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GUIDELINES FOR DESIGN AND INSTALLATION OF EXHAUST GAS CLEANING SYSTEMS

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Foreword

The international conventions, relevant regions and countries have laid more and more requirements on shipboard SO_x emission control. For easy reference, the Appendix 1 of the Guidelines summarizes the limit of the sulphur content of fuel oils of conventions and relevant regional/national regulations, the date of implementation and implementation areas, use and limitation of the EGC system.

Note: For users' easy reference, the Appendix 1 of the Guidelines ~~Table 0~~ only gives part of the requirements for the limit of emission control of SO_X by ships. Detailed requirements are to be referred to the convention, directive/regulations of relevant countries and regions.

SO_x in the shipboard exhaust gas is the pollutant generated after the combustion of sulphur in the fuel oil. It is very difficult to achieve the objective of controlling SO_x emission by self-improvement of fuel combustion units (such as diesel engines, boilers, etc.). Control is through pre-treatment of fuel oils, after-treatment of exhaust gas or alternative fuels, i.e.:

- pre-treatment of fuel oils: using specialized process to desulfurize fuel oil so that the ship uses low-sulphur oil complying with the requirements;
- after-treatment of exhaust gas: removing SO_x in the exhaust gas by installing exhaust gas treatment unit (e.g. the EGC system) so as to achieve emission reduction equivalent to that of using low-sulphur fuel oil;
- alternative fuels: ships use clean fuels which are sulphur free or low in sulphur, SO_x emission is low after combustion.

Regulation 14 of MARPOL Annex VI requires ships to use fuel oil with a sulphur content not exceeding that stipulated in regulations 14.1 or 14.4; regulation 4 allows, with the approval of the Administration, the use of an alternative compliance method at least as effective in terms of emission reductions as that required by the MARPOL Annex VI, including the standards set forth in regulation 14. The exhaust gas cleaning system is a frequently applied alternative compliance method in marine transportation section. IMO specifically developed the Guidelines for Exhaust Gas Cleaning Systems, 2009 (resolution MEPC.184(59)) (hereinafter referred to as the Guidelines, and the amendments to the Guidelines were approved and adopted in 2015 and 2021 respectively(resolution MEPC.259(68), resolution MEPC.340(77)). The Guidelines specifies testing methods and survey procedures of the exhaust gas cleaning system emission compliance verification (including exhaust gas emission and washwater discharge) and serves as the main basis for the statutory survey of the EGC systems. CCS developed CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems on the basis of the Guidelines.

The EGC systems, as one of the major pollution prevention equipment on board, need to take into account issues related to the system operational safety in addition to meeting requirements of statutory emission criteria and compliance verification, i.e. the operation and usage of the system will not cause unacceptable hazards to the ship, essential equipment and personnel. The Guidelines specifies the requirements for the design, manufacturing, installation and arrangement onboard, control and monitoring, survey and testing of the EGC systems from the perspective of ship safety and serves as a supplement to CCS rules, with an aim to provide guidance on the ship design, construction/conversion, survey, testing, etc.

Chapter 1 General

1.1 Application

1.1.1 The Guidelines is applicable to exhaust gas cleaning systems (hereinafter referred to as the EGC systems) installed to reduce SO_x emission in the exhaust gas of fuel oil combustion units onboard. Dry desulfurization systems are subject to special consideration by CCS.

1.1.2 In the Guidelines, the alkalic chemical substances used in the EGC systems include sodium hydroxide (NaOH), calcium hydroxide ($Ca(OH)_2$), magnesium hydroxide ($Mg(OH)_2$), and magnesium oxide (MgO). Sodium hydroxide (NaOH) and calcium hydroxide ($Ca(OH)_2$) are generally stored and used on ships in the form of chemical treatment fluids, and the requirements related to them in the Guidelines are mainly based on the characteristics of chemical treatment fluids.

1.1.3 If alkali chemicals other than those prescribed in 1.1.2 are used, applicants are to evaluate the characteristics of the chemicals, identify the potential risks of the chemical in the process of filling, storage, supply and use onboard, take appropriate safety measures according to the result of the risk assessment, so as to avoid or reduce the damage to the ship and personnel onboard, and submit relevant information to CCS for consideration.

1.1.4 The Guidelines specifies the requirements for the design, manufacturing, installation and arrangement, control and monitoring, survey and testing of the EGC systems.

1.1.5 The requirements of the Guidelines are only supplementary to CCS rules. The EGC systems, in addition to satisfying the requirements of the Guidelines, are also to comply with the relevant requirements of CCS Rules for Classification of Sea-going Steel Ships (hereinafter referred to as CCS Rules), and/or relevant provision of other applicable rules. Those ships installing the EGC system need to pay attention to the relevant provisions, if any, of the Administration of the flag States.

1.1.6 Where CCS is authorized by the Administration to issue the statutory certificates related to prevention of air pollution from ships[①], the emission compliance verification of the EGC systems in accordance with CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems is also to be carried out.

1.2 Class notation

1.2.1 Ships installed with the EGC systems for reduction of SO_x emission can be assigned with SEC (EGCS) notation upon satisfactory survey provided that the EGC systems are designed, manufactured, installed and arranged, tested according to the requirements of the Guidelines and SOx emission is in compliance with the relevant provisions of the regulations.

1.3 Definitions and abbreviations

1.3.1 Definitions

(1) **Fuel Oil Combustion Unit** means any engine, boiler or other fuel oil fired equipment, excluding shipboard incinerators.

(2) **Exhaust Gas Cleaning System (EGCS)** means a system that includes one or more EGC units,

① Statutory certificates related to prevention of air pollution from ships include the applicable International Air Pollution Prevention Certificate, Safety and Environmental Protection Certificate for Domestic Sea-going Ships, Safety and Environmental Protection Certificate for Inland Waterway Vessels.

auxiliary system, instrument, control and monitoring alarms, and which is based on technology that uses a wet cleaning medium for the reduction of SO_X from an exhaust gas stream from installed fuel oil combustion unit(s), operating in open-loop, or closed-loop mode, or hybrid mode. Several EGC units may utilize a common uptake system with a single exhaust gas monitoring system. Several EGC units may utilize a common washwater, water supply, treatment and/or overboard system and discharge water monitoring equipment.

(3) **Scheme A** means a survey method to verify that the EGC system in service will result in the intended performance through performance tests, and to prove its continuous emission compliance through in-service continuous operational parameter monitoring and periodic emission checks.

(4) **Scheme B** means a survey method to prove continuous emission compliance of the EGC system through continuous emission monitoring and indication of the Emission Ratio while the EGCS is in operation by means of an approved monitoring system together with periodic operational parameter checks.

(5) **Open-loop Mode** means EGCS operating mode in which the washwater, typically seawater, is passed through the EGC unit only once before it is being discharged overboard as discharge water.

(6) **Closed-loop Mode** means EGCS operating mode in which the washwater is passed several times through the EGC unit.

(7) **Hybrid Mode** means that EGCS can operate in both open-loop mode and closed-loop mode.

(8) **EGC Unit** means device within which exhaust gas and cleaning medium are mixed to get rid of SO_x in the exhaust gas. An EGC unit may have a single or multiple fuel oil combustion unit(s) connected to it.

(9) **Washwater** means cleaning medium brought into contact with the exhaust gas stream for the reduction of SO_x.

(10) **Discharge Water** means any water from an EGCS to be discharged overboard.

(11) **Washwater Treatment Plant** means a set of devices used to purify the washwater to make it suitable for exhaust gas cleaning in an EGC unit or to meet the discharge water criteria.

(12) **Desulfurization Agent** means a general term for chemicals used to reduce SO_x in the exhaust gas of the fuel oil combustion unit, e.g. NaOH, $Ca(OH)_2$, $Mg(OH)_2$, MgO, etc.

(13) **EGCS Residue** means material removed from the washwater or the bleed-off water by a treatment system or discharge water that does not meet the discharge criterion, or other residue material removed from the EGCS.

(14) **Alkali Solution** means the chemical treatment fluid produced after the desulfurization agents (namely NaOH, $Ca(OH)_2$) is mixed with water in the Guidelines.

(15) Slurry means the chemical treatment fluid produced after the desulfurization agents (namely MgO, $Mg(OH)_2$) is mixed with water in the Guidelines.

(16) **Pressure Resistance of the EGC Unit** means the total pressure difference of exhaust gas between the exhaust gas inlet and outlet of the EGC Unit, in Pa.

(17) **Dry Desulfurization System** means the desulfurization agent coming into direct contact with the exhaust gas of the fuel oil combustion unit in the form of particles to get rid of SO_x in the exhaust gas.

(18) **Booster Fan** means fan added to overcome the flow resistance of the exhaust gas of the fuel oil combustion unit passing the EGC unit.

1.3.2 Abbreviations and symbols

(1) $Ca(OH)_2$: calcium hydroxide.

(2) CO_2: Carbon dioxide.
(3) EGC: Exhaust Gas Cleaning.
(4) EGCS: Exhaust Gas Cleaning System.
(5) EU: European Union.
(6) MCR: Maximum Continuous Rating.
(7) $Mg(OH)_2$: magnesium hydroxide.
(8) MgO: magnesium oxide.
(9) NaOH: sodium hydroxide.
(10) SCR: Selective Catalytic Reduction.
(11) SO_x: Sulphur oxides.
(12)-SO_2: Sulphur dioxide.

1.4 Goals and functional requirements

1.4.1 The Guidelines is intended to provide standards for the design, manufacturing, installation and arrangement, control and monitoring, survey and testing-of the EGC system, so as to avoid or reduce in so far as practicable the unacceptable hazards caused by the installation and usage of the EGC system to the ship, essential equipment and personnel.

1.4.2 To achieve the above mentioned goals, the design, manufacturing, installation and arrangement of the EGC system is to comply with the following functional requirements:

(1) adapting to the environmental and working conditions of ship operation;

(2) effectively treating SO_x in the exhaust gas of the fuel oil combustion unit connected with the system;

(3) reducing in so far as practicable the impacts of the installation and operation of the EGC system on the fuel oil combustion unit to ensure that the latter can operate continuously and that the operation parameters and power output are maintained within the design limits;

(4) the materials used are to be suitable for the medium coming into contact with them and their working environment;

(5) avoiding the accidental accumulation or spread of inflammable, explosive, toxic gases;

(6) avoiding damages to the ship structure or other equipment and systems due to the leakage and spread of chemical substances (such as desulfurization agent);

(7) avoiding harms to the crew or other equipment due to high temperature, running equipment, etc.;

(8) appropriate fire detection, fire protection and fire extinguishing measures are to be taken for potential fire risks;

(9) the installation and arrangement of the EGC system are to take into account the impacts on the ship structure, ship stability and loadlines;

(10) appropriate control, monitoring, safe protection are to be adopted to ensure the safe and reliable operation of the system;

(11) facilitating the inspection, maintenance of the relevant systems and equipment as well as the replacement of internal parts.

1.5 Risk analysis

1.5.1 For novel design or when desulfurization agent other than those specified in the Guidelines are used, a recognized method for risk analysis/assessment (such as IEC/ISO 31010) is to be used

to analyze and evaluate the safety issues in relation to the design, arrangement, operation of the EGC system and appropriate measures are to be taken to control the identified risks.

1.5.2 Risk analysis is generally to take into account the following possible risks:

- adaptability to the environmental and working conditions;
- impacts on the safe operation of the fuel oil combustion unit;
- accidental accumulation or spread of inflammable, explosive, toxic gases;
- leakage and spread of chemical substances;
- harms to the crew or other equipment due to high temperature, running equipment, etc.;
- potential fire risks.

1.5.3 The risk analysis report is generally to include the following aspects:

(1) standards and methodology for risk analysis;

(2) assumptions and prerequisites of the analysis;

(3) analysis objects, such as the system, equipment, operation, etc.;

(4) potential risks;

(5) causes for the risks;

(6) possible effects of the risks;

(7) measures taken to prevent or reduce the impacts of risks and implementation.

Chapter 2 System design and arrangement

2.1 General requirements

2.1.1 The machinery, electrical equipment and controls system comprising the EGC system are to be designed, type selected, arranged in accordance with the environmental/working conditions specified by PART THREE, FOUR, SEVEN of CCS Rules for Classification of Sea-going Steel Ships respectively.

2.1.2 The materials of the relevant pipings and equipment of the EGC system is to be suitable to the characteristics of the medium coming into contact with them and working conditions. The following principles, in addition to the provisions of CCS Rules for Materials and Welding, are generally to be followed when selecting metallic and non-metallic materials:

(1) carbon steel is the preferable metallic material. Where the surface of the metallic material is likely to come into contact with corrosive medium, corrosion-resistant and abrasion-resistant non-metallic materials are to be used as lining according to the actual conditions of desulfurization process in different parts;

(2) where the metallic material is used as pressure-bearing components, and the non-metallic material is used as corrosion-resistant lining, due consideration is to be given to the bonding strength between the metallic material and the non-metallic material. Also, the design of the pressure-bearing components is to ensure that the non-metallic material can be bonded to the pressure-bearing components for a long time and in a stable manner;

(3) for some parts coming into contact with corrosive medium, where carbon steel lined with non-metallic material cannot reach the engineering application requirements, stainless steel based mainly on nickel is to be used according to the corrosiveness and abrasiveness of the medium. After sufficient justification, corrosion-resistant low alloy steel may be used for some areas. See Table 2.1.2-1 for the applicable medium conditions.

