

Figure A.2 (continued)

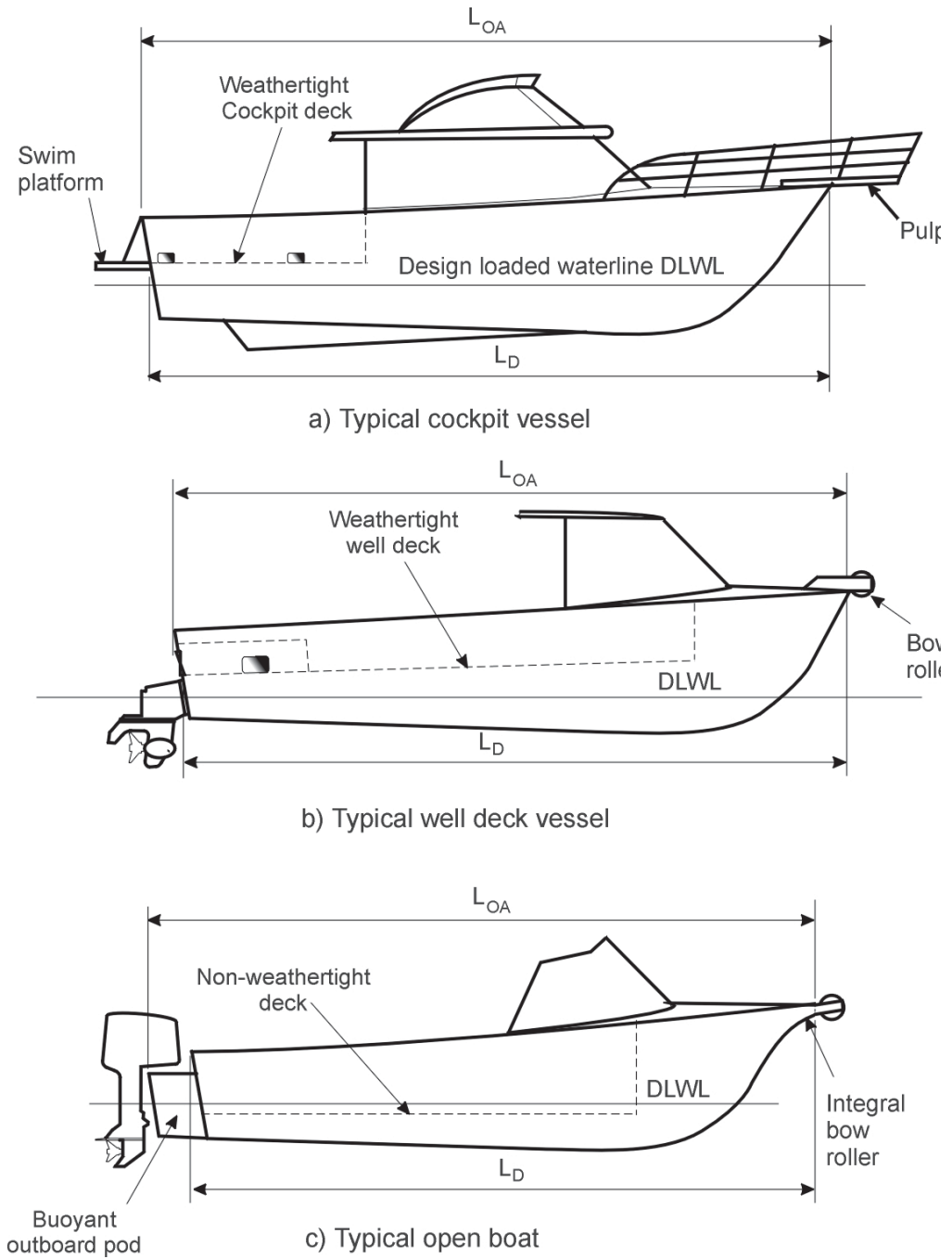
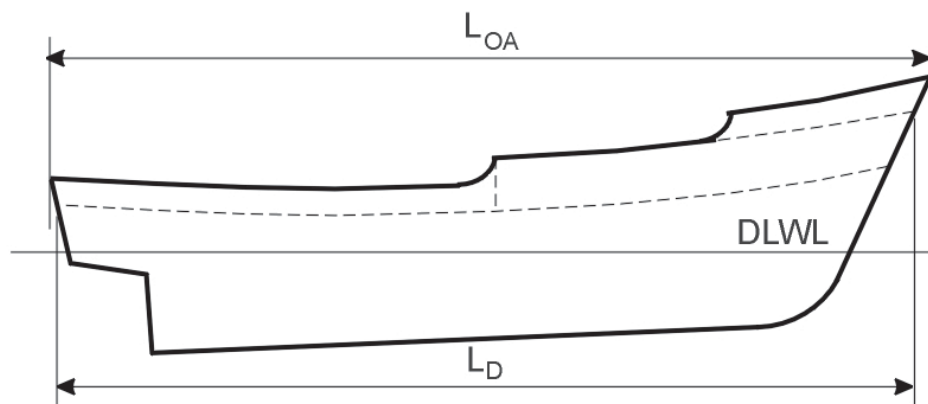


