INTERNATIONAL SHIP CLASSIFICATION

Guidelines For Implementation And Survey Of Requirements On Lubricate Oil Of EPA Of The United States

2016

Effective from 1st September 2016

Introduction

In March 2013, U.S. Environmental Protection Agency (hereinafter referred to as EPA) officially releasedthe 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 design units, shipowners/shipping companies, shipyards and classification societies have all done their own researches on EALs. ISC has also timely traced and carried out researches on the use of EALs in major areas under its administration, evaluated the suggestions provided by major shipyards and ship design units, and offered the technical guidance and service from the perspective of equipment selection, design optimization, and technological improvement. This Guideline falls into three parts. The first part clarifies EPA’s technical requirements for EALs and the relevant terms regarding EALs in VGP(2013). The second part makes clear the relevant survey requirements and processes based on relevant provisions of EPA. And the third part provides the specific requirements and ways of operation from the perspective of technology to existing problems with the use of EALs.

Note: Please be advised this Guideline of English version is subject to further literal refinement. Please take note of this website for future update.

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. This Guideline is drafted to help the industry better understand and implement relevant requirements for EALs in VGP(2013).

1.1.1.2 This Guideline has provided the key control points for ships using EALs in shafting from the perspective of shafting design, installation technology and ways of operation, with the aim to reduce the possible high temperature risk of stern tubes in the construction and early delivery stage of ships.

1.1.2 Scope

1.1.2.1 This Guideline applies 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 ISC for the class notation of “EAL”;

(3) Ships applying to ISC 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 clauses related to EALs in VGP (2013) are EPA’s latest requirements for the location prone to lubrication discharges in the normal operation of ships. EPA has signed the Memorandum of Understanding with the Coast Guard to authorize its supervision 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 this Guideline:

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

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

3. Commercial vessel. 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, propulsion pod lubrication, and wire rope and mechanical equipment subject to immersion.

5. Technically Infeasible. Technically infeasible mainly includes the following circumstances:

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

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

(3) No EAL products meeting a manufactures specifications that are available within any port in which the vessel calls;

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

Note: The high temperature alarm in stern tubes for the use of EALs cannot be considered as the sufficient condition for "technically infeasible".

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

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

8. Air control unit. 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 ISC for examination. Explanations should be made on the use of EALs in all oil-to-sea interfaces in the Report. The Report should be prepared according to Annex 2 of Chapter 6.

1.3.2 If air sealing system is adopted, the following plans and documents should also be provided apart from the relevant plans and documents required by *ISC 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 condition);
5. Reconstruction scheme (if applicable).

Section 4 Document Issuance

1.4.1 Upon the shipyard, shipowner or shipping company's request, for ships meeting the requirements of this Guideline after the survey by ISC, an EALs Statement may be issued based

on the EALs Report prepared by the shipyard, shipowner or shipping company in the form of SOC(US-EAL) listed in Annex 1 and 2.
1.4.2 Where air seal is adopted, a statement of compliance with VGP(2013) should be provided by air seal manufacturers.

Section 5 TheAssignment and Maintenance of Class Notations

1.5.1 Upon the shipyard, shipowner or shipping company's request, the class notation of EAL may be assigned to ships meeting the requirements of this Guideline after the survey by ISC. Where the class notation of EAL is necessary for ships in service, an application for the assignment of the class notation should be submitted to ISC 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 this Guideline may be exempted with the consent of ISC:

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 put into service for 2 years and over with sufficient shafting alignment when this Guideline comes into force.

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

Chapter 2 TECHNICAL TERMS ON EALs

Section 1 General Provisions

2.11 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 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, according to the official website of EPA,products that are not included in one of these labeling programs (but have been tested to sufficiently demonstrate compliance with the EAL definition in the 2013 VGP) may also be considered as EALs meeting permit requirements, provided that they are tested 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 self-certification or third-party certification.
2.2.1.3 Unless in special cases, shipyards, shipowners or shipping companies should 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 VGP(2013), all oil-to-sea interfaces onboard ships should use EALs. Regulation 1.2.1.4 of the Guideline should be referred to for the equipment containing oil-to-sea interfaces and the sketch in Figure 2.2.2.1 is forreference.

