International Standard

ISO 6319

Ships and marine technology — Marine environment protection — Conducting and documenting in-water cleaning of biofouling on ships

First edition
2026-03

Reference number
ISO 6319:2026(en)

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Published in Switzerland

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 2, *Marine environment protection*.

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

Preventing and removing biofouling on hulls of ships limits the introduction and spread of invasive aquatic species (IAS). Indeed, biofouling on ships is recognized as an important potential sub-vector to translocate IAS.[1]-[4] Such translocation threatens coastal environments by disrupting ecological systems, which can also negatively affect fisheries, aquaculture and tourism. Additionally, biofouling increases frictional drag on hulls and decreases the propeller efficiency, in turn increasing fuel consumption, greenhouse gas (GHG) emissions and air pollution from ships. Not only is biofouling estimated to increase a ship's fuel consumption by on average 9 %,[5] this added fuel consumption costs the shipping industry billions of USD.[6] Therefore, improving biofouling management across the global shipping fleet will have considerable benefits, both from an environmental and economic standpoint.

The most common way of controlling hull biofouling is applying coatings containing biocides, however, if the anti-fouling system (AFS) fails or if the ship's operational profile or environmental conditions deviate from the coating specification, removing biofouling by cleaning the hull can become necessary. Traditionally, service providers have offered in-water cleaning (IWC) services using brush-based IWC systems operated by human divers, with considerable variation among systems. More recently, IWC remotely operated vehicles (ROVs) using brush or water-jetting technology and autonomous systems as well as crew-operated systems have become available for in-port and in-transit cleaning. IWC may be conducted with or without capturing the materials liberated from the ship surface.

IWC can help to protect the environment from both IAS and harmful emissions by reducing the number of heavily fouled ships in international trade that may spread IAS during operations and idle periods. However, an inherent risk of IWC is that the cleaning operation itself may result in the release of IAS and contaminants into the local environment. The aim of this document is to provide best practices and requirements to ensure that IWC operations not only effectively achieve a clean hull, but simultaneously ensure that these measures are conducted safely, meaning that they protect human life and the environment. Environmentally sound IWC operations strive for little to no impact to marine ecosystems and avoid damage to ships' AFCs to facilitate their optimal performance.

This document aligns with and supplements the International Maritime Organization's (IMO) 2023 Guidelines for the control and management of ships' biofouling to minimize the transfer of invasive aquatic species, henceforth referred to as the IMO 2023 Biofouling Guidelines.[7] This document specifies that cleaning of microfouling (biofouling rating 1 or less) does not require the use of a capture system, while the cleaning of macrofouling (biofouling rating 2 or higher) requires the use of a capture system. At the time of publication of this document, comprehensive biofouling management policies are not widespread, and the few jurisdictions that have such policies use varying procedures.[8] This document aims to provide a level playing field by contributing to globally harmonized practices. By specifying a methodology for safe and sustainable IWC processes, procedures are provided to ports and other relevant authorities facing requests for IWC when a ship is in port or at anchorage. Furthermore, this information aims to assure shipowners that cleaning services are performed according to a set of standard practices regardless of the location. This document also informs a range of other stakeholders including ship biofouling IWC service providers, inspection service providers, IWC equipment manufacturers and coating manufacturers.

Through a stepwise approach, this document describes the IWC process chronologically. First, all relevant, preparatory aspects — such as general preparations, the assessment of the hull prior to the IWC operation, and preparations associated with any single cleaning event — are considered, then the cleaning operation itself is discussed, which is followed by considerations of post-cleaning processes and reporting. Questions of why and when cleaning is necessary, including the establishment of proactive or reactive cleaning regimes, are beyond the scope of this document. Rather, this document focuses on the questions of how the IWC preparations and operations should take place, and how they should be documented.

Ships and marine technology — Marine environment protection — Conducting and documenting in-water cleaning of biofouling on ships

1 Scope

This document provides requirements and best practices for planning, conducting and documenting in-water cleaning (IWC) operations safely, efficiently and in an environmentally sound manner. Additionally, this document provides requirements and best practices for reporting on the effectiveness of IWC operations.

This document addresses all forms of IWC of external submerged surfaces, which are hull and niche areas, all types and levels of biofouling, which means biofilms, microfouling and macrofouling, conducted both with or without capture. It does not address internal piping.