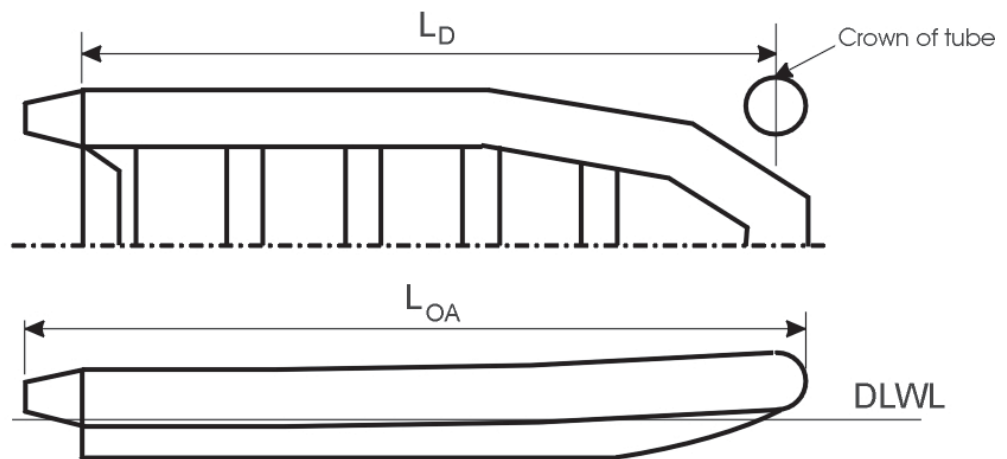
Figure A.3 — Guidance on measuring length



