

Type Approval Certificate



[Ballast Water Management System]

Initial Approval 7th May, 2020

Applicant Wartsila Water Systems Ltd.
Merchants House, Poole, Dorset, BH15 1PH, United Kingdom

Product Description Ballast Water Management System (Model: Aquarius UV BWMS)

Treatment sequence:

- Ballast water uptake : Filtration and UV Disinfection
- Ballast water discharge : UV Disinfection

* Place of Production
Wartsila Suzhou Ltd
No. 77 Hongxi Road, New District of Suzhou, 215151, PR China

" See Appendix 1 "

Approval Condition " See Appendix 1 "

THIS IS TO CERTIFY that the above-mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as follows.

Resolution MEPC.300(72) - Code for Approval of Ballast Water Management Systems, Part 9 Rules for the Classification of Steel Ships and Guidance of Approval of Manufacturing process and Type Approval, Etc.

This Certificate is valid until 6th May, 2025

Reissued at Busan, Korea on 19th January, 2021



This certificate is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "<http://e-cert.krs.co.kr>" by using the tracking No(ME21001433819) and certificate No.(LDN44093-BT001).



KOREAN REGISTER

General Manager of
Marine & Ocean Equipment Team

Note : 1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.
2. This certificate will be invalid from the expiry date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
3. Any significant modifications or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
4. Should the specified rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society in accordance with the requirements as amended.

Product Description and/or Approval Condition

Date of Issue : 19th January, 2021

A. Product Description

1. Product Specification

1) System Description (Model: Aquarius UV (X) BWMS)

The Aquarius UV(X) BWMS is a ballast water management system. The treatment sequence of Aquarius UV(X) BWMS under ballast water uptake mode is filtration and UV disinfection and UV disinfection mode is operated at the discharge mode without filtration. (* X: Explosion-proof model for hazardous area)

2) General Specification

- Capacity : 50 - 1000 m³/h
- Water temperature : Not Applicable
- Operating Salinity Condition : No limitation
- Holding Time : Marine and Brackish Water (≥ 1PSU) : Not Applicable
Fresh Water (<1 PSU) : 72 hours

Model	TRC* (m ³ /h)	Filtration Unit Filter Type	Flange (DN)	UV Reactor Model	UV Lamps No. of Lamps	UV Lamps Lamp Model
AQ-50-UV (X)	50	BS-025H/V-03 (EX) BS-031H/V-03 (EX)	80 80	BWT IL+125 (X)	6	B2020H
AQ-80-UV (X)	80	BS-050H/V-04 (EX)	100			
AQ-125-UV (X)	125	BS-050H/V-06 (EX) BS-061H/V-06 (EX)	150			
AQ-180-UV (X)	180	BS-070H/V-06 (EX) BS-061H/V-T-06 (EX)	150	BWT IL+250 (X)	12	B3535LV
AQ-250-UV (X)	250	BS-100H/V-08 (EX) BS-101 (e) H/V-08 (EX)	200			
AQ-275-UV (X)	275	BS-100H/V-T-08 (EX)	200	BWT IL+300 BWT IL+375X	12	B3535LV
AQ-300-UV (X)	300	BS-101 (e) H/V-T-08 (EX)	200		12	B3535H
AQ-375-UV (X)	375	BS-150H/V-10 (EX) BS-151 (e) H/V-10 (EX)	250	BWT IL+375 (X)	12	B3535H
AQ-410-UV (X)	410	BS-150H/V-10 (EX)	250	BWT IL+430 (X)	12	B3535H
AQ-430-UV (X)	430	BS-151 (e) H/V-T-10 (EX)	250			
AQ-500-UV (X)	500	BS-200H/V-12 (EX) BS-201 (e) H/V-12 (EX) BS-151 (e) H/V-ST-12 (EX)	300	BWT IL+500 (X)	12	B3535H
AQ-550-UV (X)	550	BS-200H/V-T-12 (EX) BS-201 (e) H/V-T-12 (EX)	300	BWT IL+750 (X)	18	B5050LV
AQ-750-UV (X)	750	BS-300 (e) H/V-14 (EX)	350			
AQ-850-UV (X)	850	BS-300 (e) H/V-T-14 (EX)	350	BWT IL+1000 (X)	18	B5050H
AQ-1000-UV (X)	1000	BS-400 (e) H/V-14 (EX) BS-300 (e) H/V-ST-14 (EX)	350			

* Minimum flow is to be maintained above 10 % of the TRC at least.

