指导性文件
GUIDANCE NOTES
GD15-2016

中 国 船 级 社
CHINA CLASSIFICATION SOCIETY

美国环保署环保润滑油要求实施检验指南

GUIDELINES FOR SURVEYS ON IMPLEMENTATION OF THE REQUIREMENTS OF U.S. ENVIRONMENTAL PROTECTION AGENCY ON ENVIRONMENTALLY ACCEPTABLE LUBRICANTS

2016

2016年9月1日生效
Effective from Sep. 1, 2016

Table of Contents

Introduction

In March 2013, U.S. Environmental Protection Agency (hereinafter referred to as EPA) officially released the latest version of Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (hereinafter referred to as VGP(2013)), which officially entered into force on 19 December 2013. According to VGP(2013), all vessels entering the waters of the United States must use Environmentally Acceptable Lubricants (hereinafter referred to as EALs) in all oil-to-sea interfaces, unless "technically infeasible". EPA's mandatory requirement for the use of EALs has attracted much attention from the industry. Oil product suppliers, stern tube sealing device suppliers, ship designers, ship owners/shipping companies, shipyards and classification societies have all carried out research on EALs to different extents. CCS has also timely traced the use of EALs in major business areas covered by CCS, carried out investigations and studies, evaluated and analyzed the suggestions provided by major shipyards and ship designers, and offered the technical guidance and service for the industry from the perspective of equipment selection, design optimization, and technological improvement.

The Guidelines fall into three parts. The first part clarifies EPA's technical requirements for EALs and describes in detail the relevant terms regarding EALs in VGP(2013). The second part makes clear the relevant survey requirements and procedures based on relevant provisions of EPA. And the third part provides specific requirements and operation methods with regard to the techniques to address existing problems occurred during the use of EALs for guidance of the industry.

Chapter 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.1 Purpose

1.1.1.1 According to the Vessel General Permit for Discharges Incidental to the Normal Operation of Vessels (hereinafter referred to as VGP (2013)) that came into force in 2013, commercial vessels entering the waters of the United States must use Environmentally Acceptable Lubricants (hereinafter referred to as EALs) in all oil-to-sea interfaces. The Guideline are drafted to help the industry better understand and implement relevant requirements for EALs in VGP(2013).

1.1.1.2 The Guidelines propose the key control points for ships using EALs in shafting, including design, installation technology and operation methods, with the aim to reduce the potential risk of high temperature of stern tubes that may be occurred in the construction stage and preliminary stage of delivery of ships.

1.1.2 Scope

1.1.2.1 The Guidelines apply to the following circumstances:

(1) All commercial vessels entering the waters of the United States on or after 19 December 2013 with a length of 79 feet (24.08m) or over;

(2) Ships applying to CCS for the class notation of "EAL";

(3) Ships applying to CCS for the issuance of "EALs statement".

1.1.3 Core requirements for EALs in VGP(2013)

1.1.3.1 The VGP (2013) released by EPA entered into force on 19 December 2013. According to regulation 2.2.9 of VGP (2013), all commercial vessels greater than 79 feet (about 24m) in length entering the waters of the United States must use EALs in all oil-to-sea interfaces, unless technically infeasible.

1.1.4 Implementation and supervision

1.1.4.1 The technical regulations related to EALs in VGP (2013) are EPA's latest requirements for the positions prone to lubrication discharges during normal operation of ships. EPA has signed the Memorandum of Understanding with the Coast Guard to authorize the Coast Guard to supervise over the implementation of VGP.

1.1.4.2 VGP(2013) will be valid until 19 December 2018.

Section 2 DEFINITIONS

1.2.1 For the purpose of the Guidelines:

1. *Environmentally acceptable lubricants* (hereinafter referred to as EALs) mean lubricants that are "biodegradable" and "minimally-toxic" and are "not bioaccumulative".

2. *Waters of the United State* refer to 3 nautical miles along the coast as defined in 40 CFR §122.2 of the Code of Federal Regulations (hereinafter referred to as CFR).

3. *Commercial vessel* means any vessel for commercial use other than a private yacht or a vessel of the U.S. armed forces as defined in Appendix A of VGP(2013).

4. Oil-to-sea Interfaces. Regulation 2.2.9 of VGP(2013) specifically identifies several types of equipment that have oil-to-sea interfaces, including but not limited to controllable pitch propeller, thruster hydraulic fluid and other equipment that might have lubrication discharges from oil seals and surfaces, such as paddle wheel propulsion, stern tubes, thruster bearings, stabilizers, rudder bearings, azimuth thrusters, podded propulsors, and wire rope and mechanical equipment subject to immersion.

5. *Technically Infeasible*. Technically infeasible mainly means the following circumstances:

(1) No EAL products (e.g. oil seal) are approved for use in a given application that meets manufacturer specifications for that equipment

(2) Products which come pre-lubricated (e.g. wire ropes) have no available alternatives manufactured with EALs;

(3) EAL products meeting a manufacture's specifications are not available within any port in which the vessel calls;

(4) Change over or use of EALs must wait until the vessel's next drydocking.

Note: The stern tube high temperature alarm which may activate during the use of EALs is not regarded as the sufficient condition to be "technically infeasible".

6. New ship. For the purpose of regulation 2.2.9 of VGP(2013), a new ship means a ship the keel of which is laid or which is at a similar stage of construction on or after 19 December 2013.

7. Existing ship. For the purpose of regulation 2.2.9 of VGP(2013), an existing ship means a ship which is not a new ship.

8. Air control unit refers to the provision of appropriate air to other units within the air sealing system and the establishment of pressure association among relevant units through the adjustment of the pressure and flow of air. Air control unit serves as the core unit in the air sealing system.

Section 3 PLANS AND DOCUMENTS

1.3.1 Shipyards, shipowners or shipping companies are to submit an EALs Report to CCS for examination. Explanations are to be made on the use of EALs in all oil-to-sea interfaces in the Report. The Report is to be prepared according to the requirements of Annex 2 of Chapter 6.

1.3.2 If an air sealing system is adopted, the following plans and documents are also to be provided in addition to the relevant plans and documents required by *CCS Rules for Classification of Sea-going Steel Ships*:

1. the schematic diagram of air sealing system;

2. the system diagram of the daily use of lubricants in stern tubes;

3. the type approval certificate of air seal;

4. the air seal manufacturer's statement (stating the non-existence of oil-to-sea interfaces in

normal working conditions);

5. Modification scheme (if applicable).

Section 4 ISSUANCE of DOCUMENTs

1.4.1 Upon the request of a shipyard, shipowner or shipping company, an EALs Statement may be issued by CCS in the form of SOC(US-EAL), as described in Annex 1 and 2, based on the EALs Report prepared by the shipyard, shipowner or shipping company, to ships in compliance with the requirements of the Guidelines after satisfactory survey carried out by CCS.

1.4.2 Where air seal is used, a statement of compliance with VGP(2013) is to be provided by air seal manufacturers.

Section 5 ASSIGNMENT AND MAINTENANCE OF CLASS NOTATIONS

1.5.1 Upon the request of shipyards, shipowners or shipping company, the class notation of EAL may be assigned to ships in compliance with the requirements of the Guidelines after satisfactory survey by CCS. Where the application for the assignment of the class notation of EAL is necessary for ships in service, an application is to be submitted to CCS in conjunction with inspections in dry-dock.

