**Annex**

**International Code for the Safe Carriage of Grain in Bulk**

**Part A**

***Specific requirements***

## 1 Application

1.1 This Code applies to ships regardless of size, including those of less than SOO tons gross tonnage, engaged in the carriage of grain in bulk, to which part C of chapter VI of the 1974 SOLAS Convention, as amended, applies.

1.2 For the purpose of this Code, the expression "ships constructed" means "ships the keels of which are laid or which are at a similar stage of construction".

## 2 Definitions

2.1 The term grain covers wheat, maize (corn), oats, rye, barley, rice, pulses, seeds and processed forms thereof, whose behaviour is similar to that of grain in its natural state.

2.2 The term *filled compartment, trimmed,* refers to any cargo space in which, after loading and trimming as required under A 10.2, the bulk grain is at its highest possible level.

2.3 Thy term *filled compartment, untrimmed,* refers to a cargo space which is filled to the maximum extent possible in way of the hatch opening but which has not been trimmed outside the periphery of the hatch opening either by the provisions of A 10.3.1 for all ships or A 10.3.2 for specially suitable compartments.

2.4 The term *partly filled compartment* refers to any cargo space wherein the bulk grain is not loaded in the manner prescribed in A 2.2 or A 2.3.

2.5 The term angle offloading ($\theta_1$) means the angle of heel at which openings in the hull, superstructures or deckhouses, which cannot be closed weathertight, immerse. In applying this definition, small openings through which progressive flooding cannot take place need not he considered as open.

2.6 The term *stowage factor*, for the purposes of calculating the grain heeling moment caused by a shift of grain, means the volume per unit weight of the cargo as attested by the loading facility, i.e. no allowance shall be made for lost space when the cargo space is nominally filled.

2.7 The term *specially suitable compartment* refers to a cargo space which is constructed with at Least two vertical or sloping, longitudinal, grain-tight divisions which are coincident with the hatch side girders or are so positioned as to limit the effect of any transverse shift of grain. If sloping, the divisions shall have an inclination of not less than 30° to the horizontal.

## 3 Document of authorization

3.1 A document of authorization shall be issued for every ship loaded in accordance with the regulations of this Code either by the Administration or an organization recognized by it or by a Contracting Government on behalf of the Administration. It shall be accepted as evidence that the ship is capable of complying with the requirements of these regulations.

3.2 The document shall accompany or be incorporated into the grain loading manual provided to enable the master to meet the requirements of A 7. The manual shall meet the requirements of A 6.3.

3.3 Such a document, grain loading stability data and associated plans may be drawn up in the official language or languages of the issuing country. If the language used is neither English nor French, the text shall include a translation into one of these languages.

3.4 A copy of such a document, grain loading stability data and associated plans shall be placed on board in order that the master, if so required, shall produce them for the inspection of the Contracting Government of the country of the port of loading.

3.5 A ship without such a document of authorization shall not load grain until the master demonstrates to the satisfaction of the Administration, or of the Contracting Government of the port of loading acting on behalf of the Administration, that, in its loaded condition for the intended voyage, the ship complies with the requirements of this Code. See also A 8.1 and A 9.

**4 Equivalents**

Where an equivalent accepted by the Administration in accordance with regulation I/5 of the International Convention for the Safety of Life at Sea, 1974, as amended, is used, particulars shall be included in the document of authorization or in the grain loading manual.

**5 Exemptions for certain voyages**

The Administration, or a Contracting Government on behalf of the Administration, may, if it considers that the sheltered nature and conditions of the voyage are such as to render the application of any of the requirements of this Code unreasonable or unnecessary. exempt from those particular requirements individual ships or classes of ships.

**6 Information regarding ship's stability and grain loading**

6.1 Information in printed booklet form shall be provided to enable the master to ensure that the ship complies with this Code when carrying grain in bulk on an international voyage. This information shall include that which is listed in A 6.2 and A 6.3.

6.2 Information which shall be acceptable to the Administration or to a Contracting Government on behalf of the Administration shall include:

1. ship's particulars;
2. light-ship displacement and the vertical distance from the intersection of the moulded baseline and midship section to the centre of gravity (KG);

3. table of liquid free surface corrections;
4. capacities and centres of gravity;
5. curve or table of angle of flooding, where less than 40°, at all permissible displacements;
6. curves or tables of hydrostatic properties suitable for the range of operating draughts; and
7. cross curves of stability which are sufficient for the purpose of the requirements in A 7 and which include curves at 12° and 40°.

