電子證書
e-Cert

第 31 期

第 二 組

澳門特別行政區公報
由第一組及第二組組成

二零一七年八月四日，星期五

Número 31

II

SÉRIE

do *Boletim Oficial* da Região Administrativa
Especial de Macau, constituído pelas séries I e II

Sexta-feira, 4 de Agosto de 2017

澳門特別行政區公報

BOLETIM OFICIAL DA REGIÃO ADMINISTRATIVA ESPECIAL DE MACAU

第 二 副 刊

2.º SUPLEMENTO

目 錄

澳門特別行政區

行政長官辦公室：

SUMÁRIO

REGIÃO ADMINISTRATIVA ESPECIAL DE MACAU

Gabinete do Chefe do Executivo:

印務局，澳門官印局街。電話：2857 3822 • 傳真：2859 6802 • 電子郵件：info@io.gov.mo
Imprensa Oficial, Rua da Imprensa Nacional — Macau. *Tel.:* 2857 3822 • *Fax:* 2859 6802 • *E-mail:* info@io.gov.mo
網址*Website*: http://www.io.gov.mo

澳門特別行政區

行政長官辦公室

第 41/2017 號行政長官公告

中華人民共和國是國際海事組織的成員國及《經1978年議定書修訂的〈1973年國際防止船舶造成污染公約〉》（廣泛稱為“73/78防污公約”）的締約國；

國際海事組織海上環境保護委員會於一九八五年十二月五日在第二十二屆會議上，透過第MEPC.20（22）號決議通過了《散裝運輸危險化學品船舶構造與設備規則》（《散化規則》），該規則於一九九九年十二月二十日對澳門特別行政區生效；

根據《73/78防污公約》附則II第11條規定，一九八六年七月一日前建造的液貨船須滿足《散化規則》的要求；

海上環境保護委員會多年來分別透過一九八九年三月十七日第MEPC.33（27）號、一九九零年三月十六日第MEPC.41（29）號、一九九二年十月三十日第MEPC.56（33）號、一九九六年七月十日第MEPC.70（38）號、一九九九年七月一日第MEPC.80（43）號、二零零零年十月五日第MEPC.91（45）號、二零零六年三月二十四日第MEPC.144（54）號、二零一四年四月四日第MEPC.249（66）號決議，通過了對《散化規則》的修正案。該等修正案於一九九九年十二月二十日至二零一六年一月一日期間已對澳門特別行政區生效；

《散化規則》及其修正案至今未公佈於《澳門特別行政區公報》；

基於此，行政長官根據第3/1999號法律《法規的公佈與格式》第六條第一款的規定，命令公佈：

——包含《散裝運輸危險化學品船舶構造與設備規則》（《散化規則》）的上指海上環境保護委員會第MEPC.20（22）號決議的英文正式文本；

——包含《散化規則》修正案並於一九九九年十二月二十日至二零零七年八月一日期間生效的上指海上環境保護委員會第MEPC.33（27）號、第MEPC.41（29）號、第MEPC.56（33）號、第MEPC.70（38）號、第MEPC.80（43）號、第MEPC.91（45）號及第MEPC.144（54）號的英文正式文本；

REGIÃO ADMINISTRATIVA ESPECIAL DE MACAU

GABINETE DO CHEFE DO EXECUTIVO

Aviso do Chefe do Executivo n.º 41/2017

Considerando que a República Popular da China é um Estado Membro da Organização Marítima Internacional e um Estado Contratante da Convenção Internacional para a Prevenção da Poluição por Navios, 1973, tal como modificada pelo seu Protocolo de 1978, vulgarmente denominada pelo seu acrónimo «MARPOL 73/78»;

Considerando igualmente que, em 5 de Dezembro de 1985, na sua 22.ª sessão, o Comité de Protecção do Meio Marinho da Organização Marítima Internacional (Comité de Protecção do Meio Marinho (MEPC)), através da sua resolução MEPC.20(22), adoptou o Código para a Construção e Equipamento de Navios que Transportam Substâncias Químicas Perigosas a Granel (Código BCH), o qual entrou em vigor em relação à Região Administrativa Especial de Macau em 20 de Dezembro de 1999;

Mais considerando que nos termos da Regra 11 do Anexo II da MARPOL 73/78 os navios-tanque construídos antes de 1 de Julho de 1986 devem satisfazer os requisitos do Código BCH;

Considerando ainda que o Comité de Protecção do Meio Marinho tem vindo ao longo dos anos a adoptar emendas ao Código BCH através das suas resoluções MEPC.33(27), de 17 de Março de 1989, MEPC.41(29), de 16 de Março de 1990, MEPC.56(33), de 30 de Outubro de 1992, MEPC.70(38), de 10 de Julho de 1996, MEPC.80(43), de 1 de Julho de 1999, MEPC.91(45), de 5 de Outubro de 2000, MEPC.144(54), de 24 de Março de 2006 e MEPC.249(66), de 4 de Abril de 2014, as quais entraram em vigor na Região Administrativa Especial de Macau entre 20 de Dezembro de 1999 e 1 de Janeiro de 2016;

