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Small craft — Remote hydraulic steering systems

Petits navires — Système de direction hydraulique commandé à distance

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 188, *Small craft*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 464, *Small craft*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 10592:1994), which has been technically revised.

The main changes are as follows:

— in Clause 3, definitions have been updated;

— throughout the text, requirements have been updated to meet the state of the art;

— the steering wheel requirements and tests have been removed;

— former Clause 12, Designation, has been removed.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Small craft — Remote hydraulic steering systems

1 Scope

This document specifies the requirements for the design, installation and testing of engine-mounted and craft-mounted remote hydraulic steering systems used with single and multiple engine installations of outboard engines over 15 kW per engine, as well as with single and multiple engines of inboard, sterndrive, and water jet drives, all used on small craft.

This document does not address emergency means of steering the craft.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 8848:2022, *Small craft — Remote mechanical steering systems*

ISO 12217-1:2015, *Small craft — Stability and buoyancy assessment and categorization — Part 1: Non-sailing boats of hull length greater than or equal to 6 m*

ISO 12217-2:2015, *Small craft — Stability and buoyancy assessment and categorization — Part 2: Sailing boats of hull length greater than or equal to 6 m*

ISO 12217-3:2015, *Small craft — Stability and buoyancy assessment and categorization — Part 3: Boats of hull length less than 6 m*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
burst pressure
pressure at which the system exceeds the ultimate strength of the weakest hydraulic component, resulting in a drop of hydraulic pressure

3.2
component interface
mechanical interface (3.4) or *hydraulic interface* (3.3) at a point in the *steering system* (3.14) where a connection is made between components that are not supplied as part of the same assembly kit

Note 1 to entry: If hydraulic fluid lines are not shipped as part of the steering kit, there is an interface between the helm and the fluid lines, and between the *output device* (3.12) and the fluid lines.

3.3
hydraulic interface
interface between two or more hydraulic components where force and motion are transmitted by hydraulic fluid

3.4
mechanical interface
interface where force and motion are transmitted mechanically

3.5
component proof pressure
pressure rating for helms, lines, fittings and *output devices* (3.12) at which the component performs as intended

3.6
component maximum working pressure
pressure equivalent to one-half of the *component proof pressure* (3.5)

3.7
drag link
link rod
link arm
mechanical device used in a *steering system* (3.14) by which the force of the *output device* (3.12) is transmitted to the *steering arm* (3.22), in either a *craft-mounted steering system* (3.15) or an *engine-mounted steering system* (3.8)

3.8
engine-mounted steering system
steering system (3.14) in which the reactionary forces of the *output device* (3.12) are resisted by the propulsion device

3.9
hydraulic helm
mechanism, exclusive of the steering wheel or control element, through which remote manual effort is converted to hydraulic pressure and flow

3.10
remote hydraulic steering system
steering system (3.14) that utilizes a *hydraulic helm* (3.9) to convert operator steering inputs into hydraulic pressure and flow to actuate an *output device* (3.12) with no additional energy source

3.11
minimum retained system performance
system performance after test(s) such that at least 90 % of the *steering arm* (3.22) travel normally available on each side of the mid-position can be attained by exertion of no more than 27 Nm of torque at the helm through the steering wheel or control element

Note 1 to entry: This criterion does not define the *steering system* (3.14) performance while a *craft* (3.23) is underway, but is intended to provide quantitative limits for design and testing purposes.