6.3 Information which shall be approved by the Administration or by a Contracting Government on behalf of the Administration shall include:

1. curves or tables of volumes, vertical centres of volumes, and assumed volumetric heeling moments for every compartment, filled or partly filled, or combination thereof, including the effects of temporary fittings;
2. tables or curves of maximum permissible heeling moments for varying displacements and varying vertical centres of gravity to allow the master to demonstrate compliance with the requirements of A 7.1; this requirement shall apply only to ships the keels of which are laid on or after the entry into force of this Code;
3. details of the scantlings of any temporary fittings and, where applicable, the provisions necessary to meet the requirements of A 7, A S and A 9;
4. loading instructions in the form of notes summarizing the requirements of this Code;
5. a worked example for the guidance of the master; and
6. typical loaded service departure and arrival conditions and where necessary intermediate worst service conditions.

**7 Stability requirements**

7.1 The intact stability characteristics of any ship carrying bulk grain shall be shown to meet, throughout the voyage, at least the following criteria after taking into account in the mariner described in part B of this Code and, in figure A 7, the heeling moments due to grain shift,

1. the angle of heel due to the shift of grain shall not be greater than $12^{o}$ or in the case of ships constructed on or after 1 January 1994 the angle at which the deck edge is immersed, whichever is the lesser;
2. in the statical stability diagram, the net or residual area between the heeling arm curve and the righting arm curve up to the angle of heel of maximum difference between the ordinates of the two curves, or $40^{o}$ or the angle of flooding WO, whichever is the least, shall in all conditions of loading be not less than 0.075 metre-radians; and
3. the initial metacentric height, after correction for the free surface effects of liquids in tanks, shall be not less than 0.30 m.

7.2 Before loading bulk grain the master shall, if so required by the Contracting Government of the country of the port of loading, demonstrate the ability of the ship at all stages of any voyage to comply with the stability criteria required by this section.

7.3 After loading, the master shall ensure that the ship is upright before proceeding to sea.

It is recommended that loading conditions be provided for three representative stowage factors, e.g. 1.25. 1.50, and 1.75 cubic, metres per tonne.

