Tanks with Favourable Lashing Angles

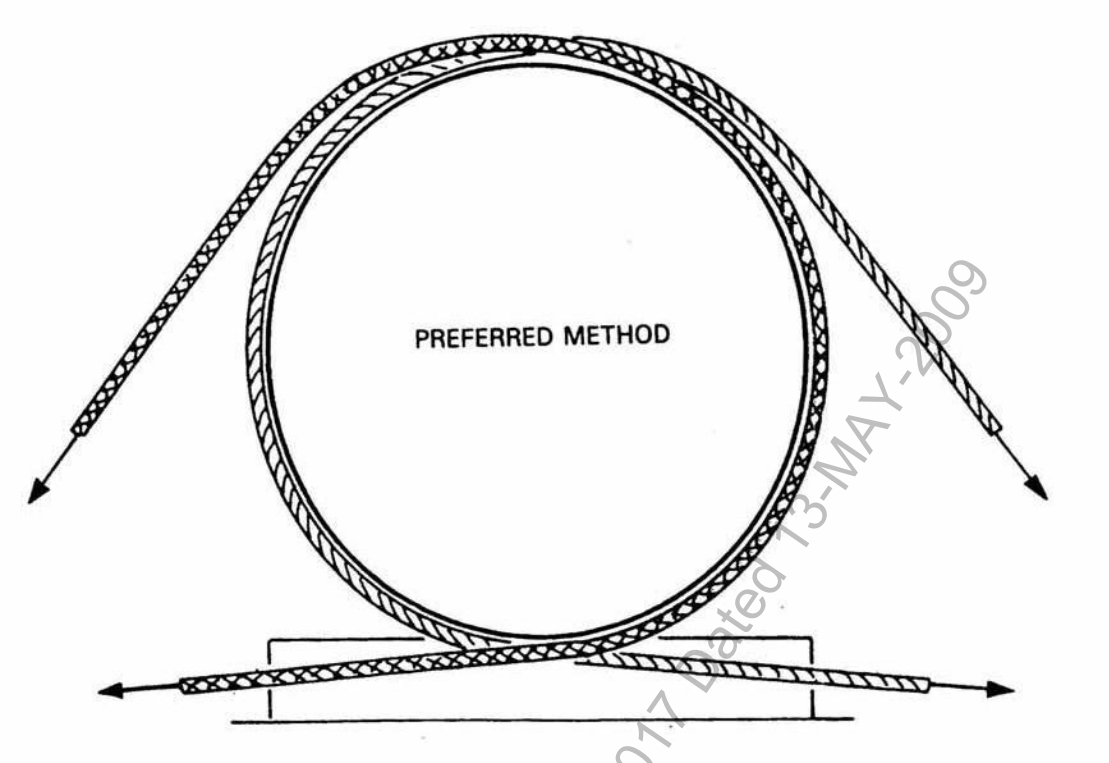


FIGURE A2.2
Securing of Portable Tanks Having No Securing Points

ANNEX 3

Safe Stowage And Securing Of Portable Receptacles

1 Introduction

1.1 A portable receptacle, in the context of these guidelines means a receptacle not being a portable tank, which is not permanently secured on board the ship and has a capacity of 1,000 l or less and has different dimensions in length, width, height and shape and which is used for the transport of gases or liquids.

Note: Where in this annex the term receptacle is used, it is meant to include both receptacles and cylinders.

2 Portable Receptacles Can Be Divided Into:

1. cylinders of different dimensions without securing points and having a capacity not exceeding 150 l;

2. receptacles of different dimensions with the exception of cylinders in conformity with 2.l having a capacity of not less than 100 l and not more than 1,000 l and whether or not fitted with hoisting devices of sufficient strength; and

3. assemblies, known as "frames", of cylinders in conformity with 2.1, the cylinders being interconnected by a manifold within the frame and held firmly together by metal fittings. The frames are equipped with securing and handling devices of Sufficient strength (e.g. cylindrical receptacles are equipped with rolling hoops and receptacles are secured on skids).

3 Cargo Information

3.1 The master should be provided with at least the following information:

1. dimensions of the receptacle and commodity if non-dangerous and, if dangerous, the information as required in accordance with the IMDG Code;

2. gross mass of the receptacles; and

3. whether or not the receptacles are equipped with hoisting devices of sufficient strength.

4 Stowage

4.1 The typical distribution of accelerations of the ship should be borne in mind in deciding whether the receptacles should be stowed on or under deck.

4.2 The receptacles should preferably be stowed in the fore-and-aft direction on or under deck.

4.3 Receptacles should be dunnaged to prevent their resting directly on a Steel deck. They should be stowed and chocked as necessary to prevent movement unless mounted in a frame as a unit. Receptacles for liquefied gases should be stowed in an upright position.

4.4 When the receptacles are stowed in an upright position, they should be stowed in a block, cribbed or boxed in with suitable and sound timber. The box or crib should be dunnaged underneath to provide clearance from a Steel deck. The receptacles in a box or crib should be braced to prevent movement. The box or crib should be securely chocked and lashed to prevent movement in any direction.

5 Securing Against Sliding And Shifting

5.1 Cylinders

Cylinders should be stowed fore-and-aft on athwartships dunnage. Where practicable, the stow should be secured by using two or more wires, laid athwartships prior to loading, and passed around the stow to securing points on opposite sides. The wires are tightened to make a compact stow by using appropriate tightening devices. During loading, wedges may be necessary to prevent cylinders rolling.

5.2 Cylinders in containers

Cylinders should, whenever practicable, be stowed upright with their valves on top and with their protective caps firmly in place. Cylinders should be adequately secured, so as to withstand the rigours of the intended voyage, by means of Steel strapping or equivalent means led to lashing points on the container floor. When cylinders cannot be stowed upright in a closed container, they should be carried in an open top or a platform-based container.

5.3 Receptacles

Securing of receptacles stowed on or under deck should be as follows:

1. lashings should be positioned as shown in Figure A3.1;

2. where possible, the hoisting devices on receptacles should be used to lash them; and

3. at regular times the lashings should be checked and retightened.

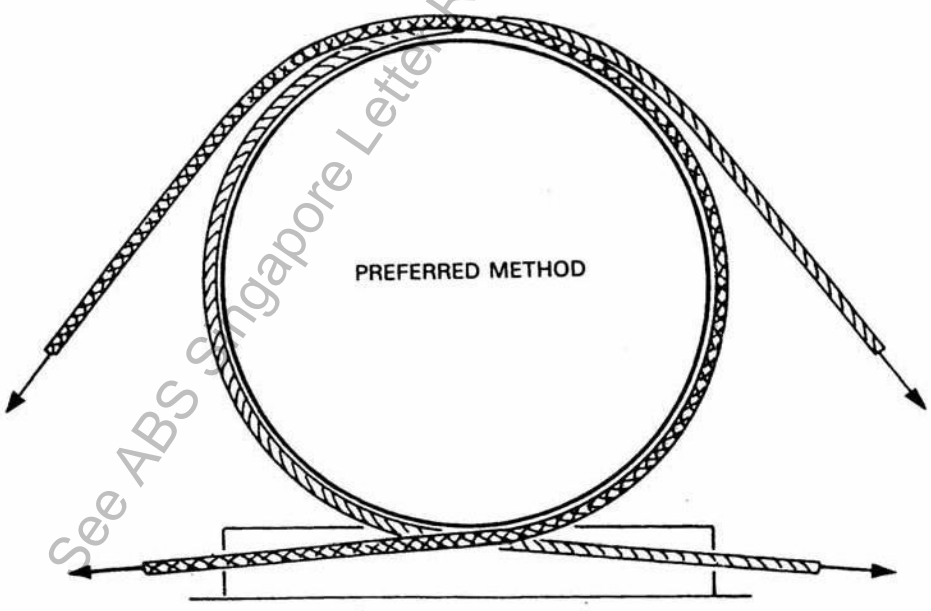


FIGURE A3.1
Securing of Receptacles Having No Securing Points

ANNEX 4

Safe Stowage And Securing Of Wheel-Based (Rolling) Cargoes

1 Introduction

Wheel-based cargoes, in the context of these guidelines, are all cargoes which are provided with wheels or tracks, including those which are used for the stowage and transport of other cargoes, except trailers and roadtrains, but including buses, military vehicles with or without tracks, tractors, earth-moving equipment, rolltrailers, etc.

2 General Recommendations

2.1 The cargo spaces in which wheel-based cargo is to be stowed should be dry, clean and free from grease and oil.

2.2 Wheel-based cargoes should be provided with adequate and clearly marked securing points or other equivalent means of sufficient strength to which lashings may be applied.

2.3 Wheel-based cargoes which are not provided with securing points should have those places where lashings may be applied, clearly marked.

2.4 Wheel-based cargoes, which are not provided with rubber wheels or tracks with friction-increasing lower surfaces, should always be stowed on wooden dunnage or other friction-increasing material such as soft boards, rubber mats, etc.

2.5 When in stowage position, the brakes of a wheel-based unit, if so equipped, should be set.

2.6 Wheel-based cargoes should be secured to the ship by lashings made of material having strength and elongation characteristics at least equivalent to Steel chain or wire.

2.7 Where possible, wheel-based cargoes, carried as part cargo, should be stowed close to the ship's side or in stowage positions which are provided with sufficient securing points of sufficient strength, or be blockstowed from side to side of the cargo space.

2.8 To prevent any lateral shifting of wheel-based cargoes not provided with adequate securing points, such cargoes should, where practicable, be stowed close to the ship's side and close to each other, or be blocked off by other suitable cargo units such as loaded containers, etc.

2.9 To prevent the shifting of wheel-based cargoes, it is, where practicable, preferable to stow those cargoes in a fore-and-aft direction rather than athwartships. If wheelbased cargoes are inevitably stowed athwartships, additional securing of sufficient strength may be necessary.

2.10 The wheels of wheel-based cargoes should be blocked to prevent shifting.

2.11 Cargoes stowed on wheel-based units should be adequately secured to stowage platforms or, where provided with suitable means, to its sides. Any movable external components attached to a wheel-based unit, such as derricks, arms or turrets should be adequately locked or secured in position.

ANNEX 5

Safe Stowage And Securing Of Heavy Cargo Items Such As Locomotives, Transformers, Etc.

1 Cargo Information

The master should be provided with sufficient information on any heavy cargo offered for shipment so that he can properly plan its stowage and securing; the information should at least include the following:

1. gross mass;
2. principal dimensions with drawings or pictorial descriptions, if possible;
3. location of the centre of gravity;
4. bedding areas and particular bedding precautions if applicable;
5. lifting points or slinging positions; and
6. securing points, where provided, including details of their strength.

2 Location Of Stowage

2.1 When considering the location for stowing a heavy cargo item, the typical distribution of accelerations on the ship should be kept in mind:

1. lower accelerations occur in the midship sections and below the weather deck; and
2. higher accelerations occur in the end sections and above the weather deck.

2.2 When heavy items are to be stowed on deck, the expected “weather side” of the particular voyage should be taken into account if possible.

2.3 Heavy items should preferably be stowed in the fore-and-aft direction.

3 Distribution Of Weight

The weight of the item should be distributed in such a way as to avoid undue stress on the ship’s structure. Particularly with the carriage of heavy items on decks or hatch covers, suitable beams of timber or Steel of adequate strength should be used to transfer the weight of the item onto the ship’s structure.

4 Cargo Stowed In Open Containers, On Platforms Or Platform-Based Containers

4.1 While the stowage and securing of open containers, ISO platforms or platform-based containers (flatracks) on a containership or a ship fitted or adapted for the carriage of containers should follow the information for that system, the stowage and securing of the cargo in such containers should be carried out in accordance with the IMO/ILO Guidelines for Packing Cargo in Freight Containers or Vehicles.

4.2 When heavy cargo items are carried on ISO platforms or platform-based containers (flatracks) the provisions of this annex should be followed. Additionally, the following items should be taken into account:

1. The ISO standard platform, etc., used should be of a suitable type with regard to strength and MSL of the securing points.

2. The weight of the heavy cargo item should be properly distributed.

3. Where deemed necessary, the heavy cargo item(s) carried on ISO standard platform(s) or platform-based containers, etc., should not only be secured to the platform(s) or platform-based containers, etc., but also to neighbouring platform(s), etc., or to securing points located at fixed structure of the ship. The elasticity of the last-mentioned lashings should be sufficiently in line with the overall elasticity of the stowage block underneath the heavy cargo item(s) in order to avoid overloading those lashings.

5 Securing Against Sliding And Tipping

5.1 Whenever possible, timber should be used between the stowage surface and the bottom of the unit in order to increase friction. This does not apply to items on wooden cradles or on rubber tyres or with similar bottom material having a high coefficient of friction.

5.2 The securing devices should be arranged in a way to withstand transverse and longitudinal forces which may give rise to sliding or tipping.

5.3 The optimum lashing angle against sliding is about 25°, while the optimum lashing angle against tipping is generally found between 45° and 60° (Figure A5.1).

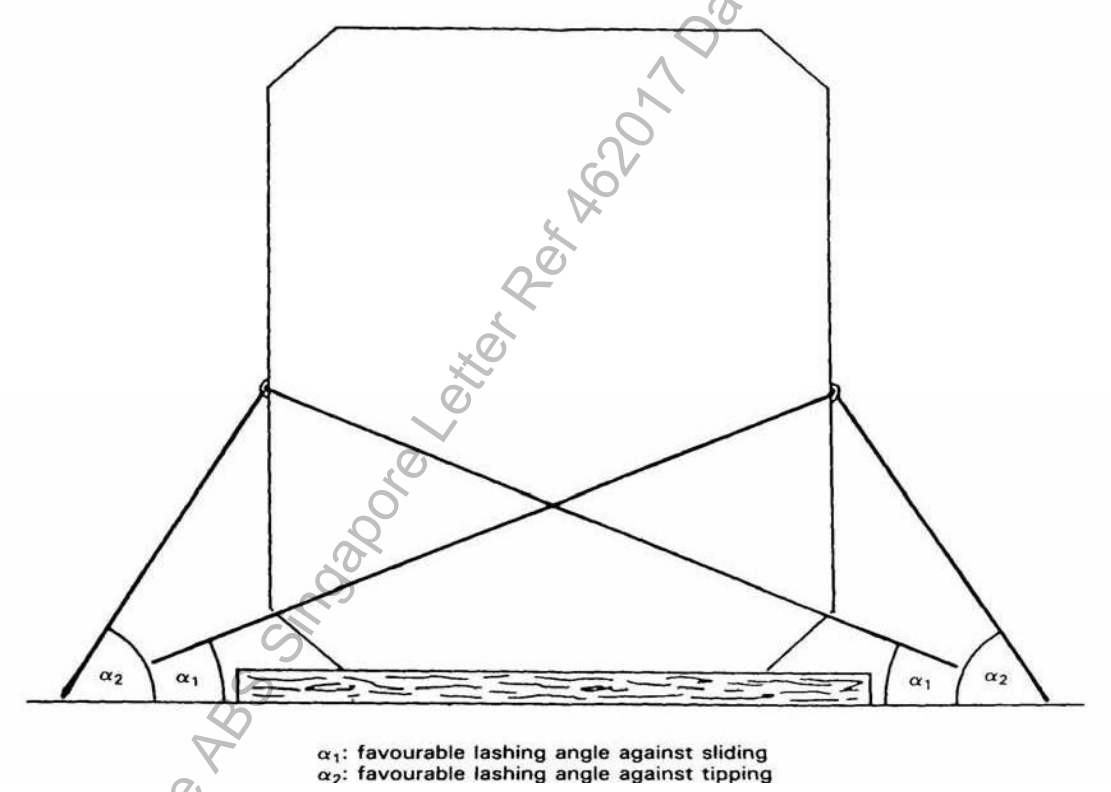


FIGURE A5.1
Principles of Securing Heavy Items Against Sliding and Tipping

5.4 If a heavy cargo item has been dragged into position on greased skid boards or other means to reduce friction, the number of lashings used to prevent sliding should be increased accordingly.

