Australian Government

Australian Maritime Safety Authority

National Standard for Commercial Vessels

Part C Design and construction

Section 5 Engineering

Subsection 5A Machinery

Amendment No. 3, 2017

Approved by the National Marine Safety Regulator on 13 November 2017 to commence on 1 January 2018.

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1 Name of instrument

This instrument is *National Standard for Commercial Vessels, Part C Design and construction, Section 5 Engineering, Subsection 5A Machinery Amendment No.3, 2017.*

2 Commencement

This instrument commences on 1 January 2018.

3 Amendment

Subsection C5A of the National Standard for Commercial Vessels (NSCV) is amended in accordance with Schedule 1.

Schedule 1 – NSCV Subsection C5A

[1] Clause 1.3

Insert after AS 2906 - *Fuel containers – Portable – plastics and metal*

AS/NZS 3000:2007 (including amendment 1:2009 and amendment 2:2012) - *Electrical installations (known as the Australian/New Zealand Wiring Rules)*

AS/NZS 3004.2:2014 (including amendment 1:2015) - *Electrical installations - Marinas and boats - Boat installations*

[2] Clause 1.3

Insert after ISO 7840—Small craft - Fire-resistant fuel hoses

ISO 8846:1990 - *Small craft - Electrical devices - Protection against ignition of surrounding flammable gases*

ISO 8849:2003 - *Small craft - Electrically operated direct-current bilge pumps*

ISO 10088:2013 - *Small Craft – Permanently installed fuel systems and fixed fuel tanks*

ISO 11105:1997 - *Small craft - Ventilation of petrol engine and/or petrol tank compartments*

ISO 15584:2001 - *Small craft - Inboard petrol engines - Engine-mounted fuel and electrical components*

ISO 21487:2012 (including amendments 1:2014 and 2:2015) - *Small craft – Permanently installed petrol and diesel fuel tanks*

[3] Clause 1.7

Omit

excessive heat and other hazards.

Insert

excessive heat, flammable vapours and other hazards.

[4] Clause 2.14.1, note

Insert after e)

f) The fitting of vapour detectors in the engine compartment and bilge on a vessel with a below deck internal combustion engine that uses low flashpoint fuel – see clause 2.14.3.7.

g) Carburettors are not permitted on below deck internal combustion engine that uses low flashpoint fuel – see clause 2.14.3.2.

h) Below deck internal combustion engine that uses low flashpoint fuel shall have electronic fuel injection – see clause 2.14.3.2.

i) After-market modifications are not permitted on below deck internal combustion engines – see clause 2.14.3.2.

[5] Clause 2.14.3

Omit

Fuel having a flashpoint less than 60ºC may be used in the following applications:

Insert

Fuel having a flashpoint less than 60ºC (low flashpoint) may be used in the following applications:

[6] Clause 2.14.3

Insert after b)

c) Inboard internal combustion engines in Classes 2C, 2D, 2E, 3C, 3D and 3E vessels that are located below decks where the vessel complies with clauses 2.14.3.1 to 2.14.3.10.

Note An engine is considered to be 'below decks' if fuel or fumes emanating from the engine installation could result in the accumulation of fuel or explosive mixtures within any space on the vessel. Fuel or fumes from the engine must be able to drain rapidly and directly overboard without the assistance of forced ventilation or wind-induced air movement.

2.14.3.1 General limitations on low flashpoint inboard engines

A vessel may have an inboard engine that operates using a fuel with flashpoint less than 60℃ only if:

a) the vessels is less than 7.5 metres long; and

b) the total power of all the installed engines is less than or equal to 320 kW; and

c) no more than one engine occupies a space.

2.14.3.2 Carburetted low flashpoint inboard engines not permitted

An inboard engine using a fuel with flashpoint less than 60°C and fitted with a carburettor is not permitted.

Inboard engines using a fuel with flashpoint less than 60°C are to have electronic fuel injection and the making or fitting of after-market modifications are not permitted.

2.14.3.3 Standards for low flashpoint inboard engine installations

A vessel fitted with an inboard engine that operates using a fuel with flashpoint less than 60°C shall meet all of the following standards:

a) ISO 11105; and

b) ISO 15584.

2.14.3.4 Electrical components installed in petrol engine and petrol tank compartments

Electrical components installed in petrol engine and petrol tank compartments and any connecting compartments, not open to the atmosphere, shall comply with ISO 8846 to demonstrate they are ignition-protected.

