RULES CHANGE NOTICE No.2 October 2022

Part 1 Seagoing Ships

Volume III

RULES FOR MACHINERY INSTALLATIONS

Consolidated Edition 2022

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Foreword

This Rules Change Notice (RCN) No.2 gives new additions and amendments to the "Rules for Machinery Installations (Pt.1, Vol.III), 2022 Consolidated Edition and Rules Change Notice (RCN) No.1 2022" along with the effective dates from which these changes are applicable.

Amendments to the preceding Edition are marked by strikethrough, red color, and expanded text. These new additions and amendments are to be read in conjunction with the requirements given in the 2022 Consolidated Edition of the Rules and Rules Change Notice (RCN) No.1 2022.

The summary of current amendments for each section including the implementation date are indicated in *Table 1 - Amendments Incorporates in This Notice.*

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Further queries or comments concerning this Rules are welcomed through communication to BKI Head Office.

Rules Changes Notice No. 2 – October 2022

Table 1 – Amendments Incorporates in This Notice

Unless otherwise stated in table 1, these amendments are to be implemented on ships contracted for construction on or after 1 January 2023.

Paragraph	Title/Subject	Status/Remark
Section 1 General Rules and Instructions		
1.A	General	
1.A.9	-	To add related Guidance as a additional requirement
Section 2 Internal Combustion Engines and Air Compressors		
2.B	Document for Approval	
2.B.1	Table 2.1	To add additional document for reference (UR M 44 Rev.10 Corr.1)
2.B.1	Table 2.1	Editorial correction (UR M 44 Rev.10 Corr.1)
Section 3 Steam Turbines, Gas Turbines and Exhaust Gas Turbocharges		
3.III	Exhaust Gas Turbochargers	
3.III.A.2.1	Documentation to be submitted	Rearrange the editorial format of documents to be submitted into table form.
3.III.C	Material certificate	Renumbering of table 3.1 title number
3.III.D.1	Workshop Inspection and Testing	To supersede requirements related to shop test in accordance with UR M73.
3.III.E	Certification	Adding new amendment for the kind of turbochargers that apply for certification (UR M73 Rev.1).
Section 11 Piping Systems, Valves and Pumps		
11.B	Materials, Testing	
11.B.2.6	Plastic piping systems	
11.B.2.6.1.3	-	To add the sentence for the type of joint (UR P4)
11.B.2.6.1.8	-	To add new amendment (UR P4 Rev.7)
11.B.2.6.1.9	-	To add new amendment (UR P4 Rev.7)
11.B.2.6.2	Scope and application	Rewording, renumbering
11.B.2.6.2.2	-	To align the sentence as UR P4
11.B.2.6.3	General requirement	Renumbering
11.B.2.6.3.4 1)	-	To add new amendment (UR P4 Rev.7)
11.B.2.6.4.3	-	To add new amendment (UR P4 Rev.7)
11.B.2.6.4	Table 11.1a	To add new amendment (UR P4 Rev.7), align the sentence as UR P4
11.B.2.6.4.6	-	To add new amendment (UR P4 Rev.7)

Paragraph	Title/Subject	Status/Remark
11.B.2.6.5	Fire endurance	To add new sub-sub paragraph as to align with UR P4
11.B.2.6.5.1 to 3	-	To add new amendment (UR P4 Rev.7)
11.B.2.6.5.4	-	To align the sentence as UR P4
11.B.2.6.5.5	-	Adding new paragraph to align the sentence as UR P4
11.B.2.6.6	Flame Spread	Renumbering
11.B.2.6.9 1)	Testing after installation on board	To add new amendment (UR P4 Rev.7)
11.P	Ballast Systems	
11.P.1.6.1	Scope and application	Adding new sub-sub paragraph
11.P.1.6.1.2 to 3	-	To add new amendment (UR M74 Rev.2)
11.P.1.6.2	Documents to be submitted	Adding new sub-sub paragraph and to detail documents to be submitted
11.P.1.6.3	Definitions	To add new amendment (UR M74 Rev.2)
11.P.1.6.4	Installations	Adding new sub-sub paragraph
11.P.1.6.4.1	General requirements	Adding new sub-sub paragraph
11.P.1.6.4.1.1 to 9	-	To add new amendment (UR M74 Rev.2)
11.P.1.6.6	-	Deleted as UR M74 Rev.2
11.P.1.6.7	-	Deleted as UR M74 Rev.2
11.P.1.6.10	BWTS not in hazardous areas	Deleted as UR M74 Rev.2
11.P.1.6.11	BWTS in hazardous areas	Deleted as UR M74 Rev.2
11.P.1.6.12	-	Deleted as UR M74 Rev.2
11.P.1.6.13	-	Deleted as UR M74 Rev.2
11.P.1.6.14	-	Deleted as UR M74 Rev.2
11.P.1.6.15	-	Deleted as UR M74 Rev.2
11.P.1.6.16	Automation	Deleted as UR M74 Rev.2
11.P.1.6.5	Special requirements for BWMS categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8 generating dangerous gas or dealing with dangerous liquid	To add new amendment (UR M74 Rev.2)
Section 12 Fire Protection and Fire Extinguishing Equipment		
12.C	Fire Detection	
12.C.6.1	-	To add related Guidance as a additional requirement
Section 14 Steering Gears, Rudder Propeller Units, Lateral Thrust Units, Winches, Hydraulic Control Systems, Fire Door Control Systems, Stabilizers		
14.A	Steering Gears	
14.A.1.3	Definitions	To add new amendment (UR M42 Rev.6)
Section 15 Special Requirement for Tankers		

Paragraph	Title/Subject	Status/Remark
15.C	Tankers for the Carriage of Oil and other Flammable Liquids having a Flash Point of 60 °C or below	
15.C.1.1	Inerting of cargo tanks	To supersede of the application of inert gas on oil tanker of 8000 DWT and 20.000 DWT (SOLAS II-2/Reg.4.5.5) (Apply for Oil tanker of 20.000 DWT and upwards constructed on or after 1 July 2002 but before 1 January 2016 and tankers of 8000 DWT and upwards constructed on or after 1 January 2016)
15.C.2	Inerting of double hull spaces	Adding the note describes the double hull spaces room that refer to Guidance for Code and Convention Interpretation (Pt.1, Vol.Y), Sec.11. SC272.
15.D	Inert Gas Systems for Tankers	
15.D.1	General	Adding new general requirements for inert gas on oil tankers in accordance with SOLAS II-2/Reg.4.5.5.
15.C.4	Venting of cargo tanks	
15.C.4.1.2	-	Adding new requirement for secondary means of for preventing over/under pressure of cargo tanks as stipulated in SOLAS II-2/11 6.3.2 (Apply for Oil tanker constructed on or after 1 January 2017)
15.E	Additional Requirements for Installations of Ballast Water Management Systems (1 July 2022)	
15.E.1.1	-	To add new amendment (UR M74 Rev.2)
15.E.1.1.1 to 2	-	To add new amendment (UR M74 Rev.2)
15.E.1.2	-	To delete the previous requirements according to new amendment of UR M74 Rev.2
15.E.1.3	-	To add new amendment (UR M74 Rev.2) and superseding the previous provisions
15.E.2	Installations of one single BWMS on tankers	To add new amendment (UR M74 Rev.2)
15.E.3	BWMS technology categorization (Informative)	To add tecnology categorization (informative) (UR M74 Rev.2)
Annex A Installations of BWMS on-board Ships (1 July 2022)		
A to H	-	Adding new Annex based on UR F45

Section 1 General Rules and Instructions

A. General

9. For the interpretation of International Convention and Code, Guidance for Code and Convention Interpretation (Pt.1, Vol.Y) is to be observed.

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Section 2 Internal Combustion Engines and Air Compressors

B. Document for Approval

1. General

For each engine type the drawings and documents listed in Table 2.1 and Table 2.2 shall, wherever applicable, be submitted by the engine manufacturer to BKI for Approval or Reference. Where considered necessary, BKI may request further documents to be submitted. This also applies to the documentation of design changes according to 4. The documents shall be submitted in form of electronic format for approval.

Table 2.1 Document to be submitted for Reference

No	Description
1	Engine particulars (e.g. Data sheet with general engine information)
2	Engine cross section
3	Engine longitudinal section
4	Bedplate and crankcase of cast design
5	Thrust bearing assembly [1]
6	Frame/ framebox/ gearbox of cast design [2]
7	Tie rod
8	Connecting rod
9	Connecting rod, assembly [3]
10	Crosshead, assembly [3]
11	Piston rod, assembly [3]
12	Piston, assembly [3]
13	Cylinder jacket/ block of cast design [2]
14	Cylinder cover, assembly [3]
15	Cylinder liner
16	Counterweights (if not integral with crankshaft), including fastening
17	Camshaft drive, assembly [3]
18	Flywheel
19	Fuel oil injection pump
20	Shielding and insulation of exhaust pipes and other parts of high temperature which may be impinged as a result of a fuel system failure, assembly
For electronically controlled engines, construction and arrangement of:	
21	Control valves
22	High pressures pumps
23	Drive for high pressure pumps
24	Operation and service manuals [4]

Table 2.1 Document to be submitted for Reference (*continued*)

No	Description
25	FMEA (for engine control system) [5]
26	Production specifications for castings and welding (sequence)
27	Evidence of quality control system for engine design and in service maintenance
28	Quality requirements for engine production
29	Type Approval certification for environmental tests, control components [6]

[1] If integral with engine and not integrated in the bedplate.

[2] Only for one cylinder or one cylinder configuration.

[3] Including identification (e.g. drawing number) of components.

[4] Operation and service manuals are to contain maintenance requirements (servicing and repair) including details of any special tools and gauges that are to be used with their fitting/settings together with any test requirements on completion of maintenance.

[5] Where engines rely on hydraulic, pneumatic or electronic control of fuel injection and/or valves, a failure mode and effects analysis (FMEA) is to be submitted to demonstrate that failure of the control system will not result in the operation of the engine being degraded beyond acceptable performance criteria for the engine. ~~The FMEA reports required will not be explicitly approved by BKI.~~

[6] Tests are to demonstrate the ability of the control, protection and safety equipment to function as intended under the specified testing conditions per Rules for Eletrical Installations (Pt.1, Vol.IV) Sec.9.

----------*end*----------

Section 3 Steam Turbines, Gas Turbines and Exhaust Gas Turbochargers

III. Exhaust Gas Turbochargers

A. General

1. Application

1.1 This Subsection are applicable for approval of turbochargers fitted on diesel engines and describe the required procedures for drawing approval, testing, and shop approval.

1.2 The requirements escalate with the size of the turbochargers. The parameter for size is the engine power (at MCR) supplied by a group of cylinders served by the actual turbocharger, (e.g. for a V-engine with one turbocharger for each bank the size is half of the total engine power).

1.3 Turbochargers are categorised in three groups depending on served power by cylinder groups with:

- Category A : ≤ 1000 kW
- Category B : > 1000 kW and ≤ 2500 kW
- Category C : > 2500 kW

2. Type approval

Turbochargers are to be type approved, either separately or as a part of an engine. The requirements are written for exhaust gas driven turbochargers but apply in principle also for engine driven chargers.

For approval of exhaust gas turbocharger, see C.8.

2.1 Documentation to be submitted

The documents in the following Table 3.1 - 3.3 are to be submitted by the manufacturer to BKI for approval or information:

Table 3.1 Documents to be submitted on request for approval of Category A turbocharger

No.	Documents
1	Containment test report.
2	Cross sectional drawing with principal dimensions and names of components.
3	Test program

Table 3.2 Documents to be submitted for Category B and C turbochargers

No.	Documents	A/I
1	Cross sectional drawing with principal dimensions and materials of housing components for containment evaluation.	I
2	Documentation of containment in the event of disc fracture, see C.7.	A
3	Operational data and limitations as[1]: – Maximum permissible operating speed (rpm) – Alarm level for over-speed – Maximum permissible exhaust gas temperature before turbine – Alarm level for exhaust gas temperature before turbine – Minimum lubrication oil inlet pressure – Lubrication oil inlet pressure low alarm set point – Maximum lubrication oil outlet temperature – Lubrication oil outlet temperature high alarm set point – Maximum permissible vibration levels, i.e. self and externally generated vibration	I
4	Arrangement of lubrication system, all variants within a range.	I
5	Type test reports.	A
6	Test program.	I

[1] Alarm levels may be equal to permissible limits but shall not be reached when operating the engine at 110% power or at any approved intermittent overload beyond the 110%

Note:

A = Documents for approval

I = Documents for information

Table 3.3 Additional documents to be submitted for Category C turbocharger

No.	Documents	A/I
1	Drawings of the housing and rotating parts including details of blade fixing.	A
2	Material specifications (chemical composition and mechanical properties) of all parts mentioned above.	I
3	Welding details and welding procedure of above mentioned parts, if applicable.	A
4	Documentation[1] of safe torque transmission when the disc is connected to the shaft by an interference fit, see B.6.	A
5	Information on expected lifespan, considering creep, low cycle fatigue and high cycle fatigue.	I
6	Operation and maintenance manuals[1]	I

Table 3.3 Additional documents to be submitted for Category C turbocharger (*continued*)

[1] Applicable to two sizes in a generic range of turbochargers **Note:** A = Documents for approval I = Documents for information

----------*end*----------

C. Test

1.5 Material Certificates

Material Certificates shall contain at least the following information:

- quantity, type of product, dimensions where applicable, types of material, supply condition and weight
- name of supplier together with order and job numbers, if applicable
- construction number, where known
- manufacturing process
- heat numbers and chemical composition
- supply condition with details of heat treatment
- identifying marks
- results of mechanical property tests carried out on material at ambient temperature

Depending on the produced component of turbocharger material test certificates are to be issued by the manufacture or BKI. The required Certificates are summarized in Table 3.~~1~~4.

Table 3.~~1~~4 Material certificates

Turbocharger components	Type of Certificates [1)]
Shaft	BKI Material Certificate
Rotors (compressor and turbine)	BKI Material Certificate
Blades	BKI Material Certificate
Casing	Manufacturer Test Report
[1)] Test Certificates are to be issued in accordance with Rules for Materials (Part 1, Vol.V) Section 1.	

----------*end*----------

D. Workshop Inspection and Testing

1. Category B and C turbochargers shall go through following inspections and testings and associated certificates shall be produced as mentioned in Table 3.4.

E. Certification[1]

[1] The date of application for certification is the date of whatever document the Classification Society requires/accepts as an application or request for certification of a new turbocharger type or of a turbocharger type that has undergone substantive modifications in respect of the one previously type approved, or for renewal of an expired type approval certificate.

1. The manufacturer shall adhere to a quality system designed to ensure that the designer's specifications are met, and that manufacturing is in accordance with the approved drawings.

2. For category C, this shall be verified by means of periodic product audits of an Alternative Certification Scheme (ACS) by BKI

3. These audits shall focus on:

- Chemical composition of material for the rotating parts.
- Mechanical properties of the material of a representative specimen for the rotating parts and the casing.
- UT and crack detection of rotating parts.
- Dimensional inspection of rotating parts.
- Rotor balancing.
- Hydraulic testing of cooling spaces to 4 bars or 1,5 times maximum working pressure, whichever is higher.
- Overspeed test of all compressor wheels for a duration of 3 minutes at either 20% above alarm level speed at room temperature or 10% above alarm level speed at 45 ^{O}C inlet temperature when tested in the actual housing with the corresponding pressure ratio. The overspeed test may be waived for forged wheels that are individually controlled by an approved non-destructive method.

4. Turbochargers shall be delivered with:

- For category C, BKI certificate, which at a minimum cites the applicable type approval and the ACS, when ACS applies.
- For category B, a work's certificate, which at a minimum cites the applicable type approval, which includes production assessment.

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Section 11 Piping Systems, Valves and Pumps

B. Materials, Testing

2.6 Plastic piping systems

2.6.1 Terms and Condition

.3 "Joint" means joining pipes the location at which two pieces of pipe or a pipe and a fitting are connected together. The joint may be made by adhesive bonding, laminating, welding, flanges and mechanical joints according to Table 11.13.

.4 "Fittings" means bends, elbows, and fabricated branch pieces etc. of plastic materials.

.5 "Nominal pressure" means the maximum permissible working pressure which should be determined in accordance with the requirements in 2.6.2.1.

.6 "Design pressure" means the maximum working pressure which is expected under operation conditions or the highest set pressure of any safety valve or pressure relief device on the system, if fitted.

.7 "Fire endurance" means the capability of piping to maintain its strength and integrity (i. e. capable of performing its intended function) for some predetermined period of time while exposed to fire.

.8 "Essential to the safety of ship" means all piping systems that in event of failure will pose a threat to personnel and the ship[2].

.9 "Essential services" are those services essential for propulsion and steering and safety of the ship as specified in Guidance for Code and Convention Interpretations (Pt.1, Vol.Y) Sec.11.SC 134.

2.6.2 Scope and application

.1 These requirements are applicable to piping systems on ships, including pipe joints and fittings, made predominately of other material than metal.

.2 The use of mechanical joints approved for the use in metallic piping systems only are not permitted.

.3 Piping systems intended for non-essential services are to meet only the requirements in 2.6.2.1 ii), 2.6.5, 2.6.8 and for prototype testing representative samples of pipes and fittings are to be selected to the satisfaction of BKI and recognized standards.

2.6.3 General requirement

Plastic piping systems are to be type approved by BKI. The requirements are defined in Guidance for The Approval and Type Approval of Materials and Equipment for Marine Use (Pt.1, Vol.W), Sec.3.O.

The specification of piping is to be in accordance with a recognised national or international standard acceptable to BKI. In addition, the following requirements apply:

.4 Temperature

1) The permissible working temperature depending on the working pressure is to be in accordance with Manufacturer 's recommendations, but in each case it is to be at least 20 ^{O}C lower than the

[2] Examples for piping systems essential to the safety are provided by Table 11.1a

minimum heat distortion/deflection temperature of the pipe material, determined according to ISO 75 -2:2013 method A, or equivalent e. g. ASTM D648-18 .

2) The minimum heat distortion/deflection temperature is to be not less than 80°C

2.6.4 Quality control during manufacture

.3 The manufacturer is to have a quality system that meets ISO 9001:2015 or equivalent. The quality system is to consist of elements necessary to ensure that pipes and fittings are produced with consistent and uniform mechanical and physical properties.