5.5 If, owing to circumstances, lashings can be set at large angles only, sliding must be prevented by timber shoring, welded fittings or other appropriate means. Any welding should be carried out in accordance with accepted hot work procedures.

6 Securing Against Heavy Seas On Deck

Whilst it is recognized that securing cargo items against heavy seas on deck is difficult, all efforts should be made to secure such items and their supports to withstand such impact and special means of securing may have to be considered.

7 Heavy Cargo Items Projecting Over The Ship's Side

Items projecting over the ship's side should be additionally secured by lashings acting in longitudinal and vertical directions.

8 Attachment Of Lashings To Heavy Cargo Items

8.1 If lashings are to be attached to securing points on the item, these securing points should be of adequate strength and clearly marked. It should be borne in mind that securing points designed for road or rail transport may not be suitable for securing the items on board ship.

8.2 Lashings attached to items without securing points should pass around the item, or a rigid part thereof, and both ends of the lashing should be secured to the same side of the unit (Figure A5.2).

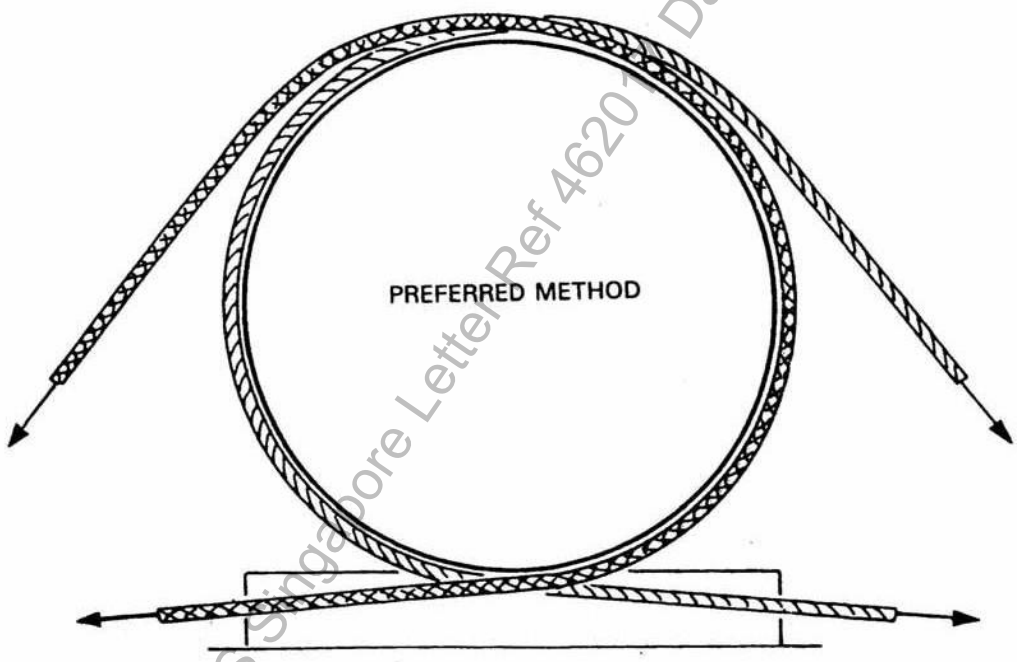


FIGURE A5.2
Principle of Securing Heavy Items Having No Suitable Securing Points

9 Composition And Application Of Securing Devices

9.1 Securing devices should be assembled so that each component is of equal strength.

9.2 Connecting elements and tightening devices should be used in the correct way. Consideration should be given to any reduction of the strength of the lashings during the voyage through corrosion, fatigue or mechanical deterioration and should be compensated by using stronger securing material.

9.3 Particular attention should be paid to the correct use of wire, grips and clips. The saddle portion of the clip should be applied to the live load segment and the U-bolt to the dead or shortened end segment.

9.4 Securing devices should be arranged in such a way that each device takes its share of load according to its strength.

9.5 Mixed securing arrangements of devices with different strength and elongation characteristics should be avoided.

10 Maintenance Of Securing Arrangement

10.1 The integrity of securing arrangement should be maintained throughout the voyage.

10.2 Particular attention should be paid to the need for tight lashings, grips and clips and to prevent weakening through chafing. Timber cradles, beddings and shorings should be checked.

10.3 Greasing the threads of clips and turnbuckles increases their holding capacity and prevent corrosion.

11 Securing Calculation

11.1 Where necessary, the securing arrangements for heavy cargo items should be verified by an appropriate calculation in accordance with Annex 13 to the Code.

ANNEX 6

Safe Stowage And Securing Of Heavy Metal Products

1 General

1.1 Heavy metal products in the context of this Code include any heavy item made of metal, such as bars, pipes, rods, plates, wire coils, etc.

1.2 The transport of heavy metal products by sea exposes the ship to the following principal hazards:

1. overstressing of the ship's structure if the permissible hull stress or permissible deck loading is exceeded;

2. overstressing of the ship's structure as a result of a short roll period caused by excessive metacentric height; and

3. cargo shifting because of inadequate securing resulting in a loss of stability or damage to the hull or both.

2 Recommendations

2.1 The cargo spaces in which heavy metal products are to be stowed should be clean, dry and free from grease and oil.

2.2 The cargo should be so distributed as to avoid undue hull stress.

2.3 The permissible deck and tank top loading should not be exceeded.

2.4 The following measures should be taken when stowing and securing heavy metal products:

1. cargo items should be stowed compactly from one side of the ship to the other leaving no voids between them and using timber blocks between items if necessary;

2. cargo should be stowed level whenever possible and practicable;

3. the surface of the cargo should be secured; and

4. the shoring should be made of strong, non-splintering wood and adequately sized to withstand the acceleration forces. One shoring should be applied to every frame of the ship but at intervals of not less than 1 m.

2.5 In the case of thin plates and small parcels, alternate fore-and-aft and athwartships stowage has proved satisfactory. The friction should be increased by using sufficient dry dunnage or other material between the different layers.

2.6 Pipes, rails, rolled sections, billets, etc., should be stowed in the fore and-aft direction to avoid damage to the sides of the ship if the cargo shifts.

2.7 The cargo, and especially the topmost layer, can be secured by:

1. having other cargo stowed on top of it; or

2. lashing by wire, chocking off or similar means.

2.8 Whenever heavy metal products are not stowed from side to side of the ship, special care should be taken to secure such stowages adequately.

2.9 Whenever the surface of the cargo is to be secured, the lashings should be independent of each other, exert vertical pressure on the surface of the cargo, and be so positioned that no part of the cargo is unsecured.

3 Wire Coils

3.1 Wire coils should be stowed flat so that each coil rests against an adjacent coil . The coils in successive tiers should be stowed so that each coil overlaps the coils below.

3.2 Wire coils should be tightly stowed together and substantial securing arrangements should be used. Where voids between coils are unavoidable or where there are voids at the sides or ends of the cargo space, the stow should be adequately secured.

3.3 When securing wire coils stowed on their sides in several layers like barrels, it is essential to remember that, unless the top layer is secured, the coils lying in the stow can be forced out of the stow by the coils below on account of the ship's motions.

ANNEX 7

Safe Stowage And Securing Of Anchor Chains

1 General

1.1 Anchor chains for ships and offshore structures are usually carried in bundles or in continuous lengths.

1.2 Provided certain safety measures are followed prior to, during and after stowage, anchor chains may be lowered directly onto the place of stowage in bundles without further handling, or stowed longitudinally either along the ship's entire cargo space or part thereof.

1.3 If the cargo plans given in the ship's documentation contain no specific requirements, the cargo should be distributed over the lower hold and 'tween-decks in such a way that stability values thus obtained will guarantee adequate stability.

2 Recommendations

2.1 Cargo spaces in which chains are stowed should be clean and free from oil and grease.

2.2 Chains should only be stowed on surfaces which are permanently covered either by wooden ceiling or by sufficient layers of dunnage or other suitable friction-increasing materials. Chains should never be stowed directly on metal surfaces.

3 Stowage And Securing Of Chains In Bundles

3.1 Chains in bundles, which are lifted directly onto their place of stowage without further handling, should be left with their lifting wires attached and should preferably be provided with additional wires around the bundles for lashing purposes.

3.2 It is not necessary to separate layers of chain with friction-increasing material such as dunnage because chain bundles will grip each other. The top layer of chain bundles should be secured to both sides of the ship by suitable lashings. Bundles may be lashed independently or in a group, using the lifting wires.

4 Stowage And Securing Of Chains Which Are Stowed Longitudinally

4.1 Stowage of each layer of chain should, whenever possible and practicable, commence and terminate close to the ship's side. Care should be taken to achieve a tight stow.

4.2 It is not necessary to separate layers of chain with friction-increasing material such as dunnage because chain layers will grip each other.

4.3 Bearing in mind the expected weather and sea conditions, the length and nature of the voyage and the nature of the cargo to be stowed on top of the chain, the top layer of each stow should be secured by lashings of adequate strength crossing the stow at suitable intervals and thus holding down the entire stow.

ANNEX 13

Methods To Assess The Efficiency Of Securing Arrangements For Non-Standardized Cargo

1 Scope Of Application

The methods described in this annex should be applied to non-standardized cargoes, but not to containers in containership.

Very heavy units as carried under the provisions of chapter 1.8 of the Code of Safe Practice for Cargo Stowage and Securing (CSS Code) and those items for which exhaustive advice on stowage and securing is given in the annexes to the Code should be excluded.

All lashing assemblies used in the application of the methods described in this annex must be attached to fixed securing points or strong supporting structures marked on the cargo unit or advised as being suitable, or taken as a loop around the unit with both ends secured to the same side as shown in Annex 5, Figure 2 of the Code. Lashings going over the top of the cargo unit, which have no defined securing direction but only act to increase friction by their pre-tension, cannot be credited in the evaluation of securing arrangements under this annex.

Nothing in this annex should be read to exclude the use of computer software, provided the output achieves design parameters which meet the minimum safety factors applied in this section.

The application of the methods described in this annex is supplementary to the principles of good seamanship and shall not replace experience in stowage and securing practice.

2 Purpose of the Methods

The methods should:

1. provide guidance for the preparation of the Cargo securing Manual and the examples therein;

2. assist ship's staff in assessing the securing of cargo units not covered by the Cargo Securing Manual;

3. assist qualified shore personnel in assessing the securing of cargo units not covered by the Cargo Securing Manual; and

4. serve as a reference for maritime and port related education and training

3 Presentation Of The Methods

The methods are presented in a universally applicable and flexible way. It is recommended that the designer of Cargo Securing Manuals convert this presentation into a form suiting the particular ship, its securing equipment and the cargo carried. This form may consists of applicable diagrams, tables and calculated examples.

4 Strength Of Securing Equipment

Manufacturers of securing equipment should at least supply information on the nominal breaking strength of the equipment in kilo-newtons (kN) (1kN=100kg).

"Maximum Securing Load" (MSL) is a term used to define the load capacity for a device used to secure cargo to a ship. "Safe Working Load (SWL) may be substituted for MSL for securing purposes, provided this is equal to or exceeds the strength defined by MSL".

The MSLs for different securing devices are given in Table 1 if not given below.

The MSL of timber should be taken as 0.3 kN/cm2 normal to the grain.

TABLE 1
Determination of MSL from Breaking Strength

Material	MSL
Lashing rods, twistlocks, stackers, sockets, 'D' rings, lashing plates, penquin hooksand bridge fittings.	50% of breaking strength
Chains	33% of breaking strength for mild Steel 40% of breaking strength for high tensile Steel
Web lashings	50% of breaking strength

For particular securing devices (e. g. fibre straps with tensioners or special equipment for securing containers), a permissible working load may be prescribed and marked by authority. This should be taken as the MSL.

When the components of a lashing device are connected in series (for example, a wire to a shackle to a deckeye), the minimum MSL in the series shall apply to that device.

Material	MSL
Shackles, rings, deckeyes, turnbuckles of mild Steel ore	50% of breaking strength
Fibre rope	33% of breaking strength
Wire rope (single use) Wire rope (re-useable)	80% of breaking strength 30% of breaking strength
Steel band (single use)	70% of breaking strength

6 Rule-of-thumb method

The total of the MSL values of the securing devices on each side of a unit of cargo (port as well as starboard) should equal the weight of the unit. (The weight of the unit should be taken in kN).

This method, which implies a transverse acceleration of 1g (9.81m/s2), applies to nearly any size of ship, regardless of the location of stowage, stability and loading condition, season and area of operation. The method, however, takes into account neither the adverse effects of lashing angles and non-homogeneous distribution of forces among the securing devices nor the favourable effect of friction.

Transverse lashing angles to the deck should not be greater than 600 and it is important that adequate friction is provided by the use of suitable material. Additional lashings at angles of greater than 600 may be desirable to prevent tipping but are not to be counted in the number of lashings under the rule-of-thumb.

6 Safety Factor

"When using balance calculation methods for assessing the strength of the securing devices, a safety factor is used to take account of the possibility of uneven distribution of forces among the devices or reduced capability due to the improper assembly of the devices or other reasons. This safety factor is used in the formula to derive the calculated strength (CS) from the MSL and shown in the relevant method used.".

CS = MSL / Safety factor

Notwithstanding the introduction of such a safety factor, care should be taken to use securing elements of similar material and length in order to provide a uniform elastic behaviour within the arrangement,

7 Advanced Calculation Method

7.1 Assumption Of External Forces

External forces to a cargo unit in longitudinal, transverse and vertical directions should be obtained using the formula:

$$F(x,y,z) = m\,a(x,y,z) + Fw(x,y) + Fs(x,y)$$

where

F(x,y,z) = longitudinal, transverse and vertical forces

m = mass of the unit

a(x,y,z) = longitudinal, transverse and vertical accelerations (see Tables 3.1, 3.2, 3.3)

Fw(x,y) = longitudinal and transverse forces by wind pressure

Fs(x,y) = longitudinal and transverse forces by sea sloshing.

The basic acceleration data are provided in Table 2.

TABLE 2
Basic Acceleration Data

Transverse acceleration a_y in m/s^2										Longitudinal acceleration a_x in m/s^2
on deck, high	7.1	6.9	6.8	6.7	6.7	6.8	6.9	7.1	7.4	3.8
on deck, low	6.5	6.3	6.1	6.1	6.1	6.1	6.3	6.5	6.7	2.9
'tween-deck	5.9	5.6	5.5	5.4	5.4	5.5	5.6	5.9	6.2	2.0
lower hold	5.5	5.3	5.1	5.0	5.0	5.1	5.3	5.5	5.9	1.5
	0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9 L
Vertical acceleration a_z in m/s^2										
	7.6	6.2	5.0	4.3	4.3	5.0	6.2	7.6	9.2	

Remarks:
The given transverse acceleration figures include components of gravity, pitch and heave parallel to the deck. The given vertical acceleration figures do not include the static weight component.