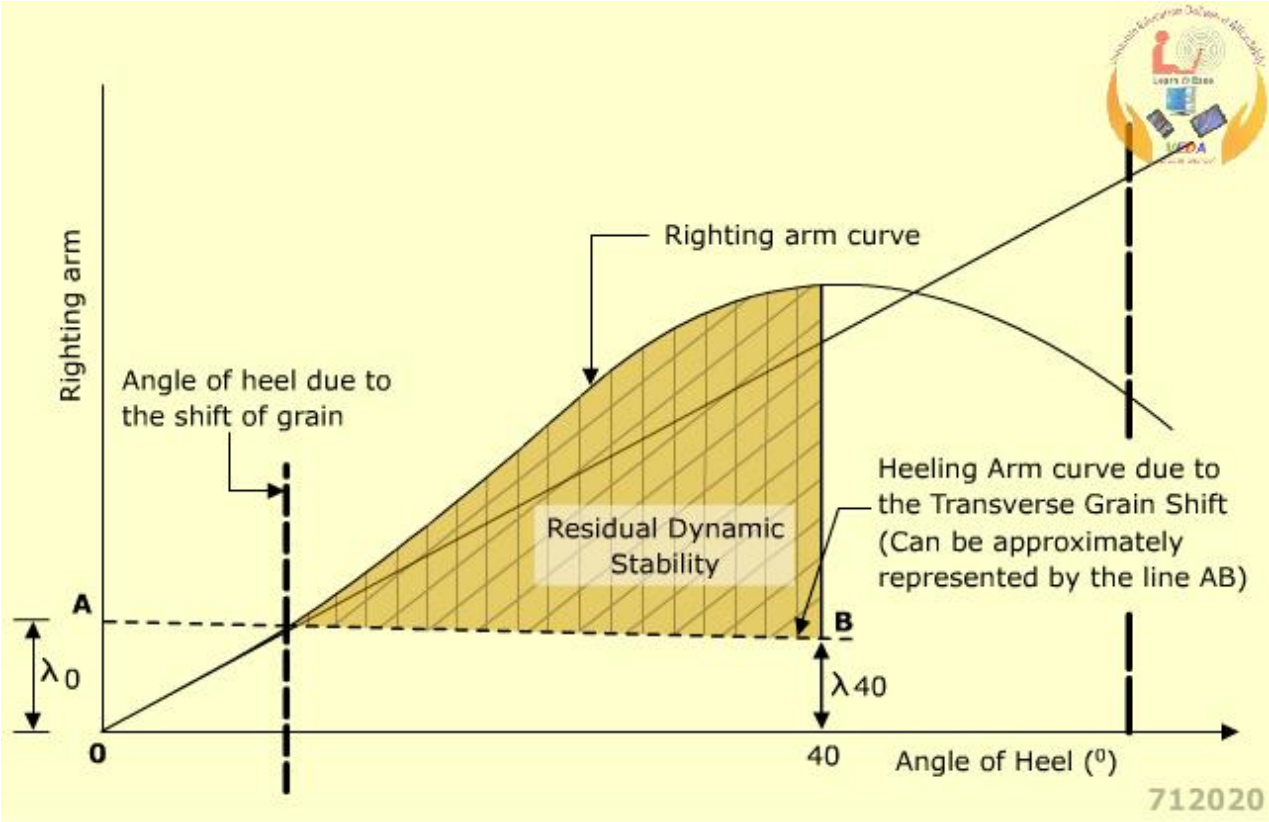


**Figure A 7**

(1) Where:

$$\lambda_0 = \frac{\text{assumed volumetric heeling moment due to transverse shift}}{\text{stowage factor} \times \text{displacement}}$$

$$\lambda_{40} = 0.8 \times \lambda_0$$

Stowage factor = volume per min weight of grain cargo;

Displacement - weight of ship, fuel, fresh water, stores etc. and cargo.

(2) The righting arm curve shall be derived from cross-curves which are sufficient in number to accurately define the curve for the purpose of these requirements and shall include cross-curves at 12° and 40°.

**8 Stability requirements for existing ships**

8.1 For the purposes of this section the term existing ship means a ship, the keel of which is laid before 25 May 1980.

8.2 An existing ship loaded in accordance with documents previously approved under regulation 12 of chapter VI of SOLAS 1960, IMO resolutions A.184(VI) or A.264(V I l shall be considered to have intact stability characteristics at least equivalent to the requirements of A 7 of this Code. Documents of authorization permitting such loadings shall be accepted for the purposes of A 7.2.

8.3 Existing ships not having on board a document of authorization issued in accordance with A 3 of this Code may apply the provisions of A 9 without limitation on the deadweight which may be used for the carriage of bulk grain.

**9 Optional stability requirements for ships without documents or authorization carrying partial cargoes of bulk grain**

9.1 A ship not having on board a document of authorization issued in accordance with A 3 of this Code may be permitted to load bulk grain provided that:

1. the total weight of the bulk grain shall not exceed one third of the deadweight of the ship;
2. all filled compartments, trimmed, shall be fitted with centreline divisions emending, for the full length of such compartments, downwards from the underside of the deck or hatch covers to a distance below the deck line of at least one eighth of the maximum breadth of the compartment or 2.4 m, whichever is the greater, except that saucers constructed in accordance with A 14 may be accepted in lieu of a centreline division in and beneath a hatchway except in the case of linseed and other seeds having similar properties;
3. all hatches 10 filled compartments, trimmed, shall be closed and covers secured in place;
4. all free grain surfaces in partly filled cargo space shall be trimmed level and secured in accordance with A 16, A 17 or A 18;
5. throughout the voyage the metacentric height after correction for the free surface effects of liquids in tanks shall be 0.3 m or that given by the following formula, whichever is the greater:

$$\mathrm{GM_R} = \frac{\mathrm{L\ B\ Vd\ (0.25\ B - 0.645\ Vd\ B}}{\mathrm{SF\ \times \Delta \times 0.0875}}$$

Where:

L = total combined length of all full compartments (metres)

B = moulded breadth of the vessel (metres)

SF = stowage factor (cubic metres per tonne)

Vd = calculated average void depth calculated in accordance with B 1 (metres — Note: not millimetres)

Δ = displacement (tonnes); and

6. the master demonstrates to the satisfaction of the Administration or the Contracting Government of the port of loading on behalf of the Administration that the ship in its proposed loaded condition will comply with the requirements of this section.