Mais considerando que o Código BCH assim como as suas emendas não foram até ao momento publicados no *Boletim Oficial da Região Administrativa Especial de Macau*;

O Chefe do Executivo manda publicar, nos termos do n.º 1 do artigo 6.º da Lei n.º 3/1999 (Publicação e formulário dos diplomas):

— a *supra* referida resolução do Comité de Protecção do Meio Marinho MEPC.20(22), que contém o Código para a Construção e Equipamento de Navios que Transportam Substâncias Químicas Perigosas a Granel (Código BCH), no seu texto autêntico em língua inglesa;

— as *supra* referidas resoluções do Comité de Protecção do Meio Marinho MEPC.33(27), MEPC.41(29), MEPC.56(33), MEPC.70(38), MEPC.80(43), MEPC.91(45) e MEPC.144(54), que contêm emendas ao Código BCH, nos seus textos autênticos em língua inglesa, as quais entraram em vigor entre 20 de Dezembro de 1999 e 1 de Agosto de 2007;

——包含《散化規則》修正案的上指海上環境保護委員會第MEPC.249（66）號決議的中文及英文正式文本。該決議於二零一六年一月一日在國際法律秩序生效，包括對中華人民共和國及澳門特別行政區生效；

——中央人民政府提供的《散化規則》中文綜合文本，其中包含一九八九年第MEPC.33（27）號決議至二零零六年第MEPC.144（54）號決議通過的修正案。

為了法律效力，所公佈的中文綜合文本不影響對有關規定的正式文本的查閱。

二零一七年七月二十四日發佈。

行政長官　崔世安

— a *supra* referida resolução do Comité de Protecção do Meio Marinho MEPC.249(66), que contém emendas ao Código BCH, nos seus textos autênticos em línguas chinesa e inglesa, a qual entrou em vigor na ordem internacional, incluindo a República Popular da China e a sua Região Administrativa Especial de Macau, em 1 de Janeiro de 2016;

— a versão consolidada em língua chinesa do Código BCH, facultada pelo Governo Popular Central, que incorpora as emendas adoptadas desde 1989 (MEPC.33(27)) até 2006 (MEPC.144(54)).

Para efeitos legais, a versão consolidada em língua chinesa ora publicada não prejudica a consulta dos textos autênticos das disposições em causa.

Promulgado em 24 de Julho de 2017.

O Chefe do Executivo, *Chui Sai On*.

Resolution MEPC 20(22)

ADOPTION OF THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

adopted on 5 December 1985

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38 of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MEPC 16(22) by which it adopted amendments to the Annex of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973, (the 1978 Protocol), to make the provisions of the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) and the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code) mandatory under the International Convention for the Prevention of Pollution from Ships, 1973 as modified by the 1978 Protocol (MARPOL 73/78),

NOTING ALSO that the BCH Code was adopted by the Assembly by resolution A.212(VII) and subsequently incorporated ten sets of amendments adopted by the Maritime Safety Committee,

HAVING CONSIDERED the proposed text of the BCH Code which incorporates amendments from the marine pollution point of view developed by the Committee in pursuance of resolution 15 of the International Conference on marine Pollution, 1973,

1. ADOPTS the BCH Code, the text of which is given in the Annex to the present resolution, for the purposes of Annex II of MARPOL 73/78;

2. REQUESTS the Secretary-General to transmit a copy of the present resolution together with the text of the BCH Code to all Members of the Organization and to all Parties to MARPOL 73/78 which are not Members of the Organization.

ANNEX

THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF
SHIPS CARRYING DANGEROUS CHEMICALS IN BULK

(The BCH Code to be annexed to the MEPC resolution will incorporate the amendments listed below)

Preamble

Paragraph 1

In the existing text, after the word "dangerous", the words "and noxious" are inserted.

Paragraph 7

Existing paragraph 7 is replaced by the following:

"7 In response to resolution 15 of the International Conference on Marine Pollution, 1973, the Marine Environment Protection Committee at its twenty-second session adopted with resolution MEPC ...(22) the BCH Code extended to cover the marine pollution prevention aspects for the implementation of Annex II to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78)."

Paragraph 8

In the existing text, after the word "dangerous", the words "and noxious" are inserted.

1.1 Purpose

In the existing text, the words "or noxious" are inserted between the words "dangerous" and "chemical".

In the existing text the words "the neighbourhood" are replaced by the words "to the environment".

The following sentence is added to the existing text:

> "For the purposes of MARPOL 73/78, the Code applies only to chemical tankers as defined in regulation 1(1) of Annex II thereof, which are engaged in the carriage of noxious liquid substances falling into Category A, B or C and identified as such by an entry of "A, B or C" in column b"."

1.2 Scope

1.2.1 In the existing text of the first sentence, the words "and noxious" are inserted between the words "dangerous" and "chemical" and the words "(c) products which may present a hazard to the environment, if accidentally released." are added.