The basic acceleration data are to be considered as valid under the following operational conditions:

1. Operation in unrestricted area;

2. Operation during the whole year;

3. Duration of the voyage is 25 days;

4. Length of vessel is 100m;

5. Service speed is 15 knots;

6. B/GM≥13 (B = breadth of ship, GM = Metacentric height).

For operation in a restricted area, reduction of these figures may be considered, taking into account the season of the year and the duration of the voyage.

For ships of a length other than 100 m and a service speed other than 15 knots, the acceleration figures should be corrected by a factor obtained from Table 3.

TABLE 3
Correction Factors for Length and Speed (this table to compute for UFS LIMA after availability of their stability booklet)

Speed (knots)	length (m)										
	50	**60**	70	80	90	100	120	140	160	180	200
9	1.20	**1.09**	1.00	0.92	0.85	0.79	0.70	0.63	0.57	0.53	0.49
12	1.34	**1.22**	1.12	1.03	0.96	0.90	0.79	0.72	0.65	0.60	0.56
14	**1.44**	**1.31**	**1.20**	**1.11**	**1.03**	**0.97**	**0.86**	**0.77**	**0.70**	**0.65**	**0.61**
15	1.49	**1.36**	1.24	1.15	1.07	1.00	0.89	0.80	0.73	0.68	0.63
18	1.64	**1.49**	1.37	1.27	1.18	1.10	0.98	0.89	0.82	0.76	0.71
21	1.78	**1.62**	1.49	1.38	1.29	1.21	1.08	0.98	0.90	0.83	0.78
24	1.93	**1.76**	1.62	1.50	1.40	1.31	1.17	1.07	0.98	0.91	0.85

For length / speed combinations not directly tabulated, the following formula may be used to obtain the correction factor with v = speed in knots and L = length between perpendiculars in metres:

Correction factor = (0.345*v / L^0.5) + (58.62*L-1034.5)/L^2

This formula shall not be used for ship lengths less than 50m or more than 300m.

In addition, for ships with B/GM less than 13, the transverse acceleration figures should be corrected by a factor given in Table 4.

TABLE 4
Correction Factors for B/GM < 13

B/GM	7	8	9	10	11	12	13 or above
On deck high	1.56	1.40	1.27	1.19	1.11	1.05	1.00
On deck low*	1.42	1.30	1.21	1.14	1.09	1.04	1.00
Tween deck	1.26	1.19	1.14	1.09	1.06	1.03	1.00
Lower hold	1.15	1.12	1.09	1.06	1.04	1.02	1.00

The following cautions should be observed:

- In the case of marked roll resonance with amplitudes above ±30o, the given figures of transverse acceleration may be exceeded. Effective measures should be taken to avoid this condition.

- In the case of heading into the seas at high speed with marked slamming shocks, the given figures of longitudinal and vertical acceleration may be exceeded. An appropriate reduction of speed should be considered.

- In the case of running before large stern or quartering seas with a stability which does not amply exceed the accepted minimum requirements, large roll amplitudes must be expected with transverse accelerations greater than the figures given. An appropriate change of heading should be considered.

Forces by wind and sea to cargo units above the weather deck should be accounted for by a simple approach:

force by wind pressure = 1 kN/m2
force by sea sloshing = 1 kN/m2

Sloshing by sea can induce forces much greater than the figure given above. This figure should be considered as remaining unavoidable after adequate measures to prevent overcoming seas.

Sea sloshing forces need only be applied to a height of deck cargo up to 2m above the weather deck or hatch top.

For voyages in a restricted area, sea sloshing forces may be neglected.

7.2 Balance Of Forces And Moments

The balance calculation should preferably be carried out for:

- transverse sliding in port and starboard directions;
- transverse tipping in port and starboard directions;
- longitudinal sliding under conditions of reduced friction in forward and aft directions.

In the case of symmetrical securing arrangements, one appropriate calculation is sufficient.

“Friction contributes towards prevention of sliding. The following friction coefficients (u) should be applied.”

TABLE 5
Friction coefficients

Materials in contact	Friction coefficient, (u)
Timber-timber, wet or dry	0.4
Steel-timber or Steel-rubber	0.3
Steel-Steel, dry	0.1
Steel-Steel, wet	0.0

7.2.1 Transverse Sliding

The balance calculation should meet the following condition (see also Figure A8.1):

$$Fy \leq \mu\, m\, g + CS1\, f1 + CS2\, f2 + ...+ CSn\, fn$$

where,

n is the number of lashings being calculated
Fy is transverse force from load assumption (kN)
μ is friction coefficient
~~(μ = 0.3 for Steel-timber or Steel-rubber)~~
~~(μ = 0.1 for Steel-Steel, dry)~~
~~(μ = 0.0 for Steel-Steel, wet)~~
m is mass of the cargo unit (t)
g is gravity acceleration of earth = 9.81 m/s2
CS is calculated strength of transverse securing devices (kN)
CS = MSL/1.5
f is a function of μ and the vertical securing angle α (see Table 6).

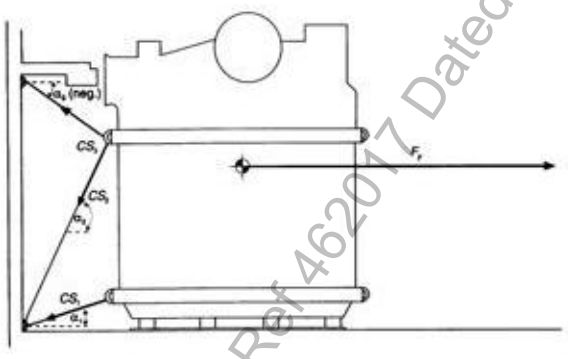


FIGURE 1
Balance of Transverse Forces

A vertical securing angle α, greater than 600 will reduce the effectiveness of this particular securing device in respect to sliding of the unit. Disregarding of such devices from the balance of forces should be considered, unless the necessary load is gained by the imminent tendency to tipping or by a reliable pre-tensioning of the securing device and maintaining the pre-tension throughout the voyage.

Any horizontal securing angle, i.e. deviation from the transverse direction, should not exceed 300, otherwise an exclusion of this securing device from the transverse sliding balance should be considered

TABLE 6
f-Values as a Function of α and μ

μ \ α	-30°	-20°	-10°	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0.3	0.72	0.84	0.93	1.00	1.04	1.04	1.02	0.96	0.87	0.76	0.62	0.47	0.30
0.1	0.82	0.91	0.97	1.00	1.00	0.97	0.92	0.83	0.72	0.59	0.44	0.27	0.10
0.0	0.87	0.94	0.98	1.00	0.98	0.94	0.87	0.77	0.64	0.50	0.34	0.17	0.00

Remark: $f = \mu \sin\alpha + \cos\alpha$

7.2.2 Transverse Tipping

This balance calculation should meet the following condition (see also Figure A8.2):

$$Fya \leq b\ m\ g + CS1\ c1 + CS2\ c2 + \ldots + Cs\ n\ c\ n$$

where,
Fy, m, g, CS, n are as explained under 7.2.1
a is lever-arm of tipping (m) (see Figure 2)
b is lever-arm of stableness (m) (see Figure 2)
c is lever-arm of securing force (m) (see Figure 2)

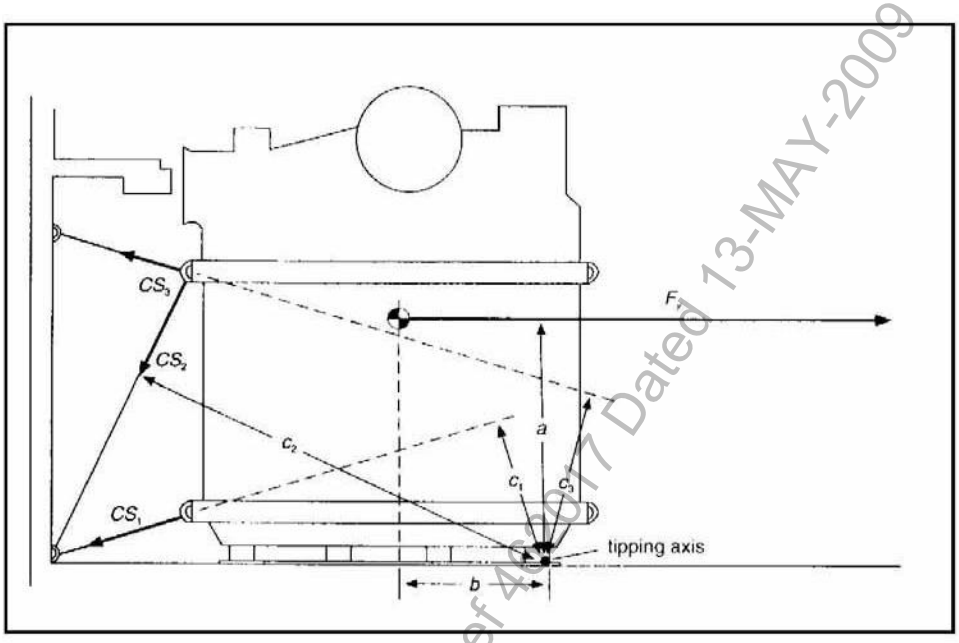


FIGURE 2
Balance of Transverse Moments

7.2.3 Longitudinal Sliding

Under normal conditions the transverse securing devices provide sufficient longitudinal components to prevent longitudinal sliding. If in doubt, a balance calculation should meet the following condition:

$$Fx \leq \mu\ (m\ g - Fz) + CS1f1 + CS2f2 + \ldots + CSn\ fn$$

where,
Fx is longitudinal force from load assumption (kN)
μ, m, g, f, n are as explained under 7.2.1
Fz is vertical force from load assumption (kN)
CS s calculated strength of longitudinal securing devices (kN)
CS = MSL/1.5

Remark:
Longitudinal components of transverse securing devices should not be considered greater than 0.5 CS.

Note: Under certain circumstances, depending upon the length of the cargo unit, its stowage position and the height of the centre of gravity, it may be necessary to undertake a balance calculation to ascertain if longitudinal tipping could also present a stowage problem.

7.2.4 Calculated Example

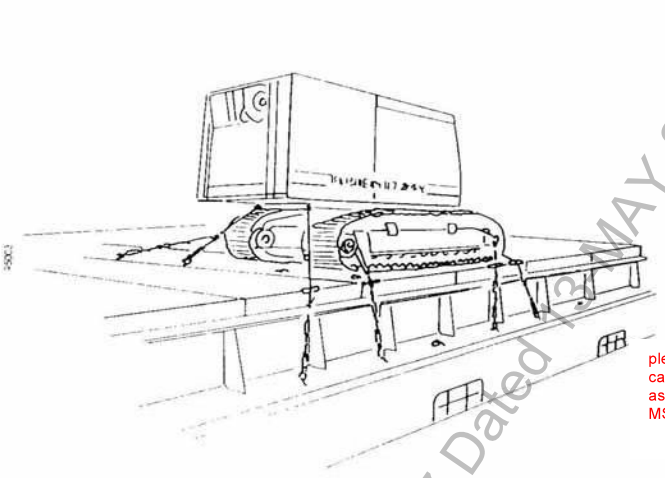
A Calulated example for this method is shown in Appendix 1

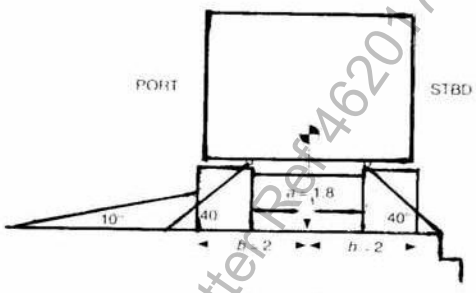
~~ADVANCED CALCULATION METHOD~~

Calculated Example 1

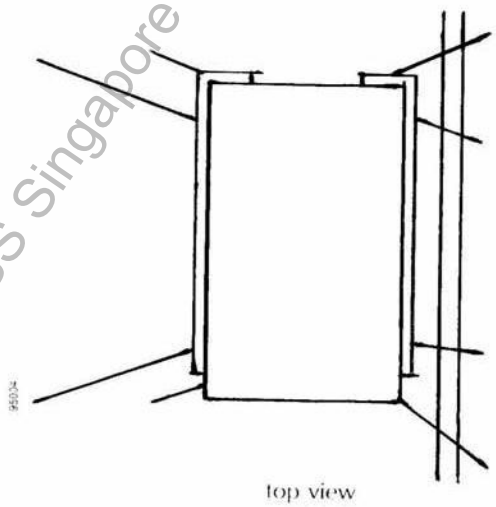
(refer to paragraph 7.2, Balance of forces and moments)

Ship: L = 120 m; B = 20 m; GM = 1.4 m; speed = 15 knots
Cargo: m= 62 t; dimensions = 6 x 4 x 4 m; stowage at 0.7L on deck, low





front view



top view

"The text under the heading "Advanced calculation method: calculated example" with the heading are deleted from section 7 and added in as new appendix 1 to the Annex.

please add Calculated example 2 after calculated example 1 in new Appendix 1 as per the amendment to CSS CODE MSC/Circ 1026 dated 27 May 2002

Securing material:

wire rope	:	breaking strength = 125 kN; MSL = 100 kN
shackles, turnbuckles, deck rings	:	breaking strength = 180 kN; MSL = 90 kN
stowage on dunnage boards	:	μ =0.3; CS = 90/1.5 = 60 kN

Securing arrangement:

side	n	CS	α	f	c
STBD	4	60kN	40°	0.96	-
PORT	2	60kN	40°	0.96	-
PORT	2	60kN	10°	1.04	-

External forces:

FX = 62 x 2.9 x 0.89 + 16 + 8 = 184 kN

FY = 62 x 6.3 x 0.89 + 24 + 12 = 384 kN

FZ = 62 x 6.2 x 0.89 + na + na = 342 kN

Guidance Notes:

1. *External force components Fx, Fy and Fz are calculated by adding (i) force due to acceleration (i.e. mass x acceleration), (ii) force by wing pressure and (iii) force by sea sloshing. The forces due to wind pressure and sea sloshing are applicable only in longitudinal and transverse directions.*
2. *The sum of the securing forces and friction forces, if any, resisting sliding, should be greater than the external forces Fx, Fy and Fz.*

Balance of forces (STBD arrangement):

384 < 0.3 x 62 x 9.81 + 4 x 60 x 0.96
384 < 412 this is OK!

Balance of forces (PORT arrangement):

384 < 0.3 x 62 x 9.81 + 2 x 60 x 0.96 + 2 x 60 x 1.04
384 < 422 this is OK!

Balance of moments:

384 x 1.8 < 2 x 62 x 9.81
691 < 1216 no tipping, even without lashings !

Guidance Notes on balance of longitudinal sliding :

Annex 13 to CSS Code does not contain a worked example for the balance of longitudinal sliding. The following may help to understand which lashings should be considered in this calculation.