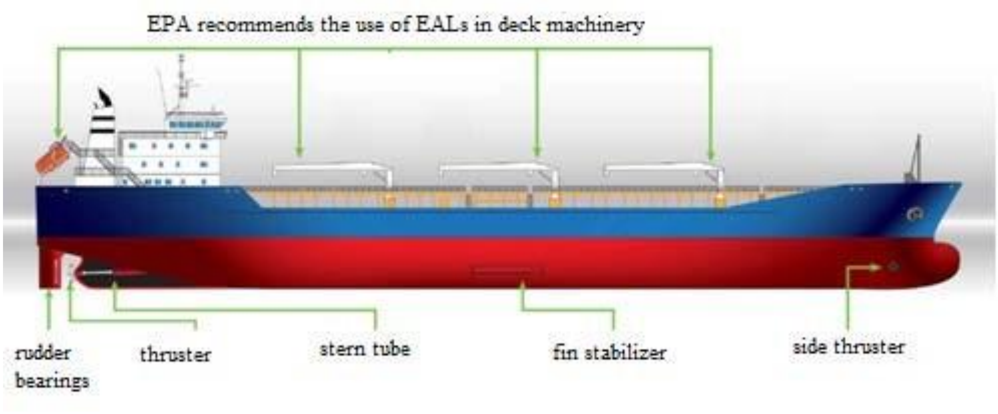

Figure 2.2.2.1 Sketch of the distribution of oil-to-sea interfaces onboard ships

2.2.2.2 Where there is sufficient evidence showing the non-existence of oil-to-sea interfaces onboard ships, including the seawater-lubricated rudder bearings, seawater-lubricated stern tubes, and air sealing system, then it can be considered as meeting the requirement of regulation 2.2.9 of VGP(2013). Where the application for the statement of EALs or the class notation of EAL is necessary under this circumstance, explanations should be made in the EALs Report.

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

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

2.2.2.5 Wire ropes or mechanical equipment that are planned to be immersed in water should use EALs. Excessive lubricants should be cleaned before the immersion, unless the captain deems it unsafe.

CHAPTER 3 EAL-RELATEDINSPECTION REQUIREMENTS

Section 1 General Provisions

3.1.1 This Chapter applies to ships applying for EAL class notations to ISC, or ships applying for issuing EALs Statement to ISC.

3.1.2 Shipyard and shipowner/shipping company are to prepare EALs Report according to the requirements of the Guidelines in combination with actual ship condition and with real-time updating.

3.1.3 Replacement of environmentally acceptable lubricants is to be carried out in drydock as far as possible, but in special conditions, it is allowed to replace lubricants under floating condition with the consent of ISC. Shipyard and shipowner/shipping company are to ensure sufficient replacement of lubricants under the guidance of supplier, update EALs Report in time according to the requirements and submit it to the site surveyor for review.

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

3.1.5 Using EALs does not represent random discharge, the amount of oil spill still needs to satisfy the requirements of 40CFR110.3.

3.1.6 If existing stern shaft tubes are intended to adopt air seal or transform oil seal, the requirements of Chapter 5 of the Guidelines may be referred to.

3.1.7 The Guidelines is the supplement of 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 combination with conventional inspection. If air seal system is adopted, function tests are to be carried out to 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 issuing EALs Statement are to be subject to following survey:

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

.2 Annualsurvey, the interval of annual survey is the same as that of annual survey of ship classification certificate. EAL annual inspection is generally in combination with annual inspection of ship classification certificate. Annual survey is to include inspection of documents,appliances and equipmentrelating to paragraph 2.2.9 of VGP(2013) in the Guidelines, confirm validity of relevant documents such as EALs Report, confirm that arrangement and condition of air seal system do not cause change which affects validity of class notation and statement, confirm relevant alarm point and safety valve and ensure that relevant requirements of the Guidelines are satisfied.

.3 Specialsurvey, the interval of special survey is the same as that of special survey of ship classification certificate. EAL special inspection is generally in combination with special inspection of 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, confirm relevant alarm point and safety valve, confirm validity of documents mentioned in the Guidelines, confirm that condition of air seal system does not cause change which affects validity of class notation and statement, and ensure that relevant requirements of the Guidelines are complied with.

3.2.1.2 Application for interim survey may occur in either of the following conditions:

.1 surveydue to equipment repair and modification or lubricant replacement involving EAL class notation;

.2 survey when the ship needs to replace previous mineral oil with environmentally acceptable lubricants. Such case is to be in combination with drydocking 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 ISC.

3.2.2 Issuance of EALs Statement

3.2.2.1 For ships subject to initial, special and interim survey and complying with applicable requirements of the Guidelines, ISC will issue or renew EALs Statement with term of validity of not more than 5 years. Special survey is to be completed prior to the expiry date of certificate.

