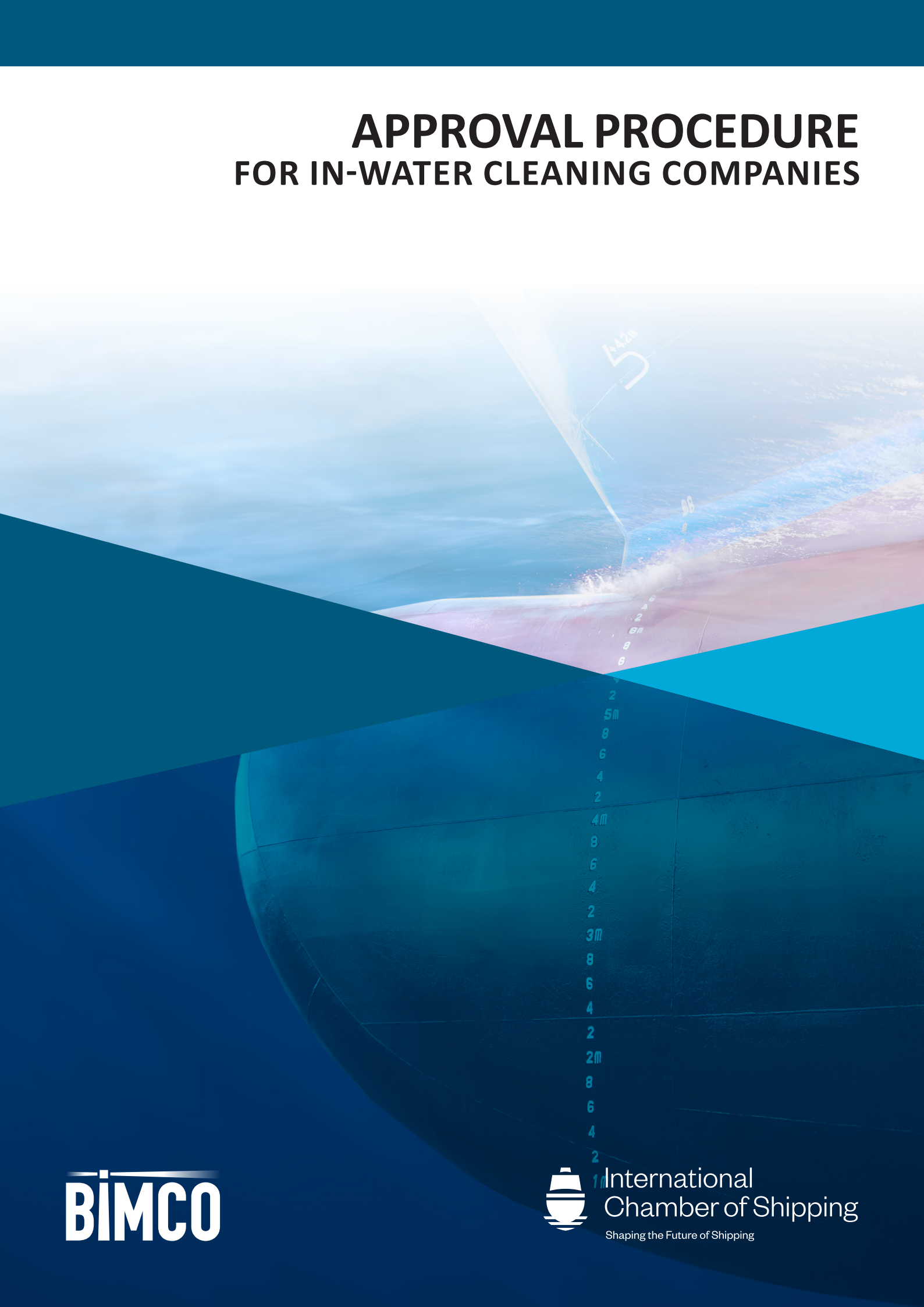
# APPROVAL PROCEDURE
## FOR IN-WATER CLEANING COMPANIES



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International Chamber of Shipping
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# Approval procedure for in-water cleaning companies

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# Introduction

The objective of this procedure is to set minimum requirements for approval of cleaning companies for various types of operations. The *Approval procedure for in-water cleaning companies (Approval procedure)* is one of two separate documents that outline performance-based requirements for in-water cleaning of a ship's hull, propeller and niche areas with the capture of the materials that are removed during the process:

- *Approval procedure for in-water cleaning companies (Approval procedure)*
- *Industry standard on in-water cleaning with capture (Industry standard)*.

The *Approval procedure* ensures:

1. that the cleaning system and process are tested, audited and approved in accordance with the *Approval procedure* by an independent approval body
2. that after approval, the quality management systems of the cleaning companies are subject to periodic internal audits, and external audits are to be carried out by the Approval Body at regular intervals
3. that ships, AFS manufacturers and cleaning companies will use the requirements in the *Industry standard on in-water cleaning with capture* for planning, conducting, and reporting on the cleaning itself
4. that testing results can be utilised to apply for local permissions from port and other relevant authorities to operate within their jurisdictions.

The *Approval procedure* has been written by an industry working group consisting of AFS manufacturers, in-water cleaners, shipowners, ports, international organisations and authorities. The following were represented in the work: Akzo Nobel, BIMCO, C-Leanship, CMA Ships, DG Diving Group, Fleet Cleaner, Hapag-Lloyd AG, Hempel, HullWiper, International Association of Classification Societies, International Chamber of Shipping, Minerva Marine, Portland Port (UK), Port of Rotterdam and PPG Coatings.

A reference group has been invited twice to comment on the *Approval procedure* and it has been updated accordingly. Members of the reference group are: Chevron Shipping, CleanSubSea Ltd, DHI, NACE International and, PML Applications Ltd.

# Contents

# 1 Bibliography


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# 2 Definitions

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| **Accredited laboratory** | A laboratory verified to an appropriate level of expertise, and whose quality management system can perform specific test methods accredited to internationally accepted standards or standards recognized by the government of the country, in which the laboratory is located. |
| **Anti-fouling paint coating system (AFC)** | The combination of all component coatings, surface treatments (including primer, sealer, anti-corrosive and anti-fouling coatings) or other surface treatments, used on a ship to control or prevent attachment of unwanted aquatic organisms. |
| **Anti-fouling system (AFS)** | A coating, paint, surface treatment, surface, or device that is used on a ship to control or prevent attachment of unwanted organisms. |
| **Approval Body** | An organisation which audits the cleaning company (including its subsidiaries and sub-contractors) in accordance with the requirements of the *Industry standard on in-water cleaning with capture* and the *Approval procedure for in-water cleaning companies* and issues a certificate of approval. |
| **Background sample** | A sample of water from the place or in the vicinity where cleaning takes place but that is not impacted in any way by the cleaning activity. The sample can be collected before, during and/or after a designated test cleaning event. |
| **Biocide** | A chemical substance incorporated into anti-fouling coatings to prevent settlement or survival of aquatic organisms. |
| **Biofouling** | The accumulation of aquatic organisms such as micro-organisms, algae, and animals on surfaces and structures immersed in or exposed to the aquatic environment. Biofouling types can include soft biofouling (soft microfouling and soft macrofouling) and hard calcareous biofouling (see below). |
| **Cables and hoses** | These connect the cleaning unit to the unit ashore or on a barge. The hoses may carry water or other means of transporting the captured material from the cleaning unit to the separation and/or treatment unit. Cables are used to power the cleaning unit. |
| **Cleaning company** | A person or company who provides services in reference to underwater hull cleaning which may also include services such as in-water inspection. |
| **Cleaning inspection** | An inspection of the area to be cleaned prior to the actual cleaning activity or just the cleaning. |
| **Cleaning unit** | The cleaning device interacts with the ship's hull and other areas to remove and capture the material attached to the surface. This unit may be operated by a diver or by a remotely operated vehicle (ROV) pilot. |
| **Continuous, time-integrated water sample** | A representative sample taken continuously during the designated cleaning period. This approach integrates concentrations of water quality parameters over the testing period into one single sample. |

