

F45 Installation of BWMS on-board ships

(June 2021)

1 General

1.1 Application

1.1.1 This Unified Requirement details fire safety measures, in addition to that required by SOLAS II-2, related to the installation of Ballast Water Management Systems onboard any ship.

This UR is to be read in conjunction with IACS UR M74 rev.2 - Ballast Water Management Systems.

1.1.2 The requirements of this UR apply for BWMS technologies as listed in Table 1. BWMS with alternative technologies are to be specially considered by the Classification Society.

1.2 Definitions

1.2.1 Airlock

An airlock is a space enclosed by gastight steel bulkheads with two gastight doors spaced not more than 2.5 m apart. The doors shall be self-closing without any holding back arrangements. Air locks shall have mechanical ventilation and shall not be used for other purposes. An audible and visual alarm system to give a warning on both sides of the air lock shall be provided to indicate if more than one door is moved from the closed position. The air lock space shall be monitored for dangerous gas as defined in UR M74 §2.3.

1.2.2 Ballast Water Management System (BWMS)

Ballast Water Management System means any system defined in paragraph 2.1 of UR M74, Rev.2.

Note:

1. This UR is to be uniformly implemented by IACS Societies for BWMS:

- i) For existing ships, where the application for approval for the [installation] plans of BWMS is dated on or after 1 July 2022; or
- ii) For new ships contracted for construction on or after 1 July 2022.

2. The “contracted for construction” date means the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. For further details regarding the date of “contracted for construction”, refer to IACS Procedural Requirement (PR) No.29.

Table 1 - Categorization of BWMS technologies

BWMS's Technology category* →		1	2	3a	3b	3c	4	5	6	7a	7b	8
Characteristics ↓		In-line UV or UV + Advanced Oxidation Technology (AOT) or UV + TiO2 or UV + Plasma	In-line Flocculation	In-line membrane separation and de-oxygenation (injection of N2 from a N2 Generator)	In-line de-oxygenation (injection of Inert Gas from Inert Gas Generator)	In-tank de-oxygenation with Inert Gas Generator	In-line full flow electrolysis	In-line side stream electrolysis (2)	In-line (stored) chemical injection	In-line side-stream ozone injection without gas/liquid separation tank and without Discharge treatment tank	In-line side-stream ozone injection with gas/liquid separation tank and Discharge water treatment tank	In-tank pasteurization and de-oxygenation with N2 generator
Des-infection when ballasting	Making use of active substance		X			In-tank technology: No treatment when ballasting or de-ballasting	X	X	X	X	X	In-tank technology: No treatment when ballasting or de-ballasting
	Full flow of ballast water is passing through the BWMS	X	X	X	X		X				X	
	Only a small part of ballast water is passing through the BWMS to generate the active substance							X				
After-treatment when de-ballasting	Full flow of ballast water is passing through the BWMS	X									X	
	Injection of neutralizer						X	X	X	X	X	
	Not required by the Type Approval Certificate issued by the Administration		X	X								
Examples of dangerous gas as defined in UR M74 §2.3			(1)	O2 N2	CO2 CO		H2 Cl2	H2 Cl2	(1)	O2 O3 N2	O2 N2	
Notes:												
(1) To be investigated on a case by case basis based on the result of the IMO (GESAMP) MEPC report for Basic and Final approval in accordance with the G9 Guideline.												
(2) In-line side stream electrolysis may also be applied in-tank in circulation mode (no treatment when ballasting or de-ballasting)												
Footnote: * Taking into consideration future developments of BWMS technologies, some additional technologies may be considered in this Table 1 by identifying their characteristics in the same manner as for the above BWMS cat.1, 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8.												

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1.2.3 Ballast Water Management Room (BWMR)

A Ballast Water Management Room is any space containing equipment belonging to the Ballast Water Management System. A space containing remote controls for the BWMS or a space dedicated to the storage of liquid or solid chemicals for BWMS need not be considered as a BWMR for the purposes of this UR.

1.2.4 BWMS storing, introducing or generating chemicals.

In general, BWMS storing, introducing or generating chemicals refer to:

- In-line flocculation (cat.2 as per Table 1),
- Chemical injection (cat.6 as per Table 1) and
- BWM technologies using neutralizers injection (cat.4, 5, 6 and 7 as per Table 1)

BWMS that do not store, introduce or generate toxic or flammable chemicals may be specially considered as detailed in Table 2 below.

