
Small craft — Remote mechanical steering systems

Petits navires — Appareils à gouverner commandés à distance

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 of ISO 8848, together with ISO 23411:2020, cancels and replaces ISO 8848:1990, ISO 9775:1990 and ISO 15652:2003, which have been technically revised.

The main changes compared to the previous edition are as follows:

- ISO 8848:1990, ISO 9775:1990 and ISO 15652:2003 have been consolidated into this document;
- added "mechanical" in the title;
- updated definitions;
- updated requirements to meet current industry practices;
- added 7.7 regarding control lever to steering wheel clearance;
- steering wheel requirements and tests have 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 mechanical steering systems

1 Scope

This document specifies design, construction, installation and test requirements for remote mechanical cable steering systems and the output ram interface point to rudders, jet drives, outboard and sterndrive engines for small craft.

It is applicable to three distinct classes of steering systems for use on various types of craft:

- standard duty steering systems, for small craft with single and twin installations of outboard engines with a total over 15 kW power, and with rudders, sterndrives, and water-jet drives;
- light duty steering systems, for small craft with a single outboard engine of 15 kW to 40 kW power;
- mini-jet steering systems, excluding personal watercraft.

NOTE Standard and light duty steering systems are mechanically interchangeable. A standard duty steering system can be used on a craft designed for a light duty system. However, a light duty steering system cannot be used on a craft that requires a standard duty steering system. Mini-jet steering systems are mechanically differentiated from the previously mentioned systems and can only be used on mini-jet craft as defined in this document.

This document does not address emergency means for 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 10240:2019, *Small craft — Owner's manual*

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 terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

craft-mounted steering system

assembly including all components necessary to transmit remote manual effort to the end of the *output ram* (3.20) and a means to secure an output ram guide tube to the craft

**3.2
interface point**

point of mechanical interface in the *steering system* (3.11) where a connection is made between the *output ram* (3.20) and the craft components that are not supplied as part of the same assembly

**3.3
control element**

device connected to the *steering mechanism* (3.6) that allows the operator to apply manual steering effort to the *steering system* (3.11)

EXAMPLE *Steering wheel* (3.13), *handlebar* (3.5), *joystick* (3.7).

**3.4
drag link**

device in an *engine-mounted steering system* (3.10) by which the linear force of the *output ram* (3.20) is transmitted to the engine steering arm

**3.5
handlebar**

mechanical means for applying a manual steering effort to the *steering mechanism* (3.6) in a horizontal configuration, with hand grips at each end and the helm connected at the middle

**3.6
steering mechanism**

device, to which a *control element* (3.3) is attached for manual application of a controlling force, and by which the controlling force is fed into a *steering system* (3.11)

**3.7
joystick**

operator input device for the simultaneous control of thrust, steering and propulsion

**3.8
mini-jet craft**

craft weighing less than 1 000 kg, with an inboard engine powering a water-jet pump as its primary method of propulsion, designed to be operated with one or more persons within the confines of a hull

**3.9
minimum retained system performance**

system performance after test(s), such that at least 90 % of the steering arc normally available each side of the mid-position can be obtained by exertion of no more than 27 N·m of torque at the *steering mechanism* (3.6), through the *control element* (3.3)

Note 1 to entry: This criterion does not define the *steering system* (3.11) performance while a craft is underway, but is rather intended to provide quantitative limits for design and test purposes.

**3.10
engine-mounted steering system**

assembly including all components necessary to transmit a remote manual effort to the end of the *output ram* (3.20) which is affixed to an engine mounted steering tube and a *drag link* (3.4) supplied by the engine manufacturer

**3.11
steering system**

assembly including all components necessary to transmit a remote manual effort to the rudder, outboard engine, sterndrive or water-jet drive

**3.12
two-cable steering system**

two independent cables attached at the *interface point(s)* (3.2) of the *output ram(s)* (3.20) and at the helm and driven by a common steering shaft, generally used to minimize steering backlash or lost motion

3.13**steering wheel**

mechanical means for applying a manual steering effort to the helm, normally a circular configuration with a continuous loop at the distal end of support spokes with the helm connected at the rotational axis

3.14**steering wheel diameter
actual diameter**
 D_a

diameter of the circle formed by the outermost sections of the *steering wheel* (3.13)

Note 1 to entry: See [Figure 6](#).