2.14.3.5 Ventilation for low flashpoint inboard engine installations

A powered ventilation system shall be fitted to any compartment containing a low flashpoint inboard engine. The airflow capacity and intake duct location for the blower or combination of blowers shall comply with ISO 11105.

2.14.3.6 Operator notice for low flashpoint engine installations

A vessel fitted with a low flashpoint inboard engine shall be provided with a notice to the operator that:

a) is located as close as practicable to each ignition switch;

b) is clearly visible to the operator; and

c) contains the words:

(i) WARNING

(ii) petrol vapours can explode, resulting in injury or death;

(iii) operate blower for 4 min before starting engine;

(iv) run blower when boat is operating below cruising speed.

Example of notice for (c)

2.14.3.7 Vapour detectors for low flashpoint engine installations

A vessel fitted with a low flashpoint inboard engine shall have a detector fitted in both the engine compartment and the vessel's bilge that:

a) is able to analyse a gaseous mixture of petrol at the sensing element to determine the level of vapour;

b) indicates visually and audibly if any vapour is detected;

c) provides an alert if the vapour level reaches 20% of the lower explosive limit (LEL) of the vapour;

d) contains an indicator that shows whether it is working; and

e) can be periodically inspected and tested in accordance with the manufacturer's instructions.

Note for (c) Some vapour detectors may detect flammable vapour by total volume. Where such a detector is used, the limits should be confirmed to be within the requirements of (c) for the applicable type of fuel.

2.14.3.8 No-smoking signs for low flashpoint engine installations

A vessel with a low flashpoint inboard engine shall prominently display 'no smoking' signs.

2.14.3.9 Prevention of flammable emissions for low flashpoint engine installations

An inboard petrol engine shall incorporate measures, including all of the following, to ensure that the engine's starting circuit is spark arrested:

a) a spark arrested starter motor; and

b) spark plug leads with sealed boots; and

c) wiring that has rubber boots, sealed lug ends and terminals encased in sheathed tubing to prevent rubbing; and

d) fuel piping made of rigid metallic seamless tube or pipe, or flexible hose incorporating a braided metal sheath with crimped end fitting; and

e) a circuit breaker, outside the fuel or engine compartment, that protects the electrical system; and

f) batteries located outside the engine space.

2.14.3.10 Intrinsic safety of electrical equipment within bilge and engine compartment for low flashpoint engine installations

On a vessel with an inboard petrol engine, electrical connections, devices and wiring in spaces that are vulnerable to vapour shall be intrinsically safe and comply with AS/NZS 3004.2.

2.14.3.11 Maintenance for vessels with low flashpoint engine installations

Documentary evidence of inspections, repairs, replacements and any testing of the electrical systems are to be kept with the vessels maintenance records.

Inboard petrol engines are to be serviced in accordance with the manufacturer's specifications and requirements and a service log book is to be kept as part of the vessels safety management system.

[7] Clause 2.14.4.2

Omit

2.14.4.2 Requirements for second outboard engine

Each of the two engines specified in Clause 2.14.4.1 shall be capable of maintaining sufficient speed and directional control to bring the vessel to a safe haven in all weather conditions likely to be encountered.

Note The outboard engines need not be of equal power.

Insert

2.14.4.2 Requirements for second outboard engine

Each of the two engines specified in Clause 2.14.4.1 shall be:

a) permanently attached to the transom; and

b) capable of maintaining sufficient speed and directional control to bring the vessel to a safe haven in all weather conditions likely to be encountered in the vessel operational area.

Note When considering the size of the second or auxiliary outboard engine the owner should consider the vessels operational area, the time it would take to reach a safe haven, the quantity of supplies and fuel available for persons on board in the event the second engine was required; the need to cross a bar etc.