Table 11.1a Fire endurance requirements matrix

Piping system		Location										
No.	Description	A	B	C	D	E	F	G	H	I	J	K
Freshwater												
20	Cooling water, essential services	L3	L3	NA	NA	NA	NA	0	0	0	L3	L3
21	Condensate return	L3	L3	L3	0	0	NA	NA	NA	0	0	0
22	Non-essential systems	0	0	0	0	0	NA	0	0	0	0	0
Sanitary / Drains / Scuppers												
23	Deck drains (internal)	L1W 4)	L1W 4)	NA	L1W 4)	0	NA	0	0	0	0	0
24	Crude oil washing lines	0	0	NA	0	0	NA	0	0	0	0	0
25	Vent lines	0 1)8)	0 1)8)	0 1)8)	0 1)8)	0 1)8)	0	0	0	0	0 1)8)	0
Sounding / Air												
26	Water tanks / dry spaces	0	0	0	0	0	0 10)	0	0	0	0	0
27	Oil tanks (Flash point > 60 °C)	0	0	0	0	0	0 10)	0	0	0	0	0
Miscellaneous												
28	Control air	L1 5)	L1 5)	L1 5)	L1 5)	L1 5)	NA	0	0	0	L1 5)	L1 5)
29	Service air (non-essential)	0	0	0	0	0	NA	0	0	0	0	0
30	Brine	0	0	NA	0	0	NA	NA	NA	0	0	0
31	Auxiliary low pressure steam (≤ 7 bar)	L2W	L2W	0 9)	0 9)	0 9)	0	0	0	0	0 9)	0 9)
32	Central vacuum cleaners	NA	NA	NA	0	NA	NA	NA	NA	0	0	0
33	Exhaust gas cleaning system effluent line	L3 1)	L3 1)	NA	NA	NA	NA	NA	NA	~~NA~~0	L3 1), 11) NA	~~NA~~0
34	Urea transfer/supply system (SCR installations)	L1 12)	L1 12)	NA	NA	NA	NA	NA	NA	0	L3 11) NA	0

Location definition:

A	Machinery spaces of category A	Machinery spaces of category A as defined in SOLAS[1] II-2/3.31.
B	Other machinery spaces and pump room	Spaces other than category A machinery spaces and cargo pump rooms, containing propulsion machinery, boilers, fuel oil units, steam and internal combustion engines, generators and major electrical machinery, pumps, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery and similar spaces and trunks to such spaces
C	Cargo pump rooms	Spaces containing cargo pumps and entrances and trunks to such spaces
D	Ro-ro cargo holds	Ro-ro cargo holds are ro-ro cargo spaces and special category as defined in SOLAS[1] II-2/3.41 and SOLAS II-2/3.46.
E	Other dry cargo holds	All spaces other than ro-ro cargo holds used for non-liquid cargo and trunks to such spaces
F	Cargo tanks	All spaces used for liquid cargo and trunks to such spaces
G	Fuel oil tanks	All spaces used for fuel oil (excluding cargo tanks) and trunks
H	Ballast water tanks	All spaces used for ballast water and trunks to such space

Table 11.1a Fire endurance requirements matrix *(continued)*

Location definition:		
I	Cofferdams, Voids etc	Cofferdams and voids are those empty spaces between two bulkheads, separating two adjacent compartments
J	Accommodation, service	Accommodation spaces, service and control station as defined in SOLAS II-2/3.1, SOLAS II-2/3.45 and SOLAS[1] II-2/3.18.
K	Open Decks	Open Deck as defined in SOLAS[1] Chapter II-2/9.2.2.3.2(5).
[1] SOLAS Chapter II-2		
Abbreviations:		
L1	Fire endurance test (appendix 1 of IMO Resolution A.753(18), as amended by IMO Resolutions MSC.313(88) and MSC.399(95) in dry conditions, 60 min.	
L1W	Piping systems similar to level 1 systems except these systems do not carry flammable fluid or any gas and a maximum 5% flow loss in the system after exposure is acceptable (see 2.6.5.2)	
L2	Fire endurance test (appendix 1 of IMO Resolution A.753(18), as amended by IMO Resolutions MSC.313(88) and MSC.399(95)) in dry conditions, 30 min.	
L2W	Piping systems similar to level 2 systems except a maximum 5% flow loss in the system after exposure is acceptable (see 2.6.5.2)	

.6 In case the manufacturer does not have an approved quality system complying with ISO 9001:2015 or equivalent, pipes and fittings are to be tested in accordance with Guidance for The Approval and Type Approval of Materials and Equipment for Marine Use (Pt.1, Vol.W).

2.6.5 Fire endurance

.1 Pipes and their associated joints and fittings whose integrity is essential to the safety of ships, including plastic piping required by SOLAS II-2/21.4 to remain operational after a fire casualty, are required to meet the minimum fire endurance requirements of Appendix 1 or 2, as applicable, of IMO Resolution A.753(18), as amended by IMO Resolutions. MSC.313(88) and IMO Res. MSC.399(95).

.2 Unless instructed otherwise by the Flag Administration, fire endurance tests are to be carried out with specimen representative for pipes, joints and fittings[3]:

i) Pipes
- for sizes with outer diameter < 200 mm the minimum outer diameter and wall thickness[4]
- for sizes with outer diameter ≥ 200 mm one test specimen for each category of t/d (D = outer diameter, t = structural wall thickness). A scattering of ±10% for t/D is regarded as the same group. Minimum size approved is equal to the diameter of specimen successfully tested.

ii) Joints
- Each type of joint applicable for applied fire endurance level tested on pipe to pipe specimen

.3 Means are to be provided to ensure a constant media pressure inside the test specimen during the fire test as specified in Appendix 1 or 2 of the IMO Res.A.753(18),

[3] A test specimen incorporating several components of a piping system may be tested in a single test.

[4] Test conditions are most demanding for minimum wall thickness and thus larger wall thickness is covered. A key factor determining the fire performance of a pipe component variant is the thickness-to-diameter (t/D) ratio and whether it is larger or smaller than that of the variant which has been fire-tested.
If fire-protective coatings or layers are included in the variant used in the fire test, only variants with the same or greater thickness of protection, regardless of the (t/D) ratio, shall be qualified by the fire test.

as amended by IMO Resolutions MSC.313(88) and MSC.399(95). During the test it is not permitted to replace media drained by fresh water or nitrogen.

.4 Depending on the capability of a piping system to maintain its strength and integrity, three different levels of fire endurance for plastic pipe systems are to be distinguished (see IMO Resolution A.753 (18), Appendix 1 and 2).

i) Level 1 - Piping having passed the fire endurance test specified in Appendix 1 of IMO Resolution. A.753(18), as amended by IMO Resolutions. MSC.313(88) and MSC.399(95) for a duration of a minimum of one hour without loss of integrity in the dry condition is considered to meet level 1 fire endurance standard (L1). Level 1W – Piping systems similar to Level 1 systems except these systems do not carry flammable fluid or any gas and a maximum 5% flow loss in the system after exposure is acceptable (L1W).

ii) Level 2 - Piping having passed the fire endurance test specified in Appendix 1 of IMO Resolution. A.753(18), as amended by IMO Resolutions. MSC.313(88) and MSC.399(95) for a duration of a minimum of 30 minutes in the dry condition is considered to meet level 2 fire endurance standard (L2). Level 2W – Piping systems similar to Level 2 systems except a maximum 5% flow loss in the system after exposure is acceptable (L2W).

iii) Level 3 - Piping having passed the fire endurance test specified in Appendix 2 of IMO Resolution. A.753(18) as amended by IMO Resolutions MSC.313(88) and MSC.399(95) for a duration of a minimum of 30 minutes in the wet condition is considered to meet level 3 fire endurance standard (L3)

.5 Permitted use of piping depending on fire endurance, location and type of system is given in Table 11.1a.

.6 For Safe Return to Port purposes (SOLAS II-2/21.4), plastic piping can be considered to remain operational after a fire casualty if the plastic pipes and fittings have been tested to L1 standard.

2.6.6 Flame Spread

.1 All pipes, except those fitted on open decks and within tanks, cofferdams, pipe tunnels, and ducts if separated from accommodation, permanent manned areas and escape ways by means of an A class bulkhead are to have low surface flame spread characteristics not exceeding average values listed in Appendix 3 of IMO Resolution A753(18), as amended by IMO Res. MSC. 313(88) and MSC. 399(95).

2.6.9 Testing after installation on board

1) Piping systems for essential services are to be subjected to a test pressure not less than 1.5 times the design pressure or 4 bar whichever is greater. Notwithstanding the requirement above, the requirement in 2) may be applied to open ended pipes (drains, effluent, etc.).

2) Piping systems for non-essential services are to be checked for leakage under operational conditions.

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P. Ballast Systems

1.6. Ballast water treatment plants

1.6.1 Scope and application

.1 Ballast water treatment plants are to be approved by a flag administration acc. to IMO Resolution MEPC.174(58), MEPC.169(57) respectively. The obligation to install a ballast water treatment plant depends on the ballast water capacity and keel laying date of the ship which processes ballast water such that it meets or exceeds Ballast Water Performance Standard in Regulation D-2 of the BWM Convention. Refer to International Convention for The Control and Management of Ship's Ballast Water and Sediments, 2004 – Regulation B-3.

.2 The requirements in this subsection are not applied to ship's ballast water systems including piping valves, pumps, etc. where the BWMS is not fitted.

.3 This subsection is to be read in conjunction with Annex A - Installation of BWMS on-board ships.

1.6.2 Documents to be submitted

.1 Ballast water treatment systems (BWTS) includes ballast water ~~management~~ equipment, all associated ~~control equipment, monitoring equipment~~ piping arrangements as specified by the manufacturer, control and monitoring equipment and sampling facilities and shall in addition to the provisions of 1.6.1.1 comply with the Rules in Section 8 and in this Section as well as in the Rules for Electrical Installations (Pt 1, Vol.IV), Sec. 9, D.8. The following documents shall be submitted once for each BWTS type for approval:

~~Drawings and technical specification of piping systems including material specification~~

~~Drawings of all pressure vessels and apparatus exposed to pressure including material specification~~

~~Details on electrical and electronic systems~~

- A copy of the Type Approval Certificate of BWM System (issued by flag administration in accordance with (G8) MEPC 174(58) or MEPC 279(70)/BWMS Code MEPC 300(72)*)
- Ballast water management plan
- Arrangement of Ballast piping including sampling points
- BWM System arrangement drawing including details of structural modifications, foundation details
- Wiring Diagram (including power, detailed wiring, control, safety, monitoring and alarm circuit)
- Arrangement of electric apparatus
- Electrical power balance
- Short circuit current analysis
- List of explosion-proof type electric equipment and arrangement (If applicable)
- Lightship calculation
- Other drawings considered necessary by BKI
- Note: In addition, on board test procedure is also to be submitted to the BKI survey location.

* BWMS installed on ships on or after 28 October 2020 shall be approved in accordance with MEPC 279(70) or BWMS Code MEPC 300(72).

If compliance with BKI Rules has already been ascertained as part of the flag state oapproval process in line with 1.6.1, documents for that BWTS type need not be submitted.

On manufacturer's application, BKI may issue an approval certificate confirming compliance with BKI Rules referenced above.

1.6.3 Definitions

.1 Ballast Water Management System (hereinafter referred to as 'BWMS') means any system which processes ballast water such that it meets or exceeds the Ballast Water Performance Standard in Regulation D-2 of the BWM Convention. The BWMS includes ballast water management equipment, all associated control equipment, monitoring equipment piping arrangements as specified by the manufacturer, control and monitoring equipment and sampling facilities. The categorization of BWMS technologies is given in Table 11.18. Applicability of the requirements for each BWMS technology is in accordance with Table 11.19.

.2 Dangerous gas means any gas which may develop an explosive and/or toxic atmosphere being hazardous to the crew and/or the ship due to flammability, explosivity, toxicity, asphyxiation, corrosivity or reactivity and for which due consideration of the hazards is required, e.g. hydrogen (H_2), hydrocarbon gas, oxygen (O_2), carbon dioxide (CO_2), carbon monoxide (CO), ozone (O_3), chlorine (Cl_2) and chlorine dioxide (ClO_2), etc.

.3 Dangerous liquid means any liquid that is identified as hazardous in the Material Safety Data Sheet or other documentation relating to this liquid.

.4 Hazardous area is defined in IEC 60092-502:1999 and means an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment electrical apparatus. When a gas atmosphere is present, the following hazards may also be present: toxicity, asphyxiation, corrosivity and reactivity.

.5 Non-hazardous area means an area which is not a hazardous area as defined in 4 above.

Table 11.18 Categorization of BWMS technologies

BWMS's technology category		1	2a	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 water 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 N_2 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 deballasting	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								
Example of dangerous gas as defined in 1.6.3.4			(1)	O_2 N_2	CO_2 CO		H_2 Cl_2	H_2 Cl_2	(1)	O_2 O_3 N_2		O_2 N_2

Note:

(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)

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 categories 1, 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8.

Table 11.19 Applicability of the requirements for each BWMS technology

BWMS's technology category	1	2a	3a	3b	3c	4	5	6	7a	7b	8
Requirements	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 N_2 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 N_2 generator
1.6.1 to 1.6.3	X	X	X	X	X	X	X	X	X	X	X
1.6.4.1 to 1.6.4.4	X	X	X	X	X	X	X	X	X	X	X
1.6.4.5			X	X	X						X
1.6.4.6	X	X	X	X	X	X	X	X	X	X	X
1.6.4.7			X	X	X						X
1.6.4.8				X						X	
1.6.4.9	X	X	X	X	X	X	X	X	X	X	X
Section 15 E.1.1.1				X	X				X	X	
Section 15 E.1.1.2						X	X	X			
Section 15 E.1.2	X	X	X	X		X	X	X	X	X	
Section 15 E.1.3	X	X	X	X	X	X	X	X	X	X	X
Section 15 E.1.4	X	X	X	X		X	X	X	X	X	
1.6.5.1 1)		X	X			X	X	X	X	X	X
1.6.5.1 2)			X	X	X				X	X	X
1.6.5.1 3)									X	X	
1.6.5.1 4)						X	X	X	X	X	
1.6.5.1 5)						X	X	X			
1.6.5.1 6)			X	X	X				X	X	X
1.6.5.2 1) - 1.6.5.2 4)		X	X	X	X	X	X	X	X	X	X
1.6.5.2 5)			X			X	X	X	X	X	X
1.6.5.2 6)			X						X	X	X
1.6.5.2 7)			X			X	X	X	X	X	X
1.6.5.3		X				X	X	X	X	X	
1.6.5.						X	X	X	X	X	

1.6.4 Installations

.1 General requirements

.1.1 All valves, piping fittings and flanges are to comply with the relevant requirements of this Section and B.2.6. In addition, special consideration can be given to the material used for this service with the agreement of BKI.

.1.2 BWTS is to be provided with by-pass or override arrangement to effectively isolate it from any essential ship system to which it is connected. For new installation or retrofit to existing ships, under normal operating conditions of ballasting and de-ballasting given in the Ballast Water Management Plan (BWMP) the adequacy of the generating plant capacity installed on the vessel is to be demonstrated by an electrical load analysis.

For retrofit installation to exiting ships, a revised electrical load analysis with preferential trips of non-essential services can be accepted.

.1.3 The BWMS is to be operated in accordance with the requirements specified in the Type Approval Certificate (TAC) issued by the Flag Administration. BWMS should be operated within its Treatment Rated Capacity (TRC) as per the TAC. This may require limiting of ship's ballast pump flowrates.

The arrangement of the bypasses or overrides of the BWMS is to be consistent with the approved Operation Maintenance and Safety Manual by the Flag Administration's Type Approval.

In case the maximum capacity of the ballast pump(s) exceeds the maximum treatment rated Capacity (TRC) of the BWMS specified in the TAC issued by the Flag Administration, there should be a limitation on the BWMP giving a maximum allowable flow rate for operating the ballast pump(s) that shall not exceed the maximum TRC of the BWMS.

.1.4 BWMS should be subject to design review by BKI to verify the compliance of the BWMS's manufacturer package with the BKI Rules.

Manufacturers of the BWMS may apply for this design review at the type approval process.

In general, monitoring functions of BWMS belongs to system category I under the application of the Rules for Electrical Installations (Pt.1, Vol.IV) Section 10. However, in case a by-pass valve is integrated in the valve remote control system, the by-pass valve belongs to the system category II Ballast transfer remote control system.

The BWMS's components are required to be inspected and certified by the BKI the manufactory (BKI Certificate (BC) as defined in Section 2.D.2) including pressure vessels, piping class I or II, filters, switchboards, etc.

.1.5 Where a vacuum or overpressure may occur in the ballast ~~line~~ piping or in the ballast tanks due to the height difference or injection of inert gas or nitrogen (N_2), a suitable protection ~~means~~ device is to be provided, (i.e. ~~e.g.~~ P/V valves ~~or~~ P/V breakers, P/V breather valves or pressure safety relief valve or high/low pressure alarms) ~~. and their outlets are to be led to safe area on open deck.~~

The pressure and vacuum settings of the protection device should not exceed the design pressure of the ballast piping (BWMS categories 3a and 3b) or ballast tank (BWMS categories 3a, 3b and 3c), as relevant.

For BWMS categories 3a, 3b and 3c, the inert gas or nitrogen product enriched air from the inert gas system and from the protection devices installed on the ballast tanks (i.e. P/V valves, P/V breakers or P/V breather valves) are to be discharged to a safe location5(1) & (2) on the open deck.

When the concerned ballast tanks are hazardous areas, an extension of hazardous area is to be considered at the outlet of the protection devices: with reference to IEC 60092-502:1999 §4.2.2.9 the areas on open deck, or semi-enclosed spaces on open deck, within 1.5 m of their outlets are to be categorized hazardous zone 1 and with reference to IEC 60092-502:1999 §4.2.3.1, an additional 1.5 m surrounding the 1.5 m hazardous zone 1 is to be categorized hazardous zone 2. Any source of ignition such as anchor windlass or opening into chain locker should be located outside the hazardous areas.

Where products covered by IEC 60092-502:1999 are stored on-board or generated during operation of the BWMS, the requirements of this standard shall be followed in order to:

- Define hazardous areas and acceptable electrical equipment, and
- Design ventilation systems.

.1.6 Electric and electronic components are not to be installed in a hazardous area unless they are of certified safe type for use in the area. Cable penetrations of decks and bulkheads are to be sealed when a pressure difference between the areas is to be maintained.

.1.7 Inert gas systems installed for de-oxygenation BWMS (categories 3a, 3b, 3c and 8) are to be designed in accordance with the following requirements:

1) FSS Code Ch 15 requirements
   - 2.1.2, 2.1.3
   - 2.2.1.3, 2.2.1.4, 2.2.2.1, 2.2.2.2, 2.2.2.3, 2.2.2.6, 2.2.4.1, 2.2.4.2, 2.2.4.3, 2.2.4.4, 2.2.4.5 except 2.2.4.5.1.3 and 2.2.4.5.3
   - 2.3.1.1.2, 2.3.1.2, 2.3.1.4.2, 2.3.1.5, 2.3.1.6, 2.3.2 except 2.3.2.2.1
   - 2.4.1.3, 2.4.1.4 and 2.4.2
   - For inert gas systems installed for in-tank de-oxygenation BWMS (category 8): 2.2.3.1, 2.2.3.2 except 2.2.3.2.6, 2.2.3.2.7 and 2.2.3.2.10

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[5] Footnotes safe location(1) and safe location(2)
Safe location needs to address the specific types of discharges separately.
Signboards or similar warnings at the discharge areas are to be provided.
Safe location(1): inert gas or nitrogen product enriched air from:
- in-line (categories 3a and 3b) and in-tank (categories 3c and 8) de-oxygenation BWMS: the protection devices installed on the ballast tanks, nitrogen or inert gas generators, nitrogen buffer tank (if any); or
- in-line ozone injection BWMS (categories 7a and 7b): the oxygen generator;

safe locations on the open deck are:
- not within 3 m of areas traversed by personnel; and
- not within 6 m of air intakes for machinery (engines and boilers) and all ventilation inlets/outlets.

Safe location(2): oxygen-enriched air from:
- in-line and in-tank de-oxygenation BWMS (categories 3a and 8): the nitrogen generator; or
- in-line ozone injection BWMS (categories 7a and 7b): the protection devices or vents from oxygen generator, compressed oxygen vessel, the ozone generator and ozone destructor devices;

safe locations on the open deck are:
- outside of hazardous area;
- not within 3 m of any source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard;
- not within 3 m of areas traversed by personnel; and
- not within 6 m of air intakes for machinery (engines and boilers) and all ventilation inlets.

In general, when applying FSS Code Ch.15 requirements to inert-gas based BWMS, the following modifications are to be considered:

- The terms "cargo tank" and "cargo piping" are to be replaced by "ballast water tank" or "ballast water piping" as relevant.
- The term "cargo control room" is to be replaced by "BWMS control station" as relevant
- Requirements for slop tanks on combination carriers are to be disregarded
- When applying FSS Code / 15.2.2.4.5.1.1, the acceptable oxygen content is to be specified by the manufacturer, 5% oxygen content need not necessarily be applied.

2) IACS UR F20 requirements F20.1.1.1, F20.1.1.3, F20.3.1, F20.3.3, F20.3.7, F20.3.8, F20.4.4, F20.4.5 and F20.4.6. In applying F20.4.6, the terms “cargo tanks” and “cargo piping” are to be understood as “ballast tanks” and “ballast piping” respectively. For de-oxygenation BWMS (categories 3a, 3b, 3c and 8), the requirements in 1) prevail.

.1.8 When cavitation is the BWMS treatment process (for example by use of pressure vacuum reactor working in combination with a vertical ballast water drop line) or part of the BWMS treatment process (for example by use of “smart pipe” or “special pipe” in BWMS category 7b or by use of “venturi pipe” in BWMS technology 3b) or by use other means, the design and the wall thickness or grade of materials or inside coating or surface treatment of the part of the piping where the cavitation is taking place is to be specifically considered.