3.15**steering wheel dish**

distance between the two parallel planes formed by the aft rim surface and the forward hub surface of a *steering wheel* (3.13)

Note 1 to entry: See [Figure 6](#).

3.16**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 the length of hull is defined in ISO 8666.

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

3.17**standard duty steering system**

remote mechanical *steering system* (3.11) designed to the requirements of this standard for use on small craft with outboard engines (single and dual) with a total of 15 kW and greater power, inboard engines, sterndrives, and water-jet drives

3.18**light duty steering system**

remote mechanical *steering system* (3.11) designed to the requirements of this standard for use on small craft with single outboard engines between 15 kW and 40 kW power that is permanently marked with a maximum power rating of 40 kW

3.19**mini-jet steering system**

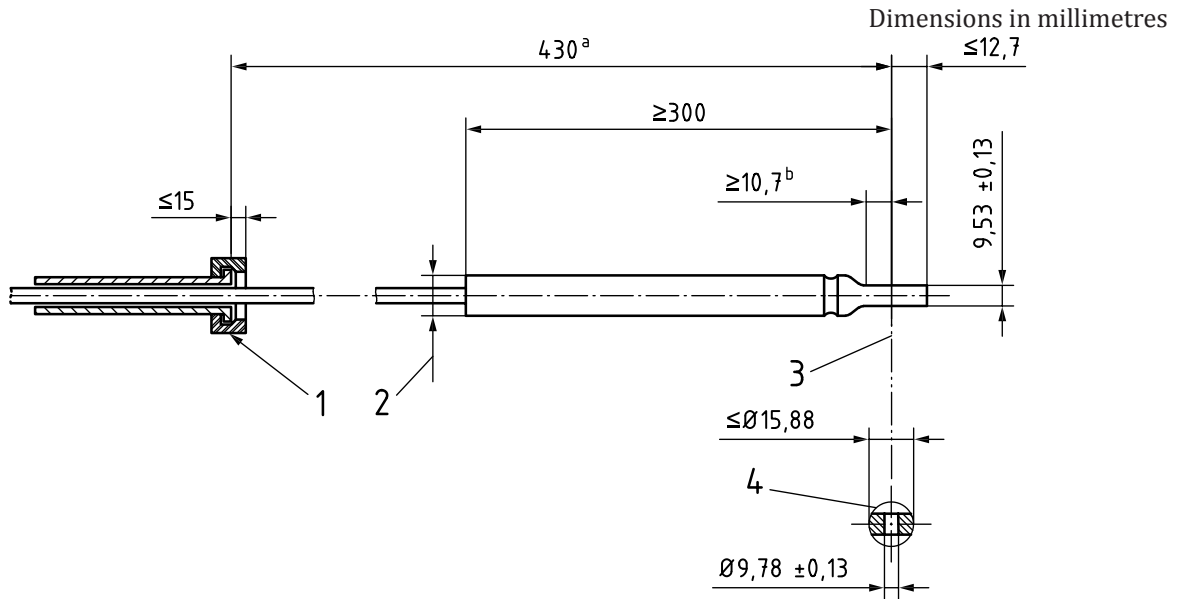
remote mechanical *steering system* (3.11) designed to the requirements of this standard for use on *mini-jet craft* (3.8)

3.20**output ram**

portion of the remote mechanical steering cable that interfaces with the outboard engine steering tube and *drag link* (3.4), steering actuator or craft mounted steering tube/rudder

4 Constructional requirements

4.1 When steering systems are factory-installed in the craft, the complete system shall be supplied. In outboard engine craft, the system shall be supplied complete to the interface point at the output ram end as shown in [Figure 1](#).