[8] Table 1

Substitute

Table 1 — Alternative arrangements for watertight integrity of exhaust pipe discharges on non-load line vessels

Height of discharge above the deepest loaded waterline and applicable vessel class	Requirement
Less than 75mm – for Class 1C vessels	On a Class 1C vessel of any length, where the height of discharge above the deepest loaded waterline is less than 75 mm on wet exhaust a shut-off valve is not required where all of the following apply: a) bilge alarms are fitted in the compartments that the exhaust passes through; and b) a flowmeter is fitted with an alarm for the water injection line for wet exhaust indicating failure of water supply; and c) a exhaust gas pyrometer with alarm for high gas temperature indicating failure of cooling water system is fitted; and d) an assessment of damaged stability for the compartments in case of water ingress has been undertaken; and

Height of discharge above the deepest loaded waterline and applicable vessel class	Requirement
	e) the exhaust system is at least as strong as, and have similar properties to, the surrounding hull that it penetrates.
Less than 75 mm **<u>Option 1</u>** for <12.5m long Class 2D, 2E, 3D and 3E vessels	On a Class 2D, 2E, 3D and 3E vessel that is less than 12.5m long — A non-return valve, non-return flap, one-way "flapper valve" (see Figure 3), or similar device to prevent back-flooding by waves or wash may be fitted provided a level of safety equivalent to a one-compartment standard of subdivision is achieved in the event of the compartment containing the exhaust discharge becoming flooded.
Less than 75 mm – for Class 1D, 1E, 2C vessels & **<u>Option 2</u>** for <12.5m long Class 2D, 2E, 3C, 3D or 3E vessels	On a Class 1D, 1E, 2C, 2D, 2E, 3C, 3D or 3E vessel of any length, where the height of discharge above the deepest loaded waterline is less than 75 mm on wet exhaust a shut-off valve is not required where all of the following apply: a) bilge alarms are fitted in the compartments that the exhaust passes through; and b) an assessment of damaged stability for the compartments in case of water ingress has been undertaken; and c) the exhaust system is at least as strong as, and have similar properties to, the surrounding hull that it penetrates; and d) one of the following: (i) a flowmeter is fitted with an alarm for the water injection line for wet exhaust indicating failure of water supply; or (ii) a exhaust gas pyrometer with alarm for high gas temperature indicating failure of cooling water system is fitted.
Between 75 mm and 225 mm – for Class B, C, D or E vessels	On a Class B, C, E vessel - A non-return valve, non-return flap, one-way "flapper valve" (see Figure 3) or similar device to limit the rate of flooding by waves or wash may be fitted provided: a) a bilge level alarm is fitted in the compartment where the exhaust pipe discharge penetrates the hull; and b) that part of the exhaust system between the shell and the highest point of the loop or riser in the exhaust piping or the apparatus to prevent back-flooding of the engine is constructed of stainless steel or other material of equivalent corrosion resistance; and

Height of discharge above the deepest loaded waterline and applicable vessel class	Requirement
	c) the non-return valve, non-return flap, one-way “flapper valve” or other device to limit the rate of flooding by waves or wash is resistant to corrosion due to the products of combustion and water, and to weathering.
Greater than 225 mm – for Class B, C, D or E vessels	On a Class B, C, E vessel - No non-return valve or flap may be fitted (see Figure 4) provided: a) a bilge level alarm is fitted in the compartment where the exhaust pipe discharge penetrates the hull; and b) the means provided to prevent back-flooding of the engine is capable of dealing with frequent water ingestion; and c) that part of the exhaust system between the shell and the highest point of the loop or riser in the exhaust piping or the apparatus to prevent back-flooding of the engine is constructed of stainless steel or an equivalent corrosion-resistant material.

[9] Clause 3.10.2, note 2

Omit

2. Values of coefficient k for direct-drive, in-line internal combustion engines may be obtained from Section 9 of the USL Code, dated 1 October 1993.

Insert

2. Values of coefficient *k* for direct-drive, in-line internal combustion engines may be obtained from Table 1a.

Table 1a — Coefficient for *k* for direct drive, in-line internal combustion engines

Number of cylinders	2 stroke *k*	4 stroke *k*
1 & 2	110	110
3	107	109
4	102	109
5	99	105
6	96.5	102
7	95	101
8	93	99
9	90	98
10	90	94
11 or more	90	90

[10] Clause 3.10.5

Substitute

The diameter of solid intermediate shafting shall not be less than that determined by the following formula:

$$d_i = d_r f_i$$

where:

d_i = minimum diameter of intermediate shaft in millimetres

d_r = reference diameter of shaft in millimetres, calculated in accordance with Clause 3.10.2

f_i = material factor for intermediate shaft, determined in accordance with the following formula:

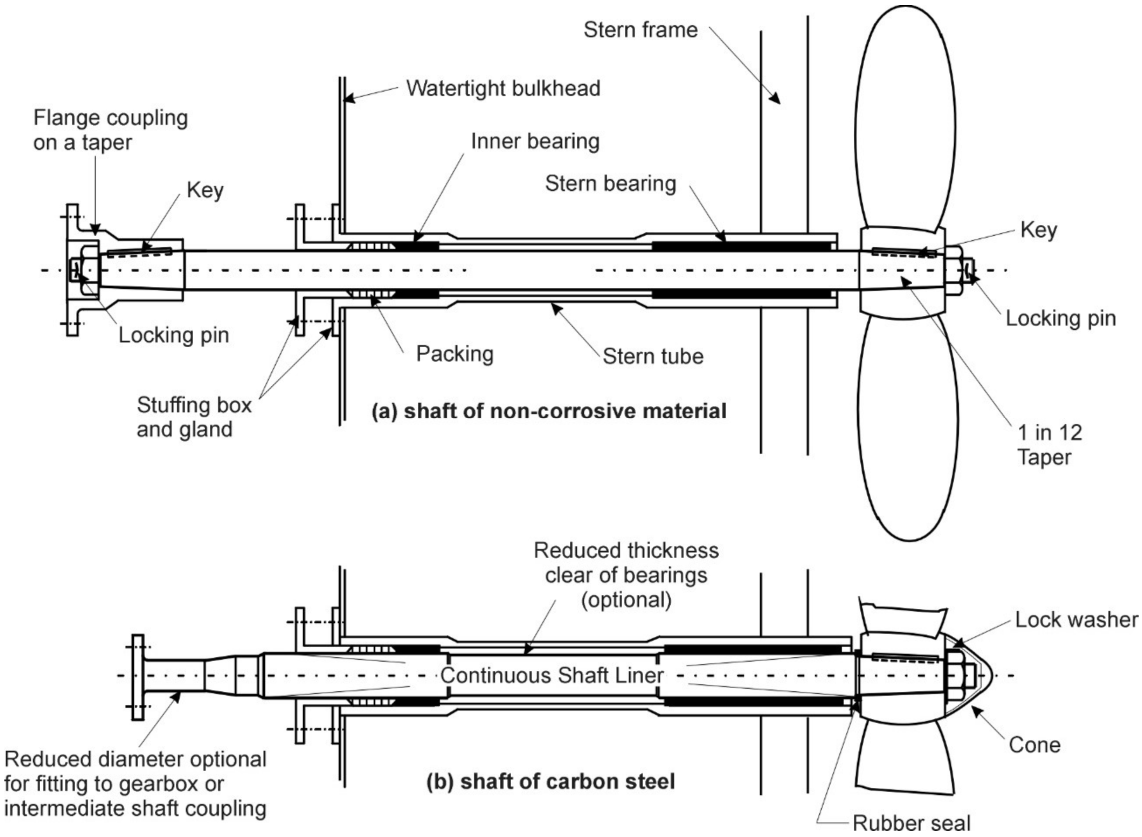

Figure 5 — Typical propeller shaft, stern tube, stern bearing and gland

$$f_i = \sqrt[3]{\frac{410}{UTS_{shaft}}}$$

where:

UTS_{shaft} = ultimate tensile strength of the intermediate shaft material, in mega pascals (MPa).

[11] Clause 4.6

Substitute

For the purpose of this National Standard, the fuel system of a vessel shall be deemed to have satisfied the required outcomes in clauses 4.3, 4.4 and 4.5 if it complies with clauses 4.7 to 4.10 or clause 4.11.

[12] Clause 4.7.1.5

Substitute

A fuel shut-off valve or cock shall be fitted in each tank outlet line as described in (a) to (d) –

(a) Non-metallic piping may be used in the line between the tank and this shut-off valve or cock only where the line runs from a non-portable fuel tank located in a cofferdam and passing only through void spaces without any ignition sources to outboard engines.

(b) Non-metallic piping and fittings shall not be fitted in the line between the tank and this shut-off valve or cock, other than in the circumstances described in (a).

(c) The fuel shut-off valve or cock shall be provided with a means of closing located outside a machinery space in a position that is readily accessible and is not likely to be isolated by a fire in the machinery space.

(d) Where remote fuel shut-off arrangements lead from or pass through a machinery space, they shall be capable of operating when exposed to flame and heat from a fire within that space.

[13] Clause 4.7.1.2

Substitute

A non-portable fuel tank made of a material other than thermoplastic shall be pressure tested to an equivalent of 2.5 m of fresh water above the top of the tank, or to the maximum head to which the tank may be subject to in service, whichever is the greater.