Ideally a unit should be secured with pure transverse lashings in athwartship direction (port and starboard) and with pure longitudinal lashings in the fore and aft direction. However, this ideal lashing arrangement would rarely be found, due to practical difficulties, and it is common practice to have transverse lashings at an angle to the true transverse direction. According to Annex 13, item 7.2.1, this angle should not exceed 30 degrees so as not to reduce the effectiveness of the lashings. These lashings have a longitudinal component in the fore and aft direction, which may be adequate to prevent longitudinal sliding under normal circumstances. (Stowage positions aft of 0.2L and forward of 0.7L from A.P. would normally require additional longitudinal securing.)

The following example demonstrates the transverse and longitudinal sliding balances for such an arrangement.

***Ship**: L= 100m, Speed = 15 knots B/GM > 13*

***Cargo**: m = 42 t dimensions = 6 x 4 x 3 m*
stowage position = 0.7L, on deck, Low

Lashings:	*CS = 60 kN;*		*$\alpha = 40^{\circ}$;*		*$\mu = 0.3$*	
Forces:		*Fx*	=	*2.9 x 45 + 12 + 8*	=	*151 kN*
		Fy	=	*6.3 x 45 + 18 + 12*	=	*314 kN*
		Fz	=	*6.2 x 45*	=	*279 kN*
Transverse Sliding:		*314*	<	*0.3 x 45 x 9.81 + 4 x 60 x 0.96*		
		314	<	*363 OK*		
Longitudinal Sliding:		*151*	<	*0.3 x (45 x 9.81- 279) + 4 x 30 x 0.96*		
		151	<	*164 OK*		

It should be noted that the balance of longitudinal sliding uses 0.5CS, i.e. the longitudinal component of each lashing.

If, however, transverse lashing are applied with deviations to the transverse direction of more than 30 degrees i.e. $\alpha = 45^{\circ}$, this situation is not exactly covered by Annex 13. A reasonable solution would be to calculate with appropriately reduced values of CS in both the transverse and longitudinal sliding balances.

7.3 Balance Of Forces – alternative method

The balance of forces described in paragraphs 7.2.1 and 7.2.3 will normally furnish a sufficiently accurate determination of the adequacy of the securing arrangement. However, this alternative method may allows a more precise consideration of horizontal securing angles.

Securing devices usually do not have a pure longitudinal or transverse direction in practice but have an angle â in the horizontal plane. This horizontal securing angle â is defined in this annex as the angle of deviation from the transverse direction. The angle â is to be scaled in the quadrantal mode, i.e. between 0 to 90°.

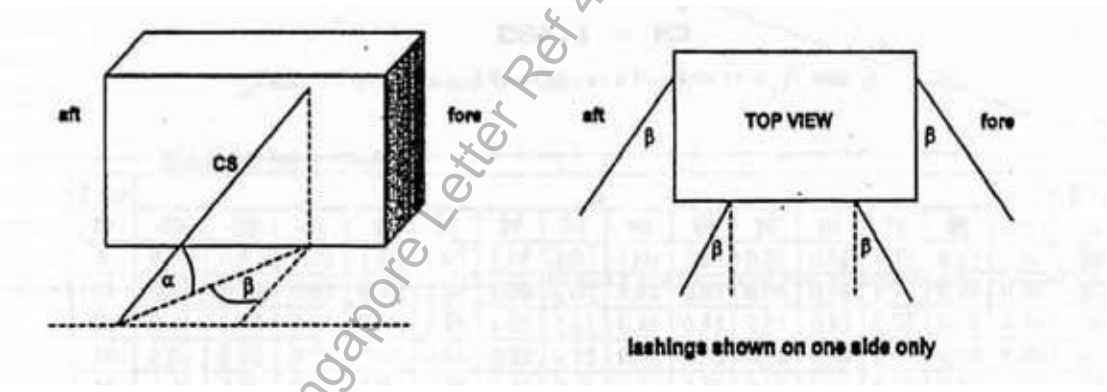


Figure 3 – Definition of the vertical and horizontal securing angles α and β.

A securing device with an angle â develops securing effects both in longitudinal and transverse direction, which can be expressed by multiplying the calculated strength CS with the appropriate values of fx or fy. The values of fx and fy can be obtained from Table 7.

Table 7 consists of five sets of figures, one each for the friction coefficients μ = 0.4, 0.3, 0.2, 0.1 and 0. Each set of figures is obtained by using the vertical angle á and horizontal angle â. The value of fx is obtained when entering the table with a â from the right while fy is obtained when entering with â from the left, using the nearest tabular value for á and â. Interpolation is not required but may be used.

The balance calculations are made in accordance with the following formulae:

Transverse sliding : $Fy < \mu.m.g + fy1 * CS1 + \ldots + fyn * CSn$
Longitudinal sliding : $Fx < \mu (m.g - Fz) + fx1 * CS1 + \ldots + fyn * CSn$
Transverse tipping : $Fy.a < b.m.g + 0.9*(CS1* Cn1 + CS2* C2 + \ldots.. + CSn * Cn)$

Caution:

Securing devices, which have a vertical angle á of less than 45° in combination with horizontal angle â greater than 45°, should not be used in the balance of transverse tipping in the above formulae.

All symbols used in these formulae have the same meaning as defined in paragraph 7.2 except fy and fx, obtained from Table 7 and CS is as follows:

CS = MSL/1.35

A Calulated example for this method is shown in Appendix 1

TABLE 7

fx-values and fy-values as a Function of α, β and μ

Table 7.1 for μ = 0.4

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.67	0.80	0.92	1.00	1.05	1.08	1.07	1.02	0.99	0.95	0.85	0.72	0.57	0.40	90
10	0.65	0.79	0.90	0.98	1.04	1.06	1.05	1.01	0.98	0.94	0.84	0.71	0.56	0.40	80
20	0.61	0.75	0.86	0.94	0.99	1.02	1.01	0.98	0.95	0.91	0.82	0.70	0.56	0.40	70
30	0.55	0.68	0.78	0.87	0.92	0.95	0.95	0.92	0.90	0.86	0.78	0.67	0.54	0.40	60
40	0.46	0.58	0.68	0.77	0.82	0.86	0.86	0.84	0.82	0.80	0.73	0.64	0.53	0.40	50
50	0.36	0.47	0.56	0.64	0.70	0.74	0.76	0.75	0.74	0.72	0.67	0.60	0.51	0.40	40
60	0.23	0.33	0.42	0.50	0.56	0.61	0.63	0.64	0.64	0.63	0.60	0.55	0.48	0.40	30
70	0.10	0.18	0.27	0.34	0.41	0.46	0.50	0.52	0.52	0.53	0.52	0.49	0.45	0.40	20
80	-0.05	0.03	0.10	0.17	0.24	0.30	0.35	0.39	0.41	0.42	0.43	0.44	0.42	0.40	10
90	-0.20	-0.14	-0.07	0.00	0.07	0.14	0.20	0.26	0.28	0.31	0.35	0.38	0.39	0.40	0

Table 7.2 for μ = 0.3

β for fy	α														β for fx
	-30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	
0	0.72	0.84	0.93	1.00	1.04	1.04	1.02	0.96	0.92	0.87	0.76	0.62	0.47	0.30	90
10	0.70	0.82	0.92	0.98	1.02	1.03	1.00	0.95	0.91	0.86	0.75	0.62	0.47	0.30	80
20	0.66	0.78	0.87	0.94	0.98	0.99	0.96	0.91	0.88	0.83	0.73	0.60	0.46	0.30	70
30	0.60	0.71	0.80	0.87	0.90	0.92	0.90	0.86	0.82	0.79	0.69	0.58	0.45	0.30	60
40	0.51	0.62	0.70	0.77	0.81	0.82	0.81	0.78	0.75	0.72	0.64	0.54	0.43	0.30	50
50	0.41	0.50	0.58	0.64	0.69	0.71	0.71	0.69	0.67	0.64	0.58	0.50	0.41	0.30	40
60	0.28	0.37	0.44	0.50	0.54	0.57	0.58	0.58	0.57	0.55	0.51	0.45	0.38	0.30	30
70	0.15	0.22	0.28	0.34	0.39	0.42	0.45	0.45	0.45	0.45	0.43	0.40	0.35	0.30	20
80	0.00	0.06	0.12	0.17	0.22	0.27	0.30	0.33	0.33	0.34	0.35	0.34	0.33	0.30	10
90	-0.15	-0.10	-0.05	0.00	0.05	0.10	0.15	0.19	0.21	0.23	0.26	0.28	0.30	0.30	0

Table 7.3 for μ = 0.2

β for fy	α: -30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	β for fx
0	0.77	0.87	0.95	1.00	1.02	1.01	0.97	0.89	0.85	0.80	0.67	0.53	0.37	0.20	90
10	0.75	0.86	0.94	0.98	1.00	0.99	0.95	0.88	0.84	0.79	0.67	0.52	0.37	0.20	80
20	0.71	0.81	0.89	0.94	0.96	0.95	0.91	0.85	0.81	0.76	0.64	0.51	0.36	0.20	70
30	0.65	0.75	0.82	0.87	0.89	0.88	0.85	0.79	0.75	0.71	0.61	0.48	0.35	0.20	60
40	0.56	0.65	0.72	0.77	0.79	0.79	0.76	0.72	0.68	0.65	0.56	0.45	0.33	0.20	50
50	0.46	0.54	0.60	0.64	0.67	0.67	0.66	0.62	0.60	0.57	0.49	0.41	0.31	0.20	40
60	0.33	0.40	0.46	0.50	0.53	0.54	0.53	0.51	0.49	0.47	0.42	0.36	0.28	0.20	30
70	0.20	0.25	0.30	0.34	0.37	0.39	0.40	0.39	0.38	0.37	0.34	0.30	0.26	0.20	20
80	0.05	0.09	0.14	0.17	0.21	0.23	0.25	0.26	0.26	0.26	0.26	0.25	0.23	0.20	10
90	-0.10	-0.07	-0.03	0.00	0.03	0.07	0.10	0.13	0.14	0.15	0.17	0.19	0.20	0.20	0

Table 7.4 for μ = 0.1

β for fy	α: -30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	β for fx
0	0.82	0.91	0.97	1.00	1.00	0.97	0.92	0.83	0.78	0.72	0.59	0.44	0.27	0.10	90
10	0.80	0.89	0.95	0.98	0.99	0.96	0.90	0.82	0.77	0.71	0.58	0.43	0.27	0.10	80
20	0.76	0.85	0.91	0.94	0.94	0.92	0.86	0.78	0.74	0.68	0.56	0.42	0.26	0.10	70
30	0.70	0.78	0.84	0.87	0.87	0.85	0.80	0.73	0.68	0.63	0.52	0.39	0.25	0.10	60
40	0.61	0.69	0.74	0.77	0.77	0.75	0.71	0.65	0.61	0.57	0.47	0.36	0.23	0.10	50
50	0.51	0.57	0.62	0.64	0.65	0.64	0.61	0.56	0.53	0.49	0.41	0.31	0.21	0.10	40
60	0.38	0.44	0.48	0.50	0.51	0.50	0.48	0.45	0.42	0.40	0.34	0.26	0.19	0.10	30
70	0.25	0.29	0.32	0.34	0.35	0.36	0.35	0.33	0.31	0.30	0.26	0.21	0.16	0.10	20
80	0.10	0.13	0.15	0.17	0.19	0.20	0.20	0.20	0.19	0.19	0.17	0.15	0.13	0.10	10
90	-0.05	-0.03	-0.02	0.00	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.09	0.10	0.10	0

Table 7.5 for μ = 0.0

β for fy	α: -30	-20	-10	0	10	20	30	40	45	50	60	70	80	90	β for fx
0	0.87	0.94	0.98	1.00	0.98	0.94	0.87	0.77	0.71	0.64	0.50	0.34	0.17	0.00	90
10	0.85	0.93	0.97	0.98	0.97	0.93	0.85	0.75	0.70	0.63	0.49	0.34	0.17	0.00	80
20	0.81	0.88	0.93	0.94	0.93	0.88	0.81	0.72	0.66	0.60	0.47	0.32	0.16	0.00	70
30	0.75	0.81	0.85	0.87	0.85	0.81	0.75	0.66	0.61	0.56	0.43	0.30	0.15	0.00	60
40	0.66	0.72	0.75	0.77	0.75	0.72	0.66	0.59	0.54	0.49	0.38	0.26	0.13	0.00	50
50	0.56	0.60	0.63	0.64	0.63	0.60	0.56	0.49	0.45	0.41	0.32	0.22	0.11	0.00	40
60	0.43	0.47	0.49	0.50	0.49	0.47	0.43	0.38	0.35	0.32	0.25	0.17	0.09	0.00	30
70	0.30	0.32	0.34	0.34	0.34	0.32	0.30	0.26	0.24	0.22	0.17	0.12	0.06	0.00	20
80	0.15	0.16	0.17	0.17	0.17	0.16	0.15	0.13	0.12	0.11	0.09	0.06	0.03	0.00	10
90	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0

Remark: $fx = \cos\alpha \cdot \sin\beta + \mu \cdot \sin\alpha$ $fy = \cos\alpha \cdot \cos\beta + \mu \cdot \sin\alpha$

Explanations And Interpretation Of "*Methods To Assess The Efficiency Of Securing Arrangements For Non-Standardized Cargo*"

1. The exclusion of very heavy units as carried under the provisions of chapter 1.8 of the Code from the scope of application of the methods should be understood to accommodate the possibility of adapting the stowage and securing of such units to specifically determined weather conditions and sea conditions during transport. The exclusion should not be understood as being a restriction of the methods to units up to a certain mass or dimension.

2. The acceleration figures given in Table A8.2, in combination with the correction factors, represent peak values on a 25-day voyage, This does not imply that peak values in x, y, and z directions occur simultaneously with the same probability. It can be generally assumed that peak values in the transverse direction will appear in combination with less than 60% of the peak values in longitudinal and vertical directions.

   Peak values in longitudinal and vertical directions maybe associated more closely because they have the common source of pitching and heaving.

3. The advanced calculation method uses the "worst case approach". That is expressed clearly by the transverse acceleration figures, which increase to forward and aft in the ship and thereby show the influence of transverse components of simultaneous vertical accelerations. Consequently there is no need to consider vertical accelerations separately in the balances of transverse forces and moments.
   These simultaneously acting vertical accelerations create an apparent increase of weight of the unit and thus increase the effect of the friction in the balance of forces and the moment of stableness in the balance of moments. For this reason there is no reduction of the force ***m.g*** normal to the deck due to the presence of an angle of heel.

4. The situation is different for the longitudinal sliding balance. The worst case would be a peak value of the longitudinal force Fx accompanied by an extreme reduction of weight through the vertical force Fz.

5. The friction coefficients shown in the methods are somewhat reduced against appropriate figures in other publications. The reason for this should be seen in various influences which may appear in practical shipping, as moisture, grease, oil, dust and other residues, and vibration of the ship.

6. The principal way of calculating forces within the securing elements of a complex securing arrangement should necessarily include the consideration of:

   1. load-elongation behaviour (elasticity),

   2. geometrical arrangement (angles, length),

   3. pre-tension

   of each individual securing element.

   This approach would require a large volume of information and a complex, iterative calculation. The results would still be doubtful due to uncertain parameters.