Table 2: Requirements that may be reduced for BWMS storing, introducing or generating chemicals depending on the chemicals.

Requirement	Conditions to be met before reducing the requirement
2.3.4	The stored chemicals are neither toxic nor flammable
3.1.1	The BWMS does not use any flammable or toxic chemical substances
3.3.1	No dangerous gas as defined in UR M74 §2.3 will be generated by the BWMS
6.1.1	No toxic chemical is stored and no toxic gas will be generated by the BWMS
7.1.1 7.1.3 7.1.6	No toxic chemical is used or will be generated by the BWMS

The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guidelines) and "safety hazard" as listed in Ch.17 of IMO IBC code are to be considered for this purpose.

Note: Chemicals include additives for BWMS.

2 Fire categorization

2.1 General

BWMR shall be classified as follows for the purpose of applying the requirements of SOLAS Chapter II-2:

- BWMR containing oil-fired inert gas generators (i.e. BWMS cat.3b and 3c as per Table 1) shall be treated as machinery spaces of category A
- Other BWMR shall be considered as other machinery spaces and shall be categorized, depending on the ship type (10) or (11) according to SOLAS II-2/9.2.2.3 or (7) according to SOLAS II-2/9.2.2.4, II-2/9.2.3 and II-2/9.2.4

2.2 BWMS located in the cargo area of tankers

Notwithstanding the above, where a BWMS is located in the cargo area of a tanker as allowed by UR M74, the BWMR shall be categorized as (8), a cargo pump-room, according to SOLAS II-2/9.2.4.2.2 for determining the extent of fire protection to be provided.

Note: The cargo area of a tanker is defined in para 2.2 of UR M74 Rev.2.

2.3 Storage of chemicals

2.3.1 Spaces where the storage of liquid or solid chemicals for BWMS is intended shall be categorized as store-rooms for the purpose of applying the requirements of SOLAS Chapter II-2, i.e.:

- On passenger ships carrying more than 36 passengers:
 - “Other spaces in which flammable liquids are stowed” as defined in SOLAS II-2/9.2.2.3.2.2(14), if flammable products are stored
 - “Store-rooms, workshops, pantries, etc.” as defined in SOLAS II-2/9.2.2.3.2.2(13) otherwise
- On other ships:
 - “Cargo pump-rooms” as defined in SOLAS II-2/9.2.4.2.2.2(8) if located in the cargo area of a tanker
 - “Service spaces (low risk)” as defined in SOLAS II-2/9.2.2.4.2.2(5), SOLAS II-2/9.2.3.3.2.2(5) or II-2/9.2.4.2.2.2(5) if the surface area is less than 4m² and if no flammable products are stored
 - “Service spaces (high risk)” as defined in SOLAS II-2/9.2.2.4.2.2(9), SOLAS II-2/9.2.3.3.2.2(9) or II-2/9.2.4.2.2.2(9) otherwise

Note: It is understood that only chemical injection (cat.6 as per Table 1), in-line flocculation (cat.2 as per Table 1) and technologies using neutralizer injection (cat.4, 5, 6 and 7 as per Table 1) will require chemical or additive storage.

2.3.2 Where the storage of chemicals is foreseen in the same room as the ballast water management machinery, this room shall be considered both as a store-room and as a

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machinery space in line with 2.1.

2.3.3 When the chemical substances are stored inside integral tanks, the ship's shell plating shall not form any boundary of the tank.

2.3.4 Tanks containing chemicals shall be segregated from accommodation, service spaces, control stations, machinery spaces not related to the BWMS and from drinking water and stores for human consumption by means of a cofferdam, void space, cargo pump-room, empty tank, oil fuel storage tank, BWMR or other similar space. On-deck stowage of permanently attached deck tanks or installation of independent tanks in otherwise empty hold spaces should be considered as satisfying this provision.

3 BWMR location and boundaries

3.1 BWMS using chemical substances

3.1.1 For BWMS storing, introducing or generating chemicals, the BWMR and chemical substance storage rooms are not to be located in the accommodation area. Any ventilation exhaust or other openings from these rooms shall be located not less than 3m from entrances, air inlets and openings to accommodation spaces. This requirement need not apply in case the BWMS is located in the engine room.

3.2 Ozone-based BWMS

3.2.1 Ozone-based BWMS – i.e. cat.7a and 7b - shall be located in dedicated compartment, separated from any other space by gastight boundaries. Access to the BWMR from any other enclosed space shall be through airlock only, except if the only access to that space is from the open deck.