**10 Stowage of bulk grain**

10.1 All necessary and reasonable trimming shall be performed to level all free grain surfaces and to minirni7t the effect of grain shifting.

10.2 In any filled compartment, trimmed, the hulk grain shall be trimmed so as to fill all spaces under the decks and hatch covers to the maximum extent possible.

10.3 In any filled compartment, untrimmed, the bulk grain shall be filled to the maximum extent possible in way of the hatch opening but may be at its natural angle of repose outside the periphery of the hatch opening. A filled compartment may qualify for this classification if it falls into one of the following categories:

1. the Administration issuing the document of authorization may, under B 6. grant dispensation from trimming in those cases where the underdeck void geometry resulting from free flowing grain into a compartment, which may be provided with feeder ducts, perforated decks or other similar means, is taken into account when calculating the void depths; or
2. the compartment is "specially suitable" as defined in A 2.7, in which case dispensation may be granted from trimming the ends of that compartment.

10.4 If there is no hulk grain or other cargo above a lower cargo space containing grain, the hatch covers shall be secured in an approved manner having regard to the mass and permanent arrangements provided for securing such covers.

10.5 When bulk grain is stowed on top of closed 'tween-deck hatch covers which are not grain-tight, such covers shall be made grain-tight by taping the joints, covering the entire hatchway with tarpaulins or separation cloths, or other suitable means.

10.6 After loading, all free grain surfaces in partly filled compartments shall he level.

10.7 Unless account is taken of the adverse heeling effect due to the grain shift according to this Code, the surface of the bulk grain in any partly filled compartment shall be secured so as to prevent a grain shift by overstowing as described in A 16. Alternatively, in partly filled compartments, the bulk grain surface may he secured by strapping or lashing as described in A 17 or A 18.

10.8 Lower cargo spaces and tween-deck spaces in way thereof may he loaded as one compartment provided that, in calculating transverse heeling moments, proper account is taken of the flow of grain into the lower spaces.

10.9 In filled compartments, trimmed; filled compartments, untrimmed; and partly filled compartments, longitudinal divisions may be installed as a device to reduce the adverse heeling effect of grain shift provided that:

1. the division is grain-tight;
2. the COMI ruction meets the requirements of A 11, A 12 and A 13; and
3. in 'tween-decks the division extends from deck to deck and in other cargo spaces the division extends downwards from the underside of the deck or hatch covers, as described in B 2.8.2, note (2); B 2.9.2, note 0): or B 5.2, as applicable.

**11 Strength of grain fittings**

*11.1 Timber*

All timber used for grain fittings shall he of good sound quality and of a type and grade which has been proved to be satisfactory for this purpose. The actual finished dimensions of the timber shall he in accordance with the dimensions specified below. Plywood of an exterior type bonded with waterproof glue and fitted so that the direction of the grain in the face plies is perpendicular to the supporting uprights or binder may be used provided that its strength is equivalent to that of solid timber of the appropriate scantlings.

11,2 *Working stresses*

When calculating the dimensions of divisions loaded on one side, using tables A 13.1 to A 13-6, the following working stresses should be adopted:

For divisions of steel: 19,6 $kN/cm^2$

For divisions of wood: 1.5 $kN/cm^2$

(1 newton is equivalent to 0.102 kilograms).

11.3 *Other materials*

Materials other than wood or steel may be approved for such divisions provided that proper regard has been paid to their mechanical properties.

11.4 *Uprights*

1. Unless means are provided to prevent the ends of uprights being dislodged from their sockets, the depth of housing at each end of each upright shall be not less than 75 mm. If an upright is not secured at the top, the uppermost shore or stay shall be fitted as near thereto as is practicable.
2. The arrangements provided for inserting shifting boards by removing a part of the cross-section of an upright shall be such that the local level of stresses k not unduly high.
3. The maximum bending moment imposed upon an upright supporting a division loaded on one side shall normally be calculated assuming that the ends of the uprights are freely supported. However, if an Administration is satisfied that any degree of fixity assumed will be achieved in practice, account may be taken of any

reduction in the maximum bending moment arising from any degree of fixity provided at the ends of the upright.

11.5 *Composite section*

Where uprights, binders or any other strength members are formed by two separate sections, one fitted on each side of a division and interconnected by through bolts at adequate spacing, the effective section modulus shall be taken as the sum of the two moduli of the separate sections.

