



Domestic Commercial Vessel INSTRUCTIONS TO SURVEYORS

DCV-ITS-017 (12/2017)

Subject:	Initial and Periodic surveys of Low Density Flotation Material (LDFM) fitted to Domestic Commercial Vessels (DCV) for additional buoyancy.	
General:	<p>This Instruction to Surveyors (ITS) provides advice and outlines the processes and standards that may be applied to the initial and periodic surveys of LDFM fitted to DCVs. It should be read in conjunction with survey checklist AMSA554</p> <p>In the event of a vessel capsize or sinking a life raft is considered an essential piece of safety equipment. However, small vessel space and weight restrictions often make it impractical to carry a life raft. Without a life raft vessel survival becomes critical. To mitigate the risks of swamping or hull damage resulting in flooding, the NSCV requires many DCVs without life rafts to be fitted with <i>additional buoyancy</i>.</p> <p>Additional buoyancy may be incorporated into the hull of a vessel to supplement the inherent buoyancy of the vessel. The additional buoyancy may be provided by;</p> <ul style="list-style-type: none"> • Watertight compartments – as detailed in NSCV 6B Chapter 9, • Low Density Flotation Material, (LDFM) - as detailed in NSCV 6B Chapter 10, • Air chambers - as detailed in NSCV 6B Chapter 10 or, • A combination of the above. <p>The most popular form of additional buoyancy LDFM is expanded plastic foam.</p> <p>Annex I of this ITS summarises the NSCV additional buoyancy requirements for vessels fitted with LDFM. The Annex is presented as a quick reference guide. The surveyor should always refer to the standard shown in column 2 of the Annex for the complete limitations, criteria and applicability to the vessel being surveyed.</p>	
Definitions:	Additional buoyancy	Supplementary buoyancy fitted to a vessel in addition to the inherent buoyancy of the vessels structure and equipment. Additional buoyancy is intended to mitigate the consequences of incidents such as flooding, swamping or capsizing.
	Basic	<p>The vessel shall have sufficient buoyancy to keep any portion of the vessel above the surface when the vessel has been submerged in calm, fresh water for at least 18 hours when loaded with both of the following:</p> <ol style="list-style-type: none"> a) A weight that, when submerged equals 10 per cent of the dry weight of persons on the boat assuming 80 kg per person. b) A weight equal to 25 per cent of the result of the maximum dry dead weight of the vessel minus the dry weight of persons calculated at 80 kg per person.
	Examine	<p>As per NSAMs Section 4; A process that commences with a visual inspection, to the extent that the item is reasonably accessible, that identifies the evidence of damage, deterioration and/or modification.</p> <p><i>NOTE: Where the visual inspection identifies evidence of potential deficiencies, the examination process may require dismantling, tests, trials or other forms of closer examination needed to confirm the deficiencies and/or clarify the extent of deficiencies or risks associated with the deficiencies.</i></p>

Verify	As per NSAMs Section 4; To ensure that an item exists and is as per the plan, meets an applicable standard or has been declared as meeting an applicable standard by a recognised organisation or an Authority.
Level flotation	A flotation system that will keep a vessel carrying its maximum load from sinking when swamped, assuming the occupants remain within the boat and supported by the flotation system. The flotation system must be such that it will keep the swamped boat floating level, and prevent it from capsizing in calm water. Level flotation does not provide a self-righting capacity.
LDFM	Low Density Flotation Material
LDFM A	Complies with Table F.2 material resistance tests for immersion in petrol, oil and bilge cleaner.
LDFM B	Complies with Table F.2 material resistance tests for immersion in petrol and oil.
LDFM C	Complies with Table F.2 material resistance tests for exposure to hydrocarbon vapours.

