

TECHNICAL SPECIFICATION



**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**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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CONTENTS

FOREWORD.....	6
INTRODUCTION.....	8
1 Scope.....	9
2 Normative references	9
3 Terms, definitions and acronyms	10
3.1 Terms and definitions.....	10
3.2 Acronyms.....	12
4 Staged development approach	12
4.1 General.....	12
4.2 Stage gates	13
4.2.1 General	13
4.2.2 Criteria	13
4.3 Stage 1.....	14
4.3.1 Scope	14
4.3.2 Stage Gate 1	15
4.4 Stage 2.....	15
4.4.1 Scope	15
4.4.2 Stage Gate 2	16
4.5 Stage 3.....	16
4.5.1 Scope	16
4.5.2 Stage Gate 3	17
5 Test planning.....	17
5.1 WEC similitudes.....	17
5.1.1 General	17
5.1.2 Power conversion chain (PCC) similitude.....	17
5.2 Design statement.....	18
5.3 Facility selection and outline plan	19
5.3.1 General	19
5.3.2 Stages 1 and 2	20
5.3.3 Stage 3.....	21
5.4 Physical model considerations	22
5.4.1 Stage 1.....	22
5.4.2 Stage 2.....	22
5.4.3 Stage 3.....	22
6 Reporting and presentation.....	23
6.1 Reporting of test conditions and goals	23
6.2 Presentation of results	23
6.2.1 General	23
6.2.2 Wave parameters	23
6.2.3 Response amplitude operators (RAOs) curves.....	24
6.2.4 Scatter diagrams	24
6.2.5 Alternative iso-variable curves.....	25
6.3 Presentation of performance indicators	25
6.3.1 General	25
6.3.2 Presentation performance indicators in regular waves	25
6.3.3 Presentation performance indicators in irregular long-crested wave.....	26

6.3.4	Presentation of performance indicators in irregular short-crested waves	27
7	Testing environment characterisation	27
7.1	General.....	27
7.2	Wave tank characterisation (Stages 1 and 2)	27
7.3	Trial site characterisation (Stage 3)	29
7.4	Wave characterisation.....	29
7.4.1	General	29
7.4.2	Laboratory regular waves	29
7.4.3	Laboratory irregular long-crested waves	29
7.4.4	Laboratory irregular short-crested waves	29
7.4.5	Sea trials	29
8	Data acquisition.....	30
8.1	Signal conditioning.....	30
8.2	Sample rate	31
8.3	Analogue to digital conversion and DAQ system	31
8.4	Frequency response	31
8.5	Data synchronisation	31
8.6	Data recording	32
8.7	Recording of supplementary test data	32
8.8	Calibration factors.....	32
8.9	Instrument response functions	32
8.10	Health monitoring and verification of signals	32
8.11	Special data acquisition requirements for Stage 3 sea trials.....	33
9	Power performance	33
9.1	Testing goals	33
9.2	WEC and mooring similitude	33
9.3	Power conversion chain similitude	34
9.3.1	General	34
9.3.2	Stage 1.....	35
9.3.3	Stage 2.....	35
9.3.4	Stage 3.....	35
9.4	Signal measurement	36
9.5	Calibration and setup	36
9.6	Wave parameters.....	37
9.6.1	Stage 1 and 2	37
9.6.2	Stage 3.....	38
9.7	Performance indicators	38
10	Kinematics and dynamics in operational environments	38
10.1	Testing goals	38
10.2	Testing similitude.....	39
10.3	Signal measurement	40
10.4	Calibration and setup	42
10.5	Wave parameters.....	43
10.5.1	Stages 1 and 2	43
10.5.2	Stage 3.....	44
10.6	Performance indicators	44
11	Kinematics and dynamics in survival environments.....	45
11.1	Testing goals	45