1.5.2 Unless otherwise expressly provided, where ships under the following circumstances apply for the class notation of EAL, the requirements in Chapter 4 of the Guidelines may be exempted with the consent of CCS:

1. Ships adopting the air sealing system for the stern tube sealing and using mineral oil as lubricants; or

2. Ships using sea water lubrication system for shafting;

3. Ships already put into service for 2 years or longer at the time of applying for the class notation of EAL and with shafting well running-in.

1.5.3 The maintenance of the class notation of EAL

1.5.3.1 The periodical survey is to be carried out for ships assigned with the class notation of EAL according to regulation 3.2.1 of the Guidelines. When the requirements of the Guidelines are met, the class notation of EAL will continue to be valid.

Chapter 2 TECHNICAL PROVISIONS OF EALs

Section 1 GENERAL PROVISIONS

2.1.1 Requirements related to EALs in VGP(2013) apply to all ships;

2.1.2 “Technical infeasible” as defined in VGP(2013) only applies to existing ships in principle;

Section 2 DEFINITION AND DISTRIBUTION OF EALs

2.2.1 Approved labels for EALs

2.2.1.1 EPA recommends that a lubricant should be certified and receive a label from the following labeling programs as an environmentally acceptable lubricant:

1. German Blue Angel;

2. European Eco-label;

3. Nordic Swan;

4. the Swedish Standards SS 155434 and 155470;

5. Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR) requirements);

6. EPA’s Design for the Environment (DfE).

2.2.1.2 On the other hand, EPA stated on its official website that products that are not included in one of the above labeling programs may also be considered as EALs in compliance with the requirements of VGP(2013) provided that they have been tested to sufficiently demonstrate compliance with the requirements to be “biodegradable” and “minimally-toxic” and are “not bioaccumulative” as defined in Annex A of VGP(2013). Under this circumstance, EALs providers are requested by EPA to provide information on internal certification or third-party certification.

2.2.1.3 Except for special cases, shipyards, shipowners or shipping companies are to use products labeled as EALs as far as possible.

2.2.2 Distribution of and requirements for EALs onboard ships

2.2.2.1 According to the requirements of VGP(2013), all oil-to-sea interfaces onboard ships should use EALs. Paragraph 1.2.1.4 of the Guidelines is to be referred to for the equipment containing oil-to-sea interfaces and the sketch in Figure 2.2.2.1 is for reference.

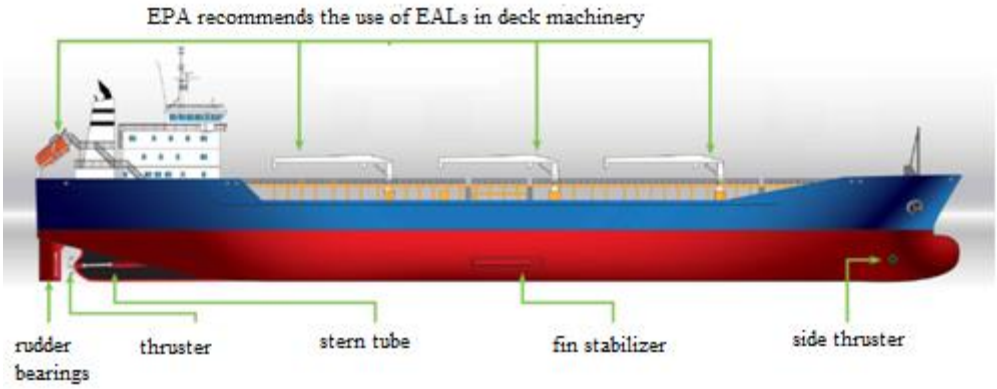

Figure 2.2.2.1 Sketch of the distribution of oil-to-sea interfaces onboard ships

2.2.2.2 Where there is sufficient evidence showing the non-existence of oil-to-sea interfaces onboard ships, e.g. the seawater-lubricated rudder bearings, seawater-lubricated stern tubes, and air sealing system, then it can be regarded as meeting the requirement of 2.2.9 of VGP(2013). Where the issuance of the statement of EALs or the assignment of class notation of EAL is requested under the above circumstance, explanations are to be made in the EALs Report.

2.2.2.3 The leakage of lubricants on deck machinery resulting from the rain wash is not subject to the mandatory provisions of VGP(2013). EPA recommends the use of EALs for this type of equipment.

2.2.2.4 Except for special cases, wire ropes of cranes and material hoists that will not be immersed beneath the water surface during usage are not subject to the provisions in relation to EALs in oil-to-water interfaces.

2.2.2.5 For wire ropes or mechanical equipment that are intended to be immersed in water, EALs are to be used. Excessive lubricants are to be removed before the immersion, unless the captain deems it is unsafe to do so.

CHAPTER 3 EAL-RELATED INSPECTION REQUIREMENTS

Section 1 General Provisions

3.1.1 This Chapter applies to ships applying for assignment of EAL class notations by CCS, or ships applying for issuing EALs Statement by CCS.

3.1.2 Shipyards and shipowners/shipping companies are to prepare EALs Report according to the requirements of the Guidelines based on the actual ship condition and update it in real time .

3.1.3 Replacement of environmentally acceptable lubricants is to be carried out in dry dock as far as possible, but in special conditions, replacement of lubricants under floating condition is allowed with the consent of CCS. Shipyards and shipowners/shipping companies are to ensure sufficient replacement of lubricants under the guidance of lubricant suppliers, update EALs Reports in time according to the requirements and submit the reports to site surveyors for review.

3.1.4 On completion of satisfactory inspection, an EALs Statement in the form of SOC (US-EAL) may be issued with a period of validity of not more than 5 years.

3.1.5 Using EALs does not mean that random discharge is allowed, so the amount of oil spill still needs to comply with the requirements of 40CFR110.3.

3.1.6 If air seal is intended to be used in the existing stern shaft tube or existing oil seal is to be transformed, the requirements of Chapter 5 of the Guidelines may be referred to.

3.1.7 The Guidelines are the supplement of the inspection requirements for conventional stern shaft seals under the frame of VGP(2013), and inspection of environmentally acceptable lubricants is to be carried out in conjunction with conventional inspection. If air seal system is adopted, function tests are to be carried out on air control units, oil spill recovery and alarm systems.

Section 2 Survey and Statement

3.2.1 Survey type and period

3.2.1.1 Ships applying for EAL class notations or ships applying for issuance if EALs Statement are to be subject to following surveys:

1. Initial survey, i.e. survey of ships applying for EAL class notations for the first time or applying for issuing EALs Statement. Initial survey is to include overall inspection for the relevant requirements for environmentally acceptable lubricants in paragraph 2.2.9 of VGP(2013), documents described in the Guidelines as well as arrangement, installation and test of air seal system so as to ensure that relevant requirements of the Guidelines are complied with.

2. Annual survey. The interval of annual survey is the same as that of annual survey for ship classification certificate. EAL annual inspection is generally carried out in conjunction with annual inspection for ship classification certificate. Annual survey is to include inspection of documents, appliances and equipment relating to paragraph 2.2.9 of VGP(2013) in the Guidelines, in order to confirm the validity of relevant documents such as EALs Report, confirm that the arrangement and condition of air seal system have not undergone changes which may affect the validity of class notation and the statement, confirm on relevant alarm positions and safety valves and ensure that relevant requirements of the Guidelines are complied with.