Instruction:	<p>A surveyor conducting a survey of a vessel's additional buoyancy LDFM installation must assure themselves of the following 7 NSCV requirements;</p> <p>1. The requirement for additional buoyancy & related conditions.</p> <p>The requirements for a DCV to be fitted with LDFM are mostly found in NSCV Part C chapters 6B, 7A, Part G, USL Code 5C C62 and general exemption EX40. Annex I of this ITS summarises these requirements by vessel category. These requirements often incur additional requirements and conditions. The surveyor should consult Annex I and then refer to the relevant reference to read the complete text and context.</p> <p>2. The type of flotation required, either Basic or Level.</p> <p>The surveyor should consult Annex I to determine if the vessel is required to have Level or Basic flotation and then refer to the relevant reference to determine the flotation criteria and any additional requirements and conditions.</p> <p>3. The class of LDFM required and suitability to the location.</p> <p>The surveyor should consider the compartment or space where the LDFM is located and the likely exposure to;</p> <ul style="list-style-type: none"> a. hydrocarbon vapors, b. immersion in petrol, c. immersion in oil, d. immersion in bilge cleaner <p>Refer to NSCV C 6B, Annex F, table F.2 <i>Low-density flotation material resistance tests</i> to determine if LDFM class A, B or C is required. The surveyor is to ensure the class of LDFM is suitable for the compartment or space.</p>
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4. The LDFM complies with NSCV deemed-to-satisfy solution.

A. Block foam

For sheet and block forms of LDFM NSCV C 6B, Annex F details the minimum requirements for the following material properties;

- a. Resistance to hydrostatic pressure
- b. Stability under temperature cycling
- c. Resistance to water absorption
- d. Resistance to hydrocarbons and bilge cleaner

Annex F Table F.1 lists the following deemed-to-satisfy standards to assess the compliance of LDFM for additional buoyancy;

- IMO Resolution MSC. 81(70)
- MIL-P-21929C (with amendment)
- MIL-P-21929B (now superseded by MIL-P-21929C)

Table F.1 lists the immersion depths to which each standard may apply and the additional test requirement for LDFM A.

Table 45 of 6B, 10.3.2.1 defines bilge spaces in spaces containing machinery or fuel tanks. LDFM A is the only grade of foam permitted in the bilge spaces of these spaces without being encapsulated. Grades B and C may be used in other locations depending on the vessels Flooding Risk Category, (FRC) and likely exposure to hydrocarbons and cleaners.

Fitted foam must remain in "as tested" form. E.g.; Thin tested compliant sheets that have been glued together into slabs may no longer be compliant if not tested in that configuration.

LDFM cannot materially add to the fire risk of the compartment (C4, Annex I).

B. Poured foam

Poured LDFM, where permitted by Clause 10.4, shall comply with BS 5241-2 when dispensed or sprayed on a construction site. Also note;

- Proper mixing and installation is critical to achieving the required properties.
- The calculation for the required volume of LDFM contained in NSCV Subsection 6B, Annex C includes a margin of uncertainty for poured foam above the nominal volume requirement. This calculation also provides the margin need not apply where the density and actual volume of the foam resulting from the pour can be verified.

C. Encapsulation

Polyurethane pouring foams are generally encapsulated to protect the material from mechanical damage, exposure to liquids, solvents, heat and sunlight or to control the risks of fire or corrosion. The LDFM as encapsulated must comply with the relevant requirements in NSCV Part C 6B clause 10.3.3 for air chambers. Any LDFM that is likely to degrade due to the environment it is located in should be encapsulated.

5. The required quantity and distribution of LDFM.

NSCV Part C Subsection 6B, Annex C, Additional Buoyancy Calculation specifies calculation methods for determining the volume and location of additional buoyancy required for a vessel to satisfy the criteria for basic flotation or level flotation specified in clauses 8.6 and 8.7 respectively.

Annex C provides a method for the calculation of additional buoyancy for *Basic flotation*. Annex D presents guidance on the distribution of additional buoyancy to achieve *Level flotation*.

6. The fitting and fixing of LDFM.

Underdeck voids filled with LDFM to over 90% of the void volume are not required to have a bilge system to pump those spaces (NSCV C 5A 5.8.2.3.2 *Low permeability voids*).

The cellular structure of many common buoyancy foams are formed by using a blowing agent. Flammable hydrocarbons are commonly used as blowing agents for polyethylene foam buoyancy. If stored in well ventilated spaces most of these gases will disperse leaving only trace amounts in the foam cells. The type of blowing agent is indicated on the products Material Safety Data Sheet, MSDS.

The surveyor should be aware;

- a. Welding operations in close proximity to LDFM increase the likelihood of gas entrapment, out-gassing, possibility of fire and weld defects.

