IEC TS 62600-2

Edition 2.0 2019-10

TECHNICAL SPECIFICATION

colour inside

Marine energy – Wave, tidal and other water current converters – Part 2: Marine energy systems – Design requirements

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MARINE ENERGY – WAVE, TIDAL AND OTHER WATER CURRENT CONVERTERS –

Part 2: Marine energy systems – Design requirements

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The main task of IEC technical committees is to prepare International Standards. In exceptional circumstances, a technical committee may propose the publication of a Technical Specification when

- the required support cannot be obtained for the publication of an International Standard, despite repeated efforts, or
- the subject is still under technical development or where, for any other reason, there is the future but no immediate possibility of an agreement on an International Standard.

Technical Specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 62600-2, which is a Technical Specification, has been prepared by IEC technical committee 114: Marine energy – Wave, tidal and other water current converters.

This second edition cancels and replaces the first edition published in 2016. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) The first edition published in 2016 was based on design methodologies developed by TC88. The second edition sets forth design conditions unique to marine energy converters.

The text of this Technical Specification is based on the following documents:

Enquiry draft	Report on voting
114/306/DTS	114/322/RVDTS

Full information on the voting for the approval of this Technical Specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 62600 series, published under the general title *Marine energy – Wave, tidal and other water current converters*, can be found on the IEC website.

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The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- transformed into an International Standard,
- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 62600 outlines minimum design requirements for marine energy converters (MECs) and is not intended for use as a complete design specification.

Any of the requirements of this document may be altered if it can be demonstrated that the overall safety of the marine energy converter is not compromised. Compliance with this document shall be done in observance of applicable regional regulations.

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MARINE ENERGY – WAVE, TIDAL AND OTHER WATER CURRENT CONVERTERS –

Part 2: Marine energy systems – Design requirements

1 Scope

This document provides design requirements to ensure the engineering integrity of wave, ocean, tidal and river current energy converters, collectively referred to as marine energy converters. Its purpose is to provide an appropriate level of protection against damage from all hazards that may lead to catastrophic failure of the MEC structural, mechanical, electrical or control systems. Figure 1 illustrates the scope of this document and critical interfaces with other elements of a marine energy converter installation.