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| **Control unit** | This unit houses the controls such as remote control of ROVs, communication devices with divers, camera monitors etc. |
| **Diver** | A person who is qualified to dive underwater safely using self-contained breathing apparatus or other similar systems. He/she is trained in one of the diving standards recognized by relevant authorities and has working knowledge on the use of tools normally used in in-water cleaning/visual inspection as well as emergency escape training. |
| **Hard biofouling** | Often referred to as hard calcareous biofouling, which consists of organisms visible to the human eye. It can include barnacles, mussels tube worms and bryozoans etc. |
| **Independent Testing Organisation** | A testing facility with appropriate quality assurance and quality control (QA/QC) in place, that is not owned or affiliated with the cleaning company, manufacturer or vendor of any equipment, by the manufacturer or supplier of the major components of that equipment for. |
| **Invasive aquatic species** | A species which may pose threats to human, animal and plant life, economic and cultural activities and the aquatic environment. |
| **In-water cleaning** | The physical removal of biofouling from a ship while in the water. |
| **Manufacturer** | A company who manufactures the equipment utilized in the in-water cleaning process (eg hull cleaning equipment, water treatment systems etc). |
| **Macrofouling** | Large, distinct multicellular organisms visible to the human eye such as barnacles, tube worms, or fronds of algae. |
| **Marine growth prevention system (MGPS)** | An AFS used for the prevention of biofouling accumulation in internal seawater cooling systems and sea chests and can include the use of anodes, injection systems, electrolysis, ultrasound or other methods. |
| **Materials** | The solid substances captured during the cleaning of the ship. This may include biofouling (macro and micro) growth, paint flakes and the matters contained within, such as biocides, heavy metals, silicon substances etc. |
| **Niche areas** | Areas on a ship that may be more susceptible to biofouling due to different hydrodynamic forces, coating system wear or damage, or being inadequately, painted, eg, sea chests, bow thrusters, propellers and propeller shafts, rope guards, inlet gratings, dry-dock support strips, rudder pintle areas etc. |
| **Out of water cleaning** | The cleaning of the hull areas when the ship is out of water, for example, in a dry-dock. |
| **Proactive cleaning** | Cleaning carried out at pre-planned intervals regardless of ship's performance. |
| **Remotely operated vehicle (ROV)** | A vehicle that may be used as part of a cleaning unit, which is and navigated remotely from the surface to inspect and/or clean submerged hull and niche areas. |
| **Responsive cleaning** | Cleaning initiated by a marked reduction in the ship's performance or when an inspection shows that cleaning is needed. |

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| **Sea water effluent** | The water that has been filtered, and/or treated to specifications mentioned in the *Industry standard* and is ready to be discharged back into the environment. |
| **Sea water influent** | The water that is captured into the cleaning system during the cleaning process. This water may still contain biofouling, paint flakes and other associated solids. |
| **Separation performance** | The effectiveness of separating solid materials from water during in water cleaning. The separation unit used in connection with in-water cleaning shall be able to remove particles of solid materials that are larger than a defined limit. |
| **Separation unit** | Consists of the equipment that uses physical processes to remove solid material (macrofouling, coating chips, etc) from water, including but not limited to settling tanks, filtration, and centrifugation. Separation and treatment stages may be combined into one unit. |
| **Ship** | A watercraft of any type whatsoever operating in the aquatic environment and includes hydrofoil boats, air-cushion vehicles, submersibles, floating craft, fixed or floating platforms (excluding licensed aquaculture assets), floating storage units (FSUs) and floating production storage and off-loading units (FPSOs). |
| **Single test cleaning event** | A test cleaning event starts with the onsite safety preparation of the in-water cleaning and lasts until the cleaning and associated equipment have been returned to its original state. |
| **SOP (Standard Operating Procedure)** | A set of step-by-step instructions compiled by a cleaning company to help workers carry out routine operations. |
| **Storage unit** | Captured material is pumped directly into tanks, a barge, etc. The captured material and seawater in storage can be directly disposed of appropriately or subsequently processed through separation and/or treatment units. |
| **Subcontractor** | A person or company providing services to the cleaning company. |
| **Subsidiary** | A company partly or wholly owned by the cleaning company. |
| **Treatment unit** | Treatment consists of a physical, chemical or biological addition(s) to alter or remove solid and/or dissolved material. They can include but are not limited to flocculation, metals sorbent media, UV and biocides. Treatment and separation stages may be combined into one unit. |
| **Total suspended solids (TSS)** | Solids in water that can be trapped by a filter. |

# 3 In-water Cleaning Systems

This *Approval procedure* is specific to in-water cleaning service providers that remove and capture macrofouling organisms (ie, visible to the human eye, as defined in IMO Guidelines 2011) which have colonized the immersed surfaces of ships. Cleaning systems comprise a series of units, which manage the cleaning process (figure 1).


*Figure 1: Schematic diagram of a cleaning system outlining the various component parts that are common to such systems.*

The cleaning system is made up of one or more of the modules shown on Figure 1 and the order of operation in which these components are placed will vary between systems. The cleaning system can be self-contained on a waterborne platform or contained from a jetty or pier.

The cleaning unit may be either diver operated or remotely operated using a remotely operated vehicle (ROV). The cleaning unit is used to clean the hull, propeller and/or niche areas. The cleaning unit removes and captures materials and is attached to the separation and/or treatment unit by hoses.

Some cleaning systems pump the captured material and seawater into a storage unit (eg, a barge or mono-hull tanker). The captured material and seawater in the storage unit will subsequently be pumped to the separation and/or treatment unit.

The hoses provide means of transporting the captured material and seawater from the cleaning unit to the separation and treatment unit or a storage unit. Cables are used for communication purposes and to power and control the ROV or other cleaning technology.

The separation unit houses the equipment that removes the captured material from the seawater influent.

The treatment unit can be used as an integrated part of the separation unit or as an additional unit to further treat the influent water after the separation unit. Treatment may include use of heat, biocides or sorbent media, as examples. The separation and treatments units can be used to ensure the seawater effluent comply with the performance criteria of this standard and local regulations.

Seawater effluent is generally returned to the environment although there are examples where the seawater can or must be discharged elsewhere eg to comply with local regulations.

The following parameters can affect the performance of in-water cleaning systems and have been considered in the development of the testing protocol (Annex A). While it is not feasible to include all parameters listed as variables in performance testing, they should be considered in the approval process.

| **Key ship parameters** |
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| Ship type (design, complexities/niche areas and operational profile: where the ship has operated during which seasons and what type of activities have been undertaken)<br>Ship availability/access for cleaning and/or testing (eg, time at berth or anchorage) |
| Ship AFC(s) type, age and history<br>Ship MGPS |
| Ship biofouling coverage and types<br>History of cleaning operations of the ship<br>Biofouling distribution on hull and niche areas |
| **Key environmental parameters** |
| Water depth, under keel clearance<br>Water visibility |
| Currents, wind and waves |
| Water quality (eg, salinity, temperature, total suspended solids (TSS), pH, metals, and dissolved and particulate organics) |
| Ambient levels of biocides (eg, background levels of copper) |
| **Key in-water cleaning with capture system parameters** |
| In-water cleaning system design[1] and operations, including:<br>■ diver or ROV driven<br>■ operator/diver skill and experience<br>■ mode of attachment to and movement over ship<br>■ cleaning brushes, blades, or water jets and type, amount, configuration, etc.<br>■ maximum curvature radius that can still be cleaned while capturing the removed biofouling<br>■ planned and actual rate of movement of cleaning unit over the test area<br>■ number and overlap of passes (accuracy of surface coverage)<br>■ capture methods (eg, cleaning unit shroud and suction)<br>■ flow rate of sea water influent including materials<br>■ materials and sea water influent and effluent transport and processing (eg, time for particle settlement, level of handling, treatment, separation, type media removal of metals)<br>■ various pre-set modes of operations and operational adjustments during cleaning<br>■ contingency plans and response to system failures. |
| **Regulatory status at the location of the test and/or operational cleaning** |
| National, regional and local jurisdictions<br>for eg but not limited to the following water quality regulations<br>Biosecurity regulations |

*Table 1: Parameters that affect the testing of cleaning systems (based on Tamburri et al, 2020).*

1 Includes information relevant to cleaning methodology but excludes propriety and commercially confidential information.