Applicable Medium Conditions for Nickel-Based Stainless Steel Table 2.1.2-1

No.	Material composition	Applicable medium	Remarks
1	Iron-nickel-chromium alloy	Clean flue gas, low-temperature raw flue gas	
2	Iron-nickel-chromium alloy Iron-molybdenum-nickel-chromium alloy	Serous fluid with pH between 3 to 6 and chloride ion concentration≤60000 mg/L	The usage conditions of these two are different and attention is to be paid to the difference during application

(4) For non-metallic materials, glass flake resin, solvent-free resin ceramics, fiber reinforced plastics, plastics, rubber, ceramics are to be used to protect the system against corrosion and abrasion. The parts for which such materials are suitable are given in Table 2.1.2-2. For flue gas with high concentration of fluorine, the corrosion-resistant materials are not to contain glass.

Main Non-metallic Materials and Their Applied Parts Table 2.1.2-2

No.	Material name	Major composition of the material	The applied part
1	glass flake resin	vinyl ester resin, phenolic resin, epoxy resin	inner lining of inner lining of desulfurization slurry tank

2	solvent-free resin ceramics	resin ceramics	inner lining of desulfurization slurry tank
3	plastics	polypropylene, polyethylene, polyurethane, polyvinyl chloride	inner lining of pipes for desulfurization agent, dehumidifier pump impeller, pump body
4	fiber reinforced plastics	glass flake glass fiber vinyl ester resin phenolic resin	scrubber spray layer, pipelines, tanks
5	ceramics	silicon carbide, silicon nitride	desulfurization nozzles, cooling nozzles
6	rubber	chlorobutyl rubber, chlorinated rubber, styrene-butadiene rubber	inner lining of pipelines, tanks, hydroclone vacuum belt conveyor, belt conveyor

Note: The materials of all parts of the EGC unit that may come into contact with exhaust gas are to meets the requirements of 3.1.1, Chapter 3 of these Guidelines.

2.1.3 Spaces where inflammable or toxic vapour may accumulate are to comply with the ventilation requirements of 1.3.4 of PART THREE of CCS Rules.

2.1.4 Appropriate protective measures are to be provided in accordance with 1.3.6, Chapter 1, PART THREE of CCS Rules for Classification of Sea-going Steel Ships to prevent damages to the personnel onboard that might be caused by the operation and maintenance of the EGC system.

2.1.5 The impacts of the EGC system on ship tonnage, power load, stability and loadlines are to be evaluated. During evaluation, the working condition of the EGC system is to be taken into account and detailed information related to calculation and evaluation is to be submitted to the classification society for approval.

2.1.6 When the EGC system without bypass is put into work, thermal shock is not to cause any damage.

2.1.7 Where soot sediment and deposit occur during the operation of the system, appropriate measures are to be taken to clean the sediment and deposit.

2.1.8 The installation and operation of the EGC system are not to lead to the NO_x emission of the diesel engine exceeding the specified value in the EIAPP certificate of the diesel engine or Marine Engine Air Pollution Prevention Certificate.

2.1.9 The structural design and arrangement of the EGC system are to facilitate installation, operation and maintenance.

2.1.10 Where the exhaust gas system is installed with other post-treatment device (such as SCR) in addition to the EGC system, the compatibility of those post-treatment systems is to be considered.

2.2 Compatibility with fuel oil combustion units (FOCUs)

2.2.1 Each EGC system intended to be installed is to be able to accommodate the exhaust gas temperature, back pressure, SOx concentration, exhaust gas volume and other operating parameters of the fuel combustion unit to which it is connected. The relevant working conditions, limits, exhaust gas treatment capacity, etc., are to be specified in the operating manual.

2.2.2 The EGC system is to be compatible with the FOCU connected under all working

conditions and operation modes when the ship is in operation and relevant information is to be submitted to the classification society for review.

2.3 Exhaust backpressure

2.3.1 The exhaust backpressure, after installation of the EGC system, is to remain within the limits stated by FOCU manufacturers under all operating conditions.

2.3.2 Where an induced draught fan is fitted to maintain the required exhaust backpressure, measures are to be taken to ensure that a fan failure is not to prevent the FOCU connected from operating. Where the EGC system is fed from multiple FOCUs, the installation of the fan is to consider the backpressure requirement of all connected FOCUs.

2.3.3 Appropriate measures are to be taken to reduce the risk of fan (if any) not working properly due to corrosion or blockage.

2.4 Bypass or other equivalent measures

2.4.1 The design and arrangement of the EGC system is to ensure continued operation of the FOCUs in the event the EGC system is not in operation, either through operational selection or equipment failure.

2.4.2 A bypass fitted for the purpose of 2.4.1 above is to comply with the following requirements:

(1) The local and remote control positions are provided with a correct indication of the working status of the bypass.

(2) The bypass is to work reliably and ensure the safe operation of the FOCU in any condition.

(3) A safety interlock device is to be provided between the bypass valve and the corresponding EGC unit inlet valve to ensure that the exhaust gas of the FOCU can be emitted smoothly under any circumstances;

(4) Automatically activated according to Table 4.2.3, Chapter 4 of these Guidelines.

2.4.3 Where a bypass is not provided, it is to be ensured that even washwater sprinkling is stopped within the EGC unit, high temperature exhaust gas generated by the FOCU can also be emitted smoothly without causing damages to the EGC system and its components or affecting the continuous safe operation of the FOCU. Under such circumstance, the design of the EGC system is to fully consider risks such as the fire, soot accumulation and carbonization due to direct erosion of the high temperature exhaust gas and appropriate measures are to be taken to control such risks.

2.5 Interconnections of exhaust gas piping

2.5.1 Normally, exhaust pipes from FOCUs are to be routed separately and not interconnected. However, interconnected exhaust piping systems to a common EGC unit may be accepted subject to the agreement of CCS if the designer takes full consideration of the potential risks and makes effective isolation arrangements preventing the exhaust gas from flowing back or leaking to the stopped FOCU(s) or other spaces.

2.5.2 A safety interlock device is to be provided between the starting device and the isolation device for remotely controlled or automatically started FOCU(s) to prevent the isolated FOCU(s) from being started when the isolation device is in the closed condition.

2.5.3 The isolation device is to work reliably and failure of the isolation device under any circumstances is to ensure the safe operation of the FOCU(s).

2.6 Selection, storage and transfer of desulfurization agent

2.6.1 Where MgO is used as the desulfurization agent, the content of MgO is preferable above 85% or complies with the provisions of the manufacturer of the EGC system, and the content of acid insolubles is preferably below 3% (dry basis).

2.6.2 The storage, transfer, preparation system of the desulfurization agent is to be provided with necessary means to control particle pollution.

2.6.3 Where powder desulfurization agent is used, the arrangement of the store handling area is to consider the wind direction.

2.6.4 Necessary measures are to be taken to prevent the desulfurization agent from moisture absorption, deterioration and hardening.

2.6.5 The capacity design of the desulfurization agent tank is to take into account the intended operation route of the ship, the sulphur content of the intended fuel oil, fuel oil consumption rate of the FOCUs, etc.

2.6.6 Where alkali solution is used as the desulfurization agent, the following requirements are to be complied with:

(1) Storage tanks for alkali solution, drip trays or any other components which may come into contact with the alkali solution are to be made of steel or other equivalent material with a melting point above 925℃. The materials used are to be compatible with the alkali solution to be used, or coated with appropriate anti-corrosion coating. When NaOH solution is used as the desulfurization agent,-aluminum, zinc, brass, or galvanized steel are not to be used.

(2) Alkali solution is to be maintained within the temperature range suitable for its concentration during the storage and transfer processes. For this purpose, necessary heating and/or cooling systems are to be equipped depending on the shipping route or operating area to prevent crystallization when the temperature is too low or excessive corrosion when the temperature is too high. If alkali solution storage tanks are equipped with heating and/or cooling systems, high and/or low temperature alarms or temperature monitoring is also be provided accordingly.

(3) The arrangement of the storage tanks is to take into account the impacts of heat transfer from other heated tanks or facilities. When spillage or leakage occurs, the solution will not fall onto combustibles or heated surfaces. In particular, these tanks are not to be located over boilers or in close proximity to steam piping.

(4) Air pipes, overflow pipes and sounding devices are to be provided for storage tanks in accordance with Section 10, Chapter 3, PART THREE of CCS Rules for Classification of Sea-going Steel Ships. The outlets of air pipes and sounding pipes (if provided) are to be led to a safe open location, and be arranged to prevent entrance of water into the alkali solution tanks and necessary measures are to be taken to prevent harms to the personnel. The spilled alkali solution is to be led to appropriate overflow tanks or other tanks.

Where high level alarms are provided instead of overflow pipes, the following requirements are to be complied with:

① the design pressure of the tanks is to take into account the hydrostatic pressure generated by the height from the tank bottom to the air pipe outlet; and

② a suitable alkali drip tray is to be provided below the air pipe outlet.

(5) Each storage tank for alkali solution is to be provided with level monitoring arrangements and high/low level alarms.

(6) Drip trays are to be provided where leakage may be expected to prevent the spilled alkali

solution from falling onto or spreading to other structures or equipment and therefore causing damages.

(7) Drip trays are to be provided with drainage arrangements draining alkali solution in the trays to the overflow tank or other appropriate tanks. The drain line is to be fitted with a non-return valve. Alternatively, drip tray level monitoring devices and quick-closing valves are to be provided, which can cut off alkali solution automatically and quickly when spillage occurs. When this design is adopted, the capacity of the drip tray is to be sufficient to hold possible spillage.

(8) The bunker station(s) is to be located on the open deck away from sources of ignition and arranged such that a spill at a bunker station would not result in alkali contacting or mixing with other incompatible materials. Alternatively, closed or semi-enclosed bunker stations may be accepted subject to the provision of effective ventilation. Drip trays are to be provided according to the requirements of 2.6.6(6)&(7) at bunkering joints or other locations where spillage may occur.

(9) All pipes or penetrations on the storage tank for alkali solution are to be provided with a manual closing valve connected to the storage tank. If the valve is installed on a rigid short pipe welded to the bulkhead, it is to comply with the requirements of 4.2.5.2, Chapter 4, PART THREE of CCS Rules. If such valves mentioned above are provided below the storage tank top, every pipe emanating from a storage tank, which, if damaged, would allow alkali solution to escape from the tank, they are to be arranged with a quick acting shutoff valves. These valves are to be operable from a readily accessible safe location outside the spaces where these tanks are situated in addition to be able to be closed locally.

(10) The storage tank for alkali solution and pump are not to be located in the control station, accommodation and service spaces. If the storage tank for alkali solution and pump are located in enclosed spaces, the area is to be served by an effective mechanical ventilation system of extraction type providing not less than 6 air changes per hour which is independent from the ventilation system of control stations, accommodation and service spaces. The ventilation system is to be capable of being controlled from outside the compartment. A warning notice requiring the use of such ventilation before entering the compartment is to be provided outside the storage space for alkali solution adjacent to each point of entry.

(11) The storage tank for alkali solution may be located in the engine room. In this case, a separate ventilation system is not required when the general ventilation system for the space providing not less than 6 air changes per hour is arranged so as to provide an effective movement of air flow near the storage tank, and is maintained in operation continuously except when the storage tank is empty and has been thoroughly ventilated.

(12) The storage tanks are to have sufficient strength to withstand a pressure corresponding to the maximum height of a fluid column in the overflow pipe, with a minimum of 2.4 m above the top plate taking into consideration the specific density of the alkali solution.

(13) Where alkali solution is stored in integral tanks, the following are to be considered during the design and construction:

① These tanks may be designed and constructed as integral part of the hull, (e.g. double bottom, wing tanks).

② These tanks are to be coated with appropriate anti-corrosion coating and are to be segregated by cofferdams, void spaces, pump rooms, empty tanks or other similar spaces so as to not be located adjacent to accommodation, cargo spaces containing cargoes which react with chemical

treatment fluids in a hazardous manner as well as any food stores, oil tanks and fresh water tanks.

③ These tanks are to be designed and constructed as per the structural requirements applicable to hull and primary support members for a deep tank construction.

④ These tanks are to be included in the ship's stability calculation.

(14) The requirements specified in 2.6.6(10) also apply to closed compartments normally entered by persons:

① when they are adjacent to the integral storage tank for alkali solution and there are possible leak points (e.g. manhole, fittings) from these tanks; or

② when the alkali solution piping systems pass through these compartments, unless the piping system is made of steel or other equivalent material with melting point above 925 degrees C and with fully welded joints.

(15) For the protection of crew members, the ship is to have on board suitable personnel protective equipment, including protective clothing, boots, gloves and tight-fitting goggles. The number of personnel protective equipment carried onboard is to be appropriate for the number of personnel engaged in regular handling operations or that may be exposed in the event of a failure; but in no case is there to be less than two sets available onboard. Protective equipment is to be provided in easily accessible lockers outside the accommodation spaces.

Eyewash and safety showers are to be provided, the location and number of these eyewash stations and safety showers are to be derived from the detailed installation arrangements. As a minimum, the following stations are to be provided:

① In the vicinity of transfer or treatment pump locations. If there are multiple transfer or treatment pump locations on the same deck then one eyewash and safety shower station may be considered for acceptance provided that the station is easily accessible from all such pump locations on the same deck.