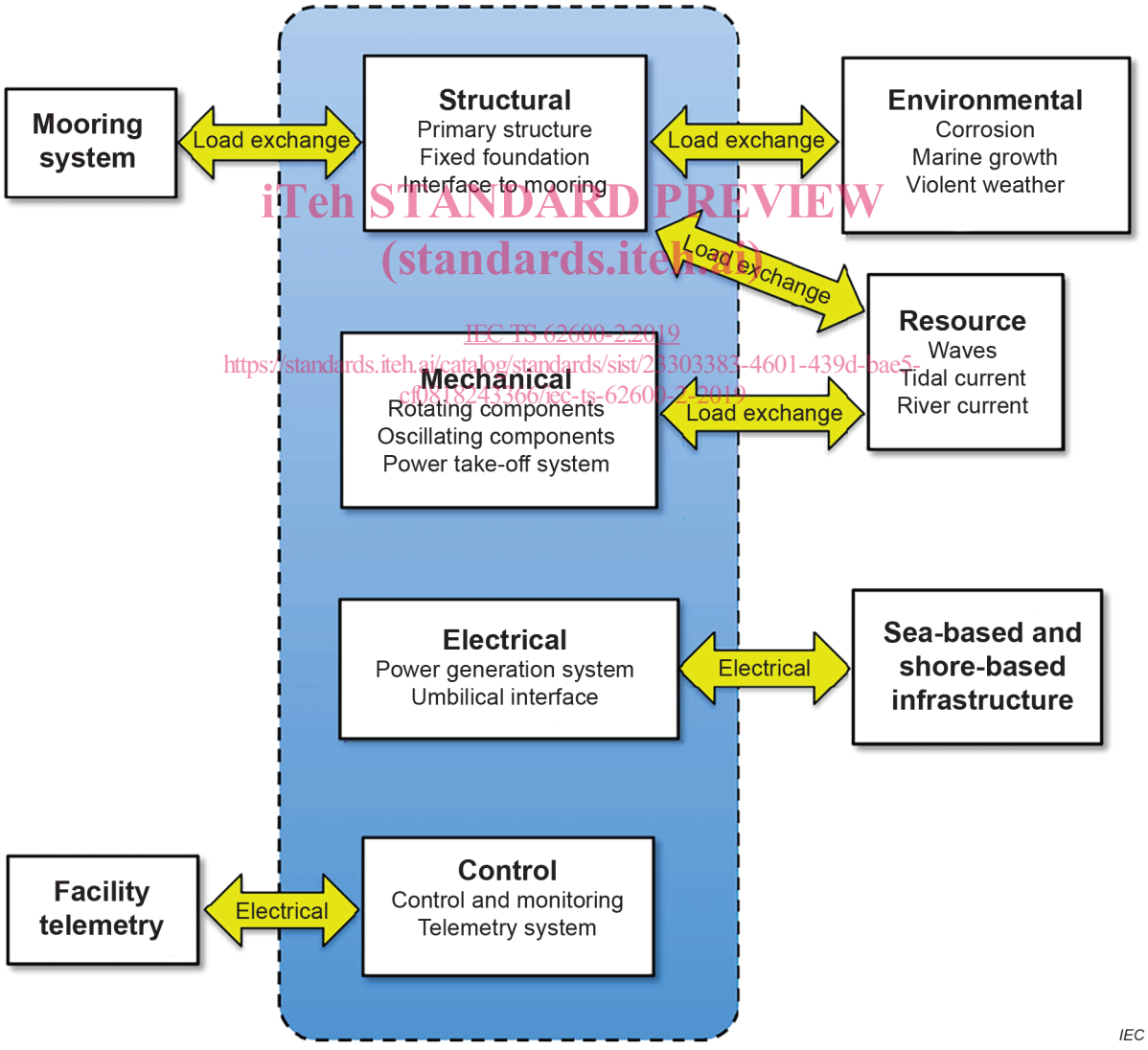

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Figure 1 – Marine energy converter system boundary for IEC TS 62600-2 and interfaces

This document provides requirements for MEC main structure, appendages, seabed interface, mechanical systems and electrical systems as they pertain to the viability of the device under site-specific environmental conditions. This document applies to MECs that are either floating or fixed to the seafloor or shore and are unmanned during operational periods.

NOTE Refer to IEC 62600-10 for guidance on the design of moorings for floating MECs.

In addition to environmental conditions, this document addresses design conditions (normal operation, operation with fault, parked, etc.); design categories (normal, extreme, abnormal and transport); and limit states (serviceability, ultimate, fatigue and accidental) using a limit state design methodology.

Several different parties may be responsible for undertaking the various elements of the design, manufacture, assembly, installation, erection, commissioning, operation, maintenance and decommissioning of a marine energy converter and for ensuring that the requirements of this document are met. The division of responsibility between these parties is outside the scope of this document.

This document is used in conjunction with IEC and ISO standards cited as normative references, as well as regional regulations that have jurisdiction over the installation site.

This document is applicable to MEC systems designed to operate from ocean, tidal and river current energy sources, but not systems associated with hydroelectric impoundments or barrages. This document is also applicable to wave energy converters. It is not applicable to ocean thermal energy conversion (OTEC) systems or salinity gradient systems.

Although important to the overall objectives of the IEC 62600 series, this document does not address all aspects of the engineering process that are taken into account during the full system design of MECs. Specifically, this document does not address energy production, performance efficiency, environmental impacts, electric generation and transmission, ergonomics, or power quality.

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This document takes precedence over existing applicable standards referred to for additional guidance. This document adheres to a limit state design approach utilizing partial safety factors for loads and materials to ensure MEC reliability in accordance with ISO 2394.

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MECs designed to convert hydrokinetic energy from hydrodynamic forces into forms of usable energy, such as electrical, hydraulic, or pneumatic may be different from other types of marine systems. Many MECs are designed to operate in resonance or conditions close to resonance. Furthermore, MECs are hybrids between machines and marine structures. The control forces imposed by the power take-off (PTO) and possible forces from faults in the operation of the PTO distinguish MECs from other marine structures.