3. Special survey. The interval of special survey is the same as that of special survey for ship classification certificate. EAL special inspection is generally carried out in conjunction with special inspection for ship classification certificate. Special survey is to include inspection of documents, appliances and equipment relating to paragraph 2.2.9 of VGP(2013) in the Guidelines, in order to confirm on relevant alarm positions and safety valves, confirm the validity of documents described in the Guidelines, confirm that the condition of air seal system have not undergone changes which may affect the validity of class notation and the statement, and ensure that relevant requirements of the Guidelines are complied with.

3.2.1.2 An interim survey may be requested in either of the following conditions:

1. in case of survey due to equipment repair and modification or lubricant replacement involving

EAL class notation;

2. in case of survey due to the replacement of previous mineral oil by environmentally acceptable lubricants for ships. In such case, the survey is to be carried out in conjunction with dry docking survey. When the shipowner/shipping company has sufficient measures to ensure full replacement of lubricants, lubricants can be replaced under floating condition with the consent of CCS.

3.2.2 Issuance of EALs Statement

3.2.2.1 For ships that have been subjected to initial, special and interim surveys and are in compliance with applicable requirements of the Guidelines, CCS will issue or renew the EALs Statement with a period of validity of not more than 5 years. Special survey is to be completed prior to the expiry date of the certificate.

3.2.3 Invalidation of Statement

3.2.3.1 EALs Statement is automatically invalidated in either of the following conditions:

1. the ship replaces brand or type of environmentally acceptable lubricants, but EAL Report is not revised timely and classification society is not informed in time;

2. air seal of stern shaft tube air seal system is out of work, but repair is not carried out in time and classification society is not informed of survey;

3. air seal system is not used in the stern shaft onboard ships, and environmentally acceptable lubricants are replaced by mineral oil;

4. survey is not carried out according to the specified intervals within the period of validity of statement.

3.2.4 Initial survey

3.2.4.1 Document check

1. The EALs Report submitted by the shipyard and shipowner/shipping company is to be checked, to confirm that the report provides detailed description of the usage of lubricants in all oil-to-sea interfaces onboard the ship, confirm that its usage is in compliance with the requirements of the Guidelines. Where necessary, supporting documents such as product certificate, manufacturer's statement, oil product approval label and compatibility reports, etc. are to be examined;

2. Where stern shaft tube air seal system is used, the approved Schematic Diagram of Air Seal System and the Drawing of Stern Tube Lubricant Daily Service System are to be examined and air seal system product certificate and manufacturer's statement are also to be examined.

3.2.4.2 Site survey requirements

1. Where EALs is used in onboard oil-to-sea interfaces, attention is to be paid to the examination according to the following requirements:

(1) Checking EALs approval document and confirming whether EALs approval label complies with EPA requirements. Where necessary, the EALs supplier is required to supply a copy of approval certificate, and relevant documents are to be attached to the EALs Report;

(2) Confirming that EALs is compatible with stern shaft tube sealing material, and compatible material is to be attached to the EALs Report;

(3) All EALs brands used in oil-to-sea interfaces are to be recorded in the report, and all EALs need corresponding Material Safety Data Sheet (MSDS/Part 4.2.9);

(4) Condition of lubricants in oil-to-sea interfaces is to be recorded in detail in the EALs Record, including MSDS, evidence of approval label and compatible material;

(5) The EALs Report is to be prepared by the shipyard or shipowner/shipping company, submitted

to site surveyor for review and kept on board;

(6) In U.S. waters, maintenance outside dry dock is to be avoided as far as possible;

(7) If maintenance or emergency repair is unavoidable, attention is to be paid to oil spill amount control and oil spill recovery. For example, proper leakage handling devices (e.g. oil fences) are to be used to control oil spill, and in addition, direct means of access to leakage handling devices is to be provided to remove oil spill (for the requirements for oil spill amount, refer to the requirements of Appendix 3 of the Guidelines);

(8) Maintenance of oil-to-sea interfaces is to be record in the logbook.

2. If using EALs for oil-to-sea interface is technically infeasible, attention is to be paid to the examination according to the following requirements:

(1) Checking whether the ship satisfies the conditions for "technically infeasible". VGP(2013) provides clear definition of "technically infeasible". For the implementation in relation to "technically infeasible", reference may be made to Appendix 2 of the Guidelines;

(2) If using EALs for oil-to-sea interfaces is technically infeasible, the shipowner/shipping company is to fill in the report (Recordkeeping/Part 4.2) onboard according to form required by VGP (2013), and state the reason for not using EALs;

(3) Each year the shipowner/shipping company is to submit the information on the usage of non-EALs to EPA by means of an annual report, and rectify this during next dry docking survey;

(4) The positions where non-EALs are used are to be described in EALs Record, stating reason for "technically infeasible" and providing corrective measures;

(5) EALs Report is to be prepared by the shipyard or shipowner/shipping company, submitted to site surveyor for review and kept on board;

(6) Maintenance outside of the dry dock is to be avoided as far as possible;

(7) If maintenance or emergency repair in the U. S. waters is unavoidable, attention is to be paid to oil spill amount control and oil spill recovery. For example, proper leakage handling devices (e.g. oil fences) are to be used to control oil spill, and in addition, there is to be direct means of access to the leakage handling device to remove oil spill;

(8) Maintenance of oil-to-sea interfaces is to be record in the logbook.

3. If air seal system is adopted for stern tube to replace EALs, attention is to be paid to the following requirements:

(1) If air seal is adopted instead of EALs, the requirements of Chapter 5 of the Guidelines are to be complied with;

(2) The shipyard or shipowner/shipping company is to pay attention to requiring the air seal system manufacturer to provide Statement of Compliance with VGP(2013) and the type approval certificate of stern shaft seal. The surveyor is to confirm the Statement of Compliance and the type approval certificate of stern shaft air seal provided by the manufacturer;

(3) Stern tube lubricant consumption is to be recorded and examined periodically on board ships according to the form of the Consumption Record of Stern Tube Lubricant System;

(4) Operational oil spill is not to take place for air seal system within its service life;

(5) Condition of stern shaft tube air seal system is to be described in EALs Record, including type, product certificate and statement of the manufacturer;

(6) EALs Report is to be prepared by the shipyard or shipowner/shipping company, submitted to site surveyor for review and kept on board;

(7) In the U.S. waters, if mineral oil leakage occurs due to adoption of air seal system, record is to be made according to paragraph 4.2.3 of VGP(2013). For lubricant leakage due to special conditions, detailed record is to be made on the accident and its cause in accordance with the form in paragraph 4.4.3 of VGP(2013), including cause of leakage and how it is handled.

4 If seawater lubricating system is used for stern shaft, the following requirements may be applied:

(1) For a ship using seawater lubricating system for stern shaft, if its other areas satisfy the requirements of the Guidelines, upon the request of the shipowner/shipping company or shipyard and on completion of satisfactory survey according to the requirements of CCS, the whole ship may be issued with EALs Statement or assigned with EAL class notation.