Key

- | | | | |
|---|-----------------|---|----------------------|
| 1 | coupler nut | a | Mid-travel position. |
| 2 | output ram tube | b | Flat. |
| 3 | interface point | | |
| 4 | end fitting | | |

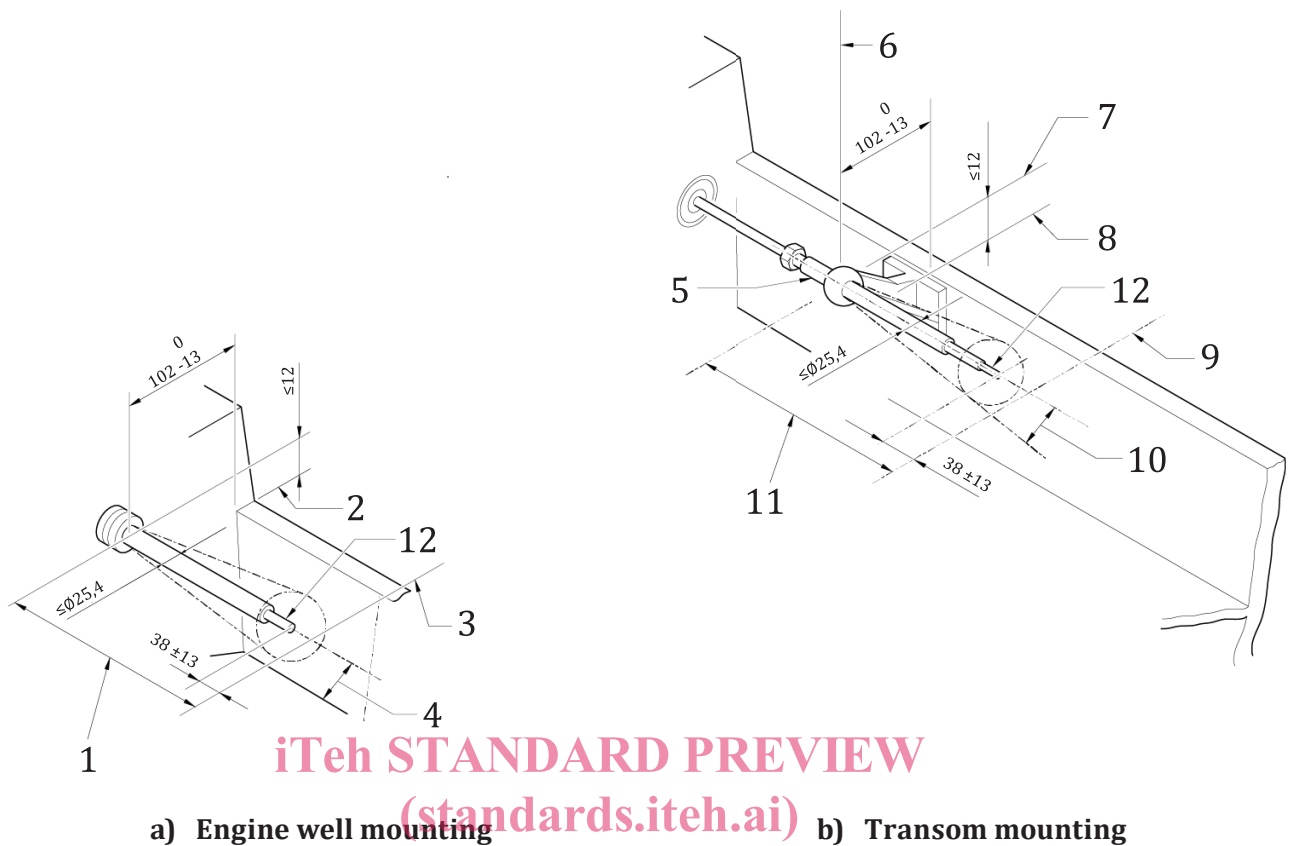
NOTE Minimum travel: 100 mm each side of mid-travel position.
 Maximum travel: 115 mm each side of mid-travel position.
 Coupler nut 7/8-14 UNF-2B thread (optional for boat mounted systems).