3.12
output device
hydraulic cylinder, rotary actuator or other device that converts hydraulic pressure and flow into force on, and movement of, the steerable device

3.13
rate of steering response
ratio of output movement to input movement

3.14
steering system
assembly that includes all components necessary to transmit remote manual effort to the steerable device

3.15
craft-mounted steering system
steering system (3.14) in which the reactionary forces of the *output device* (3.12) are resisted by the *craft* (3.23)

3.16
hydraulic fitting
part or design feature on a component used to join (i.e. connect) any pressure retaining components in the *steering system* (3.14)

3.17.1
system design peak pressure
<single and twin engines> greater of the pressures generated by the application of either a 1 672 Nm *system torque* (3.20) to the steering axis of the outboard engine(s), inboard engine rudder, sterndrive, or water jet drive(s), or a single tangential load of 445 N; or *system relief pressure* (3.19) if relief activates during application of a 445 N load at D_s on the steering wheel rim or at D_s on the handgrip with the largest diameter D_s wheel specified for the hydraulic helm

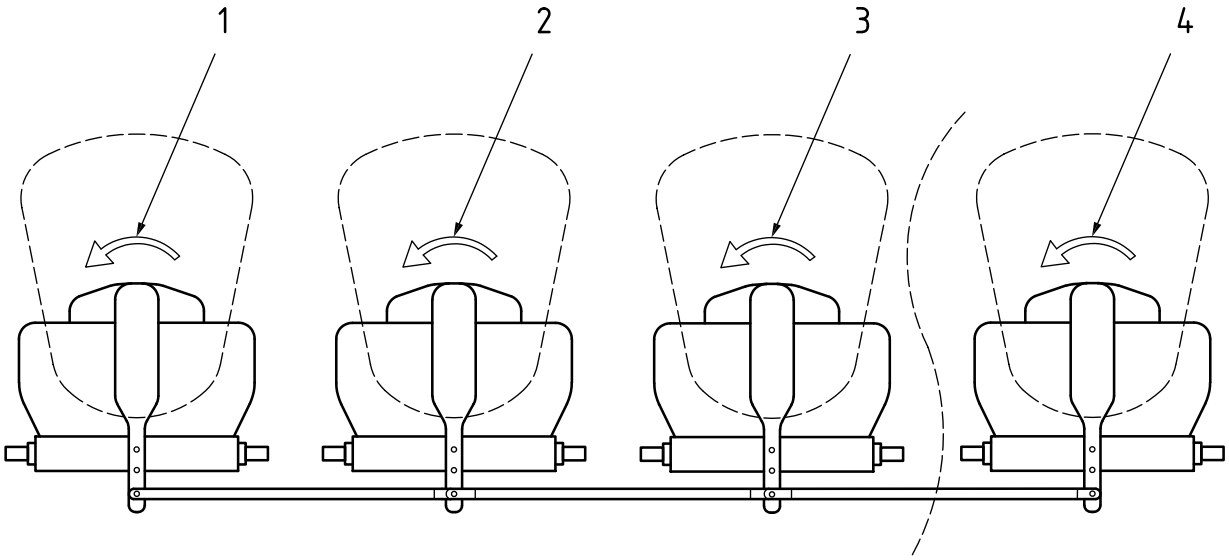
3.17.2
system design peak pressure
<triple and quadruple outboard engines> greater of the pressures generated by the application of either a 3 344 Nm *system torque* (3.20) to the steering axis of the outboard engines, or a single tangential load of 445 N; or *system relief pressure* (3.19) if relief activates during application of a 445 N load at D_s on the steering wheel rim or at D_s on the handgrip with the largest diameter D_s wheel specified for the hydraulic helm

3.18
system proof pressure
pressure attained by a system if equipped with an activated pressure relief device, or a single tangential load of 450 ± 5 N at the steering wheel rim or handgrip with the largest diameter D_s wheel specified for the helm

3.19
system relief pressure
pressure limit when a pressure relief device activates

3.20
system torque
total combined torque applied to the outboard engine(s) axis (or axes), inboard rudder, sterndrive or waterjet propulsion system that is resisted by the component(s) of the *steering system* (3.14)

Note 1 to entry: Outboard engine example shown in Figure 1.



