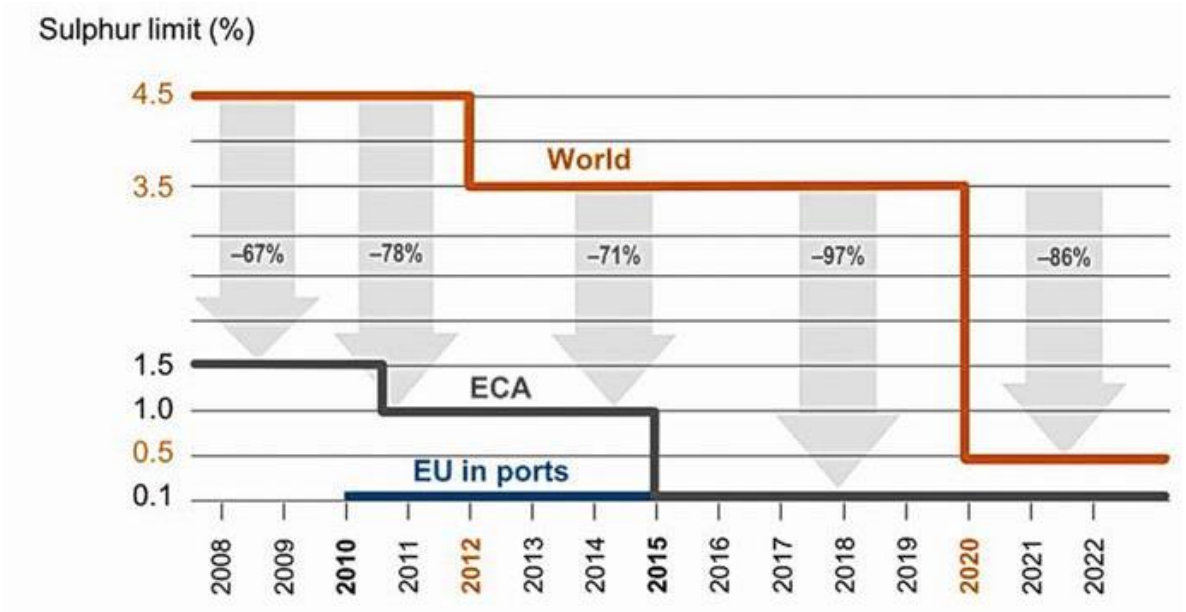
SOx Scrubber (Exhaust Gas Cleaning System)

Korean Resister of Shipping

Contents

SOx Scrubber - Regulation

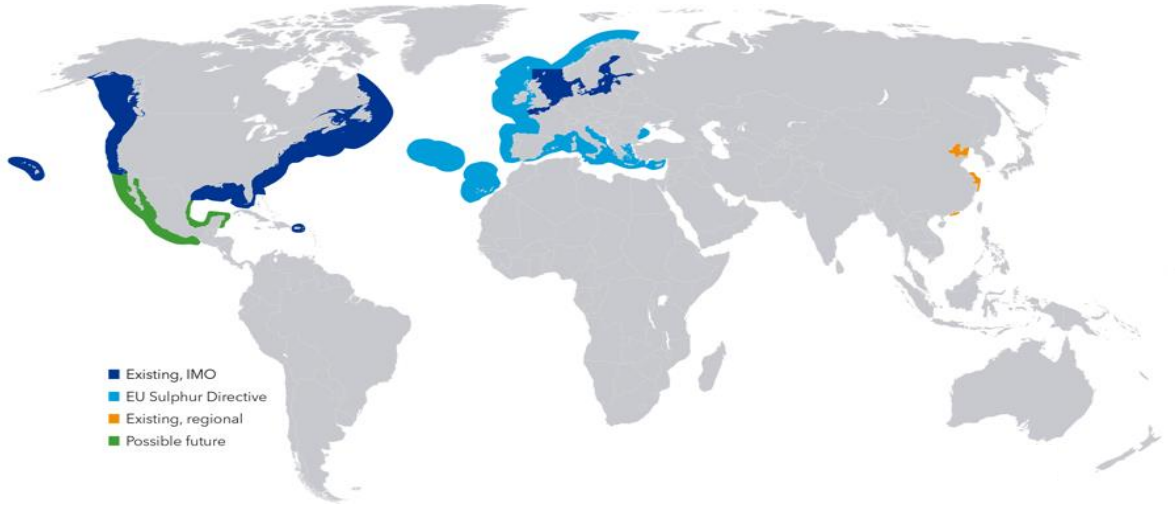
■ MARPOL Annex.VI Reg.14



	Sulphur Limit of Fuel oil		
Global (excluding SECA)	Before 2012. 1. 1.	After 2012. 1. 1.	**After 2020. 1. 1.**
	4.5%	3.5%	**0.5%**
SECA	Before 2010. 7. 1.	After 2010. 7. 1.	After 2015. 1. 1.
	1.5%	1.0%	0.1%

SOx Scrubber - Regulation

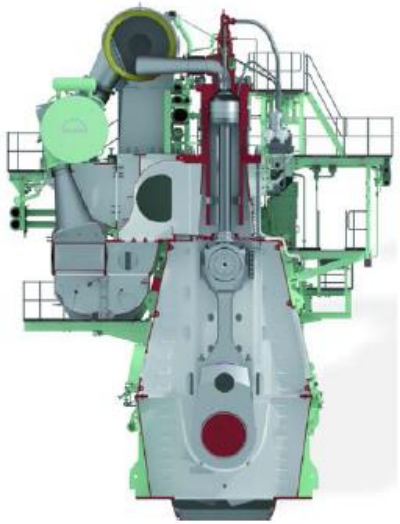
■ SOx Emission Control Area



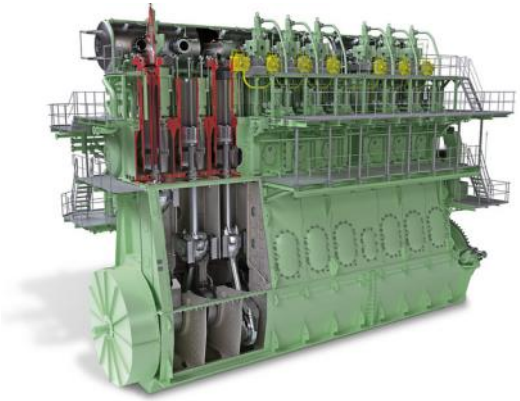
	Area	Sulphur Limit
by IMO	Global	0.5% (after 2020)
	SECA	0.1%
by Local Regulation	EU	0.1% in all ports
	China	0.5% in selected areas
	Hong Kong	0.5%
	Etc.	Case by case