# 4 Approval requirements

Cleaning companies approved in accordance with this procedure should be considered competent at meeting the minimum requirements to conduct safe and effective operations worldwide, for the specific applications and operations tested.

An approved cleaning company may have to apply for a local permission(s) to operate in a country, region or port. Compliance with performance criteria may suffice in some locations but further criteria may be required by local regulations or requirements.

Approvals may be issued by the Approval Body based on test results, relevant documentation and the outcome of third party audits verifying the cleaning company meets the requirements of the *Industry standard* and the *Approval procedure*.

The approval shall clearly state the scope of services including type of equipment whilst specifying any limitations or restrictions imposed.

**Verification testing**
The capability of the cleaning system shall be tested by an independent Testing Organisation. While being tested, the system shall be operated in the way it is intended to be used during normal operation.

In-water cleaning companies will be tested for different performance criteria relevant to their declaration of the cleaning system's operational capabilities and performance ie (A) the capability of the system to remove macrofouling; (B) the effectiveness of the separation and/or treatment unit system at removing material, and (C and D) control of the emission to the local environment from the cleaning unit and from the separation and/or treatment unit.

The verification testing will take place on actual ship surfaces (submerged hull, propeller and/or niche areas) and AFC (non-biocidal and/or biocidal) depending on cleaning company's declarations. The cleaning company's declaration should, as a minimum, include the following information:

- biofouling type and extent
- AFC type(s)
- division of categories of ship areas to be cleaned:
  - hull and niche areas that do not need special cleaning equipment
  - niche areas that require special cleaning equipment; and/or
  - propellers
- visibility and operational limits.

The Approval Body should develop test plans that are based on which stratum (vertical and flat-bottom hull, curved areas, niche areas, or propeller) the cleaning company declared that the individual cleaning devices can clean and any stated limitations these devices may have for example in terms of the curvature of surfaces, AFC, distances to bilge keels etc. Depending on the intended use of the system, the test plans may include:

- areas used for testing on the flat sides of the hull
- curved areas used for testing, for example the turn of bilge, and angles where the orientation of the surface changes abruptly, such as the chine, keel and skegs

- niche areas used for testing, eg, propeller shafts, rudders, anodes and gratings
- propellers.

The performance criteria, and protocols to measure them, are described in detail in Annex A.

**Certification audit**
The cleaning company, subsidiaries and subcontractors if any, shall be subject to an audit of relevant documentation, training and experience of personnel, and quality management system, (see below). Upon successful completion of this certification audit and testing process, a certificate of Approval shall be issued (See Annex B. Sample format of certificate of Approval). The cleaning company will be subject to periodical renewal audits (see below) after approval.

Testing should involve development of detailed, individualized test plans (including Standard Operating Procedures) for each in-water cleaning system tested, in consultation with the cleaning company and Approval Body. Testing shall be conducted by an independent Testing Organisation.

**Documentation**
The following documentation shall be submitted for verification:

1. outline of cleaning company eg organisation and management structure, including subsidiaries to be included in the approval/certification process
2. The cleaning company shall give information of agreements and arrangements if any parts of the services provided are subcontracted. This should include quality management by the cleaning company when following-up such subcontracts to ensure the relevant requirements of this procedure are met.
3. declaration of the services requested to be under the scope of approval
4. experience of prior in-water cleanings carried out by the cleaning company (ie companies requiring personnel that have experience in cleaning specific ship categories, hull forms, AFC coating types, propellers and niche areas)
5. description of equipment(s) used in cleaning process, including but not limited to cleaning units, hoses, cables, surface units, separation and treatment units, communication devices, recording devices such as cameras. Manufacturer's technical documentary evidence where applicable, to the operations being carried out eg filter sizes
6. documentation of part-testing or pilot-testing on a smaller scale showing, eg performed under laboratory conditions, the results of that testing eg:
    a. Site Acceptance Testing (SAT) of system (test propulsion, test control systems including ROV and diver control systems, Factory Acceptance Testing (FAT), test camera system, test cleaning unit, test collection system (cables, hoses, and pumps), test separation system, etc
    b. capture test of cleaning unit (test vacuum, test enclosure, test pumps, stationary test, moving test etc)
    c. efficacy test of separation unit (test flowrates, test filters, etc)
    d. impact test of cleaning unit and/or cleaning methodology (test for level of contact with ship coated surfaces (note-brushes have to have contact), test standoff distance if applicable (note – as above), test brushes/nozzles cleaning focal point, details of material type of brush bristles & nozzles, test continuity of speed of cleaning, etc)
    e. quality of photographic camera, video camera and CCTV system
    f. test quality of video and photo recording and CCTV or photographic reporting
    g. small scale test on paint systems, which can be done in partnership with paint manufacturers (test different paint types, test different setups depending on system, test scrub pressure (brushes), test water pressure (ROV), test stationary, test moving, test rotation, test speed, etc)
7. list of operators/technicians/inspectors/divers

8. training records for operators/technicians/inspectors/divers
9. an SOP manual covering at least the following:
    a. Specific operational procedure to be followed by the personnel involved when undertaking cleaning activity. This shall include specific procedures followed in the use of the cleaning equipment, guidance of diver along the hull to provide complete coverage of cleaning as required, camera and/or video operation.
    b. If the above includes a ROV, procedures to follow for the operation of ROV, methods and equipment to ensure the ROV operator can determine the ROV's location and orientation in relation to the ship.
    c. maintenance and calibration of equipment involved in accordance with the instructions of the manufacturer
    d. training requirements of the operators/technicians/inspectors/divers – these should as a minimum cover the points mentioned in the "training of personnel" below
    e. supervision and verification process to ensure compliance with operational procedures
    f. recording and reporting of information such as collection of photographs of AFS condition, biofouling status, use of biofouling coverage scale, development of cleaning and service reports
    g. periodic review of near misses, work processes, procedures, complaints, corrective and preventive actions
    h. process of issuance, maintenance and control of documents
    i. contingency plans based on risk analysis for breakdowns, accidental discharges, and any other untoward incident that the cleaning company anticipates during the cleaning process.

A set of procedures covering the following environmental aspects shall be submitted for verification against the performance criteria:

1. operational procedure of the cleaning system's capability in capturing the materials from hull and/or niche areas, as applicable
2. operational procedure for separation, treatment, and maintenance of the units in the systems
3. operational procedures for the handling of the captured material including disposal or alternative arrangements
4. record of each cleaning operation[2] for eg number of hours cleaning, amount of material captured, record of separation/treatment and discharge of seawater effluent, record of separation/ treatment and disposal of the captured material
5. operational procedure for self-checks and testing/monitoring of the system on an ongoing basis and associated reporting, including how the risk of incidents is thus reduced.

Records of near misses, incidents and corrective actions thereof:

1. damages to AFS
2. deficiencies in cleaning
3. accidental discharges
4. personnel injuries
5. other incidents, such as damage to ship, jetty structures, equipment damage.

The records should include both documents as well as visual evidence (videos, photographs, etc).

2 In instances where a cleaning company has extensive experience detailed and specific information should be given for the last five cleanings. For cleanings before a summary will suffice indicating the number of cleans, types of ships, AFCs cleaned, types of cleaned biofouling, procedures for effluent and waste handling etc.