d) Raised fo'c'sle and poop deck



e) Overhang of solid bulwarks



f) RIB or Inflatable

**Figure A.3** (continued)

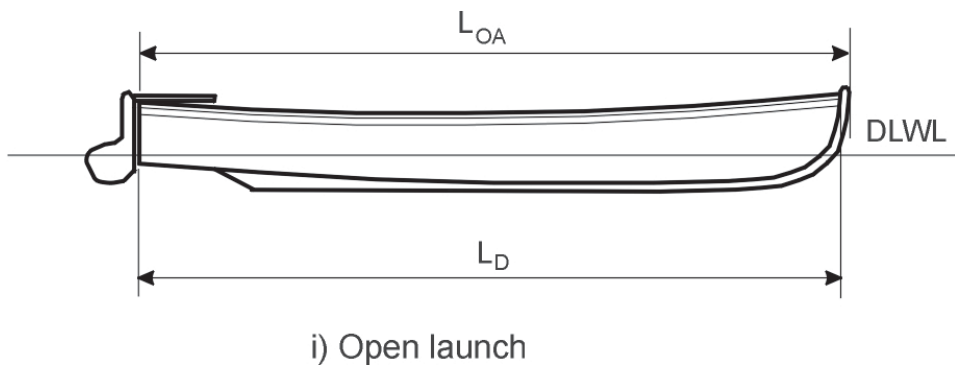
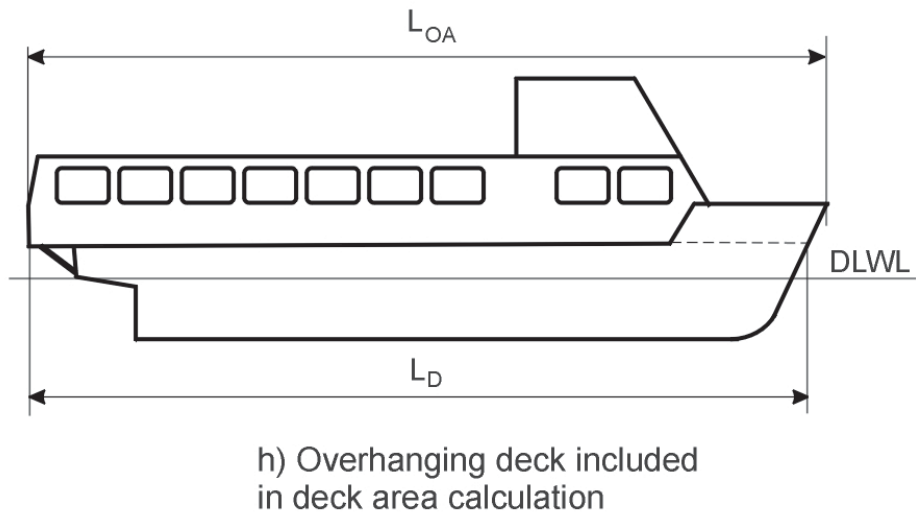
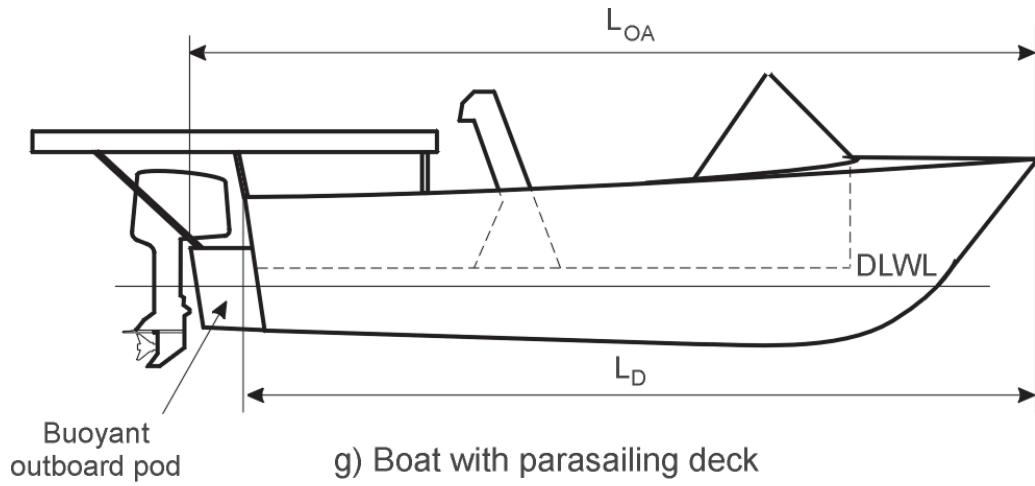
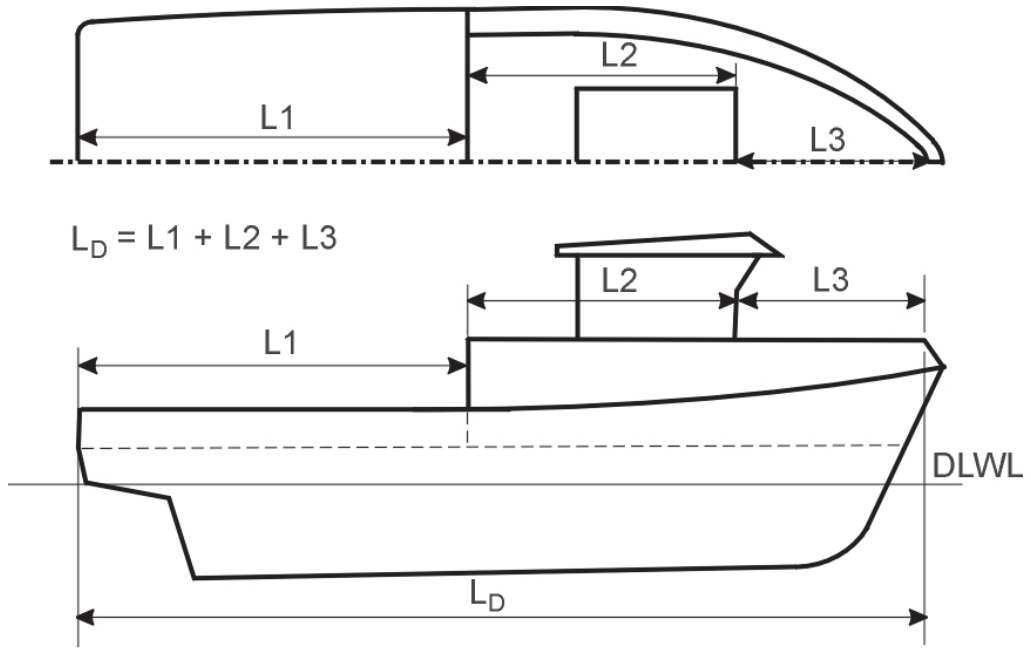
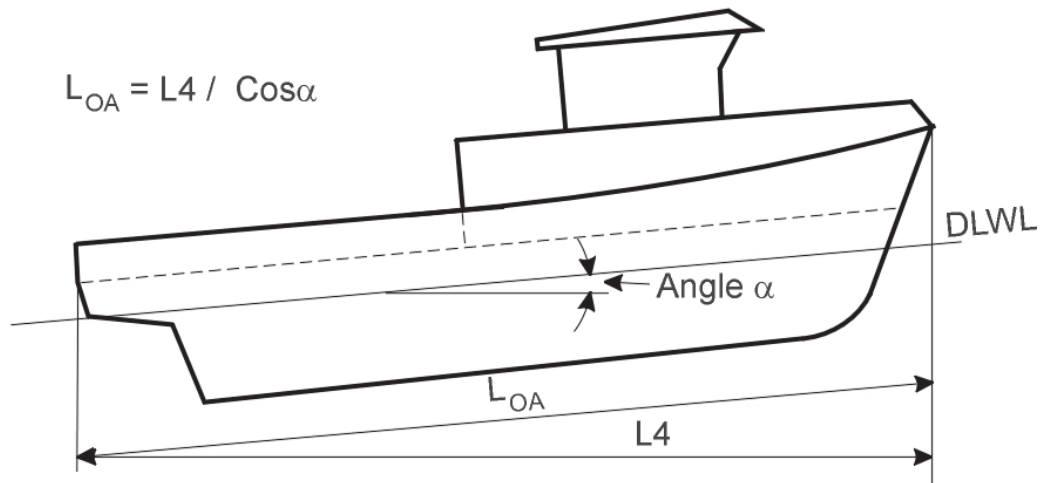


Figure A.3 (continued)

