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GUIDELINES FOR EXHAUST GAS CLEANING SYSTEM READY

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CONTENTS

Foreword

IMO fuel oil standards of 0.5% sulphur content for ships engaged on worldwide voyages will be implemented in 2020 (2025 at the latest, subject to evaluation results of IMO expert group on fuel oil availability) while the mandatory implementation of fuel oil standards of 0.5% sulphur content in 2020 by EU has been defined by EU Directives. As the supply and price of fuel oil with 0.5% sulphur content in the future are not determined, it is difficult to estimate the pressure of fuel oil cost in the operation of ship and as a result, more and more ship owners and designers consider selecting the EGC system as a main alternative solution at ship construction stage.

The EGC system is relatively complicated, including scrubbers, alkali solution storage tanks, water treatment devices, washwater systems, seawater/fresh water systems, residue systems and control and monitoring systems. If the design and arrangement of main equipment and systems of EGC are not considered at the ship design and construction stage, many difficulties (especially the issue regarding the space for the installation and arrangement of scrubbers and alkali solution storage tanks) will be encountered during the installation and modification in the future. As a result, the ship owner and designer wish to adopt a more flexible "EGC system ready" plan, i.e. the design and arrangement in relation to the application of an EGC system onboard has been taken into consideration during the ship design and construction stage, and the space for installation for primary equipment and system interfaces have been reserved for future installation of the EGC system.

Based on the needs of EGC system ready mentioned above, the Guidelines are developed by CCS by carrying out research on factors and technical issues that need to be considered in terms of the design of installation of the EGC system on board as well as installation and arrangement, the purpose of which is to define the class notation for EGC system ready and relevant technical requirements, and provide technical support and services to ship design, construction/modification and survey.

Chapter 1 General

1.1 Application

1.1.1 The Guidelines apply to newly constructed ships for which an EGC system ready plan is adopted and modification and installation of an EGC system is intended in the future.

1.1.2 The Guidelines only provide basic requirements in the respects of EGC system design, installation and arrangement, structural strengthening and interfaces, etc. for ships adopting an EGC system ready plan.

1.1.3 The components/equipment of an EGC system that have been pre-installed during the ship construction stage are to comply with the relevant requirements of CCS Guidelines for Design and Installation of Exhaust Gas Cleaning Systems (hereinafter referred as EGC System Installation Guidelines).

1.1.4 Conventional systems and/or equipment of ship shared with the EGC system are to satisfy CCS classification rules and the relevant provisions of the Administration of the flag State.

1.2 Definitions and abbreviations

1.2.1 For the purpose of the Guidelines:

(1) *EGC system ready* means that the design and arrangement in relation to the application of an EGC system onboard has been taken into consideration during the ship design and construction stage, and the space for installation for primary equipment and system interfaces have been reserved for future installation of the EGC system.

(2) *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.

(3) *Open loop exhaust gas cleaning system* means a system directly using seawater for cleaning and desulfurization of the exhaust gas whereby the washwater upon completion of desulfurization is treated by special water treatment devices to meet the discharge criteria before being discharged overboard.

Note: Washwater discharge criteria are given in Chapter 8 of the Guidelines for Testing and Survey of Exhaust Gas Cleaning Systems (hereinafter referred to as EGC System Survey Guidelines).

(4) *Closed loop exhaust gas cleaning system* means a system using water solutions added with desulfurization agent for cleaning and desulfurization of the exhaust gas whereby the washwater upon completion of desulfurization is recycled for exhaust gas cleaning after it undergoes treatment processes of adding desulfurization agent, replenishing water and cooling.

(5) *Open-closed hybrid system* means a system of combined open and closed loop system. The operation of open or closed loop system is selected as needed when navigating in different sea/water areas. E.g. the open loop system may be selected when navigating on the high sea while the closed loop system may be selected when navigating/berthing in areas where washwater discharge is restricted or in fresh water areas.

1.2.2 For other terms, definitions, abbreviations and nomenclatures involved in the Guidelines, please refer to 1.3, Chapter 1 of EGC System Installation Guidelines and 1.3, Chapter 1 of EGC System Survey Guidelines.

1.3 Class notation

1.3.1 A ship adopting the EGC system ready plan, which has, upon the request by the ship owner or shipyard/designer, undergone satisfactory plan approval and surveys by CCS may be assigned the EGC Ready(X) class notation.

1.3.2 For EGC Ready(X) class notation, the symbol X stands for the type of the EGC system[①②], including:

(1) dry desulfurization system, expressed by the capital letter D;

(2) open loop exhaust gas cleaning system, expressed by the capital letter O;

(3) closed loop exhaust gas cleaning system, expressed by the capital letter C;

(4) open-closed hybrid system, expressed by the capital letter H.