Access to the ozone based BWMR may be provided through the engine room only provided:

- Access from the engine room to the BWMR is through airlock and,
- An alarm repeater is provided in the BWMR, which will repeat any alarm activated in the engine room.

3.2.2 A sign shall be affixed on the door providing personnel with a warning that ozone may be present and with the necessary instructions to be followed before entering the room

3.3 General

3.3.1 BWMR containing equipment for BWMS of the following types shall be equipped with tested gastight and self-closing doors without any holding back arrangements:

- BWMS storing, introducing or generating chemical substances
- De-oxygenation based on inert gas generator
- Electrolysis
- Ozone injection

Doors leading to the open deck need however not to be self-closing.

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(Cont)**4 Fire fighting****4.1 Fixed fire-extinguishing system**

4.1.1 Where fitted, fixed fire extinguishing systems shall comply with the relevant provisions of the Fire Safety Systems Code

4.1.2 Ozone-based BWMS

BWMS containing equipment related to ozone-based BWMS shall be provided with a fixed fire extinguishing system suitable for category A machinery spaces and capable of manual release.

4.1.3 Where a fixed fire-extinguishing system is provided in the BWMS, it should be compatible with the BWMS and the chemical products that are used, produced or stored in the BWMS. Specific attention shall be paid to potential chemical reactions between the fire extinguishing medium and chemical products used for water treatment.

Especially, water-based fire-extinguishing systems should be avoided in case of sulfuric acid storage.

4.1.4 Foam fixed fire-extinguishing system

For all kinds of BWMS, in case a foam fire extinguishing system is installed in the BWMS, its efficiency shall not be impaired by chemicals used by the BWMS where relevant.

4.1.5 Where a fixed fire-extinguishing system is installed in the BWMS, automatic shutdown of the BWMS upon release of the fixed fire extinguishing system shall be arranged. Any need for cooldown necessary for safe shutdown to be considered in the shutdown sequence.

4.1.6 Where BWMS that includes air or O₂ storage is located in a room covered by a fixed gas fire-extinguishing system, air or O₂ storage shall be taken into account for the gas capacity calculation, unless the discharge pipe from safety valves for air or O₂ storage are led directly to outside the room.

4.2 Portable fire-fighting equipment

4.2.1 There shall be at least one portable fire extinguisher that complies with the provisions of the Fire Safety Systems Code and suitable for electrical fires in the BWMS containing UV-type BWMS.

5 Fire prevention**5.1 Equipment protection**

5.1.1 Overcurrent or overvoltage protection is to be installed to protect UV type BWMS.

5.1.2 Electrolysis reactors are to be provided with at least with two independent means of monitoring operation. The monitoring system shall initiate audible and visual alarms and automatic shutdown of the BWMS in the event that an anomaly is detected. Requirements for shutdown arrangement are clarified in UR M74. 3.1.9.

Note: If a pressure relief valve is also provided, the vent of this valve is to be led to a safe location on the open deck, as clarified in UR M74. The valve should be positioned to optimally remove gas from the electrolysis reactor.

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5.2.1 A fixed fire detection and fire alarm system complying with the provisions of the Fire Safety Systems Code shall be installed in spaces containing an inert gas generator or an ozone generator.

5.2.2 A section of fire detectors which covers a control station, a service space or an accommodation space is not to include a BWMR containing equipment related to ozone based BWMS.

6 Ventilation**6.1 Ventilation arrangement**

6.1.1 The ventilation systems for BWMR containing BWMS of the following types shall be independent of the ventilation systems serving any other spaces:

- BWMS storing, introducing or generating chemical substances.
- De-oxygenation, including pasteurization and de-oxygenation (cat.3 and cat.8 as per Table 1)
- Electrolysis
- Ozone injection

6.1.2 The ventilation exhaust for BWMR containing a nitrogen generator shall be located in the lower part of the room in order to efficiently evacuate dangerous gases – as defined in UR M74 §2.3 - heavier than air.

6.1.3 The ventilation exhaust for BWMR containing electrolysis systems shall be located so as to be able to efficiently evacuate dangerous gases – as defined in UR M74 §2.3 - that could be generated during the electrolysis process. Due regard shall be paid to the expected quantity and density of such gases when designing the ventilation exhaust.