1.3 Hazards

The existing text of 1.3 is designated as 1.3.1 and in the first line the words "relating to human life" are inserted between the words "substances" and "considered".

New paragraph 1.3.2 is added to the existing text as follows:

> "1.3.2 Hazards of chemicals and other substances relating to the marine environment considered by this Code are:
>
> .1 bioaccumulation with attendant risk to aquatic life or human health or cause tainting to seafood;
> .2 damage to living resources;
> .3 hazard to human health; and
> .4 reduction of amenities."

1.4 Definitions

In the existing text of paragraph 1.4.15 after the words "propylene oxide" the words "and ethylene oxide/propylene oxide mixtures with an ethylene oxide content of not more than 30 per cent by weight" are added.

The following definitions are added to the existing text:

"1.4.16A Noxious liquid substance means any substance designated in appendix II to Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) or provisionally assessed under the provisions of regulation 3(4) of that Annex as falling into category A, B, C or D."

"1.4.16B Standards for Procedures and Arrangements means the Standards for the Procedures and Arrangements for the Discharge of Noxious Liquid Substances, called for by Annex II of MARPOL 73/78, adopted by the Marine Environment Protection Committee at its twenty-second session by resolution MEPC 18(22) and as may be amended by the Organization."

1.5 Equivalents

1.5.2 In the existing text the words "other Parties to MARPOL 73/78 and" are inserted after the words "circulate the same to".

1.6 Certification

1.6.3.1 In the existing text the words "to a chemical tanker" the words "engaged in international voyages" are added.

1.7 Effective date

1.7.2 The following sentence is added to the existing text of paragraph 1.7.2

"This conversion provision does not apply to the modification of a ship referred to in regulation 1(12) of Annex II of MARPOL 73/78."

1.8 New products

In the first line of the existing text between the words "chemicals" and "which" the following words are added:

"and noxious liquid substances of category A, B or C, either of".

2.2 Ship types

The following sentence is added to the existing texts of subparagraphs 2.2.4(a)(iii) and 2.2.4(b)(iii)

"This requirement does not apply to the tanks for diluted slops arising from the tank washing."

2.6 Cargo segregation

2.6.2 The first line of the existing text is amended to read:
"Cargoes, residues of cargoes or mixtures containing cargoes which react in a hazardous manner with other cargoes, residues or mixtures, should:"

Chapter IV - Special requirements

The existing text of section 4.7 is replaced by the following:

"4.7 Propylene oxide and mixtures of ethylene oxide/propylene oxide with an ethylene oxide content of not more than 30 per cent by weight.

4.7.1 Products transported under the provisions of this section should be acetylene free.

4.7.2 (a) Unless cargo tanks are properly cleaned, these products should not be carried in tanks which have contained as one of the three previous cargoes any products known to catalyse polymerization, such as:

(i) mineral acids (e.g. sulphuric, hydrochloric, nitric);

(ii) carboxylic acids and anhydrides (e.g. formic, acetic);

(iii) halogenated carboxylic acids (e.g. chloracetic);

(iv) sulphonic acids (e.g. benzene sulphonic);

(v) caustic alkalis (e.g. sodium hydroxide, potassium hydroxide);

(vi) ammonia and ammonia solutions;

(vii) amines and amine solutions;

(viii) oxidizing substances.

(b) Before loading, tanks should be thoroughly and effectively cleaned, to remove all traces of previous cargoes from tanks and associated pipework, except where the immediately prior cargo has been propylene oxide or ethylene oxide/propylene oxide mixtures. Particular care should be taken in the case of ammonia in tanks made of steel other than stainless steel.

(c) In all cases, the effectiveness of cleaning procedures for tanks and associated pipework should be checked by suitable testing or inspection, to ascertain that no traces of acidic or alkaline materials remain that might create a hazardous situation in the presence of these products.

(d) Tanks should be entered and inspected prior to each initial loading of these products to ensure freedom from contamination, heavy rust deposits and visible structural defects. When cargo tanks are in continuous service for these products, such inspections should be performed at intervals of not more than two years.

(e) Tanks for the carriage of these products should be of steel or stainless steel construction.

(f) Tanks for the carriage of these products may be used for other cargoes after thorough cleaning of tanks and associated pipework systems by washing or purging.

4.7.3 (a) All valves, flanges, fittings and accessory equipment should be of a type suitable for use with the products and should be constructed of steel or stainless steel or other material acceptable to the Administration. The chemical composition of all material used should be submitted to the Administration for approval prior to fabrication. Discs or disc faces, seats and other wearing parts of valves should be made of stainless steel containing not less than 11 per cent chromium.

(b) Gaskets should be constructed of materials which do not react with, dissolve in, or lower the auto-ignition temperature of, these products, and which are fire resistant and possess adequate mechanical behaviour. The surface presented to the cargo should be polytetrafluorethylene (PTFE), or materials giving a similar degree of safety by their inertness. Spirally-wound stainless steel, with a filler of PTFE or similar fluorinated polymer, may be accepted by the Administration.