SOx Scrubber - Regulation

■ Compliance Techniques for SOx Regulation



[with LSMGO/LSHFO]



[LNG Fuelled Engine]

[with SOx Scrubber]

Techniques	Methods
with LSMGO/LSHFO	using Low sulphur fuel (below 0.1% or 0.5% S)
LNG Fuelled Engine	using LNG fuel (about 0% S)
with SOx Scrubber	Cleaning of Exh. Gas

SOx Scrubber - Regulation

■ Application of SOx Scrubber

Basic Requirement	Alternative Means	Guideline for Alternative
MARPOL Annex.VI/Reg.14	MARPOL Annex.VI/Reg.4	Res.MEPC.259(68)
The sulphur content of any fuel oil shall not exceed regulation on MARPOL Annex.VI/Reg.14	Other means can be used as an alternative of compliance with MARPOL Annex.VI/Reg.14	Detail guideline for alternative means ; '2015 Guidelines for Exhaust Gas Cleaning System'

SOx Scrubber Solution

*Revision of Res.MEPC.259(68) is under review by IMO.

SOx Scrubber - Regulation

■ Exhaust Gas / Washwater Discharge Criteria

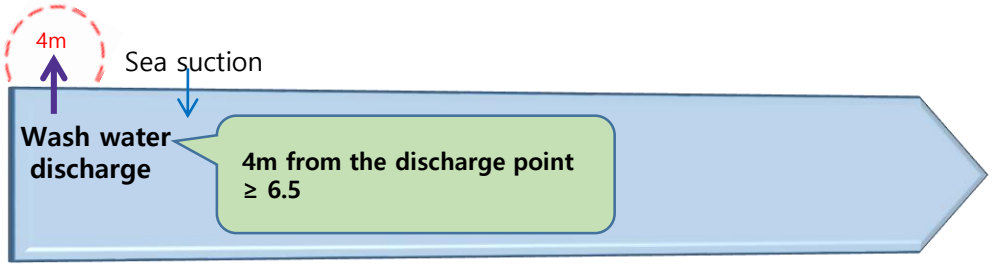
• Exh. Gas : SO2 and CO2 are to be monitored to confirm the satisfaction of fuel oil sulphur content

	Fuel oil sulphur content (% m/m)	Ratio emission SO_2(ppm)/CO_2(%v/v)
	4.50	195.0
Global (~2020)	3.50	151.7
	1.50	65.0
	1.00	43.3
Global	0.50	21.7
SECA	0.10	4.3

Fuel oil Sulphur limits corresponding emissions values

• Washwater

- pH
- PAH
- Turbidity
- Nitrates



SOx Scrubber - Regulation

■ Required approval documents

	Scheme A	Scheme B
SECP (SOx Emission Compliance Plan)	X	X
ETM-A (EGC System – Technical Manual for Scheme A)	X	
ETM-B (EGC System – Technical Manual for Scheme B)		X
OMM (Onboard Monitoring Manual)	X	X
EGC Record Book	X	X

* SECC (SOx Emission Compliance Certificate) should be issued under Scheme A

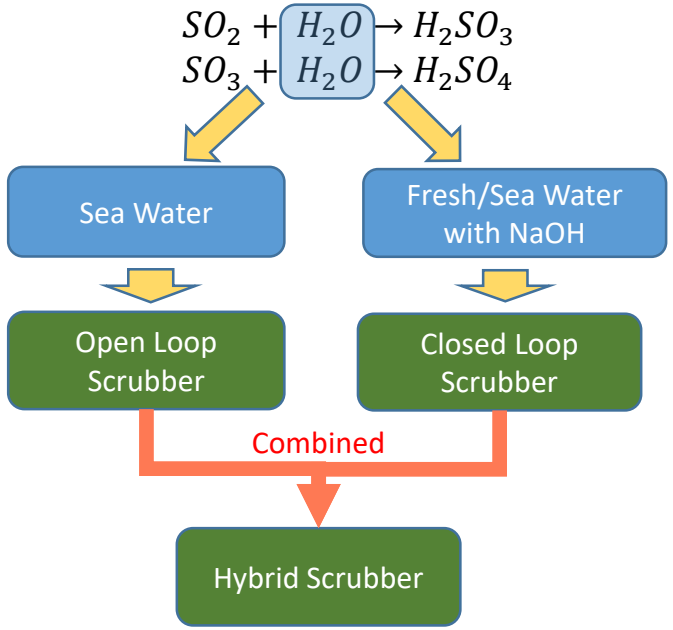
* Almost vessels comply with '**Scheme B**'

- Scheme A : EGC system approval, survey and certification using parameter and emission checks
- Scheme B : EGC system approval, survey and certification using continuous monitoring of SOx emissions

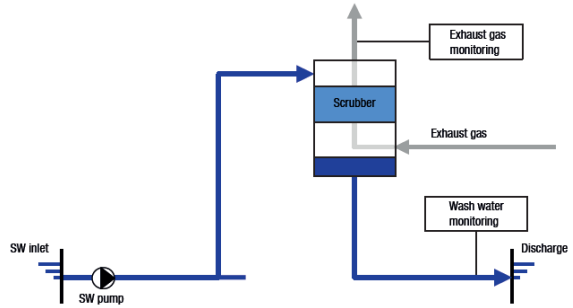
SOx Scrubber - Installation

■ Type of SOx Scrubber

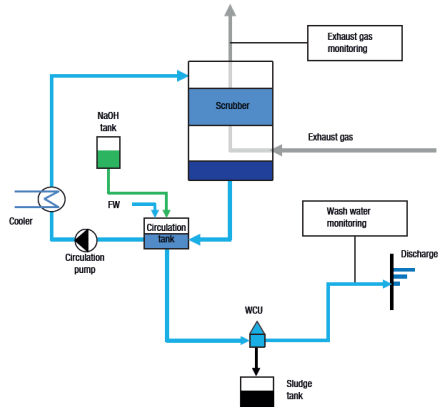
$$SO_2 + H_2O \rightarrow H_2SO_3$$
$$SO_3 + H_2O \rightarrow H_2SO_4$$