② An eyewash station and safety shower is to be provided in the vicinity of a chemical bunkering station on-deck. If the bunkering connections are located on both port and starboard sides, then consideration is to be given to providing two eyewash stations and safety showers, one for each side.

③ An eyewash station and safety shower is to be provided in the vicinity of any part of the system where a spillage/drainage may occur and in the vicinity of system connections/components that require periodic maintenance.

(16) Storage tanks for chemical treatment fluids are to be arranged so that they can be emptied of the fluids and ventilated by means of portable or permanent systems.

2.6.7 Where the slurry is used as desulfurization agent, the requirements of 2.6.6(5), (6), (11), (12) as well as (13)①, ③, ④ are generally to be complied with or applicable requirements of 2.6.6 are to be evaluated and determined following same safety principles according to the characteristics and dangerousness of the slurry.

2.7 Preparation and supply of alkali solution/ slurry

2.7.1 Where desulfurization agent is stored onboard in solid form, necessary alkali solution/ slurry preparation system is to be provided, preparing solid desulfurization agent into alkali solution/ slurry with certain concentration for the EGC system.

2.7.2 The alkali solution/slurry preparation system is to be fitted with metering device. The prepared alkali solution/slurry concentration is to comply with the requirements for the EGC

system and be controlled within the limits allowed by the process. The concentration and consumption volume of alkali solution/slurry are preferably included in the automatic control system.

2.7.3 Where MgO is used as the desulfurization agent, the fineness of the prepared slurry is to ensure 90% filtration rate of 200 mesh, otherwise a pre-treatment system is to be provided.

2.7.4 The preparation capacity of alkali solution/ slurry is to be designed according to 150% of the desulfurization agent consumption in the design condition and storage tanks of sufficient capacity are to be provided. The capacity of the storage tanks is not to be less than 2h alkali solution/ slurry consumption of the desulfurization system in the design condition.

2.7.5 Appropriate means are to be taken to prevent damages due to heat release during the preparation of alkali solution/ slurry.

2.7.6 The storage tanks for slurry are to be provided with anti-sediment means, such as installation of additional paddle mixer, pneumatic/hydraulic mixing equipment, etc.

2.7.7 The preparation and supply piping systems for alkali solution are also to comply with the following requirements:

(1) piping systems are to be made of steel or other equivalent material with a melting point above 925℃. The materials used are to be compatible with the alkali solution to be used, or coated with appropriate anti-corrosion coating. When NaOH solution is used as the desulfurization agent,- aluminum, zinc, brass, or galvanized steel are not to be used.

(2) Regardless of design pressure and temperature, piping systems containing alkali solution only are to comply with the requirements applicable to Class I piping systems.

(3) The capacity of the supply pump for alkali solution is to satisfy the needs of the EGC system in the design condition.

(4) The supply of alkali solution is to be controlled automatically to ensure that the desulfurization efficiency of the system satisfies the design requirements continuously.

(5) The alkali solution piping system is to be independent of other piping systems onboard and is not to be fitted in or through the accommodation, service spaces and control stations.

(6) The alkali solution piping system is not to be arranged over boilers or in close proximity to steam piping, exhaust systems, hot surfaces required to be insulated, or other sources of ignition.

(7) The joints of the alkali solution pipe lines are to be kept to a minimum. The piping systems are to be joined by welding except for necessary flanged connections to valves and other equipment for maintenance in order to minimize risk of leakage from the pipe lines.

(8) The following connections are to be screened and fitted with drip trays to prevent the spilled alkali solution from falling onto or spreading to other structures or equipment and therefore causing damages:

① Detachable connections between pipes (flanged connections and mechanical joints, etc.);

② Detachable connections between pipes and equipment such as pumps, strainers, heaters, valves; and

③ Detachable connections between equipment mentioned in ② above.

The installed drip tray is to comply with the requirements of 2.6.6(7) of these Guidelines.

(9) Valves and fittings selected for the piping system are to be suitable to the characteristics of the working medium.

(10) The alkali solution pipe lines are to be fitted with suitable means of filtering, the arrangement of which is to ensure that when the filter is being washed, alkali solution can still be

provided uninterruptedly.

(11) The alkali solution piping system is to be provided with draining and flushing facilities which drainage and flushing can be carried out when the EGC system stops operation.

2.7.8 The piping system for slurry is to comply with the requirements of 2.7.7(3), (4), (5), (9), (10), (11) or applicable requirements of 2.7.7 are to be evaluated and determined following same safety principles according to the characteristics and dangerousness of the slurry.

2.8 Washwater system

2.8.1 Pipelines and fittings of the washwater system are to take into account the characteristics of the contact medium, such as temperature and pH value for selection of suitable materials. Where plastic pipes are used, the requirements of 2.4.3, Chapter 2, PART THREE of CCS Rules for Classification of Sea-going Steel Ships are to be complied with.

2.8.2 The inlets of the supply pumps are to be provided with filtration devices.

2.8.3 A washwater supply monitoring alarm is to be provided to give alarm when the washwater supply pressure is detected to be low and safe protection is activated as per Table 4.2.3 of the Guidelines.

2.8.4 Necessary cooling system is to be provided depending on the needs for exhaust gas treatment in the EGC unit to ensure that the temperature of the washwater entering the EGC unit is always maintained within the design limits.

2.8.5 The washwater overboard discharge system is not to be interconnected to other systems. The discharge pipelines and fittings are to take into account the corrosion-resistant means. Where dissimilar metals are used, consideration is to be given to galvanic corrosion.

2.8.6 It is to be ensured that the overboard discharges are always below the overboard water level in normal draught and effective measures are to be taken to prevent backflow of the overboard water.

2.8.7 The washwater overboard discharges are to be away from the sea suctions in so far as practicable and to take into account the vessel propulsion features to prevent corrosion to the propellers, thrusters or shell platings when discharging washwater overboard. Discharges are to be arranged to enable safe sampling of washwater.

2.9 Residue system

2.9.1 The EGCS residues generated from the exhaust gas cleaning process are to be stored in a designated EGCS residue tank, which is to be separate from other tanks in addition to the provisions of 2.9.3 of this Chapter .

2.9.2 The material of the EGCS residue tank is to be selected based on the corrosive nature of the EGCS residue.

2.9.3 The EGCS residue tank is to be designed to facilitate cleaning. Where EGCS residue tanks are also used as the overflow tank for the desulfurization agent storage tank, the additional requirements for the storage tank are to be applied.

2.9.4 The capacity of the EGCS residue tank is to be based on the expected residue volumes applicable to the number and type of installed SO_x scrubbers and the maximum period of voyage between ports where EGCS residue can be discharged. In the absence of precise data, a figure of 30 days is to be used.

2.9.5 The EGCS residue tank is to be provided with air pipes and sounding devices in

accordance with Section 10, Chapter 3, PART THREE of CCS Rules for Classification of Sea-going Steel Ships. The outlets of air pipes and sounding pipes, if fitted, are to be lead to safe open locations.

2.9.6 The EGCS residue tank is to be provided with a high level alarm.

2.10 Exhaust system

2.10.1 The exhaust system is to comply with the requirements of the Guidelines and the materials, design, manufacturing, installation and arrangement of the system are also to comply with the relevant requirements of Chapters 1, 2, 4, 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

2.10.2 See 2.4 and 2.5 of the Guidelines for the requirements related to exhaust gas bypass and isolation.

2.10.3 The EGC unit and its fittings installed in the exhaust system are to comply with the requirements of 3.1 of the Guidelines.

2.10.4 The exhaust gas pipes at the inlets of the EGC unit are to take full account of the corrosion likely to be caused by changes in temperature and humidity.

2.10.5 Necessary corrosion prevention measures are to be taken for exhaust pipes and components downstream of the EGC unit and means of drainage are to be provided if condensated water is likely to accumulate in the exhaust gas pipes.

2.11 Seawater/fresh water system

2.11.1 The seawater and/or fresh water system serving the EGC system is to comply with the relevant requirements of Chapters 1, 2, 3, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

2.11.2 Where the seawater/fresh water system of the EGC system is interconnected with other systems onboard, reliable means preventing backflow of water are to be provided.

2.11.3 The capacity of the seawater/fresh water pump is to be sufficient to provide the EGC system with the required seawater/fresh water at the system’s maximum working load without affecting normal operation of other essential auxiliary systems.

2.11.4 For an EGC system that is capable of operating in open-loop mode, the risk of large amount of seawater ingress in the space where the EGC unit is located and the machinery space where the washwater pipes of the EGC unit pass through (when below the waterline) is to be considered, and appropriate measures are to be taken to control the risk.

Chapter 3 Machinery equipment

3.1 EGC units

3.1.1 The EGC unit is to be considered as an integral part of the exhaust system of the fuel oil combustion unit. All parts of the EGC unit that may come into contact with the exhaust gas is to be able to adapt to the possible high exhaust gas temperature unless there is a bypass device and effective measures to prevent overheating of the internal components of the EGC unit to ensure material temperature tolerances may not be exceeded at any time during operation, shutdown and after shutdown.

3.1.2 The EGC unit and its fittings which come into contact with washwater, are to be made of corrosion-resistant stainless steel or other corrosion-resistant materials to be capable of withstanding acid and alkali corrosion and temperature changes of the medium with which the EGC unit and its fittings are likely to come into contact.

3.1.3 The body, supporting members, etc. of the EGC unit are to be able to withstand possible loads that might be encountered in the design conditions of the ship, including dynamic loads due to wave-induced motions.

3.1.4 The design of EGC unit and its internal structure is to take into account resistance against abrasion, corrosion and erosion.

3.1.5 Reliable drainage arrangements are to be provided so that when the EGC system operating in close loop mode is not working or emergency requires, the washwater in the system can be drained to the designated tank immediately.

3.1.6 The EGC unit is to be airtight, preventing exhaust gas and/or washwater from leaking into spaces.

3.1.7 The design of flue inlets of the EGC unit is to take into account the backflow of the exhaust gas and deposition of particles.

3.1.8 Where the EGC unit is designed with working liquid level, means are to be taken to ensure the washwater level in the EGC unit is maintained within the limits. Level indications and monitoring devices are to be provided to give alarm when the level exceeds the limits.

3.1.9 The EGC unit is to be provided with means to prevent the backflow of the washwater to the fuel oil combustion unit.

3.1.10 Necessary manholes/inspection holes, passages and platforms are to be provided to facilitate repair, inspection, maintenance and cleaning of the EGC unit.

3.1.11 The design and arrangement of the spray system are to take into account the risks of deposit, clogging, abrasion and suitable flushing installation is to be provided.

3.1.12 Necessary dehumidifiers are to be provided to prevent the desulfurized exhaust gas with droplets.

3.2 Pressure vessels

3.3.1 Pressure vessels used in the EGC system are to be designed, manufactured, installed and tested in accordance with Chapter 6, PART THREE of CCS Rules for Classification of Sea-going Steel Ships.

3.3 Bypass and isolation devices

3.3.1 Exhaust gas bypass and isolation devices are to comply with the requirements of 2.4 and 2.5, Chapter 2 of the Guidelines.

3.4 Washwater treatment units

3.4.1 The washwater treatment units and their components are to be provided with suitable pressure release devices to prevent possible overpressure.

3.4.2 The installation and arrangement of the filters are to ensure continuous operation of the EGC system during cleaning and replacement.

3.4.3 Residues generated after the treatment of the washwater are to be stored and disposed of according to 2.9 of the Guidelines.

Chapter 4 Control, monitoring and safety protection

4.1 General requirements

4.1.1 The control, monitoring and safety systems of the EGC system are to comply with the provisions of Chapters 1 and 2, PART SEVEN of CCS Rules in addition to satisfying the requirements of this Chapter.

4.1.2 The EGC systems are to be configured in accordance with the requirements of CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning systems in addition to be provided with monitoring, alarm and safety protection in accordance with 4.2 of this Chapter.

4.2 Control, monitoring and safety systems

4.2.1 The EGC system is to be provided with automatic control, monitoring, alarm and safety functions and be provided with means for manual operation to ensure the working parameters of the EGC system and connected fuel oil combustion units are maintained within the specified limits.

4.2.2 The control system for the EGC system may be connected to an integrated control system of the vessel or may be a standalone system. The system is to be designed such that a single fault of a component will not lead to a potentially dangerous situation for human safety and/or the vessel. A risk analysis is to be carried out when the control system of the EGC system is connected to the integrated control system of the vessel and the risk analysis report is to be submitted to CCS for information.

For vessels with periodically unmanned machinery space, the alarm and monitoring systems of the EGCS can be integrated in the vessel's centralized monitoring systems

4.2.3 The monitoring and safety protection items of the EGC system are to be determined according to the results of the risk analysis. In general, monitoring, alarm and indication can be set up according to the requirements of Table 4.2.3. The control station of the EGC system is to be provided with relevant alarms and indications. All alarms of the EGC system are to be extended in the form of single alarms or combination alarms to continuously manned positions.

4.2.4 Emergency shutdown devices are to be provided in the local control station and central control room (if any) to stop the operation of the system and open the exhaust gas bypass (if fitted). The shutdown of the EGC system is not to affect the reliable operation of the FOCUs.