3.2.3 Invalidation of Statement

3.2.3.1 EALs Statement is validated in either of the following conditions:

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

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

.3 air seal system is not adopted for stern shaft of ship, and environmentally acceptable lubricants are replaced into mineral oil;

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

3.2.4 Initial survey

3.2.4.1 Document check

.1 It is to check EALs Report submitted by the shipyard and shipowner/shipping company, check that the report provides detailed description of adopting lubricants for oil-to-sea interface of the whole ship, confirm that it satisfies the requirements of the Guidelines, and when necessary, check supporting documents such as product certificate, manufacturer statement, oil approval indicator and compatibility report;

.2 when stern shaft tube air seal system is adopted, it is to check approved Schematic Diagram of Air Seal System and Plan of Stern Tube Lubricant Service System as well as air seal system product certificate and manufacturer statement.

3.2.4.2 Site survey requirements

1 When EALs is adopted for onboard oil-to-sea interface, attention is to be paid to checking following requirements:

(1) Checking EALs certification document and confirming whether EALs approval indicator complies with EPA requirements. When necessary, EALs supplier is required to supply copy of approval certificate, and relevant documents are to be attached to EALs Report;
(2) Confirming that EALs is compatible with stern shaft tube sealing material, and compatibility material is to be attached to EALs Report;
(3) All EALs brands in oil-to-sea interface are to be recorded in the report, and all EALs need corresponding Material Safety Data Sheet (MSDA/Part 4.2.9);
(4) Condition of lubricants in oil-to-sea interface is to be recorded in detail in EALs Record, including MSDS, approval indicator supporting document and compatibility material;
(5) EALs Report is prepared by the shipyard or shipowner/shipping company, submitted to site surveyor for review and kept on board;
(6) In American waters, maintenance outside drydock is to be avoided as far as possible;
(7) If maintenance or emergent repair is unavoidable, attention is to be paid to oil spill amount control and oil spill recovery. For example, proper leak handling equipment (e.g. oil fence)is to be used to control oil spill, and in addition, there is to be direct access to leak handling equipment 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 interface 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 checking following requirements:

(1) Checking whether the ship complies with the requirements for “technically infeasible”. VGP(2013) provides clear definition of “technically infeasible”. For the implementation of “technically infeasible”, reference may be made to Appendix 2 of the Guidelines;
(2) If using EALs for oil-to-sea interface is technically infeasible, shipowner/shipping company is to fill in report (Recordkeeping/Part 4.2) according to the requirements of VGP (2013) fixed form, and state the reason for not using EALs;
(3) Shipowner/shipping company is to submit the condition of using oil rather than EALs to EPA by means of annual report every year, and correct during next drydocking survey;
(4) Location where oil rather than EALs is used is to be described in EALs Record, stating reason for “technically infeasible” and providing corrective measures;
(5) EALs Report is prepared by the shipyard or shipowner/shipping company, submitted to site surveyor for review and kept on board;
(6) Maintenance outside drydock is to be avoided as far as possible;
(7) If maintenance or emergent repair in American waters is unavoidable, attention is to be paid to oil spill amount control and oil spill recovery. For example, proper leak handling equipment (e.g. oil fence) is to be used to control oil spill, and in addition, there is to be direct access to leak handling equipment to remove oil spill;
(8) Maintenance of oil-to-sea interface 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 following requirements:

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

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

(3) Stern tube lubricant consumption is to be recorded and examined periodically on board ship according to the form requirements for 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 manufacturer;

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

(7) In American waters, if mineral oil leakage occurs due to adoption of air seal system, record is to be made with reference to paragraph 4.2.3 of VGP(2013). For lubricant leakage due to special conditions, detailed record is to be made on accident condition and cause with reference to form requirements in paragraph 4.4.3 of VGP(2013), including leakage cause and handling method;

4 Ifseawater lubricating system is used for stern shaft, following requirements may be referred to:

(1) For ships with seawater lubricating system for stern shaft, if other areas satisfy the requirements of the Guidelines, upon application of shipowner/shipping company or shipyard and on completion of satisfactory survey according to the requirements of ISC, the whole ship can be issued with EALs Statement or granted 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 oil-to-sea interface on board ship has replaced lubricant, if yes, confirming whether EALs Report is renewed on board ship and ensuring replaced lubricant has complete information and satisfies requirements;

3 Checking that arrangement and condition of air seal system do not cause change which affects validity of class notation and statement, confirming relevant alarm point and safety valve and ensuring that relevant requirements of the Guidelines are satisfied;

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

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

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

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

3.2.6 Special survey

1 Checking EALs Report, confirming whether oil-to-sea interface on board ship has replaced lubricant, if yes, confirming whether EALs Report is renewed on board ship and ensuring replaced lubricant has complete information and satisfies requirements;

2 Checking that arrangement and condition of air seal system do not cause change which affects validity of class notation and statement;

3 Checking alarm points 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 ship and its validity;

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

CHAPTER 4 REQUIREMENTS FOR SHAFTING ALIGHMENT USING EAL

Section 1 General Provisions

4.1.1 The provisions are intended to adapt the difference between EAL and conventional mineral oil on partial performance at present stage by means of design, technology and operation.
4.1.2 Calculation and technology of shafting alignment using EAL are to satisfy, in addition to the requirements of relevant ISC rules, but also the requirements of this Chapter.
4.1.3 This Chapter is not applicable to ships with new propulsion methods such as podded propulsion and azimuth propulsion.