(c) Insulation and packing, if used, should be of a material which does not react with, dissolve in, or lower the auto-ignition temperature of, these products.

(d) The following materials are generally found unsatisfactory for gaskets, packing and similar uses in containment systems for these products and would require testing before being approved by the Administration:

(i) Neoprene or natural rubber, if it comes into contact with the products.

(ii) Asbestos, or binders used with asbestos.

(iii) Materials containing oxides of magnesium, such as mineral wools.

4.7.4 Threaded joints should not be permitted in the cargo liquid and vapour lines.

4.7.5 Filling and discharge piping should extend to within 100 mm of the bottom of the tank or any sump pit.

4.7.6 (a) The containment system for a tank containing these products should have a valved vapour return connection.

(b) The products should be loaded and discharged in such a manner that venting of the tanks to atmosphere does not occur. If vapour return to shore is used during tank loading, the vapour return system connected to a containment system for the product should be independent of all other containment systems.

(c) During discharging operations, the pressure in the cargo tank must be maintained above 0.07 kp/cm^2 gauge.

4.7.7 The cargo may be discharged only by deepwell pumps, hydraulically operated submerged pumps, or inert gas displacement. Each cargo pump should be arranged to ensure that the product does not heat significantly if the discharge line from the pump is shut off or otherwise blocked.

4.7.8 Tanks carrying these products should be vented independently of tanks carrying other products. Facilities should be provided for sampling the tank contents without opening the tank to atmosphere.

4.7.9 Cargo hoses used for transfer of these products should be marked "FOR ALKYLENE OXIDE TRANSFER ONLY".

4.7.10 Cargo tanks, void spaces and other enclosed spaces, adjacent to an integral gravity cargo tank carrying propylene oxide, should either contain a compatible cargo (those cargoes specified in 4.7.2 are examples of substances considered incompatible) or be inerted by injection of a suitable inert gas. Any hold space in which an independent cargo tank is located should be inerted. Such inerted spaces and tanks should be monitored for these products and oxygen. The oxygen content of these spaces should be maintained below 2 per cent. Portable sampling equipment is satisfactory.

4.7.11 In no case should air be allowed to enter the cargo pump or piping system while these products are contained within the system.

4.7.12 Prior to disconnecting shore-lines, the pressure in liquid and vapour lines should be relieved through suitable valves installed at the loading header. Liquid and vapour from these lines should not be discharged to atmosphere.

4.7.13 Propylene oxide may be carried in pressure tanks or in independent or integral gravity tanks. Ethylene oxide/propylene oxide mixtures should be carried in independent gravity tanks or pressure tanks. Tanks should be designed for the maximum pressure expected to be encountered during loading, conveying and discharging cargo.

4.7.14 (a) Tanks for the carriage of propylene oxide with a design pressure less than 0.6 kp/cm^2 gauge and tanks for the carriage of ethylene oxide/propylene oxide mixtures with a design pressure less than 1.2 kp/cm^2 gauge should have a cooling system to maintain the cargo below the reference temperature.*

(b) The refrigeration requirement for tanks with a design pressure less than 0.6 kp/cm^2 gauge may be waived by the Administration for ships operating in restricted areas or on voyages of

* See 1.4.15.

restricted duration, and account may be taken in such cases of any insulation of the tanks. The area and times of year for which such carriage would be permitted should be included in the conditions of the Certificate of Fitness.

4.7.15 (a) Any cooling system should maintain the liquid temperature below the boiling temperature at the containment pressure. At least two complete cooling plants automatically regulated by variations within the tanks should be provided. Each cooling plant should be complete with the necessary auxiliaries for proper operation. The control system should also be capable of being manually operated. An alarm should be provided to indicate malfunctioning of the temperature controls. The capacity of each cooling system should be sufficient to maintain the temperature of the liquid cargo below the reference temperature* of the system.

(b) An alternative arrangement may consist of three cooling plants, any two of which should be sufficient to maintain the liquid temperatures below the reference temperature*.

(c) Cooling media which are separated from the products by a single wall only should be non-reactive with the products.

(d) Cooling systems requiring compression of the products should not be used.

4.7.16 Pressure relief valve settings should not be less than 0.2 kp/cm^2 gauge and for pressure tanks not greater than 7.0 kp/cm^2 gauge for the carriage of propylene oxide and not greater than 5.3 kp/cm^2 gauge for carriage of propylene oxide/ethylene oxide mixtures.

---

* See 1.4.15.

4.7.17 (a) The piping system for tanks to be loaded with these products should be separated (as defined in 1.4.13) from piping systems for all other tanks, including empty tanks. If the piping system for the tanks to be loaded is not independent (as defined in 1.4.14), the required piping separation should be accomplished by the removal of spool pieces, valves, or other pipe sections, and the installation of blank flanges at these locations. The required separation applies to all liquid and vapour piping, liquid and vapour vent lines and any other possible connections, such as common inert gas supply lines.