The surveyor should check;

- a. The LDFM is installed as per the vessels approved drawings and NSCV C 6B, 10.4 *Installation*.
- b. LDFM is removable allowing inspection of the LDFM, hull structure and plating.
- c. LDFM is not fitted in direct contact with metallic plating, timber planking or plywood.
- d. There is a gap of at least 50mm between LDFM and any welding operations conducted after the LDFM fitment.
- e. LDFM is placed and secured so it will effectively contribute to supporting the mass of the vessel in the flooded condition.
- f. LDFM installation must not increase the fire risk of the compartment or space it is fitted in, or reduce the effectiveness of any of the NSCV Part C section 4 measures to control or mitigate the risk of fire.

Notes for Item b. above;

The National Standard for the Administration of Marine Safety, NSAM section 4 lists;

- *Survey Level 1 vessels have their additional buoyancy examined at years 2, 3 & 4 and verified at year 5.*
- *Survey Level 2 vessels have their additional buoyancy examined at the third year and verified at the fifth year.*
- *At Ten year survey verify internal foam buoyancy (if not inspected in fifth year because of inaccessibility) and internal hull inspection (if not inspected in fifth year because of inaccessibility).*

Many smaller vessels have LDFM fitted extensively below the watertight deck often making its' removal difficult. In these cases the surveyor should discuss alternative arrangements with the vessel builder and owner to ensure the additional buoyancy and internal hull structure can be adequately assessed at future surveys. Typically such arrangements may include;

- a. *The provision of access ports to allow partial foam removal and inspection of the hull structure by borescope.*
- b. *Removal of areas of deck plating on a rolling basis, i.e.; 30% of internal buoyancy compartments inspected each 5 years.*

7. Record keeping and making a recommendation

Designers, builders and suppliers of LDFM intended as additional buoyancy for DCVs have a duty under the Marine Safety (Domestic Commercial Vessel) National Law Act 2012 to ensure the material is safe for the intended purpose. Schedule 1, Part 3, Division 2, Section 14 *Duties of designers, builders, suppliers etc.* is reproduced in Annex II of this ITS for reference.

Additionally builders and owners may be required to show their vessel is fitted with LDFM that complies with the deemed-to-satisfy requirements of the NSCV. Surveyors require this assurance to be able to support their survey recommendation (AMSA 901 or 606).

Manufacturers and suppliers of LDFM should be able to provide proof of compliance with applicable standards for their product. Copies of this documentation is to be collected by the surveyor and retained on file with other survey documentation.

Additional buoyancy fitted to *grandfathered* and *transitional* vessels must be surveyed in accordance with the requirements of the standard(s) that currently apply to the vessel (E.g.; *USL Code Section 10 Life Saving Appliances appendix N*). Unless the surveyor has reason to believe the foam buoyancy fitted to a grandfathered vessel is not suitable for the intended purpose, e.g.; damaged, deteriorated or water logged, etc. they may assume issuance of a Certificate of Survey by a state or territory marine safety authority is evidence of the foams compliance with the relevant standard.

Surveyors attending NSCV vessel additional buoyancy surveys, must retain copies of any certificates or test reports as a record of the inspection of the installed LDFM. Where the surveyor is unable to ascertain the compliance of LDFM buoyancy through examination, certification or test documentation, verification of the LDFMs compliance with the applicable standard is required by testing. The tests should be carried out by an independent testing authority.

The surveyor should record the agreement made with the vessel owner regarding future inspection and removal internal LDFM and hull structure as a condition on the Certificate of Survey.