A non-portable fuel tank made of thermoplastic shall be pressure tested to an equivalent of 2.0 m of fresh water above the top of the tank, or to the maximum head to which the tank may be subject to in service, whichever is the greater.

The distance from the top of the air pipe, sounding pipe or filling pipe, whichever is the greater, shall be taken into account in determining the head.

Non-portable, free-standing fuel tanks shall be pressure tested prior to installation in the vessel.

[14] Clause 4.7.3.1

Substitute

Non-portable, free-standing fuel tanks shall be constructed of carbon steel, stainless steel, copper, marine-grade aluminium alloy, FRP; or thermoplastic. No part of a metallic fuel tank shall depend on soft solder for tightness.

Thermoplastic tanks may only be used on class 2 or 3 vessels in C, D or E waters and Class 1 vessels with less than 36 passengers in D or E waters. Thermoplastic tanks shall not exceed a capacity of 400 litres.

[15] Clause 4.7.3.2

Insert new clause after 4.7.3.2

4.7.3.2.1 Additional requirements for non-portable, freestanding thermoplastic fuel tanks

Non-portable, freestanding thermoplastic fuel tanks shall not be installed in spaces containing sources of ignition or installed in spaces of moderate or high fire risk.

Note High and moderate risk fire risk spaces are defined in NSCV Part C Section 4.

[16] Clause 4.7.3.3

Substitute

Non-portable, free-standing fuel tanks shall be adequately supported and braced to prevent dislodging due to high accelerations that might arise through motions at sea or by a collision. The supports and braces shall be insulated from contact with the tank surfaces with a non-abrasive and non-absorbent material compatible with the tank material. Any securing straps used to secure a tank, shall be designed to allow for thermal expansion of the tank.

Note Thermoplastic tanks in particular have a high coefficient of thermal expansion.

[17] Clause 4.9.4

Omit

Unless provided for in Clause 4.9.5, fuel piping for non-portable fuel tanks shall be of seamless, heavy gauge metal. The piping shall be connected by flanged joints, metal to metal joints of the conical type or other suitable means. Such connections shall be kept to a minimum, and shall be readily visible and accessible. Where cone nipples are used, they shall be welded. Olive-type compression fittings shall not be used.

Insert

Unless provided for in Clause 4.9.5, fuel piping for non-portable fuel tanks shall be of seamless metal tube or pipe suitable for the systems pressure and environment. The piping shall be connected by flanged joints, metal to metal joints of the conical type or other suitable means. Such connections shall be kept to a minimum, and shall be readily visible and accessible. Where cone nipples are used, they shall be welded. Olive-type compression fittings shall not be used.

[18] Clause 4.10

Substitute

Refer Figure 13.

[19] Clause 4.10.5, note

Substitute

NOTE: The likelihood of fuel leaking from a tank is reduced when penetrations such as fuel take-offs, tank vents and inspection covers are arranged to pass through the top of the tank; e.g. refer to Figure 13.

[20] Clause 4.11

Insert new clause after 4.10.14

Clause 4.11 Fuel systems using ISO

On a class 1D, 1E, 2C, 2D, 2E, 3C, 3D or 3E vessel ≤ 13m long, the installation of the fuel system may be in accordance with:

a) ISO 21487; and

b) ISO 10088; and

c) ISO 11105.

For (b), compliance with ISO 10088 includes complying with the minimum fire rating for flexible fuel hoses.

[21] Figure 12

Delete figure 12

[22] Clause 5.8.2.1

Substitute

5.8.2.1 Capability of bilge pumping system

Unless otherwise provided for in Clauses 5.8.2.2 or 5.8.2.3, a vessel shall be fitted with the number and capacity of pumps specified in this section, arranged so that they are capable of pumping from and draining any bilge or watertight compartment in the vessel.

Note Australia is a party to MARPOL Annex 1. The discharge of oil or other pollutants (including oily bilge water) overboard is subject to Commonwealth, State or Territory marine pollution legislation. For bilge systems, this may necessitate the fitting of oily bilge water holding tanks or oil separation equipment.

[23] Clause 5.8.2.2

Substitute

5.8.2.2 Alternative arrangements

5.8.2.8.1 Small open vessels

Open vessels of measured length less than 5 m may be provided with a bailing bucket in lieu of a bilge system, provided there is ready access to the bilge for bailing.