X is to be replaced by one of the four letters above based on the type of the EGC system intended to be installed.

Note: ① Special provisions for desulfurization system and washwater discharge of EU and California of USA are to be noted by the ship owner/shipyard/designer during type selection of the EGC system.

Note: ② an example of the class notation for EGC Ready is as follows:

EGC Ready (H) means that the ship is intended to install an open-closed hybrid system. The plans and documents related to installation, design and arrangement of the EGC system onboard have been examined. Installation space and system interfaces for primary equipment have been reserved and are suitable for future installation and modification onboard.

1.3.3 After EGC Ready (X) class notation is assigned and before the installation and modification of EGC system onboard, if the ship has undergone other conversion which leads to the modification of the plans and documents as specified in 1.4 of this Chapter, such modified plans need be submitted to CCS for review.

1.3.4 After completion of installation and modification of the EGC system onboard, the SEC(EGCS) class notation may be assigned upon satisfactory survey by CCS and EGC Ready (X) class notation is to be withdrawn.

1.4 Plans and documents

1.4.1 The following plans and documents related to EGC system ready are to be submitted:

(1) instructions of EGC system ready, including working principles and processes, methods of onboard installation, main performance specifications of the EGC system, treatment capacity of the EGC system (including exhaust gas, washwater), compatibility of the EGC system with fuel oil combustion units, etc.;

(2) information on desulfurization agent (if used), including the corrosion, toxicity, flammability, chemical reaction, etc. as well as the relevant limitation conditions for the storage, transfer, disposal and usage;

(3) arrangement of equipment related to the EGC system, including a list of such equipment;

(4) arrangement, structural plan and relevant calculations (including capacity calculation) of desulfurization agent storage tanks;

(5) installation and arrangement of the scrubber, including exhaust gas collection device (if applicable), bypass and isolation devices (if installed);

(6) supporting structural plan of installation of the scrubber, assessment and calculation of local strength and vibration;

(7) information on assessment of the effect on ship's longitudinal strength after installation of the EGC system;

(8) arrangement of the bunker station of desulfurization agent (if applicable);
(9) arrangement and relevant calculations of tanks related to treatment of residue;
(10) piping diagram related to the EGC system;
(11) electrical load calculations, including rated power and operating conditions of electrical installations related to the EGC system;
(12) diagrams of power systems and single line diagram of main switchboard related to the EGC system, including parameters of breakers, type and cross section of cables of electrical installations related to the EGC system;
(13) arrangement of electrical equipment related to the EGC system, including control cabinets, pumps, fans, emergency shutdown devices of the EGC system;
(14) stability calculation information related to EGC system ready, including estimation of the weight and center of gravity of the EGC system and its relevant hull structures, capacity plan/table (if applicable), calculation of loading conditions (if applicable), damage stability calculations (if applicable), tonnage calculations (if applicable);
(15) other statutory plans and documents affected by change of ship's tonnage (if applicable);
(16) other necessary plans and documents.

1.4.2 For plans and documents related to conventional systems and/or equipment of ship shared with the EGC system, plan approval and survey are to be carried out in accordance with class requirements.

1.4.3 The components/equipment of the EGC system which have been pre-installed are to be clearly identified on the submitted plans and documents (e.g. alkali tank, washwater overboard discharge valve etc.) and inspected in accordance with relevant requirements.

Chapter 2 EGC System Ready Requirements

2.1 General requirements

2.1.1 For a ship intended to use the EGC system ready plan, the ship owner/designer is in general to determine the type selection, onboard installation and arrangement plan of the EGC system together with the manufacturer/designer of the EGC system.

2.1.2 The desulfurization agent intended to be used for the EGC system is to be defined. 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.

2.1.3 In order to ensure that the space, location and interfaces reserved at the design and construction stage of ship are suitable for the installation and modification of the EGC system on board in the future, the EGC system ready plan is to be developed based on a product with finalized design instead of a prototype product or a novel design, unless such design has obtained qualified third-party certification. When the EGC system is installed on board in the future, similar systems may be selected for replacement and the plans and documents of such systems are to be submitted.

2.1.4 Consideration is to be given to the effect of the EGC system on NO_x emission of diesel engines, in order to ensure that the exhaust backpressure is maintained within the range specified by the technical files of NO_x emission of diesel engines when the EGC system is installed and operated in the future.

2.1.5 Where other after-treatment devices (e.g. SCR) are installed or intended to be installed in the future in addition to the EGC system, compatibility between those after-treatment devices is also to be considered for EGC system ready.