6.1.4 The following requirements apply to ventilation ducts serving BWMR for ozone-based BWMS:

- The part of the ducts located outside of the BWMR shall be made of steel having a thickness of at least 3 mm for ducts with a free cross-sectional area of less than 0.075 m², at least 4 mm for ducts with a free cross-sectional area of between 0.075 m² and 0.45 m², and at least 5 mm for ducts with a free cross-sectional area of over 0.45 m²; and
- The ducts shall be suitably supported and stiffened
- The outside openings of the ducts shall be fitted with protective screens of not more than 13 mm square mesh.

6.1.5 The ventilation system for BWMR containing ozone-based BWMS or ventilation system for hydrogen de gas arrangement as required by UR M74 3.3.1.5 shall be interlocked with the BWMS such that:

- In case of loss of ventilation (primary and secondary), a visual and audible alarm shall be triggered both inside and outside the BWMR and at a place where a responsible member of the crew is on duty. If the ventilation is not restored after a pre-set time, the

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BWMS shall then be automatically shut down. Any need for cooldown necessary for safe shutdown is to be considered in the shutdown sequence.

- It shall not be possible to start the BWMS without the ventilation running

For ventilation systems serving BWMR and containing or conveying a dangerous gas, relevant requirements in UR M74 3.3 are to be satisfied.

6.2 Ventilation rate

6.2.1 An adequate power ventilation system shall be provided in enclosed BWMR.

6.2.2 The ventilation capacity shall be at least 30 air changes per hour where explosive or toxic gases may be generated during operation of the BWMS. The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guidelines) and "safety hazard" as listed in Ch.17 of IBC code are to be used as references for identifying those cases.

6.2.3 The ventilation capacity may be reduced as follows:

- | | |
|--------------------------------------------------------------------------------------------|-------------------------|
| • Flocculation-type BWMS | 6 air changes per hour |
| • De-oxygenation, incl. pasteurization and de-oxygenation (cat.3 and cat.8 as per Table 1) | 6 air changes per hour |
| • Full flow electrolysis | 6 air changes per hour |
| • Side-stream electrolysis | 20 air changes per hour |
| • Ozone injection | 20 air changes per hour |
| • Chemical injection | 6 air changes per hour |

Note: More stringent ventilation capacity requirements may arise from other regulations e.g. IBC Code requirements for spaces located in the cargo area.

7 Personal equipment

7.1.1 Suitable protection equipment shall be available onboard for the protection of the crew members who are engaged in the servicing, maintenance and repair of BWMS storing, introducing or generating chemicals, as recommended by the product manufacturers. The protection equipment shall consist of large aprons, special gloves with long sleeves, suitable footwear, coveralls of chemical-resistant materials, and tight fitting goggles or face shields or both. The protective clothing and equipment shall cover all skin so that no part of the body is unprotected. This protection equipment is to be provided separately without taking into account equipment required by other mandatory requirements.

7.1.2 Work clothes and protective equipment shall be kept in easily accessible places and in special lockers. Such equipment shall not be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. Notwithstanding the above, storage rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc.

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7.1.3 When a BWMS storing, introducing or generating chemicals is installed on board, suitably marked decontamination showers and an eyewash shall be available in a convenient location in close proximity to the BWMS and the chemical store room(s).

7.1.4 An emergency escape breathing apparatus (EEBD) is to be provided in the BWMR. This emergency escape breathing apparatus may be one of the EEBDs provided in accordance with the requirements of SOLAS II-2/13.

An EEBD need not be required for BWMS of cat.1 as per Table 1.

7.1.5 A personal ozone detector, calibrated as per the manufacturer's specifications, shall be provided for each person engaged in the servicing, maintenance and repair of BWMS utilizing ozone.

7.1.6 A two-way portable radiotelephone apparatus dedicated for the BWMS service, maintenance and repair shall be provided, in addition to those required by SOLAS for fire-fighting purposes. This two-way radiotelephone apparatus is to be properly identified in order to avoid mix-up with the apparatus intended for fire-fighting operations. Where the BWMS may release explosive gases, this two-way radiotelephone apparatus shall be of a certified safe type suitable for use in zone 1 hazardous areas, as defined in IEC Publication 60079. Where the BWMS stores, utilizes or introduces chemicals, the apparatus shall undergo deep cleaning or de-contamination after use.

A two-way portable radiotelephone apparatus need not be required for BWMS of cat.1 as per Table 1.

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