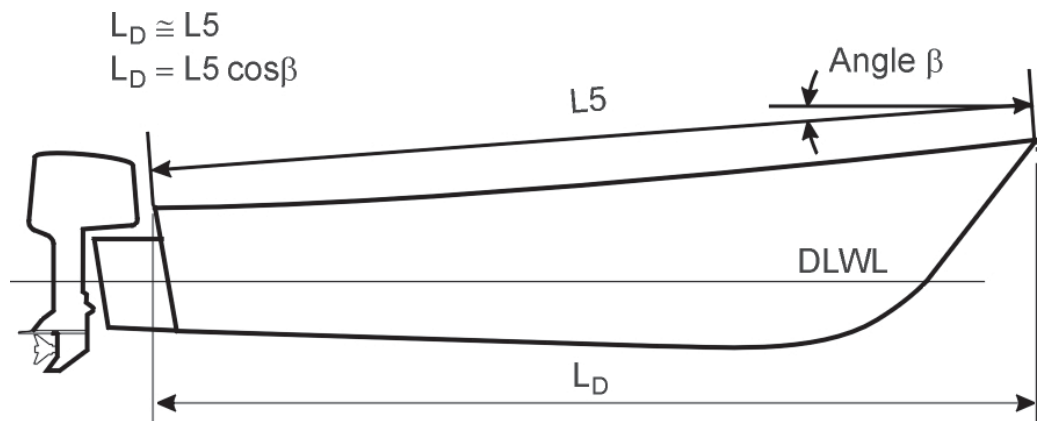


a) Measurement using sight boards ashore or afloat

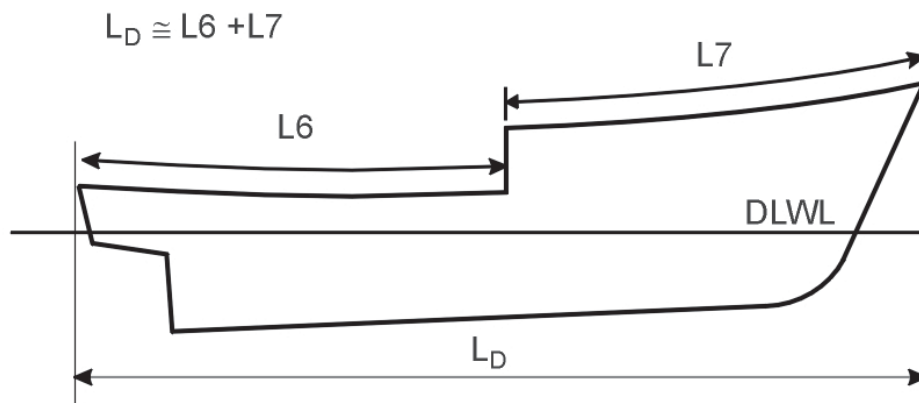


b) Measurement on-shore using plumb-bobs

Figure A.4 — Methods for measuring length



a) Approximate method 1



b) Approximate method 2

Figure A.5 — Approximate methods for measuring length

## ANNEX B GUIDANCE ON HAZARD IDENTIFICATION, RISK ASSESSMENT AND CONTROL OF RISK

### B1 SCOPE

This Annex B gives guidance on hazard identification, risk assessment and control of risk for vessels for the purpose of fulfilling safety obligations described under Part A, and assessing solutions under Clause 2.7.3 above. It forms an informative part of this document, unless designated as mandatory by the Authority.

### B2 APPLICATION

This Annex applies to new and existing vessels. The hazards identified in Clause B3.2 are not exhaustive in that they do not cover every type of vessel, operation, or risk.

### B3 HAZARD IDENTIFICATION

#### B3.1 Reasonably foreseeable hazards to be identified

All reasonably foreseeable hazards to health and safety arising from a vessel and systems of work associated with the vessel should be identified.

#### B3.2 Typical factors pertaining to hazards on vessels

Without limiting the generality of Clause B3.1, hazards associated with the following factors so far as they are relevant to the design, construction, commissioning and use of the vessel, should be identified:

- a) Suitability of the type of vessel for the particular service.
- b) Characteristics of the actual and intended areas of operation including: navigational hazards; sea and wind states; traffic; rescue facilities; availability of shelter; weather forecasting; maintenance facilities; berthing facilities.
- c) Characteristics of the actual and intended use of a vessel, e.g. carriage of dangerous cargoes, high-speed operations, special loading facilities, use by a wide cross-section of the community, rescue capability.
- d) Foreseeable abnormal situations, misuse and fluctuation of operating conditions.
- e) Potential for personal injury due to: entanglement; crushing; trapping; cutting; stabbing; puncturing; shearing; abrasion; tearing; and stretching.
- f) Generation of hazardous conditions due to: pressurised content; electricity; noise; vibration; fire; smoke; explosion; temperature; moisture; vapour; gases; dust; ice; hot or cold parts.
- g) Failure of machinery or engineering systems on a vessel resulting in: the loss of the watertight integrity; loss of control and manoeuvrability; fire; explosion; loss of emergency systems; evacuation.
- h) Failure of the structure by: yield; buckling; ultimate failure or fatigue resulting in the loss of watertight integrity; structural collapse under load; loss of emergency systems; effect on evacuation.