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Figure 1 – Output ram

4.2 Installation of the steering system shall be in accordance with the instructions provided by the steering system manufacturer.

4.3 Craft suitable for twin outboard engines shall be so designated, and it shall also be specified whether the craft is suitable for engine-mounted steering systems, craft-mounted steering systems or both. If the craft is suitable for craft-mounted steering systems, it shall also be specified whether engine well mounting, transom mounting or both (see [Figure 2](#)) may be used.

Dimensions in millimetres



Key

- | | | | |
|---|--|----|-----------------------|
| 1 | 380 mid-travel position | 7 | centreline of swivel |
| 2 | engine mounting face of clamp bracket | 8 | face of clamp bracket |
| 3 | engine centreline | 9 | engine centreline |
| 4 | articulation 15° min. | 10 | articulation 15° min. |
| 5 | 7/8-14 NF2B thread – 16 min. length on tube | 11 | mid-travel position |
| 6 | swivel axis 102 0 -13 square off face of transom | 12 | interface point |

NOTE Minimum travel: 100 mm each side of mid-travel position.
Maximum travel: 115 mm each side of mid-travel position.

Figure 2 — Craft-mounted steering system

4.4 Components of the steering system shall be resistant to corrosion, either by virtue of material or coating thereof, and shall be galvanically compatible with adjoining components.

4.5 All threaded fasteners whose integrity affects safe operation of the system, such that separation or loss of the fastener would cause sudden loss of steering without warning, shall be provided with a locking means.

4.6 Threaded fasteners whose integrity affects operation of the system, such that separation or loss of the fastener would cause sudden 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 shall either:

- be locked by a device whose presence is determinable by visual inspection, or by feel, following assembly; or

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

NOTE Self-locking nuts with plastic inserts that create mechanical plastic interference meet the requirements of this subclause.

4.6.1 Loose lock-washers, distorted thread nuts, or separately applied adhesives are prohibited.

4.6.2 Plain, threaded jam nuts are prohibited except that they may be used to permit adjustment and shall then be designed so that total separation of parts or other complete loss of steering will not occur, should they loosen.

NOTE These assemblies are not intended to be disassembled for installation; the choice of locking means is within the discretion of the system manufacturer.

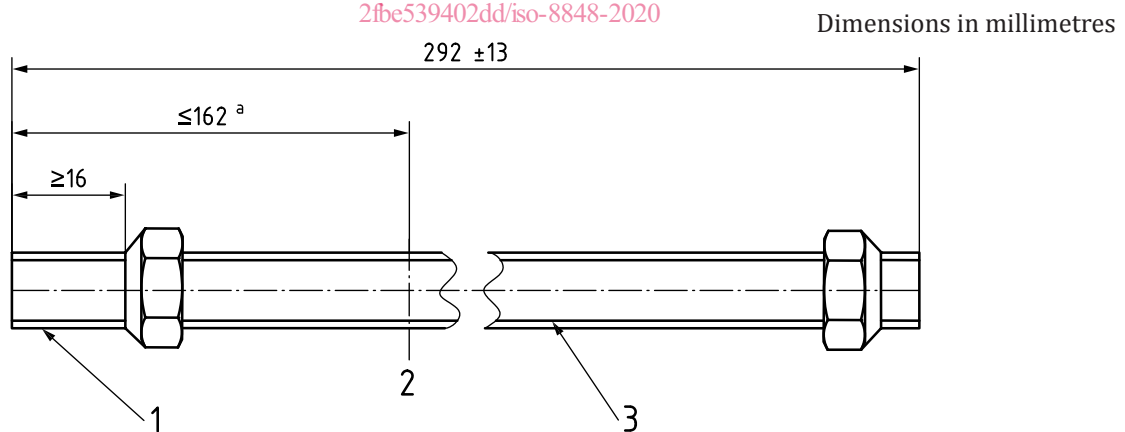
4.6.3 A locking device shall be so designed that its presence can be determined by visual inspection or feel after installation.