4.2.5 Where the remote control system (if any) fails, or in emergency, the EGC system is to be capable of being controlled and monitored locally. Important parameters required for the safe operation of the system as well as the working condition of the equipment are to be indicated in the local control station.

4.2.6 A safety shutdown system is to be provided complying with the following requirements:

(1) Upon activation of the safety shutdown system, visual and audible alarms are to be indicated at both the remote control position and at the local control position. Means are to be provided to indicate the parameters causing shutdown. In the event where shutdown by the safety shutdown system is activated, the restart should not occur automatically, unless after the system is manually reset.

(2) Safety shutdown is to be automatically activated for the conditions in Table 4.2.3.

Monitoring, alarm and safety protection Table 4.2.3

Monitored Parameters	Display	Alarm Activated	Automatic Shutdown and Bypass①
Exhaust gas booster fan, where provided	Running	Stop②	-
Exhaust gas bypass or isolation, where provided	Position		-
Control-actuating medium of the exhaust gas bypass or isolation valves	Running	Failed	-
Exhaust gas temperature before EGC unit	X	High	-
Exhaust gas temperature after EGC unit	X	High	X (High-High)
Differential pressure of exhaust gas across EGC unit③	X	High	X (High-High)
Washwater pumps and/or alkali solution/serous fluid pumps	Running	Stop②	-
Washwater and alkali solution/serous fluid supply pressure	X	Low②	X (Low-Low)
Washwater and alkali solution/serous fluid supply temperature	X	High	-
Water level in EGC unit, if applicable	X	High	X (High-High)
Alkali storage tank temperature	X	Low/High	-
Alkali storage tank level	X	Low/High	-
Alkali system drip tray level, if applicable	X	High④	-
Residue tank level	X	High	-
Control, alarm and safety system power supply	Running	Failed	-
Emergency shutdown	X	X	X

Notes:

× ——Applicable; -——Not applicable.

① If the EGC unit is not suitable for working in the dry condition, the exhaust gas is to be automatically bypassed after shutdown.

② Standby fans or pumps are to be activated, where fitted. Otherwise automatic shutdown is to be activated and exhaust gas is to be bypassed.

③ Alarm is to be given before the backpressure exceeds the allowed maximum value of the FOCU.

④ Alarm is to be given after alkali leakage is detected and the supply of alkali is to be cut off automatically as required by 2.6.6(7).

Chapter 5 Operation manual

5.1 General requirements

5.1.1 The ship is to carry the EGC system operation manual onboard specifying procedures and plans for system operation, inspection, maintenance, safety, etc.

5.1.2 The manual is generally to include the following aspects:

(1) procedures and plans related to the operation, inspection, maintenance of the EGC system;

(2) procedures and plans related to routine testing and maintenance of the monitoring and safety system;

(3) special notes related to the bunkering, storage and usage of the chemical substances intended for the EGC system;

(4) working conditions and limitations related to the operation of the EGC system;

(5) emergency procedures.

5.2 Emergency procedures

5.2.1 Emergency procedures corresponding to the failures likely to occur during operation of the EGC system are to be developed, such as operation procedures and responsible person in case of emergency shutdown, exhaust bypass and isolation, washwater/alkali leakage, so as to reduce the impact on the safety operation of the ship and related FOCUs in so far as practicable.

Chapter 6 Survey and certification

6.1 Plans and documents

6.1.1 The following plans and documents related to the EGC system are to be submitted to CCS for approval:

(1) product technical specifications, mainly including but not limited to:

① design treatment capability, such as the maximum mass flow rate of exhaust gas and washwater that can be treated by the EGC system;

② working conditions and limitations, such as applicable maximum fuel oil sulphur content, inlet exhaust gas temperature and pressure of the EGC unit , outlet exhaust gas temperature of the EGC unit, pressure loss when the exhaust gas passing through the EGC unit, applicable seawater alkalinity and temperature;

③ main indicators, such as consumption rate of desulphurization agents, fresh water/sea water consumption rate, SO_2 (ppm)/CO_2 (%v/v) ratios in the treated exhaust gas, discharge indicators for discharge water, etc.

(2) the general EGC system plan;

(3) structural diagrams and details of the EGC unit, including arrangements such as the connection structure, openings, nozzles, fillers, dehumidifying structure;

(4) working principles and diagram of the EGC system showing the process flow as well as the instructions;

(5) material details of main components and parts (including corrosion analysis of the contact medium to the materials used);

(6) detailed information on the added chemical substances, including their corrosion, toxicity, flammability, chemical reaction, etc. as well as the relevant limitation conditions for their storage, transfer, disposal and usage;

(7) diagrams of the control, monitoring and safe protection systems, including basic control strategy, setup, monitoring locations for exhaust gas and washwater, etc.;

(8) type test program (when applying for type approval);

(9) other plans and documents deemed necessary by CCS.

6.1.2 The following plans and documents related to the EGC system are to be submitted to CCS for information:

(1) risk analysis report (according to provisions of 1.5 of Chapter 1 and 4.2 of Chapter 4);

(2) operation manual (according to provisions of Chapter 5)

(3) calculation (such as the calculation for the treatment capacity of the EGC system);

(4) list, model and technical specification of main spare parts, if any;

(5) name plate.

6.1.3 For ships intended to be installed with the EGC system, the following plans and documents related to the installation of the EGC system onboard are to be submitted to CCS for approval:

(1) diagram of the installation foundation of the EGC unit and diagrams related to ship structural connection;

(2) documentation detailing the effect on loadline and stability of EGC system;

(3) diagram of the main piping systems;

(4) diagram of the electrical systems;

(5) list of alarm and indication points;
(6) EGC system emergency shut-down device;
(7) on-board test program;
(8) other plans and documents deemed necessary by CCS.

6.1.4 For ships intended to be installed with the EGC system, the following plans and documents related to the installation of the EGC system onboard are to be submitted to CCS for information:

(1) arrangement plan, including arrangement and information of bunkering stations, relevant systems and equipment, storage tanks;

(2) capacity calculation of the storage tank for desulfurization agents;

(5) capacity calculation of tanks for EGCS residue;

(4) detailed information demonstrating compatibility of the EGC system with the fuel oil combustion units onboard (according to the provisions of 2.2 of Chapter 2).

6.1.5 The requirements on plans and documents in CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems are also to be complied with according to the provision of 1.1.6, Chapter 1 of the Guidelines in addition to the requirements above.

6.2 Survey

6.2.1 In addition to the relevant statutory survey specified in 1.1.6 of the Guidelines, the EGC system is generally to include the following classification survey: product inspection, initial survey and survey after construction.

6.2.2 Product inspection: the EGC system and its components are to be inspected and certified according to Chapter 3, PART ONE of CCS Rules.

(1) EGCS for scheme A is to be type-approved by CCS. The requirements for plan approval and test verification are as follows:

① Plans and documents are to be submitted to CCS for approval or information as per 6.1.1 and 6.1.2 of this Chapter;

② The relevant systems and equipment are verified through the test to show that they function normally and operate stably, and the main working parameters are controlled within the design range. The test is to consider the fuel oil intended for use, operating mode and operating condition. The test requirements are as follows:

a The operation test of the EGC system is to be carried out in the applicable operating mode, and at least 4 load points are to be selected for the operation test. One load point is to be at 95% to 100% of the exhaust gas mass flow rate for which the EGC system is to be certified. One load point is to be within ± 5% of the minimum exhaust gas mass flow rate for which the EGC system is to be certified. The other two load points are to be equally spaced between the maximum and minimum exhaust gas mass flow rates. The test time for each load point depends on the time when the system reaches the stable state and the time required for the collection of operation parameters, generally not less than 0.5h, but it is to be ensured that the surveyor has enough time for inspection. The operation test of the EGC system can be carried out in conjunction with the emission test specified in 3.4,Chapter 3 of CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems;

b Switch over tests between operating modes are carried out under different load points (if applicable);

c The response of all mechanical, hydraulic and electronic systems involved in the operation of the

EGC system is verified to be as predicted for all intended operating modes through the integration tests, and the test scope can be determined according to the results of the risk analysis;

d After the test is completed, the EGC unit is to be dismantled to check the scaling, fouling and corrosion of the internal structure, including the washwater nozzle, heat exchanger (if any), dehumidifiers, etc.

(2) Inspection requirement for EGCS under scheme B:

① Plans and documents are to be submitted to CCS for approval or information as per 6.1.1 and 6.1.2 of this Chapter;

② All electric and electronic products used by EGCS are to be subject to the environmental condition test required by CCS Guidelines for Type Approval Test of Electric and Electronic Products.

6.2.3 Initial survey: after the EGC system is installed onboard but before it is put into use, initial survey is to be carried out to confirm that each system certificate and related documents are complete, that the system is installed according to the approved plans and documents, and verify that the performance of the system during operation complies with the requirements according to the on-board test procedures, mainly including:

(1) Certificate check, including:

① According to chapter 3, part one in CCS Rules, the certificate of EGCS and its major parts (if not integral assembly) needs to be checked, and special attention is to be paid to whether the models and specifications of the main parts of system meet the requirements of the EGCS marine product certificates.

② According to the requirement of chapter 3, part one of CCS Rules, the product certificates of pipe materials, valves and ship cables need to be checked.

③ For approved EGCS under scheme A, SOx Emission Compliance Certificate (SECC) needs to be checked.

④ For approved EGCS under scheme B, Approval Certificate for Exhaust Gas Emission Monitoring System needs to be checked.

⑤Vessels of EU flags are to comply with the requirements of MED certification.

(2) Check of onboard documents, information and records, including:

① SOx Emissions Compliance Plan (SECP);

② EGCS -Technical Manual for Scheme A (ETM-A), or EGCS -Technical Manual for Scheme B (ETM-B);

③ Onboard Monitoring Manual (OMM);

④ EGCS Record Book or Electronic Logging System;

⑤ EGCS Operation Manual (classification requirement);

⑥ Detailed information of chemical substances added.

(3) Installation inspection and test, including:

① Inspecting the arrangement and installation of exhaust system, and when applicable, including exhaust gas bypass devices and its indicating devices, exhaust converging apparatus, exhaust gas isolation devices as well as the starting interlock arrangement with fuel oil combustion unit, soot blower, etc.

② Inspecting the support and strengthening of funnel structure, and the closing device of the ventilation opening. The enclosed space of EGC Unit is other machinery, when applicable, attention is to be paid to examine for the integrity of fire division.

③ EGC unit arrangement and installation inspection.
④ Inspecting the installation and arrangement of sea valve, overboard valve and shipside distance pieces.
⑤ Inspecting the arrangement, isolation, installation, welding and structural test of desulfurization storage tank, alkali solution/slurry solution supply tank, circulation tank and wash water drain tank.
⑥ Inspecting the arrangement and installation of all piping systems, pumps, valves or fitting, as well as the hydraulic test and tightness test of piping system. Special attention is to be paid to preventive measures for potential damage or harm to personnel, onboard equipment or structure while operating EGCS as well as the requirements for anti-overflow measures, anti-corrosion technology, prevention of heat conduction and temperature control demonstrated in the Guidelines .
⑦ Considering of good anti-corrosion characteristic of fiber glass, fiber glass pipes (GRE/GRP Pipe) are always used in EGC wash water pipeline, therefore special attention is to be paid to the inspection:
a. The application range of fiber glass pipe and arrangement of isolation valve, to minimize the penetration of current structures.
b. Arrangement of thermal expansion compensation in fiber glass pipeline system, including base and pipeline connection, in order to eliminate the risk of malfunction, and the pipeline should keep away from the source of heat.
c. Regarding the usage of plastic pipe, please refer to the requirement from Production and application of plastic pipe on ship in Appendix 1, Chapter 2, PART THREE of CCS Rules as well as satisfy the certificate requirements for classed marine products in Appendix 1A, Chapter 3, PART ONE of CCS Rules.
⑧ Inspecting the personnel protective equipment, eyewash and safety shower station, and safety operation notices.
(4) Dock trials
① Effectiveness test on pumps, blowers (if any), coolers, separator (if any).
② Test for drainage valve and safety valve.
③ Effectiveness test on gas analysis monitoring device, exhaust gas monitoring device (if any) and discharge water monitoring device.
④ Effectiveness test on control, monitoring and alarm, safety system, in accordance with the approved control/monitor and safety system plan, alarm and display checklist and test program, detail refers to Chapter 4 of the Guidelines.
(5) Onboard testing and survey
① After the installation of the EGC system onboard, an integration test is to be carried out to confirm that the relevant systems and equipment function normally and operate stably, and that the main working parameters are controlled within the design range. The test is to consider various operating modes and operating conditions;
② The test items are to be determined according to the results of risk analysis, and the control, alarm and safety protection related to the system operation are to be verified;
③ The EGC system is also to be tested and inspected on board in accordance with the CCS Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems to verify that the EGC system installed meets the requirements of the Technical Manuals (ETM-A/ETM-B) and the

Onboard Monitoring Manual (OMM).

④ There are situations of one to one or one to more for EGCS connection with onboard fuel oil combustion unit (such as main, auxiliary engine and fuel oil boiler utilize a common EGC unit), therefore the EGCS's actual configuration is to be taken into account during the onboard test.