   Therefore the simplified approach was chosen with the assumption that the elements take an even load of CS (calculated strength) which is reduced against the MSL (maximum securing load) by the safety factor 1.5.

7. When employing the advanced calculation method, the way of collecting data should be followed as shown in the calculated example. It is acceptable to estimate securing angles, to take average angles for a set of lashings and similarly to arrive at reasonable figures of the levers **a, b** and **c** for the balance of moments.

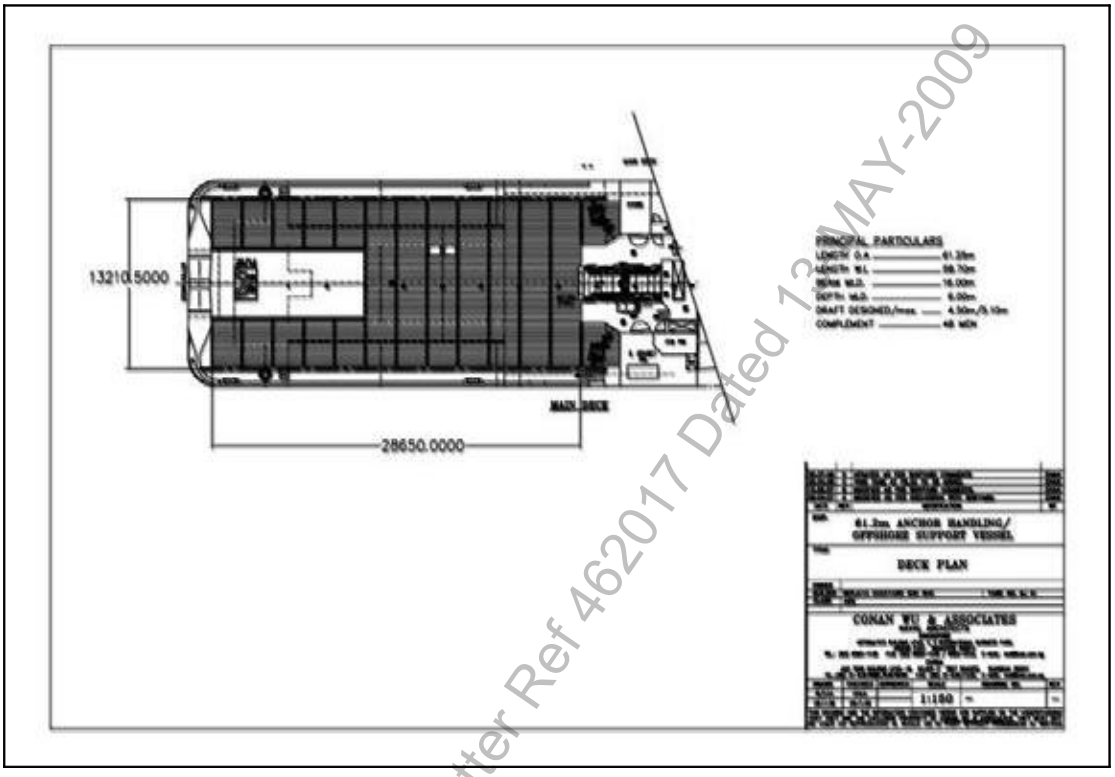
It should be borne in mind that meeting or missing the balance calculation just by a tiny change of one or the other parameters indicates to be near the goal anyway. There is no clear-cut borderline between safety and non-safety. If in doubt, the arrangement should be improved.

"Explanation and interpretation of "Methods of asses the efficiency of securing arrangements for non - standarized cargo" withthe heading are deleted from section 7 and added to Appendix 2 to the Annex.

APPENDIX 1A

Location Of Fixed Securing Devices

Refer to Vessel Deck Plan Drawing



APPENDIX 1B

Details Of Fixed Securing Devices (to verify onboard "UFS ENAM")

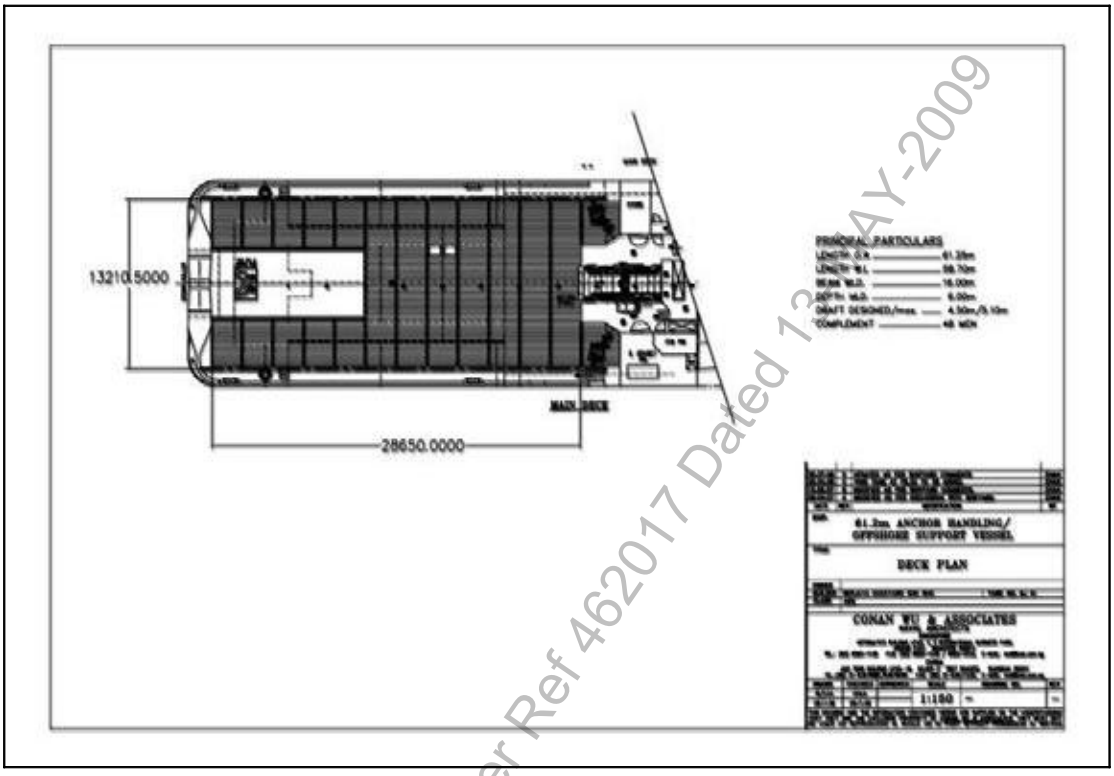
ITEM	QUANT.	M AT'L	LOC'N	SW L (MSL) (M TONS)	CS (M TONS)	REMARKS
LASHING EYE PAD	25 ton (4 on PORT & 2 on STBD)	Steel	Located on deck in way of cargo rails 6750 mm from centerline. Fr 3, 12, 21and 35.	**25**	**16.7**	SEE APP'X 1C
LASHING EYE PAD	10 ton (5 on PORT & 5 on STBD)	Steel	Located on deck in way of cargo rails 6750 mm from centerline. Fr 1, 7,15,23,39	**10**	**6.67**	SEE APP'X 1C
CARGO RAILS AND STANCHIONS	2 cargo rails,1 port and 1 stbd.		2 cargo rails, 1 port and 1 stbd positioned 6750mm off the longitudinal centerline.	**10**	**6.67**	

Note: CALCULATED STRENGTH (CS) = MSL/1.5

APPENDIX 1C

Sketches/Dwgs. Of Fixed Securing Devices on Deck Plan

DRAWING "ARRANGEMENT IN UPPER DECK"



APPENDIX 2A

Table Of Portable Securing Devices

TABLE OF PORTABLE SECURING DEVICES

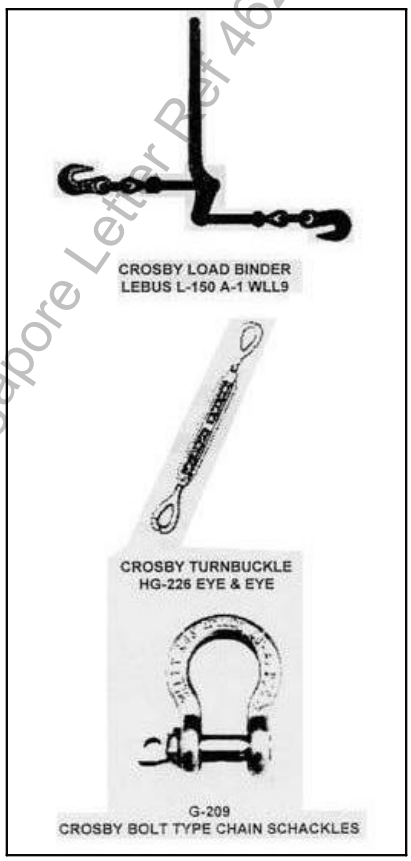
ITEM	MANU-FACT'R	MODEL/ TYPE	QUANT.	MAT'L	LOCATION	BREAKING STRENGTH	SWL(MSL) (MTONS)	CS (MTONS)	REMARKS
20mm x 130 mtr (6x36) Tugger Wire Rope	Haggie	EIPS Steel Wire Rope	2 lengths	Steel	Tugger Winch Drum	291.90	**5.9**	**3.97**	SEE APP'X 2B
Snatch Block 6" Sheave	Kondotec Inc	Single Sheave	2 Pcs	Steel	Bosun Store	10.0	**5.0**	**3.33**	SEE APP'X 2B
Rachet Type Load Binder 5/16" - 3/8"	CROSBY	Lebus R-7 L140	20 Pcs	Steel	Bosun Store	6.0	**4.0**	**2.66**	SEE APP'X 2B
Grab Hook 1/2" dia	CROSBY	Crosby A-1338	6 Pcs	STEEL	Bosun Store	10.22	**6.8**	**4.55**	SEE APP'X 2B
Lashing Chain 13mm x 300 Ft	CROSBY	Spectrum 8 Alloy Chain	One Length	Alloy	Bosun Store	-	**6.8**	**4.55**	-
D-Shackle dia 22mm	Van Beest	Screw Pin Type IVA Class 2	10 Pcs	Steel	Bosun Store	-	**6.5**	**4.33**	SEE APP'X 2B
D-Shackle dia 25mm	Van Beest	Screw Pin Type IVA Class 2	12 Pcs	Steel	Bpsun Store	-	**8.5**	**5.66**	SEE APP'X 2B

Notes:

1. CALCULATED STRENGTH (CS) = MSL/1.5
2. Where MSL is not specified/available, but breaking strength is specified, the MSL can be obtained using the guidelines in CSS Code Annex 13, or Table A8.1, of this manual.
3. For wire rope clips, at least four pieces are required per loop (22mm wire rope).
4. Refer to drawing in ATTACHMENTS for location of portable securing devices, both usable and damaged.

APPENDIX 2B

Sketches Of Portable Securing Devices

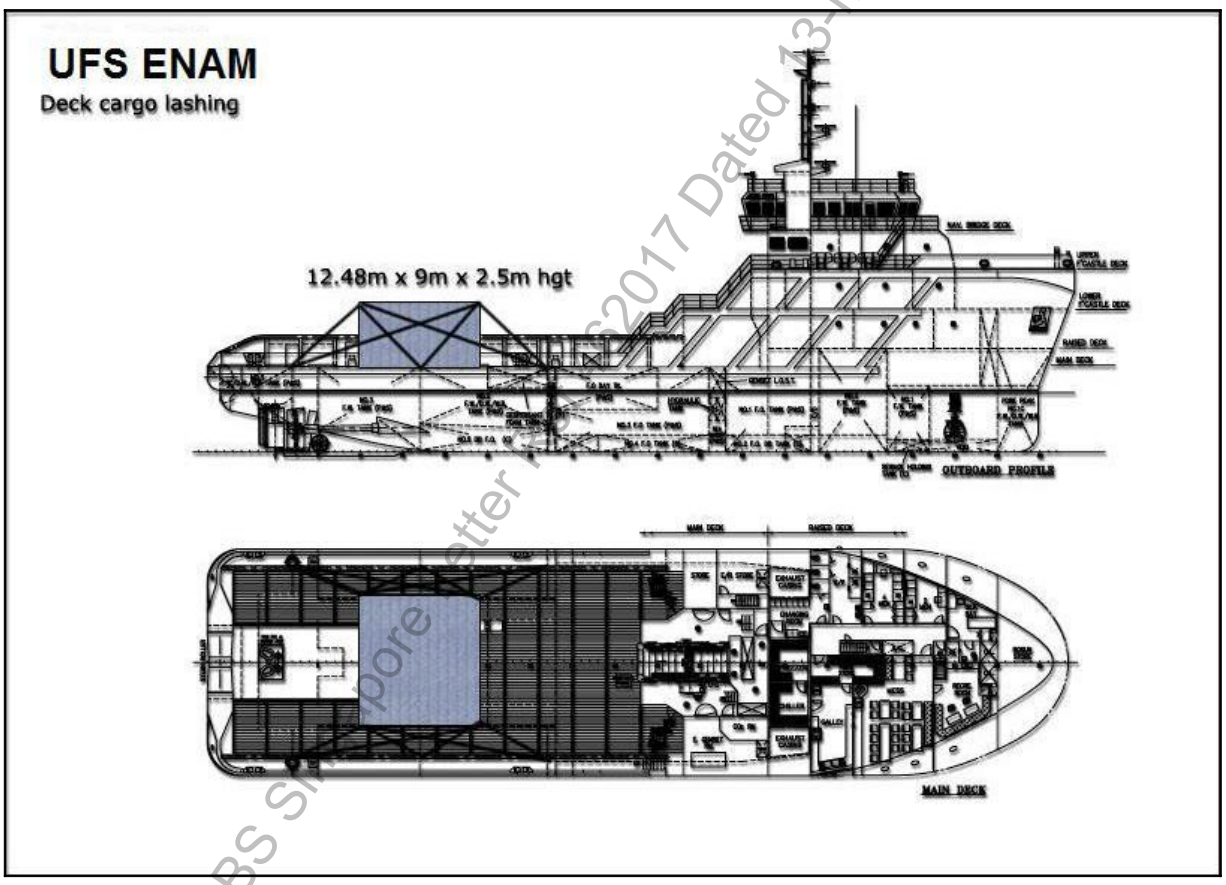


APPENDIX 3A

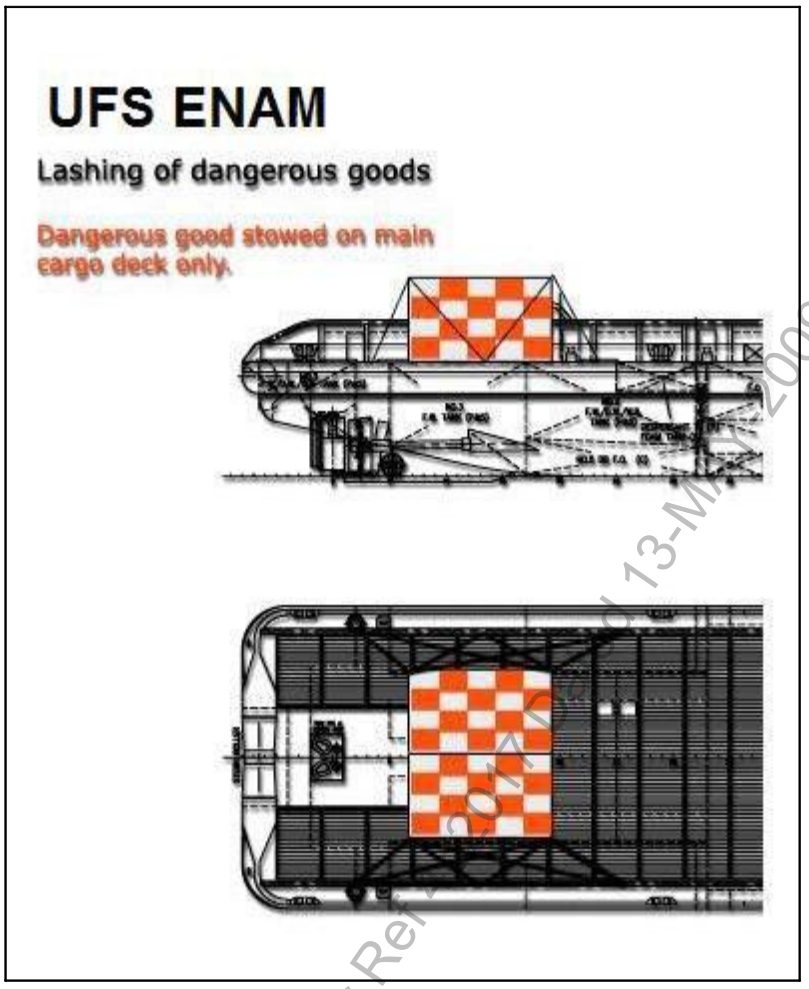
Hand Calculation Sheet For Advanced Calculation

In accordance with Annex 13 to the Code of Safe Practice for Cargo Stowage and Securing

Example Data:
Cargo details = 12.48m length x 2.5m hgt x 9.0m width
Lashed on main deck on fixed securing cargo rail stanchions.
MSL: 200kN
Angles (alpha) refer to below diagram
Angles (beta) refer to below diagram
Lever length C refer to below diagram.



