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## Technical Considerations for Exchange of BWMS Components

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### I. Purpose

The purpose of this document is to raise awareness about the challenges manufacturers face with respect to exchanging components and implementing equipment improvements within an approved ballast water management system (BWMS), and to generate discussion about the associated technical considerations and the need to move towards reaching industry agreement for how changes to approved BWMS are handled. The target groups for this discussion are the regulatory bodies that approve BWMS including the International Maritime Organization (IMO), the United States Coast Guard (USCG), national Administrations and classification societies, along with BWMS manufacturers and component suppliers.

### II. Introduction

Current IMO and USCG frameworks each include an approved bill of materials (BOM) associated with the BWMS type approval. A significant number of components included with the approved BOM do not directly impact the reliability or the ability of the BWMS to meet the IMO and / or USCG ballast water performance standards. Many BWMS components listed on a BOM are considered common marine equipment such as valves and pumps. While such components are important to overall system functionality, exchanging them with components of similar or greater specifications does not alter the operational principles of a BWMS.

Over time, needs arise to update the approved BOM, driven by many possible factors. These scenarios can include component availability, a discontinued or obsolete components, an improved component, or an installation-specific required component. Additionally, BWMS manufacturers may seek to improve their equipment, based on operational experience gained and/or industry demands, such as ways to address ballast water management in ports with challenging water quality (PCWQ) or improving energy efficiency. Currently, the time and cost associated with regulatory submittals, reviews and discussion to achieve approval prevent efficient completion of needed component exchanges resulting in project delays and escalating costs. Considering that some ships have had a BWMS installed for ten years and there are now many more ships with an installed BWMS, the impacts of the related cost and time to implement changes to equipment with existing type approval are much greater.

Having a common and agreed approach for the exchange of components amongst the organizations approving BWMS is vital to BWMS manufacturer's ability to properly maintain the respective technology and product being supplied to the market. The level of regulatory review, and additional testing if required, to exchange BWMS components should be proportional to the function of the BWMS component under consideration. Streamlining of the approval process is needed to minimize time, enhance cost efficiency and manage CAPEX for shipowners, and reduce redundant component testing.

To begin a dialogue with relevant stakeholders, this document presents current regulatory background information, technical considerations, current challenges and suggestions for moving towards common approaches for approval of BWMS component changes.

### III. Regulatory Background and Definitions

#### A. Regulatory Background

Both the IMO and USCG requirements include provisions regarding changes to a BWMS either during type approval testing or after the system has received type approval. The applicable IMO and USCG text is provided in Table 1 below. Exchange of BWMS components also requires review and approval by classification societies, which adds complexity to making BWMS changes and is an important aspect that

stakeholders should be aware of. However, due to the wide variation of class rules, the scope of this document is limited to USCG and IMO requirements.

For the United States, it should be noted that the Vessel Incidental Discharge Act (VIDA) was signed into law in 2018, which will result in the development of new national ballast water regulations. These were anticipated to be finalized by late 2022; existing USCG regulations remain in effect until the new regulations are finalized.