⑤ For the EGCS under scheme B, in order to demonstrate performance of EGCS, emission measurements are to be undertaken at a minimum of four load points. One load point is to be at 95% to 100% of the maximum exhaust gas mass flow rate of the certified EGC system (If there are difficulties to reach this load point during onboard test, the maximum exhaust gas mass flow rate that can be achieved by simultaneous operation of the connected fuel oil combustion units is to be selected as far as possible). One load point is to be within ± 5% of the minimum exhaust gas mass flow rate for which the unit is to be certified. The other two load points are to be equally spaced between the maximum and minimum exhaust gas mass flow rates. Emission tests are to be carried out in applicable operating mode and switch over between operating modes are to be carried out under different load conditions. The test time for each load point shall be half an hour after working condition stabilized.

For the EGCS under scheme A, the operation test of the EGC system can be carried out in conjunction with the onboard test of the relevant fuel oil combustion units onboard.

⑥ For the EGCS under scheme B, fuel oil with the maximum sulphur content specified in the technical manual is to be used in the emission performance test to confirm the reliable and effective operation of the relevant systems and equipment. If the maximum sulphur content fuel oil declared by the manufacturer is not available at the time of the test, it is permitted to use the maximum sulphur content fuel oil available for the onboard test, provided that relevant materials are submitted to demonstrate that, even the declared maximum sulphur content fuel oil is used, the EGCS related systems and equipment can operate stably as intended by the design;

⑦ During the test, the backpressure of the fuel oil combustion units connected to the EGC system (e.g. diesel engine, fuel oil boiler) is to be checked and conformed to the requirements from the manufacturer. If the back pressure exceeds the range specified by the fuel oil combustion unit manufacturer, the parties concerned are to negotiate with the fuel oil combustion unit manufacturer to determine the solution to ensure the stable operation of the fuel oil combustion unit. If applicable, confirm that the diesel engine operation parameters do not exceed the specified value in NOx technical file; otherwise it may be required to inform the diesel engine manufacturer and request to amend the NOx technical file of the diesel engine.

⑧ During the test, attention is to be paid to check the function of the discharge water monitoring system of EGC system;

⑨ The discharge capacity of sea water pump/ fresh water pump/ desulphurization supply pump is to be checked and confirmed to meet maximum load operation need of EGCS and make sure of the normal operating under automatic adjustment. Other important auxiliary systems onboard are not to be affected by the operation of the relevant systems of EGCS.

⑩ Temperature of EGCS hot surface is to be checked in order to confirm the effectiveness and completeness of insulation cover.

⑪ Check to confirm all the other tests required by EGCS marine product certificate have been completed.

⑫ Details of check and record requirement for EGCS operation parameters can be referred to Appendix 2 of the Guidelines.

6.2.4 Survey after construction: The EGC system is to be subject to special survey, intermediate survey, annual survey and additional survey in conjunction with the International Air Pollution Prevention Certificate and the classification certificate. Relevant survey requirements are as follows:

(1) Annual survey, including:

① Checking the onboard documents, information and records according to the requirements of 6.2.3(2);

② Conducting visual inspection of exhaust system, to confirm that no aging or leakage existed. And confirm that the bypass device (if applicable), exhaust converging apparatus, isolation device (and/or gas seal blower), starting interlock between isolation device and fuel oil combustion unit etc. are in normal working condition;

③ Confirming that the protective shield or isolation device, operation personnel protective equipment, eye drop, eye wash and safety notice are in normal condition;

④ Conducting visual inspection of desulphurization agent storage tank, alkali solution/slurry solution supply tank, circulation tank, wash water drainage tank and EGCS residues tank, to confirm that no obvious aging or leakage existed. Check that the integrity, ventilation and passage of the space that tank locating are in normal condition;

⑤ Conducting visual inspection for the EGC unit and its foundation and fitting, to confirm that no aging or leaking condition;

⑥ Conducting visual inspection for all piping system, valve and its fitting, heat insulation and isolation materials. Particular attention is to be paid to relevant preventive measures for potential damage or harmful to personnel, onboard equipment or structure while operating EGCS as well as the requirements for anti-overflow measures, anti-corrosion technology, prevention of heat conduction and temperature control demonstrated in the Guidelines;

⑦ Considering the effect of corrosion, wash water discharge overboard valve and distance pieces is to be inspected; if surveyors deem necessary, thickness measurement is to be conducted, and if any obvious corrosion is found, relevant parts is to be replaced or repaired..

⑧ Confirming that the service pump, cooler, blower (if applicable), water treatment equipment (if applicable) and other machinery equipment for EGCS are maintained and are under normal working condition;

⑨ Confirming that electric appliances related to EGCS are maintained and under normal working condition;

⑩ Confirming that the remote control and automatic control valve related to EGCS is under normal working condition;

⑪ As far as possible, conducting general effectiveness test for EGCS monitoring, alarm and safety system, to confirm that they are under normal working condition;

⑫ As far as possible, conducting inspection for EGCS under working condition, and confirm that the system is under normal working condition;

⑬ Conducting visual inspection to gas analysis monitoring device, SOx monitoring device (if applicable), wash water monitoring device, and the related sampling probe, sample pretreatment device, analysis unit, pneumatic valve system and meters, to confirm all in good operating condition;

⑭ In accordance with the requirements of Onboard Monitoring Manual(OMM)/ EGCS Operation Manual, inspecting the gas analysis monitoring device or SOx monitoring device (if applicable) by

compressed pure gas or calibrated gas, to confirm its normal function of monitoring and data transmitting;

⑮ In accordance with the requirements of Onboard Monitoring Manual(OMM)/ EGCS Operation Manual, inspecting the wash water monitoring device, confirming its normal function of monitoring and data transmitting.

(2) Intermediate survey: Apart from the applicable requirements of annual survey in (1) above, intermediate survey requires focus inspection on wash water discharge overboard valve and distance pieces, which may be carried out in conjunction with survey of the outside of the ship's bottom.

(3) Special survey: In addition to the requirements applicable to annual survey and intermediate survey, the following items will be inspected in special survey:

① EGC unit, wash water pump, wash water disposal pump, desulfurizer supply pump, cooler, fan (if needed) and water treatment equipment (if needed) are to be inspected or tested. They are to be opened for inspection if necessary.

② Internal inspections of desulfurizer storage tanks, alkali solution/slurry solution supply tanks, circulation tanks, wash water drainage tanks and EGC residue tank.

③ Conducting thickness measurement of distance pieces connecting discharge overboard valves of wash water to shell plating. If there is notable corrosion, it is to be repaired or renewed.

④ Conducting the inspection and necessary thickness measurement of shell plating in an enough range (at least 4m) near the wash water discharge port. If the corrosion exceeds the allowable limit, it is to be repaired or renewed.

⑤ By-bass valves of exhaust pipe (if any), manifold valves of exhaust pipe, isolation valves, emergency shut-off valves and control valves are to be inspected or tested. They need to be randomly opened for inspection and adjustments, if necessary.

⑥ All piping systems, valves and accessories are to be inspected and tested. Pressure relief valves are to be subject to functional test. They are to be randomly opened for inspection and/or adjustments, if necessary. If surveyors deem necessary, they can request that hydraulic tests are to be carried out.

⑦ All machinery, hydraulic or pneumatic actuator and their power systems of EGCS need to be inspected and tested, if surveyors deem this as necessary.

⑧ Electrical equipment and its cables and supports of EGCS are to be inspected. The insulation resistance of its electrical systems and circuits is to be measured. However, if there is a proper measurement record, recent measurement data can be adopted.

⑨ Motors of EGCS and its auxiliary control and operation mechanism are to be inspected. Running test should be carried out in working condition, if necessary.

⑩ Functional test on EGCS's automatic control system (including pumps, fans and automatic switch of electricity supply), monitoring, alarm and safety systems and their instrumentation is to be carried out, in order to confirm the proper functioning of them, and confirming the manual control function of EGCS and its equipment.

Appendix 1: Summary of additional requirements of IMO, some flag state administrations and port state authorities on the 2020 Sulphur Cap

Notes:

(1) This Table lists regulatory requirements for SOx emission, such as fuel oil sulphur content limit, implementation date and area, usage and limitation of the EGC system, for easy reference of the users.

(2) Below requirements may change with the new requirements of the competent authority, ship owners and the relevant parties shall keep track of the latest information to ensure the ship's SOx emission control in line with the latest requirements of the competent authority.

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
1	IMO	Global	0.50	2020.01.01	Outside of the SOx ECA	1. Develop an implementation plan for the consistent implementation of the 0.50% m/m	Requirements of MEPC.340 (77)	1.MEPC.320 (74) & MSC. 465(101) 2.MEPC.321(74) 3.MEPC.1/Circ.864/rev.1&MEPC.1/Circ.882 4.MEPC.1/Circ.881 5.MEPC.1/Circ.878&MEPC.1/Circ.883 Rev.1 6. MEPC.340(77)

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						Sulphur Cap effective on January 1, 2020. 2. Port State Control under MARPOL ANNEXVI. 3. Sampling on board and verification of Sulphur content of fuel oil. 4. Emergency		

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						handling non-compliant fuels. 5. Procedures to the use of Fuel non-availability 6. Response measures to any mechanical or equipment failure (such as EGCS Malfunction)		
			0.10	2015.01.01	Within the SOx ECA			MARPOL Annex V
Asian area								

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
2	AE	UAE	Same as IMO requirements	Same as IMO requirements	UAE waters	1. IMO requirements 2. Requirements for the report of fuel oil non-availability 3. Requirements for the sampling of fuel oil	---	UAE Circular No.(11) 2019
		UAE-Abu Dhabi	Same as IMO requirements	Same as IMO requirements	Ports area	Same as above	1. Wash water discharge is permitted with restrictions. 2. Discharges must not contain any pollutants. Waste should be collected	1.ABDP Circular No. 08-2018 2.ABDP Vessel 1.2 Discharge Guidelines (Version 2.0)

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							and discharged to an Abu Dhabi Ports' licensed waste contractor.	
		UAE-Fujairah	Same as IMO requirements	Same as IMO requirements	Ports area* Fujairah Offshore Anchorage Area(FOAA)	Same as above	1.Wash water discharge is prohibited. 2. Discharge from Open-loop EGC systems is prohibited	1.NTM-148 2.FOAA
		UAE- Ports and Maritime areas falling under PCFC Trakhees	Same as IMO requirements	Same as IMO requirements	Ports and Maritime areas*	Same as above	1. Discharge of washwater is prohibited. 2. Closed loop EGCS residues discharge is prohibited. 3. Enforcement action against violating ships including financial penalties	Circular CED-PM-05-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
		Jurisdiction					4. Discharge from Open-loop EGC systems is prohibited(Port of Dubai)	
3	BH	Kingdom of Bahrain	Same as IMO requirements	Same as IMO requirements	The port of Bahrain, including anchorage*	Same as IMO requirements	1. Discharge of wash water is prohibited. 2. Discharge of wash water from open EGCS into Bahrain waters and exclusive economic zone (EEZ) are not allowed unless the discharges can be proved to comply with IMO 2015 guidelines for exhausted gas cleaning systems (MEPC.259 (68)) and have no negative impact on Marine ecosystems.	BH MN PMA-03-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							3. The PMA strongly encourages the use of closed EGCS (no overboard discharge) when vessels are sailing in Bahrain waters. 4. EGCS washing water residue discharge, treatment and recording requirements.	
4	CHN	China	0.50	2019.01.01	China ECA (River-sea ships, fulfilled the requirement of sulphur content of fuel oil ≤0.5%)	1. IMO requirements 2. Disposal requirement for non compliant fuel oil carried for use on board. 2.1 Report of non-compliant fuel oil used or carried	1. It is required to provide product certificate when using EGCS onboard. 2. The use detail of EGCS shall be recorded. 3. Open-loop EGCS wash water discharge is prohibited in the ECA of China. 4. EGCS washing water	1.China MSA notice No.20 2.Jiaohaifa (2018)No.168 3.Haiweifang (2019) No.449

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						for use on board. 2.2 Disposal Requirements of non-compliant fuel oil remaining on board, or 2.3 A commitment letter of not using non-compliant fuel oil. 3. Inspections on compliance under Sulphur Cap.	residue discharge, treatment and recording requirements.	
			0.10	2020.01.01	Emission Control area of inland river; inland ship; using fuel oils in accordance with the	---	Same as above	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
					requirements of the newly revised national standard for marine fuel oil from Jan.1, 2019			
		China	0.10	2022.01.01	Coastal control areas (Hainan waters)	---	Same as above	Same as above
			0.10	2025.01.01	Coastal control areas (Except Hainan waters)			
		HK, China	0.50	2019.01.01	Berth waters or ports under the jurisdiction of Hong Kong	Same as IMO requirements	1. Written application for exemptions on the use of EGCS must be made to the authorities at least 14 days before the date on which the vessel intends to make its first or renew exempted call	HK Cap 311AB

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							at Hong Kong. Authority will grant an exemption for a maximum of 3 years after satisfactory reviewed documents. 2. If the ship use non-compliant fuel oil, an exemption may be granted for 1 stay period with the consent of Hong Kong authority (HK Environmental Protection Department)	
		Taiwan, China	0.50	2019.01.01	International commercial port region (Keelung, Taichung, Kaohsiung,	Same as IMO requirements	Accepted EGCS as equivalent method, approved and operated in accordance with the requirements of	---