3.2.5 Annual survey

3.2.5.1 Document check:

1 Checking class certificate and/or EAL Statement;

2 Checking EALs Report, confirming whether lubricants have been replaced in oil-to-sea interfaces. If they have been replaced, confirming whether EALs Report is renewed on board the ship and ensuring that the replaced lubricants are provided with complete documents and are in compliance with relevant requirements;

3 Checking that the arrangement and condition of air seal system have not undergone changes which may affect the validity of class notation and the statement, confirming relevant alarm positions and safety valves and ensuring that relevant requirements of the Guidelines are satisfied;

4 Checking Record of Stern Tube Lubricant Consumption onboard the ship and its validity;

5 For propeller shaft lubricated by EAL, during each annual survey of the ship, confirming that the ship is to be subject to the following action at least once every 6 months, i.e. submitting propeller shaft EAL sample to a recognized lubricant analysis organization for testing and analyzing viscosity, water content, chloride content, content of metal particles in bearings and lubricant aging condition (antioxidant capability);

6 Verifying that analysis record of a recognized lubricant analysis organization is kept on board the ship with conclusion on lubricant condition and suitability;

7 The surveyor is to verify lubricant analysis report within the latest 6 months.

3.2.6 Special survey

1 Checking EALs Report, confirming whether lubricants have been replaced in oil-to-sea interfaces. If they have been replaced, confirming whether EALs Report is renewed on board the ship and ensuring that the replaced lubricants are provided with complete documents and are in compliance with relevant requirements;

2 Checking that arrangement and condition of air seal system have not undergone changes which may affect the validity of class notation and the statement;

3 Checking alarm positions and safety valves of air seal system and confirming that they are in good condition;

4 Checking Record of Stern Tube Lubricant Consumption on board the ship and its validity;

5 Checking EAL condition according to the requirements of 3.2.5.5~7.

CHAPTER 4 REQUIREMENTS FOR ALIGHMENT OF SHAFTING USING EALs

Section 1 General Provisions

4.1.1 The provisions are intended to provide guidance on design, technique and operation to help to adapt to the potential difference between certain performance of EAL and conventional mineral oil at present stage.

4.1.2 Calculation and technology in relation to alignment of shafting using EAL are to satisfy, in addition to the requirements of relevant CCS rules, the requirements of this Chapter.

4.1.3 This Chapter is not applicable to ships with new means of propulsion, such as podded propulsion and azimuth propulsion.

Section 2 Key Points for Control

4.2.1 Requirements for shafting design and alignment calculation

1. Forward stern tube bearing is to be used on stern shafts of ships as far as possible. For ships without forward stern tube bearing, in order to facilitate site calibration and confirmation of stern shaft, displacement of certain positions relative to the shafting reference line is to be provided in the shafting alignment calculations, e.g. providing displacement of shaft in the position of forward seal;

2. Relative angle of inclination between ship stern shaft and aftermost sterntube bearing is to be reduced as far as possible;

3. In shafting alignment calculation, full consideration is to be given to the effect of hull deformation under different loading conditions. If effect of hull deformation is not considered in the calculations, at least the cold or hot load of bearings is to be measured when the ship is ballasted and aft peak tank is fully loaded and when the ship is ballasted and aft peak tank is empty. The measurement results are to satisfy relevant requirements of CCS rules.

4.2.2 Requirements for shafting installation and alignment technique

1. The shipyard is to give full consideration to the influence of deflection of boring equipment on the machining precision of stern tubes.

2. After finish machining of stern tubes, sizes of bores on stern tubes are to be measured to confirm the deviation of center lines of the stern tube body (in vertical and horizontal directions).

3. The above deviation is to be taken into consideration during cylindrical grinding of stern bearing and compensation during machining is to be made for deviation from stern tube center line as appropriate. (Direct modification of stern tube size is to be avoided on site).

4. Aftermost stern bearing is fitted with pressure, displacement, straightness and slope in way of

stern bearing are to be measured and calculated. When verifying the slope of stern bearing relative to the reference line, at least 4 peripheral sections (or at an interval of at least 300mm) are to be taken in aft bearing for measurement.

5. For the stern tubes fixed by pouring of epoxy resin, on completion of pouring by epoxy resin, the displacement, straightness and slope of stern tubes are to be measured and verified according to the requirements of 4.2.2.4.

6. For ships without forward stern tube bearing, prior to installation of forward seal, the position of stern tube in way of forward seal is to be marked according to the requirements in shafting alignment calculations, and original measured value is to be recorded. Installation of forward seal is not to affect retesting of this value.

7. For ships without forward stern tube bearing, random adjustment of height of intermediate bearing and main engine is to be avoided as far as possible. If there is big deviation of the bearing load and fine adjustment of intermediate bearing height is necessary, it is to be ensured that the height of the marked position as specified in above 6 is not higher than the original measured value, while the loads of bearing are to meet the requirements of shafting calculations.

4.2.3 Sea trial of ships

4.2.3.1 In addition to meeting relevant requirements of sea trial, ships using EAL are to satisfy the following requirements:

1. Prior to sea trial, the shipyard is to submit the running-in procedure for sea trial of a newly built ship to the site surveyor. Prior to steering test and turning test, ship shafting is to run in fully under the condition of low speed and small rudder angle;

2. During sea trial of the ship, including during implementing running-in procedure, the shipyard is to record data of temperature of all bearings (including last three bearings of main engine crankshaft), main engine speed and rudder angle at an interval of every 5 minutes. The surveyor is to witness the recording of relevant data during the implementation of running-in procedure.

4.2.4 Ship operation

1. When the ship is in no-load and light draught condition, especially when the propeller is not fully immersed, high-speed running of propeller is to be avoided.

2. Under severe weather condition, sufficient ballast condition of the ship is to be ensured to avoid free running of propeller.

3. At the initial stage of ship delivery, full rudder in light draught condition is to be avoided, and at the same time, change of bearing temperature is to be monitored closely.

4.2.5 Others

1. Discharge and sampling of lubricants in the stern tube is to be optimized, and the stern tube lubricant discharge and sampling ports are to be arranged in way of stern aft bearing as far as possible. On one hand, lubricant residue in stern tube is to be reduced as far as possible during the replacement of lubricants, on the other hand, lubricants in stern tube may be sampled through stern tube lubricant discharge outlet so as to help crew to carry out sampling and analysis of lubricant in

stern tube on a regular basis;

2. If specific pressure of thermal stern bearing exceeds 0.6 N/mm^2 or the relative inclination angle exceeds 0.2×10^{-3} rad as specified in shafting alignment calculations, the ship is to be deemed as a target ship for close attention on the temperature of stern shaft.

CHAPTER 5 AIR SEAL SYSTEM

Section 1 General Provisions

5.1.1 This Chapter applies to ships with air seal system for stern shaft tube.

5.1.2 In principle, requirements for air seal modification survey is similar to that for newbuildings, and relevant modification plan is to be approved by CCS.

5.1.3 Air seal for stern shaft sealing is to be subject to CCS type approval.

5.1.4 Condition of air seal system is to be recorded periodically on board ship according to the form of Consumption Record of Stern Tube Lubricant System.

5.1.5 In addition to the requirements of the Guidelines, air seal system is to satisfy the requirements of CCS Rules for Classification of Seagoing Steel Ships.