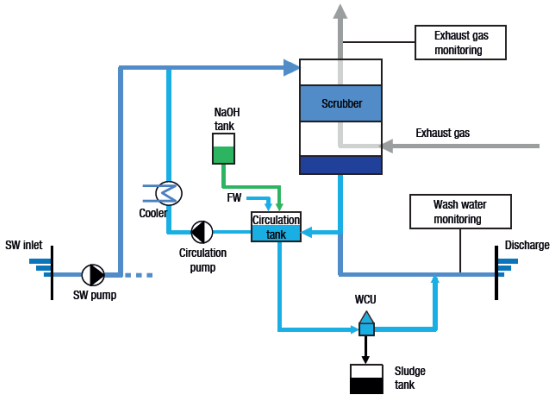
	Cleaning Medium
Open Loop Scrubber	Sea Water
Closed Loop Scrubber	Freash/Sea Water with NaOH
Hybrid Scrubber	Flexible to operate open & closed



[Open loop system]



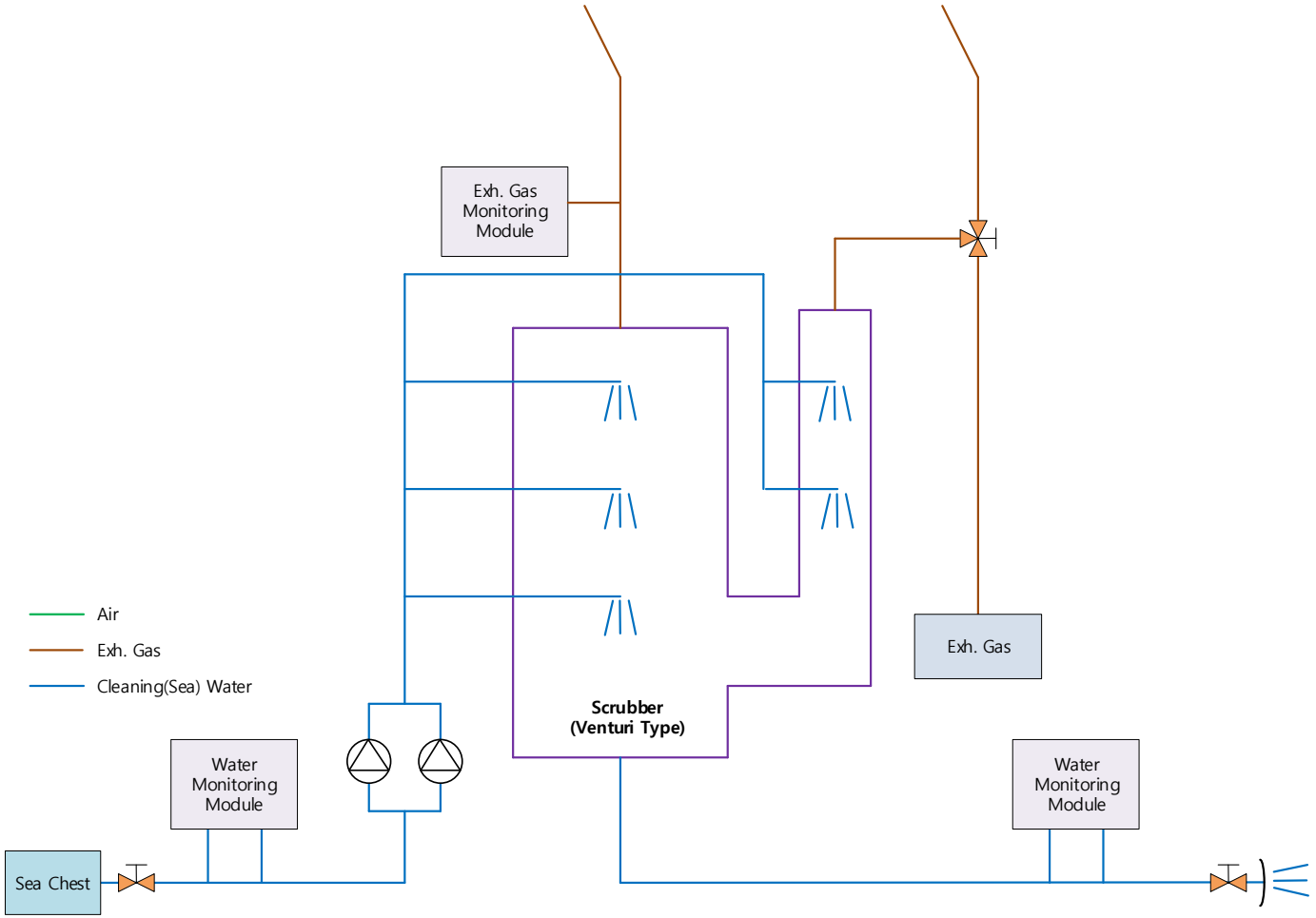
[Closed loop system]



[Hybrid system]

