2019

Guidance for Exhaust gas Emission Abatement System

GC-26-E

KR

APPLICATION OF
"Guidance for Exhaust gas Emission Abatement System"

1. Unless expressly specified otherwise, the requirements in the Guidance apply to ships for which contracts for construction are signed on or after July 1st 2019.
2. The amendments to the Guidance for 2018 edition and their effective date are as follows;

Effective Date 1 July 2019

Section 1 Selective Catalytic Reduction system Using Ammonia Solutions or Urea Solutions as the Reductant Agents(SCR)

- 101. 1.(4) has been amended.

Section 2 Exhaust Gas Recirculation system(EGR)

- 201. 3 has been amended.

Section 3 Exhaust Gas Cleaning system(EGC)

- 301. 3 has been amended and 4 newly added.
- 302. 1 has been amended.
- 304. 3 & 4 have been amended.
- 306. 2.(3), (4) & 3 have been amended.
- 307. 3 has been amended.
- 308.2 & 3 have been amended.

CONTENTS

Section 1 Selective Catalytic Reduction system Using Ammonia Solutions or Urea Solutions as the Reductant Agents(SCR)

101. General

1. Application

(1) This Guidance applies to the SCR systems, reductant agent tanks and piping systems of reductant agents, etc. using ammonia solutions or urea solutions as the reductant agents to reduce NOx emission from diesel engines. In cases where agents other than those mentioned above are used, they are to be as deemed appropriate by the Society.

(2) This Guidance covers only the safety requirements for the installation of SCR systems, the performance and tests, etc. related to SCR systems to reduce NOx emission are to comply with **MARPOL Annex VI** and Marine Environment Management Act.

(3) The requirements in this Guidance are to apply in addition to the other requirements of the Rules.

(4) Where a ship designed for the reduction of NOx emissions by the use of Selective Catalytic Reduction system is designed, is to be constructed and tested in accordance with this Guidance, the **EEAS-SCR** notation is to be assigned.

(5) Since Selective Catalytic Reduction System technology will be under constant development, the requirements of this Guidance may need to be supported by additional information and requirements, on a case by case basis. Designs that are not in compliance with this Guidance may be approved after evaluation by the Society, provided that it can be demonstrated that the design represents an equal or better level of safety.

2. Definitions

The definitions of terms are to be followed to the Rules, unless otherwise specified below.

(1) **SCR system** means a system consisting of a an SCR chamber and a reductant injection system.

(2) **SCR chamber** means an integrated unit, which contains the catalyst blocks, and into which flows exhaust gas and reductant, and which receives the reductant agent supply from the reductant agent injection system.

(3) **Catalyst block** means a block of certain dimension through which exhaust gas passes and which contains catalyst composition on its inside surface to reduce NOx from exhaust gas.

(4) **Reductant injection system** means a system, which consists of the pumps to supply reductant to the nozzles, the nozzles to spray reductant into the exhaust gas stream and control devices of the spray.

(5) **Control system** means a system, which adjust quantity of the reductant agent required depending on the changes of engine load and speed, and which supply to the reductant injection system by compressed air and control the operation of the soot blowing system, includes the system to control the changeable device of exhaust gas.

(6) **Soot blowing system** means a system, which blows soot accumulated inside the catalyst block using the air or steam.

(7) **Ammonia slip** means that ammonia is released into the atmosphere without being completely consumed at the catalytic reaction.

102. Plans and Data

1. Plans and specifications covering the Selective Catalytic Reduction(SCR) system are to be submitted and are, as applicable, to include:

(1) General arrangement of the SCR installation, layout, and systems

(2) Documentation detailing the SCR specification

(3) Documentation demonstrating the **104.(2).(1)**

(4) Material specifications for the SCR equipment and associated systems, including blowers, pumps, valves, storage/process tanks, residue tanks, piping

(5) Arrangement and capacity of tanks for reductant agents storage

(6) Details of all piping systems

(7) Descriptions and schematic diagrams for the control and monitoring systems

(8) Details of damper/bypass valves

(9) Documentation detailing the effect on Load Line and Stability of the exhaust gas cleaning system(retrofit only)
(10) Documentation detailing the effect on electric load(retrofit only)

103. Operation and Maintenance Manuals

1. Detailed instruction manuals are to be provided onboard, covering the operations, safety, and maintenance requirements and occupational health hazards relevant to the SCR equipment and associated systems.

2. These manuals are to include, but not necessarily be limited to, the procedures and schedules for operation, inspection, testing, and maintenance of the SCR system and associated systems, the regular testing and maintenance procedures for the monitoring systems, safety shutoff systems, and the integrity of backup systems, together with special instructions for the bunkering, storage, and use of hazardous and non-hazardous chemicals that may be used in the SCR system.

3. The manuals may be produced as standalone documents or incorporated within the general engine operation and service manuals.

104. System design

1. General

(1) The piping system which may contain ammonia solution and urea solution is to comply with the requirements of the Rules in addition to the requirements of this Guidance.
(2) The control system of the reductant injection system is to be in accordance with the requirements in **Pt 6, Ch 2** of the Rules, automatic and remote control system is to be in accordance with the requirements in **Pt 9, Ch 3** of the Rules.
(3) Structural materials used for SCR systems and reductant agent tank construction, together with associated piping, pumps, valves, vents and their component materials, are to be suitable at the temperature and pressure for the reductant agent to be carried.

2. SCR system

(1) SCR chamber
  (A) SCR chamber is to be arranged so that the back pressure of the exhaust pipes connecting exhaust pipe end of the stack to the engine does not exceed the allowable back pressure recommended by the engine manufacturer.
  (B) Changeable device of exhaust gas piping
    (a) In cases where exhaust gas piping system of the engines can be changed over from ordinary exhaust gas piping to piping connected to the SCR system, the branch pipe is to be provided with the changeable damper.
    (b) The changeable damper is to be fitted with interlock devices, etc. to prevent the closing of both the exhaust gas piping of ordinary use and the piping supplying exhaust gas to the SCR chamber in the same time.
    (c) The changeable damper is to be fitted with the indicators showing the exhaust gas piping being used.
  (C) Catalyst blocks are to be constructed which can be easily replaced. Sufficient space for replacing catalyst blocks is to be provided on board ship.
  (D) Consideration is to be given to SCR chambers so that the degradation of catalytic reaction by the adherence of soot, etc. is prevented.
(2) Reductant injection system
  (A) Injection control system
    (a) Reductant injection system is to be provided with interlock devices so that the reductant solution can not be injected in cases where the temperature of exhaust gas at the inlet of the SCR chamber is below the design temperature specified by the manufacturer.
    (b) The amount of injected reductant is to be appropriately controlled depending upon the load of the engines or quantity of NOx emissions in consideration of the temperature of the exhaust gas at the inlet of the SCR chamber and the sulphur content concentration in the fuel oil.
    (c) The amount of injected reductant is to be appropriately controlled in order to prevent from occuring the ammonia slip.

(B) Devices for monitoring amount of injected reductant

Device for monitoring the amount of reductant injected when using the SCR system are to be provided at at least one of the monitoring stations for engine (eg, a bridge if a bridge control system is installed, engine control room, or machine control side,).

(C) Injecting position of reductant agents

The reductant is to be injected at the proper positions inside the exhaust gas piping or SCR chamber so that the ammonia gas is able to inflow uniformly.

(D) Safety and alarm devices

The reductant injection system is to be provided with safety and alarm devices to prevent the injection of reductant when the temperature at the outlet of engines or the inlet of the SCR chamber exceeds the preset level in order to avoid any self-ignition of ammonia gas caused by an abnormal rise in exhaust gas temperature.

(3) Storage and Supply system of reductant agents

(A) Construction and Arrangement

(a) Compartment excluding machinery spaces provided with reductant agent storage tanks(excluding solid urea storage tanks) and reductant injection systems, etc. are not to be adjacent to accommodation spaces, service spaces or control stations.

(b) Piping systems for the supply, transfer, injection or discharge of the reductant agent are not to pass through accommodation spaces, service spaces or control spaces.

(c) Piping systems for the supply, transfer, fill, or discharge of the reductant agent are not to pass through liquid storage tanks.

(d) The supply and transfer pipes of reductant agents, other than the reductant agent injection nozzles, are not to be located immediately above or near units of high temperature including boilers, steam pipelines and exhaust manifolds, silencers or other equipment required to be insulated as specified in **Pt 8, Ch 2, 102. 6** of the Rules. As far as practicable, supply and transfer pipes are to be arranged far apart from hot surfaces, electrical installations or other sources of ignition and are to be screened or otherwise suitably protected to avoid reductant agent spray or leakage onto the sources of ignition.

(e) Drain trays of adequate size are to be provided at a position which is lower than the reductant agent storage tanks, reductant injection systems and etc. in the SCR system compartment so that reductant agent does not leak outside the compartment.

(B) Closing and Shut-off devices

(a) Reductant agent pipes, which, if damaged, would allow reductant agent to escape from a storage tank situated above the double bottom, are to be fitted with a cock or valve directly on the tank capable of being closed from a safe position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated. In the special case of deep tanks situated in any shaft or pipe tunnel or similar space, valves on the tank are to be fitted, but control in the event of fire may be effected by means of an additional valve on the pipe or pipes outside the tunnel or similar space. If such an additional valve is fitted in a machinery space, it is to be operated from a position outside this space.

(b) Shut-off devices are to be provided with the reductant agent supply pumps. Such devices are to be installed outside of the space concerned, where they will not be cut off in the event of fire in the space they serve, in addition to being installed inside such space.

(c) In cases where exhaust gas heating devices which are fitted with burners and blowers are installed, burners and air supply systems are to be provided with shut-off devices capable of being operated from outside the spaces in case of a fire, in addition to those installed inside the space.