- i) Unsuitability of materials or fabrication methods used in the construction of a vessel; and the effects of corrosion, fatigue, electro-compatibility, impact, overstressing and watertight integrity.
- j) Collision or grounding of the vessel resulting in: loss of watertight integrity; loss of stability; loss of emergency systems; need for evacuation.
- k) Failure of closing appliances on the vessel through the force of the sea resulting in: loss of watertight integrity; loss of stability; loss of emergency systems; need for evacuation.
- l) Uncontrollable fire resulting in: flame; heat; smoke and toxic fumes; loss of emergency systems; need for evacuation.
- m) Inadequate arrangements for access, egress and escape from within the vessel or from the vessel itself resulting in personal injuries in normal conditions and injuries and potential loss of life in emergency conditions.
- n) Inadequate arrangements for seating or berthing resulting in personal injuries in normal or abnormal conditions of operation.
- o) Operator error arising from lack of competency (skill and knowledge), fatigue, inadequate systems of work, inadequate information and feedback.
- p) Inability of the safety system to forgive operator error.
- q) Failure of control, monitoring or communication systems resulting in: loss of control; loss of manoeuvrability; mechanical failure; failure to identify and respond quickly to an emergency; failure of emergency systems.
- r) Loss of stability arising from: improper loading; excessive heeling moments (wind, passenger, crane, fishing, etc.); dynamic effects of a seaway; breach of watertight integrity.
- s) Ergonomic needs relating to use.
- t) Hazards arising during and after evacuation including: personal injury during disembarkation; exposure; hypothermia; drowning; starvation; thirst.

## **B4 RISK ASSESSMENT**

### **B4.1 Risks to be assessed**

Where a hazard is identified under Clause B3, an assessment of risks associated with that hazard should be made.

### **B4.2 Method of risk assessment**

A person carrying out a risk assessment under Clause B4.1 should, as far as practicable, determine a method of assessment that adequately addresses the hazards identified, and includes one, or a combination of the following:

- a) A visual inspection of the vessel and its associated environment.
- b) Auditing.
- c) Testing.
- d) A technical or scientific evaluation.
- e) An analysis of injury and near-miss data.

- f) Discussions with designers, builders, suppliers, owners, employers, employees, and other relevant parties.
- g) A quantitative risk analysis.
- h) Professional judgement with or without a qualitative risk analysis.

## **B5 CONTROL OF RISK**

### **B5.1 Risk to be eliminated or controlled**

Where an assessment under Clause B4 identifies a requirement to control a risk to health or safety, that risk should be eliminated or, where it cannot be eliminated, controlled to an acceptable level.

### **B5.2 Approaches to controlling risk**

To reduce the risk to health and safety, one or a combination of the following approaches should be used:

- a) Modification of the design of the vessel.
- b) Modification of the operational limits imposed on a vessel.
- c) Engineering controls such as fail-safe mechanisms, redundancy, duplication, guarding.

### **B5.3 Administrative alternatives**

Where through the application of Clause B5.2 the risk cannot be reduced to an acceptable level, appropriate administrative controls (including changes to the system of work), training and personal protective equipment should be used.

### **B5.4 Vessel unsuitable**

Where through the application of Clauses B5.2 and B5.3 the risk still cannot be reduced to an acceptable level, then the vessel may be unsuited for the intended operation. In such cases, the risk should be reduced by substituting the vessel with a less hazardous type of vessel; or finding employment for the vessel that is less hazardous.

### **B5.5 Access/egress**

There should be sufficient access and egress to each of the following:

- a) The vessel itself, having regard to the demographic characteristics of persons on board, including access for the disabled, where appropriate.
- b) Public spaces in both normal and abnormal conditions, having regard to the demographic characteristics of persons on board, including access for the disabled, where appropriate.
- c) Assembly and evacuation stations.
- d) Parts of a vessel that require inspection, cleaning and maintenance.
- e) Spaces normally or potentially manned by members of the crew, and control stations in both normal and abnormal conditions.

**B5.6 Enclosed spaces**

Where access to enclosed spaces in a vessel is required as part of normal operation, and persons may become entrapped exposing them to increased risk due to heat, cold or lack of oxygen, then the following should be provided:

- a) Emergency lighting.
- b) Means of opening the door from both sides.
- c) Alarm systems.

**B5.7 Dangerous areas**

Where an assessment under Clause B4 identifies a risk of exposure to areas that are or become dangerous during operation, examination, lubrication, adjustment or maintenance, that risk should be eliminated or, where it cannot be eliminated, controlled to an acceptable level.

**B5.8 Guarding****B5.8.1 Arrangement**

Where guarding is used as a control measure, a person with the responsibility for the control of risk should ensure that the arrangements for guarding are appropriate for the particular application. In particular—

- a) where no part of a person requires access to the dangerous area during normal operation, maintenance or cleaning, any guard provided is a permanently fixed barrier;
- b) where access to dangerous areas is required during the operating sequence, any guard provided is an interlocked physical barrier;
- c) where a guard in accordance with Clause B5.8.1 a) or b) is not practicable, that it is a physical barrier securely fixed in position by means of fasteners or other suitable devices, which ensures that the guard cannot be altered or detached without the aid of a tool or key; and
- d) where a guard in accordance with Clause B5.8.1 a), b) or c) is not practicable, that presence-sensing safeguarding systems are provided.