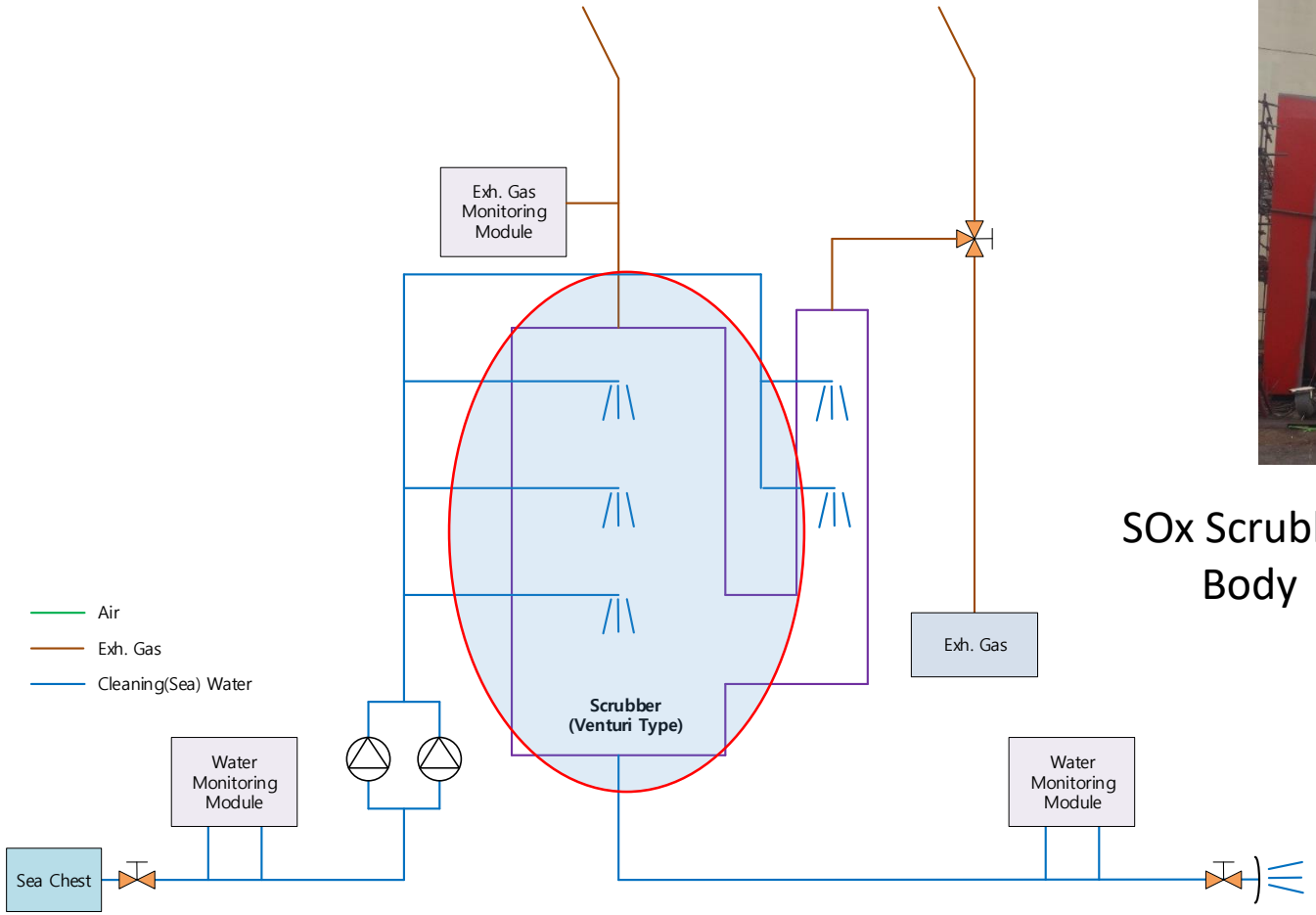
SOx Scrubber - Installation

■ Open Loop SOx Scrubber

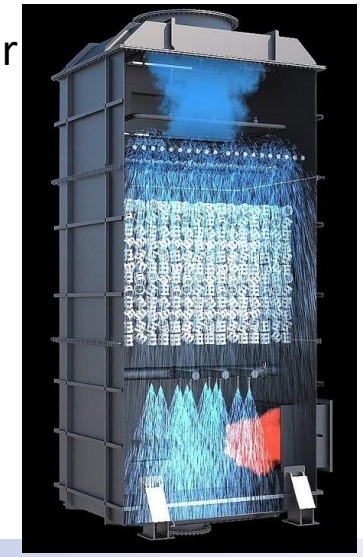


SOx Scrubber - Installation

SOx Scrubber Body



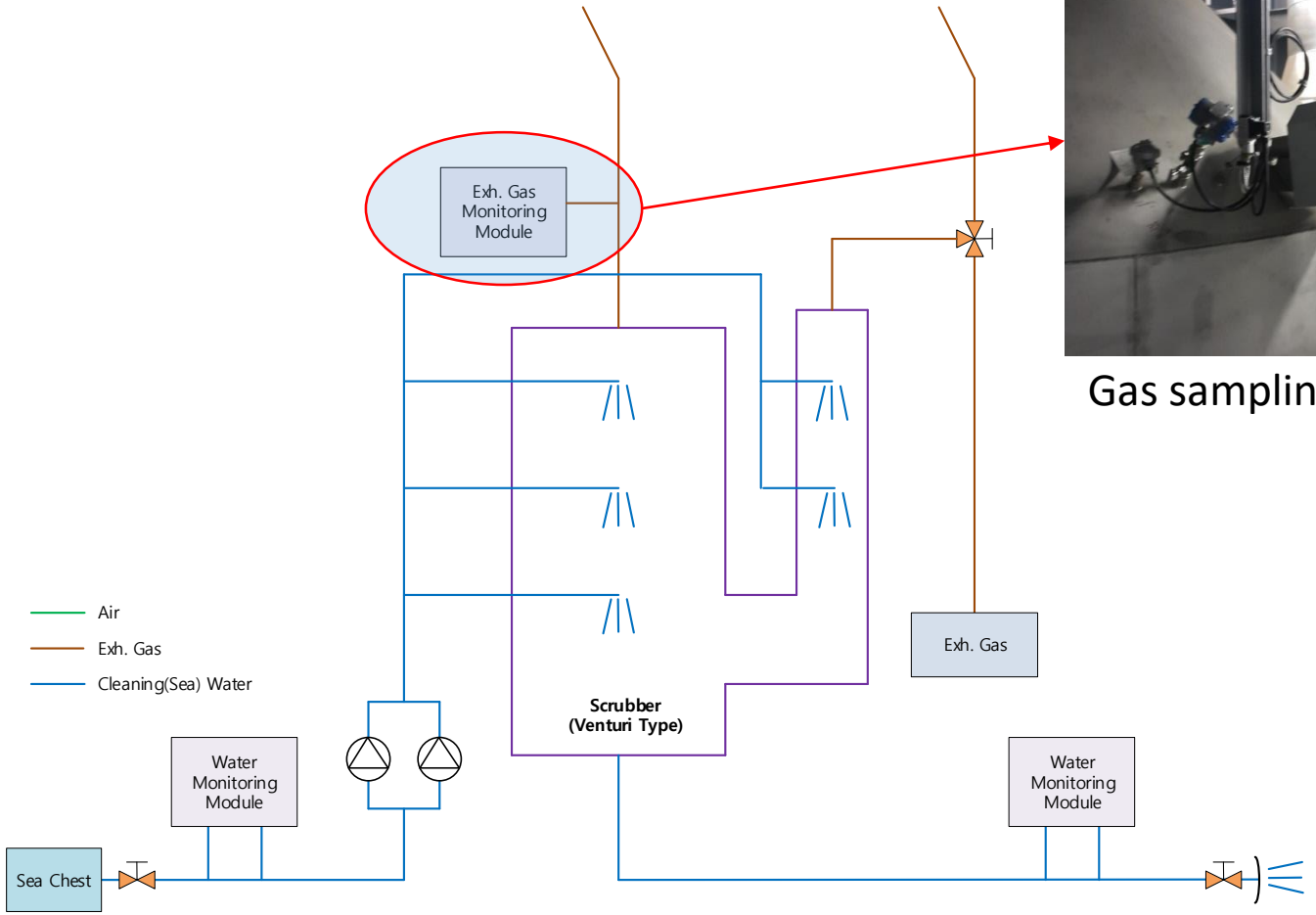
SOx Scrubber Body



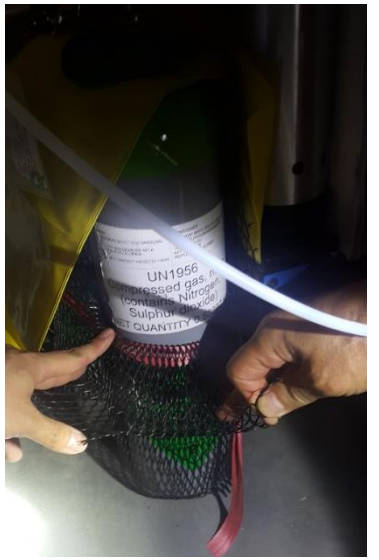
Washwater nozzles and filter inside SOx Scrubber