.1.9 When it is required to have an automatic shutdown of the BWMS for safety reasons, this must be initiated by a safety system independent of the BWM control system.

~~1.6.6 Where the operating principle of the BWMS involves the generation of a dangerous gas which includes any gas which may develop an explosive and/or toxic atmosphere being hazardous to the crew and/or the ship, e.g. hydrogen (H2), hydrocarbon gas, ozone (O3), chlorine (Cl2) and chlorine dioxide (ClO2), etc., the following requirements are to be satisfied:~~

~~.1 Gas detection equipment is to be fitted in the spaces where dangerous gas could be present, and an audible and visual alarm is to be activated both locally and at the BWMS control station in the event of leakage. The gas detection device is to be designed and tested in accordance with IEC 60079-29-1 or recognized standards acceptable to the BKI.~~

~~.2 The ventilation line of a space where dangerous gas could be present is to be led to a safe area on open deck.~~

~~.3 The arrangements used for gas relieving, i.e. degas equipment or equivalent, are to be provided with monitoring measures with independent shutdown. The open end of the gas relieving device is to be led to a safe area on open deck.~~

~~1.6.7 Ballast piping, including sampling lines from ballast tanks considered as hazardous areas, is not to be led to an enclosed space regarded as a safe area, without any appropriate measures, except ships carrying liquefied gases in bulk. However, a sampling point for checking the performance of BWTS, for ballast water containing dangerous gas, may be located in a safe area provided the following requirements are fulfilled:~~

~~.1 The sampling facility (for BWTS monitoring/control) is to be located within a gas tight enclosure (hereinafter, referred to as a ‘cabinet’), and the following i) through iii) are to be complied.~~

~~In the cabinet, a stop valve is to be installed in each sample pipe.~~

~~Gas detection equipment is to be installed in the cabinet and the valves specified in paragraph above are to be automatically closed upon activation of the gas detection equipment.~~

~~Audible and visual alarm signals are to be activated both locally and at the BWTS control station when the concentration of explosive gases reaches a pre-set value, which should not be higher than 30% of the lower flammable limit (LFL) of the concerned product.~~

~~.2 The standard internal diameter of sampling pipes is to be the minimum necessary in order to achieve the functional requirements of the sampling system.~~

~~.3 The measuring system is to be installed as close to the bulkhead as possible, and the length of measuring pipe in any safe area is to be as short as possible.~~

~~.4 Stop valves are to be located in the safe area, in both the suction and return pipes close to the bulkhead penetrations. A warning plate stating "Keep valve closed when not performing measurements" is to be posted near the valves. Furthermore, in order to prevent backflow, a water seal or equivalent arrangement is to be installed on the hazardous area side of the return pipe.~~

~~.5 A safety valve is to be installed on the hazardous area side of each sampling pipe.~~

.1.10 For the spaces, including hazardous areas, where toxicity, asphyxiation, corrosivity or reactivity is present, these hazards are to be taken into account and additional precautions for the ventilation of the spaces and protection of the crew are to be considered.

.1.11 Additional requirement for tankers shall be in accordance with Section 15.

~~1.6.10 BWTS not in hazardous areas:~~

~~.1 A BWTS that does not generate dangerous gas is to be located in an adequately ventilated area.~~

~~.2 A BWTS that generates dangerous gas is to be located in a space fitted with a mechanical ventilation system providing at least 6 air changes per hour or as specified by the BWMS manufacturer, whichever is greater.~~

~~1.6.11 BWTS in hazardous areas:~~

~~A BWTS, regardless of whether or not it generates dangerous gas, is to be located in a space fitted with mechanical ventilation complying with relevant requirements, e.g. IEC60092-502, IBC Code, IGC Code, etc.~~

~~1.6.12 The length of pipe and the number of connections are to be minimized in piping systems containing dangerous gases/liquids in high concentration. The following requirements are also to be satisfied:~~

~~.1 Pipe joints are to be of welded type except for connections to shut off valves, double walled pipes or pipes in ducts equipped with mechanical exhaust ventilation. Alternatively it is to be demonstrated that risk of leakage is minimized and the formation of toxic or flammable atmosphere is prevented.~~

~~.2 Location of the piping system is to be away from heat sources and protected from mechanical damage.~~

~~1.6.13 For BWMS using chemical substances, handling procedures are to be in accordance with the Material Safety Data Sheet and BWM.2/Circ.20, and the following measures are to be taken as appropriate:~~

~~.1 The materials used for the chemical storage tanks, piping and fittings are to be resistant to such chemicals.~~

~~.2 Chemical storage tanks are to have sufficient strength and be constructed such that maintenance and inspection can be easily performed.~~

~~.3 Chemical storage tank air pipes are to be led to a safe area on open deck.~~

~~.4 An operation manual containing chemical injection procedures, alarm systems, measures in case of emergency, etc, is to be kept onboard.~~

~~1.6.14 Where the BWMS is installed in an independent compartment, the compartment is to be:~~

~~Provided with fire integrity equivalent to other machinery spaces.~~

~~Positioned outside of any combustible, corrosive, toxic, or hazardous areas unless otherwise specifically approved.~~

~~1.6.15 A risk assessment may be conducted to ensure that risks, including but not limited to those arising from the use of dangerous gas affecting persons on board, the environment, the structural strength or the integrity of the ship are addressed.~~

~~1.6.16 Automation~~

~~In case of any by-pass or override operation of BWMS, an audible and visual alarm is to be given and these events are to be automatically recorded in control equipment. The valves in the by-pass line which trigger the by-pass operation are to be remote controllable by control equipment or fitted with open/close indicator for automatic detection of the by-pass event.~~

.1.12 Additional requirements for tankers, see Section 15.E

1.6.5 Special requirements for BWMS categories 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8 generating dangerous gas or dealing with dangerous liquids

.1 Where the operating principle of the BWMS involves the generation of a dangerous gas, the following requirements are to be satisfied:

1) Gas detection equipment is to be fitted in the spaces where dangerous gas could be present, and an audible and visual alarm is to be activated both locally and at the BWMS control station in the event of leakage.
   i) The gas detectors should be located as close as possible to the BWMS components where the dangerous gas may accumulate.
   ii) For flammable gases and explosive atmosphere including but not limited to H2, the Construction, testing and performance of the gas detection devices is to be in accordance with IEC 60079-29-1:2016, IEC 60079-29-2:2015, IEC 60079-29-3:2014 and/or IEC 60079-29-4:2009, as applicable.
   iii) Where other hazards are considered like toxicity, asphyxiation, corrosive and reactivity hazards, a recognized standard acceptable to the Society is to be selected with due consideration of the specific gases to be detected and due consideration of the performance of the detection device with regards to the specific atmosphere where it is used.
2) In spaces where inert gas generator systems are fitted (BWMS categories 3b and 3c) or nitrogen generators are fitted (BWMS categories 3a and 8), at least two oxygen sensors shall be positioned at appropriate locations (as required by Paragraph 2.2.4.5.4 of Chapter 15 of the FSS Code as amended by IMO resolutions up to MSC.410(97)) to alarm when the oxygen level falls below 19%. The alarms shall be both audible and visual and shall be activated:

– inside the space;
– at the entry into the space; and
– inside the BWMS control station.

For BWMS categories 7a and 7b, at least two oxygen sensors shall be positioned at appropriate locations in the following spaces:

– spaces where ozone generators are fitted, or
– spaces where ozone destructors are fitted, or
– spaces where ozone piping is routed;

i) to alarm when the oxygen level raises above 23 %. The alarms shall be both audible and visual and shall be activated at the following locations:
   – inside the space; and
   – at the entry into the space; and
   – inside the BWMS control station.

ii) Automatic shut-down of the BWMS is to be arranged when the oxygen level raisesabove 25%. Audible and visual alarms independent from those specified in the preceding paragraph are to be activated prior to this shut-down.

3) For BWMS categories 7a and 7b, at least one ozone sensor shall be provided at the vicinity of the discharge outlet to the open deck from the ozone destructors addressed in Footnote[6](4) to alarm when the ozone concentration level raises above 0.1 ppm. The alarms shall be both audible and visual and shall be activated in the BWMS control room. In addition, at least two ozone sensors shall be positioned at appropriate location in the following spaces:

– spaces where ozone generators are fitted, or
– spaces where ozone destructors are fitted, or
– spaces where ozone piping is routed;

to alarm when the ozone concentration level raises above 0.1 ppm. The alarms shall be both audible and visual and shall be activated at the following locations:

– inside the space;
– at the entry into the space; and
– inside the BWMS control station.

Automatic shut-down of the BWMS is to be arranged when the ozone concentration measured from one of the two sensors inside the space raises above 0.2 ppm.

4) Inside double walled spaces or pipe ducts constructed for the purpose of .2, 1) Note 1), sensors are to be provided for the detection of H_2 leakages (BWMS categories 4, 5 and 6 when relevant) or O_2 leakages (BWMS categories 7a and 7b) or O_3 leakages (BWMS categories 7a and 7b). The sensors are to activate an alarm at the high level settings and automatic shut-down of the BWMS at the high-high level settings described in above 1) to 3).

Note:

As an alternative to the sensor for the gas detection, monitored under-pressurization inside the double walled spaces or pipe ducts could be provided with an automatic alarm and shut-down of the BWMS in case of loss of the under-pressurization. The monitoring

[6] For (4), refer to footnote 12

can be achieved either by monitoring the pressure inside the double walled spaces or pipe ducts or by monitoring the exhaust fan.

5) For in-line full flow electrolysis BWMS (category 4), in-line side-stream electrolysis BWMS (category 5) and in-line injection BWMS using chemical which is stored onboard (category 6): the hydrogen de-gas arrangement (when provided) is to be provided with redundant ventilation fans and redundant monitoring of the ventilation system.

   In addition the ventilation fan shall be certified explosion proof and have spark arrestor to avoid ignition sources to enter the ventilation systems whereas remaining H_2 gas may be present in dangerous concentrations.

   Audible and visual alarms and automatic shut-down of the BWMS are to be arranged for respectively high and high-high levels of H_2 concentration. The open end of the hydrogen by-product enriched gas relieving device is to be led to a safe location[7(3)] on open deck.

6) The open end of inert gas or nitrogen gas enriched air (BWMS categories 3a, 3b, 3c and 8) or oxygen-enriched air (BWMS categories 3a, 7a, 7b and 8) are to be led to a safe location [8(1) & (2)] on open deck.

.2 Where the piping is conveying active substances, by-products or neutralizers that are containing dangerous gas or dangerous liquids as defined respectively in 1.6.3.3 and 1.6.3.4, the following requirements are to be satisfied:

Notes:

1) This requirement is applicable to the injection lines conveying the dangerous gas or dangerous liquids but not applicable to the ballast water lines where the dangerous gas or dangerous liquids are diluted.

2) The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guideline) could be used for assessing the hazards that could be expected from the media conveyed by the BWMS piping.

1) Irrespective of design pressure and temperature, the piping is to be either of Class I (without special safeguard) or Class II (with special safeguard) as required by IACS UR P2 table 1. The selected materials, the testing of the material, the welding, the non-destructive tests of the welding, the type of connections, the hydrostatic tests and the pressure tests after assembly on-board are to be as required in IACS UR P2. Mechanical joints, where allowed, are to be selected in accordance with Table 11.15.

Notes:

1) For piping class II with special safeguards conveying dangerous gas like hydrogen (H_2), oxygen (O_2) or ozone (O_3), the special safeguards are to be either double walled pipes or pipe duct.

2) For piping class II with special safeguards conveying dangerous liquids, other special safeguards could be considered like shielding, screening, etc.

3) Plastic pipes may be accepted after due assessment of the dangerous gas or dangerous liquids conveyed inside. When plastic pipes are accepted, the requirements of B.2.6 apply.

[7] For safe location (3), refer to footnotes to paragraph .2, 3)

[8] For safe location (1) and safe location (2) refer to footnote 8

2) The length of pipe and the number of connections are to be minimised.

3) Inside double walled space or pipe ducts constructed as the special safeguard for the purpose of 1) Note 1) are to be equipped with mechanical exhaust ventilation leading to a safe location[9(3)&(4)] on open deck.

4) The routing of the piping system is to be kept away from any source of heating, ignition and any other source that could react hazardously with the dangerous gas or liquid conveyed inside. The pipes are to be suitably supported and protected from mechanical damage.

5) Pipes carrying acids are to be arranged so as to avoid any projection on crew in case of a leakage.

6) H_2 by-product enriched air vent pipes (BWMS categories 4, 5 and 6) or O_2 enriched air vent pipes (BWMS categories 3a, 7a, 7b and 8) or O_3 piping (BWMS categories 7a and 7b) shall not be routed through accommodation spaces, services spaces and control stations.

7) O_2 enriched air vent pipes (BWMS categories 3a, 7a, 7b and 8) shall not be routed through hazardous areas unless it is arranged inside double walled pipes or pipe ducts constructed as the special safeguard for the purpose of 3.3.2.1 Note 1) and provided with suitable gas detection as described in 3.3.1.4 and mechanical exhaust ventilation as described in 3).

8) The routing of H_2 by-product enriched air vent pipes (BWMS categories 4, 5 and 6) or O_2 enriched air vent pipes (BWMS categories 3a, 7a, 7b and 8) is to be as short and as straight as possible. When necessary, horizontal portions may be arranged with a minimum slope in accordance with the manufacturer's recommendation.

---

[9] Footnotes safe location(3) and safe location(4):
Safe location(3): hydrogen by-product enriched gas from:
- in-line full flow electrolysis BWMS (category 4), in-line side-stream electrolysis BWMS (category 5) and in-line injection BWMS using chemical which is stored onboard (category 6): the hydrogen de-gas arrangement (when provided);

safe locations on the open deck are:
- not within 5 m of any source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard;
- not within 3 m of areas traversed by personnel; and
- not within 5 m of air intakes from non-hazardous enclosed spaces.

The areas on open deck, or semi-enclosed spaces on open deck, within 3 m of the outlets are to be categorized hazardous zone 1 plus an additional 1,5 m surrounding the 3 m hazardous zone 1 is to be categorized hazardous zone 2.

Electrical apparatus located in the above hazardous areas zone 1 and zone 2 is to be suitable for at least IIC T1.

Safe location(4): For in-line ozone injection BWMS (categories 7a and 7b), vent outlet from O3 destructor device (ODS) can be considered as oxygen-enriched air provided that:
- the ODS are duplicated; and
- the manufacturer justified that the quantity of consumable (activated carbon) used by the ODS is sufficient for the considered life cycle of the BWMS; and
- ozone detection is arranged in the vicinity of the discharge outlet from the vent outlet of the ODS to alarm the crew in case the ODS is not working.

If one of the above 3 conditions is not fulfilled, the safe location from ODS on open deck are:
- outside of hazardous area;
- not within 3 m of any source of ignition;
- not within 6 m of areas traversed by personnel; and
- not within 6 m of air intakes for machinery (engines and boilers) and all ventilation inlets.

.3 For BWMS using chemical substances or dangerous gas which are stored on-board for either:

- storage or preparation of the active substances (BWMS categories 2 and 6), or
- storage or preparation of the neutralizers (BWMS categories 4, 5, 6, 7a and 7b), or
- recycling the wastes produced by the BWMS (BWMS category 2),

procedures are to be in accordance with the Material Safety Data Sheet and BWM.2/Circ.20 "Guidance to ensure safe handling and storage of chemicals and preparations used to treat ballast water and the development of safety procedures for risks to the ship and crew resulting from the treatment process", and the following measures are to be taken as appropriate:

1) The materials, inside coating used for the chemical storage tanks, piping and fittings are to be resistant to such chemicals substances.
2) Chemical substances (even if they are not defined as dangerous liquid in the sense of 1.6.3.4) and gas storage tanks are to be designed, constructed, tested, inspected, certified and maintained in accordance with:
   - for independent tanks permanently fixed onboard containing dangerous liquids (eg. sulfuric acid H_2SO_4) or dangerous gas (eg. oxygen O_2): BKI Rules as applicable to pressure vessels
   - for independent tanks permanently fixed onboard not containing dangerous liquid (eg. sodium sulphite, sodium biosulphite or sodium thiosulfphate neutralizers) and not containing dangerous gas (eg. nitrogen N_2): BKI Rules or other industry standard recognized by BKI
   - for portable tanks: the IMDG Code or other industry standard recognized by BKI.
3) When the chemical substances are stored inside integral tanks, the ship's shell plating shall not form any boundary of the tank.
4) Dangerous liquids and dangerous gas storage tank air pipes are to be led to a safe location [10](1) & (2) on open deck.
5) An operation manual containing chemical injection procedures, alarm systems, measures in case of emergency, etc. is to be kept onboard.
6) Dangerous liquid storage tanks and their associated components like pumps and filters, are to be provided with spill trays or secondary containment system of sufficient volume to contain potential leakages from tank openings, gauge glasses, pumps, filters and piping fittings.

   Further to the safety and/or pollution assessment of the concerned chemical substances, consideration should be provided for segregation of the drains from such spill trays (or secondary containment system) or piping systems from engine room bilge system or from cargo pump room bilge system, as applicable. When necessary, arrangement should be provided within the spill trays (or within the secondary containment system) for the detection of dangerous liquid or dangerous gas as defined respectively in 1.6.3.3 and 1.6.3.4.

[10] For safe location(1) and safe location(2), refer to footnotes to 1.6.4.1.5

Note:

The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guideline) could be used for this assessment.

.4 A risk assessment is to be conducted in a generic manner during the design review mentioned in 1.6.4.1.4 and submitted to the Classification Society for approval for the following BWMS categories:

- BWMS category 4: in all cases;
- BWMS category 5: in all cases;
- BWMS category 6: when one of the MSDS indicates that the chemical substance stored on-board is either flammable, toxic, corrosive or reactive;
- BWMS category 7a and 7b: in all cases.

Note:

The IMO reports issued during the basic and final approval procedures of the BWMS that make use of active substances (G9 Guideline) could be used as a reference for this assessment.

1) The recommended risk assessment techniques for BWMS and other guidances are listed below but not limited to:
   - FMEA, FMECA, HAZID, HAZOP, etc.
   - ISO 31010 – Risk Assessment Techniques
   - IACS Recommendation Rec. 146
   - Guidance for Risk Evaluation for the Classification of Marine Related Facilities (Pt.4, Vol.A)
   - Reference Notes on Risk Assessment for the Marine and Offshore Oil and Gas Industries (Pt.4, Vol.1)
2) The risk assessment should ensure that the package supplied by the BWMS's manufacturer is intrinsically safe and/or provides mitigation measures to the hazards created by the BWMS which have been identified during the design review mentioned in 1.6.4.1.4 but that need to be implemented during the installation on-board.

----------*end*----------

Section 12 Fire Protection and Fire Extinguishing Equipment

C. Fire Detection

6. Design of fire detection and fire alarm systems

6.1 For the design and installation of fire detection and alarm systems, see Rules for Electrical Installations (Pt.1, Vol.IV) Sec. 9, D.3 and additionally C.6.2 and L.1 of this Section.

The requirement in the Guidance for Code and Convention Interpretation (Pt.1, Vol.Y) Sec.11 SC 271 is also to be applied.

----------*end*----------

Section 14 Steering Gears, Rudder Propeller Units, Lateral Thrust Units, Winches, Hydraulic Control Systems, Fire Door Control Systems, Stabilizers

A. Steering Gears

1.3 Definitions

For the purpose of this Section the definitions in Table 14.1 are applied.