**Training of Personnel**
The cleaning company shall maintain records of personnel training and present and previous work experience for all cleaning operations performed including but not limited to the following:

a. qualification of divers
b. qualification of ROV operators
c. qualification of diving and/or ROV supervisors
d. training requirements of technicians involved in operation and maintenance of surface units, separation and treatment units
e. operation of under-water communication system for manned operations
f. any special equipment necessary to carry out the work safely eg cranes, barge operations, storage units, ship to ship transfer
g. understanding of the specific cleaning process and technology applied, as applicable
h. knowledge of and ability to assess biofouling encountered during normal course of operation
i. awareness of AFS types and working knowledge of associated cleaning procedures
j. knowledge of underwater video monitoring systems using still cameras, video cameras, TV-monitors on deck.

The above records shall be updated periodically and be made available to the Approval Body upon request.

**Experience of Personnel**
The cleaning company shall demonstrate that the experience requirements for its personnel are in line with the cleaning company policy and specific to the procedure/methods/technology adopted for cleaning operations. The cleaning company will demonstrate competence and experience in diving and/or ROV operations in accordance with the documentary requirements of this procedure. Furthermore, the following experience is required for specific personnel:

- **Supervisor** – Diving and ROV supervisors shall be qualified according to cleaning company's general requirements and shall have a minimum of two years' experience as a diver carrying out cleaning or ROV operations as appropriate.
- **Divers** – An assistant diver shall participate in a number of cleaning procedures that cover the specific services of the company in accordance with the cleaning companies' internal procedures. ROV operators – ROV operators shall have participated in a minimum number of cleaning operations to be approved in accordance with the cleaning companies' internal procedures.

**Quality Assurance**
The cleaning company shall document a quality management system, which demonstrates consistency with international standards and conventions. The following should at least be covered:

- standard operating procedures for safe and environmentally sound operations
- maintenance and calibration of equipment
- training programmes for operators/technicians/inspectors/divers
- supervision and verification to ensure compliance with operational procedures
- recording and reporting of information
- quality management of subsidiaries and subcontractors
- job preparation
- periodic review of near misses, work process procedures, complaints, corrective and preventive actions as well as the issuance, maintenance and control of documents

# 5 Granting of approval

The Approval Body shall audit the cleaning company in accordance with this procedure and review and verify the outcome of the tests. Based on this, the Approval Body may approve the company and issue a certificate (see Annex B) stating that the cleaning company's operation system, procedures and management are satisfactory and that the results of services performed in accordance with that system can be accepted and utilised by shipping companies and ports.

Approval can be issued for one or a combination of the following services, based on the result of one or more of the performance criteria mentioned in the test protocol for cleaning systems with capture and should be stated in the certificate:

a. hull, and niche areas present on the vertical side or the bottom of the ship that can be readily cleaned
b. propellers
c. niche areas that due to bends, turns etc. need special cleaning equipment and procedures.

The approval shall clearly state the type of service, type of cleaning system and manufacturer, and what criteria have been passed. If the type of equipment and/or names of manufacturers of equipment result in any limitations or restrictions, these should also be listed.

The cleaning company should be included in the Approval Body's record of approved cleaning companies.

**Annual verification audit**
An annual verification audit shall be held from three months before or after the anniversary date of the issued in-water cleaning approval certificate.

The annual audit involves verification of documents and a visual inspection of the cleaning system and its units.

Annual verification audits will be performed by the Approval Body to ascertain that system structure, equipment, systems, fittings, and materials in the cleaning system have been maintained to a satisfactory level for the service, for which the cleaning system is intended.

If the cleaning company has not performed an in-water cleaning with capture during the 12 months prior to the annual audit, a renewal of certificate of approval must take place during the first upcoming cleaning event.

**Renewal of certificate of approval**
Renewal or re-endorsement of the certificate of approval shall normally be carried out at intervals not exceeding five (5) years by verification through inspection, testing and audit.

A renewal audit shall include an inspection of the system structure, equipment, systems, fittings, and materials to ascertain compliance with the requirements of the *Approval Procedure*.

As part of this audit, a renewal test, based on a single ship, shall be conducted to verify the operational performance of the cleaning system. The performance test shall be carried out in accordance with Annex A of this *Approval procedure*.

**Alterations to system or cleaning procedure**
When any alteration is made to the system or operating procedure that affects the approval criteria of the approved cleaning system, the cleaning company shall immediately notify the Approval Body. Depending on the extent of the alteration and its effect on the system, a renewal of the approval certificate or a new approval certificate may be required when deemed necessary by the Approval Body.

Furthermore, cleaning companies may request an additional audit to confirm the compliance of their systems.

**Suspension or cancellation of approval**
The Approval Body reserves the right to suspend or cancel the approval should the cleaning company breach any of the conditions of the approval. The list of approved cleaning companies will then be updated accordingly. The following circumstances may also be considered as a breach of conditions.

Approval may be suspended:

1. where an audit, requested by Approval Body, has not been carried out.
2. when no corrections or corrective actions have been taken in the following cases:
   a. where the cleaning did not meet the performance criteria as defined in the *Approval procedure* or the results were improperly reported
   b. where incidents result in a negative impact to safety of operation, personnel or protection of the environment
   c. where deficiencies have been found by an Approval Body representative.

Approval may be cancelled:

1. where alterations have been made to the cleaning company's operating procedures relevant to the approval certificates, without notifying the Approval Body beforehand.
2. where wilful acts or omissions are ascertained
3. where any deliberate misrepresentation has been made by the cleaning company
4. if the cleaning company has already been suspended and it has made no efforts to resolve the non-conformities during the next 6 months.

A cleaning company whose approval has been cancelled may apply for re-approval after it has corrected the findings/non-conformities. This re-approval will be treated like a new application for approval and will require the cleaning company to undergo a new verification test and certification audit.

Expiration or suspension of a parent company's approval automatically invalidates the approval of all subsidiaries of that company if these have been collectively certified approved in accordance with this procedure.

In case the approval is suspended or cancelled, the port and other local authorities should be notified by the Approval Body and/or the cleaning company.

# ANNEX A Test protocol for in-water cleaning systems with capture

## 1 Introduction

This annex provides the framework for verification testing of in-water cleaning with capture systems in accordance with the *Approval procedure*. As part of the approval process, a cleaning company shall be subject to testing of the cleaning system's declared operational capabilities and performance. This testing will take place on actual ship surfaces (hull, propeller and/or niche areas) depending on the cleaning system's declared operational capabilities and performance and will be based on a series of water quality samples which will be collected and analysed to quantify impacts of in-water cleaning on local water quality.

## 2 Performance criteria

The approval of in-water cleaning systems with capture will be based on an independent testing and assessment of the following criteria:

A. The in-water cleaning process removes at least 90% of macrofouling (ie individuals or colonies visible to the human eye).

B. The separation and/or treatment of captured materials during in-water cleaning both: (1) removes at least 90% (by mass) of material from seawater influent and (2) at least 95% of particulate material in effluent water is < 10 µm in equivalent spherical diameter (ESD).

C. Local water quality parameters of TSS, in the vicinity of the cleaning unit and at the effluent discharge point from the separation and/or treatment systems, are not elevated above ambient levels during the same time period.

D. When applicable, dissolved and particulate biocides found in AFC (eg, copper and zinc), in the vicinity of the cleaning unit and at the effluent discharge point from the separation and/or treatment systems, are not elevated significantly above ambient levels during the same time period.

To be approved, the test results will have to equal to or better than performance criteria A, B and C. The test results of criterion D will be published on the approval certificate enabling relevant local authorities to evaluate them and compare them to local requirements in needed.

While not a formal performance criterion, observations of any damage to ship coatings, surfaces and structures during the testing of the in-water cleaning system should also be documented (eg, scratches, brush marks, paint flakes, pits, bare metal/polish through, and blemishes).

## 3 Independent verification testing

Given the complexities of cleaning systems with capture and their application, the following test protocol is focused on a predictive and feasible series of field trials (similar to Tamburri et al, 2020). As mentioned above, it is not feasible or practicable to test all possible conditions, parameters and variables that can impact in-water cleaning performances, but specific test plans should be designed to be as predictive as possible to verify the cleaning system's declared operational capabilities and performance to the fullest extent possible.