* Filter Type : H/V symbolizes filters for horizontal or vertical installation.
(e) symbolizes filters of the BS e-series range.

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3) System Flow Rate – UV Intensity Control Logic

The system maintains the design TRC until the UVI indicates violation of the minimum UV dose. At this point, the first flow reduction step is activated and the flow is adjusted to enable the design UV dose to be achieved as a minimum. The UV dose is evaluated in real time as UVI is continuously monitored and system algorithm is embedded in the PLC.

Model	TRC	System Flow Rate – UV Intensity Control Logic					
		100%	75% TRC	UV Intensity for Flow Rate at 50% TRC	25% TRC	15% TRC	
AQ-50-UV (X)	50	≥ 494	$371 \leq I < 494$	$247 \leq I < 371$	$124 \leq I < 247$	$74 \leq I < 124$	
AQ-80-UV (X)	80	≥ 791	$593 \leq I < 791$	$395 \leq I < 593$	$198 \leq I < 395$	$119 \leq I < 198$	
AQ-125-UV (X)	125	≥ 1235	$926 \leq I < 1235$	$618 \leq I < 926$	$309 \leq I < 618$	$185 \leq I < 309$	
AQ-180-UV (X)	180	≥ 139	$104 \leq I < 139$	$69 \leq I < 104$	$35 \leq I < 69$	$21 \leq I < 35$	
AQ-250-UV (X)	250	≥ 193	$145 \leq I < 193$	$96 \leq I < 145$	$48 \leq I < 96$	$29 \leq I < 48$	
AQ-275-UV (X)	275	≥ 258	$193 \leq I < 258$	$129 \leq I < 193$	$64 \leq I < 129$	$39 \leq I < 64$	
AQ-300-UV (X)	300	≥ 281	$211 \leq I < 281$	$140 \leq I < 211$	$70 \leq I < 140$	$42 \leq I < 70$	
AQ-375-UV (X)	375	≥ 307	$230 \leq I < 307$	$154 \leq I < 230$	$77 \leq I < 154$	$46 \leq I < 77$	
AQ-410-UV (X)	410	≥ 342	$256 \leq I < 342$	$171 \leq I < 256$	$85 \leq I < 171$	$51 \leq I < 85$	
AQ-430-UV (X)	430	≥ 358	$269 \leq I < 358$	$179 \leq I < 269$	$90 \leq I < 179$	$54 \leq I < 90$	
AQ-500-UV (X)	500	≥ 511	$383 \leq I < 511$	$255 \leq I < 383$	$128 \leq I < 255$	$77 \leq I < 128$	
AQ-550-UV (X)	550	≥ 252	$189 \leq I < 252$	$126 \leq I < 189$	$63 \leq I < 126$	$38 \leq I < 63$	
AQ-750-UV (X)	750	≥ 343	$257 \leq I < 343$	$172 \leq I < 257$	$86 \leq I < 172$	$51 \leq I < 86$	
AQ-850-UV (X)	850	≥ 426	$320 \leq I < 426$	$213 \leq I < 320$	$107 \leq I < 213$	$64 \leq I < 107$	
AQ-1000-UV (X)	1000	≥ 502	$376 \leq I < 502$	$251 \leq I < 376$	$125 \leq I < 251$	$75 \leq I < 125$	

4) Filter

- Manufacturer : Filtersafe or Wartsila under license (Designed by Filtersafe)
- Mesh : 40 micron weave of SUS 904L
- Minimum Filter Inlet Pressure : ≥ 1.6 bar
- Maximum Working Pressure : 6 bar
- Differential Pressure Triggering Back flushing : ≥ 0.5 bar
- Max. Working Temperature : 55 °C
- Filter Housing Material : Carbon Steel
- Mounting : Vertical or Horizontal