11.6 *Partial division*

Where divisions do not extend to the full depth of the cargo spa= such division and their uprights shall be supported or stayed so as to be as efficient as those which do extend io the full depth of the cargo space.

**12 Divisions loaded on both side**

12.1 *Shifting boards*

1. Shifting boards shall have a thickness of not less than 50 mm and shall be fitted grain-tight and where necessary supported by uprights.
2. The maximum unsupported span for shifting boards of various thicknesses shall be as follows:

| Thickness | Maximum unsupported span |
|---|---|
| 50 mm | 2.5 m |
| 60 mm | 3.0 m |
| 70 mm | 3.5 m |
| 80 mm | 4.0 m |

   If thicknesses greater than these are provided the maximum unsupported span will vary directly with the increase in thickness.

3. The ends of all shifting boards shall be securely housed with 75 mm minimum bearing length.

12.2 *Other materials*

Divisions formed by using materials other than wood shall have a strength equivalent to the shifting boards required in A 12.1.

12.3 *Uprights*

1. Steel uprights used to support divisions loaded on both sides shall have a section modulus given by

$W — a \times W_1$

Where:

W - section modulus in cubic centimetres

a = horizontal span between uprights in metres.

The section modulus per metre span $W_1$ shall be not less than that given by the formula:

$W_1 — 14.8 (h_1 — 1.2.)$ $cm^3/m$

Where:

$h_1$ is the vertical unsupported span in metres and shall be taken as the maximum value of the distance between any two adjacent stays or between a stay and either end of the upright. Where this distance is less lhan 2.4 m the respective modulus shall be calculated as if the actual value were 2.4 m.

2. The moduli of wood uprights shall be determined by multiplying by 12.5 the corresponding moduli for steel uprights. If other materials arc used their moduli shall he at least that required for steel increased in proportion to the ratio of the permissible stresses for steel to that of the material used. In such cases attention shall be paid also to the relative rigidity of each upright to ensure that the deflection is not excessive.
3. The horizontal distance between uprights shall he such that the unsupported spans of the shifting boards do not exceed the maximum span specified in A 12.1.2.

**12.4 Shores**

1. Wood shores, when used, shall be in a single piece and shall be securely fixed at each end and heeled against the permanent structure of the ship except that they shall not bear directly against the side plating of the ship.
2. Subject to the provisions of A 12.4.3 and A 12.4.4, the minimum sin of wood shores shall be as follows:

| Length or shore (m) | Rectangular section (mm) | Diameter of circular section (mm) |
|---|---|---|
| Not exceeding 3 m | 150 x 100 | 140 |
| Over 3 m but not exceeding 5 m | 150 x 150 | 165 |
| Over 5 m but not exceeding 6 m | 150 x 150 | 180 |
| Over 6 m but not exceeding 7 m | 200 x 150 | 190 |
| Over 7 m but not exceeding 8 m | 200 x 150 | 200 |
| Exceeding 8 m | 200 x 150 | 215 |

Shores of 7 m or more in length shalt be securely bridged at approximately mid-length.

3. When the horizontal distance between the uprights differs significantly from 4 m the moments of inertia of the shores may be changed in direct proportion.
4. Where the angle of the shore to the horizontal exceeds 10° the next larger shore to that required by A 12.4.2 shall be fitted provided that in no case shall the angle between any shore and the horizontal exceed 45°.

**12.5 Stays**

Where stays are used to support divisions loaded on both sides, they shall be fitted horizontally or as near thereto as practicable, well secured at each end and formed of steel wire rope. The sizes of the wire rope shall be determined assuming that the divisions and upright which the stay supports are uniformly loaded at 4.9 $kN/m^2$. The working load so assumed in the stay shall not exceed one third of its breaking load.

**14 Saucers**

14.1 For the purpose of reducing the heeling moment a saucer may be used in place of a longitudinal division in way of a hatch opening only in a filled, trimmed, compartment as defined in A 2.2, except in the case of linseed and other seeds having similar properties, where a saucer may not be substituted for a longitudinal division. If a longitudinal division is provided, it shall meet the requirements of A 10.9

14.2 The depth of the saucer, measured from the bottom of the saucer to the deck line, shall he as follows:

1. For ships with a moulded breadth of up to 9.1 m, not less than 1.2 m.
2. For ships with a moulded breadth of 18.3 m or more, not less than 1.8
3. For ships with a moulded breadth between 9.1 m and 18.3 m, the minimum depth of the saucer shall be calculated by interpolation.