(b) These products may be transported only in accordance with cargo handling plans that have been approved by the Administration. Each intended loading arrangement should be shown on a separate cargo handling plan. Cargo handling plans should show the entire cargo piping system and the locations for installation of blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo handling plan should be maintained on board the ship. The Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should be endorsed to include reference to the approved cargo handling plans.

(c) Before each initial loading of these products and before every subsequent return to such service, certification verifying that the required piping separation has been achieved should be obtained from a responsible person acceptable to the Port Administration and carried on board the ship. Each connection between a blank flange and a pipeline flange should be fitted with a wire and seal by the responsible person to ensure that inadvertent removal of the blank flange is impossible.

4.7.18 (a) No cargo tanks should be more than 98 per cent liquid full at the reference temperature.*

---

* See 4.7.14(a).

(b) The maximum volume to which a cargo tank should be loaded is:

$$V_L = 0.98\,V\,\frac{d_R}{d_L}$$

where V_L = maximum volume to which the tank may be loaded

V = volume of the tank

d_R = relative density of cargo at the reference temperature*

d_L = relative density of cargo at the loading temperature and pressure

(c) The maximum allowable tank filling limits for each cargo tank should be indicated for each loading temperature which may be applied, and for the applicable maximum reference temperature, on a list to be approved by the Administration. A copy of the list should be permanently kept on board by the master.

4.7.19 The cargo should be carried under a suitable protective padding of nitrogen gas. An automatic nitrogen make-up system should be installed to prevent the tank pressure falling below 0.07 kp/cm^2 gauge in the event of product temperature fall due to ambient conditions or maloperation of refrigeration systems. Sufficient nitrogen should be available on board to satisfy the demand of the automatic pressure control. Nitrogen of commercially pure quality (99.9 per cent by volume) should be used for padding. A battery of nitrogen bottles connected to the cargo tanks through a pressure reduction valve satisfies the intention of the expression "automatic" in this context.

---

* See 1.4.15.

4.7.20 The cargo tank vapour space should be tested prior to and after loading to ensure that the oxygen content is 2 per cent by volume or less.

4.7.21 A water spray system of sufficient capacity should be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling, and the tank domes. The arrangement of piping and nozzles should be such as to give a uniform distribution rate of 10 $l/m^2/min$. The water spray system should be capable of both local and remote manual operation, and the arrangement should ensure that any spilled cargo is washed away. Additionally, a water hose with pressure to the nozzle, when atmospheric temperatures permit, should be connected ready for immediate use during loading and unloading operations.

4.7.22 A remotely operated, controlled closing-rate, shut-off valve should be provided at each cargo hose connection used during cargo transfer."

4.20 Hydrogen peroxide solutions over 60% but not over 70%

<u>The existing title is amended to read "Hydrogen peroxide solutions" and a subtitle without a number is inserted to read "Hydrogen peroxide solutions over 60% but not over 70%."</u>

4.20.1 <u>In the existing text the words "solutions over 60% but not over 70%" are inserted between the words "peroxide" and "should".</u>

4.20.14 <u>The following text is added after the existing paragraph 4.20.13.</u>

"Hydrogen peroxide solutions over 8 per cent but not over 60 per cent by weight.

4.20.15 The ship's shell plating should not form any boundaries of tanks containing this product.

4.20.16 Hydrogen peroxide should be carried in tanks thoroughly and effectively cleaned of all traces of previous cargoes and their vapours or ballast. Procedures for inspection, cleaning, passivation and loading of tanks should be in accordance with MSC/Circ.394. A certificate should be on board the vessel indicating that the procedures in the Circular have been followed. The passivation requirement may be waived by an Administration for domestic shipments of short duration. Particular care in this respect is essential to ensure the safe carriage of hydrogen peroxide.

.1 When hydrogen peroxide is carried no other cargoes should be simultaneously carried.

.2 Tanks which have contained hydrogen peroxide may be used for other cargoes after cleaning in accordance with the procedures outlined in MSC/Circ.394.

.3 Consideration in design should provide minimum internal tank structure, free draining, no entrapment and ease of visual inspection.

4.20.17 Cargo tanks and associated equipment should be either pure aluminium (99.5%) or solid stainless steel of types suitable for use with hydrogen peroxide (e.g. 304, 304L, 316, 316L, 316Ti). Aluminium should not be used for piping on deck. All non-metallic materials of construction for the containment system should neither be attacked by hydrogen peroxide nor contribute to its decomposition.

4.20.18 Cargo tanks should be separated by a cofferdam from fuel oil tanks or any other space containing materials incompatible with hydrogen peroxide.

4.20.19 Temperature sensors should be installed at the top and bottom of the tank. Remote temperature readouts and continuous monitoring should be located on the navigating bridge. If the temperature in the tank rises above 35°C, visible and audible alarms should activate on the navigating bridge.