Section 2 Control Points

4.2.1 Requirements for shafting design and alignment calculation

1 Ship stern shafts are to adopt the type with stern tube fore bearings as far as possible. For ships without stern tube fore bearings, in order to facilitate site calibration and confirmation of stern shaft, displacement of proper location relative to shafting theoretical line is to be provided in the shafting alignment calculation, e.g. providing displacement of shaft in way of bow seal;

2 It is to decrease relative angle of inclination between ship stern shaft and stern tube aft bearing as far as possible;

3 In shafting alignment calculation, full consideration is to be taken to the effect of hull deformation under different loading conditions. If effect of hull deformation is not considered in the calculation, it is at least to measure cold and hot loads of bearing under both conditions that the ship is ballasted and aftpeak tank is fully loaded as well as the ship is ballasted and aftpeak tank is empty, and the measuring results are to satisfy relevant requirements of ISC rules.

4.2.2 Requirements for shafing installation and alignment technology

1 Shipyard is to take full account of the effect of boring machine deflection on stern shaft tube processing precision;

2 After the stern shaft tube is finished, size of stern tube boring is to be measured to confirm (vertical and horizontal) deviation of body centerline;

3 When stern bearings are subject to encircleprocessing, above deformation is to be taken into account, and deformation of stern tube centerline may be subject to processing compensation as the case may be (direct amendment of stern tube size is to be avoided at site);

4 On completion of stern bearing press, displacement, straightness and slope in way of stern bearing are to be measured and calculated. When verifying slope of stern bearing relative to theoretical line, at least 4 peripheral sections (or with interval of at least 300mm) are to be taken in aft bearing for measurement;

5 On completion of pouring by epoxy resin, the stern tubes are to be measured according to the requirements of 4.2.2.4 and subject to verification of displacement, straightness and slope;

6 For ships without stern tube fore bearing, prior to installing bow seal, stern tube is to be calibrated in way of bow seal according to the requirements of shafting alignment calculation, and original measuring value is to be recorded. Installation of bow seal is not to affect value retest;

7 For ships without stern tube fore bearing, random adjustment of height of intermediate bearing and main engine is to be avoided as far as possible. If the bearing has bigger load

deflection and fine tuning of intermediate bearing height is necessary, in addition to ensuring that bearing loads satisfy the requirements of shafting calculation, it is to ensure that the height of calibrated position in above 6 is not higher than the original value.

4.2.3 Sea trial of ship

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

1 Prior to sea trail of ship, the shipyard is to submit newbuildings sea tail running-in procedure to site surveyor. Prior to steering test and turning test, ship shaftings are to run in fully under the condition of low speed and small rudder angle;

2 During sea trial of ship, including 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 the interval of 5 minutes. The surveyor is to witness relevant data during running-in procedure.

4.2.4 Ship operation

1 When the ship is under empty load and shallow draught condition, especially when the propeller is naked, high-speed operation of propeller is to be avoided;

2 Under severe weather condition, it is to ensure that ship has sufficient ballast condition to avoid propeller racing;

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

4.2.5 Others

1 It is to optimize discharge and sampling of lubricants in the stern tube, 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 lubricant replacing process, 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 periodical sampling and analysis of lubricant in stern tube;

2 In shafting alignment calculation, if specific pressure of thermal stern bearing exceeds 0.6 N/mm^2 or the relative inclination angle exceeds 0.2×10^{-3}rad, the ship is to be deemed as target ship and close attention is to be paid to 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 transformation survey is similar to newbuildings, and relevant transformation plan is to be approved by ISC.

5.1.3 Air seal type stern shaft sealing equipment is to be subject to ISC product type approval.

5.1.4 Condition of air seal system is to be recorded periodically on board ship according to the requirements of 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 ISC Rules for Classification of Seagoing Steel Ships.

Section 2 Survey Requirements for Air Seal System

5.2.1 If air seal system is adopted for the ship, shipyard and shipowner/shipping company may apply to ISC Plan Approval Center. With approval of Plan Approval Center, site surveyors are to confirm according to documents approved by Plan Approval Center, and SOC (US-EAL) is to be issued or EAL class notation is to be granted after satisfactory survey/confirmation.