**B5.8.2 Additional requirements**

Where guards are used in accordance with Clause B5.8.1, they should be—

- a) designed and constructed to make by-passing or defeating them, whether deliberately or by accident, as difficult as is reasonably possible;
- b) of solid construction and securely mounted so as to resist impact and shock;
- c) regularly maintained; and
- d) designed so as not to cause a risk in themselves.

**B6 RECOMMENDED FORMAT FOR DOCUMENTING HAZARDS, RISKS AND OPTIONS FOR CONTROLLING RISK****B6.1 Tables**

Table B.1 and Table B.2 provide a convenient format for identifying hazards and analysing risks and the options for controlling risk.

**B6.2 Acceptable risk**

When using these tables, decisions need to be made as to whether a risk is acceptable or unacceptable. Guidance on what constitutes an acceptable or unacceptable risk is provided in Annex C below.

**B6.3 Risk management process**

AS/NZS 4360 provides a detailed and structured approach to the whole risk management process including its context within the management of an organisation. The management of a vessel, and those responsible for the design and construction of a vessel are encouraged to adopt risk management strategies such as those presented in AS/NZS 4360.

**Table B.1 — Risk register**

REF	THE HAZARD What can happen and how it can happen	THE CONSEQUENCES OF A HAZARD HAPPENING WITHOUT CONTROLS		EXISTING CONTROLS	THE CONSEQUENCES OF A HAZARD HAPPENING WITH EXISTING CONTROLS		LEVEL OF RISK	RISK PRIORITY
		Likelihood Rating	Consequence Rating		Likelihood Rating	Consequence Rating		

**Table B.2 — Risk treatment options**

REF	RISK	PRIORITY	POSSIBLE TREATMENT OPTIONS	PREFERRED OPTION	RISK RATING AFTER TREATMENT	COST/BENEFIT ANALYSIS RESULT
			1. 2. 3.			

## ANNEX C GUIDANCE ON ACCEPTABLE RISK

### C1 SCOPE

This Annex C gives guidance on what constitutes acceptable risk on a vessel for the purpose of fulfilling safety obligations described under Part A, and assessing solutions under Clause 2.7.3 above. It forms an informative part of this document, unless designated as mandatory by the Authority.

### C2 APPLICATION

This Annex applies to new and existing vessels.

### C3 DESIRED OUTCOME

For the purposes of a risk management analysis of a vessel, the probability of serious injury to personnel should be very remote and the probability of deaths should be improbable.

### C4 NATURE OF RISK

Risk is a function of likelihood and consequence.

### C5 LIKELIHOOD

The various levels of hazard likelihood are as follows<sup>3</sup>:

**frequent—**

where an occurrence is likely to occur often during the operational life of a particular vessel (probability more than  $10^{-3}$  per hour or per journey, whichever is the lesser period of time).

**reasonably probable—**

where an occurrence is unlikely to occur often but which may occur several times during the total operational life of a particular vessel (probability between  $10^{-3}$  and  $10^{-5}$  per hour or per journey, whichever is the lesser period of time).

**remote—**

where an occurrence is unlikely to occur to every vessel but may occur to a few vessels of a type over the total operational life of a number of vessels of the same type (probability between  $10^{-5}$  and  $10^{-7}$  per hour or per journey, whichever is the lesser period of time).

**very remote—**

where an occurrence is unlikely to occur when considering the total operational life of a number of vessels of the type, but nevertheless should be considered as being possible (probability between  $10^{-7}$  and  $10^{-9}$  per hour or per journey, whichever is the lesser period of time).

**improbable—**

where an occurrence is so extremely remote that it should not be considered as possible to occur (probability less than  $10^{-9}$  per hour or per journey, whichever is the lesser period of time).

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<sup>3</sup> Adapter from HSC Code Annex 3 Clauses 2.2.1 to 2.2.6

**C6 CONSEQUENCE**

The various levels of hazard consequence are as follows<sup>4</sup>:

**minor—**

an effect which can be readily compensated for by the operating crew. It may involve one or more of the following:

- a) A small increase in the operational duties of the crew or in their difficulty in performing their duties.
- b) A moderate degradation in handling characteristics.
- c) Slight modification of the permissible operating conditions.

**major—**

an effect which produces one or more of the following:

- a) A significant increase in the operational duties of the crew or in their difficulty in performing their duties which by itself should not be outside the capability of a competent crew provided that another major effect does not occur at the same time.
- b) Significant degradation in handling characteristics.
- c) Significant modification of the permissible operating conditions, but will not remove the capability to complete a safe journey without demanding more than the normal skill on the part of the operating crew.

**hazardous—**

an effect which produces one or more of the following:

- a) A dangerous increase in the operational duties of the crew or in their difficulty in performing these duties of such magnitude that they cannot reasonably be expected to cope with them and will probably require outside assistance.
- b) Dangerous degradation of handling characteristics.
- c) Dangerous degradation of the strength of the vessel.
- d) Marginal or actual conditions for, or injury to, occupants.
- e) An essential need for outside rescue operations.

**catastrophic—**

an effect which results in the loss of the vessel and/or fatalities.

**C7 ACCEPTABLE AND UNACCEPTABLE LEVELS OF RISK**

Relative levels of risk are determined by considering the likelihood of occurrence against the severity of the consequences. An assessment is made to determine whether particular combinations of likelihood and consequence are a negligible, tolerable or intolerable risk<sup>5</sup>.