4.20.20 Fixed oxygen monitors (or gas sampling lines) should be provided in void spaces adjacent to tanks to detect leakage of the cargo into these spaces. The enhancement of flammability by oxygen enrichment should be recognized. Remote readouts, continuous monitoring (if gas sampling lines are used, intermittent sampling is satisfactory) and visible and audible alarms similar to those for the temperature sensors should also be located on the navigating bridge. The visible and audible alarms should activate if the oxygen concentrations in these void spaces exceed 30% by volume. Two portable oxygen monitors should also be available as back-up systems.

4.20.21 As a safeguard against uncontrolled decomposition, a cargo jettisoning system should be installed to discharge the cargo overboard. The cargo should be jettisoned if the temperature rise of the cargo exceeds a rate of 2°C per hour over a five hour period or when the temperature in the tank exceeds 40°C.

4.20.22 Cargo tank venting systems with filtration should have pressure vacuum relief valves for normal controlled venting, and a device for emergency venting, should tank pressure rise rapidly as a result of an uncontrolled decomposition rate, as stipulated in 4.20.20. These venting systems should be designed in such a manner that there is no introduction of sea water into the cargo tank even under heavy sea conditions. Emergency venting should be sized on the basis of tank design pressure and tank size.

4.20.23 A fixed water spray system should be provided for diluting and washing away any concentrated solution spilled on deck. The areas covered by the waterspray should include the manifold/hose connections and the tank tops of those tanks designated for the carriage of hydrogen peroxide solutions. The minimum application rate should satisfy the following criteria:

.1 The product should be diluted from the original concentration to 35 per cent by weight within five minutes of the spill.

.2 The rate and estimated size of the spill should be based upon maximum anticipated loading and discharge rates, the time required to stop flow of cargo in the event of tank overfill or a piping/hose failure, and the time necessary to begin application of dilution water with actuation at the cargo control location or on the navigating bridge.

4.20.24 Hydrogen peroxide should be stabilized to prevent decomposition. A certificate of stabilization should be provided by the manufacturer specifying:

.1 name and amount of stabilizer added;

.2 date stabilizer was added and duration of effectiveness;

.3 any temperature limitations qualifying the stabilizer's effective lifetime;

.4 the action to be taken should the product become unstable during the voyage.

4.20.25 Only those hydrogen peroxide solutions which have a maximum decomposition rate of 1.0 per cent per year at 25°C should be carried. Certification from the shipper that the product meets this standard should be presented to the Master and kept on board. A technical representative of the manufacturer should be on board to monitor the transfer operations and have the capability to test the stability of the hydrogen peroxide. He should certify to the Master that the cargo has been loaded in a stable condition.

4.20.26 Protective clothing that is resistant to hydrogen peroxide should be provided for each crew member involved in cargo transfer operations. Protective clothing should include coveralls that are non-flammable, suitable gloves, boots and eye protection.

4.20.27 During transfer of hydrogen peroxide the related piping system should be separate from all other systems. Cargo hoses used for transfer of hydrogen peroxide should be marked "for hydrogen peroxide transfer only"."

5.2 Cargo information

The following paragraphs 5.2.5, 5.2.6, 5.2.7 and 5.2.9 and a footnote for paragraph 5.2.7 are added to the existing text:

5.2.5 Where column "k" in the table of chapter VI refers to this paragraph, the cargo's viscosity at 20°C should be specified on a shipping document and if the cargo's viscosity exceeds 25 mPa.s at 20°C, the temperature at which the cargo has a viscosity of 25 mPa.s should be specified in the shipping document.

5.2.6 Where column "k" in the table of chapter VI refers to this paragraph, the cargo's viscosity at 20°C should be specified on a shipping document and if the cargo's viscosity exceeds 60 mPa.s at 20°C, the temperature at which the cargo has a viscosity of 60 mPa.s should be specified in the shipping document.

5.2.7 Where column "k" in the table of chapter VI refers to this paragraph and the possibility exists that it will be unloaded within Special Areas*, the cargo's viscosity at 20°C should be specified on a shipping document and if the cargo's viscosity exceeds 25 mPa.s at 20°C, the temperature at which the cargo has a viscosity of 25 mPa.s should be specified in the shipping document.

5.2.8 Where column "k" in the table of chapter VI refers to this paragraph, the cargo's melting point should be indicated in the shipping document.

VA New Chapter VA is added to the existing text as follows:

"CHAPTER VA - ADDITIONAL MEASURES FOR THE PROTECTION OF THE MARINE ENVIRONMENT

5A.1 GENERAL

5A.1.1 The requirements of this chapter apply to ships carrying products noted as category A, B or C noxious liquid substances in chapter VI.

5A.2 CONDITION OF CARRIAGE

5A.2.1 The condition of carriage for products listed in the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should reflect the requirements of regulation 5A of Annex II of MARPOL 73/78.

---

* Special areas are defined in regulation 1(7) of Annex II to MARPOL 73/78".