5.2.2 Plans and documents

5.2.2.1 Shipyard and shipowner/shipping company are to submit following documents to ISC:

1 Principle plan of air seal system;

2 Stern tube lubricant system plan;

3 Air seal type approval certificate;

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

5 Transformation plan (when 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 for the integral construction of air seal system.

5.2.3.2 Air seal system is to 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 space is to take service life of sealing ring into account, for details, see data provided by the supplier.

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 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 display at 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 points
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 AirSeal System Alarm Points

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

5.2.7 Requirements for automatic monitoring of air seal alarm points 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 ISC Rules for Classification of Seagoing Steel Ships).

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

Items	Centralized control station (room) in engine room		Action category of safety system	Alarm method of bridge control station
	Display	Limit alarm		
1	2	3	4	5
26 Air seal system				
Pressure of air control system		Low	-	Y
Liquid level of drain collection unit		High	-	Y
Liquid level of stern seal lubricant tank		Low	-	Y
		High	-	Y

5.2.8 Installation and inspection

1 Checking product certificate;

2 The whole arrangement of system is consistent with the requirements of plan, and it is to pay attention to check installation height of stern seal lubricant tank and drain collection unit;

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

4 Alarm point simulating test.

Section 3 Existing Ships Transformed to Air Seal System

5.3.1 If existing ship has been subject to transformation of stern seal system, application for temporary inspection is to submitted to ISC. For details, reference is to be made to Section 5.2 of this Chapter.

5.3.2 When existing ship with automation class notation is subject to transformation, 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 add alarm points in centralized control room or navigation bridge, with the consent of surveyor, arrangement of single alarm point may be exempted, and alarm function will be realized through general alarm points in navigation bridge or centralized control room.

5.3.3 On completion of transformation, function test is to be carried out with reference 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 prepared by shipyard and shipowner/shipping company and submitted to ISC for review.

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

1 Defining management responsibilities, requiring that specially-assigned personnel are arranged on board ship to check stern tube lubricant consumption at regular intervals with record;

2 Defining inspection period and scope;

3 Record form is to be provided in the form.

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 ship with record according to following requirements:

1 Daily inspection items:

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

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

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

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

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

2 Weekly inspection items:

(1) Checking normal opening and closing conditions of valve or components of air

seal system;

(2) Confirming that liquid level alarm of lubricant tank and bow seal tank is good order;

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

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

3 Other inspection items:

(1) Lubricant sampling and analysis (with reference to the requirements of ISC Rules for Classification of Seagoing Steel Ships);

(2) Stern bearing sinking measurement (with reference to the requirements of ISC Rules for Classification of Seagoing Steel Ships).

CHAPTER 6 APPENDIX

Appendix 1 Traditional Air Seal System

6.1.1 This Chapter is only the introduction of principle of air seal system rather than principle requirements for product inspection.