Section 2 Survey Requirements for Air Seal System

5.2.1 If air seal system is used onboard a ship, the shipyard and shipowner/shipping company may apply to CCS Plan Approval Center. Upon approval by Plan Approval Center, site surveyors are to make confirmation of relevant condition according to documents approved by Plan Approval Center, and SOC (US-EAL) is to be issued or EAL class notation is to be assigned after satisfactory survey/confirmation.

5.2.2 Plans and documents

5.2.2.1 Shipyards and shipowners/shipping companies are to submit the following documents to CCS:

1 Schematic diagram of air seal system;

2 Stern tube lubricant daily service system plan;

3 Air seal type approval certificate;

4 Air seal manufacturer’s statement (stating that there is no oil-to-sea interface under normal conditions);

5 Modification plan (where applicable).

5.2.3 Design and construction

5.2.3.1 Stern seal of air seal system is functionally to at least include seal against seawater leakage and oil leakage to ensure an air space between seawater and lubricant to recover oil and water so that there is no oil-to-sea interface in the integral construction of air seal system.

5.2.3.2 Air seal system is to, according to the draught condition, provide clean compressed air with relatively stable pressure to ensure that seawater will not continuously penetrate into air space under normal condition. Pressure difference between each chamber is to be in conformity with the data provided by the product supplier, by taking into account of the service life of seal ring.

5.2.3.3 If there is transient failure of air supply, sufficient measures are to be taken to ensure that

air seal system has same sealing effect as oil seal, or other equivalent measures are to be taken to ensure safe navigation of the ship.

5.2.3.4 Under all draught conditions, when seal system loses air supply, sufficient measures are to be taken to ensure that there is no risk of lubricant leakage.

5.2.4 Air control units

5.2.4.1 Air control units are to be able to provide clean air with relatively stable pressure.

5.2.4.2 At least one set of air indicator is to be provided.

5.2.4.3 Air seal system is to be provided with pressure adjusting device.

5.2.4.4 For system with automatic air pressure adjustment, when air pressure is connected to stern seal lubricant tank, the tank is to be provided with safety valve to prevent overpressure. At the same time, stern seal lubricant tank is to be provided with high level alarm.

5.2.4.5 At least one set of air pressure alarm system is to be provided to give visual and audible alarm when the pressure of air supply is low. For AUTO-0 ship, air supply pressure alarm is to be able to be displayed at the navigation bridge.

5.2.5 Drain collection units

5.2.5.1 Air seal system is to be provided with drain collection units.

5.2.5.2 Drain collection units are to be lower than the bottom of stern seal.

5.2.5.3 Drain collection units are to be provided with high level alarm.

5.2.6 Requirements for air seal system alarm positions

5.2.6.1 Air seal system is to be provided with alarms mentioned in Table 5.2.6.1 to monitor system operation.

Table 5.2.6.1 Air Seal System Alarm positions

Items	Centralized control station (room) in engine room	
	Display	Limit alarm
Pressure of air control system		Low
Level in drain collection unit		High
Level in stern seal lubricant tank		High
		Low

5.2.7 Requirements for automatic monitoring of air seal alarm positions in periodically unattended machinery spaces

5.2.7.1 Table 5.2.7.1 is supplementary to Automatic Control and Monitoring Items for Ships with Class Notation AUT-0 (Table 3.10.1.1, PART SEVEN of CCS Rules for Classification of Seagoing Steel Ships).

Table 5.2.7.1 Automatic Control and Monitoring Items for Air Seal System Alarm positions

Items	Centralized control station (room) in engine room		Mode of protective control action	Mode of alarm at BCS
	Display	Limit alarm		
1	2	3	4	5
26 Air seal system				
Pressure of air control system		Low	-	Y
Level in drain		High	-	Y

collection unit				
Level in stern seal lubricant tank		Low	-	Y
		High	-	Y

5.2.8 Installation and inspection

1. Checking product certificate;

2. Checking that the whole arrangement of system is consistent with the requirements of the drawing, and attention is to be paid to checking installation height of stern seal lubricant tank and drain collection unit;

3. After the air seal system is installed on board the ship, pressure test and function test are to be carried out;

4. Alarm position simulation test.

Section 3 Modification of Existing Ships for Air Seal System

5.3.1 If an existing ship has been subject to modification of stern seal system, application for interim survey is to submitted to CCS. For details, see Section 5.2 of this Chapter.

5.3.2 When an existing ship with automation class notation is subject to modification, requirements of 5.2.6 and 5.2.7 of this Chapter are to be satisfied as far as possible. For old ships, if it is confirmed that it is difficult to provide additional alarm positions in the centralized control room or navigation bridge, arrangement of a single alarm position may be exempted with the consent of surveyor and the alarm function may be achieved through general alarm positions in the navigation bridge or centralized control room.

5.3.3 On completion of modification, functional test is to be carried out according to 5.2.8 of this Chapter.

Section 4 Consumption Record of Stern Tube Lubricant System

5.4.1 Consumption Record of Stern Tube Lubricant System is to be prepared by the shipyard and shipowner/shipping company and submitted to CCS for review.

5.4.2 Consumption Record of Stern Tube Lubricant System is to include the following contents:

1. Defining management responsibilities, requiring that a designated person be arranged on board the ship to check stern tube lubricant consumption at regular intervals and make relevant record;

2. Defining inspection period and scope;

3. Form of record is to be provided.

5.4.3 Inspection period and scope

5.4.3.1 Air seal system (including lubricant system) is to be subject to inspection on board ships according to the following requirements and relevant records are to be made:

1. Daily inspection items:

(1) Inspecting and recording level of stern seal lubricant tank;

(2) Inspecting and recording level of forward seal lubricant tank;

(3) Inspecting and recording bearing and stern tube oil temperature;

(4) Visual inspection of forward seal to confirm whether there is lubricant leakage or not;

(5) Checking whether other parts of air seal system are in good condition, including lubricant pump, cooler and filter, etc.

2. Weekly inspection items:

(1) Checking normal opening and closing conditions of valve or components of air seal system according to the system diagram;

(2) Confirming that level alarm of lubricant tank and forward seal tank is good condition;

(3) Inspecting and recording level of stern seal lubricant tank;

(4) Inspecting and recording level of forward seal lubricant tank.

3. Other inspection items:

(1) Lubricant sampling and analysis (according to the requirements of CCS Rules for Classification of Seagoing Steel Ships);

(2) Stern bearing offset measurement (according to the requirements of CCS Rules for Classification of Seagoing Steel Ships).

CHAPTER SIX APPENDIX

Appendix 1 Typical Air Seal System

6.1.1 This Chapter only provides introduction of the fundamentals of air seal system instead of requirements for product inspection.