14.3 The top (mouth) of the saucer shall be formed by the underdeck structure in way of the hatchway, i.e. hatch side girders or coamings and hatch end beams. The saucer and hatchway above shall be completely filled with bagged grain or other suitable cargo laid down on a separation cloth or its equivalent and stowed tightly against adjacent structure so as to have a hearing contact with such structure to a depth equal to or greater than one half of the depth specified in A 14.2. If hull structure to provide such bearing surface is not available, the saucer shall be fixed in position by steel wire rope, chain, or double steel strapping as specified in A 17.4 and spaced not more than 7.4 m apart.

**15 Bundling of hulk grain**

As an alternative to filling the saucer in a filled, trimmed compartment with bagged grain or other suitable cargo a bundle of bulk grain may be used provided that:

1. The dimensions and means for securing the bundle in place are the same as specified for a saucer in A 14.2 and A 14.3.

2. The saucer is lined with a material acceptable to the Administration having a tensile strength of not less than 2,687 N per 5 cm strip and which is provided with suitable means for securing at the top.
3. As an alternative to A 15.2, a material acceptable to the Administration having a tensile strength of not less than 1,344 N per 5 cm strip may be used if the saucer is constructed as follows:

3.1 Athwartship lashings acceptable 10 the Administration shall be placed inside the saucer formed in the bulk grain at intervals of not more than 2.4 m, These lashings shall be of sufficient length to permit being drawn up tight and secured at the top of the saucer.

3.2 Dunnage not less than 25 mm in thickness or other suitable material of equal strength and between 00 mm and 300 mm in width shall be placed lore and aft over these lashings to prevent the cutting or chafing of the material which shall he placed thereon to line the saucer.

4. The saucer shall be filled with bulk grain and secured at the top except that when using material approved under A 15.3 further dunnage shall he laid on top after lapping the material before the saucer is secured by setting up the lashings.
5. If more than one sheer of material is used to line the saucer they shall be joined at the bottom either by sewing or by a double lap
6. The top of the saucer shall be coincidental with the bottom of the beams when these are in place and suitable general cargo or hulk grain may be placed between the beams on top of the saucer.

**16 Overstowing arrangements**

16.1 Where bagged grain or other suitable cargo is utilized for the purpose of securing partly filled compartments, the free grain surface shall be level and shall be covered with a separation cloth or equivalent or by a suitable platform. Such platform shall consist of bearers spaced not more than 1.2 m apart and 25 mm boards laid thereon spaced not more than 100 ram apart. Platforms may be constructed of other materials provided they are deemed by the Administration to be equivalent.

16.2 The platform or separation cloth shall he topped off with bagged grain tightly stowed and extending to a height of not less than one sixteenth of the maximum breadth of the tree grain surface or 1.2 m, whichever is the greater.

16.3 The bagged grain shall he carried in sound bags which shall he well tilled and securely closed.

16.4 Instead of bagged grain, other suitable cargo tightly stowed and exerting at least the same pressure as bagged grain stowed in accordance with A 16.2 may be used.

**17 Strapping or lashing**

When, in order to eliminate heeling moments in partly tilled compartments, strapping or lashing; is utilized, the securing shall he accomplished as follows:

1. The grain shall be trimmed and levelled to the extent that it is very slightly crowned and covered with burlap separation cloths, tarpaulins or the equivalent.
2. The separation cloths and/or tarpaulins shall overlap by at least 1.8 m.
3. Two solid floors of rough 25 mm x 150 mm to 300 mm lumber shall be laid with the top floor running longitudinally and nailed to an athwartships bottom floor. Alternatively, one solid floor of 50 mm lumber, running longitudinally and nailed over the top of a 50 mm bottom bearer not less than 150 mm wide, may be used. The bottom bearers shall extend the full breadth of the compartment and shall be spaced not more than 2,4 m apart. Arrangements utilizing other materials and deemed by the Administration to the equivalent to the foregoing may he accepted.
4. Steel wire rope 19 mm diameter or equivalent), double steel strapping (50 mm x 1.3 mm and having a breaking load of at least 49 k N), or chain of equivalent strength, each of which shall he set tightly by means ill a 32 mm turnbuckle, may be used for lashings. A winch tightener, used in conjunction with a locking arm, may he substituted for the 32 mm turnbuckle when steel strapping is used, provided suitable wrenches are available for setting up as necessary. When steel strapping is used, not less than three crimp seals shill he used for securing the ends. When wire is used, not less than four clips shall he used for forming eyes in the lashings.
5. Prior to the completion of loading the lashing shall be positively attached to the framing at a point approximately 450 runt below the anticipated final grain surface by means of either a 25 mm shackle or beam clamp of equivalent strength.
6. The lashings shall be spaced not more than 2.4 m apart and each shall be supported by a bearer nailed over the top of the fore and aft floor. This hearer shalt consist of lumber of not less than 25 mm x 150 mm or its equivalent and shall extend the full breadth of the compartment.
7. During the voyage the strapping shall be regularly inspected and set up where necessary,