Testing should involve development of detailed, individualized test plans (including scope of testing, methods, SOP, quality management system, etc) for each in-water cleaning system tested, in consultation with the cleaning company and Approval Body. The cleaning company should secure permission from local authorities to undertake testing if applicable.

All testing of in-water cleaning systems should be conducted by a third-party testing facility or organisation that:

a. is independent from the cleaning company and technology manufacturer or vendor
b. implements appropriate quality assurance and quality control (eg International Organization for Standardization/International Electrotechnical Commission [ISO/IEC] 17025 standard)
c. acceptable to the Approval Body.

# 4 Experimental design

A single cleaning event, on an individual test ship, is considered the unit of replication. A minimum of three consecutive cleaning events involving a different ship on each occasion is required for approval. The goal is to capture variability in operations, applications and environmental conditions that will allow for verification of in-water cleaning company claims with respect to the cleaning system's declared operational capabilities and performance. Thus, if the in-water cleaning company claims to meet the above criteria for safe and effective biofouling removal on both hull and/or niche areas, performance will be quantified on both hull and/or niche areas on each of the three test ships. Similarly, if the in-water cleaning company claims to meet criteria on both non-biocidal and biocidal AFCs, at least two of the three ships must have appropriate biocidal coating for testing.

Conditions or applications (eg, niche areas, biocidal AFCs, biofouling level, etc.) outside of specifications and claims for the cleaning system's declared operational capabilities and performance do not need to be included in the approval tests but those restrictions or limitations will be clearly noted in the approval certificate.

# 5 Documentation of test conditions and operations

As part of the documentation, a list of participants of the people who take part in the test and operation shall be made (for example handlers, workers, controllers, and/or divers). Details of who does what shall be documented.

The following information shall be documented and reported for each test ship:

- ship type (design, complexities/niche areas and operational profile of the ship)
- ship availability/access for cleaning and/or testing (eg, time at berth or anchorage)
- AFC type, age, and history
- biofouling type and percentage cover on relevant surfaces (hull, propeller and/or niche areas) eg from a recent inspection report
- history of cleaning operations of the ship since last drydocking.

The following environmental information shall be measured, documented and reported for each test trial:

- water depth and under keel clearance
- water visibility
- currents, wind and waves

- water quality parameters of interest (eg, salinity, temperature, TSS)
- ambient levels of biocides (eg, background levels of copper).

The following cleaning system design and operational information (during the cleaning of each test ship), shall be documented and reported (excluding propriety and commercially confident information):

- in-water cleaning system design and operations
- diver or ROV driven
- operator/diver skill and experience
- mode of attachment to, and movement over ship, cleaning brushes, blades, or water jets and type, amount, configuration, etc
- planned and actual rate of movement of cleaning unit over the test area
- number and overlap of passes (accuracy of surface coverage)
- capture methods (eg, cleaning unit shroud and suction)
- flow rate of influent water including materials
- materials and seawater influent and effluent transport and processing (eg, time for particle settlement, level of handling, treatment, separation, type media removal of metals)
- various pre-set modes of operations and operational adjustments during cleaning
- contingency plans and response to system failures
- the claimed maximum curvature, and the maximum curvature where cleaning was carried out successfully during the test without loss of material into the water column
- the diameter of the hose from the cleaning unit to the treatment and/or separation unit and the declared flow rate.

# 6 Criterion A – removal of macrofouling

The in-water cleaning process removes at least 90% of macrofouling (ie individuals or colonies visible to the human eye).

## 6.1 Sampling procedure

A semi- quantitative assessment of cleaning efficacy should be made to determine the amount of biofouling removed from each of the areas defined during test cleaning events. Using images and/or videos of selected areas selected for testing before and after cleaning, each area should be assessed for percentage coverage and basic type of macrofouling. For consistency, the same video or camera equipment, and methods should be used to assess the coverage of macrofouling before and after cleaning.

To avoid any confusion resulting from possible changes to the biofouling over time, all before and after images and/or videos shall be taken within a timeframe of seven days.

The Approval Body will randomly choose the areas to be used for the testing. Areas used for testing should be relevant for the cleaning device and take into consideration safety factors such as local weather conditions and other activities being carried out on the ship during the testing.

Before the testing, areas shall be selected by the Approval Body. Areas used for testing should be chosen to match the sampling stratum (vertical and flat-bottom hull, curved areas, niche areas, or propeller).

For each of the test areas, macrofouling organisms should be identified in broad taxonomic groups (eg, soft corals, barnacles, sponges, mussels, hydroids, tube worms, anemones, bryozoans, tunicates and algae).

The following methods should be considered before and after cleaning biofouling assessments:

1. use of the installed cameras on the cleaning unit showing videos in front of (before video) and behind the cleaning unit (after video)
2. use of ROV's filming minimum three vertical runs starting from the surface and moving down to the keel – the runs should be done so the areas used for testing are easily identifiable making it possible to compare the same areas before and after the cleaning
3. use of still photos.

For niche areas and the propeller, the entire area should be pictured or videoed before and after the cleaning. In case of using divers during such inspections, the IMO Code of safety for diving systems should be adhered to.

Photographs and videos should clearly depict the condition of the AFS and biofouling growth and be taken in a consistent manner in terms of angle and distance from the surface during each run.
The water visibility should be a least 0.5 metres during the testing

The pictures and video should include or be accompanied by the name of the ship. The dive/camera operator should carefully choose the camera settings to ensure proper lighting, exposure, focus, colour, tone etc for capturing an accurate image.

## 6.2 Analytical Procedures

The percentage coverage of the biofouling should be determined before and after by comparing both sets of images. The before and after pictures should:

1. use the same distance between the ship's surface and the camera
2. be taken either perpendicular to the surface or if that is not possible at the same angle to the surface
3. be date and time stamped and
4. if possible, include an electronic scale that enables the size of the pictured area to be estimated.

Each before and after image should be the same size and shape or cropped to be the same size and shape. The size of images used for comparison should be at least 400 $cm^2$.

The Approval Body should plan the documentation to cover different test areas to be representative of the entire underwater area. The minimum number of images, that should be compared, depends on:

- hull, and niche areas present on the vertical side or the bottom of the ship that can be readily cleaned at least 60 images
- propellers at least 20 images
- niche areas that due to bends, turns etc need special cleaning equipment and procedures at least 5-10 images per niche area.

## 6.3 Determining if Criterion A has been met

Videos or pictures as described in section 6.2 should be used for comparison to assess the efficacy of the cleaning.

The percentage of the biofouling coverage should be estimated by superimposing a 50-point grid to the images.

The percentage coverage of the before and after pictures must be determined for each image in order to compare them in pairs. The efficacy of the removal shall be calculated as follows:

$$Efficacy = \frac{percentage\ before - percentage\ after}{percentage\ before}$$

The comparison can made using artificial intelligence/machine learning or an automated software analysis system.

The average of efficacy of the cleaning of all the examined areas shall be no less than 90%.

In case one or more of the calculated efficacies are smaller than 90%, an assessment must be carried out to determine if the results were caused by curves or bends on the surface or by restrictions in manoeuvrability of the cleaning unit. The result of the assessment should determine if restrictions or limitations should be added to the approval certificate.

# 7 Criterion B – effectiveness of the separation and/or treatment unit of removing captured materials

The separation and/or treatment units remove(s) captured materials during in-water cleaning as follows:

1. at least 90% (by mass) of material from seawater influent and
2. at least 95% of particulate material in effluent water is < 10 µm in equivalent spherical diameter (ESD).

## 7.1 Sampling procedures

A series of water quality samples should be collected and analysed to quantify impacts of in-water cleaning on local water quality during each approval test of the hull, propeller and/or niche areas, in accordance with Tamburri et al, 2020. Continuous, time-integrated water samples, during a predesignated in-water cleaning test period of at least one hour, should be collected at two locations: at the inlet (influent) of the separation and/or treatment unit, and at the outlet (effluent) of the separation and/or treatment unit (figure 2).