**Table 1 – IMO and USCG Text related to BWMS Changes**

Regulatory documents	
<p><b>IMO</b>            RESOLUTION MEPC.300(72)            Code for Approval of Ballast Water Management Systems (BWMS Code), Annex Part 1</p>	<p><b>Requirements during testing</b></p>
	<p>[1.10] During the readiness evaluation the major components of the BWMS shall be identified. Major components are considered to be those components that directly affect the ability of the system to meet the performance standard described in regulation D-2. Upgrades or changes to major components shall not take place during type approval testing. A change to a major component requires a new submission of the test proposal and shall involve a new evaluation and repeating of the land-based and shipboard tests.</p> <p>[1.11] The Administration may allow replacements of non-major components of equivalent specification (independently approved to a recognized and equal operational standard) during type approval. Replacements of non-major components during testing should be reported.</p> <p>[1.13] The evaluation shall identify consumable components in the BWMS. The Administration may allow replacement of like-for-like consumable components during type approval testing and all replacements shall be reported.</p>
	<p><b>Requirements during testing or for an approved BWMS</b></p>
	<p>[1.12] Upgrades of the BWMS that relate to the safe operation of that system may be allowed during and after type approval and should be reported. If such safety upgrades directly affect the ability of the system to meet the standard described in regulation D-2, it should be treated as a change of a major component, as per paragraph 1.10 above.</p>
<p><b>USCG:</b>            46 CFR 162.060-16            Changes to an approved ballast water management system (BWMS)</p> <p><b>**Note that additional USCG guidance on changes to an approved system is provided within the USCG's "<a href="#">Ballast Water FAQs</a>" document, dated April 24, 2018.</b></p>	<p><b>Requirements for an approved BWMS</b></p> <p>(a) The manufacturer of a BWMS that is approved by the Coast Guard must notify the Commanding Officer, U.S. Coast Guard Marine Safety Center (MSC), in writing of any change in design or intended operational conditions of the BWMS.</p> <p>(b) The notification required by paragraph (a) of this section must include -</p> <ul style="list-style-type: none"> <li>(1) A description of the change and its advantages; and</li> <li>(2) An indication of whether or not the original BWMS will be discontinued.</li> </ul>

Regulatory documents	
	<p>(c) After receipt of the notice and information, the Coast Guard will notify the manufacturer, in writing, of any tests or evaluations that must be conducted, and then determine if BWMS recertification and/or modification is required.</p> <p>The manufacturer may appeal this determination to the Director of Commercial Regulations. Contact Commandant (CG-5PS), Attn: Director of Commercial Regulations, U.S. Coast Guard Stop 7509, 2703 Martin Luther King Jr. Avenue SE., Washington, DC 20593-7509.</p> <p>From the “<i>Ballast Water FAQs</i>”: Changes requiring notification include deviations from the software code, hardware components and design parameters as listed on the type approval certificate and associated OMSM.</p>

It is important to note that in the IMO approval process, the national Administration will approve the new components, based on the approval of a class society as the Recognized Organization. In contrast, the USCG allows testing of common marine equipment in accordance with International Association of Classification (IACS) Test Specification for Type Approval (UR E10) and accepts certification to UR E10 in lieu of component testing in certain circumstances (refer to USCG’s “*Ballast Water FAQs*”). This is discussed further in Section IV.

**B. Definitions**

The available definitions from the IMO and USCG regulatory documents are summarized below; however, specific definitions are not provided in the regulatory documents for all terms used by the IMO and USCG with respect to BWMS changes. Lack of definitions, or inconsistent definitions between bodies that approve BWMS, can cause confusion for BWMS manufacturers trying to determine the steps needed to gain approval of a change. To support the discussion in this document, when a definition is not provided within the respective regulatory documents, BEMA provides a relevant interpretation from the BWMS manufacturer and/or component supplier perspective.

**1. Major Components**

IMO definition: “*Major components are considered to be those components that directly affect the ability of the system to meet the ballast water performance standard described in regulation D-2*”.

This definition is BWMS technology specific and must be understood as the technology’s effectiveness in removing, killing or rendering harmless organisms in one or more of the three organism size classes of the discharge standards (i.e., the biological efficacy).

Examples of major components and an associated biological efficacy impact for different technologies include:

- Filter – affects biological efficacy via removal of organisms bigger than filter mesh size.
- Ultraviolet (UV) module – affects biological efficacy via UV dose / organism inactivation.
- Electrochlorination (EC) cell – affects biological efficacy via active substance production rate and/or concentration.
- Chemical Injection (CI) equipment – affects biological efficacy via active substance production and/or dosing.

- Sensors & Instrumentation with a control function – applicable components such as TRO sensors, flow meters, oxygen sensors, temperature sensors, and/or UVI/UVT sensors that impact BWMS performance by monitoring the dose, quantity, or concentration of disinfectant applied to the ballast water.
- Software Code (all technologies) – while not a 'physical' component, software affects biological efficacy and environmental acceptability (i.e., G9 Final Approval limits) via approved alarm thresholds and control parameters impacting overall BWMS operation.