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

5 Outboard engine and inboard-sterndrive design requirements

5.1 The steering stops on the outboard engine shall permit at least 30° of angular movement to either side of the centreline.

5.2 The outboard engine steering system shall meet the applicable dimensional requirements indicated in Figures 1, 3, and 4.



Key

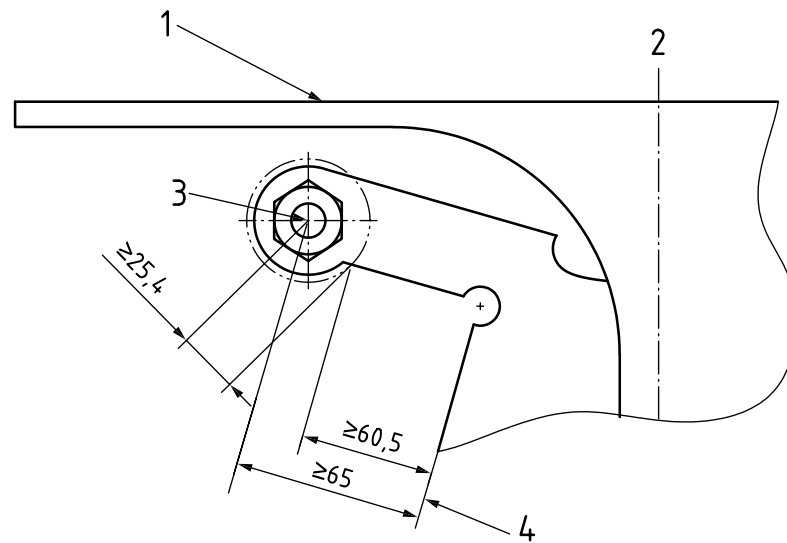
- 1 engine axis
 - 2 7/8-14 UNF-2A thread both ends
 - 3 tube \varnothing int. $16^{+0,25}_0$
- a Either side.

NOTE 1 The tube can be threaded equal length on both ends or reversible for port steering installations.

NOTE 2 The above inner tube dimensions are for the as installed tube.

Figure 3 — Engine-mounted steering tube

Dimensions in millimetres

**Key**

- | | |
|-----------------|--------------------------|
| 1 steering arm | 3 tilt axis |
| 2 steering axis | 4 transom mating surface |

Figure 4 — Engine-mounted steering tilt axis

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5.3 The drag link and the necessary fittings to attach an outboard engine to the steering output ram shown in [Figure 1](#) shall be supplied with the outboard engine.

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5.4 The outboard engine shall be designed so that, with any combination of engine turn and tilt, there shall be no damaging interference between the engine, its accessories, and both the craft-mounted steering system installed as shown in [Figure 2](#) and the engine-mounted steering system, provided the engine is designed for both systems. Appropriate written information and installation instructions shall be provided, clearly indicating the type of steering system(s) that should be used.

5.5 All mechanical parts of a steering system transmitting steering forces shall meet the applicable steering system component requirements in [8.2](#).

NOTE 1 Electrical parts of a steering system are addressed in ISO 25197.

NOTE 2 Hydraulic parts of a steering system are addressed in ISO 10592.

5.6 Outboard engines shall be designed so that the geometry ensures that the static loads defined below, when applied at the steering-arm connection point normal to the steering arm in its plane of operation, throughout the maximum steering arc, do not result in steering output ram loadings greater than those specified in [8.3.1](#).

- 3 300 N for standard duty steering system;
- 2 200 N for light duty steering system.

5.7 The steering arm of the outboard engine shall be provided with a 3/8-24 UNF thread, or a plain hole of 9,65 mm to 9,9 mm diameter at the connection point.

5.8 Sterndrives designed for remote mechanical steering systems shall be designed with proper geometry to ensure that a torque of 680 Nm applied about the sterndrive steering axis does not result in a steering component loading greater than that specified in [8.3.1](#).