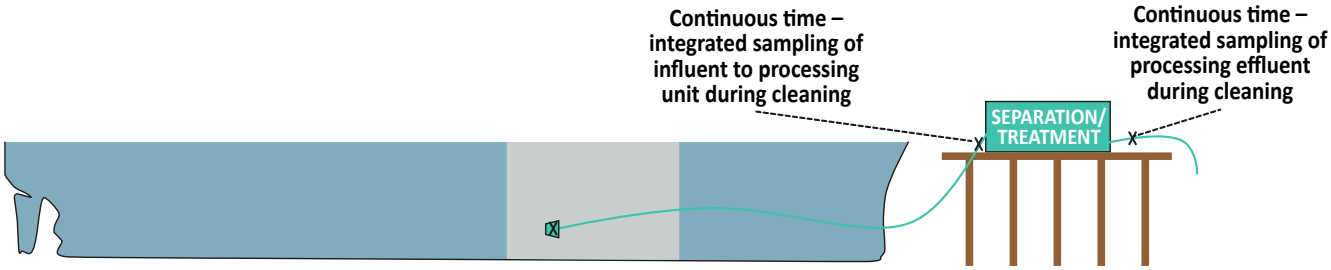


*Figure 2: Schematic arrangement of sampling.*

Details for each station includes the following:

- **Separation and/or treatment unit inlet sample** – During the test cleaning event, a continuous, time-integrated sample of the influent to the treatment unit, should be collected to quantify captured material and separation and/or treatment unit efficacy. An appropriate inlet sample port should be provided by the cleaning company. Flow rate should be set to draw at least 10 – 20 litres of sample water (exact volume and flow rate should be measured) continuously during the entire test cleaning period. The large container sample should be uniformly mixed prior to distributing sub-samples for at minimum, triplicate analyses of each parameter. Note that in some cases, where large amounts of hard macrofouling is captured, a two-stage sampling approach may be needed for effective inlet sampling, which can involve a sieve to both collect and quantify (by wet and dry weight) material larger than 1 mm in size and for material passing through the 1mm sieve to be analysed for TSS.
- **Separation and/or treatment unit outlet sample** – During the test cleaning event, a continuous, time-integrated sample of the effluent from the treatment unit, should be collected to quantify separation and/or treatment unit efficacy and environmental safety of treatment discharges. An appropriate outlet sample port should be provided by the cleaning company. Flow rate should be set to draw at least 10-20 litres of sample water (exact volume and rate should be measured) continuously during the entire test cleaning period. The large container sample should be uniformly mixed prior to distributing sub-samples for, triplicate analyses of each parameter as a minimum and as per any test method requirements (ie ASTM or ISO method necessary for each parameter).

Sampling should only be conducted when the cleaning unit is transferring biofouling material to the separation and/or treatment unit. When cleaning unit is idle during a test cleaning event, but the capturing system remain active the sampling activities should be paused.

| Sample | Location | When sampled | Type of sample | Sample depth | Analyses | Relevant performance criteria |
|---|---|---|---|---|---|---|
| Separation and/or treatment unit inlet | Just prior to separation and/or treatment unit | 1x, during cleaning | Time-integrated | NA | TSS, particle size distribution (PSD) and biocide | B |
| Separation and/or treatment unit outlet | Just after the separation and/or treatment unit | 1x, during cleaning | Time-integrated | NA | TSS, PSD and biocide | B, C and D |

*Table 2: Water quality collection sampling summary.*

## 7.2 Analytical Procedures

After the initial sample collection, exact container volumes should be measured. Then the container samples should be uniformly mixed prior to collecting sub-samples for triplicate analyses of TSS and PSD. All sub-samples should be placed in cleaned bottles of the appropriate analysis type and size and all sample bottles should be labelled with unique identification numbers prior to sampling. Sub-samples should be stored at the appropriate temperature for the analysis and delivered to the accredited/approved analytical laboratories within the appropriate time frame for each analysis.

The following standard and/or approved methods may be relevant when determining TSS and PSD in water samples collected during assessment of the cleaning system. The list is not exhaustive and other methodologies may be available.

- *US EPA Residue, Non-Filterable (Gravimetric, Dried at 103-105°C) (EPA 160.2)*: Published 1971
- *ISO Particle size analysis – Image analysis methods (13322-1)*: Published May 2014.
- *US EPA Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry (EPA 200.8)*: Published 1994.
- *US EPA Inductively Coupled Plasma – Mass Spectrometry (EPA 6020A)*: Published January 1998.

### 7.3 Determining if Criteria B has been met

The separation and/or treatment of captured materials during in-water cleaning both removes: (1) at least 90% (by mass) of material and (2) at least 95% of particulate material in effluent water is < 10 µm in equivalent spherical diameter (ESD).

For criteria B, the percent reduction in mass of material in water entering the separation and/or treatment unit(s) (influent) versus the water discharged from the separation and/or treatment unit(s) (effluent) for each test cleaning event should be calculated and reported. The mass of material should be determined, per unit volume, using accepted methods for TSS. The two sub-criteria must be met for each individual test cleaning.

## 8 Criteria C and D – Impact on local water quality

Particulate and dissolved biocides and compounds relating to the AFS shall be tested and reported to measure if local water quality parameters of TSS, and when applicable dissolved biocides found in AFC (eg, copper and zinc), in the vicinity of the cleaning unit and at the effluent discharge point from the separation and/or treatment systems, are not elevated significantly above ambient levels during the same time period.

### 8.1 Sampling procedures

A series of water quality samples should be collected and analysed to quantify impacts of in-water cleaning on water quality during each approval test of the hull, propeller and/or niche areas, in accordance with Tamburri et al, 2020. Continuous, time-integrated water samples, during a predesignated in-water cleaning test period of at least one hour, should be collected at three locations: on the cleaning unit (to quantify debris capture efficacy), greater than 50 m away from the cleaning activity (as simultaneous quantification of background conditions), and at the outlet (effluent) of the separation and/or treatment unit (figure 3). It is also recommended that background/ambient water quality conditions also be measured by using discrete time point samples before and after the test cleaning event at the discretion of the Approval Body and Testing Organisation.

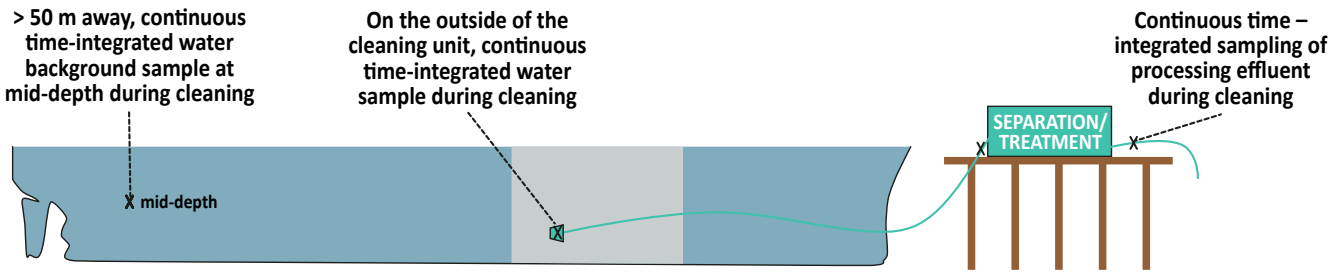


*Figure 3: Schematic arrangement of sampling.*

Details for each station includes the following:

- **Cleaning unit sample** – A sampling hose or submersible pump should be attached to the cleaning unit to collect a continuous, time-integrated samples for at least 1 hour during each test cleaning event. The intake location (and method of mounting the hose or pump) should be agreed with Approval Body and should be based on location of highest possible signal (eg, computational fluid dynamics assessment of the location of the highest potential concentrations of material removed from the test ship during in-water cleaning). Water should be drawn to sample container(s) using a pump or pushed from a pump attached to the cleaning unit to the sample container(s). The sample collection station can be located on the shoreside or on a small boat/barge positioned at the cleaning unit's point of entry into the water. Flow rate should be set (and recorded) to draw at least 10 - 20 litres of sample water (exact volume should be measured) continuously. The large container sample should then be uniformly mixed prior to distributing sub-samples for, at minimum, triplicate analyses of each parameter.
- **Background sample during cleaning** – In order to assess ambient levels of measuring parameters during the test cleaning event, a continuous, time-integrated sample should be collected at least 50 metres away from the test area (not impacted by cleaning or discharges from the ship). A pump and hose system should be deployed adjacent or adhered to the test ship with intake positioned at approximately mid-depth between water line and bilge keel. Flow rate should be set to draw at least 10 - 20 of sample water (exact volume and flow rate should be measured) continuously during the entire test cleaning period. The large container sample should be uniformly mixed prior to distributing sub-samples for at minimum, triplicate analyses of each parameter
- **Separation and/or treatment unit outlet sample** – During the test cleaning event, a continuous, time-integrated sample of the effluent from the treatment unit, should be collected to quantify treatment unit efficacy and environmental safety of treatment discharges. An appropriate outlet sample port should be provided by the cleaning company. Flow rate should be set to draw at least 10 – 20 litres of sample water (exact volume and rate should be measured) continuously during the entire test cleaning period. The large container sample should be uniformly mixed prior to distributing sub-samples for a minimum, triplicate analyses of each parameter. Note, that the same outlet/effluent sample, analyses and results above in criteria B can be used for criteria C.
- **Pre and post cleaning background samples (optional)** – Variability in ambient water quality should be characterized by discrete sampling at a predetermined test ship berth or anchorage location before and after the in-water cleaning event. At least one sample should be collected before, and at least one sample collected after, the test cleaning event, using a discrete water sampling device (eg, Van Dorn- or Niskin-style water sampler) lowered to the same depth as the background sample above (approximately mid-depth between water line and bilge keel of the test ship). Each sample should be uniformly mixed prior to distributing sub-samples for at minimum, triplicate analyses of each parameter.

| Sample | Location | When sampled | Type of sample | Sample depth | Analyses | Relevant performance criteria |
|---|---|---|---|---|---|---|
| Cleaning unit | Attached to cleaning unit | 1x, during cleaning | Time-integrated | Varies over cleaning period | TSS, PSD and biocide | C and D |
| Separation and/or treatment unit outlet | Just after the separation and/or treatment unit | 1x, during cleaning | Time-integrated | NA | TSS, PSD and biocide | B, C and D |
| Background during cleaning | Adjacent to the ship, at least 50 metres from cleaning activity | 1x, during cleaning | Time-integrated | Mid-draft | TSS, PSD and biocide | C and D |
| Optional pre-clean background within 24 hours | Berth or anchorage | 1x, during cleaning | Discrete | Mid-draft | TSS, PSD and biocide | C and D |
| Optional post-clean background within 24 hours | Berth or anchorage | 1x/day prior to test | Discrete | Mid-draft | TSS, PSD and biocide | C and D |

*Table 3: Water quality collection sampling summary.*

## 8.2 Analytical procedures

The analytical procedures for TSS and PSD are described above in section 7.2. The following are examples of standard and/or approved methods for quantifying AFS biocides. The list is not exhaustive and other methodologies may be available.

- ASTM Rotating Cylinder (method D6442-06)
- ISO Method for Copper-ION (15181-2): published 01 June 2007.
- ASTM Method for organotin (method D5108-07): re-approved 2007
- ASTM Methods for organic biocides (zinc and copper pyrithione, DCOIT and CDMTD) (method D6903-07): published 2007.
- ISO Method for Zineb (15181-3): published 01 June 2007.
- ISO Method for pyridine-triphenylborane (PTPB) (15181-4): published August 2008. I
- ISO Method for tolylfluanid and dichlofuanid (15181-5): published May 2008. vi.
- ISO Method for tralopyril (15181-6): expected publication, 2011.

## 8.3 Determining if Criteria C and D have been met

**Criterion C**
TSS is used as a measure of both biofouling and the impact that particulate material from the AFS has on water quality, and determination of this criteria should assess:

1. cleaning unit samples, against the same parameter(s) from background samples during the same cleaning time period, and
2. outlet samples from separation and/ or treatment unit against the same parameter(s) from background samples.

Test results should not be elevated significantly above ambient levels. To determine this statistical analysis (eg confidence interval of 95% or α = 0.05 in a t-test) should be used.

**Criterion D**
Dissolved biocides and compounds (eg copper and zinc) are used as a measure of AFS' impact on water quality and determination of this criteria should assess: eg

1. cleaning unit samples, against the same parameter(s) from background samples during the same cleaning time period, and
2. outlet samples from separation and/or treatment unit against the same parameter(s) from background samples.

Results of the test(s) should not be elevated significantly above ambient levels. To determine this statistical analysis (eg confidence interval of 95% or α = 0.05 in a t-test) should be used.

If the system cannot comply with the requirements of D, it is recommended that a risk-based approach is used to establish the potential impact on water quality in consultation with the local authorities. The result of testing for dissolved biocides and compounds found in the AFS (eg copper and zinc) shall be stated on the approval certificate to allow for the system to be evaluated in accordance with local requirements.

# 9 Assessment of paint damage

Pictures and/or videos of AFC should be examined for obvious signs of in water cleaning damage. While not a performance criterion, a description of any and all observed damage should be included in the final report. Such damage can include symmetrical swirl patterns caused by the cleaning mechanism and/or linear traction damage caused by drive wheels.

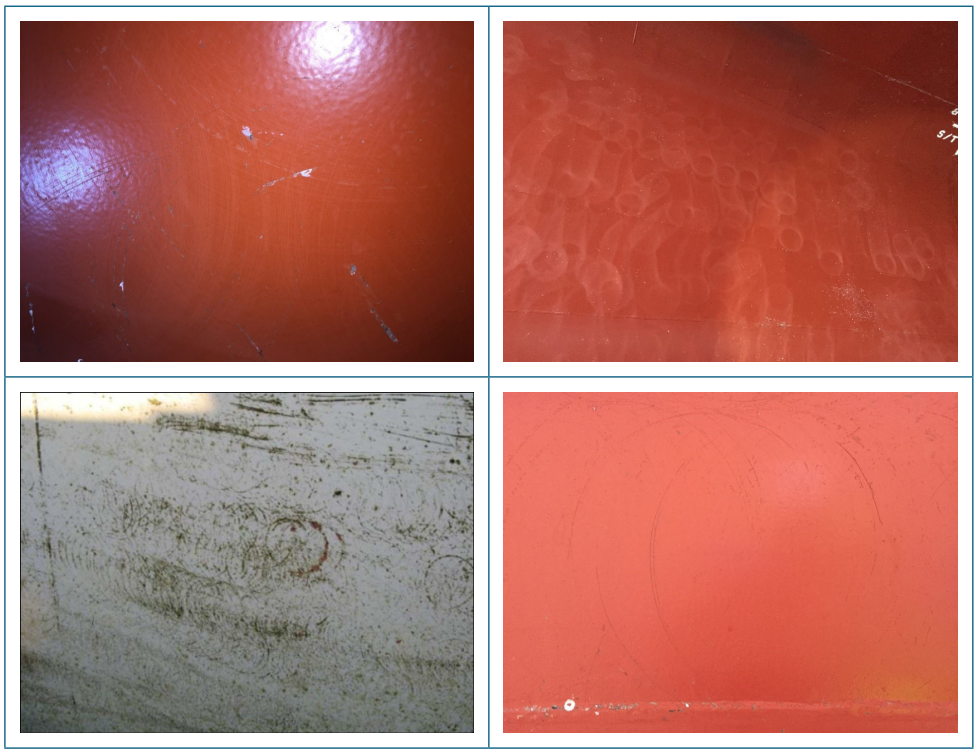

*Figure 4: Examples of paint damages.*

## 9.2 Analytical procedures

Images taken before and after the cleaning procedure under criteria A should be selected to visually assess if the painting has been damaged during the cleaning process. If possible, images with a coverage of biofouling less than 15 percent should be used.