5.8.2.2.2 Small compartments

A watertight compartment less than 7 per cent of the total under deck volume may be drained into an adjacent compartment by means of a self-closing valve or cock. The adjacent compartment shall itself be served by the bilge system.

5.8.2.2.3 Low permeability voids

Underdeck voids filled with foam to over 90% of the void volume are not required to have a bilge system to pump those spaces.

Note Other bilge pumping arrangements for small compartments are possible but would need to be considered as equivalent solutions. For example, bilge pumping arrangements may not be needed on small vessels having numerous small compartments where it can be shown that the safety of the vessel is not materially reduced by the flooding of adjacent compartments. Key factors would include: the effectiveness of watertight boundaries; the flooded characteristics of the vessel; the effect on systems essential to the safety of the vessel; means for monitoring water levels within compartments; and arrangements to remove accumulated water in the bilge.

[24] Clause 5.8.2.3

Omit 5.8.2.3

[25] Clause 5.8.2.7

Substitute

The bilge system in vessels of 25 m measured length and over shall:

a) be provided with a bilge distribution manifold located in an accessible position. Valves in bilge distribution manifolds shall be of non-return type; or

b) in bilge pump arrangements where a bilge manifold is not provided, then:

(i) at least two pumps, shall be provided capable of pumping each space; and

(ii) at least one of the pumps per space mentioned in (i) shall be a metal bodied, low voltage type, fixed submersible pump; and

(iii) where permitted by 5.8.3.3 (d) the other pump may be portable, supplied from the emergency supply, if electric, for use on individual spaces; and

(iv) the capacity of each pump shall be no less than 15.0 kL/h.

Note Arrangements (a) and (b) are also deemed to satisfy solutions for vessels less than 25m

[26] Clause 5.8.3.2

Insert after d)

e) A powered bilge pump may be driven by an extra low voltage (ELV) electric motor in vessels that are ≤ 13 metres long where:

(i) the pump complies with ISO 8849;

(ii) the capacity of the bilge pump meets the requirements in 5.8.3.1;

(iii) the pump circuit does not include an automatic float switch;

(iv) the high water bilge alarm is contained on a separate circuit;

(v) batteries are sealed valve regulated (SVR) type with sufficient reserve capacity for operation of the pump and other emergency electrical systems for the time specified for emergency electrical systems in Table 1 in NSCV Part C, Subsection 5B;

(vi) lead acid batteries can be substituted for SVR type provided the batteries are positioned above the loaded waterline in acid proof battery boxes fitted with secured lids.

(vii) Sufficient reserve capacity for operation of the pump and other emergency electrical systems as specified in Table 1 in NSCV Part C, Subsection 5B;

(viii) the installation of the ELV pump and wiring meet IP67 rating in accordance with AS/NZS 3000;

(ix) the battery supply is fitted with volt meters;

(x) piping for the suction and discharge connected to the ELV pump is ISO 7840 type A2, discharge point a minimum of 250mm above the loaded waterline with a heavy duty non return valve fitted in a position that prevents back flooding; and

(xi) ELV pump(s) are located in the low point of the vessel for operation in both heel and trim.

[27] Clause 5.8.8.2, note

Delete the note to 5.8.8.2

[28] Clause 6.11.3

Substitute

6.11.3 Length and thickness of tiller or quadrant boss

The length and wall thickness of the tiller or quadrant boss shall comply with the following:

$$B_t \geq 0.4 d_u$$

$$B_l = 1.3 d_u$$

where:

B_t = Tiller / quadrant boss wall thickness at mid depth, (mm)

B_l = Tiller / quadrant boss length, (mm)

d_u = Minimum diameter (mm) of upper rudder stock as calculated in 6.8.4.2

[29] Clause 6.11.4

Substitute

6.11.4 Securing of tiller or quadrant boss on the rudder stock

The tiller or quadrant boss shall be securely affixed to the rudderstock by a key or other equivalent means. Where a key is fitted, the size of the key shall be determined in accordance with the following:

$$k_t \geq 0.17 d_u$$

$$k_l = B_l$$ (key is to extend the full length of the boss)

$$A_s \geq 0.25 d_u^2$$

where:

k_t = Tiller / quadrant boss key thickness (mm)

kl = Tiller / quadrant boss key length (mm)

A_s = Effective shear area of key (mm^2)