TOP AND SIDE VIEW OF CARGO STOWAGE



DANGEROUS CARGO STOWAGE / LASHING

APPENDIX 3A-1 LASHING GEARS INSPECTION RECORDS

VESSEL NAME: _____

S/NO	ITEMS	IDENTIFCATION NO.	Date of Examination	Conditions		CHECKED BY	REMARKS
				Good	Poor		

Instructions:
a) Inspections and maintenance to be carried out every June and December
b) To Tick (/) in boxes [Good] or [Poor] after inspection
c) Items discarded due to defects to be deducted from list of inventory and replacement requested.
d) This record to be maintained on board and made available for vertifications.

APPENDIX 3B

Hand Calculation Sheet For Advanced Calculation

In accordance with Annex 13 to the Code of Safe Practice for Cargo Stowage and Securing (***BLANK FORM***)

Procedure to Calculate Acceleration

1. Determine vertical position (on deck - high, on deck - low, 'tween deck or lower hold)
2. Determine the longitudinal position with respect to A.P. (within the range 0 to 1.0 L, where L is LBP)
3. Determine the basic accelerations in transverse, longitudinal and vertical directions using Table 2 in Annex 13
4. Apply correction to the basic acceleration for the length and speed of the specific vessel using the Tables in Annex 13
5. If the B/GM ratio is less than 13, the transverse accelerations are to be corrected using the Tables in Annex 13

Abbreviations :
CS : Calculated Strength in kN
ø : angle of lashing device to horizontal plane
c : lever-arm of securing force
f = μ.sin ø + cos ø

Friction Coefficient	μ
Steel to timber or rubber	0.3
Steel to Steel (dry)	0.1
Steel to Steel (wet)	0.0

Ship	Length		m	
	Breadth		m	
	GM		m	
	Speed		knots	
	B/GM			
Cargo Location	Vertical Location (DH/DL/TD/LH)			
	Longitudinal Location (* L from aft)			
Acceler'n	Longitudinal (x)		m/s²	
	Transverse (y)		m/s²	
	Vertical (z)		m/s²	
	Length Correction Factor			
	GM Correct'n for Transv. Acceler'n			
Cargo Details	Mass		tonnes	
	Dimensions	Longitudinal	m	
		Transverse	m	
		Vertical	m	
	Center Gravity Height		m	
	Half Base	Longitudinal	m	
		Transverse	m	
	Friction Coefficient		μ	
Wind Affected?				
Sea Sloshing Affected?				

Securing Material Details

Securing Device	Breaking Strength (KN)	MSL (KN)	CS (KN)

Lashing Details and Securing Forces

	No.	CS	Angle(ø)	LeverArm (c)	f	CSn.fn	CSn.cn
Long'l Lashing (Fore)	1						
	2						
	3						
	4						
	5						
	6						
	7						
					Total		

	No.	CS	Angle(ø)	LeverArm (c)	f	CSn.fn	CSn.cn
Long'l Lashing (Aft)	1						
	2						
	3						
	4						
	5						
	6						
	7						
					Total		

	No.	CS	Angle(ø)	LeverArm (c)	f	CSn.fn	CSn.cn
Transv. Lashing (Port)	1						
	2						
	3						
	4						
	5						
	6						
	7						
					Total		

	No.	CS	Angle(ø)	LeverArm (c)	f	CSn.fn	CSn.cn
Transv. Lashing (Starboard)	1						
	2						
	3						
	4						
	5						
	6						
	7						
					Total		

Corrections to Basic Accelerations

Basic Acceleration (m/s^2)	Length Correction Factor	GM Correct'n for Transv. Acceler'n	Corrected Acceleration (m/s^2)
Longitudinal (x)		N.A.	
Transverse (y)			
Vertical (z)		N.A.	

Calculation of External Forces

Wind and Sea Sloshing		Horizontal Dimension (m)	Vertical Dimension (m)	Project Area (m^2)	Force (KN)
Wind	Longl Force				
	Transv. Force				
Sea Sloshing	Longl Force				
	Transv. Force				

Remarks : Sea Sloshing apply only to deck cargo up to 2m above deck/hatch top

External Force	Corrected Acceleration	Acceleration Force	Wind Force	Sea Sloshing	total force	Vertical Lever	moment
Longl (x)							
Trans (y)							
Vert (z)							

Results

Sliding Forces		Securing Force			External Force	OK or NG?
		Friction	Lashing	Total		
Long'l	Fore					
	Aft					
Transv.	Port					
	Starboard					

Tipping Moment		Securing Moment						OK or NG?
		Self-Weight	Lever	Moment	Lash mt	Total	Moment	
Long'l	Port							
	Starboard							
Transv.	Port							
	Starboard							

APPENDIX 5A CODE OF SAFE PRACTICE

FOR THE CARRIAGE OF CARGOES AND PERSONS BY OFFSHORE SUPPLY VESSELS (OSV CODE)

RESOLUTION A.863(20)

adopted on 27 November 1997
(Agenda item 9)
(SOLAS Chs VI and XI, ISM Code)

THE ASSEMBLY,

RECALLING Article 15(j) of the Convention on the International Maritime Organization concerning the functions of the Assembly in relation to regulations and guidelines concerning maritime safety,

RECALLING ALSO resolution A.741(18) on the International Management Code for the Safe Operation of Ships and Pollution Prevention (International Safety Management (ISM) Code),

RECALLING FURTHER that the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, adopted, on 24 May 1994, a new SOLAS chapter IX (Management for the safe operation of ships), by virtue of which the ISM Code is due to become mandatory for certain classes of ship as from 1 July 1998,

BEING AWARE that the specialized operations of offshore supply vessels may expose personnel and cargoes on board to additional hazards,

BEARING IN MIND that a number of serious accidents have occurred on offshore supply vessels, during cargo and person carriage operations,

RECOGNIZING that proper practice in the operation and management of offshore supply vessels when interfacing with offshore installations, could avoid such accidents in the future,

HAVING CONSIDERED the recommendation made by the Maritime Safety Committee at its sixty-sixth session,

1. ADOPTS the Code of Safe Practice for the Carriage of Cargoes and Persons by Offshore Supply Vessels (OSV Code) set out in the Annex to the present resolution;
2. INVITES Governments to apply the OSV Code;
3. REQUESTS the Maritime Safety Committee to keep the OSV Code under review and to amend it, as necessary.

ANNEX

CODE OF SAFE PRACTICE FOR THE CARRIAGE OF CARGOES AND PERSONS BY OFFSHORE SUPPLY VESSELS (OSV CODE)

Contents

FOREWORD

The purpose of this Code of Safe Practice is to provide, for both operator and contractor, an international standard to avoid or reduce to a minimum the hazards which affect offshore supply vessels in their daily operation of carrying cargoes and persons to, from and between offshore, installations. It is not intended to address contractual matters or the financial implications that occur in the operator/contractor relationship.
This standard should be considered when implementing a Safety Management System (SMS) within the meaning of 1.4 of the IMO International Safety Management (ISM) Code.

1 GENERAL

1.1 Definitions

1.1.1 Contractor means the organization that has the responsibility for the operation of the ship as laid down in 1.1.2 of the International Safety Management (ISM) Code.

1.1.2 Operator* means the party who contracts an offshore supply vessel.

* A mobile offshore unit (MOU) owner/contractor is the operator in cases where he contracts an offshore supply vessel.

1.1.3 Offshore supply vessel (OSV) means a vessel which is used for the transportation of stores, materials, equipment or personnel to, from and between offshore installations.

1.1.4 Offshore installation manager (OIM) means the person responsible for all activities on the offshore installation.

1.1.5 Offshore installation means a structure which is, or is to be, or has been used, while standing or stationed in water, or on the foreshore or other land intermittently covered with water (see appendix 1).

1.1.6 Logistics co-ordinator means a person or persons based on shore or offshore, specifically designated by the operator as a focal point and having responsibility for:

.1 the proper preparation of cargo for transport offshore;
.2 loading/unloading/backloading plans;
.3 sailing schedules;
.4 contingencies; and
.5 other matters, as required by the situation, including dangerous goods.

1.1.7 Cargo handler means a member of ship or offshore installation handling the cargo on board the OSV at the offshore installation.

1.2 Information and documentation

1.2.1 OSVs should be supplied with all relevant information to undertake the intended voyage(s).
In deciding upon the relevancy of the information provided, a distinction should be made between:

.1 vessels chartered for a stated period or for consecutive voyages; and
.2 vessels chartered for one voyage or a short period of time.

1.2.2 The operator and the contractor should have documents containing procedures and instructions, preferably used to describe and implement the Safety Management System (SMS), that address the relevant items of Table 1 and Table 2 below:

Table 1

Operator and contractor

Detailed communication procedures
Procedures for reporting accidents and non-conformities, follow-up action
Vessel sailing schedule, taking into account assessment of weather and sea conditions
Routeing/re-routeing instructions
Arrival/departure procedures vessel-shore base
Arrival/departure procedures vessel-offshore installation
Detailed loading/unloading/backloading procedures with checklist, including those related to dangerous goods, heavy lifts and unusual loads
Responsibilities and authorities
Emergency procedures
Special operations
Critical operations

Table 2

Operator	Contractor
Incoming materials on the shore base with and offshore destination Mooring and anchoring procedures at the offshore installation Operations regarding sea-transport Cargo-handling Cargo-handling equipment Offshore(waste) skips, toolboxes Portable tanks Installation layout and plans with respect to vessel's interest Weather / field operation Marine control onshore/offshore Update field information	Arrival of vessel in 'safety zone' at offshore installation Cargo procedure Bulk cargo procedure Check on checklist for securing cargo Passenger transport Checklist on seaworthiness and cargo-worthiness Checking stability conditions

1.2.3 Further to 1.2.2, it is recommended that all interfacing activities, such as those set out in appendix 3, are addressed.

1.3 Communication

There should be effective communications between all responsible persons involved in all OSV operations. When radio communications are used, dedicated channels should be maintained throughout an operation.

1.4 Cargo handling and stability

1.4.1 General

1.4.1.1 Both during sea-transport and operations at the offshore installation, OSVs with an open stern, under certain conditions (e.g. certain weather and sea conditions, deeply laden), are troubled with incoming water on the exposed cargo deck. This can lead to dangerous situations, especially if cargoes with a tendency to float and/or with low friction coefficients are stowed on the exposed deck of the vessel. It is recommended that these vessels be provided with instructions to counter these dangers.

1.4.1.2 The number of cargo handlers should be sufficient for safe and effective cargo operations.

1.4.1.3 The crew of OSVs should be adequately trained.

1.4.1.4 During deck cargo handling operations other activities on the cargo deck of the vessel should be avoided.

1.4.1.5 Safe havens and escape routes for personnel from the cargo deck should be properly marked and kept clear at all times. A crash barrier, fitted along each side of the deck, could be one method of achieving a safe haven.

1.4.2 Pre-planning

1.4.2.1 A passage plan and sailing schedule should be made and taken into consideration when a loading plan is made. After departure the passage plan may only be changed by the responsible logistics co-ordinator in cooperation with the master. It is essential therefore that liaison, preferably by the logistics co-ordinator, is established between the OIM and the master prior to unloading or backloading of cargo.

1.4.2.2 The master should be advised of expected delays to operations. Excessive stand-by times in close proximity to offshore installations should be avoided.

1.4.3 Cargo

1.4.3.1 The master should ensure coordination of all parties involved in the loading or discharging of cargoes or persons before transfer operations begin, to ensure that all those involved recognize their responsibilities and reach agreement on the equipment, communications and safety procedures to be used.

1.4.3.2 Before loading, the master should be provided with details on dangerous cargoes, non-standardized cargoes and cargoes which are heavy or difficult to stow, secure, or unload.

1.4.3.3 The master should not accept the loading of any cargo which is not safe for cargo handling, not adequately packed, not properly marked or not properly documented.
The responsibility for ensuring that cargoes are properly prepared for carriage on board OSVs rests with the operator, shipper and/or owner of the items concerned.

1.4.3.4 All cargo operations should be supervised by the officer in charge.

1.4.3.5 Operators should ensure that as much cargo as possible is containerized to allow safer stowage and securing on deck. Where different container sizes are used, the need for safe securing should be considered when planning the stowage. For constructional requirements for containers reference should be made to the Guidelines for the Approval of Containers Handled in Open Seas (MSC/Circ.613).

1.4.4 Stowage and securing of cargo

1.4.4.1 The master should ensure that the vessel has a sufficient quantity and types of lashing and securing materials for the safe operation of the vessel. The lashing and securing materials should be:

.1 suitable for their intended purpose;
.2 of adequate strength;
.3 easy to use;
.4 well maintained; and
.5 periodically inspected,

and a record should be kept of the inspections.

1.4.5 Bulk cargo*

* For hazardous and noxious liquid substances in bulk see IMO resolution A.673(16)

“Guidelines for the Transport and Handling of Limited Amounts of Hazardous and Noxious Liquid Substances in Bulk in Offshore Support Vessels".

1.4.5.1 Hoses used for the transfer of bulk substances should be color-coded at the hose terminations to identify the product for which the hose is to be used. A recommended color code is shown in appendix 2 to this Code.