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
					Hualien, Taipei, Suao and Anping*		resolution MEPC.259(68).	
5	IN	India	Same as IMO requirements	Same as IMO requirements	Same as IMO requirements	1. IMO requirement 2. Inspections on compliance under 2020 Sulphur Cap 3. Strongly advised to develop a ship specific implementation plan for the consistent implementation of the 0.50% Sulphur Cap 4. Disposal and reporting requirements for	Wash water discharge is permitted provided that the requirements of MEPC.259(68) are fully met. Local restrictions will be imposed in certain areas and it is recommended to be verified in advance.	IN EC 02-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						non-compliant fuel oil carried for use on board 5. Reporting and remedy requirements with EGCS malfunctions 6. Verification of Sulphur content in Fuel Oil Sample		
		India-Adani ports and ports under the Special Economic Zone	Same as IMO requirements	Same as IMO requirements	Adani ports and ports under the Special Economic Zone*	Same as above	Open-loop EGCS are permitted.	1.IN APSEZL 16-2020 2.IN APSEZL 18-2020
6	JP	Japan	Same as IMO	Same as IMO	Same as IMO	Same as IMO	1. Use of an EGCS as	19-2-2019 (Support file from the Ministry of

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
			requirements	requirements	requirements	requirements	equivalent method, approved and operated in accordance with the requirement of IMO guidelines. 2. Discharge of wash water from open-looped EGCS is not prohibited	Land, Infrastructure, Transport and Tourism)
7	KR	Korea	0.10	Berthing and sailing on or after 2022.01.01.	Sox Emission Control Areas(Port of Busan, Incheon, Ulsan, Yeosu, Kwangyang(including Hadong, Pyeongtaek and Dangjin port	1. Same as IMO requirements 2. Requirements for the Fuel oil changeover and recording 3. Penalties and fines when violations	1. Use of an EGCS as equivalent method, approved and operated in accordance with the requirement of IMO guidelines. 2. Not prohibit the use of open-looped EGCS. 3. Record requirements for the EGCS operation mode changeover.	1. MOF_Korean_ECA_brochure 2.2021-ETC-08(E)

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							4. Penalties and fines when violations 5. Discharge from Open-loop EGC systems is prohibited (Incheon (including Kyongin Port)- Restrictions also apply to all ships at anchor in all ports, Pyeongtaek-Dangjin, Yeosu, Gwang-yang (including Haodng port), Busan, Ulsan)	
8	MY	Malaysia	Same as IMO requirements	Same as IMO requirements	Territorial waters of Malaysia	Same as IMO requirements	Prohibits the discharge of Wash water from EGCS open-loop system whilst in Malaysian Water (12 nautical miles from the nearest land).	1.MSN 07-2019 2.MSN 08-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							(This requirement does not apply to ships passing only through the Strait of Malacca without port call)	
9	OM	Oman	Same as IMO requirements	Same as IMO requirements	Omani ports and territorial waters	Same as IMO requirements	1. Ships use open-loop EGCS is prohibited from discharging washing water. 2. Ships use hybrid EGCS must switch from open loop mode to the closed loop mode and keep the washing residues onboard and dispose of them in the designated facilities at the port. 3. Violator will be subject to legal accountability	Marine Notice 09-2020
10	PK	Pakistan	Same as IMO	Same as IMO	Ports of Pakistan	2.Inspections on	1. Wash water discharge is	PK Circular 001-2020-CE&SS

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
			requirements	requirements		compliance under Sulphur Cap. 3. Strongly advised to develop a ship specific implementation plan for the consistent implementation of the 0.50% Sulphur Cap 4. Disposal and reporting requirements for non-compliant fuel oil carried for use on board 5. Verification of	prohibited. 2. Reporting and remedy requirements with EGCS malfunctions 3. Discharge from Open-loop EGCS is prohibited (Port of Karachi, Port of Bin Qasim)	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						Sulphur content in Fuel Oil Sample		
11	QA	Qatar	Same as IMO requirements	Same as IMO requirements	Qatari territorial waters	Same as IMO requirements	1. Wash water discharge is prohibited. 2. Wash water containing chemical and/or metals are prohibited	Reg. 6.73 of MIC Regulations Guide
12	SA	Saudi Arabia	Same as IMO requirements	Same as IMO requirements	Saudi ports	1. IMO requirements 2. Reporting requirements for non compliant fuel oil carried for use on board 3. Verification of Sulphur content in Fuel Oil Sample	Wash water discharge is prohibited.	Circular 55-2020
13	SG	Singapore	Same as IMO	Same as IMO	Ports and Waters	1. IMO requirement	1. Wash water discharge	1.MPA 2020 Sulphur Limit - Ships Calling

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
			requirements	requirements	under the jurisdiction of Singapore	2. Inspections on compliance under 2020 Sulphur Cap 3. Disposal and reporting requirements for non-compliant fuel oil carried for use on board. 4. Disposal of the non-compliant fuel oil.	from Jan.01, 2020. This prohibition does not apply to ships transiting the Traffic Separation Scheme (TSS) without calling into the Port of Singapore. 2. An approval will be obtained for those Singapore-flagged ships with emission reduction technologies installed(Through RO to report to MPA) 3. Discharge from Open-loop EGC systems is prohibited (Within port limits)	Singapore Port 2.MPA2020 Sulphur Limit - A Guide for Singapore Registered Ships 3.Port Marine Circular No.26 of 2021

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
14	TH	Thailand	Same as IMO requirements	Same as IMO requirements	Some individual terminals (unknown)	Thailand has not rectified MARPOL Annex VI, some individual terminals requires arrival vessels to comply with IMO requirements and guidelines on Sulphur issues.	1.The use of EGCS is accepted as per Flag and ROs approval in accordance with IMO guidelines. 2.Wash water discharge is prohibited in Thai water	1.email dated on 7 January 2022 2.Section 119 bis of Navigation in the Thai waters Act B.E.2456
15	FL	Philippine	0.50	Same as IMO requirements	Philippine-registered ships,engaged or intending to engage in the domestic or international voyages	IMO requirements	1.The use and installation of EGCS shall be approved by the Administration or its ROs 2.System is operated in accordance with IMO requirements	MC-SR-2020-06

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
European area								

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
16	EU	European Union	0.10	2010.01.01	EU ports and anchorage	1. IMO requirements. 2. Ships berthed in Union ports (including anchoring, mooring buoying, dock berthing) for more than 2 hours are not allowed to use Marine fuel with sulfur content exceeding 0.10% m/m. 3. Implement sulfur inspection guidelines 3.1 sulfur inspection	1. Fuel oil with sulfur content exceed the limits required in EU Directive shall not be used, except for the closed-loop EGCS installed vessel. 2. For ships under the flag of EU member states, EGCS shall be approved in accordance with DIRECTIVE 2014/90 / EU Marine products (MED). 3. For research and experimental purposes EGCS, EU has proposed requirements for reporting, duration, emissions and	1.Directive 2012-33-EU 2.DIRECTIVE 2000-60-EC 3.DIRECTIVE 2016-802-EU 4.European Commission's 2016 note 5.Sulphur Inspection Guidance for EU 2016-802

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						procedure 3.2 selection of inspected ship 3.3 inspection of ships using low Sulphur oil 3.4 inspection of ships using emission control methods	assessment. 4. For EGCS using chemicals, additives, dispensing agents and related chemicals produced in the system, the washing water shall not be discharged into the ocean, including closed docks, ports and estuaries, unless the shipping company certifies that the discharge of the washing water has no significant negative effect and poses no threat to human health or the environment. If NaOH is used, the washing water can	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							be discharged if it meets the discharge standard of IMO EGCS guidelines and its pH value does not exceed 8.0. 5. Ships sailing in EU waters are required to install EGCS continuously monitoring SOx emissions, which means that the equipment approved under plan A is not suitable for use unless it is equipped with a continuous exhaust gas monitoring (SO2 / CO2) system with redundancy.	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
	EU-BE	Belgium	Same as above	Same as above	1. Above EU requirements. 2. Ports and inland waters*	Same as above	1. Above EU requirements. 2. Wash water discharge is prohibited*. 3. Discharge from Open-loop EGC systems is prohibited(All ports and inland sea areas)	European Commission's 2016 note
	EU-DE	Germany	Same as above	Same as above	1. Above EU requirements. 2. Exception of the German part of Lake Constance and the stretch of the Rhine upstream of Rheinfelden*	Same as above	1. Above EU requirements. 2. Wash water discharge is prohibited*. 3. Discharge from Open-loop EGC systems is prohibited(Port of Hamburg, Port of Rostock, River Elbe)	1.Articles 1 and 3 of the CDNI Convention (Convention on the Collection, Deposit and Reception of Waste Produced during Navigation on the Rhine and Inland Waterways)
	EU- EE	Estonia	Same as above	Same as above	1. Above EU requirements.	Same as above	1. Above EU requirements. 2. Port authorization is	1.European Commission's 2016 note 2.EE Circular No.4

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
					2. Territorial sea and port area*		required if EGCS wash water is discharged in port area.	
	EU- FI	Finland	Same as above	Same as above	1. Above EU requirements. 2. Neste Porvoo*	Same as above	1. Above EU requirements. 2. Open loop EGCS is not allowed 2. Discharge from Open-loop EGCS is prohibited (Port of Porvoo)	Neste Porvoo 2020-01-01
	EU- IT	Italy	Same as above	Same as above	Above EU requirements	Same as above	1.Above EU requirements 2.Ships installed with EGCS shall notice: keep relevant documents onboard, carry out surveys by RO, verification procedure for scheme A, Control of emissions limit	1.Circular n.132-2017-Rev.1 2. Special provisions of the port of Livorno

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							onboard, data recording and processing, EGCS management and operation, exceptional conditions notification, waste generated by EGCS, management of generators or engines and boilers in stand-by but not connected to EGCS, PSC inspections	
	EU- LV	Latvia	Same as above	Same as above	1. Above EU requirements. 2. Territorial sea and port area*	Same as above	1.Above EU requirements 2.Wash water discharge is prohibited	European Commission's 2016 note
	EU- LT	Lithuania	Same as above	Same as above	1. Above EU requirements. 2. Territorial sea and	Same as above	1.Above EU requirements 2.Wash water discharge is prohibited	1.European Commission's 2016 note 2.Notices to Mariners Shipping Regulations Edition No.1

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
					port area*			
	EU-MT	Malta	Same as above	Same as above	Above EU requirements.	Same as above	1. Above EU requirements. 2. Recommend the shipowners and operators undertake the necessary actions , note the local regulations that restrict or even completely prohibit the discharge of washwater from open loop EGCS, and provide clear procedures and guidance to the crews.	1.Merchant Shipping Notice 161 2.Port Notice Number 6 of 2019
	EU- SE	Sweden	Same as above	Same as above	1. Above EU requirements. 2. PetroPort*	Same as above	1. Above EU requirements. 2. Open-loop EGCS was prohibited	1.Port Regulations(the Port of Trelleborg) 2.Harbour Regulations(PetroPort)2020 3. Port Regulations(the Port of Gothenburg)

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
					3. Port of Trelleborg* 4. Port of Gothenburg		3. Discharge from Open-loop EGC systems is prohibited(Port of Stenungsund, Port of Trellebord, Port of Gothenburg, Port of Oxelosund, Port of Petroport)	
	EU-DK	Denmark	Same as above	Same as above	Above EU requirements.	Same as above	Reporting and remedy requirements with EGCS malfunctions: For Danish flagged ships, in case of any malfunction that lasts more than one hour, the ship owner or operator shall notify the ship's RO and port state	Circular 29

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							authorities as soon as possible	
17	IE	Ireland	Same as IMO requirements	Same as IMO requirements	1. Dublin port* 2. Cork port* 3. Waterford port*	Same as IMO requirements	1. Wash water discharge is prohibited. 2. Wash water discharge is prohibited. 3. Wash water discharge is prohibited. 4. Discharge from Open-loop EGC systems is prohibited (Port of Dublin, Port of Waterford, Port of Cork, Port of Bantry, Shannon Foynes Port)	1.Dublin NM 21-2019 2.Cork NM 15-2018 3.Waterford NM 01-2019
18	IS	Iceland	0.10	2020.01.01	Territorial sea and internal waters, i.e.	Same as IMO requirement	Accept all kinds of EGCS as an equivalent arrangement based on the criteria	Regulation banning the use of heavy fuel oil in the territorial sea of Iceland

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
					also in fjords and bays*		stipulated in the IMO guidelines.	
19	NO	Norway	0.10	2019.03.01	In the world heritage fjords*	Same as IMO requirement	1.Prohibit open-loop EGCS. Ships using closed loop or hybrid EGCS are required to use a device for reducing visible emissions to air. 2. Discharge from Open-loop EGC systems is prohibited (The World Heritage Fjords, Port of Eidfjord, Port of Stavanger)	1.Circular R No.02-2019 2.EIDF CRUISE PORT HARDANGERFJORD
20	TUR	Turkey	0.10	2012.01.01	Ports of Turkey*	Same as IMO requirement	1. Accept EGCS as an equivalent arrangement based on MEPC.259 (68). 2. It is prohibited to discharge washwaters.	1.Turkey Circular No.517-2011 2.Turkey Circular No.1590-2021