11.2	Testing similitude	45
11.3	Signal measurements	46
11.4	Calibration and setup	46
11.5	Wave parameters	47
11.5.1	Stage 1	47
11.5.2	Stage 2	47
11.5.3	Stage 3	48
11.6	Performance indicators	48
Annex A	(informative) Stage Gates	50
A.1	Overview	50
A.2	Design statements	50
A.3	Stage Gate criteria	50
A.4	Uncertainty factors	51
A.5	Third party review	52
Annex B	(informative) Example test plan	53
Annex C	(informative) Physical modelling guidance	54
C.1	Similitude	54
C.1.1	General	54
C.1.2	Geometric similitude	54
C.1.3	Structural similitude	54
C.1.4	Hydrodynamic similitude	54
C.2	Model instrumentation and data acquisition	56
C.2.1	General	56
C.2.2	Water surface elevation	56
C.2.3	PTO	56
C.2.4	Device and mooring loads	56
C.3	Recommendations on calibrations	57
Annex D	(informative) Uncertainty	58
Bibliography	60
Figure 1	– Staged development approach	13
Table 1	– Presentation of performance indicators (regular waves)	26
Table 2	– Presentation of performance indicators (irregular long-crested waves)	26
Table 3	– Presentation of performance indicators (irregular short-crested waves)	27
Table 4	– Environmental measurements	28
Table 5	– Environmental performance indicators	30
Table 6	– Power performance testing similitude	34
Table 7	– Power conversion chain (PCC) representation	34
Table 8	– Power performance signal measurements	36
Table 9	– Power performance calibrations	37
Table 10	– Power performance wave parameters	37
Table 11	– Kinematics and dynamics similitude requirements (operational environments)	40
Table 12	– Kinematic signal measurements (operational environments)	41
Table 13	– Dynamic signal measurements (operational environments)	42

Table 14 – Calibration for kinematic and dynamic testing (operational environments)	43
Table 15 – Wave parameters for kinematics and dynamics testing (operational conditions)	44
Table 16 – Kinematics and dynamics similitude requirements (survival environments)	46
Table C.1 – Scale laws	55
Table C.2 – Sensor calibrations	57
Table D.1 – Scale example	59

INTERNATIONAL ELECTROTECHNICAL COMMISSION

**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**

FOREWORD

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- 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 62600-103, 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
114/233/DTS	114/259A/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 document 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 document will remain unchanged until the stability date indicated on the IEC website under "<http://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.

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

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INTRODUCTION

Developing wave energy converters (WECs) will always be a demanding engineering process. It is important, therefore, to follow a design path that will minimise the risks encountered along a route of increasing technical complexity and fiscal commitment. This Technical Specification (TS) presents a guide that addresses these issues, the approach being based on a proven methodology adapted from other technology areas, especially NASA and similar heavy maritime engineering industries.

The scope of the work is defined in Clause 1. Normative references and definitions of important terms are introduced in Clauses 2 and 3 respectively. The core of the document then follows a twin-track approach, relying on:

- a) a structured or staged development approach outlined in Clause 4, and
- b) a set of model specific and goal orientated Clauses 9 to 11 ensuring that targets are clearly defined and attained with confidence. Testing specific requirements such as test planning (Clause 5), reporting and presentation (Clause 6), characterisation of the surrounding wave environment (Clause 7), and data acquisition (Clause 8) are also included.

The structured development schedule makes use of the ability to accurately scale WECs such that sub-prototype size physical models can be used to investigate the relevant device parameters and design variables at an appropriate dimension and associated budget.

The parallel development of mathematical models describing a WEC's behaviour and performance is encouraged, but the procedure is not included in the document.

This document is quite exacting in terms of both the approach and requirements for the development of WECs since it takes a professional approach to the process. Following these guidelines will not guarantee success, but not following them will be a recipe for lost time and opportunities.

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

1 Scope

This part of IEC TS 62600 is concerned with the sub-prototype scale development of WECs. It includes the wave tank test programmes, where wave conditions are controlled so they can be scheduled, and the first large-scale sea trials, where sea states occur naturally and the programmes are adjusted and flexible to accommodate the conditions. A full-scale prototype test schedule is not covered in this document. Bench tests of PTO (power take-off) equipment are also not covered in this document.

This document describes the minimum test programmes 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:

- Planning an experimental programme, including a design statement, technical drawings, facility selection, site data and other inputs as specified in Clause 5.
- Device characterisation, including the physical device model, PTO components and mooring arrangements where appropriate.
- Environment characterisation, concerning either the tank testing facility or the sea deployment site, depending on the stage of development.
- Specification of specific test goals, including power conversion performance, device motions, device loads and device survival.

Guidance on the measurement sensors and data acquisition packages is included but not dictated. Providing that the specified parameters and tolerances are adhered to, selection of the components and instrumentation can be at the device developer's discretion.

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

This document intends to serve a wide audience of wave energy stakeholders, including device developers and their technical advisors; government agencies and funding councils; test centres and certification bodies; private investors; and environmental regulators and NGOs.

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 62600-2, *Marine energy – Wave, tidal and other water current converters – Part 2: Design requirements for marine energy systems*

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