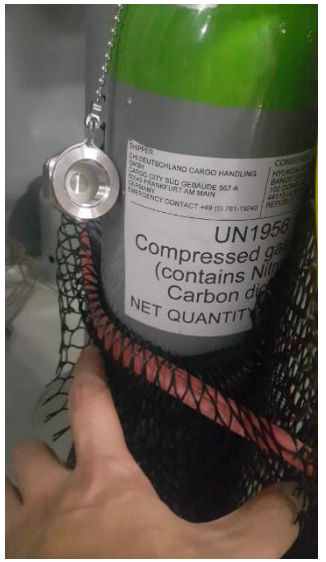
SOx Scrubber - Installation

Emission Monitoring



Gas sampling probe

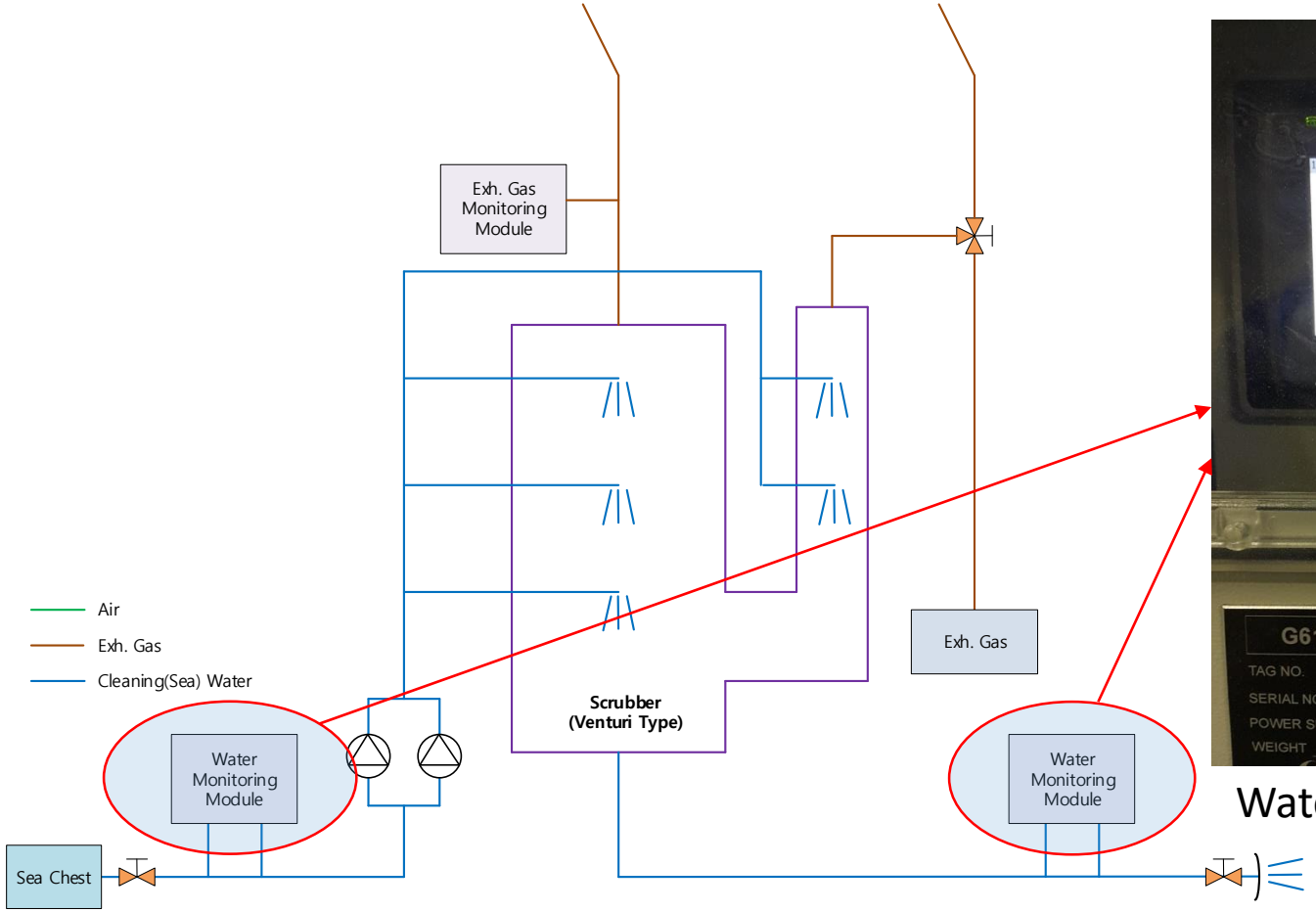


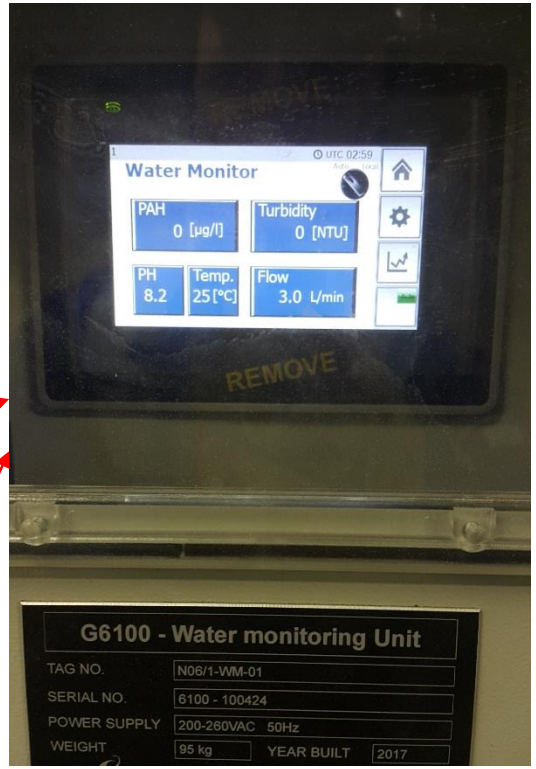


Calibration of emission monitoring system

SOx Scrubber - Installation

Washwater Monitoring



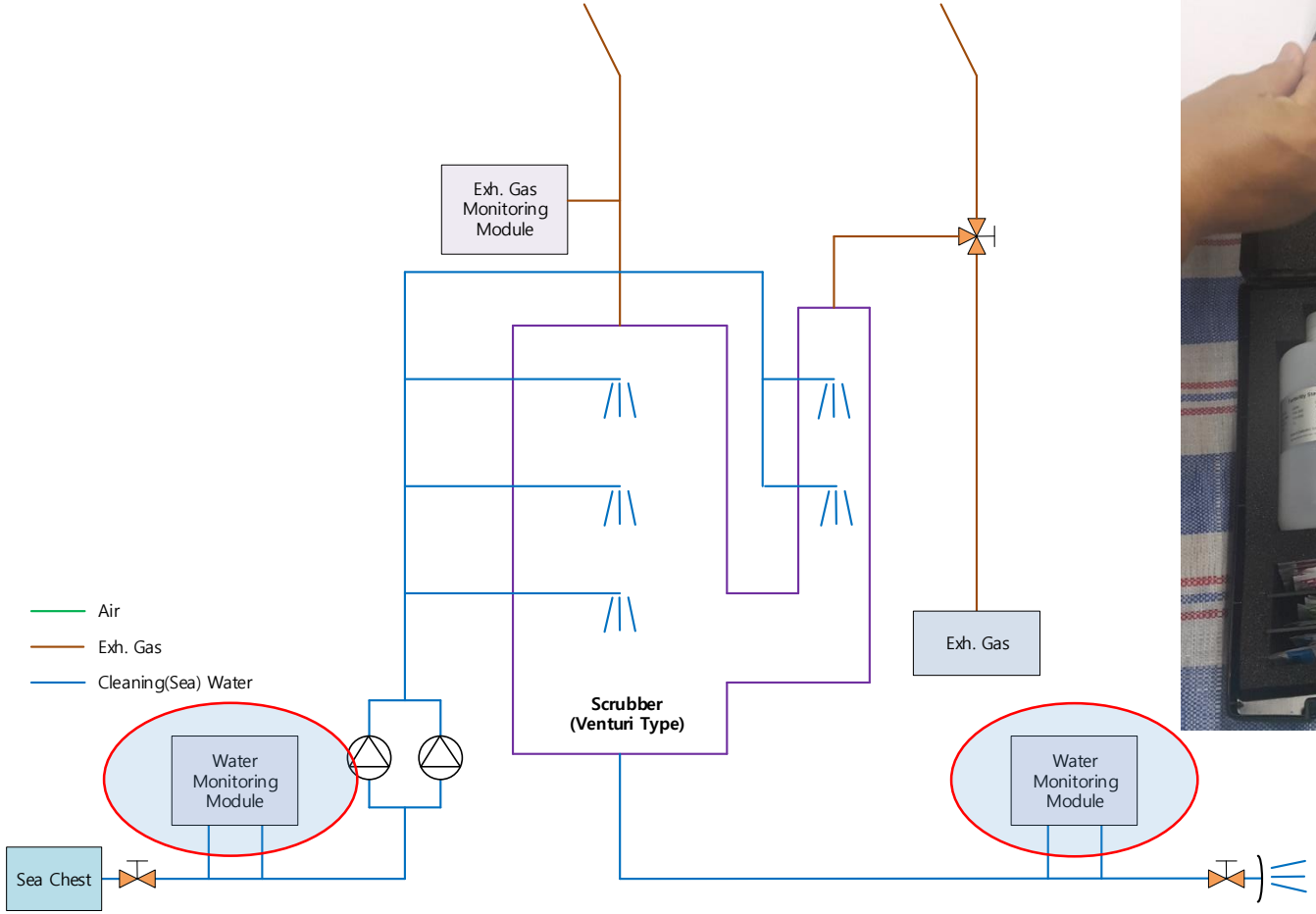


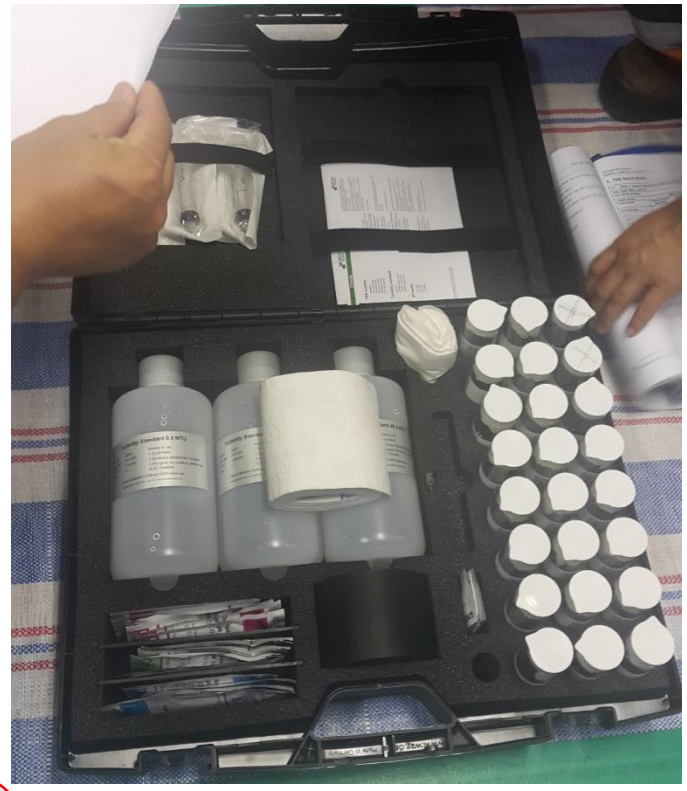
Water monitoring panel

Water monitoring sensor

SOx Scrubber - Installation

Washwater Monitoring

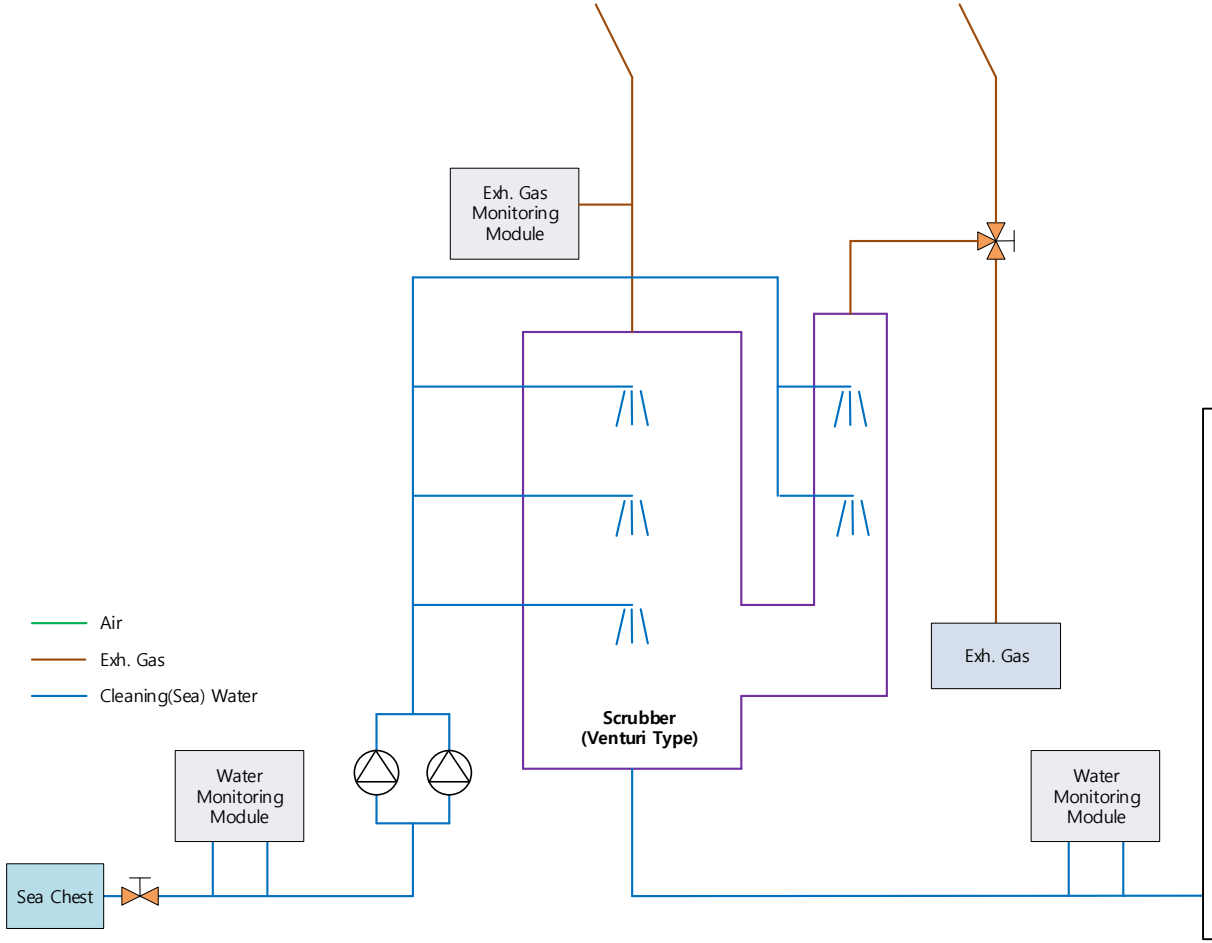


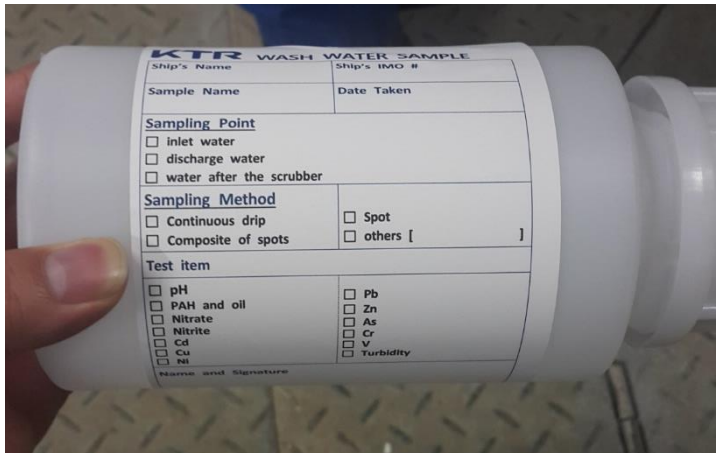


Calibration kit

SOx Scrubber - Installation

Washwater Monitoring





Bottle for washwater sample

Analytical Results

Sub-Matrix: **WATER**

	CAS Number	LOR	Unit	Client sample ID: Scrubbing Water	Client sample ID: Washing Water
Client sampling date / time				21-Jan-2019 00:00	21-Jan-2019 00:00
ALS Sample ID				SH1900219-001	SH1900219-002
INORGANICS - Physical and Aggregate Properties: APHA 22nd, 2130(2012)					
Turbidity	----	0.10	NTU	----	**0.71**