The document has been established to inform ports, regulatory agencies, ship biofouling IWC service providers, inspection service providers, IWC equipment manufacturers, coating manufacturers, shipowners, ship managers, ship operators and other relevant stakeholders.

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 20679, *Ships and marine technology — Marine environment protection — Testing of ship biofouling in-water cleaning systems*

3 Terms and definitions

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

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.1
antifouling coating
AFC
surface coating designed to prevent, repel or facilitate the detachment of *biofouling* (3.3) from *hull* (3.7) and *niche areas* (3.13) that are typically or occasionally submerged

Note 1 to entry: AFC includes both biocidal and non-biocidal coatings.

3.2
antifouling system
AFS
coating, paint, surface treatment, surface or device that is used on a *ship* (3.18) to control or prevent attachment of unwanted organisms

3.3
biofouling
accumulation of aquatic organisms such as microorganisms, plants and animals on surfaces and structures immersed in or exposed to the aquatic environment

Note 1 to entry: Biofouling can include pathogens.

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.4
capture
process of containment, collection and removal of *biofouling* (3.3) material and *waste substances* (3.21) detached from submerged surfaces during *in-water cleaning* (3.9) or in dry dock

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7] modified— "in-water cleaning" replaced "cleaning in water".]

3.5
compatibility
state in which an *in-water cleaning* (3.9) system can operate on an *antifouling coating* (3.1) without causing damage that can either reduce its performance, reduce its lifetime, or both, which can contribute to a higher risk of *biofouling* (3.3)

3.6
biofouling rating
allocation of a number for a defined inspection area of the ship surface based on a visual assessment, including description of *biofouling* (3.3) present and percentage of *macrofouling* (3.10) coverage

3.7
hull
underwater area of a *ship* (3.18), including *niche areas* (3.13)

3.8
invasive aquatic species
non-native species to a particular ecosystem which can pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.9
in-water cleaning
IWC
removal of *biofouling* (3.3) from a ship's *hull* (3.7) including *niche areas* (3.13) while in the water

3.10
macrofouling
biofouling (3.3) caused by the attachment and subsequent growth of visible plants and animals on structures and ships exposed to water

Note 1 to entry: Macrofouling comprises large, distinct multicellular individual or colonial organisms visible to the human eye such as barnacles, tubeworms, mussels, fronds/filaments of algae, bryozoans, sea squirts and other large attached, encrusting or mobile organisms.

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.11
microfouling
biofouling (3.3) caused by bacteria, fungi, microalgae, protozoans and other microscopic organisms, that creates a biofilm also called a slime layer

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.12
multiple events approval
fundamental approvals from ports and other relevant authorities allowing service providers to conduct multiple *in-water cleaning* (3.9) operations over a time period

Note 1 to entry: Commonly called licence or permit.

3.13
niche areas
subset of the submerged surface areas on a *ship* (3.18) that may be more susceptible to *biofouling* (3.3) than the main *hull* (3.7) due to structural complexity, different or variable hydrodynamic forces, susceptibility to *antifouling coating* (3.1) wear or damage, inadequate or no protection by an *antifouling system* (3.2)

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.14
operator
actor who operates the cleaning or inspection unit

3.15
proactive cleaning
periodic removal of *microfouling* (3.11) on ships' hulls to prevent or minimize attachment of *macrofouling* (3.10)

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.16
reactive cleaning
corrective action during which *biofouling* (3.3) is removed from a ship's *hull* (3.7)

3.17
service provider
person or organization that supplies the cleaning service

Note 1 to entry: In some cases, this can be the same organization as the *technology provider* (3.20).

3.18
ship
vessel of any type whatsoever operating in the aquatic environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft, fixed or floating platforms, floating storage units (FSUs) and floating production storage and off-loading units (FPSOs)

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]

3.19
single event approval
approvals from ports and other relevant authorities to *service providers* (3.17) for conducting a single *in-water cleaning* (3.9) event

3.20
technology provider
person or organization that supplies the *in-water cleaning* (3.9) technology to a *service provider* (3.17)

Note 1 to entry: In some cases, this can be the same organization as the *service provider* (3.17).

3.21
waste substances
dissolved and particulate materials that may be released or produced during cleaning or maintenance, and can include biocides, metals, organic substances, removed *biofouling* (3.3), pigments, microplastics or other contaminants that could have a negative impact on the environment

[SOURCE: IMO 2023 Biofouling Guidelines, 2.1[7]]