5) UV Reactor

- Manufacturer : Hanovia Limited
- Design Pressure : 6 bar
- Material : SUS 316L and SMO 254
- Mounting : Vertical or Horizontal
- Max. Working Temperature : 55 °C

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6) Control Equipment & Monitoring Equipment

Tag No.	Component Name	Manufacturer	Remark
MCP1	Main Control Panel UV Remote Console HMI	CMR or Wartsila Suzhou CMR or Wartsila Suzhou Beijer	BWCP1XXXX, BWCP3XXXX BWCP7XXXX T7A, X2pro7
UVI	UV Intensity Monitor	IL Metronic	SUV 20
UVPS1	Power Supply	Hanovia	BWT

7) Software Version : R12XX

* All changes in software are to be recorded as long as the system is in use onboard and major changes to the software are to be approved before its actual installation on board.

2. Approved Drawings and Documents

1) Approved Drawing

A) Piping and Instrument Diagram

- Doc. No. UV-T-001-171 Rev.4
- Doc. No. UV-T-002-171 Rev.4
- Doc. No. UV-T-004-171 Rev.7
- Doc. No. UV-T-005-171 Rev.7
- Doc. No. UV-T-006-171 Rev.7
- Doc. No. UV-T-007-171 Rev.4
- Doc. No. UV-T-008-171 Rev.4
- Doc. No. UV-T-009-171 Rev.7
- Doc. No. UV-T-010-171 Rev.4
- Doc. No. UV-T-011-171 Rev.4
- Doc. No. UV-T-012-171 Rev.4

B) General Arrangement

The listed GA drawings are generic and are not used for specific installations. The orientation and voltage/frequency of each installation will be determined to allow for the relevant GA drawing to be created, replacing -xxx with the specific type code. Each GA drawing will reference back to the generic GA drawing number listed in the below.

- UV Power Supply : Doc. 6742000100 to 6742000117
- Compact Filter : H0050FCK-xxx-171 to H0500FCK-xxx-171
H0250FCK-xxx-191 to H0500FCK-xxx-191
H0050FCXK-xxx-171 to H0500FCXK-xxx-171
H0250FCXK-xxx-191 to H0500FCXK-xxx-191
- Standard Filter : H0050FK-xxx-171 to H1000FK-xxx-171,
H0250FK-xxx-191 to H1000FK-xxx-191
H0050FXK-xxx-171 to H1000FXK-xxx-171
H0250FXK-xxx-191 to H1000FXK-xxx-191
- Super Turbo Filter : H0500FCK-SP-xxx-191 to H1000FK-SP-xxx-191
H0500FCXK-SP-xxx-191 to H1000FXK-SP-xxx-191
- UV Reactor : H0125UVK-xxx-201 to H1000UVK-xxx-201
H0125UVK-xxx-172 to H1000UVK-xxx-172
H0125UVXK-xxx-201 to H1000UVXK-xxx-201
H0125UVXK-xxx-172 to H1000UVXK-xxx-172

C) Electrical Drawing

- UV Power Supply : 6742000100 to 6742000107
6742000108 to 6742000115
6742000116, 6742000117
- UV Control Panel: BWCP-GA-01
- Remote UV Console : BWCP70051

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- 2) Reviewed Document
 - Operational Maintenance & Safety Manual (OMSM 162.060-38) Ballast Water Management System Designed for Compliance with USCG rule 33CFR part 151 and 46CFR part 162 IMO MEPC 300(72) [G8] Rev.5 dated 2020-12-08