**intolerable risk—**

the presence of the hazard in the system or situation cannot be justified and the risk level must be reduced. An intolerable risk would almost

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<sup>4</sup> HSC Code Annex 3 Clauses 2.3.2 to 2.3.5

<sup>5</sup> Kuo, Chengi, Dr. *Managing Ship Safety*. London. 1998. p.65 & p.80

certainly be unacceptable. If it is impossible to achieve risk reduction cost-effectively, serious consideration should be given to abandoning the project, activity or system for another option.

**tolerable risk—**

the hazards in the system or situation will probably give rise to accidents, but that the frequency and nature of the consequences could probably be tolerated. However, there is still some degree of uncertainty in the analysis. If it is possible to reduce the risk levels cost-effectively, then an effort should be made to do so, particularly for hazards that fall just below the intolerable threshold. A tolerable risk may or may not be acceptable depending upon the effort that might be required to further reduce the risk compared to the benefits of doing so.

To determine whether a tolerable risk is acceptable:

*The methods of reducing the risk level of a hazard can be put in one scale and balanced against the effort needed in another. This effort may be represented by money, time, or a combination of the two. If it can be shown that there is a gross imbalance between the two; e.g., the reduction in risk level is insignificant compared with the cost of implementing the proposed solution, it would not be reasonably practicable to go ahead.*<sup>6</sup>

**negligible risk—**

means the hazards in the system or situation are most unlikely to lead to accidents and no effort need be expended to reduce their risk levels. A negligible risk would normally be acceptable.

**C8 EXAMPLE**

A typical table resulting from such an analysis is provided in Table C.1<sup>7</sup>. In this analysis, intolerable risks are unacceptable. Tolerable and negligible risks are acceptable. This is consistent with the objectives stated in Clause C3 of this Appendix.

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<sup>6</sup> UK Health and Safety Executive. *The Tolerability of Risk from Nuclear Power Stations*. 1992.

<sup>7</sup> Bottom of Table 2 in HSC Code Annex 3

**Table C.1—Level of risk for given combinations of likelihood and consequence**

	<b>IMPROBABLE</b>	<b>VERY REMOTE</b>	<b>REMOTE</b>	<b>REASONABLY PROBABLE</b>	<b>FREQUENT</b>
<b>MINOR</b>	NEGLIGIBLE	NEGLIGIBLE	NEGLIGIBLE	TOLERABLE	TOLERABLE
<b>MAJOR</b>	NEGLIGIBLE	NEGLIGIBLE	TOLERABLE	TOLERABLE	INTOLERABLE
<b>HAZARDOUS</b>	NEGLIGIBLE	TOLERABLE	INTOLERABLE	INTOLERABLE	INTOLERABLE
<b>CATASTROPHIC</b>	TOLERABLE	INTOLERABLE	INTOLERABLE	INTOLERABLE	INTOLERABLE

## ANNEX D GUIDANCE ON THE PREPARATION OF INFORMATION AND PLANS FOR VESSELS

### D1 SCOPE

This Annex gives guidance on the preparation of information and plans for vessels. It forms an informative part of this document, unless designated as mandatory by the Authority.

### D2 APPLICATION

This Annex applies to new and existing vessels entering survey for the first time, existing vessels intending to upgrade service and existing vessels intending to be altered.

NOTE: For vessels operating within the jurisdiction of one Authority while under the survey of another Authority and vessels intending to transfer a current survey to another Authority, refer to The National Marine Guidance Manual—Administrative Protocol for the Mutual Recognition of Vessel Certificates of Survey.

### D3 PRELIMINARY INFORMATION

When a vessel is to be built or an existing vessel is to be put into survey for the first time, upgraded or altered, the owner or intending owner should contact the Authority as early as possible. The basic information necessary for the Authority to provide an initial assessment is as follows:

- a) Vessel identification, e.g. name or construction number, if any.
- b) Name of owner or intending owner.
- c) Hull construction material.
- d) Principal dimensions of vessel.
- e) Nature of the service in which the vessel will be engaged.
- f) Intended area of operations of the vessel.
- g) Gross tonnage or estimated lower and upper limits of gross tonnage.
- h) Whether the vessel is to be classed or is classed and if so the name of the Classification Society and details of the Classification.
- i) Whether the vessel will hold or holds a Load Line Certificate and/or Cargo Ship Safety Construction Certificate issued by a Classification Society.
- j) Whether the vessel, being an existing vessel, holds or has held any other certificates relating to survey and if so the type of each certificate, its date of expiry and the name of the authority who issued the certificate.

NOTE: The owner is normally required to supply the above information as part of the process of completing an Application for Initial Survey. Fees are usually payable with the Application for Initial Survey.

### D4 INFORMATION AND PLANS

#### D4.1 Purpose

Information and plans are normally required to verify that the vessel complies with applicable standards, to verify that those standards are

maintained over time and to provide important safety information to persons responsible for the safety of the vessel.

NOTE: Plans may not be required for some smaller vessels. Further advice can be obtained by contacting the relevant Authority.