**18 Securing with wire mesh**

When, in order to eliminate grain heeling moments in partly filled compartments, strapping Or lashing is utilized, the securing may, as an alternative to the method described in A 17, be accomplished as follows:

1. The grain shall he trimmed and levelled to the extent that it is very slightly crowned along the fore and aft centreline of the compartment.
2. The entire surface of the grain shall be covered with burlap separation cloths, tarpaulins, or the equivalent. The covering material shall have a tensile strength of not less than 1,344 N per 5 cm strip.
3. Two layers of wire reinforcement mesh shall be laid on top of the burlap or other covering. The bottom layer is to he laid athwartships and the top layer is to be laid longitudinally. The lengths of mesh are to be overlapped at least 75 mm. The top laver of meal. is to be positioned over the bottom layer in such a manner that the squares formed by the alternate layers measure approximately 75 mm x 75 mm. The wire reinforcement mesh is the type used in reinforced concrete construction. It is fabricated of 3 mm diameter steel wire having a breaking strength of not less than

52 kN/cm$^2$ welded in 150 mm x 150 mm squares. Wire mesh having mill scale may he used but mesh having loose, flaking rust may not he used.

4. The boundaries of the wire mesh, at the port and starboard side of the compartment. shall be retained by wood planks 150 mm x 50 mm.
5. Hold-down lashings, running from side to side across the compartment, shall be spaced not more than 2.4 m apart except that the first and the last lashing shall not be more than 300 mm from the forward or after bulkhead, respectively. Prior to the completion of the loading, each lashing shall be positively attached to the framing at a point approximately 450 mm below the anticipated final grain surface by means at' either a 25 mm shackle or beam clamp of equivalent strength. The lashing shall be led from this point over the top of the boundary plank described in A 18.4. which has the function of distributing the downward pressure exerted by the lashing. Two layers of 150 mm x 25 mm planks shall be laid athwartships centred beneath each lashing and extending the full breadth of the compartment.
6. The hold-down lashings shall consist of steel wire rope (19 mm diameter or equivalent), double steel strapping (50 mm x 1.3 mm and having a breaking load of at least 49 kN) or chain of equivalent strength, each of which shall be set tight by means of a 32 mm turnbuckle. A winch tightener, used in conjunction with a locking arm, may be substituted for the 32 mm turnbuckle when steel strapping is used, provided suitable wrenches are available for setting up as necessary. When steel strapping is used, not los than three crimp seals shall be used for securing the ends. When wire rope is used, not less than four clips shall be used for forming eyes in the lashings.
7. During the voyage the hold-down lashings shall be regularly inspected and set up where necessary.

1.3 For the purpose of demonstrating compliance with the stability criteria in A 7, the ship's stability calculations shall normally he based upon the assumption that the centre of gravity of cargo in a lilted compartment, trimmed, is at the volumetric centre of the whole cargo space. In those cases where the Administration authorizes account to be taken of the effect of assumed underdeck voids on the vertical position of the centre of gravity of the cargo in filled compartments, trimmed, it will be necessary to compensate for the adverse effect of the vertical shift of grain surfaces by increasing the assumed heeling moment due to the transverse shift of grain as follows:

total heeling moment = 1.06 x calculated transverse heeling moment.

In all cases the weight of cargo in a tilled compartment, trimmed, shall be the volume of the whole cargo space divided by the stowage factor.