The document is applicable to MECs at the preliminary design stage to those that have progressed to advanced prototypes and commercial deployment. It is anticipated that this document will be used in certification schemes for design conformity.

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.

IEC 60092-301, *Electrical installations in ships – Part 301: Equipment – Generators and motors*

IEC 60092-350, *Electrical installations in ships – Part 350: General construction and test methods of power, control and instrumentation cables for shipboard and offshore applications*

IEC 60204-1:2016, *Safety of machinery – Electrical equipment of machines – Part 1: General requirements*

IEC 60204-11:2018, *Safety of machinery – Electrical equipment of machines – Part 11: Requirements for equipment for voltages above 1 000 V AC or 1 500 V DC and not exceeding 36 kV*

IEC 60228, *Conductors of insulated cables*

IEC 60364-5-54, *Low-voltage electrical installations – Part 5-54: Selection and erection of electrical equipment – Earthing arrangements and protective conductors*

IEC 60812, *Failure modes and effects analysis (FMEA and FMECA)*

IEC 61508 (all parts), *Functional safety of electrical/electronic/programmable electronic safety-related systems*

IEC 61643-11, *Low-voltage surge protective devices – Part 11: Surge protective devices connected to low-voltage power systems – Requirements and test methods*

IEC 61882, *Hazard and operability studies (HAZOP studies) – Application guide*

IEC 62305-3, *Protection against lightning – Part 3: Physical damage to structures and life hazard*

IEC 62305-4, *Protection against lightning – Part 4: Electrical and electronic systems within structures*

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IEC TS 62600-1, *Marine energy – Wave, tidal and other water current converters – Part 1: Terminology*

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IEC TS 62600-201, *Marine energy – Wave, tidal and other water current converters – Part 201: Tidal energy resource assessment and characterization*

IEC TS 62600-10, *Marine energy – Wave, tidal and other water current converters – Part 10: Assessment of mooring system for marine energy converters (MECs)*

ISO 2394, *General principles on reliability for structures*

ISO 12473, *General principles of cathodic protection in sea water*

ISO 17776, *Petroleum and natural gas industries – Offshore production installations – Major accident hazard management during the design of new installations*

ISO 19900, *Petroleum and natural gas industries – General requirements for offshore structures*

ISO 19901-1: 2015, *Petroleum and natural gas industries – Specific requirements for offshore structures – Part 1: Metocean design and operating considerations*

ISO 19901-4, *Petroleum and natural gas industries – Specific requirements for offshore structures – Part 4: Geotechnical and foundation design considerations*

ISO 19901-6, *Petroleum and natural gas industries – Specific requirements for offshore structures – Part 6: Marine operations*

ISO 19902, *Petroleum and natural gas industries – Fixed steel offshore structures*

ISO 19903, *Petroleum and natural gas industries – Fixed concrete offshore structures*

ISO 31010, *Risk management – Risk assessment techniques*

DNVGL-OS-C301, *Stability and watertight integrity*

DNVGL-RP-C205, *Environmental conditions and environmental loads*

EUROCOMP, *Structural design of polymer composites*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC TS 62600-1 as well as the following apply.

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

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

4 Symbols and abbreviated terms

For the purposes of this document, the symbols and abbreviated terms given in IEC TS 62600-1 as well as the following apply.

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d	water depth
f	wave spectrum frequency
f_d	material property design value
f_k	material property characteristic value
f_P	wave spectrum peak frequency
f_E	elastic buckling stress
f_y	specified minimum yield stress
F_d	load design value
F_k	load characteristic value
g	gravitational acceleration
h	ice thickness with a 50-year return period
H_1	extreme wave height with a return period of 1 year
H_5	extreme wave height with a return period of 5 years
H_{50}	extreme wave height with a return period of 50 years
H_b	breaking wave height
H_{EWH}	extreme wave height
H_{OWH}	operational wave height
H_{rated}	device rated wave height
H_{m0}	significant wave height
$H_{m0,\ OSS}$	significant wave height of the operational sea state
H_{mn}	significant wave height with a return period of *n* years