2.1.6 For EGC system ready, consideration is to be given to the needs of system operation and maintenance in addition to the needs of installation and arrangement of system and equipment.

2.1.7 The size, weight, material, installation and arrangement, connection etc. of systems and equipment related to the onboard installation and use of the EGC system are to be indicated on the submitted plans and documents.

2.1.8 Consideration is to be given to the effect of changes in ship’s tonnage on applicable statutory requirements after installation of the EGC system.

2.1.9 Consideration is to be given to the effect on the longitudinal strength of ship due to installation of the EGC system in the future.

2.2 Matching design

2.2.1 When developing the EGC system ready plan, factors such as the mass flow rate, temperature and pressure of exhaust gas, SO_x concentration, backpressure etc. of designated fuel oil combustion units are to be comprehensively considered in order to ensure that the EGC system intended to be installed is capable of effective treatment of the maximum mass flow rate of exhaust gas generated in various conditions and operating modes from the connected fuel oil combustion units. In case of multiple fuel oil combustion units connected to a common EGC system for exhaust gas treatment, if not all fuel oil combustion units connected with the system work simultaneously in actual operation, the exhaust gas treatment capacity of the EGC system can be determined according to the sum total of the maximum possible exhaust gas in actual operation instead of the total exhaust gas when all units work simultaneously.

2.3 Exhaust backpressure

2.3.1 The pressure resistance of scrubber is to be analyzed in accordance with the connection methods and operating conditions of the EGC system and fuel oil combustion units to assess whether the exhaust backpressure of all connected fuel oil combustion units, after installation of the EGC system, can remain within the limits stated by the manufacturer. Where other after-treatment devices (e.g. SCR) are installed or intended to be installed in the future in addition to the EGC system, the assessment of backpressure is also to take into account the effect of such devices.

2.3.2 Where exhaust gas fans need to be fitted to maintain the required exhaust backpressure of connected fuel oil combustion units upon assessment, the information on the provision of fans is to be indicated in the ready plan, considering that a fan failure is not to prevent the fuel oil combustion units from operating.

2.4 Scrubber

2.4.1 Sufficient space is to be reserved for the installation and arrangement of the scrubber. In addition to satisfying the needs of the geometric structure of the scrubber, consideration is also to be given to the needs of installation of bypass and isolation devices (if any), exhaust gas collection devices (if applicable) and necessary maintenance space.

Note:

(1) Where the EGC system stops and the scrubber and its internal components cannot withstand the high temperature exhaust gas, consideration is to be given to the provision of bypass and isolation devices.

(2) For multiple fuel oil combustion units connected to a common EGC system for exhaust gas treatment, consideration is to be given to the provision of exhaust gas collection devices for multiple fuel oil combustion units. In addition, consideration is to be given to the provision of isolation devices in order to prevent the exhaust gas from flowing back to the stopped fuel oil combustion units.

2.4.2 The strength of the supporting structures of scrubber is to be assessed and consideration is to be given to the effect of the installation of scrubber on local vibration of the existing hull structures. Where strengthening is needed upon assessment, consideration is to be given to the implementation at the ship construction stage.

2.5 Subdivision and stability

2.5.1 The effect on the lightship weight and center of gravity after installation of the EGC system is to be assessed.

2.5.2 The subdivision and stability of ship after the installation of the EGC system are to be assessed, taking into account the weight of the EGC system in working condition.

2.6 Bunkering and storage of desulfurization agent

2.6.1 Sufficient space is to be reserved for the arrangement of the bunker station of desulfurization agent in accordance with the type of the EGC system. The bunker station is in general to be located on the open deck. Where it is provided in closed or semi-enclosed spaces, consideration is to be given to effective ventilation.

2.6.2 Consideration is to be given to reserving space required for installation of drip trays where leakage may be expected (e.g. bunker stations, transfer pumps, flange connections etc.) for

wet desulfurization system.

2.6.3 Sufficient space is to be reserved for the arrangement of the desulfurization agent storage tank. The capacity calculation 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 fuel oil combustion units, etc. Such reserved space is not to be located in the control station, accommodation and service spaces.

2.6.4 The arrangement of the desulfurization agent storage tanks is to take into account the impacts of heat transfer from other heated tanks or facilities and they are not to be arranged over boilers or in close proximity to steam piping, in order to avoid corrosion of materials of storage tanks after desulfurization agent is heated.

2.6.5 Hull structural strength related to the arrangement of the desulfurization agent storage tank is to be assessed and consideration is to be given to strengthening (if needed) at the ship construction stage.