5A.2.2 A category B substance with a melting point equal to or greater than 15°C should not be carried in a cargo tank any boundary of which is formed by the ship's shell plating and should only be carried in a cargo tank fitted with a cargo heating system.

5A.3 PROCEDURES AND ARRANGEMENTS MANUAL

5A.3.1 Each ship should be provided with a Procedures and Arrangements Manual developed for the ship in accordance with the provisions of the Standards for the Procedures and Arrangements and approved by the Administration.

5A.3.2 Each ship should be fitted with equipment and arrangements identified in its Procedures and Arrangements Manual.

CHAPTER VI - SUMMARY OF MINIMUM REQUIREMENTS

Existing text of chapter VI is replaced by the following:

"EXPLANATORY NOTES

Product name (column a)*	The product names are not always identical with the names given in previous issues of the Code, or the IBC Code for explanation see index of chemicals.
UN number (column b)	This is the number relating to each product shown in the recommendations proposed by the United Nations Committee of Experts on the Transport of Dangerous Goods (the "Orange Book"), New York, 1977, ST/SG/AC.10/1/Rev.1. UN numbers are given for information only.
Pollution category (column c)	The letter A, B, C or D means the pollution category assigned to each product under Annex II of MARPOL 73/78. "III" means the product was evaluated and found to fall outside the categories A, B, C or D.
Hazards (column d)	S means that the product is included in the Code because of its safety hazards; P means that the product is included in the Code because of its pollution hazards; and S/P means that the product is included in the Code because of both its safety and pollution hazards.
Ship type (column e)	1, 2 or 3 indicates ship types I, II, or III respectively as discussed in chapter II, part A - Physical Protection.
Tank type (column f)	1: Independent tank G: Gravity tank 2: Integral tank P: Pressure tank

---

* Note by the Secretariat:

References to columns a through m in other chapters of the Code will be amended according to the column designations shown here.

Tank vents (column g)	Open:	open venting
	Cont:	controlled venting
	SR:	safety relief valve
Tank environmental control (column h)	Inert:	Inerting (see 2.19.2(a))
	Pad:	Liquid or gas (2.12.2(b))
	Dry:	Drying (see 2.19.2(c))
	Vent:	Natural or forced (2.19.2(d))
Electrical requirements (column i)	St:	Standard electrical systems (products having a flashpoint exceeding 60°C (closed cup test)).
	SP:	Special requirements (products having a flashpoint not exceeding 60°C (closed cup test)).
Gauging (column j)	O:	Open
	R:	Restricted
	C:	Closed
Vapour detection (column k)	F:	Flammable vapours
	T:	Toxic vapours
Fire protection (column l)	A:	Alcohol resistant foam
	B:	Regular foam. Encompasses all non-alcohol resistant type foams including fluoroprotein and aqueous film forming foam (AFFF)
	C:	Water-spray
	D:	Dry chemical
	No:	No special requirements under this Code.
		Fire-extinguishing media considered to be suitable for certain products are listed for information in column (i) of the summary of minimum requirements.

"No" indicates nil requirement.

3357V

a	b	c	d	e	f	g	h	i	j	k	l	m
Product name	UN number	Pollution category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Electrical requirements	Gauging	Vapour detection	Fire protection	Special requirement
Acetic acid	2789	C	S/P	3	2G	Cont.	No	SP	R	F	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 4.17, 5.2.8
Acetic anhydride	1715	C	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 4.17
Acetone cyanohydrin	1541	A	S/P	2	2G	Cont.	No	St	C	T	A	4.4, 4.9, 4.12.6, 4.13, 4.14, 4.17, 4.18
Acetonitrile	1648	III	S	2	2G	Cont.	No	SP	R	F-T	A	4.9
Acrylamide solution (50% or less)	2074	D	S	2	2G	Open	No	ST	C	No	No	4.9.3, 4.10, 4.14.1, 4.15.1, 4.18.1
Acrylic acid	2218	D	S	3	2G	Cont.	No	SP	R	F-T	A	4.10, 4.12.6, 4.18.1
Acrylonitrile	1093	B	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.10, 4.12.3, 4.13.1, 4.14, 4.17
Adiponitrile	2205	D	S	3	2G	Cont.	No	St	R	T	A	–
Alkyl acrylate - vinyl pyridine copolymer in toluene		(C)	P	3	2G	Cont.	No	SP	R	F	B	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Alkyl benzene sulphonic acid	2584 2586	C	S/P	3	2G	Open	No	St	O	No	B	–
Allyl alcohol	1098	B	S/P	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.13.1, 4.14, 4.17
Allyl chloride	1100	B	S/P	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.13.1, 4.14, 4.17
2 (2-Aminoethoxy) ethanol	3055	D	S	3	2G	Open	No	St	O	No	A,C,D	4.12.2, 4.14.1
Aminoethyl ethanolamine		(D)	S	3	2G	Open	No	St	O	No	A	4.12.1
N-Aminoethyl piperazine	2815	D	S	3	2G	Cont	No	St	R	T	A,C,D	4.12.2, 4.14.1
Ammonia aqueous, (28% or less)	2672 (o)	C	S/P	3	2G	Cont	No	SP	R	T	C	4.12.4, 4.12.9, 4.17[a]
Ammonium nitrate solution, (93% or less)	2426	D	S	2	1G	Open	No	St	O	No	No	4.8.4, 4.8.6, 4.12.10, 4.13.2, 4.14.1, 4.19
Ammonium sulphide solution (45% or less)	2683	B	S/P	2	2G	No	No	SP	C	F-T	A,C	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.15.1, 4.17, 4.18