In a filled compartment, untrimmed, which is exempted from trimming in the ends of the compartment under the provisions of A 10.3.2. it shall be assumed that the surface of the grain after loading will slope in all directions away from the filling area at an angle of 30° from the lower edge of the hatch end beam. However, if feeding holes are provided in the hatch end beams in accordance with table B 1-2, then the surface of the grain alter loading shall be assumed to slope in all directions, at an angle of 30° from a line on the hatch end

beam which is the mean of the peaks and valleys of the actual grain surface as shown in figure B 1.

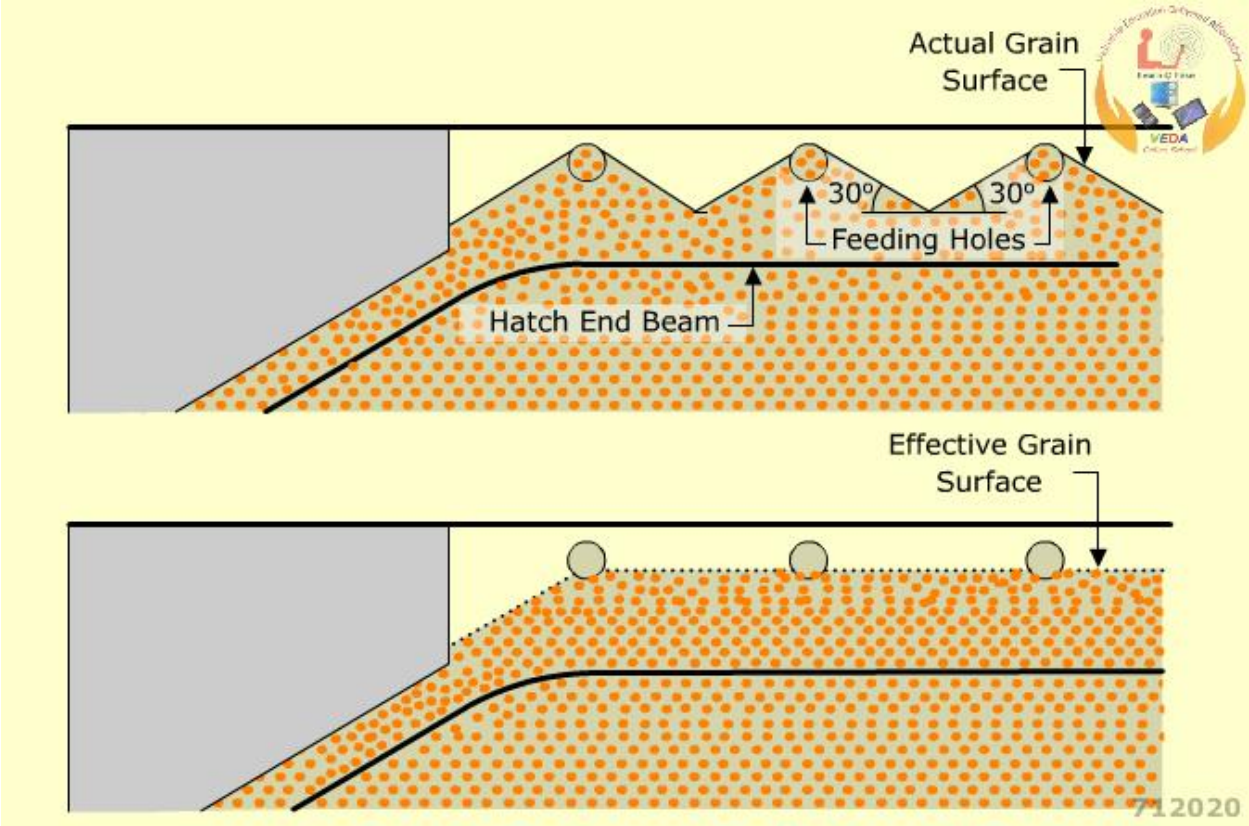


**Figure B 1**

1.4 The centre of gravity of cargo in a filled compartment, untrimmed, shall be taken to be the volumetric centre of the whole cargo compartment with no account being allowed for voids. In all cases the weight of cargo shall be the volume of the cargo (resulting from the assumptions staled in B 1.1.3 or B 1.1.4) divided by the stowage factor.

1.5 In partly filled compartments the adverse effect of the vertical shift of grain surfaces shall be taken into account as follows:

total heeling moment = 1.12 x calculated transverse heeling moment.