INORGANICS - Nonmetallic Constituents: APHA 22nd, 2320(2012)					
Alkalinity as CaCO3	----	1.0	mg CaCO3/L	**112**	----
INORGANICS - Nonmetallic Constituents: EPA 353.2 Rev.2.0(1993)					
Nitrate as N	14797-55-8	0.010	mg/L	----	**0.540**
ORGANICS - Polyaromatic Hydrocarbons (PAHs): EPA 8270E Rev.6(2017)					
Naphthalene	91-20-3	0.05	µg/L	----	<0.05
Acenaphthylene	208-96-8	0.05	µg/L	----	<0.05

Washwater analysis data

SOx Scrubber - Operation

■ Data Recording Requirement during ship's operation

Data		Scheme A	Scheme B
Exh. Gas (SO2/CO2)		Daily Spot Check	Continuously Monitored
Operating Parameter*		Continuously Monitored**	Daily Spot Check
Washwater	pH, PAH, Turbidity, Temperature	Continuously Monitored	
	Nitrate	Sample check previous 3 months prior to Renewal Survey	

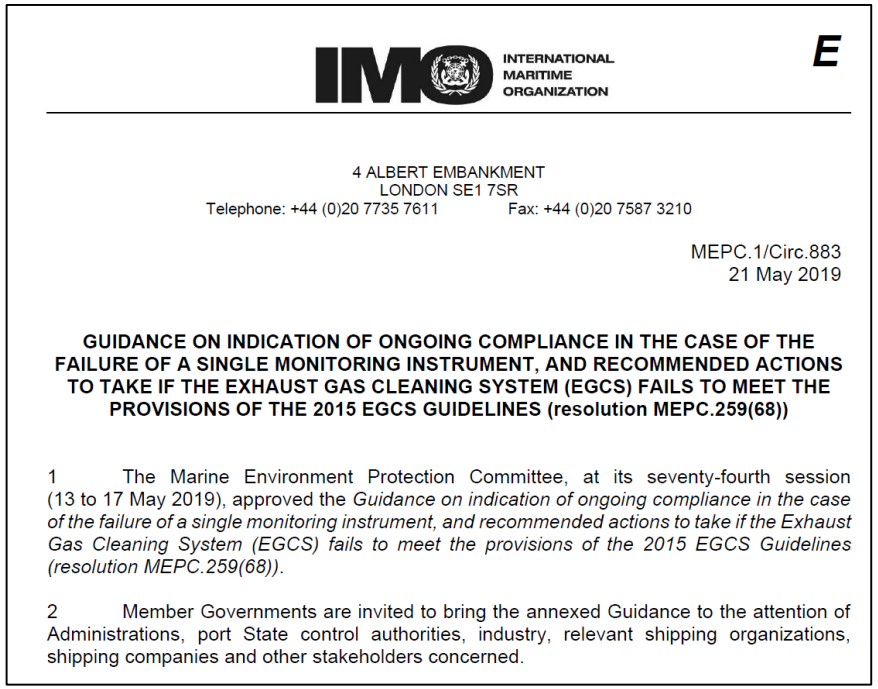
* Operating Parameter
  - Washwater : Pressure, Flow rate at the scrubber inlet connection
  - Exh. gas : Pressure before scrubber, Pressure drop across scrubber, Temperature before scrubber, Temperature after scrubber