1.4.5.2 Before bulk cargo transfer operations take place the following should be established:

.1 starting and stopping procedures;
.2 quantities and categories of product to be transferred;
.3 permitted pumping rate and pressure ; and
.4 emergency stopping procedures.

1.4.5.3 During bulk cargo transfer a responsible crew member should be in attendance to monitor, direct and control the transfer operation.

1.4.6 Stability

Reference should be made to the Guidelines for the Design and Construction of Offshore Supply Vessels (IMO resolution A.469(XII), as amended).

1.4.7 Personal protective equipment

1.4.7.1 Each crew member and/or cargo handler should, during cargo operations, be provided with personal protective equipment (PPE) in a high visibility color, appropriate to the geographical area of operation and the work to be done. Sufficient spare equipment should be available.

1.4.7.2 Crew members and/or cargo handlers working on deck should wear buoyancy aids and relevant PPE to protect head, feet and hands.

1.4.7.3 Examples of PPE which may be required are:

.1 working-life jackets;
.2 working-exposure suits (for operations in extreme areas); and
.3 hard hats, protective boots, safety glasses.

2 PORT OPERATIONS

2.1 Communication

2.1.1 Prior to departure of the OSV the logistics co-ordinator should communicate information concerning sailing-schedule, cargo manifest and other relevant items to the operator and the contractor (e.g. OIM and master).

2.1.2 Prior to the arrival of an OSV at a port, the master should communicate to the port information regarding the vessel's ETA, cargo requirements and any special circumstances of the OSV.

2.2 Cargo

2.2.1 The operator should ensure that cargoes within containers are adequately stowed and secured for sea-transport. The master has the authority to carry out random inspections. If inspection of any container reveals inadequate stowing, lashing or securing arrangements, inadequate marking or labelling of dangerous goods, or if he is in doubt as to the safety status of the container, he should refuse this container for sea-transport.

2.2.2 Reference should be made to the Code of Safe Practice for Cargo Stowage and Securing (CSS Code (IMO resolution A.714(17)) and the IMO/ILO/UN/ECE Guidelines for Packing of Cargo Transport Units (CTUs) (MSC/Circ.787).

3 SEA-TRANSPORT

3.1 General

3.1.1 Cargoes should be properly stowed and secured during sea-transport. Regular visual checks of the securing arrangements should be carried out. 3.1.2 Closed containers should not normally be opened while the vessel is at sea unless an emergency situation (e.g. fire or spillage) occurs. All necessary precautions should be taken to prevent injury to personnel.

3.2 Communication

During sea-transport the master, OIM and logistics co-ordinator should inform each other about changes in relevant schedules and conditions.

4 OPERATIONS AT THE OFFSHORE INSTALLATION

4.1 General

4.1.1 Prior to commencing cargo operations, the master and the OIM should confirm the loading/unloading plan.

4.1.2 Any circumstance limiting cargo operations between the OSV and offshore installation (e.g. the visibility of the deck from the crane control cab, blinding lighting or overboard discharges from the installation) should be immediately communicated between the master and the OIM.

4.1.3 The OIM should ensure that a sling of sufficient length is attached between the crane block and the hook to minimize danger to cargo handlers and vessel imposed by the block. The crane block should be marked in such a way that it is visible under all circumstances of operation.

4.2 Mooring requirements

4.2.1 Taking into account such factors as those listed below, the master decides whether and how he will moor and confirms this with the OIM:

.1 wind, sea and swell;
.2 current;
.3 manoeuvring characteristics of the vessel;
.4 mooring area of the offshore installation and crane specifications;
.5 specifications of the cargo (weight, location, nature); and
.6 effectiveness of anchor(s) in seabed.

4.2.2 The decision on when it is unsafe for the vessel to remain moored or in close proximity to the offshore installation can be taken by the master or the OIM.

4.2.3 "Snatching" of cargo is allowed when the master considers it safe to do so under the prevailing conditions.

4.3 Communication

4.3.1 Prior to arrival at the offshore installation the master should obtain permission from the OIM to enter the installation's exclusive zone.

4.3.2 During cargo operations and personnel transfer at the offshore installation, effective

communication should be maintained between officer in charge, cargo handlers, crane operator and deck foreman of the offshore installation.

4.3.3 The master should inform the OIM and logistics co-ordinator about the vessel's time of departure and ETA at next location.

4.4 Information and documentation

Cargo information should be available to the receiving parties before cargo operations commence.

4.5 Personnel transfer

4.5.1 When transfers of personnel are performed, the normal methods are by personnel basket or by boat. The safety of personnel should never be compromised and the highest level of control and communication should be followed throughout these operations.

4.5.2 No personnel transfer should take place on location unless the consent of the OIM has been obtained and procedures have been agreed upon by all responsible parties concerned, taking into account actual and forecast weather conditions, wind speed, sea state and visibility.

4.5.3 The OIM should ensure that personnel baskets and all associated rigging are designed and maintained to achieve a 10:1 load factor of safety. Baskets should be inspected daily and prior to use.

4.5.4 The OIM should ensure that only certified cranes and crane operators are involved in personnel transfers. Direct communications should be established, and maintained throughout the transfer, between vessel deck crew, crane operators and vessel bridge.

4.5.5 Persons being transferred should wear lifejackets, safety helmets and boots. In addition, suitable protective and exposure suits should be worn as required.

4.6 Cargo handling

To minimize the potential for injury to deck crew and/or cargo handlers, they should not attempt to assist the crane operator to position hooked cargo on deck. The cargo should be landed, unhooked, and then if need be, moved into stowage position with tugger winches or rams.

APPENDIX 1
EXAMPLES AND TYPES OF OFFSHORE INSTALLATIONS

The table below gives examples of the types of structures and vessels which, for the purposes of determining the applicability of this Code, are and are not offshore installations:

Offshore Installations	Not Offshore Installations (or parts of installations)
Fixed production platforms Floating production platforms Floating storage units Mobile offshore drilling units(MODUs) Flotels Floating production, storage and operations units(FPSO)	Heavy lift vessels Diving support vessels Shuttle tankers Well service vessels Stacked MODUs Subsea installations Dredgers Wells not connected to an installation Survey vessels Pipelaying barges Pipelines which are more than 500m from the main structure to which they are attached Structures which are permanently attached to dry land or bridges or walkways

APPENDIX 2

COLOR CODE FOR HOSES TRANSFERRING BULK SUBSTANCES

To avoid misunderstanding about the hoses to be used for transferring bulk substances to connection points on board the vessel and offshore installation, color coding should be used. For the purpose of identification the hose terminations and connection points should be color coded by use of a coloured band to mark the substance, and all offshore supply vessels and offshore installations should adopt a color code as follows:

Substance	**Coloured band**
Potable water	Blue
Drill water	Green
Fuel	Brown
Dry bulk	Yellow: cement Orange: barite/bentonite
Dedicated base oil/oil-based mud	Black
Brine	Optional
Methanol	Optional

APPENDIX 3

Interfacing activities of operators and contractors

1 The purpose of this appendix is to assist operators and contractors in addressing interfacing activities that follow from the carriage of cargoes and persons by offshore supply vessels, preferably through a Safety Management System or operating procedure, whichever is in place.

2 The operator and the contractor should establish common procedures and operating criteria and resolve conflicts on areas where both plans and instructions interface. Examples of such areas are:

.1 safety and environmental protection policies;
.2 periodical drills; and
.3 the authority and responsibilities of respective personnel representing the operator and the contractor, which include:

.3.1 the master and OIM's authority and responsibility to advise each other and to interrupt operations when they consider that safety and environmental matters make it necessary; and
.3.2 the responsibility of designated person of the contractor (reference is made to paragraph 4 of the ISM Code), and of the person of appropriate authority for the operator to communicate directly with each other with respect to safety and environmental matters.

3 The operator and the contractor should make relevant parts of their Safety Management Systems, or operating procedures, mutually available.

4 The operator and the contractor should establish procedures for the mutual exchange of information with regard to relevant non-conformities, accidents and hazardous occurrences with the objective of improving safety and environmental conditions. Meetings between key personnel including crane operators, can assist this exchange.

APPENDIX 6 VESSEL PROCEDURES FOR CARRYING DANGEROUS GOODS

INTRODUCTION:

With IMDG Coded Goods that are to be carry onboard vessel, the Master shall ensure proper segregation in accordance to IMDG book and to refer to below table.

IMDG CODE CLASS	1.1 1.2 1.5	1.3 - 1.6	1.4	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	6.2	7	8	9
Explosives 1.1, 1.2, 1.5	*	*	*	C	B	B	C	C	C	C	C	C	B	C	B	C	X
Explosives 1.3, 1.6	*	*	*	C	B	B	C	C	C	C	C	C	B	C	B	B	X
Explosives 1.4	*	*	*	B	A	A	B	B	B	B	B	B	X	C	B	B	X
Flammable Gases 2.1	C	C	B	X	X	X	B	A	B	X	B	B	X	C	B	A	X
Non Flammable Gases 2.2	B	B	A	X	X	X	B	A	B	X	B	B	X	B	A	X	X
Toxic Gases 2.3	B	B	A	X	X	X	B	X	B	X	B	X	X	B	A	X	X
Flammable Liquids 3	C	C	B	B	A	B	X	X	B	A	B	B	X	C	B	X	X
Flammable Solids 4.1	C	C	B	A	X	X	X	X	A	X	A	B	X	C	B	A	X
Spontaneously Combustible 4.2	C	C	B	B	A	B	B	A	X	A	B	B	A	C	B	A	X
Dangerous when wet 4.3	C	C	B	X	X	X	A	X	A	X	B	B	X	B	B	A	X
Oxidizing Substances 5.1	C	C	B	B	X	X	B	A	B	B	X	B	A	C	A	B	X
Organic Peroxides 5.2	C	C	B	B	A	B	B	B	B	B	B	X	A	C	B	B	X
Toxic Substances 6.1	B	B	X	X	X	X	X	X	A	X	A	A	X	A	X	X	X
Infectious Substances 6.2	C	C	C	C	B	B	C	C	C	B	C	C	A	X	C	C	X
Radioactive Materials 7	B	B	B	B	A	A	B	B	B	B	A	B	X	C	X	B	X
Corrosives 8	C	B	B	A	X	X	X	A	A	A	B	B	X	C	B	X	X
Miscellaneous 9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

X : No segregation required.
A : Away from 1 MINI
B : Separate from 2 MINI
C : Separate by complete compartment / separate longitudinally by complete compartment from 3 MINI.
* : Check IMDG Code Volume 1 Segregation Chapter 7.2

Mini Container Size: Minimum Dimension 6ft x 6ft x 8 ft or meter equivalent

Food Container Separation

1 MINI – Class 2.3, 6.1, 8
2 MINI – Class 7
3 MINI – Class 6.2

For dangerous goods carried onboard, these shall be on main deck only and within the assigned area(s). See figure 6A.

Vessel Master shall NOT carry specialized cargo deem dangerous under the IMDG code onboardunless approval is given by Class and the carriage of such cargo has been accepted by Owner's
underwriter.

Master must :

1 Ensure that the vessel is properly and safely position / secure during loading and unloading.

2 Give advance notice and warning to Company in the event that there is a need to carry dangerous goods as deck cargo and to seek confirmation on insurance coverage and Class approval before proceeding.

3 Ensure the cargo manifest is in order and if goods are dangerous, their detail MSDS and Chartered's representatives must be present to complete any reporting to flag or coastal state during the carriage of these goods.

4 Ensure proper PPE is used during cargo operations.

Logistic onboard:

1 At least Four sets of full protective clothing, resistant to chemical attack are to be provided in additional to the fire-fighter's outfits required by 10.10 of Chapter II-2, Regulation 19 of SOLAS.

2 At least two self-contained breathing apparatus additional to those required by 10.10 of foregoing Regulation is to be provided.

3 Portable fire extinguishers with a total capacity of at least 12 kg of dry powder or equivalent are to be provided for the cargo spaces.

4 The dangerous goods shall be stowed at least 3 meters horizontally away from Frame 28 (see below figure 6A)

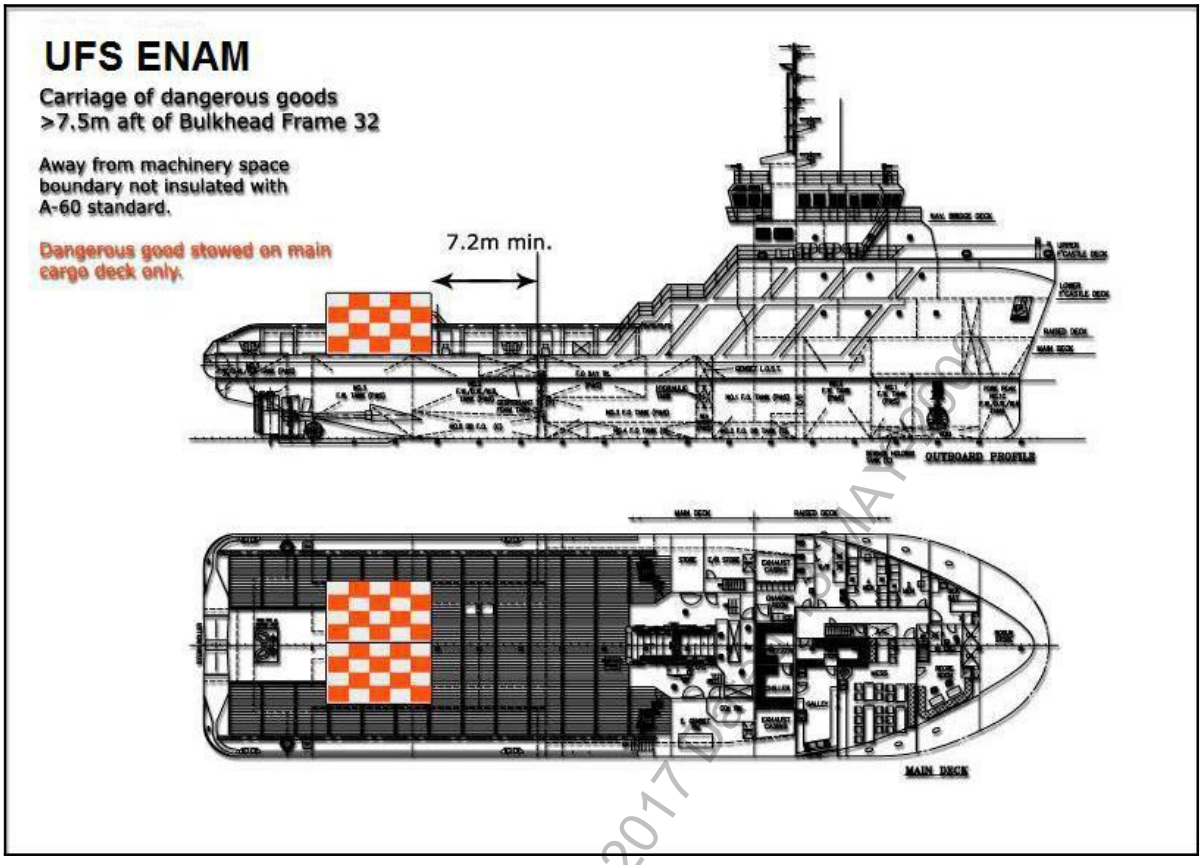


Figure 6A: Dangerous goods stowed at least 7.2m aft of Bhd Frame 32.