Key

1 engine 1 torque
2 engine 2 torque
3 engine 3 torque
4 engine 4 torque

Figure 1 — System torque

3.21
multiple engine installation
two or more engines, normally used simultaneously for a *craft's* (3.23) main propulsion, controlled by a common *steering system* (3.14)

3.22
steering arm
portion of the outboard engine that the *steering system* (3.14) makes *mechanical interface* (3.4) with

3.23
craft
small craft
recreational boat, and other watercraft using similar equipment, of up to 24 m length of hull (L_H)

Note 1 to entry: The measurement methodology for length of hull is defined in ISO 8666.

[SOURCE: ISO 8666:2020, 3.15, modified — Note 1 to entry has been added.]

4 General requirements

4.1 The craft manufacturer shall install the complete remote hydraulic steering system on the craft to at least the applicable points listed in a) or b) as follows.

a) For craft with outboard engines, the steering system shall be complete from the control element to the mechanical interface for connection of the drag link supplied with the outboard engine, or shall provide an alternative means to connect the output device to the engine so that the loading magnitude and offset are consistent with the steering arm's intended purpose.

b) In all other craft, the steering system shall be complete from the control element to the output connection point on the steerable device.

4.2 All threaded fasteners whose integrity affects operation of the remote hydraulic steering system so that separation or loss of the fastener would cause total loss of steering without warning shall be provided with a locking means. This requirement does not apply to hydraulic fittings.

4.3 Threaded fasteners whose integrity affects operation of the steering system so that separation or loss of the fasteners can cause total loss of steering without warning, and that can be expected to be disturbed by installation or adjustment procedures, shall be referenced by instructions for correct assembly, and

a) shall be locked by a device whose presence is determined by visual inspection, or by feel, following assembly, or

b) shall incorporate integral locking means, provided the fastener cannot be omitted or substituted without making the system inoperable.

The requirements of 4.3 do not apply to hydraulic fittings.

NOTE Self-locking nuts with plastic inserts that create mechanical plastic interference meet the above stated requirements.

4.4 Loose lock washers, distorted thread nuts or separately applied adhesives shall not be used.

4.5 Devices that use plain threaded jam nuts to permit adjustments shall be designed so that total separation of parts, or total loss of steering, will not occur should they loosen.

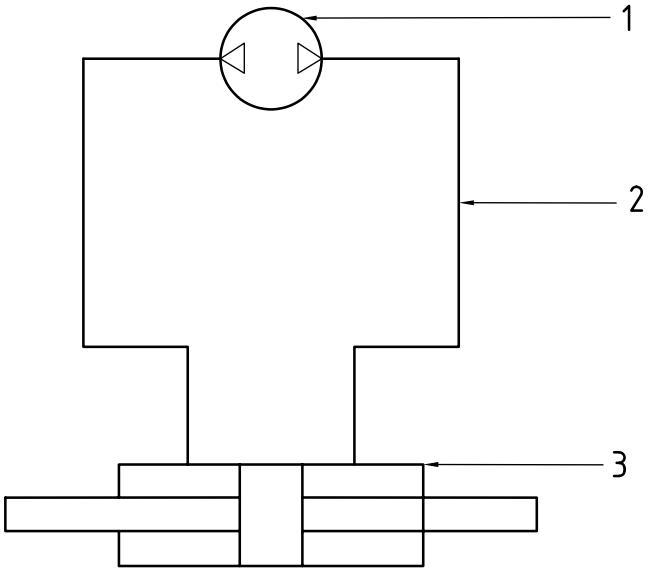
4.6 Connection fittings, including quick-disconnect fittings relying only upon a spring or springs to maintain the connection, shall not be used.

4.7 Operating temperature range — All materials used in the construction of the system and its accessories shall be capable of operating from −20 °C to +80 °C. Hydraulic system components shall not be installed in areas where the operating temperature exceeds +80 °C.

4.8 Storage temperature range — All materials used in the construction of the system and its accessories shall be capable of withstanding an ambient temperature of −40 °C to +85 °C.