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
21	UK	United Kingdom	0.10	2010.01.01	UK port*	-	1. For the discharge water: 1.1 Shall comply with Merchant Shipping Regulations 1.2 Local ports and harbours have the authority to apply local requirements 1.3 Both open and closed loop EGC systems are allowed in the tidal Thames. However, open loop EGC systems are not permitted at any berths operated by the Port of Tilbury. 2. For private ports, suggest to contact UK major Port Group and Associated	1.E-mail from the Environment Policy Branch of Maritime and Coastguard Agency 2.MSN 1819 3.Notice to Agents,Berth And Ship Operators No.15 of 2020

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							British Ports 3. The master of any ship within United Kingdom waters that is to use an exhaust gas cleaning system shall provide documentation that demonstrates that waste streams discharged to the sea will have no adverse impact on the ecosystem of that port, harbour or estuary. Such documentation shall be forwarded to the Maritime and Coastguard Agency via The environment@mcga.gov.uk email address. If the	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							chemical used is caustic soda it is sufficient that the washwater meets the criteria set out in Resolution MEPC.184(59) and its pH does not exceed 8,0. The relevant SOx Emission Compliance Certificate/s and SOx Emission Compliance Plan must be attached to this document	
	UK-SCOT	Scotland	Same as above	Same as above	Forth and Tay *	-	Open loop EGC systems is prohibited	Notice to Mariners No. 45 of 2019
	UK-WALSE	Wales	Same as above	Same as above	Milford Haven		Wash water from EGC shall not be discharged to surface waters within its jurisdiction, unless the discharge is	Notice to Mariners No.127 of 2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							covered by a marine licence from Natural Resources Wales	
22	AB	Albania					Discharge from Open-loop EGC systems is prohibited (All ports)	
23	CR	Croatia					Discharge from Open-loop EGC systems is prohibited(Port areas)	
24	FR	France	Same as IMO requirements	2022.01-2026.01	Territorial sea and port area of France		It is not allowed to discharge EGCS wash water in territorial waters within three nautical miles from January 2022. On a case by case basis, a temporary exemptions to vessels already equipped	PVCCS 958/REG02(2021.7.7 版本)

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							with open loop EGC systems and on regular lines can applied to French “Direction des Affaires Maritimes” By Shipowners. From January 2022, it is not allowed to discharge EGCS wash water while at berth in French ports. Discharge from Open-loop EGC systems is prohibited (Cannes- Restriction applies to cruise ships only, Marseille, Le Havre, Cherbourg, Reunion, Dunkirk)	
					Port of Cannes		Cruisers are prohibited to	le-port-de-cannes-charte-croisiere

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							use EGCS in the port of cannes	
25	PG	Portugal					Discharge from Open-loop EGC systems is prohibited (Port of Aveiro, Port of Leixoes, Port of Lisbon, Port of Sines)	
26	RO	Romania					Discharge from Open-loop EGC systems is prohibited(Within port limits)	
27	ES	Spain					Discharge from Open-loop EGC systems is prohibited(Port of Cadiz, Port of Algeciras, Port of Cartegena, Port of Huelva, Port of Barcelona (at berth), Canary islands ports, Port of Gijon)	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
28	GI	Gibraltar			Gibraltar waters		Closed loop EGC systems and hybrid EGC systems operating in closed loop are permitted, open loop EGC systems are temporarily not permitted by GoG	Email dated on 1 December 2021
29	CY	Cyprus			Ports and anchorage of Cyprus		Ships requiring to use ECGS at Cyprus' ports or anchorage area must submit a written request for assessment and approval by the CPA at least 48 hours prior to the arrival of the ship. The written request shall provide the following detailed information: the location that EGCS will be	1.Email dated on 28 December 2021 2..Requirements from CPA and Ministry of Energy

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							used (port, anchor); and the type of EGCS.	
30	RU	Russia			Russian Ports(Including ports at Baltic sea:Primorsk, Ust-Luga etc)		Open-loop EGCS cannot be used	Email dated on 29 December 2021
African area								
31	KE	Kenya	Same as IMO requirements	Same as IMO requirements	Kenya ports*	1. Same as IMO requirements 2. Reporting requirements for the non-compliant fuel oil	1. Reception facilities for EGCS residue 2. Discharge of wash water is prohibited 3. Discharge from Open-loop EGCS is prohibited (Within port limits)	National Guideline on IMO 2020

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
32	ZA	South Africa	Same as IMO requirements	Same as IMO requirements	South African waters.	1.Same as IMO requirements 2. Recommend develop Ship Implementation Plan for Achieving Compliance with the 0.50% Sulphur Limit Entering Into Force on 1 January 2020 Using Compliant Fuel Oil Only 3. Reporting requirements for the carriage of non-compliant fuel oil	1. Accept all kinds of EGCS as an equivalent arrangement based on the criteria stipulated in the IMO guidelines. 2. Evidence that the personnel involved in the operation of EGCS are adequately trained and familiar with its operation 3. Reporting requirements for the breakdown or malfunction	SAM MN 22-2019 SAM MN 42-2020

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
33	MU	Mauritius	Same as IMO requirements	Same as IMO requirements	Territorial sea of Mauritius	Same as IMO requirements	1. ships proceeding to waters within 12 nautical miles from the shore of Mauritius that use high sulphur fuel oil (HSFO) in combination with open-loop EGCS shall changeover from HSFO to compliant fuel oil. 2. Discharge of wash water in the territorial waters of Mauritius is prohibited	Merchant Shipping Notice 02-2019
34	MO	Mozambique					Discharge from Open-loop EGCS is prohibited(Nacala Port)	Mozambique Decree No. 452006 approving the Regulation for the prevention of marine pollution.
35	GH	GHANA	Same as IMO requirements	Same as IMO requirements	Territorial sea and ports of Ghana	Same as IMO requirements	Discharge from Open-loop EGCS is prohibited. Hybrid EGCS are required	Shipping Notice No.019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							to switch to the closed-loop mode of operation. Otherwise compliant fuel oil shall be used	
American area								
36	AR	Argentina	Same as IMO requirements	2021.9.8	Argentina jurisdictional waters (including internal waters, territorial sea, contiguous zone and exclusive economic zone)	Same as IMO requirements	1. Discharge of wash water is prohibited 2. Wash water of the closed EGCS can only be discharged in port through authorized companies for its disposal 3. Entail fine from criminal prosecution 4. The enforceability of above requirements was suspended by Circular	1.DISFC-2020-15-APN-DPAM#PNA 2.DISFC-2020-22-APN-DPAM#PNA

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							DISFC-2020-22-APN-DPAM#PNA	
37	BER	Bermuda	Same as IMO requirements	Same as IMO requirements	Bermuda territorial waters	Same as IMO requirements	1. Ships equipped with closed-loop EGCS (including hybrid mode) shall seek the prior approval of the Environmental Authority before its use in Bermuda's territorial waters. 2.Washwater and residue from the EGCS shall be not disposed of in Bermuda or discharged into Bernuda's water but shall be stored on board the ship until outside of Bermuda's waters.	1.Environmental Policy for Ships 2.Bermuda - Territorial waters
38	BR	Brazil	Same as IMO	Same as IMO	Some bulk terminals *	1. Same as IMO	1. According to a statement	1.Statement of 20 Dec 2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
			requirements	requirements		requirements 2.Requirements of the PSC inspection for the compliant fuel oil 3.Handle and fine requirements for the non-compliant fuel oil	issued by Brazil's vale on 20 December 2019, the bulk terminals/ports operated by vale are not allowed to discharge wash water in their waters. 2. Once in the contiguous zone or 24 nautical miles from the coastline, it is recommended that ships use only low Sulphur fuel oil and do not discharge any wash water into the ocean. 3. Handle and fine requirements for the non-compliant of EGCS 4. Discharge from	2. Circular No. 7-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							Open-loop EGCS is prohibited(Terminal of Ponta da Madeira, Complex of Tubarao e Praia Mole Ports, Terminal of Ilha Guaibe)Additional information: All ports owned by Vale	
39	US	The United States	Same as IMO requirements	Same as IMO requirements	Outer reach of the 3 miles territorial sea, including all navigable waters of the Great Lakes.	1. Same as IMO requirements. 2. Inspection of Sulphur Cap compliance. MARPOL ANNEX VI COMPLIANCE CHECK SHEET in CG-CVC-WI-022.	1. Difference to the IMO requirements: 1.1 Wash water discharge must not contain oil, including oily mixtures, in quantities that may be harmful as determined in accordance with 40 CFR Part 110.	1.USCG CG-CVC-WI-022 2.Reg. 2.2.26 of VGP 2013

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						3. Verify fuel samples onboard. 4. Report and handling requirements while non-compliance fuel oil onboard, mainly same as MEPC.321(74) and MEPC.1/Circ.881.	1.2. Sludge or residues of wash water must not be discharged and must be delivered ashore to adequate reception facilities. 1.3. Special requirements for the use of EGCS: 1.3.1 All continuous monitoring equipment must be calibrated as recommended by probe manufacturers or EGCS manufacturers. 1.3.2 The continuously monitoring equipment for PAH discharges must available for a minimum of	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							two years. 1.3.3 Requirements for the discharge of the EGCS wash water: 1) The discharge of wash water must have a pH of no less than 6.0 measured at the ship's overboard discharge, with the exception that during maneuvering and transit, the maximum difference between inlet and outlet of 2.0 pH units is allowed. This difference is to be measured at the ship's inlet and overboard discharge.	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							2) USCG accepts IMO requirements for washing water discharge values and measurement methods (i.e., direct measurement or calculation method measurement) outside the 3 nautical mile range case by case. 3) Must collect and analyze two samples in the first year of permit coverage or system operation, whichever is first, for each of the constituents analyzed to demonstrate treatment equipment maintenance, probe	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							accuracy, and compliance with this permit. Samples must not be collected within 14 days of each other. Samples must be collected for inlet water (for background), water after the EGC unit (but before any treatment system), and discharge water. After the first year, samples must be collected at least once per calendar year, Records of the sampling and testing results must be retained onboard for a period of 3 years. 4) Analysis items mentioned	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							in above 3) list as follow: a. Dissolved and Total Metals, As, Cd, Cr, Cu, Pb, Ni, Se, Ti, V, Zn (Recommend using EPA Methods 200.8 or 200.9). b. PAHs (Recommend using EPA Methods 550.1, 610, 625, 8100, 8270c, 8310). c. Nitrate-Nitrite (Recommend using EPA Method 353.2). d. pH (Using Standard Methods (SM) 4500-H B). 2. Foreign-flagged ships that equipped with EGCS must ensure the flag state submits	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							the equivalency to the MARPOL Annex VI public area of IMO's Global Integrated Shipping Information System (GISIS) prior to the ship entering either U.S. ECA. The Coast Guard may review any submissions it receives, but will use GISIS database to confirm the validity of an Annex VI equivalency. 3. Report and handling requirements while equipment casualty or failure.	
	US-CT	State of	Same as IMO	Same as IMO	Outer reach of the 3	1. IMO	1. Discharge of wash water	1.Reg. 6.5.9 of VGP 2013 2.CT Standard

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
		Connecticut	requirements	requirements	miles territorial sea, including all navigable waters of the Great Lakes	requirements. 2. Above USCG and U.S legislation requirements.	is prohibited. 2. Above U.S requirements. 3. Discharge from Open-loop EGCS is prohibited	
	US-HI	State of Hawaii	Same as IMO requirements	Same as IMO requirements	Outer reach of the 3 miles territorial sea.	1. IMO requirements. 2. Above USCG and U.S legislation requirements.	1. Report as 2013 VGP 6.7.1. 2. Above USCG and U.S requirements.	Reg. 6.7.1 of VGP 2013
	US-CA	State of California	0.10	2014.01.01	all waters within 24 nautical miles of the California baseline	1. IMO requirements. 2. Above USCG and U.S legislation requirements 3. Marine fuel oil standards: 3.1 Marine gas oil,	1. Prohibit all kinds of EGCS. 2. Temporary research or experiments shall be exempted from approval.	1.CA MN 2020-1 2.CA MN 2020-2

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						corresponding to DMA grade distillate oil in ISO 8217 standards. 3.2 Marine diesel oil, corresponding to DMB grade distillate oil in ISO 8217 standards. With a maximum sulfur level of 0.1% while operating main engines, diesel-electric engines, auxiliary engines, and auxiliary boilers.		