There is no definition for "major component" in the USCG regulations, nor does the USCG distinguish between major or non-major components.

From the BEMA perspective, the IMO definition above is accurate and applicable to the review process for the exchange of components.

## **2. Non-major components**

Neither IMO nor USCG define 'non-major components', but the IMO BWMS Code uses the term.

From the BEMA perspective, and in consideration of the above IMO definition of major components, non-major components are considered in this document to be those components that do not directly affect the ability of the system to meet the ballast water performance standard (i.e., D-2 and USCG discharge standards ) but are necessary for proper system functionality, operation, or robustness in the marine environment.

Examples of non-major components and an associated impact include:

- Sensors & Instrumentation with a monitoring function – impact on readings and accuracy of alarms.
- Pumps – impact on suction capacity.
- Valves – impact on process management.
- HMI– impact on available functions.
- Equipment cabinets - impact on equipment lifespan due to external environmental factors
- Mechanical and electrical protections associated with IECEx and ATEX protection schemes - related to outside certifications and handled under these requirements.
- Common electrical / electronic components (i.e. transformers, disconnect breakers, wiring, PLC, current/voltage/power measuring devices) - impact on lifespan due to external environmental factors

## **3. Component Upgrade**

A definition is not provided, but component 'upgrades' are referenced in IMO BWMS Code paragraphs 1.10 and 1.12 (see Table 1 above). Paragraph 1.10 applies to upgrades to major components *during* type approval testing, which requires submission of a new test protocol and evaluation, and repeating testing. Paragraph 1.12 applies to upgrades relating to safe BWMS operation *during* and *after* type approval.

The USCG regulations do not define a component 'upgrade'.

From the BEMA perspective, 'upgrade' means replacing an approved component with one of equivalent or higher quality, performance, or component supplier replacement with a new version (i.e. component being made obsolete).

## **4. Component Change**

Neither IMO or USCG define a component 'change'.

From the BEMA perspective, a component 'change' applies to use of a different make, brand or specification than the approved component. Component changes can be for similar, lower or higher specifications.

#### **5. Component Replacement**

A definition is not provided, but component 'replacement' is referenced in IMO BWMS Code paragraph 1.11 (see Table 1 above), relating to replacement of non-major components *during* type approval.

The USCG regulations do not define component 'replacement'.

From the BEMA perspective, replacement means a major or non-major component with the same form, fit and function or higher specifications, from the same or different supplier.

#### **6. Spare Parts, Consumables, and Component Replacement not Authorized by the OEM**

Although numerous unauthorized spare parts and/or consumables are available on the open market (i.e., gray market spares), components and consumables supplied by any party not authorized by the OEM are not compliant with the Type Approval certificate issued for the BWMS. Nothing in this paper is intended to authorize any party other than the OEM of the BWMS to make any changes to or authorize any alterations or modifications of any component, major or minor, to the approved BOM of a BWMS approved in accordance with IMO and/or USCG regulations .

### **IV. Technical Considerations, Current Challenges, and Suggestions for Common Approval Approaches**

#### *A. Technical Considerations*

A variety of scenarios may require a BWMS manufacturer to use equipment or component(s) not within the BOM of the approved BWMS. The reasons behind BWMS component changes are important to consider and scenarios may include, but are not limited to, the following:

- Non-functioning components;
- Unreliable components;
- Components obsoleted or discontinued by component supplier;
- Component model changes or upgrades by BWMS manufacturer for system innovation, improved performance, reliability, energy efficiency, etc.;
- Component changes to reduce BWMS cost and/or delivery time;
- Installation-specific requirements (i.e., by class, flag, or BWMS manufacturer); and
- Third party issues outside the control of the BWMS OEM including supply chain issues (e.g., component shortages, lengthy lead times), delays in reviews from national Administrations and/or and classification societies, and external global factors (e.g., pandemics, acts of war, embargoes, severe weather, etc.)

As discussed in Section II, BWMS manufacturers frequently encounter the above scenarios where changing, upgrading or replacing an approved BWMS component is needed but will have no impact on the overall operation of the BWMS or its ability to meet the biological discharge standards. However, the ability to make BWMS component changes without complex, lengthy and costly review and approvals is currently limited.