2.7 Preparation (if any) and supply of desulfurization agent and alkali/serous fluid

2.7.1 Where a dry system is used, sufficient space is to be reserved for the arrangement of the preparation and supply system of desulfurization agent.

2.7.2 Where a wet system is used, sufficient space is to be reserved for the arrangement of the preparation (if any) and supply system of alkali/serous fluid. Where alkali/serous fluid is prepared by the preparation system on board, the space needs to be reserved by considering the capacity of tanks used for storage of the prepared alkali/serous fluid, which is not to be less than 2h alkali/serous fluid consumption of the desulfurization system in the design condition.

2.7.3 The alkali fluid piping system is not to be provided in or pass through accommodation spaces, service spaces and control stations, nor is it to be arranged over boilers or in close proximity to steam piping, exhaust systems, hot surfaces required to be insulated.

2.7.4 Consideration is to be given to reserving space required for installation of drip trays where leakage may be expected in the preparation and supply system of alkali/serous fluid.

2.8 Washwater system

2.8.1 Sufficient space is to be reserved for the arrangement of the washwater system.

2.8.2 The capacity of washwater treatment units is to satisfy the needs of washwater treatment of EGC system in the design condition.

2.8.3 Consideration is to be given to the arrangement of washwater overboard discharge system to ensure that it is not interconnected to other systems.

2.8.4 The overboard discharges of washwater are to be arranged to ensure that they are always below the overboard water level in normal draught. Such 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 during discharge of washwater. Discharges are to be arranged to enable safe sampling of washwater.

2.8.5 In order to facilitate the installation and modification of EGC system in the future, consideration is to be given to the installation location of washwater discharge valve. Where such valve is pre-installed, it is to be locked in the closed condition and provided with blind flanges and a sign board stating: the valve must be kept closed.

2.9 Residue system

2.9.1 Sufficient space is to be reserved for the arrangement of residue tanks, facilities for discharging residue to shore and relevant pipes. When calculating the capacity of the EGC residue tank, consideration is to be given to the number and type of installed SO_x scrubbers and the maximum period of voyage between ports where EGC residue can be discharged. In the absence of precise data, a figure of 30 days is to be used.

2.10 Exhaust system

2.10.1 The materials and design of exhaust pipes and components downstream of the scrubber are to take into account the needs of corrosion prevention and discharge of any condensate formed after installation of the EGC system.

2.10.2 Where exhaust monitoring units are required to be fitted for the EGC system, the location of exhaust sampling points is to be identified on the submitted plans and documents. The location of such sampling points is to satisfy the requirements of Chapter 5 and relevant appendix of CCS Guidelines for Testing and Survey of Emission of Nitrogen Oxide of Marine Diesel Engines.

2.11 Seawater/fresh water system

2.11.1 Sufficient space is to be reserved for the arrangement of the seawater/fresh water system of the EGC system.

2.11.2 Where the EGC system is connected to a common seawater/fresh water system on board, the capacity of the seawater/fresh water pump is to be sufficient to provide the desulfurization system with the required seawater/fresh water at the system's maximum working load without affecting normal operation of other essential auxiliary systems.

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

2.11.4 Where the sea inlet of the EGC system is connected to the existing sea chest on board, the calculation of sea chest grid area is to take into account the sea inlet area of the EGC system.

2.11.5 For closed loop desulfurization system and open-closed hybrid e system, the capacity of fresh water tanks and the provision of onboard freshwater generators are to take into account the fresh water consumption required for the operation of the EGC system.

2.11.6 Consideration is to be given to the installation location of sea inlet valve. Where such valve is pre-installed, it is to be locked in the closed condition and provided with blind flanges and a sign board stating: the valve must be kept closed.

2.12 Electrical system

2.12.1 The ship's power station is to be designed by taking into account the power needs of electrical installations such as pumps and fans which are necessary for the operation of the EGC system and sufficient capacity is to be reserved to ensure that the number or capacity of generators need not be added after installation of the above equipment.

2.12.2 Consideration is to be given to reserving breakers for electrical installations related to the EGC system on the main switchboard or the distribution board. If it is intended to be supplied by the distribution board, the capacity of the feeder switch for the distribution board on the main switchboard is to ensure the normal use after installation of the EGC system.

2.13 Control and monitoring

2.13.1 Consideration is to be given to reserving space for local control box/panel of the EGC system and it is recommended to reserve the space for the emergency shutdown devices of the EGC system in the engine room centralized control station.

2.13.2 For onboard equipment required to transmit signals to the EGC system, e.g. engine room monitoring and alarm system, GPS etc., consideration is to be given to reserving signal transmission interfaces.