(4) Exhaust gas heating device

(A) General

In cases where exhaust gas heating devices are installed in order to raise the temperature of the exhaust gas from engines, the requirements in this guidance are to be complied with. Exhaust gas heating devices which are not equipped with burners are to conform to requirements deemed appropriate by the Society.

(B) Construction and Arrangement

(a) Exhaust gas heating devices are to be arranged so that the pressure in exhaust gas pipes does not exceed the allowable back pressure recommended by the engine manufacturer.

(b) Suitable means are to be taken to prevent the frame of the burner from coming in di-

rect contact with the exhaust gas from the engines.

(c) Suitable means to prevent the accumulation of unburnt fuel from engines in exhaust gas heating devices when the SCR system is not in use or to prevent the unburnt fuel from engines from exploding when the burner is injected are to be taken. In cases where the damper is installed in the flue gas line of the exhaust gas heating device, indicators are to be provided local to the damper showing whether they are open or shut.

(d) Temperature measuring devices of the combustion gas at the outlet of the exhaust gas heating device or of the exhaust gas at the inlet of SCR systems are to be provided.

(e) Air supply system of adequate capacity is to be provided so that the temperature of the exhaust gas rises to the required level.

(f) Means to clean and inspect the combustion chambers and gas flue lines of exhaust are to be provided.

(g) The construction and control of burners are to comply with the requirements in the following :

(i) The fuel supply is to be appropriately controlled so that the temperature of the exhaust gas from engines is heated to a temperature on which the catalytic agent is able to activate effectively.

(ii) Combustion chamber is to be pre-purged by air before ignition.

(iii) In cases where an automatic ignition system is installed, the burners are to be arranged so that the fuel supply does not precede the ignition spark.

(iv) In cases where an automatic fuel supply system is installed, the burners are to be capable of controlling the amount of fuel supplied.

(v) In cases where an automatic combustion control device is installed, the main burner and pilot burner, etc. are to operate in accordance with designed procedures.

(C) Installation

Exhaust gas heating devices are to be fitted so as to minimize the effects of the following loads or external forces :

(a) Ship motions or any vibrations caused by machinery installations

(b) External forces caused by the piping and supporting members fitted on the exhaust gas heating device

(c) Thermal expansions due to temperature fluctuation

(D) Safety and Alarm devices

(a) Fuel oil shut-off device

Each exhaust gas heating device is to be provided with a safety device which is capable of shutting off automatically the fuel supply to all burners in the case of the following :

(i) When the temperature of combustion gas at the outlet of the exhaust gas heating device or exhaust gas temperature at the inlet of SCR chamber exceeds the preset temperature of the normal operation of the SCR system

(ii) When automatic ignition fails

(iii) When the flame vanishes (in this case, the fuel oil supply is to be shut-off with in 4 seconds after the extinguishing of flame)

(iv) When the combustion air supply stop

(v) When the fuel oil supply pressure to the oil burners falls in the case of pressure atomizing, or when the steam pressure to the burners falls in steam atomizing

(vi) When considered necessary by the Society

(b) Alarm device

Each exhaust gas heating device is to be provided with an alarm device which operates in the following cases :

(i) When the temperature of combustion gas at the outlet of the exhaust gas heating device or exhaust gas temperature at the inlet of SCR chamber exceeds the preset temperature of the normal operation of the SCR system

(ii) When combustion air supply reduces, or when the draught fan stops

(iii) When the fuel oil supply pressure to the oil burners falls in the case of pressure atomizing, or when the steam pressure to the burners falls in steam atomizing

(iv) When the flame vanishes

(v) When the power supply to the alarm device stops

(vi) When considered necessary by the Society

105. Special requirements in cases where the urea solution is used as reductant agent

1. Urea solution storage tank

(1) The storage tank is to be arranged so that any leakage will be contained and prevented from making contact with heated surfaces. All pipes or other tank penetrations are to be provided with manual closing valves attached to the tank.
(2) The storage tank may be located within the engine room.
(3) The storage tank is to be protected from excessively high or low temperatures applicable to the particular concentration of the solution. Depending on the operational area of the ship, this may necessitate the fitting of heating and/or cooling systems. The physical conditions recommended by applicable recognized standards (such as ISO 18611-3) are to be taken into account to ensure that the contents of the aqueous urea tank are maintained to avoid any impairment of the urea solution during storage.
(4) Where urea based ammonia solution is stored in integral tanks, the following are to be considered during the design and construction:
  (A) These tanks may be designed and constructed as integral part of the hull, (e.g. double bottom, wing tanks).
  (B) These tanks are to be coated with appropriate anti-corrosion coating and cannot be located adjacent to any fuel oil and fresh water tank.
  (C) 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.
  (D) These tanks are to be fitted with but not limited to level gauge, temperature gauge, high temperature alarm, low level alarm, etc.
  (E) These tanks are to be included in the ship's stability calculation.
(5) Each urea storage tank is to be provided with temperature and level monitoring arrangements. High and low level alarms together with high and low temperature alarms are also to be provided.
(6) Urea storage tanks are to be arranged so that they can be emptied of urea, purged and vented.

2. Ventilation

(1) If a urea storage tank is installed in a closed compartment, the area is to be served by an effective mechanical supply and exhaust ventilation system providing not less than 6 air changes per hour which is independent from the ventilation system of accommodation, service spaces, or control stations. The ventilation system is to be capable of being controlled from outside the compartment and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly air purged. If the ventilation stops, an audible and visual alarm shall be provided outside the compartment adjacent to each point of entry and inside the compartment, together with a warning notice requiring the use of such ventilation. Alternatively, where a urea storage tank is located within an engine room a separate ventilation system is not required when the general ventilation system for the space is arranged so as to provide an effective movement of air in the vicinity of the storage tank and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly air purged.
(2) In cases where urea solution is transferred to a tank which forms part of the ship's hull, the enclosed spaces(excluding water tanks and oil tanks) adjacent to the urea solution tanks are to be provided with the mechanical ventilation which can be operated from outside the spaces.

3. Piping system and venting system of urea solution storage tank

(1) The reductant piping and venting systems are to be independent of other ship service piping and/or systems. Reductant piping systems are not to be located in accommodation, service spaces, or control stations. The vent pipes of the storage tank are to terminate in a safe location on the weather deck and the tank venting system is to be arranged to prevent entrance of water into the urea tank.
(2) Reductant related piping systems, tanks, and other components which may come into contact with the reductant solution are to be of a suitable grade of non-combustible compatible material established to be suitable for the application.

4. Safety & Protective equipment

(1) For the protection of crew members, the vessel shall have on board suitable protective equipment consisting of large aprons, rubber gloves with long sleeves, rubber boots, coveralls of chemical-resistant material, and tight-fitting chemical safety goggles or face shields or both.

And, the quantity to be supplied is to be at least two sets.

(2) Eyewasher and safety showers are to be provided near the bunker manifold and the process fluid transfer pump. If several bunker manifolds are installed on the same deck, one could be installed if the bunker manifold can be easily accessed to eyewasher and safety shower from the bunker manifold. The treatment fluid transfer pump can be applied in the same manner as the bunker manifold.

106. Special requirements in cases where the ammonia solution is used as reductant agent

1. General

(1) Ammonia is not to be used as a reductant in a SCR except where it can be demonstrated that it is not practicable to use a urea based reductant. Where an application is made to use aqueous ammonia as the reductant then the arrangements for its loading, carriage and use are to be derived from a risk based analysis.

2. Construction and Arrangement

(1) The independent compartment where ammonia solution storage tanks or ammonia solution injection systems, etc. are installed(hereinafter referred to as "ammonia solution installation compartment") is to comply with the requirements in **Pt 9, Ch 1, 404. 1** of the Rules.

(2) Where ammonia solution is transferred to the tanks which form part of the ship's hull, the following are to be complied with :

(A) Requirements for both installation and design of the tank types are to comply with the requirements in **Pt 7, Ch 6, Sec 4** of the Rules. In the guidance, the word "cargo" means ammonia solution.

(B) For location of the tanks, the vertical extent is to comply with the requirements in **Pt 7, Ch 6, 205. 1** (2) of the Rules. And nowhere less than 760mm from the shell plating.

(C) The segregation of other spaces is to comply with the requirements in **Pt 7, Ch 6, 301. 1** of the Rules.

3. Materials

(1) Materials capable of highly corrosion(copper, zinc, cadmium, or their alloys) and materials containing mercury are to be not used at locations where ammonia comes in contact.

(2) Nickel steel is not to be used in pressure vessels and piping systems.

(3) Cast-iron valves are not to be used in the reductant agent piping system.

4. Ventilation

(1) Ventilation systems in the ammonia solution installation compartment are to comply with the requirements in **Pt 9, Ch 1, 405. 2** of the Rules.

(2) In cases where the required air flow is not established and maintained by the exhaust ventilation system, ammonia solution supply pumps are to stop automatically and main valves of ammonia solution tanks are to close automatically.

5. Ammonia solution piping system

Ammonia solution pipes are to be classified into Class I piping specified in **Pt 5, Ch 6** of the Rules.

6. Drain tanks

(1) Drain tanks which comply with the following are to be installed at a lower position than ammonia solution installation compartments.

(A) In cases where the drainage accumulated in the tank is to be discharged overboard, it is to be diluted or neutralized before discharge.

(B) An drain trap is to be arranged to prevent the reverse flow of the gas from the tanks.

(C) All the vent pipes of the tank are to be connected to the exhaust pipe of the ventilation system.

7. Venting systems of ammonia solution storage tanks

Each ammonia solution storage tank is to be fitted with a controlled tank venting system complying with the requirements in **Pt 7, Ch 6, 803.** of the Rules. Where, the word "cargo" means ammonia solution.