6.1.2 In general, air seal system may be mainly composed of following units:

1 Air control unit;

2 Drain collection unit;

3 S/T L.O. tank unit;

4 S/T L.O. circulation pump.

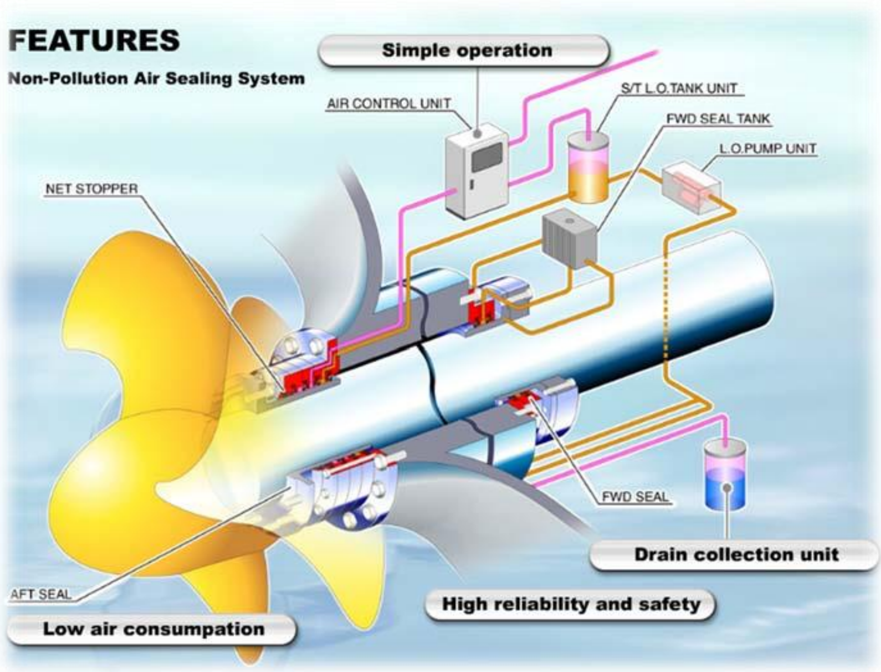

Figure 6.1.2(1) Schematic diagram of air seal system

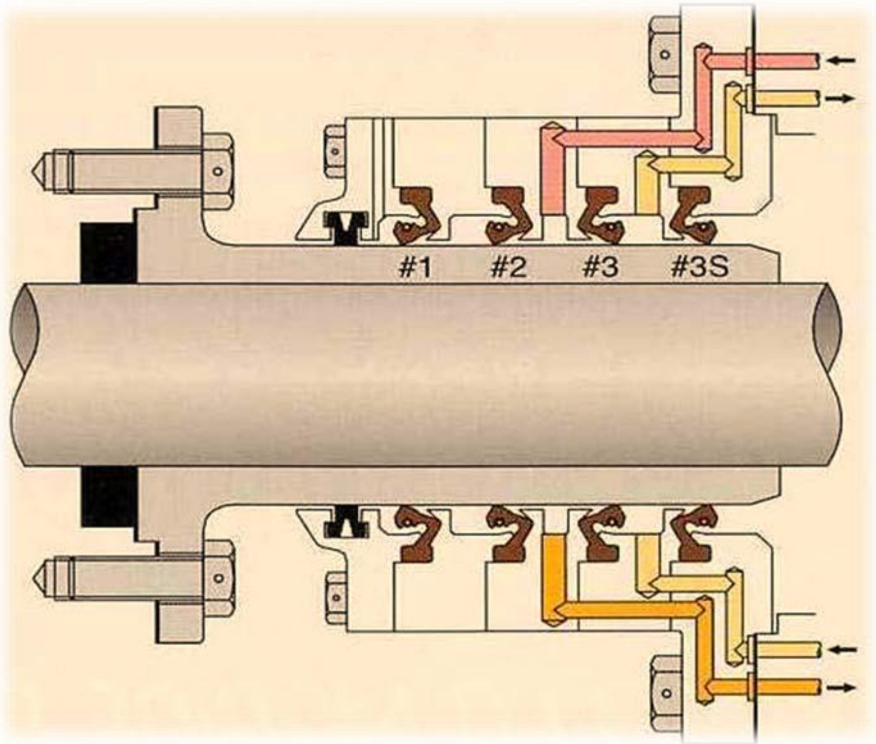

Figure 6.1.2(2) Schematic diagram of internal structure of stern seal

6.1.3 Air seal type

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

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

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

3 Stern shaft air seal III. Pressure of air in air space 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 of ship full-load waterline and ship light-load waterline. Switching principles of each manufacturer are different slightly, depending on the requirements of the seal manufacturer in principle. Figure 6.1.3.2 is schematic diagram of certain air seal type, i.e. when the draught difference of the ship reaches certain value, two oil tanks are required and subject to manual switch in way of waterline H_{SOP}.

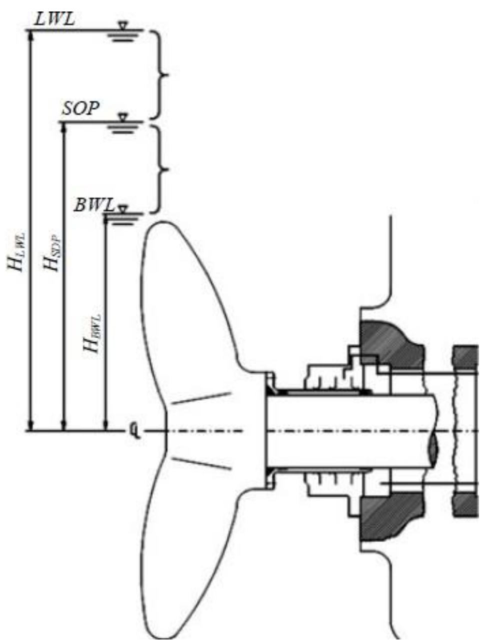

Figure6.1.3.2 Schematic diagram of stern seal type

where:

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

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

H_{SOP} (Height of Switch Over Point) is the height of mutual switch over of oil tank 1 and oil tank 2.