6.1.2 In general, an air seal system is mainly composed of the following units:

1 Air control unit;

2 Drain collection unit;

3 S/T L.O. tank unit;

4 S/T L.O. circulation pump.

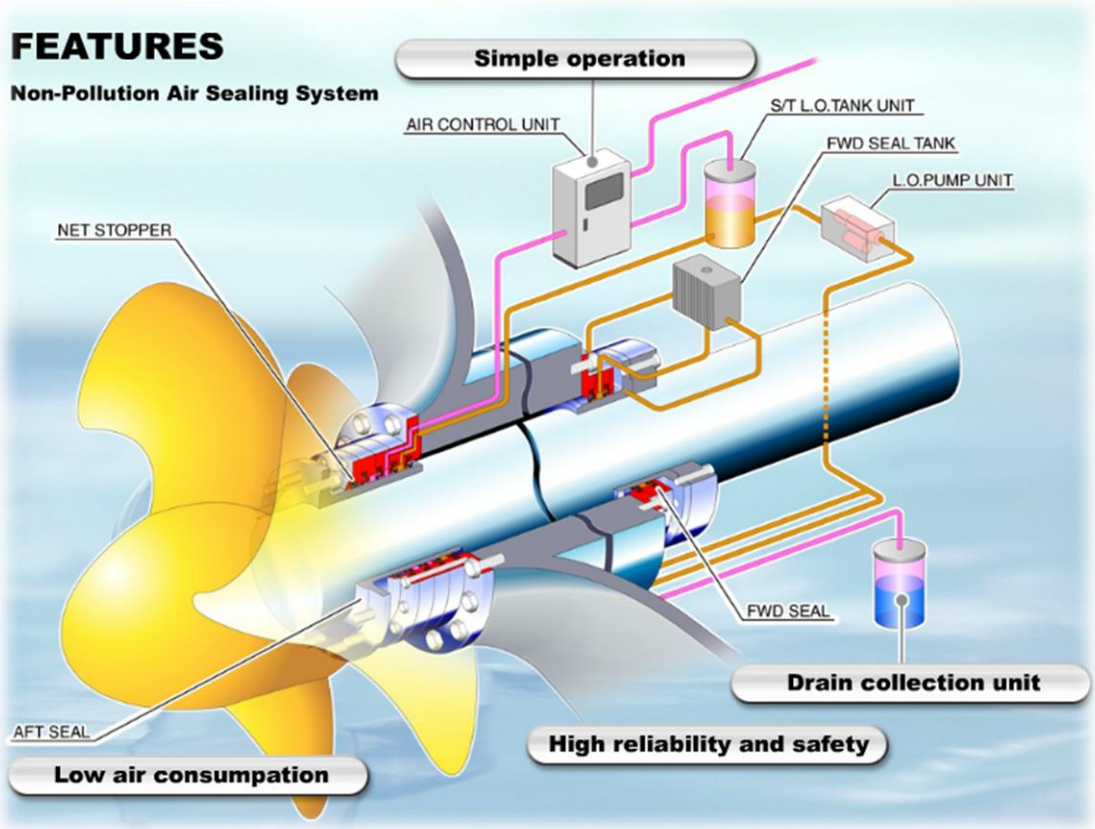

Figure 6.1.2(1) Schematic diagram of air seal system

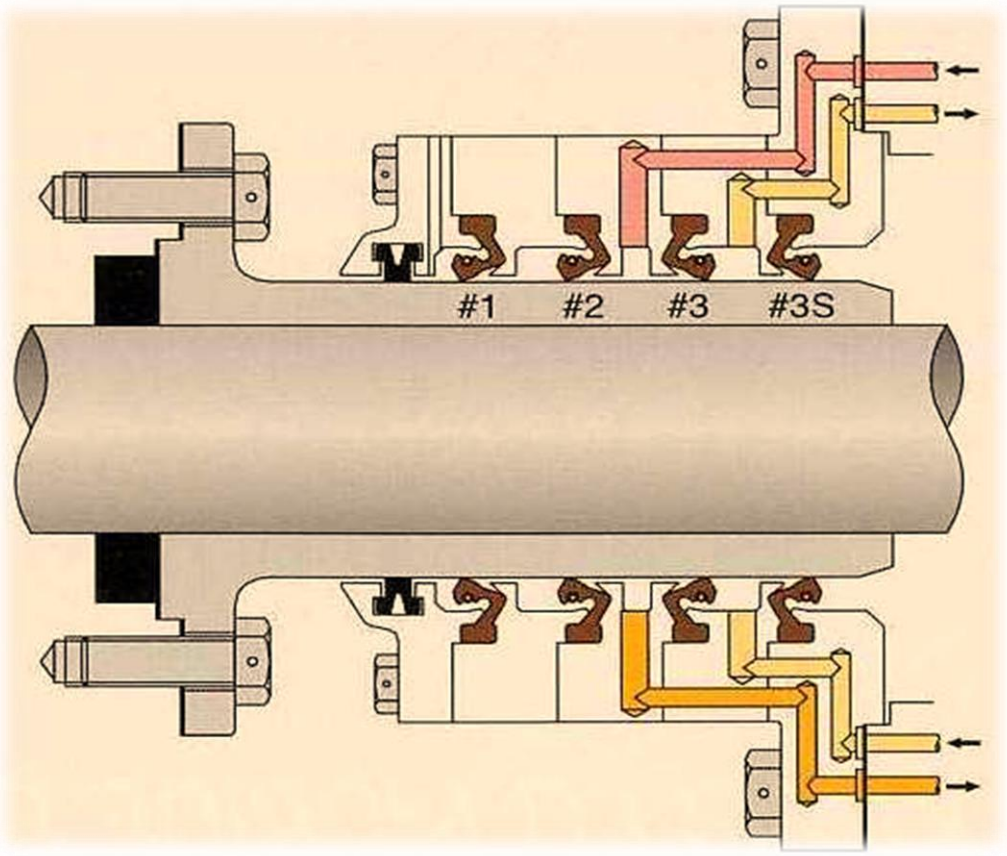

Figure 6.1.2(2) Schematic diagram of internal structure of stern seal

6.1.3 Air seal type

6.1.3.1 In general, air seal may mainly composed of following three types:

1. Stern shaft air seal I. Pressure of air in air chamber is constant and will not change automatically with draught change;

2. Stern shaft air seal II. Pressure of air in air chamber changes automatically with draught change, but pressure oil tank is not provided;

3. Stern shaft air seal III. Pressure of air in air chamber changes automatically with draught change, and pressure oil tank is provided, pressure of which changes with draught change.

6.1.3.2 Selection of air seal type is generally relating to the difference between ship full-load waterline and ship light-load waterline. Switching principles provided by individual manufacturers are different slightly, depending on the requirements of the seal manufacturers in principle. Figure 6.1.3.2 is schematic diagram of a certain air seal type, i.e. when the draught difference of the ship reaches a certain value, two oil tanks are required and subject to manual switch in way of waterline H_{SOP}.

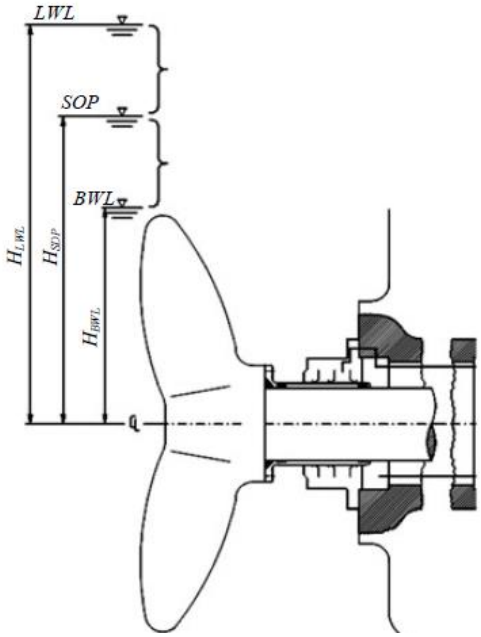

Figure 6.1.3.2 Schematic diagram of selection of stern seal

where:

H_{LWL} (Height of Load Water Line) is the height between ship's full-load waterline and shafting centerline;

H_{BWL} (Height of Ballast Water Line) is the height between ship's ballast waterline and shafting centerline;

H_{SOP} (Height of Switch Over Point) is the height when oil tank 1 and oil tank 2 are switched over with each other.