8. Ammonia solution supply system

(1) Ammonia solution supply piping is not to pass through accommodation spaces, service spaces or control stations. Ammonia solution supply piping may pass through or extend into spaces other than ones in spaces above provided they comply with the following:

(A) Ammonia solution supply piping is to be installed within a ventilated pipe or duct. The air space between the ammonia solution supply piping and the inner wall of this pipe or duct is to be equipped with mechanical exhaust ventilation having a capacity of at least 30 air changes per hour. The ventilation system is to be arranged to maintain a pressure less than the atmosphere pressure. The fan motors are to be placed outside the ventilated pipe or duct.

(B) The ventilation outlet is to be installed at the location specified in **Pt 9, Ch 1, 405. 2** (1) (C) of the Rules.

(C) The ventilation system may double as the one required for ammonia solution installation compartments. In this case, the capacity of the system is to be of 30 air changes per hour for both the ammonia solution installation compartment and the space specified in (a) above.

(D) Continuous gas detection is to be provided to indicate leaks and to shut down the ammonia solution supply to the machinery space.

(E) Ammonia solution supply pumps are to stop automatically and main valves of ammonia solution tanks are to close automatically, if the required air flow in not established and maintained by the exhaust ventilation system.

(F) If ammonia solution leak occurs, the ammonia solution supply is not to be restored until the leak has been found and repaired. Warning notices to this effect are to be placed in a prominent position in the machinery spaces.

(G) Ammonia solution leaked from ammonia solution supply pipes is to be led to drain tanks. This drain tank can double as tanks which accumulate ammonia solution leaked from ammonia solution installation compartments.

(2) The ammonia solution supply pipes arranged in ammonia solution installation compartments need not comply with the requirements specified in (A) above.

9. Ammonia solution discharge system

(1) When it is necessary to remove the ammonia solution inside pipes for repairs to any leaking areas of the pipes, ammonia solution discharge piping is to be equipped with a means to temporarily discharge ammonia solution remained in the pipes to tanks.

(2) In cases where a drain tank is used as a means specified (A) above, the following are to be complied with:

(A) Discharge piping is to be installed from the bottom of ammonia solution supply piping to a drain tank, and a stop valve is to be fitted for the discharge piping.

(B) The capacity of the drain tank is to be sufficient to storing the maximum volume of ammonia solution which can remain in the pipes from the main valve of ammonia solution tank to the injection nozzle. Drain tanks are to be equipped with a sounding device.

10. Filling pipes of ammonia solution tank

(1) Filling pipes of ammonia solution storage tank from outboard are to be of exclusive use and to be led above decks as far as possible, and to be provided with a shut-off valve and a blank flange at their open ends. This piping is to be fitted at least 760mm inboard on the open deck and to be identified definitely.

(2) Fixed drip trays or portable drip trays are to be provided below the open end of the ammonia solution filling piping.

(3) Ammonia solution filling piping is to be installed on top or near the location of the ammonia solution storage tanks.

(4) Ammonia solution filling pipes are to be arranged to prevent the emission of gas remaining in the line after use or when not in use.

11. Gas detection and alarm system

(1) Gas detection and alarm systems are to be provided in ammonia solution installation compartments, spaces adjacent to ammonia solution storage tanks which form part of the ship's hull and the empty spaces in the double wall pipes or ducts specified in **8.** (1) (A) above complying with the following requirements :

(A) The gas detector complying with the requirements given below, is to be installed on the upper-side of each ammonia solution installation compartment and at the ventilation outlet of the double wall pipes or ducts.
  (a) The detectors are to activate an alarm when the gas concentration exceeds 25 ppm.
  (b) When the gas concentration exceeds 300ppm, the detector is to automatically stop the ammonia solution supply pumps, automatically close the main valves of ammonia solution storage tanks, and activate the alarm.

(B) Regardless of (a) above, in cases where mechanical ventilation system for double wall pipes or ducts doubles as the one for the ammonia solution installation compartment, the gas detection and alarm system required for the double wall pipes or ducts may double as the one for the ammonia solution installation compartment.

(C) At least one portable gas detection instrument is to be provided for each ammonia solution installation compartment.

(D) The alarm systems are to generate visible and audible alarms near the doors, within and outside the ammonia solution installation compartment and at monitoring locations.

(E) A manually-operated transmitter for leakage warnings is to be provided, near the doors and outside the ammonia solution installation compartment.

(2) Gas detection and alarm system complying with the following requirements are to be provided in passages leading to the ammonia solution installation compartment.

(A) The gas detectors are to activate the alarm system when the gas concentration exceeds 25 ppm.

(B) The alarm systems are to generate visible and audible alarms in the passage and near the doors of the ammonia solution installation compartment.

(3) Detectors are to be capable of continuous detection and considered to be appropriate by the Society.

12. Safety and protective equipment

Ammonia solution installation compartments are to be provided with the safety and protective equipments complying with the requirements in **Pt 9, Ch 1, 408.** of the Rules, in cases where ammonia solution is used as the reductant agent.

107. Survey and Test

1. General

(1) These requirements apply to shop test and onboard test of EGC systems and associated systems. Following tests may be incorporated with the tests required by Pt 5, **Ch 2, 211.** of the Rules.

2. Test

(1) Inspection and verification that the foundations and attachments of the principal components of the SCR equipment and associated systems are in accordance with the approved plans and particulars.

(2) Piping systems are to be examined and tested in accordance with Pt 5, **Ch 6, Sec. 14** of the Rules.

(3) Electrical equipments are to be examined and tested in accordance with **Pt 6, Ch 1** of the Rules.

(4) Instrumentation is to be tested to confirm proper operation as per its predetermined set points.

(5) Pressure relief and safety valves installed on the unit are to be tested.

(6) Control system and shutdowns are to be tested for proper operation.

Section 2 Exhaust Gas Recirculation system(EGR)

201. General

1. This Guidance are to apply to Exhaust Gas Recirculation system and their auxiliary systems reducing diesel engine NOx emissions.

2. For items not specified in this Guidance, the relevant requirements specified in **Pt 5** of the Rules apply.

3. Where a ship designed for the reduction of NOx emissions by the use of Exhaust Gas Recirculation system is designed, constructed and tested in accordance with this Guidance, the EEAS-EGR notation is to be assigned. Where a ship provided EGR systems that incorporate engine systems that are designed for the purposes of removing the sulfur by-products from the exhaust gases that originate from the fuel and incorporate, for example, water scrubbing and water cleaning systems, the **EEAS-EGR** is to be assigned. Where a water treatment system is incorporated in the EGR system, the washwater discharge criteria is to meet the requirements of **IMO Res. MEPC.259(68)**.

4. Since EGR technology will be under constant development, the requirements of this Guidance may need to be supported by additional information and requirements, on a case by case basis. Designs that are not in compliance with this Guidance may be approved after evaluation by the Society, provided that it can be demonstrated that the design represents an equal or better level of safety.

202. Plans and Data

1. Plans and specifications covering the EGR arrangements are to be submitted and are, as applicable, to include:

(1) General arrangement of the EGR installation, layout, and systems
(2) Documentation detailing the EGR specification and associated water treatment systems, including details of EGR specific components such as coolers, blowers, valves, etc.
(3) Hull plans showing the foundation and attachments of accessories to the vessel's structure, including scantlings, welding details, and foundation details of principal components
(4) Material specifications for the EGR equipment and associated systems, including coolers, blowers, pumps, valves, storage/process tanks, residue tanks, piping, distribution systems, separators, and associated components, including a corrosion assessment detailing the corrosive effect of system liquids, vapors, and gases on the materials used in the exhaust emission abatement system
(5) Arrangement and capacity of tanks for storage, chemicals, process washwater, exhaust gas cleaning residues, etc.
(6) Details of all piping systems, including details of piping and associated components, design pressures, temperatures, insulation, and drip trays, where applicable
(7) Descriptions and schematic diagrams for the control and monitoring systems, including set points for abnormal conditions and details of the location and position at which exhaust emission or EGR rate monitoring and washwater monitoring are to be located
(8) Details of all electrical equipment installed for the EGR unit and associated systems, including computer-based systems
(9) Data describing the identification of hazards associated with the design and operation of the exhaust gas cleaning system and the means of safeguard or control thereof
(10) Emergency shutdown arrangements

203. EGR Operation and Maintenance Manuals

1. Detailed instruction manuals are to be provided onboard, covering the operations, safety, and maintenance requirements and occupational health hazards relevant to the EGR exhaust emission abatement equipment and associated systems.

2. These manuals are to include, but not necessarily be limited to, the procedures and schedules for operation, inspection, testing, and maintenance of the EGR system and associated systems, the regular testing and maintenance procedures for the monitoring systems, safety shutoff systems, and the

integrity of backup systems, together with special instructions for the bunkering, storage, and use of hazardous and non-hazardous chemicals that may be used in the exhaust emission abatement system.

3. The manuals may be produced as standalone documents or incorporated within the general engine operation and service manuals.

204. EGR System Configuration

1. General

(1) Exhaust Gas Recirculation is the process of recirculating a portion of the diesel engine exhaust gases, typically up to 40%, back to the engine cylinders for the purpose of reducing the amount of excess oxygen within the cylinder and thereby reducing engine NOx emissions.

(2) EGR systems are to be designed to enable continued operation of the engine at the times the EGR system is not in operation, either through operational selection, equipment failure, or system deterioration through partial blocking/clogging.

2. Compatibility with the Engine

(1) Installation and operation of the EGR system is to be compatible with the engine and not to cause any adverse effects on the engine performance such as excessive back pressures or temperatures during operation.

(2) The range of suitable fuels for which the EGR system is capable of continual operation, in particular with respect to sulfur content and other fuel elements known to cause fouling issues, is to be declared by the EGR manufacturer and included in the EGR specification documentation and instruction manuals.