#### D4.2 Format

Information and plans should facilitate their ready use for verification of compliance with standards. They should therefore be—

- a) an accurate representation of the vessel and its components in their intended form;
- b) sufficient in detail to ensure that all the relevant requirements have been incorporated in the design;
- c) legible;
- d) in the English language;
- e) if a plan, to an appropriate scale to permit accurate and efficient scaling directly from the drawing (for example: 1:1, 1:2, 1:5, 1:10, 1:20, 1:25, 1:50, 1:75, 1:100, etc);
- f) wherever possible, prepared in accordance with applicable standards such as those given in Table D.1; and
- g) of sufficient number of copies to permit the retention of at least one copy by the Authority.

NOTE: The Authority will advise on the number of copies of information and plans.

**Table D.1 — Standards applicable to the preparation of drawings**

Designation	Title
AS 1100	Technical drawing (all parts)
AS 1101	Graphic symbols for general engineering (all parts)
AS 1102	Graphical symbols for electrotechnical documentation (all parts)
AS 1266	Fire control plans for ships
AS/NZS 4383	Preparation of documents used in electrotechnology
ISO 128	Technical drawings - General principles of presentation
ISO 129	Technical drawings; Dimensioning; General principles, definitions, methods of execution and special indications
ISO 406	Technical drawings; Tolerancing of linear and angular dimensions
ISO 3098-1	Technical drawings; lettering; part 1: currently used characters
ISO 7000	Graphical symbols for use on equipment - Index and synopsis

#### D4.3 Amendments

Where a design is amended subsequent to an initial submission, every plan, specification, etc. affected by the alteration should be amended accordingly and the date of amendment recorded. Revised copies should be forwarded immediately to the Authority.

#### D4.4 Content of information and plans

The extent and content of the information and plans needed to verify compliance with standards will be dependent on categorization, size and type of vessel. Table D.2 may be used as a general guide:

**Table D.2 — Content of information and plans**

Item	Description of content	Typical application
General arrangement plans	Tanks, deck openings, seating, berths, bulkheads, access ways, bulwarks and railings, navigation lights, ventilation openings, ballast, buoyancy material, use of each space, watertight closing appliances, life-saving appliances	All vessels
Construction plans and/or specifications	Transverse and longitudinal sections, bulkheads, decks, superstructure, deckhouses, engine girders, scantlings, material details, fastening/welding/layout details, windows and window frames	All vessels
Lines plan	Body plan, sheer plan, draft marks and location of watertight bulkheads	All vessels with comprehensive stability or subdivision
Plans or specifications for closing devices	Construction and means for securing watertight or weathertight openings liable to downflooding	All vessels
Piping schematics	Essential and high risk systems including bilge, fuel, sanitary, engine exhaust, refrigeration and steam; showing valves, vents, overflows, filling stations, pipe materials, diameters and wall thicknesses	All vessels
Fire protection	Type and disposition of fire divisions, fire-extinguishing appliances, location of escapes	Vessels of 12.5 m length and more
Rudder and steering gear plan	Rudder, rudder stock, bearings, coupling, steering gear and alternative method of steering	All vessels
Shafting plan	Propeller shaft, bearings and couplings, stern tube, propeller brackets, engine and thrust seatings	All vessels
Construction schedule	Time schedule for building, laminating and welding to determine key milestones for inspections	All vessels
Electrical schematic	Electrical equipment and wiring, protection devices (overload, low voltage), emergency power arrangements	32 Volts and more, or vessels required to fit emergency power arrangements
Sail plan	Location and size of sails and underwater profile of vessel	Sailing vessels
Machinery arrangement	Arrangement and function of main and auxiliary machinery (may be incorporated on general arrangement plan)	All vessels
Freestanding fuel tanks	Construction, material details, scantlings, baffles, support	Vessels with freestanding fuel tanks
Damage control plan	Boundaries of watertight compartments, openings and means for closure, arrangements for correcting list	Vessels 35 m and more and passenger vessels 25 m and more

(continued...)

**Table D.2 (continued)**

<b>Item</b>	<b>Description of content</b>	<b>Typical application</b>
Fire control plan	Location and type of active and passive fire safety systems on board the vessel, control stations, location of divisions, fire alarms, fire detection and extinguishing systems, fire-extinguishing appliances, access to compartments and decks, ventilating systems, location of international shore connection if fitted, fire suits, breathing apparatus	Vessels 35 m and more and passenger vessels 25 m and more
Emergency plan	Assembly stations, signals, escape routes, evacuation routes, location of life saving equipment, flares, EPIRB, lifebuoys, immersion suits. On vessels of length less than 50 metres, the damage control, fire and emergency plans may be combined in a single drawing	Vessels 35 m and more and passenger vessels 25 m and more
Intact stability	Particulars of vessel, information in accordance with Part C Subsection 6A	All vessels subject to intact stability criteria
Damaged stability	Calculations and information showing the nature of damaged stability criteria and the vessel's compliance with those criteria	All vessels subject to damaged stability criteria
Manuals	Operating, maintenance and training manuals	Fast Craft
Failure mode and effect analysis	Essential machinery and systems	Fast Craft

NOTE: Some of these plans and information may not be needed for smaller vessels. Further advice can be obtained by contacting the relevant Authority.