6.1.4 Workingprinciple of certain air seal

1 Compressed air of ship enters air control units through pipes and adjusts pressure by means of pressure adjusting valve;

2 Air control units are provided with air flow gauge, which can adjust air flow according to demands;

3 Compressed air is divided into two ways after entering air control unit, one way connecting lubricant tank unit, and another connecting #2/#3 seal cavity which can be entered from top by compressed air;

4 Left side of #1 sealing ringsuffersseawater pressure P_{SW}, and pressure in #2/#3 seal cavity is generally $P_{\#2/\#3}$ = 0.02~0.04 MPa + P_{SW}. Assuming tension by #1 sealing ring is 0.01~0.02 MPa, pressure in #1/#2 seal cavity is $P_{\#1/\#2}$ = 0.01~0.02 MPa + P_{SW}. Therefore, pressure in #2/#3 seal cavity is always 0.01~0.02 MPa higher than that in #1/#2 seal cavity, and pressure in #1/#2 seal cavityis 0.01~0.02 MPa higher than seawater pressure suffered by sealing ring. Compressed air enters #1 and #2 seal cavities through #2/#3 seal cavity, and then is discharged to seawater through #1 sealing ring, so that seawater is kept out.

Note: Generally speaking, air control units can adjust relevant air supply pressure according to different draught change. Air control units of air seal system of certain manufacturer are not provided with specific pressure testing and adjusting device, and set pressure difference is ensured by equilibrium through continuous feedback of pressure change with nature of fluid itself.

5 The system is provided with drain collection units through #2/#3 seal cavity into the ship, and drain collection units are generally below axis. When seawater leaks from #1 and #2 sealing ring and lubricant leaks from #3 sealing ring, leaked seawater and lubricant may drain to drain collection units. Common failures of air seal system can be under preliminary judgment by means of composition in drain collection units in combination with different alarm signals;

6 The system is provided with two lubricant circulation pumps which are spare to each other. Lubricant in lubricant tank unit is pumped into #3/#3S seal cavity and stern shaft tube, and oil pressure in #3/#3S seal cavity is controlled 0.03~0.05 MPa higher than air pressure in #2/#3 seal cavity by adjusting needle valve on circulation pump unit, i.e. adjusting oil return amount. For automatic pressure adjusting system, when ship draught increases, seawater pressure suffered by left side of #1 sealing ringincreases, gap between sealing ring and lining becomes smaller and air discharged from #1 sealing ring to seawater decreases, causing pressure in #1/#2 seal cavity rises and pressure in #2/#3seal cavity rises accordingly. For automatic pressure adjusting system (stern shaft air seal III), lubricant tank units are directly connected with #2/#3 seal cavity through air pipes, therefore pressure of lubricant tank units increase with pressure rise in #2/#3 seal cavity, resistance of lubricant from seal cavity and stern shaft tube to lubricant tank unit becomes big and pressure of oil in #3/#3S seal cavity 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 cavities 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 cavity is lower than that in #1/#2 cavity, and there is no leakage risk for lubricant;

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

3 When #1 sealing ring fails, #2 sealing ring may avoid seawater to enter air space;

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

Note: For air seal principle, reference is made to Figure 6.1.5(2).