5 The dangerous goods shall be stowed as far away as possible from accommodation spaces.

6 The dangerous goods shall be stowed as far away as possible from machinery spaces. 7 MSDS (Material Safety Data Sheets) shall be placed in prominent and accessible area and copies filed with Master for each of the dangerous goods carried onboard.

Marking

Dangerous Goods, cargo notified as “URGENT”, items requiring special handling or heavy lifts MUST BE CLEARLY MARKED / LABELLED AND PLACED PROMINENTLY FOR ALL TO SEE.

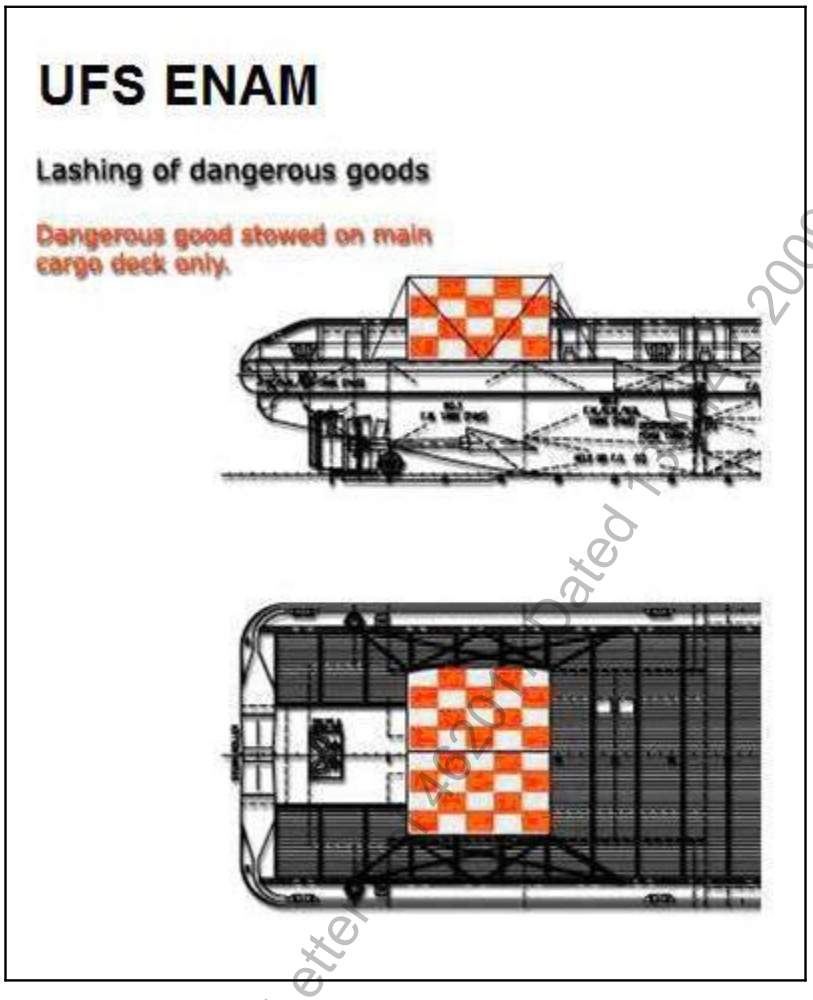
Handling and Securing:

Restraining of Dangerous Goods

The Master must ensure the dangerous goods are secured in accordance with the vessel guidance given with this manual.

- HANDLING DANGEROUS GOOD REQUIRES SPECIAL CARE, PPE REQUIREMENTS MUST BE WORN ON DECK AND CREW OR SETEVDORES MUST NOT RELEASE SEA FASTENINGS UNTIL VESSEL IS ALONGSIDE or MASTER ADVISES IT IS SAFE TO DO

SUPPLEMENT: DANGEROUS CARGO (PLACE ON MAIN DECK)
Calculation Sheet For Advanced Calculation



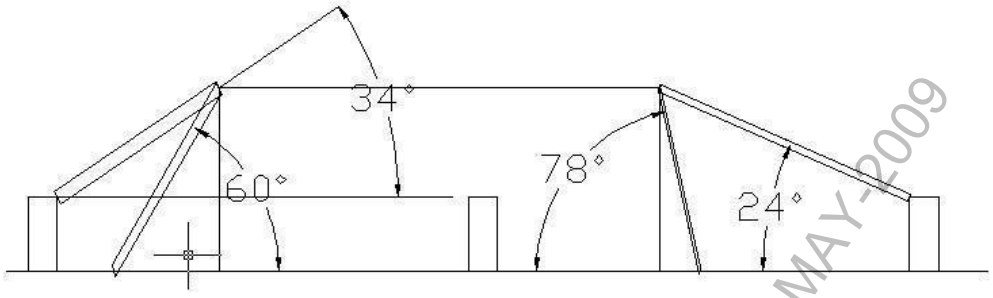
Example: Dangerous Good Data:
Dangerous Cargo details in cubic container = 3.5m width (transverse) x 3.0m hgt x 3.5m length (longitudinal)

**** Position as far away from accommodation as possible.**

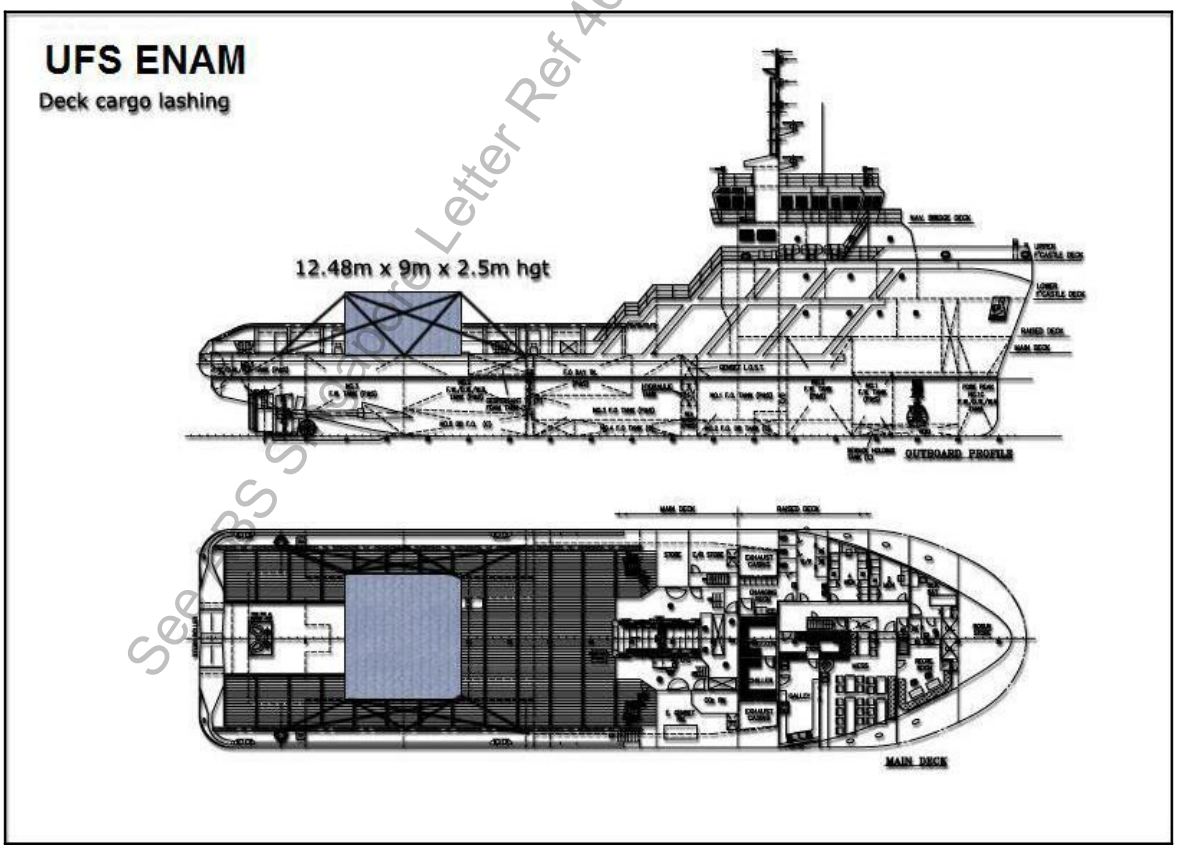
Lashed on main deck (portside) on fixed securing cargo rail stanchions.
MSL: 150kN
Angles (alpha) refer to below diagram
Angles (beta) refer to below diagram
Lever length C refer to below diagram.

CARRIAGE OF GOODS ON DECK.

5m x 6m x 2.5m height



SIDE VIEW OF CARGO STOWAGE



TOP VIEW OF CARGO STOWAGE

Cargo Securing Calculation
(Cargo Securing Calculation on Specific Ship)

Date	14 Nov 2008
Calculation by	ABSG Consulting
Ship Name	MV UFS LIMA
Class Number	-
Cargo Description	Cement, Mud tanks and Consumable
Cargo Location	Main deck

- **Input should be made in the cells of light green colour background**
- **This spreadsheet is not applicable to ships less than 30m**

DH : on-Deck High
DL : on-Deck Low
TD : Tween Deck
LH : Lower Hold

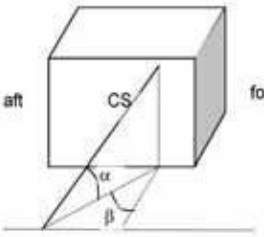
Ship	Length (30<=L<=300)		m	61.2
	Breadth		m	16
	GM		m	2.5
	Speed		knots	13.5
Cargo Location	Long'l Location (AP : 0.0, FP : 1.0)			0.4
	Vert. Location (**DH**,**DL**,**TD** or **LH**)			DL
Cargo Details	Mass		tonnes	20
	Cargo Dimensions	Long'l	m	12.48
		Transv.	m	9
		Vert'l.	m	2.5
	Tr. dist. CG to tipping Axle (c)		m	7.5
	Height of CG (a)		m	1.25
	Friction Coefficient μ			0.3
Wind Affected?	(1 : Yes, 0 : No)			1
Sea Sloshing Affected?	(1 : Yes, 0 : No)			1

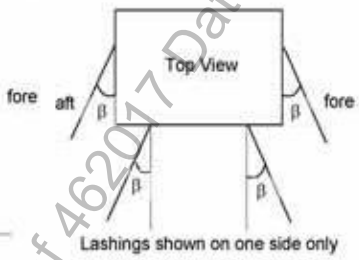
Material	MSL
shackles, rings, deckeyes, turnbuckles of mild steel	50% of breaking strength
fibre rope	33% of breaking strength
web lashing	50% of breaking strength
wire rope (single use)	80% of breaking strength
wire rope (re-useable)	30% of breaking strength
steel band (single use)	70% of breaking strength
chains	50% of breaking strength
timber	0.3kN/cm^2

Materials in contact	Friction coefficient, μ
timber-timber, wet or dry	0.4
steel-timber or steel-rubber	0.3
steel-steel, dry	0.1
steel-steel, wet	0

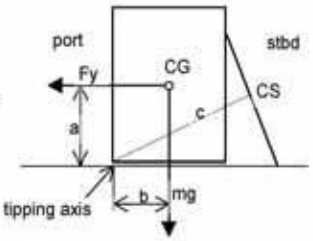
Lashing Details

$fy = \cos\alpha \cos\beta + \mu \sin\alpha$
$fx = \cos\alpha \sin\beta + \mu \sin\alpha$
CS = MSL / 1.35





Lashings shown on one side only



No.	Lashing Direction		MSL	Angle(α)	Angle(β)	Lever(c)	CS	fy	fx	CS • fy		CS • fx		CS • c	
	P/S	F/A	(kN)	(deg.)	(deg.)	(m)				Port	Stbd	Fwd	Aft	Port	Stbd
1	S	A	150	40	24	7.5	111.1	0.893	0.504		99.2		56.0		833.3
2	S	F	150	14	75	7.5	111.1	0.324	1.010		36.0	112.2			
3	S	F	150	78	19	7.5	111.1	0.490	0.361		54.4	40.1			833.3
4	S	A	90	34	29	7.5	66.7	0.893	0.570		59.5		38.0		500.0
5	P	A	150	40	24	7.5	111.1	0.893	0.504	99.2			56.0	833.3	
6	P	F	150	14	75	7.5	111.1	0.324	1.010	36.0		112.2			
7	P	F	150	78	19	7.5	111.1	0.490	0.361	54.4		40.1		833.3	
8	P	A	90	34	29	7.5	66.7	0.893	0.570	59.5			38.0	500.0	
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															
									Total	249.1	249.1	304.7	188.0	2166.7	2166.7

Acceleration Data

Accelerations Corrected for L, Speed and B/GM (m/sec²)

Vertical Location	Corr'n Factor for B/GM	Transverse Acceleration Long'l Location (*L) 0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.4	Long'l Accel'n
DH	1.69	15.34	14.91	14.69	14.47	14.47	14.69	14.91	15.34	15.99	14.47	4.85
DL	1.51	12.53	12.15	11.76	11.76	11.76	11.76	12.15	12.53	12.92	11.76	3.70
TD	1.31	9.85	9.35	9.18	9.02	9.02	9.18	9.35	9.85	10.35	9.02	2.55
LH	1.17	8.20	7.90	7.61	7.46	7.46	7.61	7.90	8.20	8.80	7.46	1.92
Vert Accel'n (az)		9.70	7.92	6.38	5.49	5.49	6.38	7.92	9.70	11.75	5.49	

Accelerations at Specified Cargo Location (m/sec²)

Cargo Location		Accelerations		
Long'l :	0.4	Long'l	(ax)	3.70
Vert. :	DL	Transv.	(ay)	11.76
		Vert.	(az)	5.49

Correction Factor for L and V (30<=L<=300)
= (0.2 * V / L^0.5 + (34 - 600 / L) / L) / 0.58
= 1.2767
B/GM = 6.4

External Forces / Moments

	Accel'n Data m/s²	Accel'n Force (kN)	Wind Hor. Dim. (m)	Vert. Dim. (m)	Project Area (m²)	Force (kN)	Sea Sloshing Hor. Dim. (m)	Vert. Dim. (m)	Project Area (m²)	Force (kN)	**Total Force (kN)**	Vertical Lever (m)	**External Moment (kN-m)**
Long'l	3.70	74	9	2.5	22.5	22.5	9	2	18	18	**115**	1.25	**143**
Transv.	11.76	235	12.48	2.5	31.2	31.2	12.48	2	24.96	24.96	**291**	1.25	**364**
Vert.	5.49	**110**											

Calculation Results

		Long'l / Transverse Sliding (kN) External Force	Securing Force Friction	Lashing	Total	OK or Not OK	Transverse Tipping (kN-m) External Moment	Securing Moment Selfwt	Lashing	Total	OK or Not OK
Transv.	**Port**	**291**	59	249	**308**	OK	**364**	1472	1950	**3422**	OK
	Stbd	**291**	59	249	**308**	OK	**364**	1472	1950	**3422**	OK
Long'l	**Fore**	**115**	26	305	**331**	OK					
	Aft	**115**	26	188	**214**	OK					

--- End of Worksheet "Calculation" --