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
	US-FL	Canaveral Port of Florida	Same as IMO requirements	Same as IMO requirements	Waterways and facilities owned, operated, and under the jurisdiction of CPA	1. IMO requirements. 2. Above USCG and U.S legislation requirements.	Discharge of wash water is prohibited	CPA Tariff No.16
	US-FL	Port Everglades of Florida	Same as IMO requirements	Same as IMO requirements	Waterways and facilities ruled by Broward County	1. IMO requirements. 2. Above USCG and U.S legislation requirements.	Discharge of wash water is prohibited, unless performed in conformance with Chapter 27, Pollution Control, of the Broward County Code	Port Everglades Tariff No. 12
	UF-DC	Port Seattle of Washington DC					Discharge from Open-loop EGCS is prohibited (Port of Seattle- Restriction applies to passenger cruise ships at berth in port terminals only)	Port of Seattle Terminals Tariff No. 5
40	CA	Canada					Discharge from Open-loop EGCS is prohibited(Port of	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							St John, Port Cartier)	
41	CO	Columbia					Discharge from Open-loop EGCS is prohibited(Internal waters, territorial sea area, and the contiguous Colombian zone)	
42	BZ	Belize		2018.12.17	Territorial waters and ports of Belize		Discharge of wash Water are prohibited in the territorial waters and ports of Belize	BPA/MS/23-1/2018(98)
Oceania area								
43	AU	Australia	Same as IMO requirements	Same as IMO requirements		1. IMO requirements 2. Inspections on compliance, Vessels that are found to be non-compliant with 2020 Sulphur Cap may be subject to	1. Must be approved by the vessel's flag State or a RO approved by the flag State. 2. The master, owner or operator of a vessel using an EGC is requested to notify AMSA before first arrival at an Australia port, and make	1. AUS MN 04-2019 2. AUS MN 02-2021 3.Port of Hastings Operating Handbook 3.Port of Hastings Operating Handbook

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						detention, refused access or granted conditional entry to Australian ports in line with requirement of “The Protection of the Sea (Prevention of Pollution from ships) Act, 1983”. 2.1 The Sulphur content of fuel oil used on board vessels for propulsion or operation must not exceed 0.50% m/m,	proper reporting. 3. Requirements for the monitoring of wash water discharge. 4. EGCS washing water residue discharge, treatment and recording requirements. 5. The testing of wash water is a sample analysis during the EGCS trial run, which is to be carried out every 12 months for at least two years. If the data or evidence for this sample water analysis is not provided to the AMSA prior to its arrival at	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						unless the ship is fitted with an Exhaust Gas Cleaning System (EGCS). 2.2 Use and submission of FONAR 2.3 Bunker Delivery Note (BDN) and representative fuel oil sample. 3. Reporting and remedy actions of mechanical or equipment failure (such as EGCS	Australia's premier port, the vessel is not allowed to discharge the EGCS wash water directly into Australian waters. 6. If EGCS system is found cannot meet the requirements of IMO guidelines (including but not limited to washing water discharge standards), the use of EGCS system in Australian waters may be prohibited. 7. Handle and report requirements of the EGCS failure.	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						malfunction), including changing over to compliant fuel oil etc.	8. AMSA is currently investigating the potential impacts of EGCS wash water discharges on Australian port environments. The discharge of wash water from EGCS is currently permitted in Australian waters, vessel owners, operators and Masters are encouraged to avoid discharging wash water within Australian port limits. 9. Discharge from Open-loop EGCS is prohibited(Ports of Hastings)	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
		Sydney	0.10(cruise ships)	2016.12.01	Sydney Harbour	1. All cruise ships use low sulfur marine fuel (fuel with a sulfur content of 0.1% m/m or less by weight or EGCS as an equivalent)while berthed within Sydney Harbor. These requirements start one hour after the ship is berthed and end one hour prior to departure. 2. Measures to	1. Must be approved by the vessel's flag State or a RO approved by the flag State. 2. Aforesaid AMSA requirements.	1. EPA 2015-0695 2. AUS MN 06-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						reduce Sulphur emissions while cruise ships (carrying more than 100 passengers) berth in Sydney Harbor. 3. Aforesaid AMSA requirements. 4. Reporting requirements for unexpected delays in departure beyond the reasonable control of the master and unscheduled berthing due to an		

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
						emergency.		
		Port Headland	Same as IMO requirements	Same as IMO requirements	Port Headland	Same as IMO requirements	The Load Power Analysis Calculation is to be referred to and amended where required to include the additional power requirements due to use of EGCS. The Load Power Analysis Calculation must be amended in consultation with, and endorsed by, the vessel's Classification Society. Main engine issues (slowdowns / failures) may occur during manoeuvring	1.Port Of Port Hedland Marine Safety Bulletin 07-2019 2.Port Of Port Hedland Marine Safety Bulletin 08-2020

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							due to EGCS inter-connected ancillary systems such as, but not limited to, exhaust gas high temperature alarms, exhaust gas deviation alarm for main engine, fire detection system alarms, failure of wash water systems, wash water accumulation in the EGC unit etc. Such scenarios must be risk assessed and mitigating control measures must be implemented by the ship's managers and crew. Vessel operators should ensure that the vessels	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							EGCS is type approved and operated in compliance with applicable requirements. Monitoring devices must be fully operational and the system should be maintained up to date. When alongside, vessel's must regularly maintain visual watch of the waters surrounding the vessel especially near the overboard discharge of the EGCS wash water, to ensure that there is no visible discharge. When visible soot like	

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							discharge is detected, the vessel must report the same to VTS and take immediate action to rectify the situation by identifying the source and stopping such discharge.	
44	NZ	New Zealand	Same as IMO requirements	Same as IMO requirements	New Zealand territorial water	Same as IMO requirements	The Ministry for the Environment supports the use of precaution by ships operating EGCS in NZ territorial waters, whilst we undertake further monitoring to address key uncertainties related to the use of these systems. All ships carrying EGCS and operating in New Zealand's territorial waters	Guidance on the use of EGCS for ports, regional authorities and ships(13 April 2021)

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							shall engage with the relevant port and regional authorities in advance, and as a precautionary measure, where possible, they avoid discharging EGCS effluent close to shore by utilising alternate options.	
Canal Authorities								
45	ACP	Panama Canal Authority	Same as IMO requirements	Same as IMO requirements	During through the Canal and its terminal ports*	Same as IMO requirements	The use of open loop EGCS or hybrid EGCS in open loop mode is prohibited in Panama Canal waters.	ACP-N01-2022
46	SCA	Suez Canal Authority	Same as IMO requirements	Same as IMO requirements	During vessel transit of Suez Canal *	Same as IMO requirements	1. Wash water shall not be discharged into water. 2. Discharge from	1.SCA Circular 08-2019 2.Clarification Related to SCA Circular No.8-2019

No.	Code	Area	Fuel oil sulphur content(%m/m)	Effective date	Effective zone	Additional requirements to low Sulphur fuel oil	Additional requirements to EGCS (Including the permission requirements; Whether wash water discharge is prohibited)	Refer files
							Open-loop EGCS is prohibited(Suez Canal)	

Notes:

1. Prohibit the discharge of wash water means, vessel shall switch to low sulphur fuel oil, or use closed loop EGCS, or switch to closed loop mood (For hybrid EGCS).
2. “*” only apply to the wash water discharge.
3. International voyage vessels sailing in waters outside the emission control zones ruled by Administrations shall meet IMO requirements.
4. Nil in refer files means the reference is collected from ICS MC(21)110, this reference list of ports around the world which prohibited the discharge from EGCS are updated by ICS, for exact information please contact the associating ports authorities..

Appendix 2 Requirements of operational parameter checks and records of EGCS

Serial No.	Data Verification	Verification Requirement	Scheme A	Scheme B
1	wash water pressure and flow rate at the EGC unit's inlet connection	Refer to the EGCS Technical Manual (ETM-A or ETM-B)	Continuous monitoring①②③	Daily spot checks③
2	exhaust gas pressure before and pressure drop across the EGC unit	Refer to the EGCS Technical Manual (ETM-A or ETM-B)	Continuous monitoring①②③	Daily spot checks③
3	fuel oil combustion equipment load	Refer to the EGCS Technical Manual (ETM-A or ETM-B)	Continuous monitoring①②③	Daily spot checks③
4	exhaust gas temperature before the EGC unit	Refer to the EGCS Technical Manual (ETM-A or ETM-B)	Continuous monitoring①②③	Daily spot checks③
5	exhaust gas temperature after the EGC unit	Refer to the EGCS Technical Manual (ETM-A or ETM-B)	Continuous monitoring①②③	Daily spot checks③
6	SO_2(ppm)/CO_2(% V/V)	(1) The emission ratio of SO2/CO2 corresponding to sulfur content 0.50%m/m is 21.7 (2) The emission ratio of SO2/CO2 corresponding to sulfur content 0.10% m/m is 4.3.	Daily spot checks③ Ships navigating the EU waters require continuous monitoring①	Continuous monitoring①
7	Wash water pH value	The pH value scale shall meet one of the following requirements (1) or (2) and the limit value shall be recorded in the applicable ETM-A or ETM-B:	Continuous monitoring①	Continuous monitoring①

<table>
<tr><td></td><td></td><td>(1) The discharge wash water is to have a pH value of no less than 6.5 measured at the ship’s overboard discharge with the exception that during maneuvering and transit, the maximum difference between inlet and outlet of 2 pH units is allowed measured at the ship’s inlet and overboard discharge.
(2) The pH discharge limit, at the overboard monitoring position, is the value that will achieve as a minimum pH 6.5 at 4 m from the overboard discharge point with the ship stationary, and which is to be recorded as the overboard pH discharge limit in the ETM-A or ETM-B. The overboard pH discharge limit can be determined either by means of direct measurement, or by using a calculation-based methodology (computational fluid dynamics or other equally scientifically established empirical formulae).
(3) The discharge requirements within 3 nautical miles from shore, including all the ships navigating in US territory waters and great lakes areas are significantly different from each other. Please refer to Appendix 1 for more details.</td><td></td><td></td></tr>
<tr><td>8</td><td>wash water PAH (Polycyclic Aromatic Hydrocarbons)</td><td>(1) PAH concentration limit
<table>
<tr><th>Flow rate(before dilution to control the pH value)(t/MWh)</th><th>Discharge PAH concentration limit (μg/L)</th></tr>
<tr><td>0-1</td><td>2250</td></tr>
<tr><td>2.5</td><td>900</td></tr>
<tr><td>5</td><td>450</td></tr>
<tr><td>11.25</td><td>200</td></tr>
<tr><td>22.5</td><td>100</td></tr>
<tr><td>45</td><td>50</td></tr>
<tr><td>90</td><td>25</td></tr>
</table>
(2) For a 15-minute period in any 12-hour period, the continuous PAH concentration limit may exceed the limit described above by up to 100%. This would allow for an abnormal startup of the EGC unit.</td><td>Continuous monitoring①</td><td>Continuous monitoring①</td></tr>
<tr><td>9</td><td>wash water temperature</td><td>According to the actual situation</td><td>Continuous monitoring①</td><td>Continuous monitoring①</td></tr>
<tr><td>10</td><td>wash water turbidity/suspende</td><td>The maximum continuous turbidity in wash water is not to be greater than 25 FNU (formazin nephlometric</td><td>Continuous</td><td>Continuous</td></tr>
</table>

	d particle matter	units) or 25 NTU (nephlometric turbidity units) or equivalent units, above the inlet water turbidity For a 15-minute period in any 12-hour period, the continuous turbidity discharge limit may be exceeded by 20%.	monitoring[①]	monitoring[①]
11	the content of nitrates in wash water[④]	1) The wash water treatment system is to prevent the discharge of nitrates beyond that associated with a 12% removal of NOx from the exhaust, or beyond 60 mg/l normalized for a wash water discharge rate of 45 tons/MWh, whichever is greater。 2)An sample to be drawn and analyzed after installation 3) At each renewal survey nitrate discharge data is to be available in respect of sample overboard discharge drawn from each EGC system with the previous three months prior to the survey. The administration or CCS surveyor may require an additional sample to be drawn and analyzed at their discretion. 4)Requirements in respect of sampling, storage, handling and analysis should be detailed in the ETM-A or ETM-B as applicable. 5) The qualification of the testing institution shall be in accordance with the ISO 17025 standard, and the quality system shall be established to obtain the certification of the qualification of the CNAS or equivalent. Details of the international mutual recognition of CNAS can be found at the following Web site: https://www.cnas.org.cn/gjhr/index.shtml	Sample checking and rate assessment The nitrate discharge data and analysis certificate is to be retained on board the ship as part of the EGC Record Book	
12	additives and other substances in wash water and discharge water	An assessment of the wash water is required for those EGC technologies which make use of chemicals, additives, preparations or create relevant chemicals in situ. The assessment could take into account relevant guidelines such as resolution MEPC.126(53), procedure for approval of ballast water management systems that make use of active substances (G9) and if necessary additional wash water discharge criteria is to be established. If the EGC system only uses the following chemicals, and the pH value of the discharge water pH does not exceed 8.0, there is no need for additional evaluation: (1) neutralizer (corrosive substances), such as sodium hydroxide (NaOH) or sodium carbonate (Na_2CO_3); (2) flocculants approved for use in marine oil-water separators.		

13	Chemicals consumption	Record according to the actual situation	EGC Record Book	EGC Record Book
14	wash water residue storage and disposal (closed–loop type)	The date, time and location of storage and disposal	EGC Record Book	EGC Record Book
15	EGCS maintenance	Repair, maintenance, or adjustment required to maintain the performance of EGCS	EGC Record Book	EGC Record Book

Remarks：

① SO_2 (ppm) and CO_2 (%) are to be continuously monitored and recorded onto a data recording and processing device at a rate which is not to be less than 0.0035 Hz.(285.7 secs =4.76 mins) and data is to be retained for a period of not less than 18 months from the date of recording.

② If a continuous exhaust gas monitoring system (in terms of SO_2 (ppm)/CO_2 (%) ratio) is fitted by Scheme A, only daily spot checks of the parameters would be needed to verify proper operation of the EGC unit.

③ Daily spot checks should be recorded in the EGC Record Book or the engine-room log-books

④ To avoid that the surveyor issue a conditioned or short-term IAPP certificate for the ship, which is unable to provide a nitrate detection report during the onboard verification, it is recommended to ship owner to obtain the above-mentioned report three months prior to the renewal verification.(i.e., at least before the verification is completed).