
**Ships and marine technology —
Aquatic nuisance species — Methods
for evaluating the performance of
compliance monitoring devices for
ballast water discharges**



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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 document 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).

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*.

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.

Introduction

A compliance monitoring device (CMD) is an instrument intended to analyse samples of ballast water, to estimate whether the concentration of living or viable organisms present in the sample exceeds, or is at risk of exceeding, the regulated limit [i.e. the discharge standard, (DS)]. Typically, CMDs are designed for use in shipboard and field locations to provide results rapidly and with less effort relative to complex analyses. CMDs are instruments that are relatively new to their application in ballast water testing. They can rely upon standard optical, chemical, or physical measurements, but these technologies are deployed in unique configurations. They can be packaged in a rugged, transportable housing, or installed as shipboard equipment. A CMD may operate along a spectrum of water types with diverse assemblages of organisms. As intended, CMDs provide critical information to vessel inspectors, ballast water management system (BWMS) commissioning test teams, Port State Control Officers, ship owners, among others.

This document was developed in response to the need for a standardized approach to evaluate the performance of CMDs. This evaluation includes:

- laboratory-based tests using prepared sample water amended with cultured organisms as well as dissolved and particulate materials;
- laboratory-based tests using samples of natural assemblages of organisms, experimentally manipulated to achieve target concentrations of living or viable organisms (but without manipulation of dissolved and particulate materials);

NOTE 1 It is recognized that the end user can require laboratory testing with ambient organisms instead of, or in addition to, cultured organisms. Additionally, the end user can require that both types of laboratory-based tests are conducted using water that is treated by a BWMS or has undergone a simulated ballast water treatment, instead of, or in addition to, un-treated water.

- field-based tests using samples of water treated with a BWMS collected aboard a ship.

This standardized approach defines a general test procedure and minimum set of trials to evaluate the performance of a CMD. The key evaluation metrics are accuracy (hereafter, “trueness” - the agreement to a reference method), precision, and reliability. While a CMD may report numerical values or estimates of organism concentrations, trueness and precision are determined based upon the agreement between the CMD and reference method on the sample disposition (i.e. whether the sample meets or exceeds the DS).

NOTE 2 This approach is not appropriate to evaluate methods or devices intended to be used as an alternate to the reference method, i.e. with precise, numerical measurements across a wide range of organism concentrations.

The test methods are adaptable, such that additional factors which are deemed important — e.g. interferences, organism types, or water characteristics — may be addressed experimentally and included in the set of performance metrics. This flexibility allows end-users to supplement these minimal test requirements to examine additional characteristics, such as CMD performance under different types of BWMS treatments.

Ships and marine technology — Aquatic nuisance species — Methods for evaluating the performance of compliance monitoring devices for ballast water discharges

1 Scope

This document specifies methods to evaluate the performance of a specific class of analytical instruments, known as compliance monitoring devices (CMDs). These instruments are designed and intended to examine ballast water to determine whether a sample meets or exceeds limits for the concentration of living or viable organisms. These limits include those specified by the International Maritime Organization (IMO) Regulation D-2 in the International Convention for the Control and Management of Ships' Ballast Water and Sediments^[4] or other discharge standards (DS) adopted by national or regional authorities.

The test methods measure the agreement between the CMD and a reference method to calculate trueness and precision. Both trueness and precision consider only simple, categorical outcomes (e.g. “meets” or “exceeds” the DS). The performance metric reliability is quantified by the frequency of instances when the CMD is not available or is not operating as expected.

The set of tests and trials is based upon the CMD manufacturer claims, such as the DS group(s) targeted by the CMD, and known limitations, including those based upon the salinity of the sample water.

NOTE Additional tests and trials, if required by the end-user, can follow this general test method. Guidance on determining experimental power is found in 7.5. This document provides guidance for customizing the tests to evaluate the claims of the manufacturer or to address optional factors of interest to the end-users.

This document does not set or recommend success criteria of any performance metric, as these are appropriately defined by the end-users.

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 11711-1:2019, *Ships and marine technology — Aquatic nuisance species — Part 1: Ballast water discharge sample port*

ISO 11711-2:2022, *Ships and marine technology — Aquatic nuisance species — Part 2: Ballast water sample collection and handling*

ISO 21748, *Guidance for the use of repeatability, reproducibility and trueness estimates in measurement uncertainty evaluation*

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

ASTM D1141-98, *Standard Practice for Preparation of Substitute Ocean Water*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.