3. Test Reports, etc.

- 1) Land-based Testing
 - Biological efficacy performance evaluation of Ballast Water Management System Wartsila Aquarius AQ-250-UV in land-based test : Final Report 11819972/2018. 10. 18-LB
- 2) Shipboard Testing
 - DHI Denmark: Biological efficacy performance evaluation of Wartsila Aquarius AQ-1000-UV Ballast Water Management System in shipboard test : Final Report 11819972/2018. 10. 17-SB
- 3) Environment Testing
 - Test Report No. U170239E1 3rd Version issued by Phoenix Testlab
 - Test Report No. U171715E1 6th Version issued by Phoenix Testlab
 - Test Report No. U181132E1 3rd Version issued by Phoenix Testlab
 - Test Report No. U180038E1 2nd Version issued by Phoenix Testlab
 - Test Report No. E171715E1 2nd Version issued by Phoenix Testlab
 - Test Report No. E172037E2 1st Version issued by Phoenix Testlab
 - Test Report No. E172037E3 1st Version issued by Phoenix Testlab
 - Test Report No. TL15076-EMC Issue 4 issued by MS Testing
- 4) Readiness Evaluation
 - Test Report No. BD00678 dated 16 April 2019 in the presence of KR Surveyor
- 5) Etc.
 - Wartsila Aquarius UV BWMS all system TRC performance claim (BD00398), rev. 4
 - Wartsila Aquarius UV BWMS control and operating philosophy (BD00292), rev. 2
 - Aquarius UV Installation Instructions (BD00198), rev. 8
 - Wartsila Aquarius UV BWMS Sizing Document USCG (BD00294), rev. 4
 - Aquarius UV PLC Alarm & Trip Summary (BD00308), rev. 11
 - Wartsila AQUARIUS UV BWMS Control System Options (BD00356), rev. 3
 - Wartsila AQUARIUS UV BWMS Operator User Guide (BD00409), rev. 2
 - Wartsila Water Systems Ltd.: Wartsila Aquarius UV BWMS basis of process design and scale-up (BD00427), rev. 1
 - BWT-Scaling-Using-CFD report (BD00451), rev. 1
 - Wartsila Aquarius UV Temperature Assessment (BD00492), rev. 1

B. Approval Condition

1. Application & Limitation

- 1) This certificate is issued on the basis of the test reports and the documentation type approved by the Norwegian Administration(Date:12 June 2020/Cert.No.TAP0000218).
- 2) Degree of protection shall be compliant with the Rule Pt.6, Ch.1, Sec.2,Art.201.2. (5).
- 3) Unless specially directed by the Administration, this approval is not to be construed as a substitute for a flag Administration's approval. This certificate may not be used for Korea flagged vessels.
- 4) This certificate will be automatically revoked when the type approval certificate issued by Norwegian Administration is not valid.
- 5) The manufacturer should inform this Society of all kinds of revisions of the equipment including software. If the changes are recognized to affect functionality of the approved equipment, type test to confirm the reliability of the revised equipment may be performed in the presence of our surveyor.

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- 6) Any latest conventions or requirements settled by International Maritime Organization or Administrations should be retroactively applied at the earliest possibility, if necessary.
- 7) The above models may be installed on board in parallel, provided that the ultimate functioning and effectiveness of the system on board a ship of the type and size for which the equipment will be certified will not be adversely affected.
- 8) Explosion-proof certification by a notified/recognized certification body is not covered by this certificate. Ratings and special condition for safe use in hazardous areas are to be obtained from the relevant valid Ex-certificate.

2. Individual Product Cert. and Drawing Approval Requirement

- 1) Individual product certification is required in accordance with Rule Pt.9 Ch. 10 Sec. 306. 4.
- 2) For the BWMS intended to undergo a Classification survey during construction or retrofit, the following documents for individual vessel are to be submitted to the Society.
 - Ballast Piping Diagram
 - Electrical Schematic Drawings of BWMS
 - Operation and Maintenance Manual (if required by Administration)
 - Any other documents deemed necessary by the Society and/or Administration

3. Marking

- 1) The product or packing is to be marked with the manufacturer's name and type designation on a suitable position.

4. Others

- 1) Test condition of Electric Equipment

Test	Condition	Remark
EMC	All locations excluding the bridge and deck zone	-
Temperature	+0 ~ +55°C	-
Vibration	Acceleration $\pm 0.7g$	-

< End of Certificate >