A minimum of 5 images taken before the cleaning, are to be compared with images of the same areas taken after the cleaning. Based on the comparison of the before and after pictures, it should be assessed if the damage likely occurred during the individual test.

The biofouling type and coverage should be taken into consideration and use of images where removal of the biofouling may cause damage to the AFC should not be used.

## 9.3 Determining the paint has been damaged

Damage to the paint that has been caused evidently by the cleaning unit should be documented in the testing report.

In case such damage has been found, a dialogue should be commenced between the Approval Body and cleaning company. Based on the dialogue, a correction plan provided by the cleaning company that describes how such damages can be avoided to be drawn up to the satisfaction of the Approval Body.

The correction plan should be accepted by the Approval Body before further testing can take place.

In case damage is observed on consecutive tests, the Approval Body may add restrictions or limitations to the approval certificate. Example: Cleaning can be carried out on AFS other than silicone based coatings.

# 10 Data management and quality

The independent testing facility should follow standard/accepted data management and analysis procedures (see Tamburri et al, 2020). For example, data logs should be recorded throughout testing, copied or duplicated, and archived. The datasheets should be signed by the analyst upon completion, verified by a quality officer, and stored until the data are logged into a digital file, and the data themselves are verified. Additionally, data from other analyses should be recorded in standard formats, such as data collection forms, bound and paginated laboratory and field notebooks, spreadsheets, and electronic data files.

Specific data analyses should be conducted as prescribed in individual test plans. All testing should occur at a Testing Organisation that has been approved, certified, and audited by an independent accreditation body or the relevant regulatory agency. A test plan and standard operating procedures (SOPs) should be followed while conducting all tests.

# 11 Reporting

The test report should include the test plan, all SOPs, all logged instrument data collected, and all raw data (both direct verification test and ancillary environmental data). Regardless of which of the three criteria Approval is granted, all results should be included in the final reports.

The following should be reported:

- an audit report from the certification audit or the renewal audit (chapter 2 and Annex C) including given recommendations, findings and corrective actions
- a description and specification of the cleaning system tested (chapter 2)
- details of the ship (Annex 1, section 5)
  - ship type (design, complexities/niche areas and operational profile of the ship)
  - ship availability/access for cleaning and/or testing (eg, time at berth or anchorage)
  - AFC type, age, and history
  - history of cleaning operations of the ship since last drydocking.
- a list of participants who took part in the test (Annex 1, section 5)
- a resume of how the test was undertaken for each of the criteria A-D, including:
  - claimed limitations of operations (chapter 2)
  - a description of the procedures followed during set-up, testing of the system and close down (*Industry standard*, chapter 9).
- before cleaning: description and coverage of biofouling present in each of the test areas (*Industry standard*, chapter 5)
- environmental information (Annex A, section 5)
- cleaning system design and operational information (Annex A, section 5)
- experimental design and conditions under which the results of samples were taken, including where and when the samples were taken and the total duration of treatment (Annex A, sections 4-8)
  - number of test areas and size of each area
  - locations of the test areas
  - a description of residual biofouling observed in images of each replicate treated area selected for analysis
  - whether a ship underwent a full or partial clean and rate of cleaning as expressed in $m^2$/unit time.
- any damage to the condition of the anti-fouling coating in each test area (section 9)
- description of any variations or deviations in application of the test relative to the SOP and test requirements
- a discussion of the system efficacy, including whether the criteria were met
  - based on report from the independent Testing Organisation
  - documentation in form of pictures and video regarding removal of macrofouling.
- recommendations for system or SOP improvement
- resume of test result including detailed information of the measured concentrations etc for all criteria (A-D) and whether the system passed the test
- conclusion stating criteria that were passed/failed and restrictions or limitations that will need to be added to the certificate.

# ANNEX B Sample format of approval certificate

**APPROVAL CERTIFICATE OF IN-WATER CLEANING COMPANIES** **Cert Number: *XXXXXX***

This is to certify that the operations and management systems of [*name of company*] is in compliance with the *Approval procedure for in-water cleaning companies* and has been approved to perform [*in-water cleaning of the hull and niche areas that do not need special cleaning equipment*] [*in-water cleaning of the niche areas that require special cleaning equipment*] [*in-water cleaning of propellers*]

The following performance criteria have been tested:

**Criteria A:** The cleaning system is able to remove *XX*% of macrofouling -

**Criteria B:** The cleaning system is able to perform the separation and/or treatment of captured materials. During in-water cleaning the system:

i) removes at least *XX*% of material from seawater influent (by mass) and

ii) *XX*% of particulate material in seawater effluent is > 10 µm in equivalent spherical diameter (ESD).

**Criteria C:** The level of applicable TSS and particulate biocides of Anti-fouling system (eg copper and zinc) found in the local water are not statistically elevated above ambient levels during cleaning -

The following performance criteria has further been tested:

**Criteria D:** Dissolved biocides and compounds (eg copper and zinc) in the effluent are/are not statistically elevated above ambient levels.

Restrictions or limitations: (height of biofouling, non-compatibility with certain AFS etc). Insert restrictions or limitations, if any, else write “none”.

Details of the cleaning system:
Type of cleaning system:
Name of the manufacturer:
Model:

Result of tests conducted:

1. claimed height of hard calcareous biofouling and maximum height of hard calcareous biofouling removed during the test: *enter text (in mm)*
2. amount of biofouling removed during the test: *enter text*
   total suspended solids released to the marine environment during testing: *enter text*

This certificate is valid until *enter date*

Issued at *enter text* on *enter date*

Details of Approval Body: *enter text*

**Digitally signed**

Approval conditions:

- The operation of cleaning system should take place within the criteria mentioned in the *Approval procedure for in-water cleaning companies, version 1.0*.
- If changes are made to the operations and management system of the cleaning company, such changes shall be reported to the Approval Body. Re-audit may be deemed necessary by the Approval Body.

The full-scale results of test are attached to this certificate as an Appendix.

Date certificate valid until (subject to annual review): *enter text*
Issuing Approval Body: *enter text*

## NOTES ON THE BACK OF THE CERTIFICATE

Performance criteria:

**Criterion A – removal of macrofouling**

The in-water cleaning process removes at least 90% of macrofouling (ie individuals or colonies visible to the human eye).

**Criterion B – effectiveness of the separation and/or treatment unit of removing captured materials**

The separation and/or treatment units remove(s) captured materials during in-water cleaning as follows:

3. at least 90% (by mass) of material from seawater influent and
4. at least 95% of particulate material in effluent water is < 10 µm in equivalent spherical diameter (ESD).

**Criteria C and D – Impact on local water quality**

Particulate and dissolved biocides and compounds relating to the AFS shall be tested and reported to measure if local water quality parameters of TSS, and when applicable dissolved biocides found in AFC (eg, copper and zinc), in the vicinity of the cleaning unit and at the effluent discharge point from the separation and/or treatment systems, are not elevated significantly above ambient levels during the same time period.

Criterion D is not mandatory for a cleaning company to get approved.

# ANNEX C Documents applicable for different types of audit

| Type of audit | Certification audit | Annual audit | Renewal audit |
|---|---|---|---|
| Agreements and arrangements for parts of the services that are subcontracted | x | | x |
| Declaration of the services requested to be under the scope of approval | x | | x |
| Description of equipment used in cleaning process | x | x | x |
| Documentation of part-testing or pilot-testing on a smaller scale | x | | |
| Experience of prior in-water cleanings carried out by the cleaning company. A history of operations undertaken | x | | x |
| List of subsidiaries, if applicable, and documentation regarding maintenance and the operation of the equipment | x | | x |
| Maintenance and calibration records | x | x | x |
| Outline of cleaning company eg organisation and management structure | x | | x |
| Records of cleaning operations | x | x | x |
| Records of near misses, incidents, and corrective actions | X | x | x |
| Risk assessments | X | | x |
| SOP manual | x | x | x |
| Staff introduction record | x | | x |
| Staff work experience and training records | x | x | x |