#### *B. Current Challenges*

Under current requirements, obtaining approval to deviate from the approved BOM and exchange BWMS components can be challenging due to the following:



- Differing regulations / requirements by IMO, national Administrations, USCG and classification societies
  - Design standards and type approval requirements can vary between approving bodies
  - Approval process varies between approving bodies or even different offices of the same body
  - Creates lack of clarity and global inconsistency
- Multiple reviews by differing approving bodies
  - Each approving body reviews component changes and may have associated fees to conduct the review / approval
  - Each approval requires time, in some cases up to 1 year for minor changes has been experienced by BEMA Members

It is also important to note that because components are associated with each BWMS approval and each manufacturer must go through approval, common components that have already undergone environmental testing are unnecessarily tested repeatedly.

The above results in inefficient, repetitious and costly approval processes that impact BWMS manufacturers, component suppliers, and ultimately shipowners in the form of increased overall BWMS cost and in some cases, significant project delays. Further, approval processes that are costly and burdensome can inadvertently stifle technical innovation and equipment improvement. There is a need to find a balance between ensuring that equipment function and safety are maintained, applicable requirements are met, yet BWMS manufacturers have ability to make equipment modifications when justified.

Finally, as the implementation phase of the Ballast Water Management Convention has commenced, lack of harmonization of component change procedures has the potential to significantly increase the workload of all stakeholders during the retrofit cycle. As specific components become obsolete or in short supply, numerous manufacturers may be held up by the need for obtaining approvals for components that have already been approved for other systems. These delays and interruptions will create additional needless bottlenecks to an already challenging implementation schedule. Additionally, as noted above significant time has passed for early BWMS installations and aging equipment needs to be maintained with newly available components. The number of installations in the global fleet is also continually increasing; therefore, the impacts of time and cost to make BWMS changes are growing exponentially.

#### *C. Suggestions for Streamlined and Standardized Approval Approaches*

BEMA suggests moving towards a streamlined, common review and evaluation process to enable BWMS manufacturers to exchange components when there is no impact to ability to meet the biological discharge standards or impact the G9 Final Approval (when applicable). Further, BEMA suggests that evaluations of BWMS component changes should be proportional to the function and specifications of the component under consideration. Referencing the definitions provided in Section III, a suggested streamlined approach for approvals related to major and non-major BWMS components could be divided as follows:

- Changes to a major component or any component that directly impacts BWMS efficacy performance and/or G9 elements (i.e., ship, crew and environmental safety) – submission must be made to IMO and/or USCG for approval and/or determination of additional testing *prior* to change being implemented; and
- Changes to a non-major component or any component that has no impact on BWMS efficacy performance and/or G9 elements is considered of similar or greater specification – proceed with the component change, ensure supporting documents are available and submitted with a future IMO and/or USCG approval update.

Regardless of the type of change (i.e. major or non-major component), the main specifications of the current component should be defined by the BWMS manufacturer, along with an evaluation of the characteristics

of the new component in relation to the approved component. Specific scenarios and suggest approaches include:

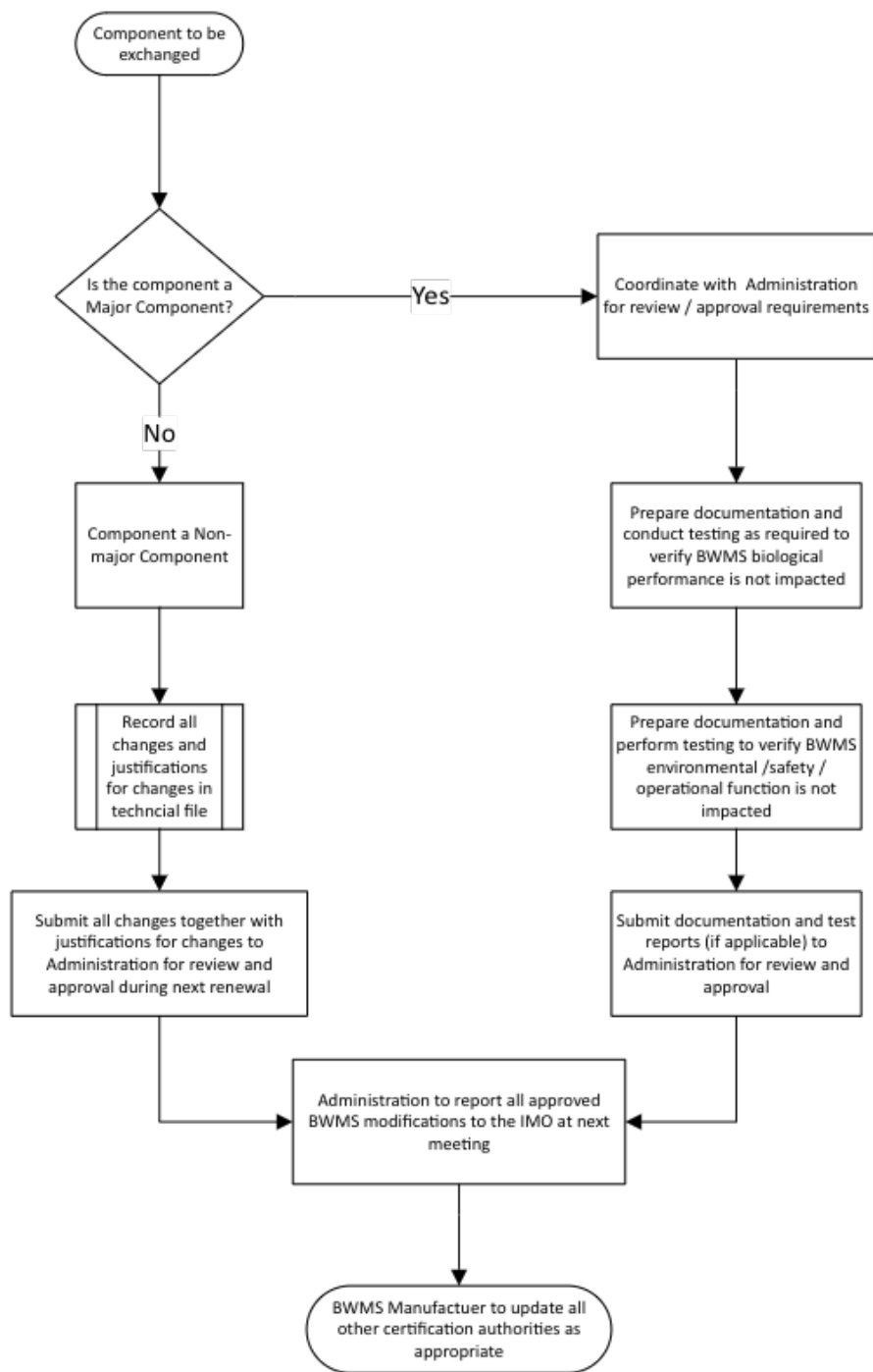
- In cases of changing a major component with one of similar or higher specification, appropriateness of the new component could be demonstrated by documentation and/or testing, if warranted.
- In cases of changing a non-major component with one of similar or higher specification, appropriateness of the new component could be demonstrated by documentation.
- In cases of changing a major or non-major component with one of lower specification, documentation to demonstrate equivalency and/or testing should be repeated, when warranted.

In summary, the extent of evaluation and any warranted testing would depend on the type of component (major component or non-major component), the component specifications and the potential impacts to the biological efficacy and/or safety or environmental aspects of the BWMS. It should be noted that changes / upgrades of components during the type approval process could require a new submission of the test proposal and could involve a new evaluation and repeating of the land-based and shipboard tests.