ANNEX I: SUMMARY CHECK LIST OF NSCV FLOTATION REQUIREMENTS

Class 1E Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	C6B, Table 9, FRC II, Arrangement 3	$L_m < 15$	Two or less bulkheads spaced at $> 45\% L_m$	Level	Restricted to maximum of 36 day passengers

Class 2B Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	6, 6B, 4.2 & 4.4, Table 5	$6 > L_m < 24$	Open vessels and other vessels not having rapid drainage of recesses	Level & Swamped	Drainage as per C6B,4.4.3

Class 2C Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	C6B, 4.2 & 4.4, Table 5	$L_m < 6$	Open vessels and other vessels not having rapid drainage of recesses.	Level & Swamped	Must be provided with arrangements to enable a single person to drain overboard all water in the well in not more than 3 min., assuming the quantity of water as determined in Clause 4.4.2.2 lies within the recess.
2	C7A, Table 3 Note (R2)	$L_m < 15$	FRC II that opt not to carry a Liferaft	Level	Flotation system fitted in accordance with C6B 8.7
3	C6B, Table 9, FRC II, Arrangement 3	$L_m < 15$	With passengers. Two or less bulkheads spaced at $> 45\% L_m$	Level	Flotation system fitted in accordance with C6B 8.7
4	C6B, 5.5.2 & Table 9, FRC I, Arrangement 3	$L_m < 15$	No passengers No watertight bulkheads or single bulkhead outside mid $10\% L_m$.	Basic	Must carry liferaft
5	C6B, 4.2.1	$6 > L_m < 24$	Open boats with passengers, no deck or with a well above a deck that is not USL freeing port compliant.	Level & Swamped	Must be provided with arrangements to enable a single person to drain overboard all water in the well in not more than 3 min., assuming the quantity of water as determined in Clause 4.4.2.2 lies within the recess.
6	6, 6B, 7.3.7	All Lengths	Inflatable Collar RIB.	Level	Flotation achieved with 2 largest forward chambers deflated and one side deflated

Classes 2D & 2E Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	C6B, 4.4.1 & Table 5 deemed to satisfy solution for swamping - Sheltered water	< 6	Open boats with no deck or with well located less than 150mm above the full laden waterline.	Basic	
2	ISO 12217	< 7.5	Engine powered	Level	No passengers Must be operate within 5nm of mainland Not high risk (see NSAMS table F.1). If air compartments used then two largest must be flooded.
3	C7A, Table 3, Scales of equipment	< 15	Does not carry buoyant appliances for 100% compliment.	Level	Flotation system fitted in accordance with C6B 8.7
4	C6B, 5.5.2 & Table 9, FRC I, Arrangement 3	< 15	No watertight bulkheads or single bulkhead outside mid 10% L_m	Basic	Carry buoyant appliances
5	C6B, 7.3.7	All Lengths	Inflatable Collar RIB	Basic	Flotation achieved with 2 largest forward chambers deflated and one side deflated

Class 3B Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	6, 6B, 4.4.3 Drainage	$6 > L_m < 24$	Vessels fitted with a well deck located less than 150 mm above the full laden waterline, but not a cockpit vessel.	Level & Swamped	Must be provided with arrangements to enable a single person to drain overboard all water in the well in not more than 3 min., assuming the quantity of water as determined in Clause 4.4.2.2 lies within the recess.

Class 3C Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	C6B, 5.5 Measures to control the risks of local flooding causing premature capsize	< 15	Not fitted with liferaft	Level	Flotation system fitted in accordance with C6B 8.7
2	C6B, 7.3.7, FRC I, Special provisions for bow collision on collared vessels with inflated collars.	All Lengths	Inflatable Collar RIB	Level	Flotation achieved with 2 largest forward chambers deflated.
3	C6B, 4.4.1, Table 5 Deemed to satisfy solutions for swamping	< 6	Vessels fitted with a well deck located less than 150 mm above the full laden waterline, but not a cockpit vessel.	Level & Swamped	Must be provided with arrangements to enable a single person to drain overboard all water in the well in not more than 3 min., assuming the quantity of water as determined in Clause 4.4.2.2 lies within the recess.
4	C6B, 5.5.2 & Table 9, FRC I, Arrangement 3	< 15	No watertight bulkheads or single bulkhead outside mid 10% L_m	Basic	Must carry liferaft.