3. Redundancy

(1) Redundancy of equipment is to be provided for those rotating and reciprocating components that form part of the EGR essential supplementary systems, such as pumps, fans, blowers, etc.

(2) Consideration will be given to alternative means of compliance or operation to meet above (A) on a case-by-case basis. As applicable, documentation is to be submitted demonstrating that the reliability of the system or component provides continued serviceability of the exhaust emission abatement system or the alternative means of operation provides continued compliance with the statutory environmental requirements, without compromising the vessel propulsion and maneuvering capability.

4. Essential Services

(1) For the purposes of design, construction, testing, and survey, EGR units and associated components and systems are considered secondary essential services in accordance with the requirements specified in **Pt 6, Ch 1, 101. 4** (13) of the Rules.

5. Prevention of Flooding

(1) For EGR systems that incorporate a wet washwater scrubbing process, arrangements are to be provided to prevent the ingress of scrubber washwater into the engine under any circumstance.

(2) Monitoring, alarm, and shutdown arrangements are to be provided to prevent an abnormal rise of washwater level in the EGR scrubber unit.

6. EGR is to be designed for proper operation at the inclination requirements specified in **Pt 5, Ch 1, 103. Table 5.1.2** of the Rules.

205. EGR System Equipment

1. Pumps/Blowers

(1) Where provided, blowers and pumps used in EGR SOx scrubber washwater, dosing, discharge, etc., systems, essential for the continual operation of the EGR exhaust emission abatement system, are to be tested and certified in accordance with the relevant requirements of **Pt 5, Ch 1, 210 & Ch 6.**

(2) Unless alternative means of compliance in accordance with **4.** (3) (B) of this Guidance are applicable, redundant washwater, dosing, discharge, etc., pumps, essential for the continual operation of the EGR water systems, are to be provided. There are to be at least two of these essential pumps, the capacity of the pumps, with any one pump out of service, is to be sufficient

for continuous operation of the exhaust emission abatement system at full rating.

(3) Where ships fitted with two or more identical exhaust emission abatement systems, the provision of a common standby pump (for each essential system) capable of serving all EGR units will suffice rather than providing individual standby pumps for each EGR unit.

(4) Unless alternative means of compliance in accordance with **204** (3) (B) of this Guidance are applicable and where exhaust fans or blowers form part of the EGR system and are essential for continual operation of the exhaust emission abatement system at full rating, such fans or blowers are to be installed in a redundant arrangement. The number and power of the fans or blowers should be such that if one unit, or group of units, is out of service the capacity of the remaining units is not to be less than 100% of the total required.

2. Heat Exchangers/EGR Exhaust Gas Coolers

(1) Where provided, heat exchangers are to comply with the requirements specified in **Ch 5, Sec. 3** of the Rules.

3. Electrical System

For items not specified in this Guidance, the relevant requirements specified in **Pt 6** of the Rules apply.

(1) Electrical Motors and Controllers
Motors and motor controllers are to be ceritified in accordnace with the relevant requirements specified in **Pt 6** of the Rules.

(2) Standby Pump/Fan
In the event of failure of the essential exhaust emission abatement system pumps or fans/blowers, the standby pump or fan/blower, where provided, is to be automatically started and put into service. This failure is to be alarmed at the local and remote control stations.

(3) Circuit Protection Devices
Circuit breakers are to be installed for miscellaneous EGR system electrical loads and are to be compatible with the prospective short circuit current level calculated at the switchboards.

206. EGR System Piping

1. Exhaust Gas Piping Systems

(1) Exhaust Gas Piping/Scrubber Materials and Installation
(A) Exhaust gas piping materials located before the EGR SOx scrubber, where fitted, may be of the same material specification as the standard engine exhaust gas piping.
(B) The sections of the scrubber that are subjected to washwater (e.g., the interior reaction chamber or washwater piping/nozzles, etc.) are to be constructed of suitable corrosion resistant materials.
(C) Exhaust gas piping materials used after the SOx scrubber unit are to be of a corrosion resistant material such as stainless steel.

(2) Exhaust Gas Piping Valves
(A) Valves used in the EGR exhaust system are to comply with the relevant requirements specified in **Pt 5, Ch 6** of the Rules. The valves are to be constructed of corrosion resistant materials.
(B) The EGR exhaust system valves are to be arranged for automatic position control and position monitoring in association with the EGR control and monitoring system.
(C) Valves are to be installed in accessible locations, clear of or protected from obstructions, moving equipment, and hot surfaces, in order to permit regular inspection and periodic servicing.

(3) Insulation
Hot surfaces of EGR systems or their associated equipment or systems likely to come into contact with the crew during operation are to be suitably guarded or insulated. Where the surface temperatures are likely to exceed 220°C and where any leakage, under pressure or otherwise, of fuel oil, lubricating oil or other flammable liquid is likely to come into contact with the EGR unit or exhaust pipes, these surfaces are to be suitably insulated with non-combustible materials that are impervious to such liquids.

2. Washwater Piping

(1) Piping and Connections
(A) Where applicable, the EGR SOx washwater system pipe fittings and joints are to comply

with the requirements specified in **Pt 5, Ch 6** of the Rules.

(B) The piping material for the corrosive scrubber washwater system is to be selected based on the corrosive nature of the liquid media.

(2) Remote Control Valves

(A) Upon loss of control power, the remote control valves are to remain in the last ordered position, provided there is a readily accessible manual means to close the valves or are to fail safe.

(B) Remote control valves are to be clearly identified and are to be provided with position indicators at the local and EGR system remote control station, as applicable.

(C) Valves are to be installed in accessible locations, clear of or protected from obstructions, moving equipment, and hot surfaces, in order to permit regular inspection and/or periodic servicing.

(3) Overboard Discharges

(A) The overboard discharges of any exhaust emission abatement system are not to be interconnected to other systems. However, if backflow prevention means are provided, seawater from other systems used for dilution is acceptable.

(B) Special attention is to be paid to the corrosion resistivity of EGR washwater overboard discharge piping. Where applicable, adequate arrangements are to be provided to prevent galvanic corrosion due to the use of dissimilar metals.

(C) The distance piece between the outboard discharge valve and the shell plating is not to be less than the thickness of the shell plating. However, it is to be at least 15mm.

(D) Due consideration is to be given to the location of overboard discharges with respect to vessel propulsion features, such as thrusters or propellers.

3. Chemical Treatment Piping Systems

The requirements for the washwater chemical treatment system detailed in this paragraph are based on the use of Caustic Soda (NaOH) in the EGR scrubber water treatment system, as applicable. If other chemicals are to be used, the requirements should be consistent with the intent of the requirements for Caustic Soda but would need to be assessed on a case-by-case basis.

(1) Material

(A) The material of the NaOH related piping systems, NaOH storage tank, EGR residue/NaOH overflow tanks, drip trays, and any other components which may come into contact with the NaOH solution or sludge is to be of a suitable grade of stainless steel or other corrosion-resistant material established to be suitable for the application. Aluminum, zinc, brass, or galvanized steel components are not to be used.

(2) Bunkering of NaOH

(A) The bunker station for NaOH 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 NaOH contacting or mixing with other incompatible materials. Alternatively, closed or semi-enclosed bunker stations may be approved subject to the provision of effective ventilation.

(B) Spill trays, which may be of the dry type or having means of drainage to the EGR residue/ NaOH overflow tank, are to be provided.

(3) Arrangement of Tank

(A) The NaOH storage and EGC residue/NaOH overflow tank are not to be situated where spillage or leakage therefrom can constitute a hazard by falling 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

(A) The NaOH storage tank is to be provided with a fill line from the bunker station and a shut off valve is to be provided at the bunkering station. Overflow and drains leading to the EGR residue/NaOH overflow tank are to enter at or near the top of the tank. However, if this is determined to be impracticable, these lines are to be fitted with a non-return valve at the EGR residue/NaOH overflow tank.

(B) The NaOH storage and EGR residue/NaOH overflow tanks are to be provided with air pipes complying with **Pt 5, Ch 6 Sec. 2** of the Rules, and the outlets are to terminate in a safe location on weather deck.

(C) Means are to be provided to prevent NaOH from spilling or accidently overflowing from the storage and EGR residue/NaOH overflow tanks. These means may comply with the requirements specified in **Pt 5, Ch 6 202. 2, 3** and **4** of the Rules and tanks are to be fit-

ted with a high level alarm.

(D) Sounding arrangements are to be provided for the NaOH storage and EGR residue/NaOH overflow tanks, and are to comply with the sounding requirements applicable to fuel oil tanks of **Pt 5, Ch 6 203.** of the Rules and **Pt 8, Ch 2, Sec 1** of the Rules. In addition to local level gauging(sounding pipe or level gauge), the NaOH storage and EGR residue/NaOH overflow tanks are to have remote level gauging indication at the manned control station.

(E) The NaOH storage and EGR residue/NaOH overflow tank are to be provided with local and remote temperature monitoring arrangements. The remote temperature indication is to be installed at the manned control station.

(5) Spill Trays

(A) Those areas of the NaOH storage and EGR residue/NaOH overflow tanks that could result in leakage, locations where leakage from pumps and other associated equipment such as strainers, heaters, flanges, valves, etc., which may require occasional dismantling for examination or maintenance may occur, and where leakage may otherwise normally be expected are to be located within spill trays.

(B) Either drainage arrangements for the spill tray that lead to the dedicated EGR residue/NaOH overflow tank are to be provided or arrangements to activate an alarm in the event of spillage are to be provided. Where drainage arrangements are provided, the drain line to the EGR residue/NaOH overflow tank is to be fitted with a non-return valve.

(6) Miscellaneous Piping

(A) The NaOH piping systems are to be independent of other ship service piping and systems.

(B) Piping systems for NaOH systems are not to be located in accommodation, service, or control spaces.

