IEC TS 62600-102

Edition 1.0 2016-08

TECHNICAL SPECIFICATION

colour inside

Marine energy – Wave, tidal and other water current converters – Part 102: Wave energy converter power performance assessment at a second location using measured assessment data

INTERNATIONAL ELECTROTECHNICAL COMMISSION

ICS 27.140

ISBN 978-2-8322-3530-0

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

_____

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

Part 102: Wave energy converter power performance assessment at a second location using measured assessment data

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.
2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.
3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.
4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.
5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.
6) All users should ensure that they have the latest edition of this publication.
7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.
8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.
9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

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 62600-102, which is a technical specification, has been prepared by IEC technical committee 114: Marine energy – Wave, tidal and other water current converters.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
114/179/DTS	114/187A/RVC

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.

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

- 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 technical specification, IEC TS 62600-102, provides a uniform methodology for estimating and reporting the performance of a Wave Energy Converter (WEC) at a prospective new deployment location. The performance estimation methodology is based primarily on observations and measurement results gathered during field deployment of the WEC at a primary location (as per IEC TS 62600-100) with different metocean conditions compared to the prospective new location. Further, it is possible that the WEC design will incorporate changes to accommodate the new site conditions. To assess the performance, inclusion of additional information based on validated numerical and physical models is specified. In this technical specification the completed field deployment location is referred to as “Location 1” and the prospective deployment location is referred to as “Location 2.”

The specification provides a methodology for arriving at the mean annual energy production (MAEP) for the WEC at Location 2. Other Technical Specifications in this series (IEC TS 62600) are drawn upon to provide the wave resource and WEC performance information needed to enable this analysis. The methodology involves:

- assessment of the wave resource at Location 1 and Location 2,
- characterization of the WEC performance at Location 1,
- assessment and compensation for the impact of discrepancies in the metocean conditions between Location 1 and Location 2 on the WEC performance characterization,
- assessment of the impact of changes to the WEC configuration between Location 1 and Location 2 on the WEC performance characterization,
- complementing the performance observations from Location 1 with fit, experimental or numerically modelled data,
- estimating the MAEP based on the composite performance characterization of the WEC.

This technical specification provides:

a) guidance on the use of observations from Location 1,

b) methods for assessing and reporting the validity of numerical and physical models,

c) limits on the permissible changes to the WEC between Locations 1 and 2,

d) limits on the use of data fitting techniques, and

e) requirements for reporting.

The wave power industry is at an early stage of development. There is little practical experience with field-scale WECs deployment. Because of this, the present document is designated as a technical specification and will be subject to change as more data is collected and experience with wave energy converters develops. This Technical Specification, when used in conjunction with other Technical Specifications in this series (IEC TS 62600), is intended for several types of users, including, but not limited to, the following:

- Project developers – income, return on investment
- Device developers – performance of device
- Utilities/investors – reliability/predictability of supply, return on investment
- Policy-makers/Planners – usage of seascape, optimisation of resource, power supply issues
- Consultants to produce resource data/due diligence – compatible/readable data format

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

Part 102: Wave energy converter power performance assessment at a second location using measured assessment data

1 Scope

Wave Energy Converters (WEC) need to be designed to operate efficiently at different locations. Systematic methods should be used to evaluate the power performance of a WEC at a second location (hereinafter Location 2) based on power performance assessment at a first location (hereinafter Location 1). The degree of similarity of the measured WEC (WEC 1) and the metocean conditions at Location 1 to the secondary WEC (WEC 2) at Location 2 determine the methodology and the applicability of this technical specification.

This part of IEC 62600, which is a Technical Specification, describes the required methods and the required conditions to determine the power performance of the WEC 2 in Location 2, possibly at a different scale and with configuration changes to accommodate the new site conditions, in all cases based on measured power performance of WEC 1 in Location 1. This technical specification allows for assessment at Location 1 or Location 2 based on limited/incomplete data material, as long as this is accompanied by a validated numerical model or physical model and assessment of the uncertainty involved. Another key element is transparency in the assessment.

This technical specification includes:

a) Specification of data requirements needed from the original measurements at Location 1 including an assessment of the uncertainty involved (if based on limited/incomplete data material) in addition to those specified in IEC TS 62600-100 and IEC TS 62600-101.
b) Limitation on the changes that are allowed to the WEC and the specification of the location.
c) Wave data required at Location 2, as a minimum the requirements found in IEC TS 62600-101.
d) Development of the power matrix at Location 2.
e) Validation of the power matrix at Location 2.
f) Assessment of uncertainties in the derived performance parameters at Location 2.
g) Requirements for the allowable power performance transfer by geometric, kinematic and dynamic similarity.
h) Requirements for the allowable incorporation of additional empirical model data.
i) Requirements for the allowable incorporation of additional numerical model data.

The technical specification does not cover the following items:

j) The original data measurement at Location 1 (see IEC TS 62600-100).
k) Environmental concerns.
l) Operation and maintenance.

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: Terminology*

IEC TS 62600-100, *Marine energy – Wave, tidal and other water current converters – Part 100: Electricity producing wave energy converters – Power performance assessment*

IEC TS 62600-101:2015, *Marine energy – Wave, tidal and other water current converters – Part 101: Wave energy resource assessment and characterization*

International Towing Tank Conference (ITTC), *Recommended Guidelines 7.5-02-07-03.7, Wave Energy Converter Model Test Experiments*