6.1.4 Working principle of a certain type of air seal

1. Compressed air of ships goes through air control units by means of pipes and pressure is adjusted by means of pressure adjusting valve;

2. Air control units are provided with air flow gauge, which can adjust air flow as needed;

3. Compressed air is divided into two ways by air control unit, one way is connected to lubricant tank unit, and the other is connected into #2/#3 seal chamber which can be entered from top by compressed air;

4. Left side of #1 sealing ring is subject to seawater pressure P_{SW}, and pressure in #2/#3 seal chamber is generally as such: $P_{\#2/\#3}$ = 0.02~0.04 MPa + P_{SW}. Assuming tension from #1 sealing ring is 0.01~0.02 MPa, then pressure in #1/#2 seal chamber is: $P_{\#1/\#2}$ = 0.01~0.02 MPa + P_{SW}. Therefore, pressure in #2/#3 seal chamber is always 0.01~0.02 MPa higher than that in #1/#2 seal chamber, and pressure in #1/#2 seal chamber is 0.01~0.02 MPa higher than the seawater pressure on #1 sealing ring. Compressed air enters #1 and #2 seal cavities through #2/#3 seal chamber, and then is discharged to seawater through #1 sealing ring, in this way seawater is kept out.

Note: Generally speaking, air control units can adjust air supply pressure according to the changes of draught. Air control units for air seal system provided by some manufacturer are not fitted with specific pressure testing and adjusting device, and the set pressure difference is guaranteed by achieving equilibrium through continuous

feedback of pressure change by the flow.

5. The system is provided with drain collection units from #2/#3 seal chamber into the inside of the ship, and drain collection units are generally positioned below the axis. When seawater leaks from #1 and #2 sealing ring and lubricant leaks from #3 sealing ring, leaked seawater and lubricant may be drained to the drain collection units. Common failures of air seal system can be identified on a preliminary stage through the composition in drain collection units and different alarm signals;

6. The system is provided with two lubricant circulation pumps which serve as spare to each other. Lubricant in lubricant tank unit is pumped into #3/#3S seal chamber and stern shaft tube, and oil pressure in #3/#3S seal chamber is controlled as 0.03~0.05 MPa higher than air pressure in #2/#3 seal chamber by adjusting the needle valve on circulation pump unit, i.e. adjusting oil return amount. For automatic pressure adjusting system, when ship draught increases, seawater pressure on the left side of #1 sealing ring increases, gap between sealing ring and lining becomes smaller and therefore air discharged from #1 sealing ring to seawater decreases, causing pressure in #1/#2 seal chamber rises and pressure in #2/#3 seal chamber rises accordingly. For automatic pressure adjusting system (stern shaft air seal III), lubricant tank units are directly connected with #2/#3 seal chamber through air pipes, therefore pressure of lubricant tank units increases with pressure rise in #2/#3 seal chamber, and resistance of lubricant flowing back from seal chamber and stern shaft tube to lubricant tank unit increases and pressure of oil in #3/#3S seal chamber and stern shaft tube increases gradually, and then new balance is reached.

6.1.5 Reliability analysis of air seal system

1. Air seal system is generally composed of three chambers formed by four sealing rings, as shown in Figure 6.1.2-2. When air supply fails or there is transient low pressure, pressure in #2/#3 chamber is lower than that in #1/#2 chamber, and there is no leakage risk for lubricant;

2. #3S sealing ring is a spare ring, and under normal condition, $P_{\#3/3S}=P_{S.T.}$ ($P_{S.T.}$ is pressure in stern tube lubricant tank), when #3 sealing ring fails, oil supply valve of #3/#3S chamber is closed and #3S sealing ring is put into use, and thus ingress of seawater into stern tube is avoided, as shown in 6.1.5-1;

3. When #1 sealing ring fails, #2 sealing ring may avoid ingress of seawater into the air chambers;

4. Oil-water mixture in air chambers may be recovered by drain collection units.

Note: For the fundamentals of air seal, see Figure 6.1.5(2).