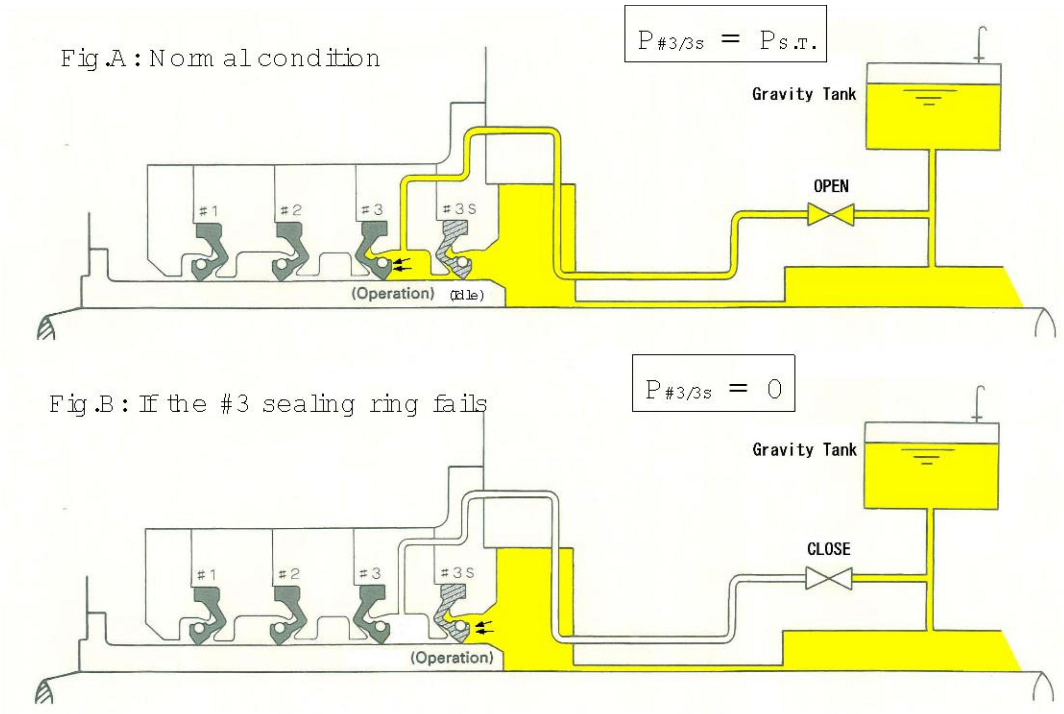

Figure 6.1.5(1) Failure mode switching principle

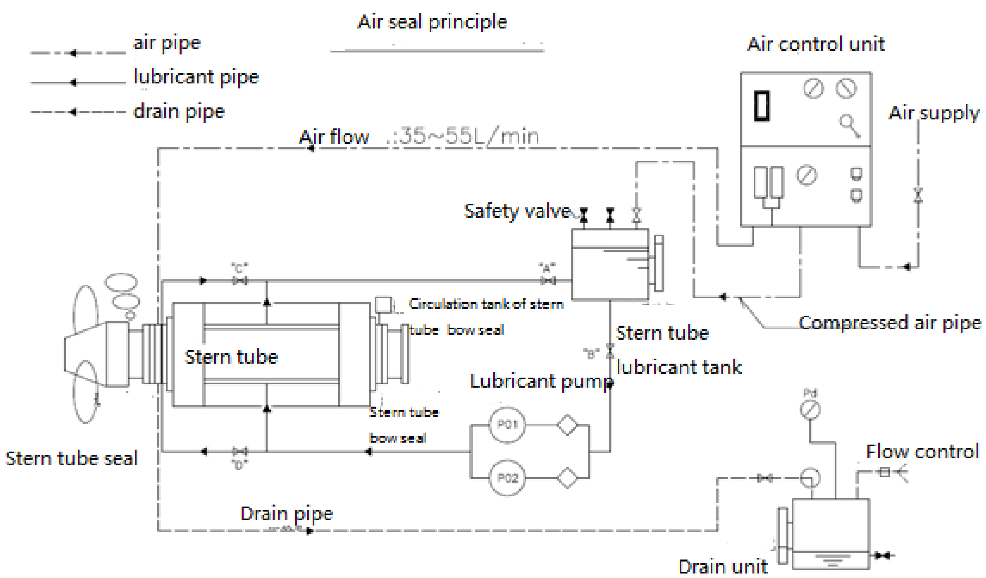

Figure 6.1.5(2) Principle of air seal system

Appendix 2 Technically Infeasible

6.2.1 For the purpose of paragraph 2.2.9 of VGP(2013), 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 ship adopt seawater lubricating system. According to the information issued on EPA website, in principle, issues with regard to implementation of EALs immediately take 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 thinks that new ship does not have technically infeasible conditions, because at design and type selection stage, new ship can select seawater based system and air space seals in addition to products complying with the requirements for EALs or similar products to avoid requirements for EALs.

6.2.3 Tofacilitate to understand "technically infeasible", EPA gives examples in official website as follows:

1 Takenewbuildings for example, certain ship has signed a contract with stern seal product supplier, but stern seal product supplier cannot supply EALs products matching seal system. For such condition, explanation of EPA is that there is no "technically infeasible" condition, and despite of contract, the shipyard may select other type 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, ship operator is to explain the reason for not using EALs and keep record. In annual record, it is to indicate and explain parts not using EALs (oil-to-sea interface) until replacing EALs at next drydocking;

3 It is mentioned in 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 betweennewbuildings 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 represent arbitrary discharge, and oil spillage amount still need to satisfy the requirements of 40CFR110.3, i.e. discharge of lubricant at oil-to-water interface cannot exceed the standard of “may be harmful” 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.

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.

Annex 1 EALs Statement

Form SOC(US-EAL)

ISClass

INTERNATIONAL SHIP CLASSIFICATION

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. International Ship Classification(ISC) 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, ISC 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 ISC.

This statement is valid until

Place ____________　　　　(　　　　　　)

Surveyor to INTERNATIONAL SHIP CLASSIFICATION

Date ____________

Annex 2 Requirements for preparing EALs Report

1 EALs Report is prepared by 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 EALs Report is to describe and illustrate distribution or location of all oil-to-water interfaces of the whole ship. If seawater lubrication or air seal is adopted, marks are to be provided and distinguished from oil-to-water interface;

3 EALs Report is to be attached with brand 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 adopted, 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, which is earlier). It is to be indicated that shipowner or shipping company must notify U.S. Environmental Protection Agency every year in the form of annual report;

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