(C) Every pipe emanating from a tank containing NaOH, which, if damaged, would allow NaOH to escape from the tank, is to be provided with a positive closing valve located directly on the tank. The positive closing valve is to be provided with means of closure both locally and from a readily accessible and safe position outside of the space.

(D) The pipe joints are to be kept to a minimum. The direct connections of pipe lengths are to be all welded except for necessary flanged connections to valves and other equipment.

(E) Supply, bunkering, and transfer lines for NaOH systems are not to be located over boilers or in close proximity to steam piping, exhaust systems, hot surfaces required to be insulated, or other sources of ignition.

(7) Ventilation

(A) The NaOH storage and EGR residue/NaOH overflow tanks may be located within the engine room or in a separate compartment. In either location, the area is to be served by an effective mechanical exhaust ventilation system. In addition, if located in a separate compartment, the ventilation system is to be capable of being controlled from outside the compartment.

(8) Personnel Protection

(A) For the protection of crew members, the vessel shall have on board suitable protective equipment consisting of large aprons, rubber gloves with long sleeves, rubber boots, coveralls of chemical-resistant material, and tight-fitting chemical safety goggles or face shields or both. And, the quantity to be supplied is to be at least two sets.

(B) Safety instructions relating to precautions and corrective response actions are to be posted in the compartment containing NaOH and beside the entrance to the compartment.

(C) Eyewasher and safety showers are to be provided near the bunker manifold and the process fluid transfer pump. If several bunker manifolds are installed on the same deck, one could be installed if the bunker manifold can be easily accessed to eyewasher and safety shower from the bunker manifold. The treatment fluid transfer pump can be applied in the same manner as the bunker manifold.

4. Residue System

(1) The residues generated from the exhaust gas cleaning process are to be stored in a designated residue tank, separate from the engine room sludge tank, and arranged for discharge to appropriate shore reception facilities in accordance with **MARPOL Annex I, Ch III, Reg.13**. The EGR residue tank is to be so designed as to facilitate cleaning. Where EGR residue tanks used in closed loop chemical treatment systems are also used as the overflow tank for the NaOH storage tank, the additional requirements of **206.(3)** of this Guidance are to be applied.

(2) The material of the EGR residue tank is to be selected based on the corrosive nature of the EGR residue.
(3) The capacity of the EGR residue tank is to be based on the expected residue volumes applicable to the exhaust gas cleaning process and the maximum period of voyage between ports where EGR residue can be discharged.
(4) The EGR residue tank is to be provided with air pipes complying with **Pt 5, Ch 6, 201.** of the Rules. The residue tank is to be arranged with a high level alarm.
(5) Sounding arrangements are to be provided for the EGR residue tank in accordance with **Pt 5, Ch 6, 203.** and **Pt 8, Ch 2, Sec 1** of the Rules.

207. Control, Alarm, and Monitoring System

1. General

(1) The EGR control system is to be integrated with, or in direct communication with, the engine control system. Control systems for associated systems, such as water treatment plants, may be connected to an integrated control system or may be a standalone system.
(2) 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 the vessel. An FMEA or equivalent demonstrating the safety system design basis is to be submitted.

2. Control and Monitoring System

(1) Automatic control, monitoring, alarm, and safety functions are to be provided for the EGR system so that operations remain within preset parameters for all engine operating conditions. Where vessels are provided with the automation equipment specified in **Pt 9, Ch 3** of the Rules, the alarm and monitoring systems are to be integrated in the vessel's centralized monitoring systems.
(2) The temperatures, pressures and flows in the EGR system and associated systems are to be controlled and monitored as follows:
  (A) A local control and monitoring system for the EGR system is to be provided to enable safe operation, maintenance, and effective control in the event of an emergency or failure of any remote controls.
  (B) The design of the control system is to provide identification of faults in the equipment, as well as the process system. The control and monitoring systems are to comply with the requirements of **Pt 9, Ch 3, 302. 4** of the Rules.
  (C) Indications of parameters necessary for the safe and effective operation of the exhaust emission abatement process are to be provided at the local and, as applicable, remote control stations, as per **Table 1** of this Guidance and are to include the following parameters:
    (a) EGR system pump/fan/blower/motor operational status
    (b) Status of any EGR system valves showing whether they are open or shut
    (c) EGR system parameters for operational safety
    (d) Level indication of EGR system tanks
    (e) Status of any EGR system alarms, shutdowns and Emergency Stop
  (D) The computer-based control systems are to comply with the applicable requirements of **Pt 6, Ch 2, 201. 7** of the Rules as a Category II system.
(3) Where power supply is electric, each of the control, monitoring and safety systems is to be supplied by a separate circuit. Each of these circuits is to be protected for short circuit and monitored for voltage failure.

3. Safety Shutdown System

(1) An independent shutdown system is to be provided. This safety shutdown system is to be based on the following:
  (A) Means are to be provided to indicate the parameters causing shutdown.
  (B) Upon activation of the safety shutdown system, alarms are to be given at the normal control position and at the local control position.
  (C) In the event where shutdown by the safety shutdown system is activated, the restart should not occur automatically, unless after the system is reset.
(2) Monitoring and safety shutdowns are to be in accordance with **Table 1** of this Guidance.

Table 1 Monitoring and Safety System Functions for EGR Systems

Parameters	Display	Alarm Activated	Automatic EGR Shutdown
EGR exhaust fan/blower motors	Run	Stop	
EGR exhaust bypass, isolation, mixing valves, where provided	Position		
Control-actuating medium of the EGR exhaust by pass or isolation valves	Run	Fail	
Exhaust gas temperature before/after EGR unit	●	H	O(HH)
Engine air intake O2 concentration(or EGR rate)	●	L/H	●(HH/LL)
Differential pressure across EGR scrubber unit or EGR circuit, as applicable	●	H	●(HH)
EGR washwater pumps, alkali system pumps	Run	Stop	
EGR washwater or alkali system valves	Position		
Control-actuating medium of the EGR washwater and alkali system valves, where provided	Run	Fail	
EGR washwater and alkali system supply pressure	●	Low	●(LL)
EGR washwater and alkali system supply temperature	●	H	●(HH)
Water level in EGR scrubber	●	H	●(HH)
Alkali storage tank temperature	●	L/H	●(HH)
Alkali storage tank level	●	L/H	●(LL)
Alkali system drip tray level	●	H	●(HH)
EGC residue tank level	●	H	●(HH)
Control power supply	Run	Stop	
Emergency shutdown	●	●	●

208. Survey and Test

1. General

(1) These requirements apply to shop test and onboard test of EGR systems and associated systems. Following tests may be incorporated with the tests required by **Pt 5, Ch 2, 211.** of the Rules.

2. Test

(1) Inspection and verification that the foundations and attachments of the principal components of the EGR equipment and associated systems are in accordance with the approved plans and particulars.

(2) Piping systems are to be examined and tested in accordance with **Pt 5, Ch 6, Sec. 13** of the Rules.

(3) Electrical equipments are to be examined and tested in accordance with **Pt 6, Ch 1** of the Rules.
(4) Instrumentation is to be tested to confirm proper operation as per its predetermined set points.
(5) Pressure relief and safety valves installed on the unit are to be tested.
(6) Control system and shutdowns are to be tested for proper operation.

Section 3 Exhaust Gas Cleaning system(EGC)

301. General

1. This Guidance are to apply to arrangements and system design of Exhaust Gas Cleaning system reducing SOx emissions of fuel oil combustion machinery except incinerator.
2. For items not specified in this Guidance, the relevant requirements specified in **Pt 5** of the Rules apply.
3. **Table 1** shows the Class Notation of EGC, and the EGC installed for the purpose as above provisions of **301. 1** is basically given **EEAS-EGC** notation of **Table 1**. In addition to **EEAS-EGC**, EEAS-EGC(R) and/or (S) may be additionally assigned if the relevant requirements are met.

Table 1. Class Notation of EGC

No.	Notation	relevant requirements
1	**EEAS-EGC**	All requirements of **Section 3 EGC** Excluding the relevant requirements of paragraphs **2** and **3** of **Table 1**
2	**EEAS-EGC(R)**	In addition to relevant requirements of **EEAS-EGC**, provisions of **304. 3**(redundancy requirements)
3	**EEAS-EGC(S)**	In addition to relevant requirements of **EEAS-EGC**, paragraphs **3~8** of **Table 4**(Type approval or test/survey requirements)

4. In addition to above **Table 1,** EGC Ready D, O, C or H as an additional special feature notation may be assigned to ships according to type of system.

Table 2. Class Notation according to EGC Type

Class Notation	Type
- D	Dry type
- O	Wet open type
- C	Wet closed type
- H	Wet hybrid type

For example, “EEAS-EGC(R) - O“ is given to ships applying the EEAS-EGC(R) class notation with wet open type.

5. The washwater discharge criteria is to meet the requirements of IMO Res. MEPC.259(68).
6. Since EGC technology will be under constant development, the requirements of this Guidance may need to be supported by additional information and requirements, on a case by case basis. Designs that are not in compliance with this Guidance may be approved after evaluation by the Society, provided that it can be demonstrated that the design represents an equal or better level of safety.