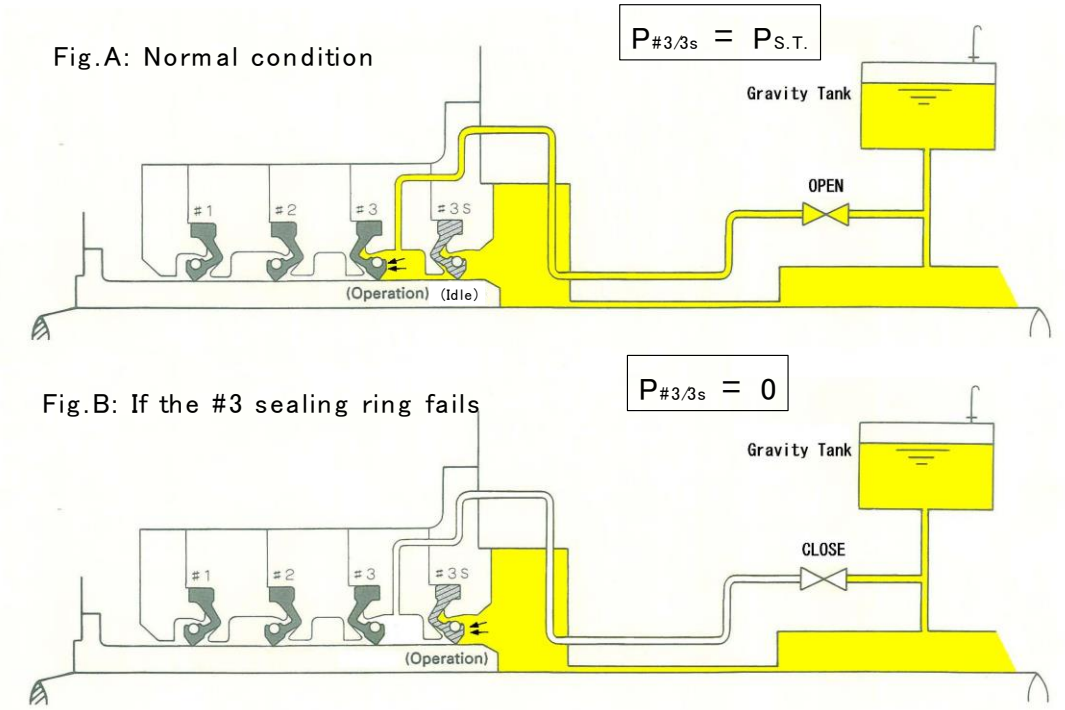

Figure 6.1.5(1) Failure mode switching over principle

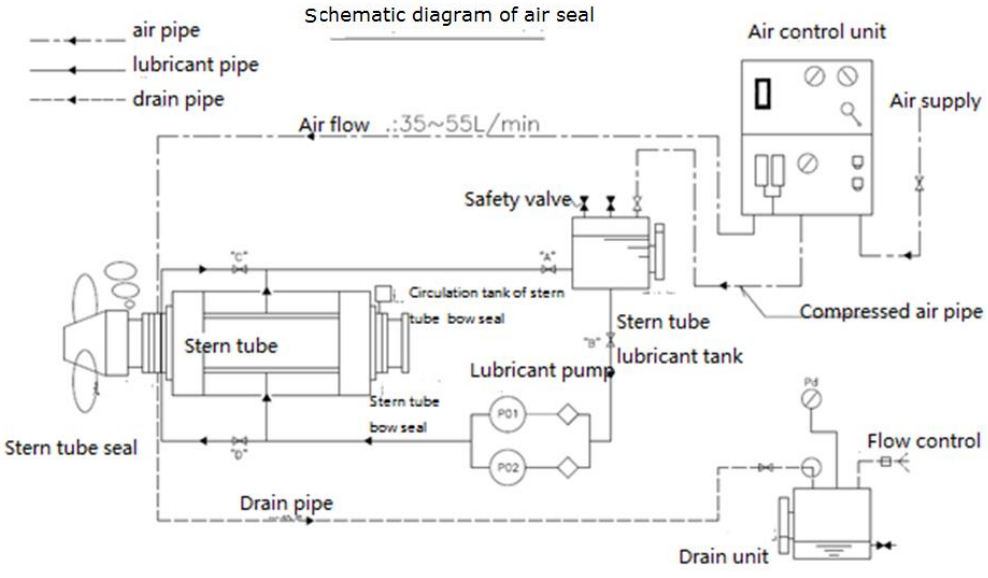

Figure 6.1.5(2) Schematic diagram of air seal system (simplified diagram)

Appendix 2 Technically Infeasible

6.2.1 For the purpose of paragraph 2.2.9 of VGP(2013), a new ship is defined as a ship the keels of which is laid or which is at a similar stage of construction on or after 19 December 2013. For the applicability of paragraph 2.2.9, EPA does not give clear explanation, and in paragraph 2.2.9, it is recommended that new ships should adopt seawater lubricating systems. According to the information released on EPA website, in principle, implementation of EALs immediately took effect as of 19 December 2013, but certain period of relaxation may be granted under the premise of “technically infeasible”.

6.2.2 In principle, EPA is of the view that a new ship does not have technically infeasible conditions, because at the design and type selection stage, a new ship can select products in compliance with EALs requirements or similar products. In addition, systems such as seawater based system and air space seals may also be adopted to avoid requirements for EALs.

6.2.3 To facilitate to understand “technically infeasible”, EPA gives examples in its official website as follows:

1. Take newbuildings for example, if a certain ship has signed a contract with a stern seal product supplier, but the stern seal product supplier cannot provide EALs products to match the seal system. In such condition, explanation of EPA should not be regarded as “technically infeasible” condition, and despite of contract, the shipyard may select other types of seal system;

2. Take existing ships for example, prior to next drydocking, failure of mixed use of two lubricants in existing equipment or failure of replacing sealing material and lubricant can be deemed as “technically infeasible”. For such case, the ship operator is to explain the reason for not being able to use EALs and make relevant record (Recordkeeping/Part4.2). This situation should be indicated in the annual record and the positions where non-EALs are used (oil-to-sea interfaces) should be described until the replacement by EALs at next drydocking;

3. It is mentioned in the official website of EPA that in principle, VGP(2013) applies to all ships, but during initial implementation of requirements for EALs in paragraph 2.2.9, there may be small differences between newbuildings and existing ships. Such differences are mainly reflected on understanding and application of “technically infeasible”.

Appendix 3 Control of Oil Spillage

6.3.1 Using EALs does not mean that arbitrary discharge is allowed, and oil spillage amount still need to satisfy the requirements of 40CFR110.3, i.e. discharge of lubricant at oil-to-water interfaces cannot exceed the standard of "may be harmful" as given in 40CFR110.3.

6.3.2 "May be harmful". Discharge of oil in such quantities as "may be harmful" pursuant to section 311(b)(4) of the Act is defined as follows:

Discharge of oil in such quantities that the Administrator has determined may be harmful to the public health or welfare or the environment of the United States include discharge of oil that:

(1) Violate applicable water quality standards; or

(2) Cause of film or sheen upon or dis-coloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines.

The original English text is as follows:

"**§ 110.3 Discharge of oil in such quantities as ''may be harmful'' pursuant to section 311(b)(4) of the Act.**

For purposes of section 311(b)(4) of the Act, discharges of oil in such quantities that the Administrator has determined may be harmful to the public health or welfare or the environment of the United States include discharges of oil that:

(a) Violate applicable water quality standards; or

(b) Cause a film or sheen upon or dis-coloration of the surface of the water or adjoining shorelines or cause a sludge or emulsion to be deposited beneath the surface of the water or upon adjoining shorelines. "

Annex 1 EALs Statement

Form SOC(US-EAL)

CHINA CLASSIFICATION SOCIETY

No. XX16XX12345

STATEMENT OF ENVIRONMENTALLY ACCEPTABLE LUBRICANTS

Name of Ship	XXXXX
Class No.	XXXX
Distinctive Number or Letters	XXXX
IMO No.	XXXXX
Port of Registry	XXXX
Gross Tonnage	XXXX
Date of Next Drydocking	dd-mm-yy

THIS IS TO STATE that:

1. Oil-to-sea interfaces and lubricant details are listed in the Report of Environmentally Acceptable Lubricants (EALs Report), which is provided by （shipyard, shipowner/shipping company）.
2. China Classification Society(CCS) has been reviewed the EALs Report against the provisions of Section 2.2.9 of the 2013 Vessel General Permit for Discharges Incidental to the normal Operation of Vessels (2013 VGP), which is related to Environmentally Acceptable Lubricants (EALs).
3. It assumed that （shipyard, shipowner/shipping company）will carry out any corrective actions documented in the EALs Report, as applicable.
4. Based on the conclusions of points 1, 2, &3above, CCS believes that the ship complies with the requirements of Section 2.2.9 of the 2013 VGP under normal operation.
5. The above statement is valid for the above referenced version/revision number of the EALs Report. And any changes of the EALs Report should Report to CCS.

This statement is valid until

Place _____ ( )

Surveyor to CHINA CLASSIFICATION SOCIETY

Date _____

Annex 2 Requirements for preparing EALs Reports

1. An EALs Report is to be prepared by the shipyard and shipowner/shipping company according to the facts, which is at least to include main parameters of the ship such as ship name and IMO No.

2. The EALs Report is to describe and illustrate the distribution or location of all oil-to-water interfaces onboard the whole ship. If seawater lubrication or air seal is adopted, relevant marks are to be provided which should be distinguished from the marks of oil-to-water interface;

3. The EALs Report is to be attached with the designation of EALs, material safety data sheet (MSDS/Part 4.2.9) and documents proving compatibility of EALs and stern shaft seal material;

4. If "technically infeasible" is applied, reasons for technically infeasible are to be stated and corrective measures are to be provided, including correction time (not exceeding next drydocking or 5 years, whichever is earlier). It is to be indicated that the shipowner or shipping company must notify U.S. Environmental Protection Agency every year in the form of an annual report;

5. If an air seal system is adopted, type approval certificate of the air seal system and statements provided by the air seal supplier are to be attached.