Table 14.1 Definitions

Item	Description
Steering gear control system	The equipment by which orders are transmitted from the navigating bridge to the steering gear power units. Steering gear control systems comprise transmitters, receivers, hydraulic control pumps and their associated motors, motor controllers, piping and cables. Steering gear control system is also understood to cover "the equipment required to control the steering gear power actuating system"
Main steering gear	The machinery, rudder actuator(s), the steering gear power units, if any, and ancillary equipment and the means of applying torque to the rudder stock (e.g. tiller or quadrant) necessary for effecting movement of the rudder for the purpose of steering the ship under normal service conditions.
Steering gear power unit	in the case of electric steering gear, and electric motor and its associated electrical equipment, in the case of electrohydraulic steering gear, an electric motor and its associated electrical equipment and connected pump, in the case of other hydraulic steering gear, a driving engine and connected pump.
Auxiliary steering gear	The equipment other than any part of the main steering gear necessary to steer the ship in the event of failure of the main steering gear but not including the tiller, quadrant or components serving the same purpose.
Power actuating system	The hydraulic equipment provided for supplying power to turn the rudder stock, comprising a steering gear power unit or units, together with the associated pipes and fittings, and a rudder actuator. The power actuating systems may share common mechanical components, i.e. tiller, quadrant and rudder stock, or components serving the same purpose.
Maximum ahead service speed	The greatest speed which the ship is designed to maintain in service at sea at her deepest sea going draught at maximum propeller RPM and corresponding engine MCR.
Hydraulic locking	means all situations where two hydraulic systems (usually identical) oppose each other in such a way that it may lead to loss of steering. It can either be caused by pressure in the two hydraulic systems working against each other or by hydraulic "bypass" meaning that the systems puncture each other and cause pressure drop on both sides or make it impossible to build up pressure.
Rudder actuator	The component which converts directly hydraulic pressure into mechanical action to move the rudder.
Maximum working pressure	The maximum expected pressure in the system when the steering gear is operated to comply with SOLAS II-1/29.3.2.

end

Section 15 Special Requirement for Tankers

C. Tankers for the Carriage of Oil and other Flammable Liquids having a Flash Point of 60 °C or below

1. General

These requirements apply in addition to the general requirements in B.

1.1 Inerting of cargo tanks

~~Tankers of 20000 DWT and above are to be equipped with a permanently installed inert gas system in accordance with D.~~

~~For tankers of less than 20000 DWT see D.9.~~

For tankers of 20,000 DWT and upwards constructed on or after 1 July 2002 but before 1 January 2016, and tankers of 8,000 DWT and upwards constructed on or after 1 January 2016 when carrying the follwing:

- Crude oil or petroleum products having a flashpoint not exceeding 60°C (closed cup test), as determined by an approved flashpoint apparatus, and a Reid vapour pressure which is below the atmospheric pressure or other liquid products having a similar fire hazard or;
- Other than those referred to in the bullet above or liquefied gases which introduce additional fire hazards are intended to be carried, for which additional safety measures shall be required, having due regard to the provisions of the International Bulk Chemical Code, the Bulk Chemical Code, the International Gas Carrier Code and the Gas Carrier Code, as appropriate,

are to be protected with a fixed inert gas system in accordance with Subsection D. Other equivalent systems or arrangement may be accepted by Administration, as desrcibed in 1.16.

For tankers not covered 1.1, see D, 9.

2. Inerting of double hull spaces

2.1 On oil tankers, required to be fitted with inert gas systems, suitable connections for the supply of inert gas shall be provided on double hull spaces. Where necessary, fixed purge pipes arranged such to take into account the configuration of these spaces shall be fitted.

Note:

The space categorizes as double hull spaces are those rooms specify in Guidance for Code and Convetion Interpretations (Pt.1, Vol.Y), Section 11, SC 272.

2.2 Where such spaces are connected to a permanently fitted inert gas distribution system, suitable means (e.g. a second water seal and check valve) shall be provided to prevent cargo vapour entering the double hull spaces.

----------*end*----------

D. Inert Gas Systems for Tankers

1. General

1.1 Tankers operating with a cargo tank cleaning procedure using crude oil washing shall be fitted with an inert gas system complying with the Fire Safety Systems Code and with fixed tank washing machines. However, inert gas systems fitted on tankers constructed on or after 1 July 2002 but before 1 January 2016 shall comply with the Fire Safety Systems Code, as adopted by resolution MSC.98(73).

1.2 Tankers required to be fitted with inert gas systems shall comply with provisions of item C.2.

1.3 The inert gas system shall be capable of inerting, purging and gas-freeing empty tanks and maintaining the atmosphere in cargo tanks with the required oxygen content.

1.4 Tankers fitted with a fixed inert gas system shall be provided with a closed ullage system.

1.~~1~~5 The inert gas system shall be capable of supplying a low-oxygen gas or gas mixture in order to achieve an inerted atmosphere in cargo tanks and slop tanks.

1.~~2~~6 Inert gas may be produced by main or auxiliary boilers (flue gas plant), inert gas generators with independent burner units, Nitrogen generators or other equipment.

Additional or deviating requirements for the relevant type of system are prescribed in 5., 6. and 7.

1.~~3~~7 In normal operation, the inert gas system shall prevent air from flowing into the tanks and shall maintain the oxygen content of the tank atmosphere at less than 8% by volume. Provision shall, however, be made for ventilating the tanks when access is required.

1.~~4~~8 It shall be possible to purge empty tanks with inert gas in order to reduce the hydrocarbon content to less than 2% by volume as to ensure subsequent safe ventilation.

1.~~5~~9 Under normal operating conditions, i.e. when tanks are either full or being filled with inert gas, it shall be possible to maintain positive pressure in the tanks.

1.16 Requirements for equivalent systems

1.16.1 The Administration may, after having given consideration to the ship's arrangement and equipment, accept other fixed installations, in accordance with 1.16.3.

1.16.2 For tankers of 8,000 DWT and upwards but less than 20,000 DWT constructed on or after 1 January 2016, in lieu of fixed installations as required by paragraph 1.16.1, the Administration may accept other equivalent arrangements or means of protection in accordance with 1.16.3.

1.16.3 Equivalent systems or arrangements shall:

.1 be capable of preventing dangerous accumulations of explosive mixtures in intact cargo tanks during normal service throughout the ballast voyage and necessary in-tank operations; and

.2 be so designed as to minimize the risk of ignition from the generation of static electricity by the system itself.

----------*end*----------

4. Venting of cargo tanks

4.1 Cargo tanks are to be equipped with redundant venting devices in accordance with B.5.4. Both devices shall comply with the requirements as set out in B.5.4.2.a).

4.1.1 In case it is necessary to separate tanks or tank groups from a common system for cargo/ballast operations these tanks or tank groups shall be equipped with redundant venting devices as per 4.1.

4.1.2 Instead of redundant devices as per 4.1 each cargo tank may be equipped with a single vent system on condition that each cargo tank is equipped with over/under pressure sensors having indicators in the cargo control room or in a location where the cargo operations are controlled. Alarms shall be activated in above location when excessive over/under pressures occur.

In the event of inadvertent closure or mechanical failure of the isolation valves required by SOLAS Reg. II-2/4.5.3.2.2, the secondary means shall be capable of preventing over-pressure or under-pressure.

For ships that apply pressure sensors in each tank as an alternative secondary means (redundant device as per 4.1) of venting, the settings are to be fixed and not arranged for blocking or adjustment in operation.

The requirement in the Guidance for Code and Convention Interpretation (Pt.1, Vol.Y) Sec.11 SC 140 is also to be applied.

----------*end*----------

E. Additional requirements for Installation of Ballast Water Management Systems

1. General

1.1 Hazardous area classification is to be in accordance with IEC 60092-502:1999 with due consideration of IACS UI SC274.

1.1.1 BWMS using ozone generators (categories 7a and 7b) and de-oxygenation BWMS using inert gas generator by treated flue gas from main or auxiliary boilers or gas from an oil or gas-fired gas generator (categories 3b and 3c) are to be located outside the cargo area in accordance with FSS Code Ch 15 §2.3.1.1.2.

Note:

this requirement does not apply to inert gas generators for which FSS Code Ch 15/2.4.1 and IACS UR F20.3 and F20.4 apply.

1.1.2 In-line full flow electrolysis BWMS (category 4), in-line side-stream electrolysis BWMS (category 5) and in-line injection BWMS using chemical which is stored onboard (category 6) can be located inside the hazardous areas with due consideration of the requirement of Section 11 P, 1.6.4.1.6 but should not be located inside the cargo pump room unless it is demonstrated by the BWMS manufacturer that the additional hazards that could be expected from dangerous liquids and dangerous gases stored or evolved from the BWMS (for example H_2 generation):

- do not lead to an upgrade of the hazardous area categorization of the cargo pump room,

- are not reactive with the cargo vapours expected to be present in the cargo pump room,
- are not reactive with the fire-extinguishing medium provided inside the cargo pump room,
- are not impacting the performance of the existing fire-fighting systems provided inside the cargo pump room, and
- are not introducing additional hazards inside the cargo pump room such as toxicity hazards that would not have been prior addressed by suitable counter measures.

Notes:

1) In-line full flow electrolysis BWMS (category 4) could be accepted in cargo compressor rooms of liquefied gas carriers and inside cargo pump rooms of oil tankers or chemical tankers if that cargo pump room is located above the cargo tank deck.

2) For submerged cargo pumps, the room containing the hydraulic power unit or electric motors is not to be considered as the "cargo pump room".

3) Ballast pump rooms and other pump rooms not containing the cargo pumps are not to be considered as the "cargo pump room".

1.2 In general, two independent BWMS should be required i.e. one for ballast tanks located within the cargo area and the other one for ballast tanks located outside cargo area. Specific arrangements where only one single In-line BWMS (categories 1, 2, 3a, 3b, 4, 5, 6, 7a and 7b) could be accepted are given in 2.

Note:

When the Fore Peak Tank is ballasted with the piping system serving the other ballast tanks within the cargo area in accordance with IACS UR F44, the ballast water of the Fore Peak tank is to be processed by the BWMS processing the ballast water of the other ballast tanks within the cargo area.

~~1.2 For tankers carrying flammable liquids having a flashpoint not exceeding 60 °C or products listed in the IBC Code having a flashpoint not exceeding 60 °C or cargoes heated to temperature above their flashpoint and cargoes heated to temperature within 15 °C of their flashpoint. In general, two independent BWMS may be required – i.e. one for ballast tanks in hazardous areas and the other for ballast tanks in non-hazardous areas.~~

1.3 Isolation between ballast piping serving the ballast tanks inside and outside of the cargo area is to be in accordance with the following requirements:

1.~~2~~3.1 Interconnection in between the ballast piping serving the ballast tanks located within the cargo area and the ballast piping serving the ballast tanks located outside the cargo area ~~The interconnection of ballast piping between hazardous areas and in non-hazardous areas~~ may be accepted if an appropriate isolation arrangement is provided in accordance with 2 is applied.

Notes:

1) The means of appropriate isolation described in 1.3.1 is necessary for the interconnection specified in said Paragraph regardless of the diameter of the piping.

2) As indicated in 2, the means of appropriate isolation described in 1.3.1 is necessary for the interconnection specified in said Paragraph in the case of the active substance piping such as N_2 gas piping, inert gas piping, neutralizer piping, freshwater piping for filter cleaning, compressed air piping for remaining water purge and sea water piping for adjusting the

salinity etc. At the discretion of BKI and for active substance piping and neutralizer piping (both up to 2 inches) only, alternative isolation arrangements, provided preferably on the open deck, offering enhanced safety and gastightness may be considered for penetration of the bulkhead separating the non-hazardous machinery space from a hazardous area (such as the cargo pump room) at as high an elevation in the machinery space as possible, preferably, just below the main deck. The arrangements are to provide suitable protection measures in addressing the pollution hazards and safety concerns due to the potential migration of hydrocarbon or flammable or toxic liquids or vapours from the hazardous areas.

3) The means of appropriate isolation described in 1.3.1 for the interconnection specified in said Paragraph need not be applied to the sampling lines described in 1.3.3.

The means of appropriate isolation ~~are~~ is to be one of the following ~~as follows~~:

~~1.3~~.1 Two ~~screw-down check~~ non-return valves with positive means of closing in series with a spool piece (Fig.15.1) (also mentioned "means of dis-connection" in 2), or

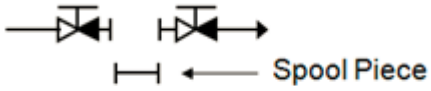


Fig.15.1

Note:

As an alternative to positive means of closure, an additional valve having such means of closure may be provided between the non-return valve and the spool piece

~~1.3~~.2 Two ~~screw-down check~~ non-return valves with positive means of closing in series with a liquid seal at least 1,5 m in depth (Fig.15.2), or

Fig.15.2

Notes:

1) As an alternative to positive means of closure, an additional valve having such means of closure may be provided between the non-return valve and the liquid seal.

2) For ships operating in cold weather conditions, freeze protection should be provided in the water seal. A portable heating system can be accepted for this purpose.

~~1.3~~.3 Automatic double block and bleed valves and a non-return valve with positive means of closing (Fig.15.~~2~~3)

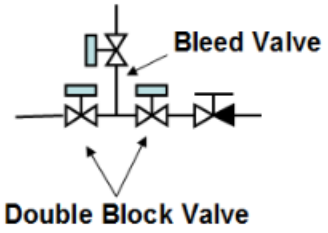


Fig.15.3

Note:

As an alternative to positive means of closure, an additional valve having such means of closure may be provided after the non-return valve

1.3.2 ~~Examples of appropriate isolation arrangements are shown in Fig.15.4 and Fig.15.5. Isolation arrangements are to be fitted on the exposed deck in the hazardous area. Also, ballast water originating from a hazardous area is not to discharge into a non hazardous area, except as given by Section 11.P.1.6.7.~~The above-mentioned means of appropriate isolation is to be provided on the open deck in the cargo area.

Note:

When the Fore Peak Tank is ballasted with the piping system serving the other ballast tanks within the cargo area in accordance with IACS UR F44, the means of appropriate isolation described in 1.3.1 and 1.3.2 is not required in between the Fore Peak Tank and the common ballast water piping serving the other ballast water tanks within the cargo area

1.3.3 Sampling lines which are connected to the ballast water piping system serving the tanks in the cargo area and provided for the purpose of the following:

- for any BWMS: ballast water sampling required by the G2 Guideline of the BWM Convention (2004), or
- for BWMS technologies categories 4, 5, 6, 7a and 7b: total residual oxidant (TRO) analysis in closed loop system;

are not to be led into a non-hazardous enclosed space outside the cargo area.

However, the sampling lines may lead into a non-hazardous enclosed space outside the cargo area provided the following requirements are fulfilled:

1) The sampling facility (for BWMS monitoring/control) is to be located within a gas tight enclosure (hereinafter, referred to as a 'cabinet'), and the following i) through iv) are to be complied.
   i) In the cabinet, a stop valve is to be installed on each sampling line.
   ii) Gas detection equipment is to be installed in the cabinet and the valves specified in A) above are to be automatically closed upon activation of the gas detection equipment.
   iii) Audible and visual alarm signals are to be activated both locally and at the BWMS control station when the concentration of explosive gases reaches a pre-set value, which should not be higher than 30% of the lower flammable limit (LFL). Upon an activation of the alarm, all electrical power to the cabinet is to be automatically disconnected.

   Note:

   when the electrical equipment is of a certified safety type, the automatic disconnection of power supply is not required.

   iv) The cabinet is to be vented to a safe location in non-hazardous area on open deck and the vent is to be fitted with a flame arrester.

   Example of isolation arrangement is shown in Figure 15.4.
2) The standard internal diameter of sampling pipes is to be the minimum necessary in order to achieve the functional requirements of the sampling system.

3) The cabinet is to be installed as close as possible to the bulkhead facing the cargo area, and the sampling lines located outside the cargo area are to be routed on their shortest ways.

4) Stop valves are to be located in the non-hazardous enclosed space outside the cargo area, in both the suction and return lines close to the penetrations through the bulkhead facing the cargo area. A warning plate stating "Keep valve closed when not performing measurements" is to be posted near the valves. Furthermore, in order to prevent backflow, a water seal or equivalent arrangement is to be installed on the hazardous area side of the return pipe.

5) A stop valve is to be installed on the cargo area for each sampling line (i.e. both the suction and return lines).

6) The samples which are extracted from the ballast water piping system serving the tanks within the cargo area are not to be discharged to a tank located outside the cargo area and not to discharge to a piping line supplying the spaces located outside the cargo area.

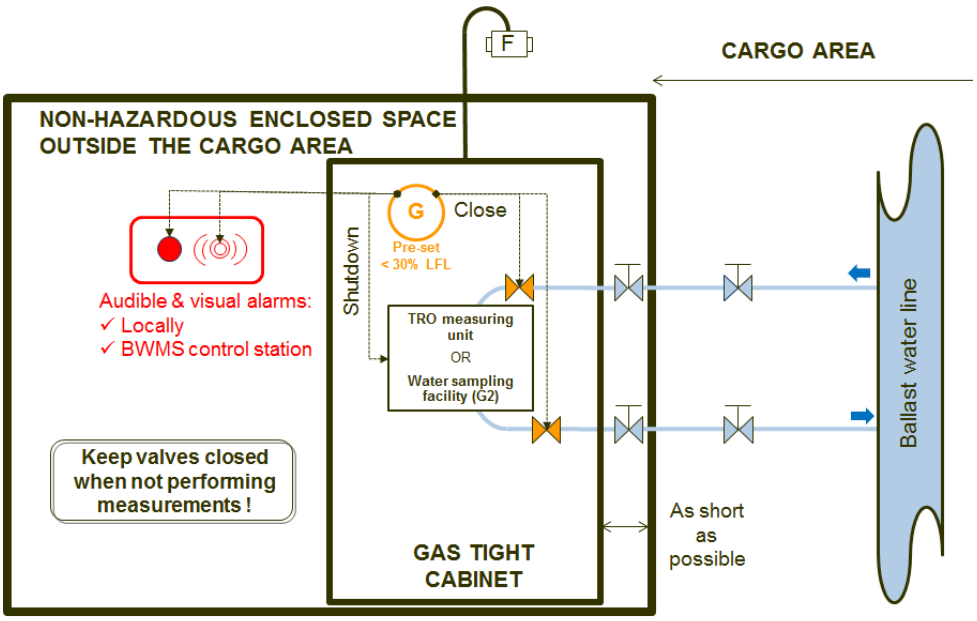
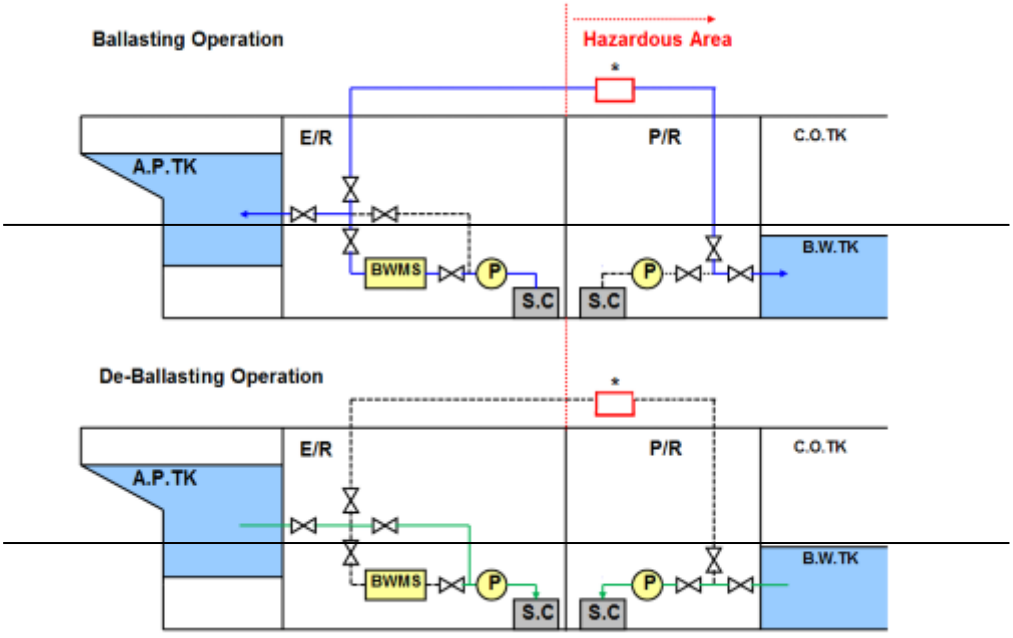
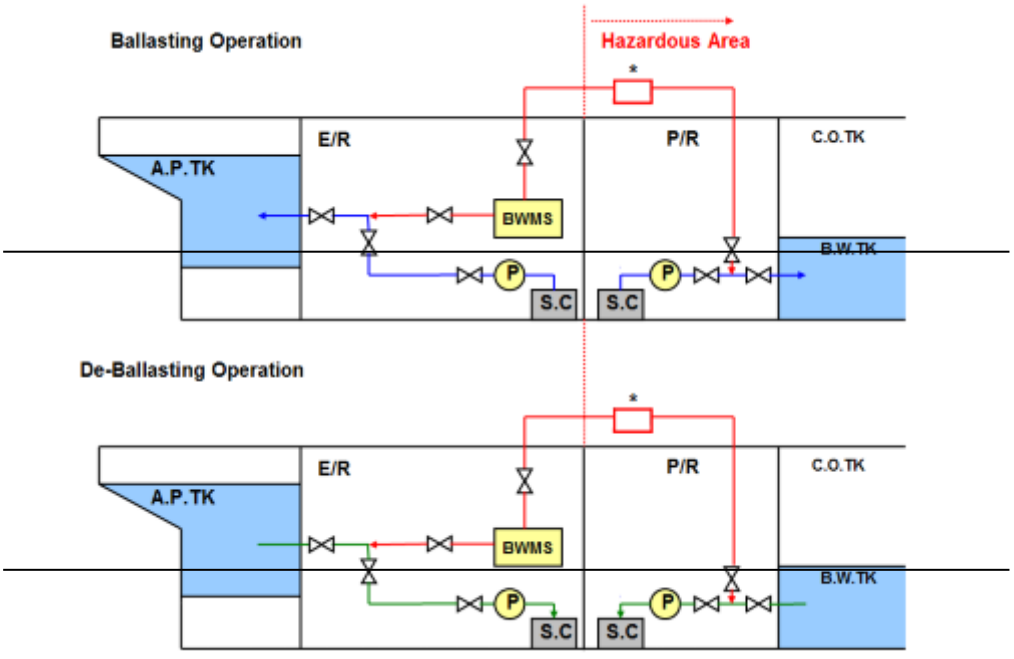