  - Fuel oil combustion unit : Load

** If a continuous exhaust gas monitoring system is fitted under Scheme A, only daily spot checks can be allowed

SOx Scrubber - Operation

■ Guidance on ongoing compliance in case of EGCS malfunction (MEPC.1/Circ.883)

- ➢ Short term temporary emission exceedance and sensor failure is *NOT a EGCS malfunction*
  - ✓ Short term exceedance : within 1 hour
  - ✓ Sensor failure : single sensor fail and other parameters are continuing at the normal level



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MEPC.1/Circ.883
21 May 2019

GUIDANCE ON INDICATION OF ONGOING COMPLIANCE IN THE CASE OF THE FAILURE OF A SINGLE MONITORING INSTRUMENT, AND RECOMMENDED ACTIONS TO TAKE IF THE EXHAUST GAS CLEANING SYSTEM (EGCS) FAILS TO MEET THE PROVISIONS OF THE 2015 EGCS GUIDELINES (resolution MEPC.259(68))

1 The Marine Environment Protection Committee, at its seventy-fourth session (13 to 17 May 2019), approved the *Guidance on indication of ongoing compliance in the case of the failure of a single monitoring instrument, and recommended actions to take if the Exhaust Gas Cleaning System (EGCS) fails to meet the provisions of the 2015 EGCS Guidelines (resolution MEPC.259(68))*.

2 Member Governments are invited to bring the annexed Guidance to the attention of Administrations, port State control authorities, industry, relevant shipping organizations, shipping companies and other stakeholders concerned.

SOx Scrubber - Operation

■ Guidance on ongoing compliance in case of EGCS malfunction (MEPC.1/Circ.883)

➢ EGCS malfunction

✓ Change over to compliant fuel if the EGCS cannot be put back within one hour

✓ If the ship does not have sufficient amount of compliance fuel, should be reported to the flag and port State

➢ MARPOL Annex VI/Reg.18.2

✓ "The ship should not be required to deviate from its intended voyage or to delay unduly the voyage in order to achieve compliance."

✓ However, approaches could be vary by each port State.

Thank you !

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