302. Plans and Data

1. Plans and specifications covering the EGC arrangements are to be submitted and are, as applicable, to include:
   (1) General arrangement of the EGC installation, layout, and systems
   (2) Documentation detailing the EGC specification
   (3) Analyses demonstrating compatibility of the scrubber with the fuel oil combustion machinery
   (4) Hull plans showing the foundation and attachments of accessories to the vessel’s structure, including scantlings, welding details, and foundation details of principal components
   (5) Material specifications for the EGC equipment and associated systems, including coolers, blowers,

pumps, valves, storage/process tanks, residue tanks, piping, distribution systems, separators, and associated components, including a corrosion assessment detailing the corrosive effect of system liquids, vapors, and gases on the materials used in the exhaust emission abatement system

(6) Arrangement and capacity of tanks for storage, chemicals, process washwater, exhaust gas cleaning residues, etc

(7) Details of all piping systems, including details of piping and associated components, design pressures, temperatures, insulation, and drip trays, where applicable

(8) Descriptions and schematic diagrams for the control and monitoring systems, including set points for abnormal conditions and details of the location and position at which exhaust emission or EGC rate monitoring and washwater monitoring are to be located

(9) Details of all electrical equipment installed for the EGC unit and associated systems, including computer-based systems

(10) Emergency shutdown arrangements

(11) Data describing the identification of hazards associated with the design and operation of the exhaust gas cleaning system and the means of safeguard or control thereof

(12) Testing procedures during commissioning trials

(13) Documentation detailing the effect on Load Line and Stability of the exhaust gas cleaning system(retrofit only)

(14) Documentation detailing the effect on electric load(retrofit only)

2. Documents required by **IMO Res. MEPC.259(68)** are to be additionally submitted.

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

303. Operation and Maintenance Manuals

1. Detailed instruction manuals are to be provided onboard, covering the operations, safety, and maintenance requirements and occupational health hazards relevant to the EGC equipment and associated systems.

2. These manuals are to include, but not necessarily be limited to, the procedures and schedules for operation, inspection, testing, and maintenance of the EGC system and associated systems, the regular testing and maintenance procedures for the monitoring systems, safety shutoff systems, and the integrity of backup systems, together with special instructions for the bunkering, storage, and use of hazardous and non-hazardous chemicals that may be used in the EGC.

3. The manuals may be produced as standalone documents or incorporated within the general engine operation and service manuals.

304. EGC System Configuration

1. General

(1) EGC systems are to be designed to enable continued operation of the engine at the times the EGC system is not in operation, either through operational selection, equipment failure, or system deterioration through partial blocking/clogging.

(2) The exhaust pipings from a number of fuel oil combustion machinery may be led to a common SOx scrubber unit.

2. Compatibility with the Engine

(1) Installation and operation of the EGC system is to be compatible with the engine and not to cause any adverse effects on the engine performance such as excessive back pressures or temperatures during operation.

(2) Details are to be submitted demonstrating the exhaust flow compatibility of the EGC unit with the connected fuel oil combustion machinery over the whole operational range of the fuel oil combustion machinery. This data is to be demonstrate that the operating parameters of the oil burning machinery are not to be exceed the approved design limits with the EGC system in operation. In the case of integrated scrubbers, this compatibility evaluation is to show that the EGC unit is capable of accommodating the maximum combined exhaust flows of all the connected oil burning equipment for the worst case scenario for that particular ship arrangement and operational profile. Consideration will be given to those EGC units that incorporate extractive exhaust fans to maintain the fuel oil combustion machinery operating parameters within the approved design limits.

3. Redundancy *(Applicable when only the "EEAS-EGC(R)" class notation of Table 1)*

(1) Redundancy of equipment is to be provided for those rotating and reciprocating components that form part of the EGC essential supplementary systems, such as pumps, fans, blowers, etc.

(2) Consideration will be given to alternative means of compliance or operation to meet above (A) on a case-by-case basis. As applicable, documentation is to be submitted demonstrating that the reliability of the system or component provides continued serviceability of the exhaust gas cleaning system or the alternative means of operation provides continued compliance with the statutory environmental requirements, without compromising the vessel propulsion and maneuvering capability.

4. Exhaust gas by-pass/dry operation

EGC units that incorporate a wet washwater scrubbing process are to be capable of being operated without the washwater system in operation or are to be installed with an exhaust bypass arrangement or changeover system to enable continued operation of the fuel oil combustion machinery in the event the exhaust emission abatement system is not in operation, either through operational selection or equipment failure. As applicable, evidence of material suitability is to be submitted for dry running of SOx scrubbers. Such a device may not be required if the flow of unrestricted exhaust gas is ensured and there is no risk of a failure that results in the stop of the oil burning machinery.

5. Prevention of Flooding

(1) Arrangements are to be provided to prevent the ingress of scrubber washwater into the fuel oil combustion machinery under any circumstance.

(2) Alarm and shutdown arrangements are to be provided to prevent an abnormal rise of washwater level in the EGC scrubber unit.

6. Exhaust gas cleaning systems are to be designed for proper operation at the inclination requirements specified in **Pt 5, Ch 1, 103. Table 5.1.2** of the Rules.

305. EGC System Equipment

1. Pumps/Blowers

(1) Equipment required for continuous operation of the EGC, such as rinse water pumps, circulation pumps, exhaust pumps and blowers are certified in accordance with the relevant requirements of **Pt 5, Ch 1, 210 & Ch 6.**

(2) Unless alternative means of compliance in accordance with **304. 3.** (2) of this Guidance are applicable, redundant washwater, dosing, discharge, etc., pumps, blowers, essential for the continual operation of the EGC water systems, are to be provided. There are to be at least two of these essential pumps, the capacity of the pumps, with any one pump out of service, is to be sufficient for continuous operation of the exhaust emission abatement system at full rating.

(3) Where ships fitted with two or more identical exhaust emission abatement systems, the provision of a common standby pump (for each essential system) capable of serving all EGC units will suffice rather than providing individual standby pumps for each EGC unit.

(4) Unless alternative means of compliance in accordance with **304. 3.** (2) of this Guidance are applicable and where exhaust fans or blowers form part of the EGC system and are essential for continual operation of the exhaust emission abatement system at full rating, such fans or blowers are to be installed in a redundant arrangement. The number and power of the fans or blowers should be such that if one unit, or group of units, is out of service the capacity of the remaining units is not to be less than 100% of the total required.

(5) If the Society considers that the redundancy of the pump and blower (including the exhaust fan) required above is acceptable to the Society, the provision of spare parts made up of rotating parts, including motors and bearings may be permitted.

2. Heat Exchangers/EGC Exhaust Gas Coolers

(1) Where provided, heat exchangers are to comply with the requirements specified in **Pt 5 Ch 5, Sec. 3** of the Rules.

3. Dry scrubber consumable equipment

(1) For dry type exhaust gas cleaning systems, details of the granulate supply and discharge systems are to be submitted.

(2) Unless alternative means of compliance in accordance with **304. 3.** (2) of this Guidance are applicable, drive arrangements for the exhaust cleaning reductant consumable are to be arranged in a redundant arrangement.

4. Electrical Systems

For items not specified in this Guidance, the relevant requirements specified in **Pt 6** of the Rules apply.

(1) Electrical Motors and Controllers
Motors and motor controllers are to be ceritified in accordnace with the relevant requirements specified in **Pt 6** of the Rules.

(2) Standby Pump/Fan
The standby pumps and blowers, where redundancy is provided according to the **304. 3.** (1), are to be automatically started and put into service. This failure is to be alarmed at the local and remote control stations.

(3) Circuit Protection Devices
Circuit breakers are to be installed for miscellaneous EGC system electrical loads and are to be compatible with the prospective short circuit current level calculated at the switchboards.

306. EGC System Piping

1. Exhaust Gas Piping Systems

(1) Exhaust Gas Piping/Scrubber Materials

(A) Exhaust gas piping materials located before the EGC SOx scrubber, where fitted, may be of the same material specification as the standard fuel oil combustion machinery exhaust gas piping.

(B) The sections of the scrubber that are subjected to washwater (e.g., the interior reaction chamber or washwater piping/nozzles, etc.) are to be constructed of suitable corrosion resistant materials.

(C) Exhaust gas piping materials used after the SOx scrubber unit are to be of a corrosion resistant material such as stainless steel or a corrosion resistant material suitable for application..

(D) Exhaust gas pipings are to comply with **sec 1** and **sec 6** in **Ch 6 Pt 5** of the Rules.

(2) Exhaust Gas Piping Valves

(A) Valves used in the EGC system are to comply with the relevant requirements specified in **Pt 5, Ch 6** of the Rules. The valves are to be constructed of corrosion resistant materials and the valves located at the front of the SOx scrubber may be the same material as the valve of the the oil burning machinery.

(B) Isolation and bypass valves used in EGC system exhaust piping systems are to prevent the passage of exhaust gases to other fuel oil combustion machinery or machinery spaces. Where bypass arrangements for the SOx scrubber unit are provided, the isolation and bypass valves are to be arranged in an interlocked, fail safe manner, such that free flow of exhaust gases to the atmosphere at all times is possible, either through the scrubber unit or through the bypass. Bypass valves are to be provided with a local position indicator.

(C) Valves are to be installed in accessible locations, clear of or protected from obstructions, moving equipment, and hot surfaces, in order to permit regular inspection and periodic servicing.

(3) Interconnection of exhaust gas piping

(A) Normally, exhaust pipes from diesel engines and flue gas pipes from oil-fired boilers are to

be routed separately and not interconnected. However, interconnected exhaust piping systems to a common EGC unit may be accepted subject to the arrangements preventing the passage or leakage of exhaust gases to other equipment or spaces that may then pose a safety risk to that equipment or health risk to the vessel's crew or passengers.

(B) The integrated EGC system is to be designed not to exceed the backpressure limits specified by the connected engines or boilers.

(4) Insulation

Hot surfaces of EGC units or their associated equipment or systems likely to come into contact with the crew during operation are to be suitably guarded or insulated. Where the surface temperatures are likely to exceed 220°C and where any leakage, under pressure or otherwise, of fuel oil, lubricating oil, or other flammable liquid is likely to come into contact with the EGC unit or exhaust pipes, these surfaces are to be suitably insulated with non-combustible materials that are impervious to such liquids.

2. Washwater piping

(1) Piping and Connections

(A) The EGC SOx washwater system pipe fittings and joints are to comply with the requirements specified in **Pt 5, Ch 6** of the Rules.