NOTE This requirement is not intended to require operation at these temperatures, but is included to determine that the system withstands the stipulated storage temperatures.

4.9 All components including, but not limited to, hydraulic lines and fittings, and input and output devices shall be marked and selected to have a component proof pressure rating not less than the proof pressure rating on the hydraulic helm as indicated by the manufacturer of the helm. (See Figure 2).



Key

1 hydraulic helm marking: system proof pressure; for example: 6 900 kPa

2 line marking; for example: ≥ 6 900 kPa proof pressure rating or ≥ 3 450 kPa component maximum working pressure rating

3 cylinder marking; for example: ≥ 6 900 kPa proof pressure rating or ≥ 3 450 kPa component maximum working pressure rating

Figure 2 — Typical hydraulic steering system schematic

4.10 Components shall have a burst pressure that is not less than the system design peak pressure throughout the operating temperature range and expected burst pressure variation due to manufacture, installation, environmental exposure and in use loading, or two times component proof pressure, whichever is greater.

4.11 Hydraulic lines and fittings shall be selected in accordance with the steering equipment manufacturers' instructions.

Hydraulic quick connect fittings whose integrity affects operation of the system so that separation or loss of the connection would cause total loss of steering without warning shall incorporate a two stage integral locking means for connection integrity.

4.12 Hydraulic steering systems, including systems with pressure relief devices, shall comply with the following test to ensure that movement after a relief event is controlled:

— apply an impulse load of at least the system design peak pressure followed directly with at least one-half system design peak pressure for a duration of at least one-half second;

— the load shall be applied to the steerable device and resisted by the steering system;

— the load shall be applied within 13 degrees of steering centre;

— the system shall not have more than 17 degrees of steering movement.

4.13 Steering systems shall cause the steerable device to turn on its axis at its rate of steering response when no greater than 4 % of the full range of the steering movement of the steering wheel or control element.

4.14 Steering systems shall not cause the operator to re-grip the steering wheel or handgrip more frequently than once every 30 s due to position drift of 1/4 turn or more of the steering wheel or handgrip relative to the position of the steerable device.

4.15 Component interfaces and hardware shall be capable of withstanding the forces generated by the system operating at the system design peak pressure.

4.16 In multiple engine installations that are not mechanically connected, sudden loss of steering synchronization shall be prevented. Series plumbing of steering components meets this requirement.

4.17 When equipped with the largest diameter D_s and the deepest dish of the steering wheel for which the helm is rated, all steering components shall be capable of meeting the applicable test requirements specified in Clause 9.

5 Materials

5.1 Materials used in remote hydraulic steering systems shall be galvanically compatible or suitably plated to minimize corrosion.

5.2 Copper-base alloys shall be separated from aluminium with a galvanic barrier, such as 300 series stainless steel or equivalent, or shall be protected from exposure.

5.3 Metallic steering components that are at or below the waterline in the light craft condition, as defined in ISO 12217-1:2015, ISO 12217-2:2015 and ISO 12217-3:2015, shall be cathodic protected or galvanically isolated.

5.4 Materials used in remote hydraulic steering systems shall be resistant to deterioration by the specified hydraulic fluid and by other liquids or compounds with which the material can come in contact under normal marine services, e.g. grease, lubricating oil, common bilge solvents, and salt and fresh water.

5.5 Plastics and elastomers that can be exposed to sunlight shall be designed to resist degradation by ultraviolet radiation.

5.6 The hydraulic fluid shall be non-flammable or have a flash point of 160 °C or over.

6 Outboard engines and sterndrives

6.1 The steering stops on the outboard engine shall permit at least 30° of angular movement either side of centre.

6.2 The outboard engine shall:

a) incorporate an integrated steering system or meet the applicable dimensional requirements indicated in Figure 3 and Figure 4, and

b) provide space for the connection of the steering components as indicated in Figure 5, Figure 6 and Figure 7.