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Marine energy – Wave, tidal and other water current converters – Part 202: Early stage development of tidal energy converters – Best practices and recommended procedures for the testing of pre-prototype scale devices

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Part 202: Early stage development of tidal energy converters – Best practices and recommended procedures for the testing of pre-prototype scale devices

FOREWORD

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IEC TS 62600-202 has been prepared by IEC technical committee 114: Marine energy – Wave, tidal and other water current converters. It is a Technical Specification.

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

Draft	Report on voting
114/407/DTS	114/414A/RVDTS

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Specification is English.

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.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

To further develop the tidal energy industry, Stage Gates, best practices and recommended procedures for the testing of pre-prototype scale devices must be well understood. This document is a collaborative effort from technology developers, academic researchers and test facility managers.

The purpose of this document is to provide a structured approach in testing and evaluating Tidal Energy Converters. By following a standardised design path, risk will be reduced and stakeholder confidence increased. Through best practise guidance and applicable methodologies this document will ensure consistent, appropriate and comparable data is collected for the characterization and analysis required in the development of a Tidal Energy Converter. Furthermore, the reporting procedures will ensure that the results can be replicated by others.

The core of this document follows a Stage Gate approach; for each stage the program of work is outlined and supporting information relating to test planning and reporting presented. The specific recommendations are provided in a holistic manner guiding the process with respect to test planning, reporting requirements, data acquisition, test environment characterization, and characterization of both rotor and device (motion) performance. Annexes provide the reader with further information on facility selection and instrumentation.

The overall goal of this document is to accommodate the majority of technology developers and facilitate a coherent and structured approach that will accelerate the tidal energy sector in fulfilling its market potential as a renewable energy contributor. However, it is recognised that this document will not cover every eventuality that may be relevant for all users. Therefore, this document assumes that the user is familiar with the subject matter and has access to, and reviews relevant literature, including the literature cited herein.

NOTE This document presently does not describe testing under wave-current interaction, effects of turbulence on tidal energy converters beyond a basic introduction to some turbulence parameters typically reported, and quantification of uncertainty which is covered in other referenced documents.

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

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1 Scope

This document specifies the development stages of Tidal Energy Converters up to the pre-prototype scale (Stages 1 to 3). It includes the hydraulic laboratory test programs, where environmental conditions are controlled so they can be scheduled, and the first scaled system open-water trials, where combinations of tidal currents, wind and waves occur naturally and the programs are adjusted and flexible to accommodate these conditions. Full-scale prototype (Stages 4 and 5) development is not covered in this document.

This document describes the minimum test programs that form the basis of a structured technology development schedule. For each testing campaign, the prerequisites, goals and minimum test plans are specified. This document addresses:

a) Planning an experimental program, including a design statement, technical drawings, selection of scale and facility based on physical laws, site data and other inputs;

b) Device representation and characterization, including the physical device model, power-take-off components, foundation and mooring arrangements where appropriate;

c) Energy resource and environment characterization, concerning either the tank testing facility or the open-water deployment site, depending on the stage of development;

d) Specification of explicit test goals, including power conversion performance and device loads.

Guidance on the measurement sensors and data acquisition packages is included, but not dictated. Providing that the specified parameters and tolerances are adhered to, the device developer is free to select the components and instrumentation.

An important element of testing is to define the limitations and accuracy of the raw data and, more specifically, the results and conclusions drawn from the trials. A methodology of addressing these limitations is presented with each goal so the plan always produces defendable results of defined uncertainty.

It is anticipated that this document will serve a wide audience of tidal energy stakeholders, including device developers and their technical advisors; government agencies and funding councils; test centers and certification bodies; private investors; and environmental regulators and non-governmental organizations.

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

IEC TS 62600-101, *Marine energy – Wave, tidal and other water current converters – Part 101: Wave energy resource assessment and characterization*

IEC TS 62600-103:2018, *Marine energy – Wave, tidal and other water current converters – Part 103: Guidelines for the early stage development of wave energy converters – Best practices and recommended procedures for the testing of pre-prototype devices*

IEC TS 62600-200, *Marine energy – Wave, tidal and other water current converters – Part 200: Electricity producing tidal energy converters – Power performance assessment*

IEC TS 62600-201:2015, *Marine energy – Wave, tidal and other water current converters – Part 201: Tidal energy resource assessment and characterization*

IEC TS 62600-300:2019 *Marine energy – Wave, tidal and other water current converters – Part 300: Electricity producing river energy converters – Power performance assessment*

ISO/IEC Guide 98-3, *Uncertainty of measurement – Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

ISO/IEC 17025:2017, *General requirements for the competence of testing and calibration laboratories*