(B) The piping material for the corrosive scrubber washwater system is to be selected based on the corrosive nature of the liquid media.

(C) The means are to be provided to prevent clogging of washwater nozzles.

(2) Remote Control Valves

(A) Upon loss of control power, the remote control valves are to remain in the last ordered position, provided there is a readily accessible manual means to close the valves or are to fail safe

(B) Remote control valves are to be clearly identified and are to be provided with position indicators at the local and EGC system remote control station, as applicable.

(C) Valves are to be installed in accessible locations, clear of or protected from obstructions, moving equipment, and hot surfaces, in order to permit regular inspection and/or periodic servicing.

(3) Overboard Discharges

(A) The overboard discharges of any EGC system are not to be interconnected to other systems. However, if backflow prevention means are provided, seawater from other systems used for dilution is acceptable.

(B) Special attention is to be paid to the corrosion resistivity of EGC washwater overboard discharge piping. Where applicable, adequate arrangements are to be provided to prevent galvanic corrosion due to the use of dissimilar metals.

(C) The distance piece between the outboard discharge valve and the shell plating is to be at least 15mm.

(D) Due consideration is to be given to the location of overboard discharges with respect to vessel propulsion features, such as thrusters or propellers.

3. Chemical Treatment Piping Systems

The requirements for the washwater chemical treatment system detailed in this paragraph are based on the use of Caustic Soda (NaOH) in the EGC scrubber water treatment system, as applicable. If other chemicals are to be used, the requirements should be consistent with the intent of the requirements for Caustic Soda but would need to be assessed on a case-by-case basis.

(1) Material

(A) The material of the NaOH related piping systems, NaOH storage tank, EGC residue/NaOH overflow tanks, drip trays, and any other components which may come into contact with the NaOH solution or sludge is to be of a suitable grade of stainless steel or products coated with corrosion-resistant materials established to be suitable for the application. Aluminum, zinc, brass, or galvanized steel components are not to be used.

(2) Bunkering of NaOH

(A) The bunker station for NaOH 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 NaOH contacting or mixing with other incompatible materials. Alternatively, closed or semi-enclosed bunker stations may be approved subject to the provision of effective ventilation.

(B) Spill trays, which may be of the dry type or having means of drainage to the EGC resi-

due/ NaOH overflow tank, are to be provided.

(3) Arrangement of Tank

(A) The NaOH storage and EGC residue/NaOH overflow tank are not to be situated where spillage or leakage therefrom can constitute a hazard by falling 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

(A) The NaOH storage tank is to be provided with a fill line from the bunker station and a shut off valve is to be provided at the bunkering station. Overflow and drains leading to the EGC residue/NaOH overflow tank are to enter at or near the top of the tank. However, if this is determined to be impracticable, these lines are to be fitted with a non-return valve at the EGC residue/NaOH overflow tank.

(B) The NaOH storage and EGC residue/NaOH overflow tanks are to be provided with air pipes complying with **Pt 5, Ch 6, Sec. 2** of the Rules, and the outlets are to terminate in a safe location on weather deck.

(C) Means are to be provided to prevent NaOH from spilling or accidently overflowing from the storage and EGC residue/NaOH overflow tanks. These means may comply with the requirements specified in **Pt 5, Ch 6, 202. 2, 3** and **4** of the Rules and tanks are to be fitted with a high level alarm.

(D) Sounding arrangements are to be provided for the NaOH storage and EGC residue/NaOH overflow tanks, and are to comply with the sounding requirements applicable to fuel oil tanks of **Pt 5, Ch 6, 203.** of the Rules and **Pt 8, Ch 2, Sec 1** of the Rules. In addition to local level gauging(sounding pipe or level gauge), the NaOH storage and EGC residue/NaOH overflow tanks are to have remote level gauging indication at the manned control station.

(E) The NaOH storage and EGC residue/NaOH overflow tank are to be provided with local and remote temperature monitoring arrangements. The remote temperature indication is to be installed at the manned control station.

(5) Spill Trays

(A) Those areas of the NaOH storage and EGC residue/NaOH overflow tanks that could result in leakage, locations where leakage from pumps and other associated equipment such as strainers, heaters, flanges, valves, etc., which may require occasional dismantling for examination or maintenance may occur, and where leakage may otherwise normally be expected are to be located within spill trays.

(B) Either drainage arrangements for the spill tray that lead to the dedicated EGC residue/NaOH overflow tank are to be provided or arrangements to activate an alarm in the event of spillage are to be provided. Where drainage arrangements are provided, the drain line to the EGC residue/NaOH overflow tank is to be fitted with a non-return valve.

(6) Miscellaneous Piping

(A) The NaOH piping systems are to be independent of other ship service piping and systems.

(B) Piping systems for NaOH systems are not to be located in accommodation, service, or control spaces.

(C) Every pipe emanating from a tank containing NaOH, which, if damaged, would allow NaOH to escape from the tank, is to be provided with a positive closing valve located directly on the tank. The positive closing valve is to be provided with means of closure both locally and from a readily accessible and safe position outside of the space.

(D) The pipe joints are to be kept to a minimum. The direct connections of pipe lengths are to be all welded except for necessary flanged connections to valves and other equipment.

(E) Supply, bunkering, and transfer lines for NaOH systems are not to be located over boilers or in close proximity to steam piping, exhaust systems, hot surfaces required to be insulated, or other sources of ignition.

(7) Ventilation

(A) If a NaOH storage tank is installed in a closed compartment, the area is to be served by an effective mechanical supply and exhaust ventilation system providing not less than 6 air changes per hour which is independent from the ventilation system of accommodation, service spaces, or control stations. The ventilation system is to be capable of being controlled from outside the compartment and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly air purged. If the ventilation stops, an audible and visual alarm shall be provided outside the compartment adjacent to

each point of entry and inside the compartment, together with a warning notice requiring the use of such ventilation. Alternatively, where a urea storage tank is located within an engine room a separate ventilation system is not required when the general ventilation system for the space is arranged so as to provide an effective movement of air in the vicinity of the storage tank and is to be maintained in operation continuously except when the storage tank is empty and has been thoroughly air purged.

(B) In cases where NaOH solution is transferred to a tank which forms part of the ship's hull, the enclosed spaces(excluding water tanks and oil tanks) adjacent to the NaOH solution tanks are to be provided with the mechanical ventilation which can be operated from outside the spaces.

(8) Personnel Protection

(A) For the protection of crew members, the vessel shall have on board suitable protective equipment consisting of large aprons, rubber gloves with long sleeves, rubber boots, coveralls of chemical-resistant material, and tight-fitting chemical safety goggles or face shields or both. And, the quantity to be supplied is to be at least two sets.

(B) Safety instructions relating to precautions and corrective response actions are to be posted in the compartment containing NaOH and beside the entrance to the compartment.

(C) Eyewasher and safety showers are to be provided near the bunker manifold and the process fluid transfer pump. If several bunker manifolds are installed on the same deck, one could be installed if the bunker manifold can be easily accessed to eyewasher and safety shower from the bunker manifold. The treatment fluid transfer pump can be applied in the same manner as the bunker manifold. And, if the treatment fluid transfer pump is shielded by a structure capable of visual surveillance, one eyewasher and safety showers could be installed in the installation area.

4. Residue System

(1) The residues generated from the exhaust gas cleaning process are to be stored in a designated residue tank, separate from the engine room sludge tank, and arranged for discharge to appropriate shore reception facilities in accordance with **MARPOL Annex I, Ch III, Reg.13**. The EGC residue tank is to be so designed as to facilitate cleaning. Where EGC residue tanks used in closed loop chemical treatment systems are also used as the overflow tank for the NaOH storage tank, the additional requirements of **306. 3.** of this Guidance are to be applied.

(2) The material of the EGC residue tank is to be selected based on the corrosive nature of the EGC residue.

(3) The capacity of the EGC residue tank is to be based on the expected residue volumes applicable to the exhaust gas cleaning process and the maximum period of voyage between ports where EGC residue can be discharged.

(4) The EGC residue tank is to be provided with air pipes complying with **Pt 5, Ch 6, 201.** of the Rules. The residue tank is to be arranged with a high level alarm.

(5) Sounding arrangements are to be provided for the EGC residue tank in accordance with **Pt 5, Ch 6, 203.** and **Pt 8, Ch 2, Sec 1** of the Rules.

307. Control, Alarm, and Monitoring System

1. General

(1) The EGC control system is to be integrated with, or in direct communication with, the engine control system.

(2) 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 the vessel. Data describing the identification of hazards associated with the design and operation of the exhaust gas cleaning system and the means of safeguard or control is to be submitted.

2. Control and Monitoring System

(1) Automatic control, monitoring, alarm, and safety functions are to be provided for the EGC system so that operations remain within preset parameters for all engine operating conditions. Where vessels are provided with the automation equipment specified in **Pt 9, Ch 3** of the Rules, the alarm and monitoring systems are to be integrated in the vessel's centralized monitoring systems.

(2) The temperatures, pressures and flows in the EGC system and associated systems are to be controlled and monitored as follows:

(A) A local control and monitoring system for the EGC system is to be provided to enable safe operation, maintenance, and effective control in the event of an emergency or failure of any remote controls.
(B) The design of the control system is to provide identification of faults in the equipment, as well as the process system. The control and monitoring systems are to comply with the requirements of **Pt 9, Ch 3, 302. 4** of the Rules.
(C) Indications of parameters necessary for the safe and effective operation of the exhaust gas cleaning process are to be provided at the local and, as applicable, remote control stations, as per **Table 1** of this Guidance and are to include the following parameters:
  (a) EGC system pump/fan/blower/motor operational status
  (b) Status of any EGC system valves showing whether they are open or shut
  (c) EGC system parameters for operational safety
  (d) Level indication of EGC system tanks
  (e) Status of any EGC system alarms, shutdowns and Emergency Stop
(D) The computer-based control systems are to comply with the applicable requirements of **Pt 6, Ch 2, 201. 7** of the Rules as a Category II system.