Fig.15.4 Isolation arrangement of BWM sampling system



~~Fig.15.4. BWMS which does not require after-treatment~~



~~Fig. 15.5 BWMS which requires after-treatment (Injection type)~~

* ~~: Appropriate Isolation Means: Two (2) screw down check valves in series with a spool piece or a liquid seal, or automatic double block and bleed valves.~~

2. Installation of one single BWMS on tankers

2.1 The BWMS's technology categorization except in-tank technology categories 3c and 8 is described in Table 15.2.

Table 15.2 In-line BWMS's technologies categorization

BWMS's technology category		1	2a	3a	3b	4	5	6	7a	7b
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 N_2 from a N_2 Generator)	In-line de-oxygenation (injection of Inert Gas from 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
Des-infection when ballasting	Making use of active substance		X			X	X	X	X	X
	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 deballasting	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						
Example of dangerous gas as defined in 1.6.3.4			(1)	O_2 N_2	CO_2 ,CO	H_2, Cl_2	H_2, Cl_2	(1)	O_2, O_3, N_2	
Arrangement of one single BWMS	BWMS is located in the outside the cargo area	Not accep table	Case 1.2 (2)	Case 1.3a (2)	Case 1.3b	Case 1.4 (2)	Case 1.5	Case 1.6	Case 1.7a	Case 1.7b (2)

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) Only (Means of dis-connection) as described in 1.3.1 are to be applied.

(3) In-line side stream electrolysis may also be applied in-tank in circulation mode (no treatment when ballasting or de-ballasting)

The following Figure 15.5 is to be used as a legend for symbol explanation of each BWMS's technology categories in 2.2.1 to 2.2.7.

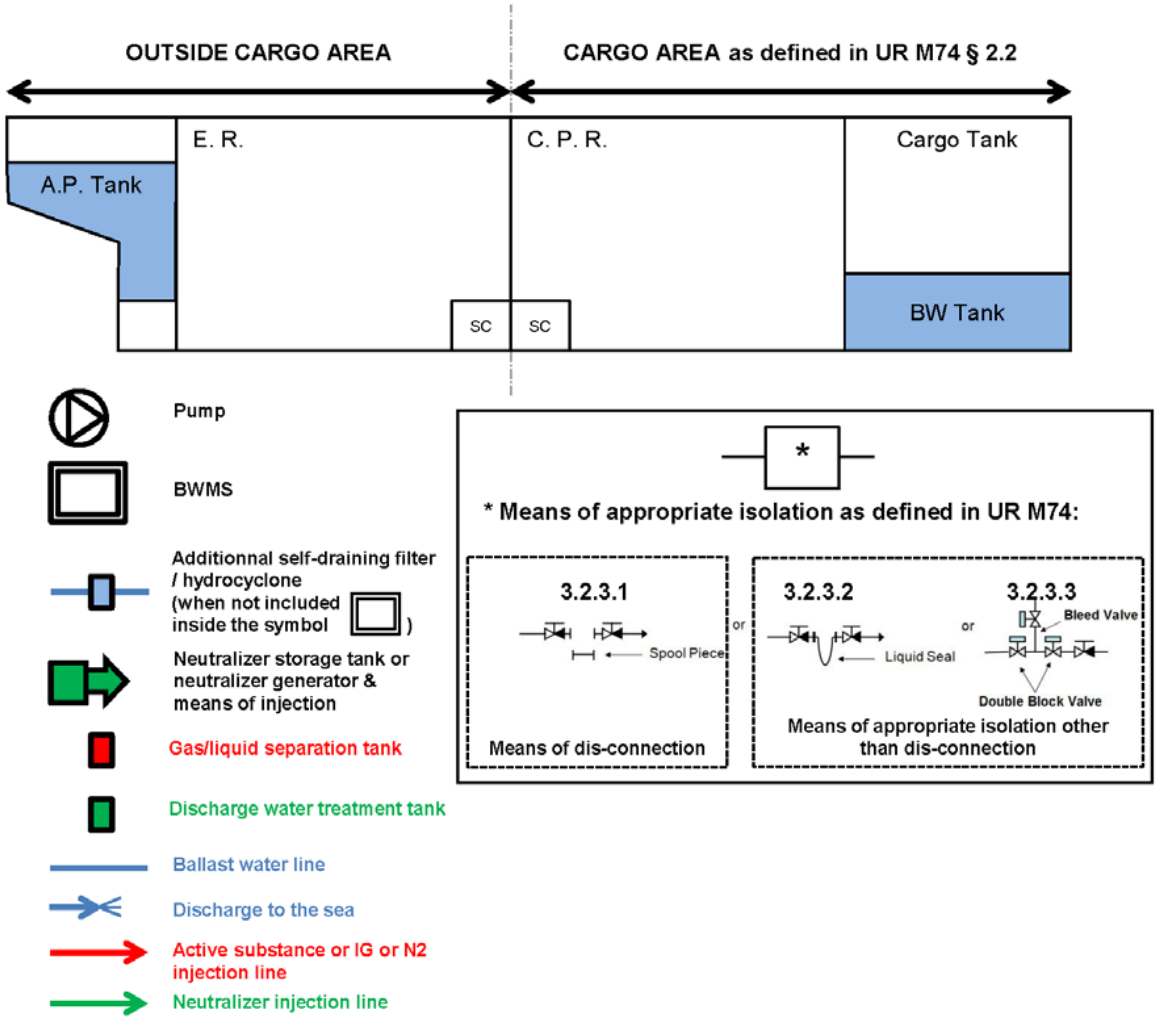
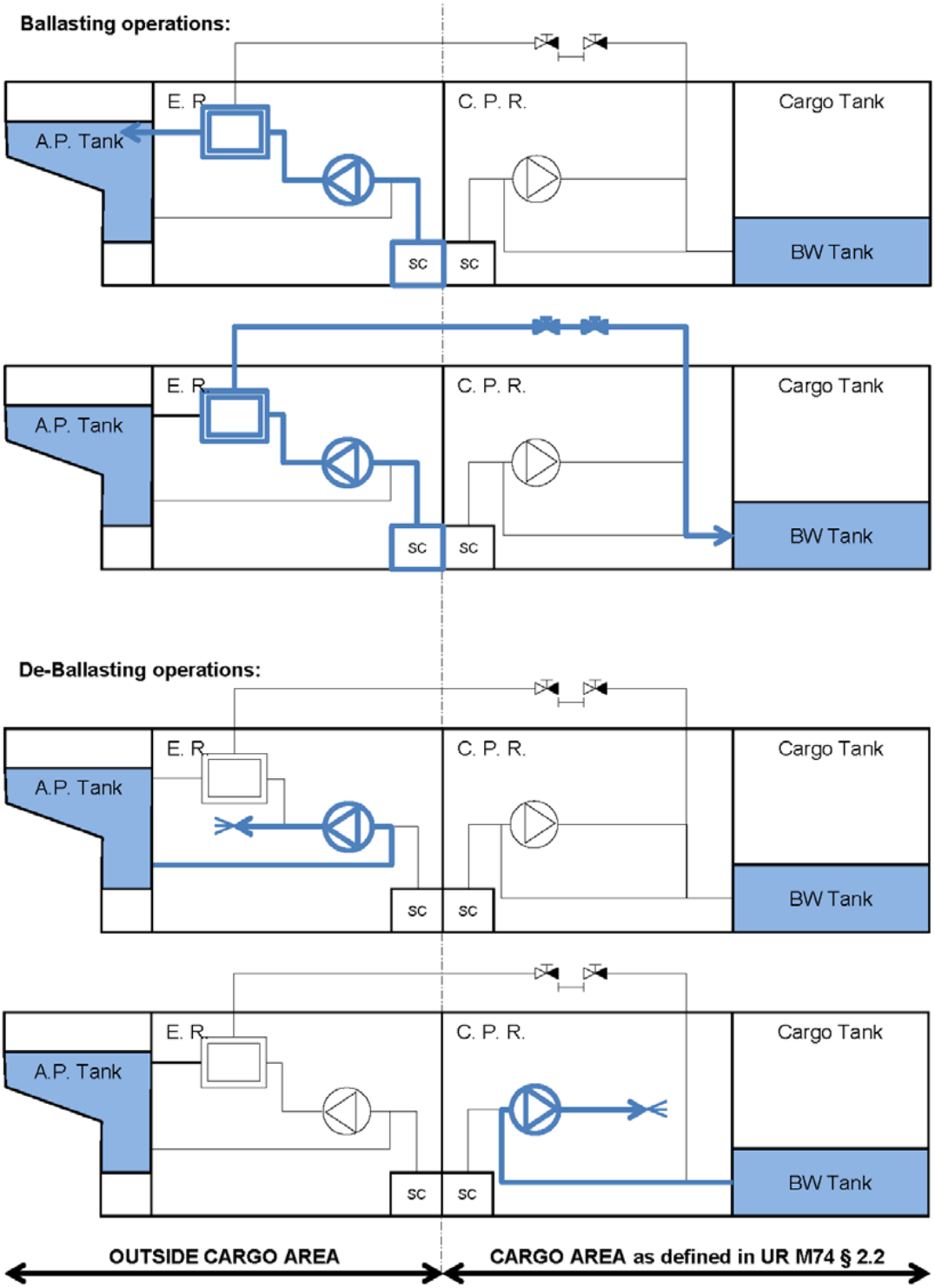


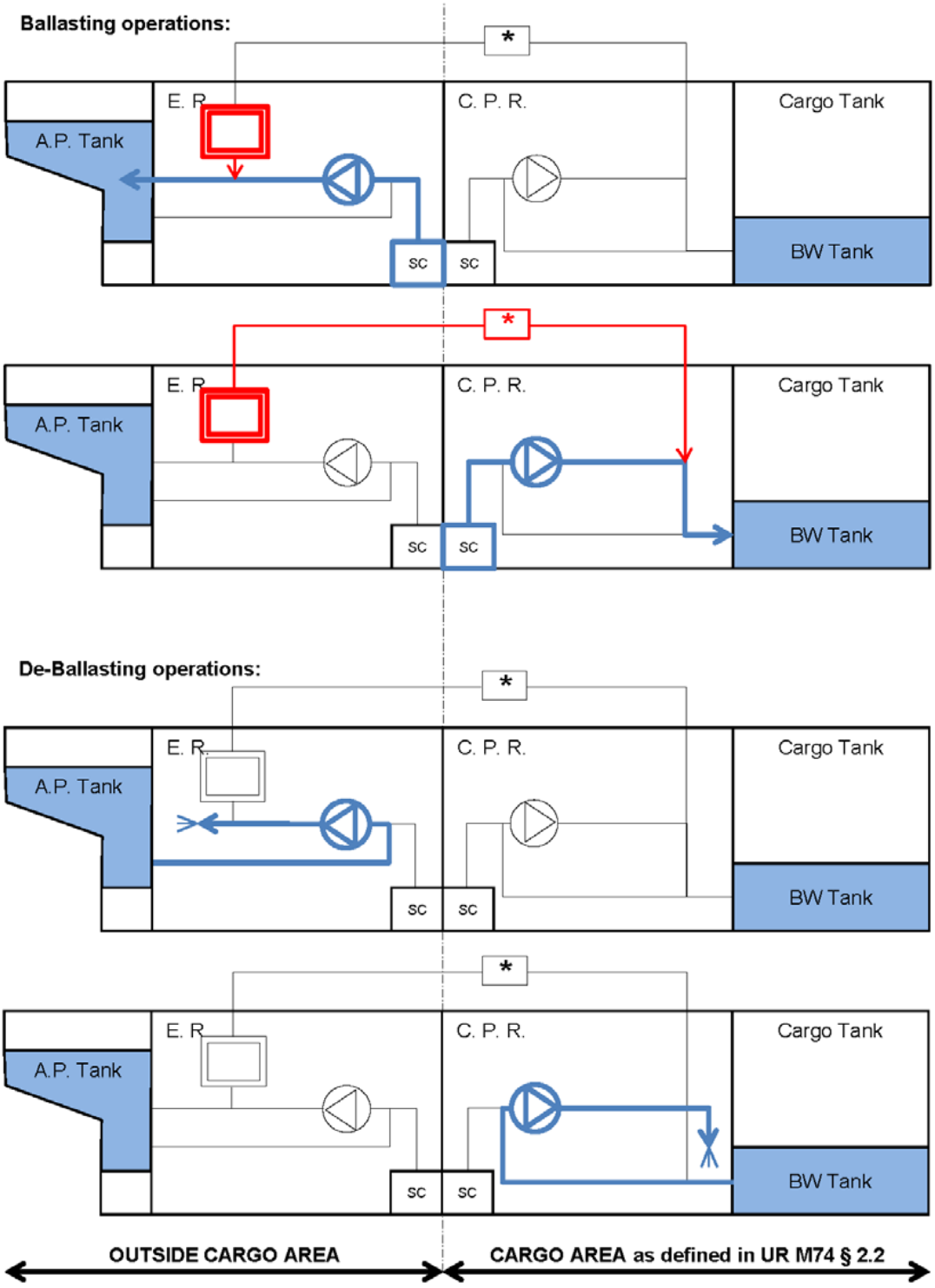
Fig.15.5 Legend

2.2 BWMS Installed outside in the cargo area

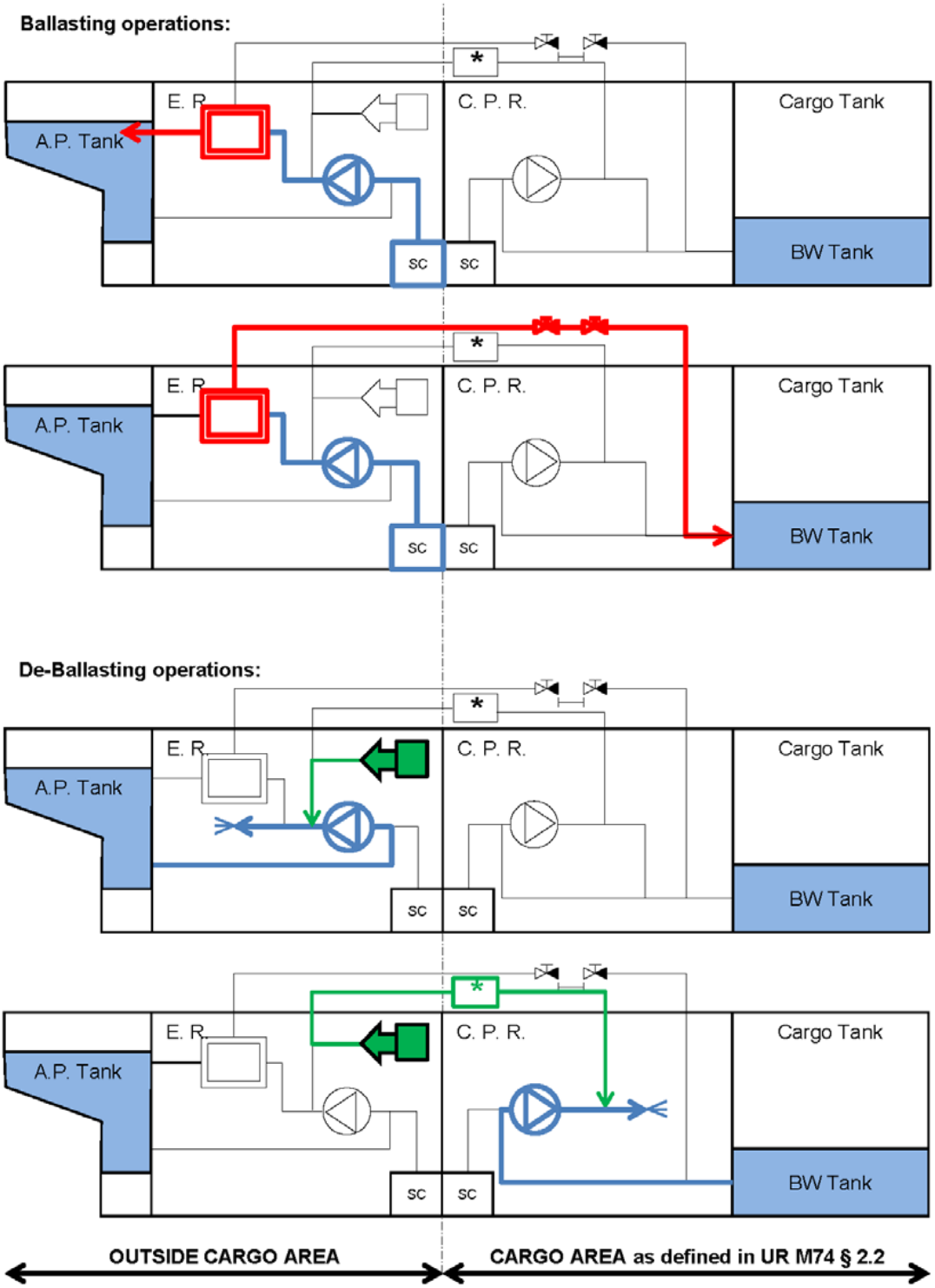
2.2.1 Case 1.2 (Technology category 2, Flocculation); and Case 1.3a (Technology category 3a De-oxygenation with N2 Generator):