Streamlining the component change review process could be accomplished by utilizing existing component testing data and/or type approval certificates. Repetitious environmental testing should not be required in cases where components have existing type approvals by the component manufacturer or when the testing data is made available by the data owner (i.e. component supplier and/or BWMS manufacturer). As mentioned in Section III, the USCG currently allows testing of common marine equipment in accordance with IACS Test Specification for Type Approval (UR E10) and accepts certification to UR E10 in lieu of component testing, except when the components are installed in a control / monitoring panel (refer to USCG's "*Ballast Water FAQs*"). This approach can be very helpful.

In IMO terms, based on the BWMS Code (MEPC.300(72), Annex Part 3, paragraph 3.3 and associated footnote 9), acceptance of components with UR E10 certification is implied, but is not explicitly stated with respect to the definitions of major and non-major components. This lack of differentiation of components and a means to approve the same on a standalone basis in support of BWMS approvals has led to a conformity assessment system wherein BWMS manufacturers are required to test the same components repeatedly in order to demonstrate compliance at the *system level*.

BEMA suggests that there be a means by which component suppliers at the *component level* may test, and gain approval of, non-major components as standalone devices for the application in BWMS. This would allow BWMS manufacturers to readily use such approved components to upgrade, change or replace existing components in a BWMS, eliminating the need to undergo redundant component level testing to obtain BWMS approval. This approach could in effect allow approved components to be considered as common marine equipment. Publication of approved components would be required in a suitable format.



**Figure 1 – Flow chart of procedures for changes to BWMS components**

Lastly, BEMA aligns with the definition within the BWMS Code (MEPC.300(72), annex, paragraph 3.2), that the BWMS equipment does not include the ship's ballast water fittings, which may include piping, valves, pumps, etc. onboard a ship that are not related to the fitted BWMS.



#### *D. Suggestions for Regulatory Instrument Improvements*

Revisions to the BWMS Code that address the various scenarios when changes to an approved system would be useful. For example, as noted in Table 1, the BWMS Code paragraph 1.12 allows for upgrades to a BWMS after type approval when related to safety of the system. This should be expanded to cover any component upgrade, change, or replacement that impacts biological efficacy, ship or crew safety, or environmental acceptability (i.e., G9 Approval, when applicable).

The USCG should include relevant regulatory language during development of BWMS regulations under the Vessel Incidental Discharge Act.

National Administrations should encourage their designated Recognized Organizations to support shipowners by having classification societies consider consistency and/or reciprocity between organizations. This should also be encouraged and facilitated by the International Association of Classification Societies (IACS), and at a minimum, individual classification societies should ensure consistent implementation between differing offices within their organization.

#### **V. Closing Remarks**

The components of every BWMS undergo a stringent approval process that includes the electro-mechanical design verification of individual components. Furthermore, biological efficacy, ship and crew safety, and environmental acceptability are validated during land based and shipboard testing programs. The suitability of a BWMS to be installed and operated efficiently and safely onboard a ship is accomplished through real time shipboard tests. Individual BWMS components and sub-assemblies are subject to rigorous validation through environmental testing under prescribed laboratory conditions and appropriate class design verification and qualification.

This systematic and rigorous approval regime makes BWMS one of the most highly reviewed and validated environmental protection systems of modern shipping. However, it has been acknowledged by the IMO that there is a lack of practical experience and “real world” data. Consequently, an “Experience Building Phase” has been implemented to allow for the collection of data from onboard ballast water operations. Although the data gathering phase of the EBP officially concluded with submission of the final data analysis report to MEPC 78 (MEPC 78/4/1), data on type approval changes, including the number of changes required over time, the number of entities requiring review of each change and the associated time and costs, inter alia, should be collected by flag and port States, as well as IACS Members, shipowners and BWMS manufacturers and submitted to the IMO as information. BEMA encourages the IMO, USCG, national Administrations and classification societies to correspond with BEMA to gain the BWMS manufacturers perspective that can facilitate BWMS technical improvements that can enhance BWMS effectiveness, make the treatment process even more effective, and ease the operation of the installed BWMS for the ships’ crew. Implementation of streamlined and standardized approval processes for BWMS component changes will ensure that all stakeholders have confidence in the supply and operation of the equipment onboard commercial vessels without prohibiting timely maintenance, support and innovation of BWMS equipment.

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