Classes 3D & 3E Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	C6B, 5.5.2 & Table 9, FRC I, Arrangement 3	< 6	Open boats with no deck or with well above deck that is not USL freeing port compliant	Basic	Must be provided with arrangements to enable a single person to drain overboard all water in the well in not more than 3 min., assuming the quantity of water as determined in Clause 4.4.2.2 lies within the recess.
2	ISO 12217	<7.5	Engine powered	Level, if air compartments used then 2 largest must be flooded	Must be operate within 5nm of mainland Not high risk (see NSAMS table F.1)
3		<15	Do not carry buoyant appliances	Level	
4	C6B, 5.5.2 & Table 9, FRC I, Arrangement 3	<15	No watertight bulkheads or single bulkhead outside mid 10% L_m	Basic	Carry buoyant appliances
5	C6B, 7.3.7 & Table 18, FRC I, Arrangement 3	All Lengths	Inflatable Collar RIB	Basic	Flotation achieved with 2 largest forward chambers deflated and one side deflated

Class 4 Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1	F2, 10.3, Table 6	$L_m < 6.0$	Leisure craft a hire and drive vessel used by the hirer only for recreational purposes	Level	Comply with one of the level flotation standards in F2, 10.3, Table 6, Option 1.
2	F2, 10.3, Table 6	$L_m < 6.0$	Leisure craft a hire and drive vessel used by the hirer only for recreational purposes	Basic	Must carry life raft or dinghy for 100% compliment. Comply with one of the basic flotation standards in F2, 10.3, Table 6, Option 2.
3	F2, 10.3, Table 6	$L_m < 6.0$	Leisure craft a hire and drive vessel used by the hirer only for recreational purposes. Must have conducted a risk assessment that is documented in the vessel's SMS and the assessment has shown it is safe to use Option 3 of table 6.	Basic	Comply with one of the flotation standards in F2, 10.3, Table 6, Option 3. (i) carry buoyant appliances sufficient to support all persons on board if they are not designed to be re-righted if capsized; or (ii) be fitted with grab lines secured to the side of the vessel.

Auxiliary, Tender & Dinghy Flotation requirements

No.	NSCV Reference <i>Section, subsection, clause, detail</i>	Measured Length, L_m , (m)	Vessel Description / Condition	Flotation requirement	Additional Requirement
1		All	Tender to mother vessel, fitted with an engine.	Level	If air compartments used then 2 largest must be flooded
2		All	Auxiliary to mother vessel.	Level	If air compartments used then 2 largest must be flooded
3	6, 6B, Table 9, FRC I, Arrangement 3, note 4(b)	$L_m > 2.4$	Dinghies of FRC I used as lifesaving appliances in Part C, subsection 7A.	Level	
4	EX40	$L_m < 12$	As meeting the operational requirements of Division 1, 1.1 of General Exemption EX40.	Level	Flotation system fitted in accordance with C6B 8.7
				Basic	Flotation system fitted in accordance with C6B 8.6 Equipped with liferafts compliant with C7A for Categories 2A & 3C, for the maximum number of persons the vessel is permitted to carry, or based on risk assessment and all persons wearing lifejackets, a lifebuoy with a light for each person on board the vessel and, if a second lifebuoy is carried a buoyant line, or a carley float.

ANNEX II: Extract from *Marine Safety (Domestic Commercial Vessel) National Law Act 2012*, Schedule 1, Part 3, Division 2

Division 2—Duties of designers, builders, suppliers etc.

14 Duty relating to design, manufacture etc. of domestic commercial vessels

A person who designs, commissions, constructs, manufactures, supplies, maintains, repairs or modifies a domestic commercial vessel, or marine safety equipment that relates to such a vessel, must:

- (a) ensure, so far as reasonably practicable, that the vessel or equipment is safe if used for a purpose for which it was designed, commissioned, constructed, manufactured, supplied, maintained, repaired or modified, as the case may be; and
- (b) either:
 - (i) carry out, or arrange the carrying out of, such testing and examination as may be necessary for compliance with paragraph (a); or
 - (ii) ensure that such testing and examination has been carried out; and
- (c) take such action as is necessary to ensure that there will be available, in connection with the use of the vessel or equipment, adequate information about:
 - (i) the use for which the vessel or equipment was designed, commissioned, constructed, manufactured, supplied, maintained, repaired or modified, as the case may be; and
 - (ii) the results of any testing or examination referred to in paragraph (b); and
 - (iii) any conditions necessary to ensure the vessel or equipment is safe if it is used for a purpose for which it was designed, commissioned, constructed, manufactured, supplied, maintained, repaired or modified, as the case may be.

Contact:

AMSA Connect 02 6279 5000