(3) Where power supply is electric, each of the control, monitoring and safety systems is to be supplied by a separate circuit. Each of these circuits is to be protected for short circuit and monitored for voltage failure.

3. Safety Shutdown System

(1) An independent shutdown system is to be provided. This safety shutdown system is to be based on the following:
(A) Means are to be provided to indicate the parameters causing shutdown.
(B) Upon activation of the safety shutdown system, alarms are to be given at the normal control position and at the local control position.
(C) In the event where shutdown by the safety shutdown system is activated, the restart should not occur automatically, unless after the system is reset.

(2) Monitoring and safety shutdowns are to be in accordance with **Table 3** of this Guidance.

Table 3 Monitoring and Safety System Functions for EGC Systems

Parameters	Display	Alarm Activated	Automatic EGC Shutdown
EGC exhaust fan/blower motors	Run	Stop	
EGC exhaust bypass, isolation, mixing valves, where provided	Position		
Normal condition of control-actuating medium of the EGC exhaust bypass or isolation valves	Normal	abnormal	
Exhaust gas temperature before/after EGC unit	●	H	●(HH)
Differential pressure across EGC scrubber unit	●	H	●(HH)
EGC washwater pumps, alkali system pumps or supply system of dry system	Run	Stop	
EGC washwater or alkali system valves	Position		
Normal condition of control-actuating medium of the EGC washwater and alkali system valves, where provided	Normal	abnormal	
EGC washwater and alkali system supply pressure	●	Low	●(LL)
EGC washwater supply temperature(Closed/Hybrid type)	●	H	
EGC alkali system supply temperature	●	L/H	
Water level in EGC scrubber	●	H	●(HH)
Alkali storage tank temperature	●	L/H	●(HH)

Alkali storage tank level	●	L/H	●(LL)
Alkali system drip tray level	●	H	●(HH)
EGC residue tank level	●	H	●(HH)
Control power supply	Run	Stop	
Emergency shutdown	●	●	●

308. Survey and Test

1. General

(1) These requirements apply to shop test and onboard test of EGC systems and associated systems. Following tests may be incorporated with the tests required by **Pt 5, Ch 2, 211.** of the Rules.
(2) SECC(SOx Emission Compliance Certificate) may be issued after inspection by the Administration or the Society.
(3) The components of the EGC are to be tested and inspected in accordance with **Table 4** below in accordance with the applicable class notation in **Table 1**.

Table 4. Test and Survey for components of EGC

No.	Components	Approval of Administration or Class Type approval	Class Type approval	Test and Survey
1	Exhaust gas emission monitoring system	●		
2	Washwater emission monitoring system		●	
3	Control panel/power panel			●
4	Pumps(incl.motor)(1)			●
5	Blowers(incl.motor)(1)			●
6	Scrubber body(2)			●
7	Heat exchanger(2)			●
8	Storage vessels for washwater treatment medium(3)			●

Note.
(1) Components for the continual operation of the EGC are to be tested in accordance with the requirements specified in **Pt 5, Ch 6 & Pt 6** of the Rules.
(2) Non-destructive testing is to be carried out on the welded parts of the equipment constituting the following exhaust gas cleaning system, and the hydrostatic test is to be carried out at a pressure 1.5 times the design pressure.
(3) Storage vessels that do not form part of the hull are to be subjected to a hydraulic test at a head pressure of 2.5 m on the tank top plate, together with the attachment after manufacture.

2. Onboard tests

(1) Inspection and verification that the foundations and attachments of the principal components of the EGC equipment and associated systems are in accordance with the approved plans and particulars.
(2) Piping systems are to be examined and tested in accordance with Pt 5, Ch 6, Sec. 14 of the Rules.
(3) Electrical equipments are to be examined and tested in accordance with Pt 6, Ch 1 of the Rules.
(4) Instrumentation is to be tested to confirm proper operation as per its predetermined set points.
(5) Pressure relief and safety valves installed on the unit are to be tested.
(6) Control system and shutdowns are to be tested for proper operation.

Section 4 Exhaust Gas Cleaning system(EGC) Ready ships

401. General

1. This Guidance applies to ships which are prepared for conversion with the design or the partial installation related with exhaust gas cleaning system mentioned in **Sec 3** during the new building phase or in-service.
2. EGC ready levels are defined in 2 steps, and additionally defined in 4 steps according to type of system.

402. Class Notation

1. General

(1) The class notations specified in **2.~4.** may be assigned according to the EGC ready levels.
(2) The requirements for the class notations in this Section are to comply with **403**.

2. EGC Ready D

EGC Ready D as an additional special feature notation may be assigned to ships for which the concept design is prepared.

3. EGC Ready I

EGC Ready I as an additional special feature notation may be assigned to ships for which parts of the systems(scrubber main unit) are installed or the detailed design in addition to the concept design.

4. D,O,C,H(Type of system)

EGC Ready D, O, C or H as an additional special feature notation may be assigned to ships according to type of system in addition to **2.~3.**.

Table 1. Class Notation according to EGC Type

Class Notation	Type
-D	Dry type
-O	Wet open type
-C	Wet closed type
-H	Wet hybrid type

For example, **EGC Ready I(EX)-O** is given to the detailed design of the exhaust gas scrubber with wet open type and the ship equipped with the exhaust gas system, and the basis for the exhaust gas scrubber with wet closed type **EGC Ready D-C** is granted for vessels prepared for design only.

403. Requirements for levels of EGC Ready

1. General

(1) This Guidance prescribes plans to be submitted and consideration for preparing(refer to below **4.**) the exhaust gas cleaning system. The design and installation of structures and systems are to be in accordance with applicable requirements in **Sec 3**.
(2) Drawing approval and survey for EGC ready are not accepted as Drawing approval and survey for conversion of exhaust gas cleaning system. When the ship is converted, drawing approval and surey are to be carried out in accordance with **Sec 3** in force at the time of the ship conversion. Approved Drawings and certifications from new building stage may be used as reference for conversion.

2. Level of preparing concept design(D)

(1) Plans and documents

(A) General arrangement of ship
(B) Arrangement of the EGC installation, layout, and systems
(C) Arrangement of machinery space including EGC component
(D) Arrangement and capacity of tanks for storage, chemicals, process washwater, exhaust gas cleaning residues, etc
(E) Arrangement of exhaust gas system
(F) Arrangement of washwater system(if applicable)
(G) Arrangement of chemical treatment system(if applicable)
(H) Schematic diagram for electrical, control, alarm, and monitoring system
(I) Documentation detailing the effect on Load Line and Stability of the exhaust gas cleaning system
(J) Documentation detailing the effect on electric load

3. Level of detailed design and installation(I)

(1) EGC Ready I includes the approval of the detailed drawings and the installation of the specific equipment mounted on the ship and is classified as a separate system as shown below
(A) Hull structural arrangement and reinforecement-SR
(B) Exhaust gas system-EX
(C) Washwater system-WR
(D) Chemical treatment system, if applicable-CH
(E) Residue system-SD
(F) SOx Scrubber system-EG

(2) Plans and documents
In order to receive EGC Ready I, the following drawings must be submitted and approved according to the specific equipment. However, if approved by the Society, some modifications may be made depending on the type of equipment.
(A) Hull structural arrangement and reinforecement-SR
- Hull plans showing the foundation and attachments of accessories to the vessel's structure, including scantlings, welding details, and foundation details of principal components

(B) Exhaust gas system-EX
- Detailed drawings of the exhaust system

(C) Washwater system-WR
- Detailed drawings of washing water system and related equipment (washing water supply and drainage equipment)

(D) Chemical treatment system, if applicable-CH
- Detailed drawings of chemical treatment piping system and related equipment

(E) Residue system-SD
- Detailed drawings of the residue piping system and related equipment

(F) SOx Scrubber system-EG
- Arrangement of the EGC installation, layout, and systems
- Material specifications for the EGC equipment and associated systems, including coolers, blowers, pumps, valves, storage/process tanks, residue tanks, piping, distribution systems, separators, and associated components
- Documentation detailing the effect on Load Line and Stability of the exhaust gas cleaning system(retrofit only)
- Documentation detailing the effect on electric load

4. Consideration for preparing

(1) It is to be considered for EGC ready D as below:
(A) The engine casings are to be designed and arranged considering size of the scrubber unit.
(B) The machinery space are to be designed and arranged considering related scrubber unit and tanks if applicable.
(C) The sea suction and overboard dischage outlets are to be designed considering installation of washwater system, washwater treatment system, and related component if applicable.
(D) In calculating the capacity of the generator and switch board, the electric load/switch board that is increased/added due to the installation of the EGC are to be considered and reflected in the submitted drawings in **403**.
(E) The effects of stability and load line due to the installation of the EGC are to be considered and reflected in the drawings submitted in **403**.
(F) In the calculation of fire extinguishing agents for fixed fire extinguishing systems for machi-

nery space, the increase or decrease in the volume of the machinery is to be considered due to the installation of the EGC.

(G) Consideration is to be given to fire extinguishing equipment which is required to be installed or maintained in the machinery space due to installation of the EGC.

404. Survey

1. Classification survey during construction

The shop test and onboard test are to be in accordance with **Sec 3**.

2. Periodical surveys

Periodical surveys in application of this Guidance, the general condition of the relevant systems installed on board is to be examined visually at periodical surveys for the vessels having EGC Ready I notation. The systems are to be surveyed and evaluated for the condition at time of conversion, and the scope of test will be defined depending on time elapsed from new building and maintenance level of the systems. ⚓

GUIDANCE FOR EXHAUST GAS EMISSION ABATEMENT SYSTEM

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