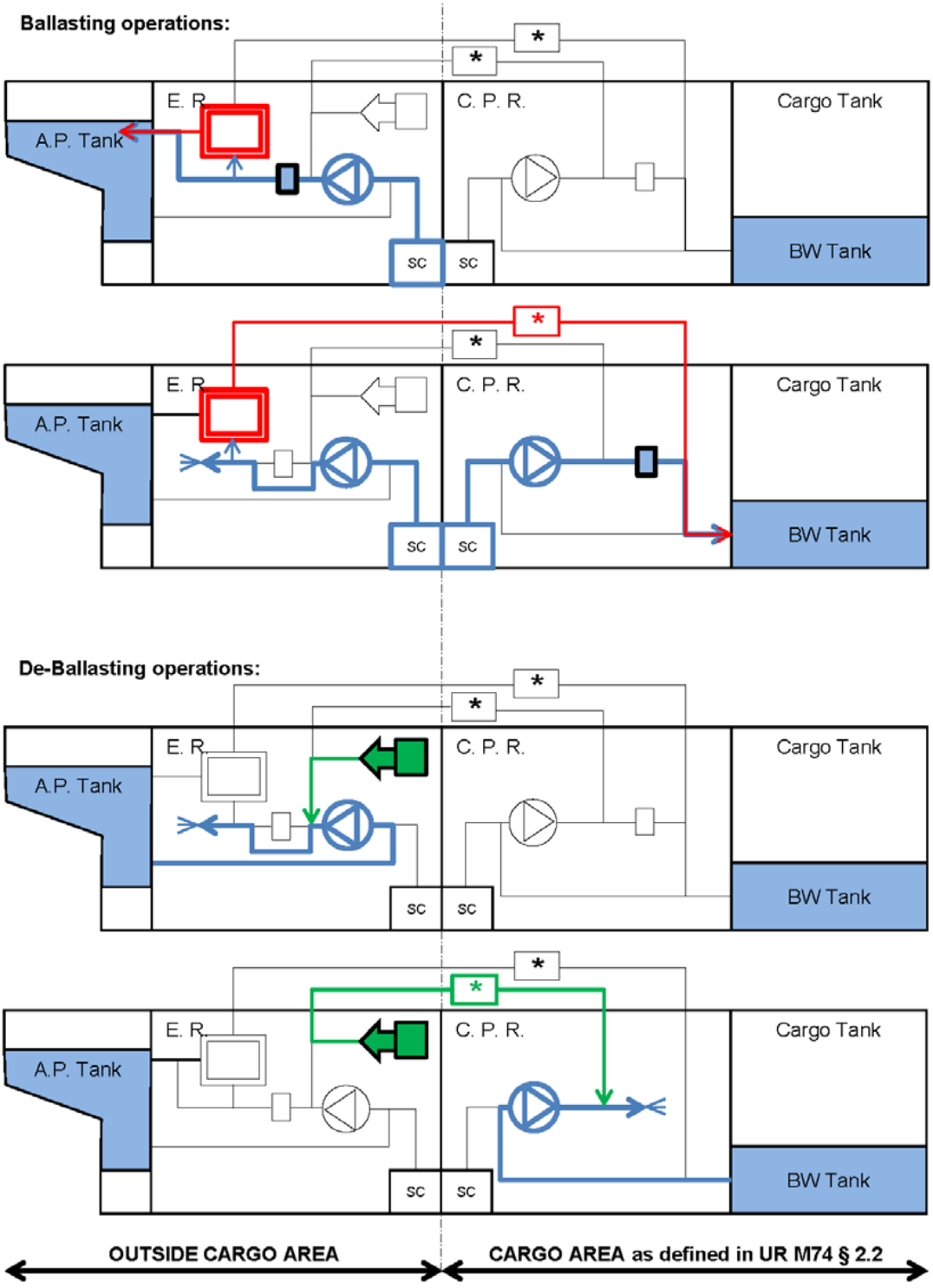
2.2.2 Case 1.3b (Technology category 3b De-oxygenation with Inert Gas Generator):



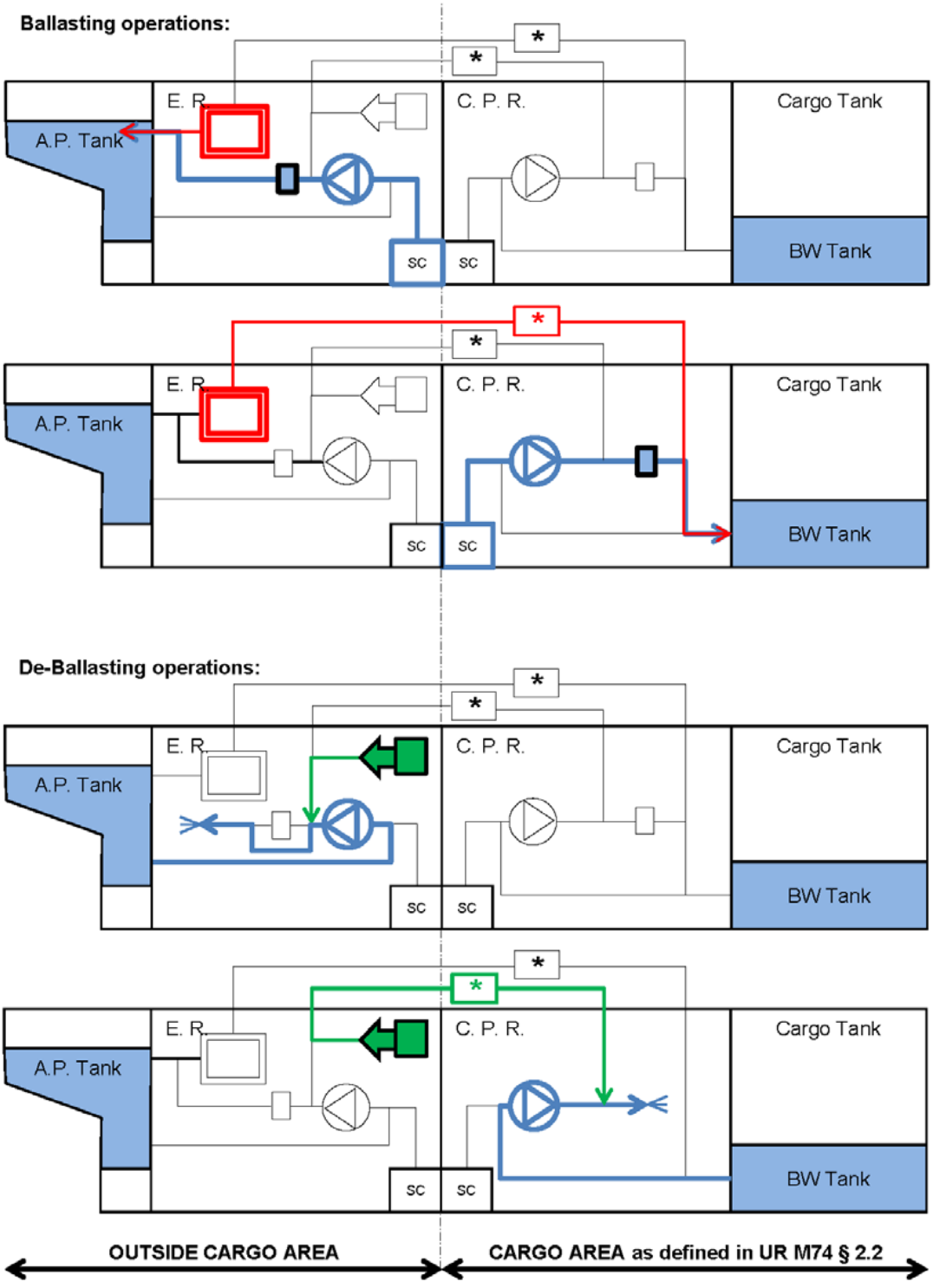
2.2.3 Case 1.4 (Technology category 4, Full-flow electorlysis):



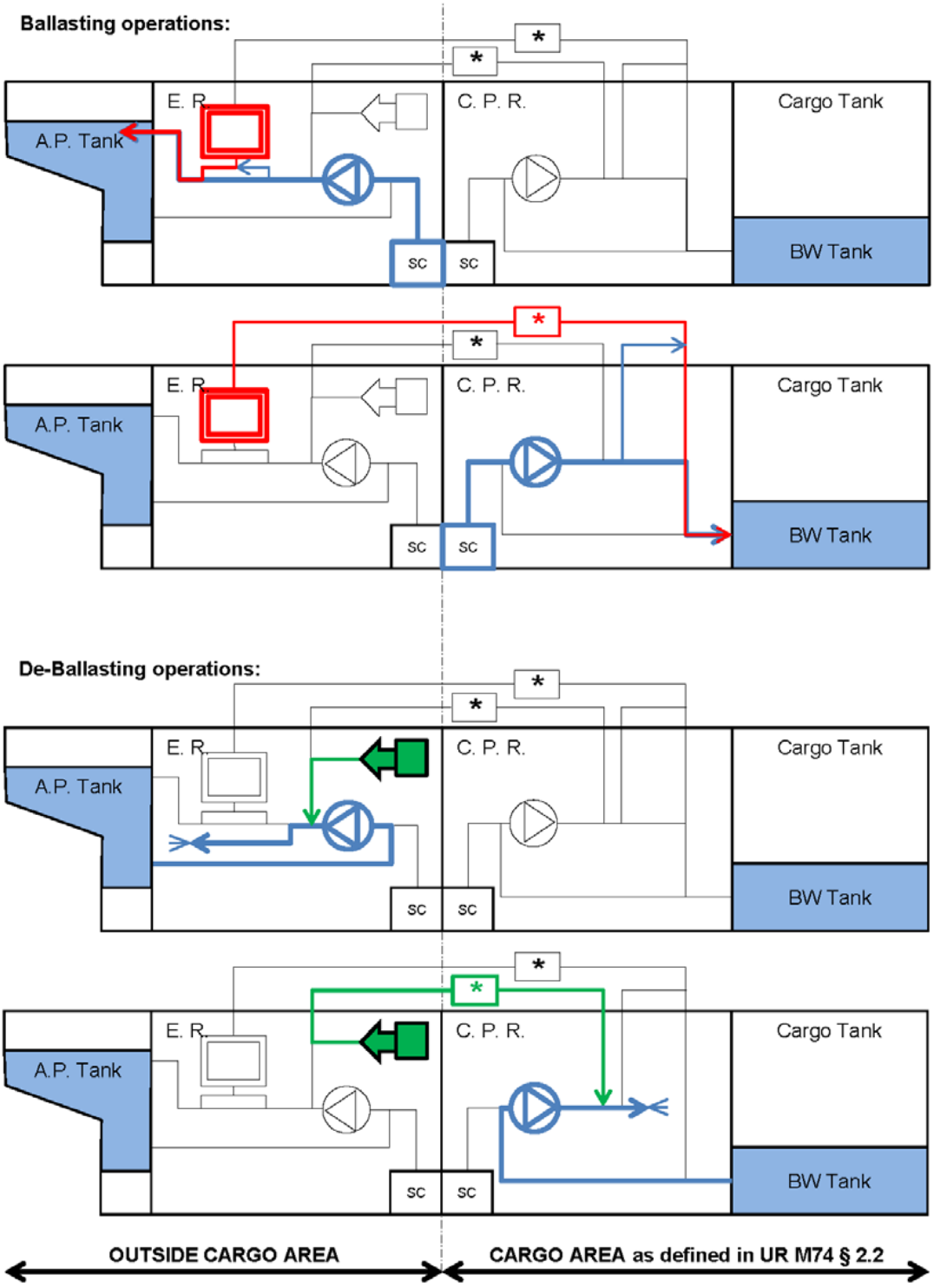
2.2.4 Case 1.5 (Technology category 5, Side-stream electorlysis):



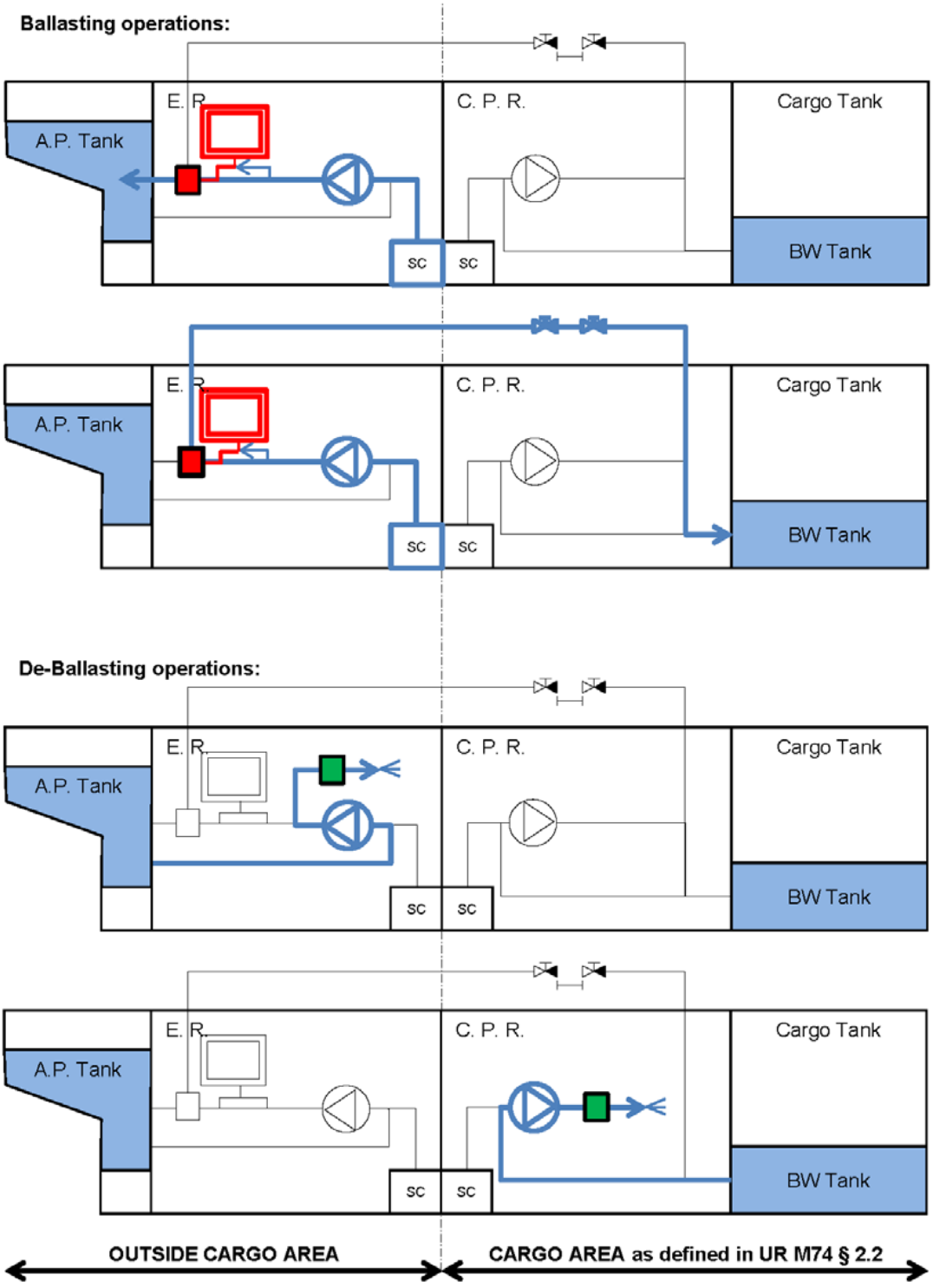
2.2.5 Case 1.6 (Technology category 6, Stored chemical injection):



2.2.6 Case 1.7a (Technology category 7a, Side-stream ozone injection without gas/liquid separation tank and without discharge water treatment tank):



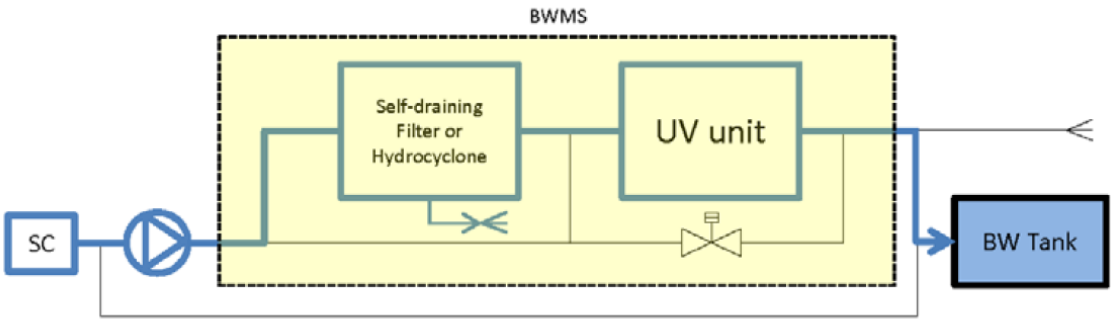
2.2.7 Case 1.7b (Technology category 7b, Side-stream ozone injection with gas/liquid separation tank and discharge water treatment tank):



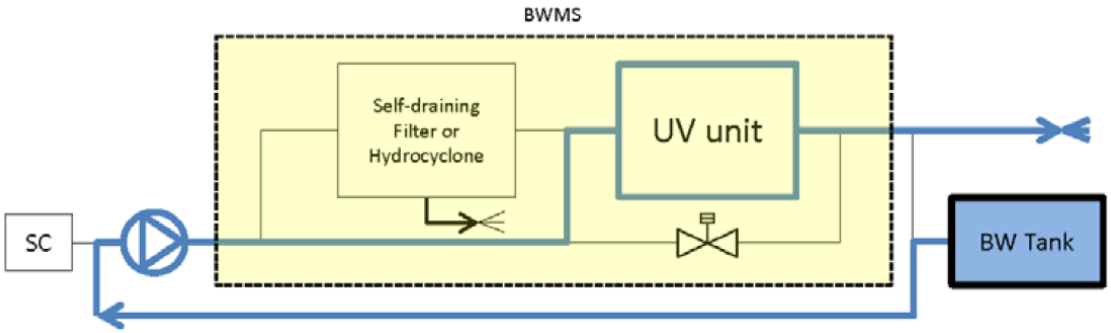
3. BMWS technology categorization (Informative)

3.1 BWMS technology group 1 (In-line UV, including UV + AOT and UV + TiO_2)

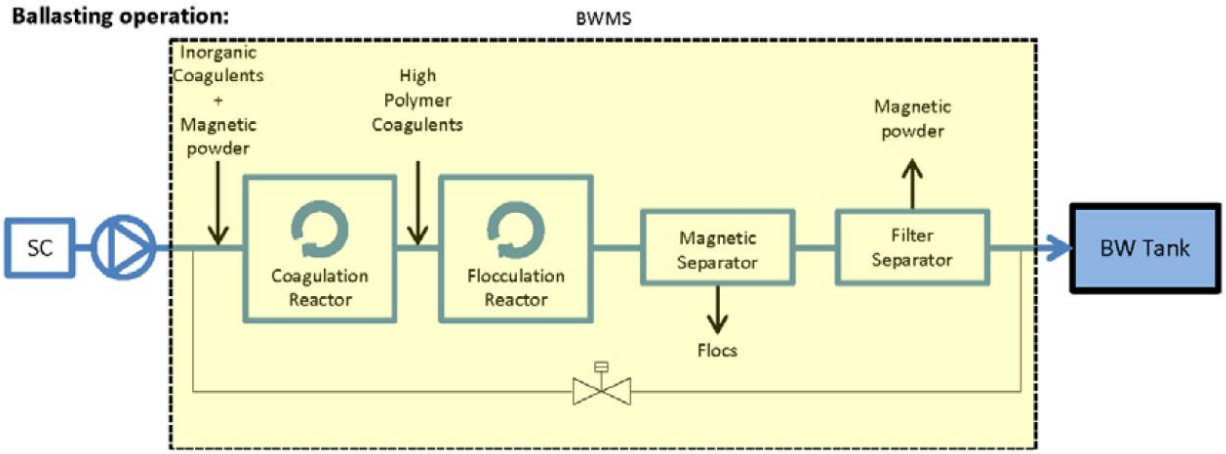
Ballasting operation:



De-ballasting operation:



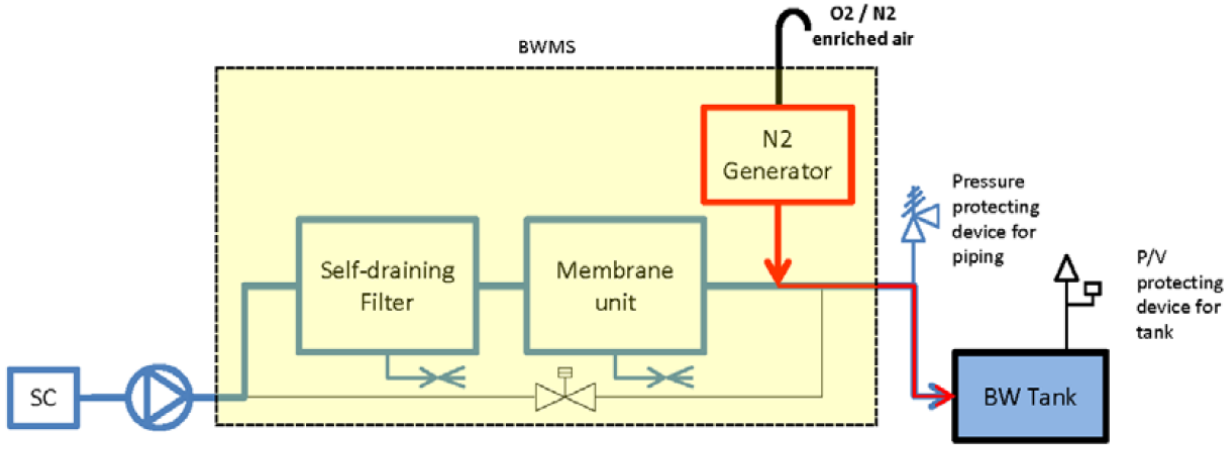
3.2 BWMS technology group 2 In-line flocculation



De-ballasting operation: no requirement for after-treatment

3.3 BWMS technology group no. 31 In-line membrane separation and de-oxygenation (injection of N_2 from N_2 generator)

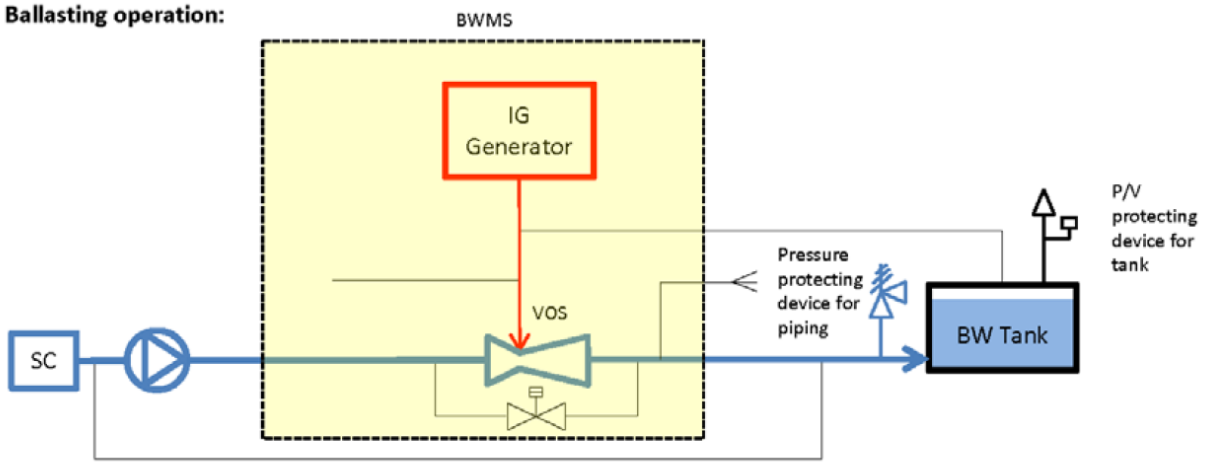
Ballasting operation:



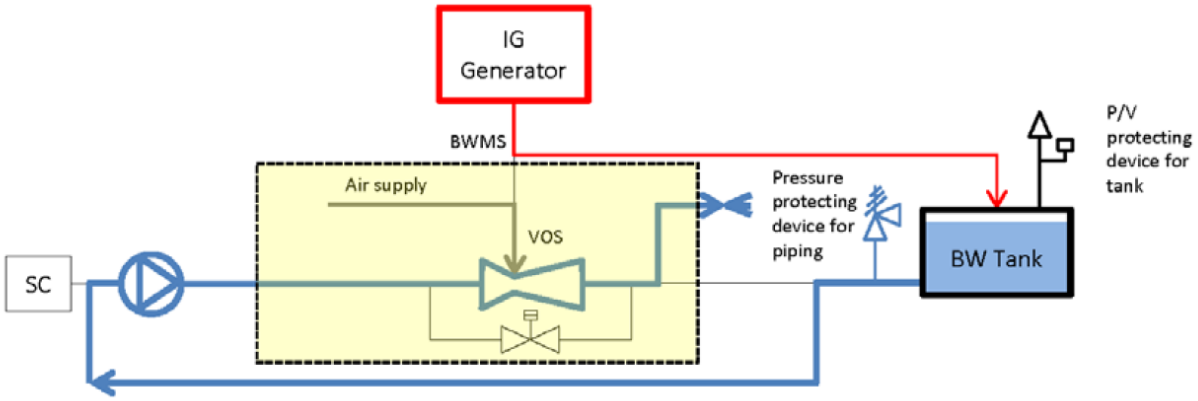
De-ballasting operation: no requirement for after-treatment

3.4 BWMS technology group no. 3b In-line de-oxygenation (injection of inert gas from either an oil-fired inert gas generator or inert gas from treatment of the flue gas from main or auxiliary boilers)

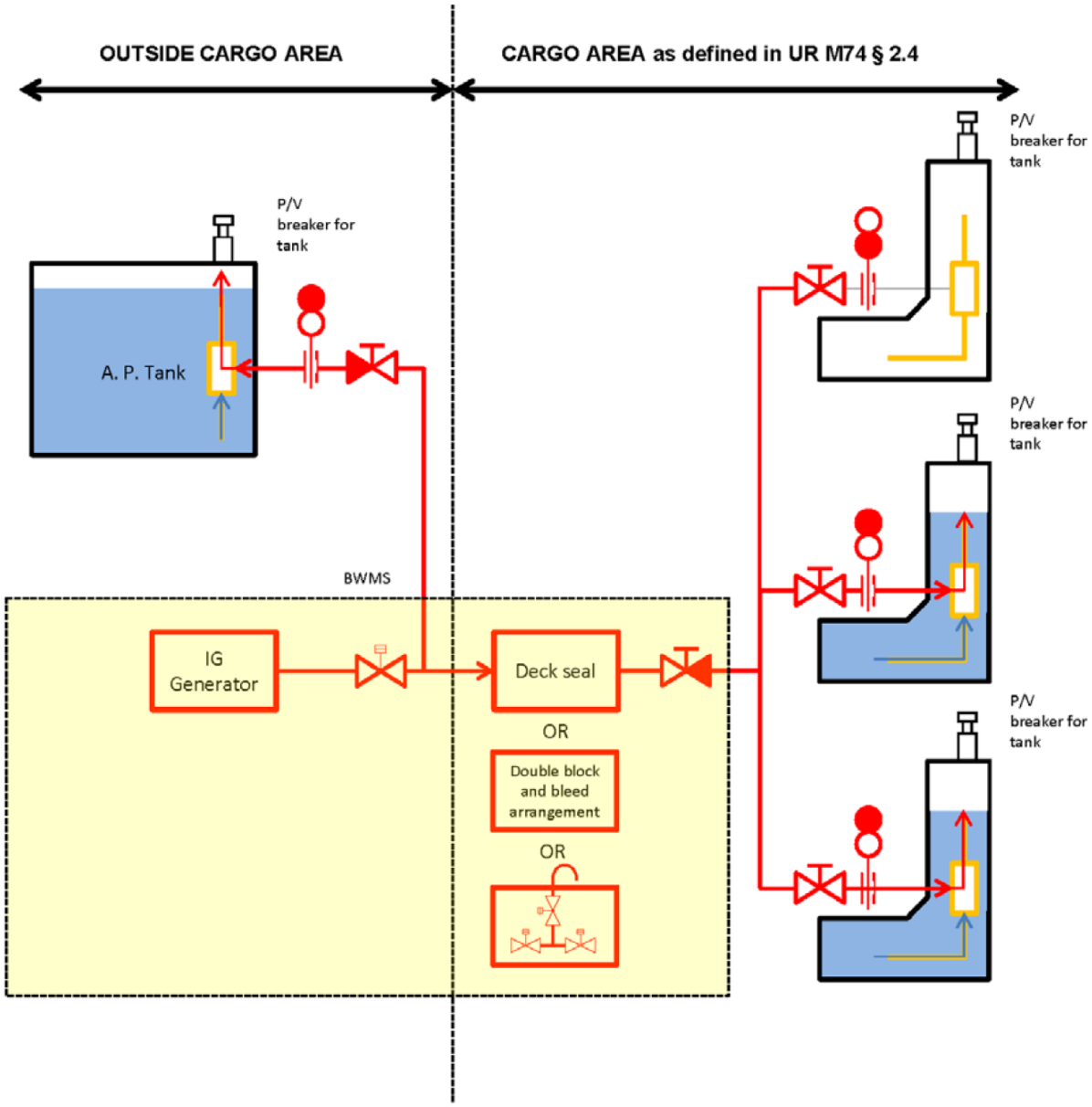
Ballasting operation:



De-ballasting operation:

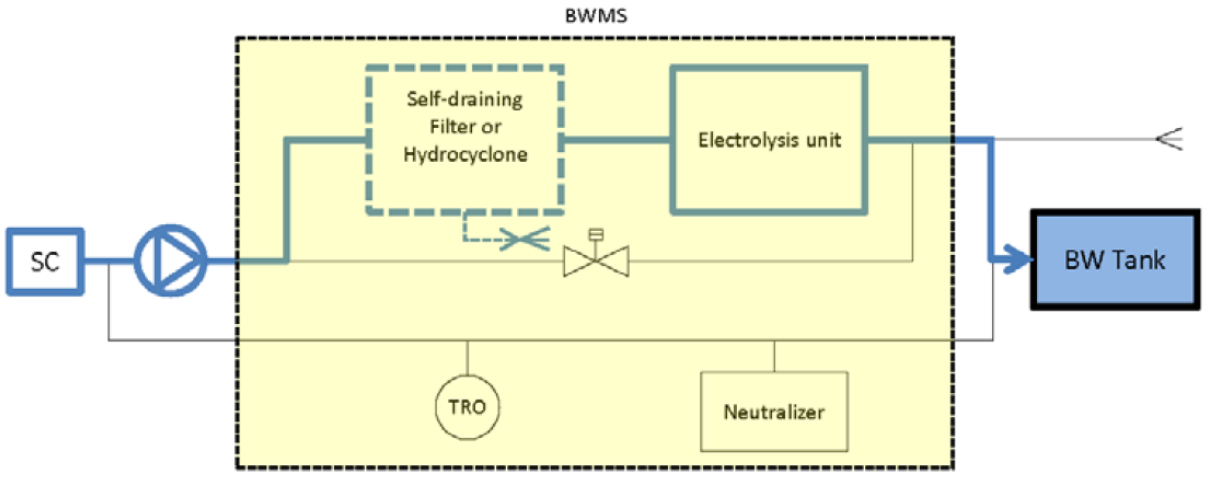


3.5 BWMS technology group no. 3c In-tank de-oxygenation with IGG

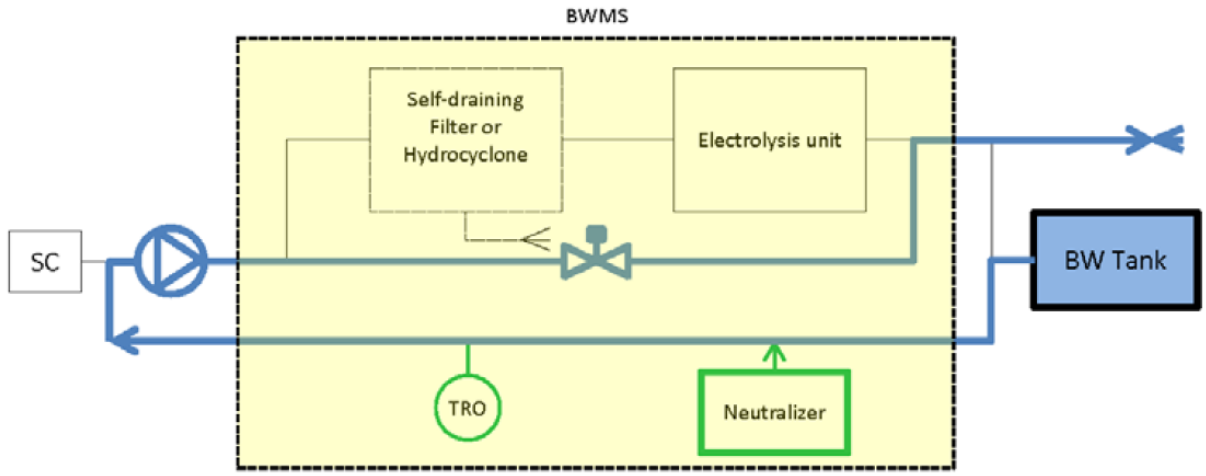


3.6 BWMS technology group no.4 In-line full flow electrolysis

Ballasting operation:

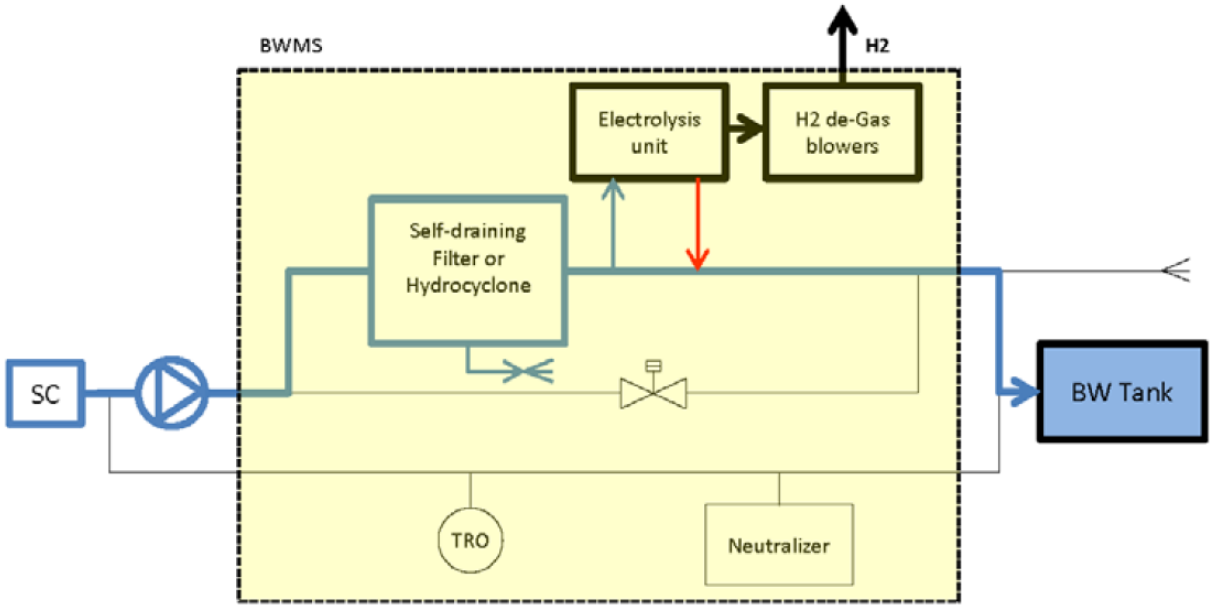


De-ballasting operation:

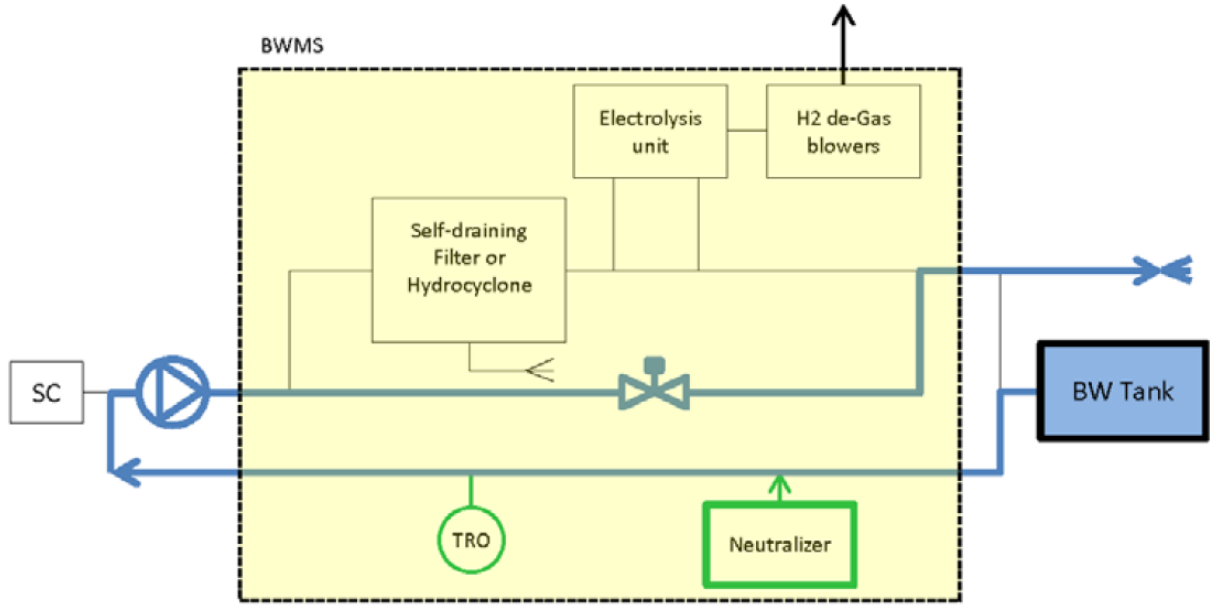


3.7 BWMS technology group no.5 in-line side-stream electrolysis (electro-chlorinization)

Ballasting operation:

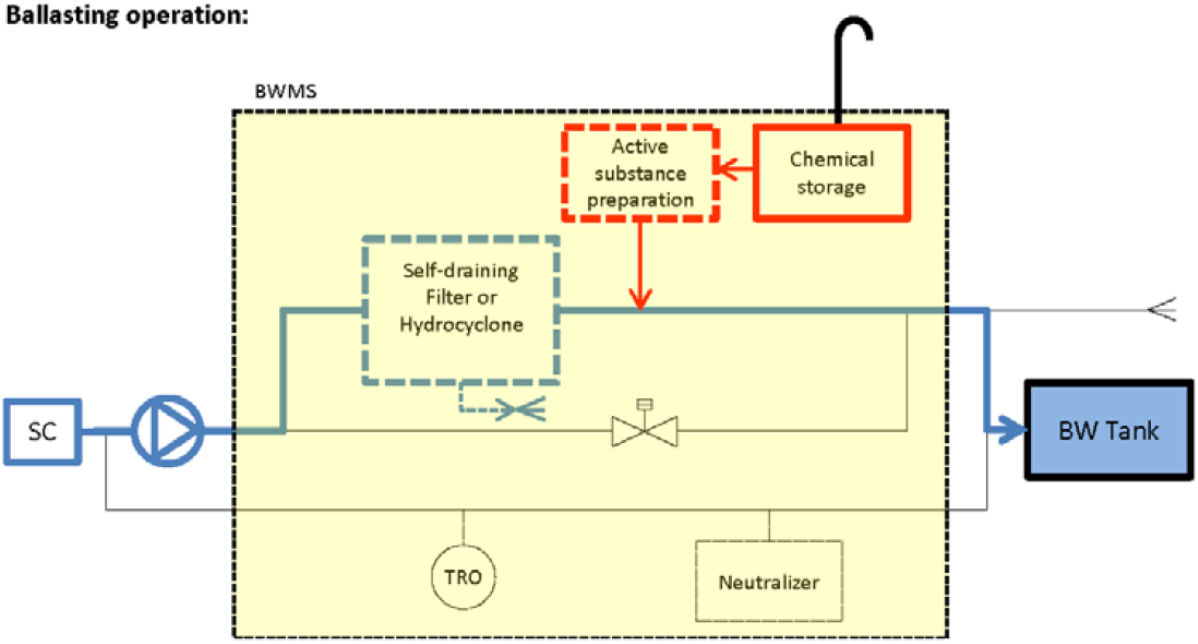


De-ballasting operation:

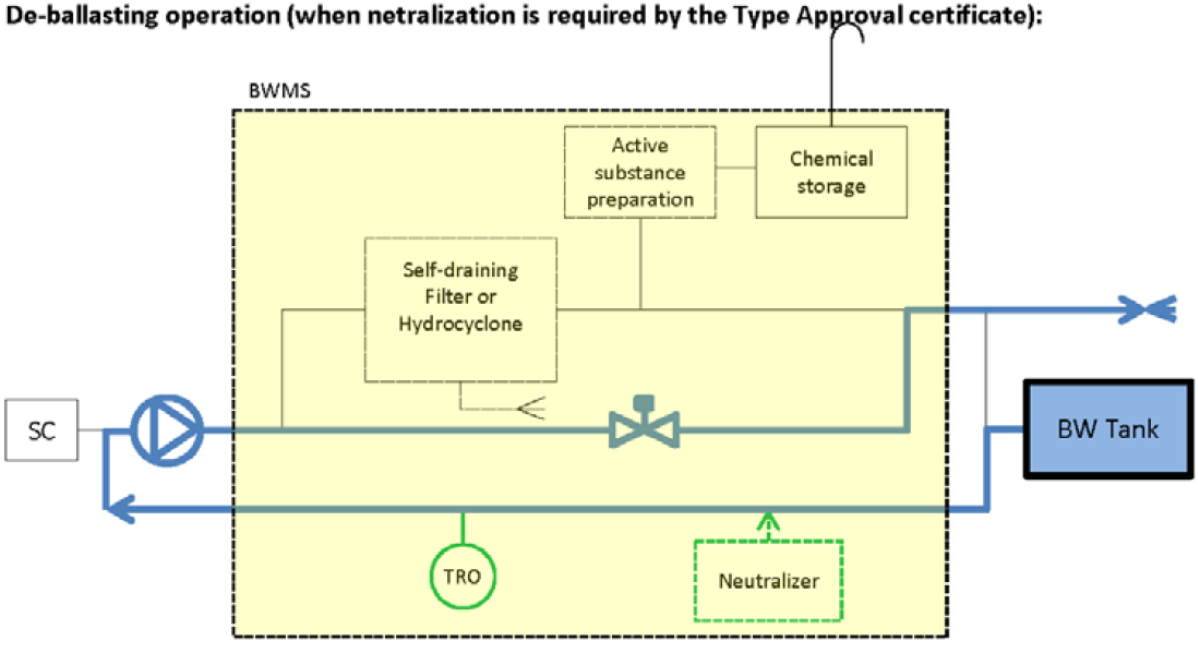


3.8 BWMS technology group no.6 In-line chemical injection

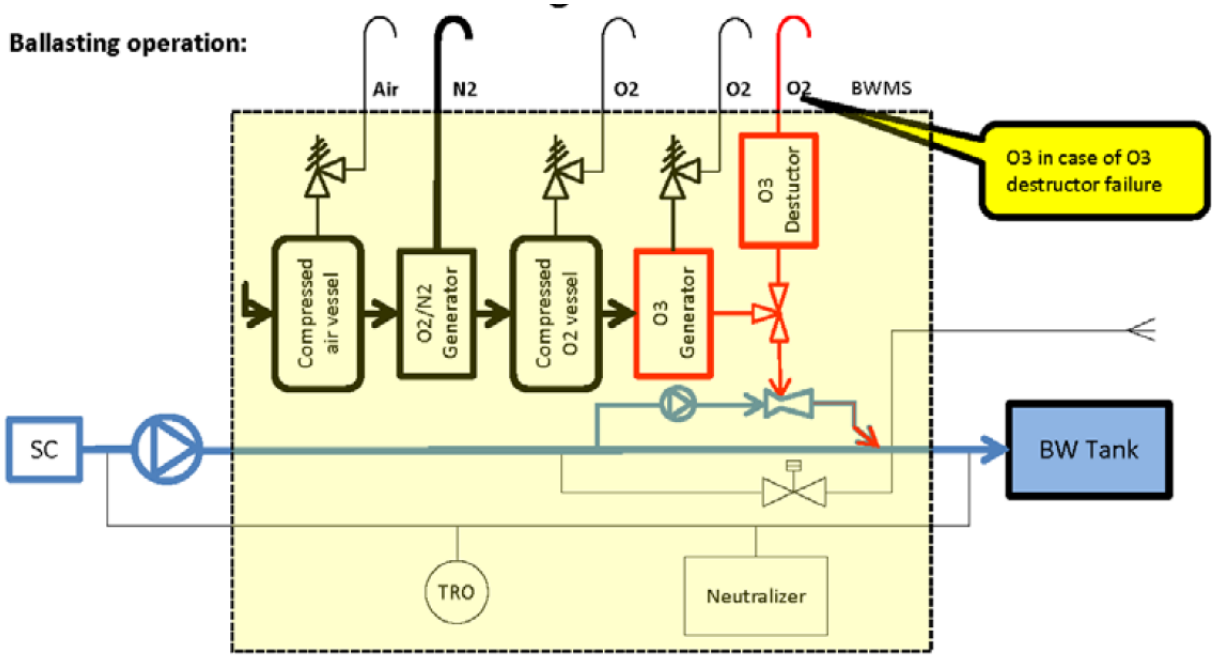
Ballasting operation:

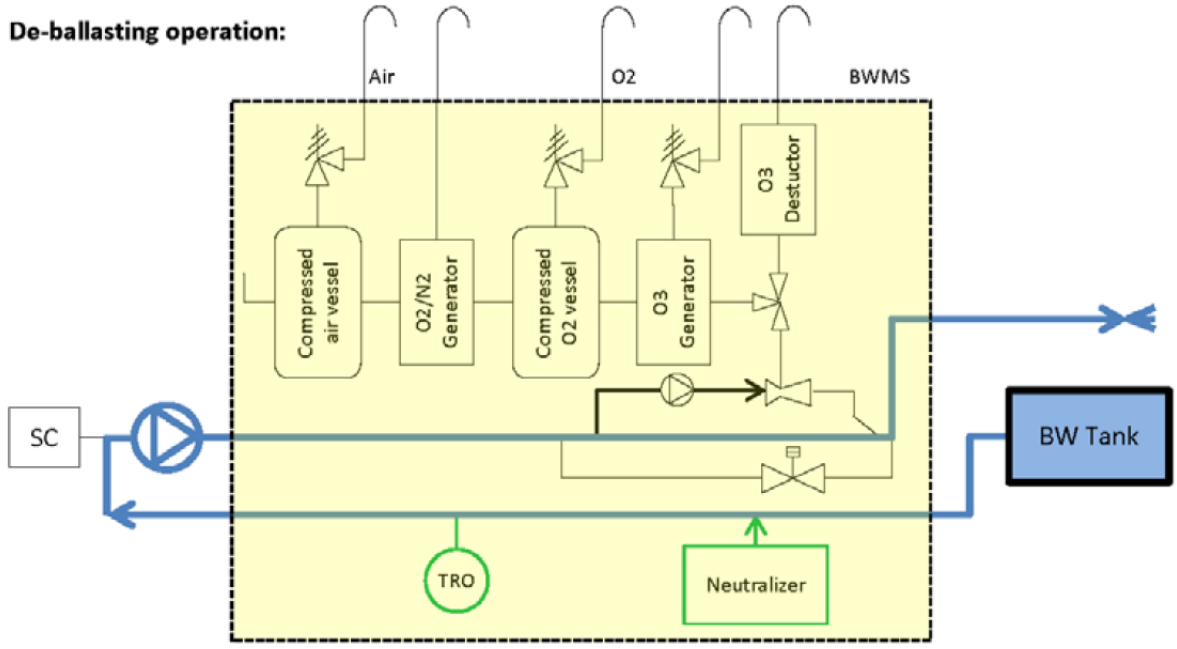


De-ballasting operation (when netralization is required by the Type Approval certificate):

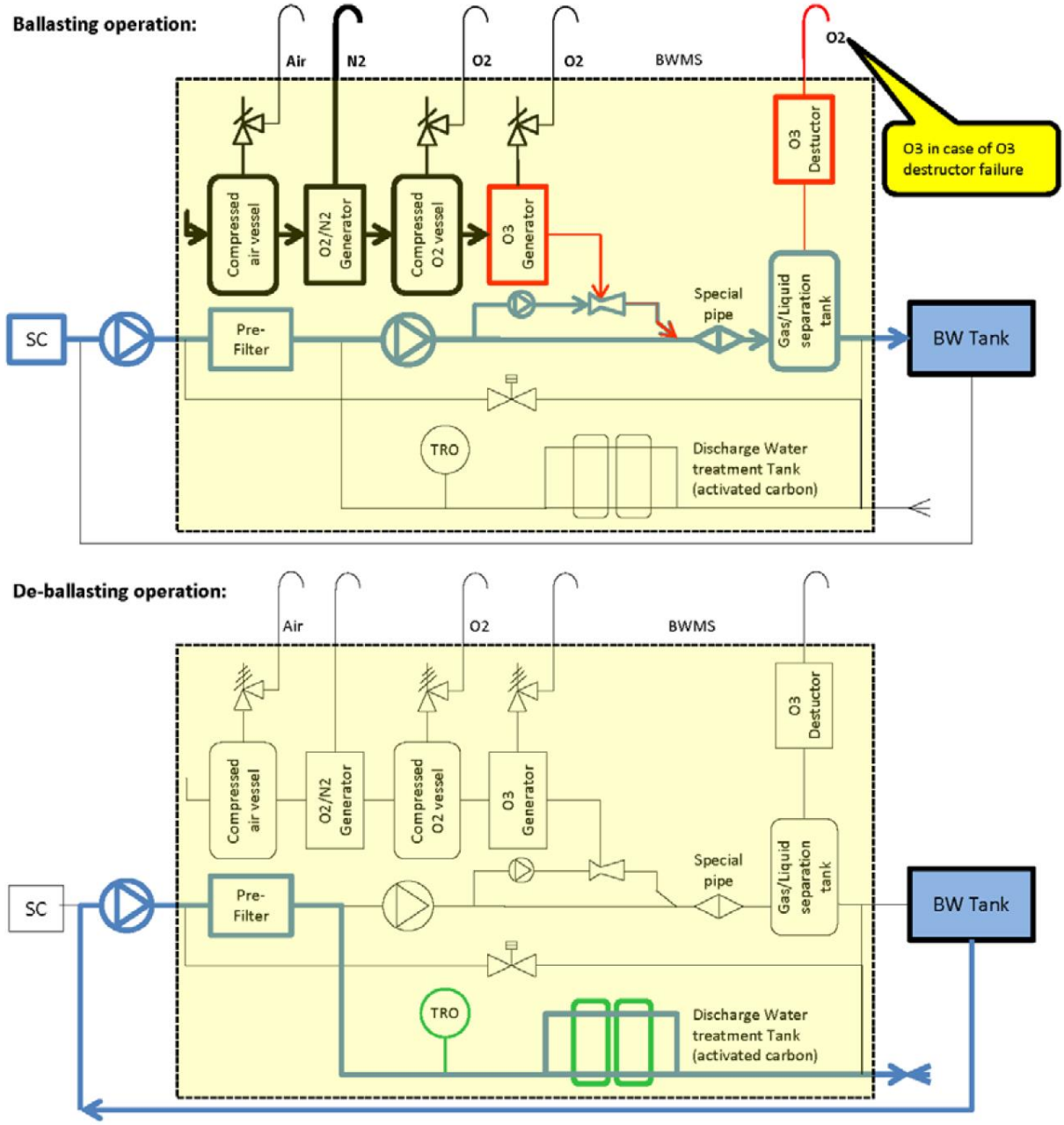


3.9 BWMS technology group no.7a In-line side-stream ozone injection without gas/liquid separation tank and without discharge water treatmnet tank

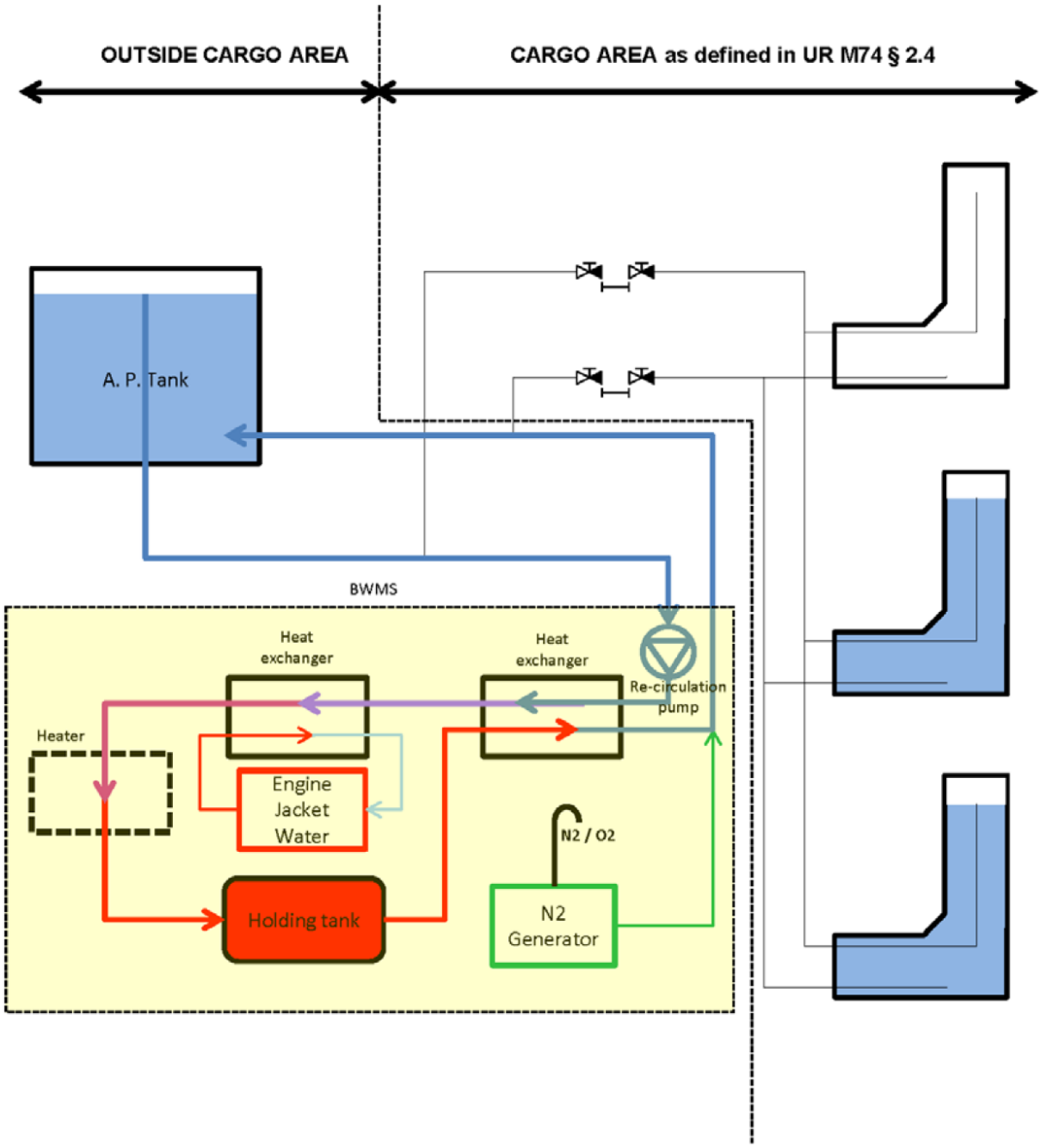




3.10 BWMS technology group no.7b In-line side-stream ozone injection with gas/liquid separation tank and with discharge water treatment tank



3.11 BWMS technology group no.8 In-tank pasteurization + de-oxygenation with N_2 generator



end

Annex A Installation of BWMS on-board Ships

A. General

1. Application

1.1 This 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.

Requirement in this Annex is to be read in conjunction with Section 11.P 1.6 - Ballast water treatment plants.

1.2 The requirements of this Annex apply for BWMS technologies as listed in Table A.1. BWMS with alternative technologies are to be specially considered by BKI.

2. Definitions

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 Section 11.P.1.6.3.2.

2.2 Ballast Water Management System (BWMS)

Ballast Water Management System means any system defined in Section 11.P.1.6.3.1.

Table A.1 Categorization of BWMS technologies

BWMS's technology category		1	2a	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 deballasting	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								
Example of dangerous gas as defined in 1.6.3.4			(1)	O_2 N_2	CO_2 CO		H_2 Cl_2	H_2 Cl_2	(1)	O_2 O_3 N_2		O_2 N_2

Note:

(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)

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 categories 1, 2, 3a, 3b, 3c, 4, 5, 6, 7a, 7b and 8.

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 Annex.

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.A),
- Chemical injection (cat.6 as per Table 1.A) 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 A.2.

Table A.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 Section 11.P.1.6.2.3 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.

B. Fire categorization

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.A) 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. 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:

- *for tankers to which regulation 1.6.1 of SOLAS Chapter II-2 as amended by IMO resolutions up to MSC.421(98) (hereinafter the same) applies, regulation 3.6 of SOLAS Chapter II-2;*
- *for chemical tankers, Paragraph 1.3.6 of the IBC Code as amended by IMO resolutions up to MSC.460(101);*

- *for gas carriers, Paragraph 1.2.7 of the IGC Code as amended by IMO resolutions up to MSC.441(99); and*
- *for offshore support vessels, Paragraph 1.3.1 of the IMO Resolution A.673(16) as amended by Resolution MSC.236(82) or Paragraph 1.2.7 of the IMO Resolution A.1122(30), as applicable.*

3. Storage of chemicals

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.:

2) 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
3) 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 A.1), in-line flocculation (cat.2 as per Table A.1) and technologies using neutralizer injection (cat.4, 5, 6 and 7 as per Table A.1) will require chemical or additive storage.

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 machinery space in line with 1.

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

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.

C. BWMR location and boundaries

1. BWMS using chemical substances

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 3 m from entrances, air inlets and openings to accommodation spaces.

This requirement need not apply in case the BWMS is located in the engine room.

2. Ozone-based BWMS

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.

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. General

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.

D. Fire fighting

1. Fixed fire-extinguishing system

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

1.2 Ozone-based BWMS

BWMR 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.

1.3 Where a fixed fire-extinguishing system is provided in the BWMR, it should be compatible with the BWMS and the chemical products that are used, produced or stored in the BWMR. 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.

1.4 Foam fixed fire-extinguishing system

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

1.5 Where a fixed fire-extinguishing system is installed in the BWMR, 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.

1.6 Where BWMS that includes air or O_2 storage is located in a room covered by a fixed gas fire-extinguishing system, air or O_2 storage shall be taken into account for the gas capacity calculation, unless the discharge pipe from safety valves for air or O_2 storage are led directly to outside the room.

2. Portable fire-fighting equipment

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 BWMR containing UV-type BWMS.

E. Fire prevention

1. Equipment protection

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

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 Section 11.P 1.6.4.1.9.

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 Section 11.P. The valve should be positioned to optimally remove gas from the electrolysis reactor.

2. Fire detection

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.

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

G. Ventilation

1. Ventilation arrangement

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.A)
- Electrolysis
- Ozone injection

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 Section 11.P 1.6.3.2 - heavier than air.

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 Section 11.P 1.6.3.2 - 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.

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 m^2, at least 4 mm for ducts with a free cross-sectional area of between 0.075 m^2 and 0.45 m^2, and at least 5 mm for ducts with a free cross-sectional area of over 0.45 m^2; 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.

1.5 The ventilation system for BWMR containing ozone-based BWMS or ventilation system for hydrogen de gas arrangement as required by Section 11.P 1.6.5.1 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 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 Section 11.P 1.6.5 are to be satisfied.

2. Ventilation rate

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

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.

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 A.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.

H. Personal equipment

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.

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.

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 proximately to the BWMS and the chemical store room(s).

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 A.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.

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 A.1.

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