a	b	c	d	e	f	g	h	i	j	k	l	m
n-Amyl acetate	1104	C	P	3	2G	Cont	No	SP	R	F	A	4.14.1
sec-Amyl acetate	1104	C	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Amyl acetate, commercial	1104	C	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Aniline	1547	C	S/P	2	2G	Cont	No	St	C	T	A	4.9, 4.13.1, 4.14,
Benzene and mixtures having 10% benzene content or more	1114 (t)	C	S/P	3	2G	Cont	No	SP	R	F-T	B	4.9.1, 4.13.1, 5.2.8
Benzenesulphonyl chloride	2225	D	S	3	2G	Cont	No	St	R	T	B,D	4.12.1, 4.14.1
Benzyl alcohol		C	P	3	2G	Open	No	St	O	No	A	
Benzyl chloride	1738	B	S/P	2	2G	Cont	No	St	C	T	B	4.9, 4.10, 4.13.1, 4.14, 4.17
n-Butyl acetate	1123	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
n-Butyl acrylate	2348	D	S	2	2G	Cont	No	SP	R	F-T	A	4.10, 4.18.1, 4.18.2
Butylamine (all isomers)	1125 1214	C	S/P	2	2G	Cont	No	SP	R	F-T	A	4.9, 4.12.1, 4.12.2, 4.13.1, 4.14.1, 4.17
Butyl benzyl phthalate		A	P	2	2G	Open	No	St	O	No	B	4.14.1
Butyl/Decyl/Cetyl/ Eicosyl methacrylate mixture		D	S	3	2G	Cont	No	St	R	No	A,C, D	4.10, 4.18.1, 4.18.2
n-Butyl ether	1149	C	S/P	3	2G	Cont	Inert	SP	R	F-T	A,D	4.2.7, 4.9
Butyl methacrylate		D	S	3	2G	Cont	No	SP	R	F-T	A,D	4.10, 4.18.1, 4.18.2
n-Butyraldehyde	1129	B	S/P	3	2G	Cont	No	SP	O	F-T	A	4.15.1
Butyric acid	2820	B	S/P	3	2G	Cont	No	St	R	No	A	4.8.2, 4.8.3, 4.8.4, 4.8.6, 4.8.7, 4.8.8, 4.12.6

a	b	c	d	e	f	g	h	i	j	k	l	m
Calcium hypochlorite solution		B	SP	3	2G	Cont	No	St	R	No	No	4.15.1
Calcium naphthenate in mineral oil		A	P	3	2G	Open	No	St	O	No	B	
Camphor oil	1130	B	S/P	2	2G	Cont	No	SP	O	F	B	4.14.1
Carbolic oil		A	S/P	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.14
Carbon disulphide	1131	A	S/P	2	1G	Cont	Inert	Use None	C	F-T	C	4.1, 4.9, 4.14, 4.17
Carbon tetrachloride	1846	B	S/P	3	2G	Cont	No	St	C	T	No	4.9, 4.13.1, 4.14.1, 4.17
Cashew nut shell oil (untreated)		D	S	3	2G	Cont	No	St	R	T	B	
Cetyl/Eicosyl methacrylate mixture		III	S	3	2G	Open	No	St	O	No	A,C,D	4.10, 4.18.1, 4.18.2
Chloroacetic acid (80% or less)	1750	C	S/P	2	2G	Cont	No	St	C	No	No	4.8.2, 4.8.4, 4.8.6, 4.8.7, 4.8.8, 4.9.3, 4.12.6 (aluminium not permitted), 4.14, 5.2.8
Chlorobenzene	1134	B	S/P	2	2G	Cont	No	SP	R	F-T	B	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Chloroform	1888	B	S/P	3	2G	Cont	No	St	R	T	No	4.9, 4.17
Chlorohydrins, crude		(D)	S	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.14
2- or 3-Chloropropionic acid	2511 (k)	(C)	S/P	3	2G	Open	No	St	O	No	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6
Chlorosulphonic acid	1754	C	S/P	1	2G	Cont	No	St	C	T	No	4.8.2 to 4.8.8, 4.9, 4.14, 4.15.2, 4.17
m-Chlorotoluene	2238	B	S/P	3	2G	Cont	No	SP	R	F-T	B,C	
o-Chlorotoluene	2238	A	S/P	3	2G	Cont	No	SP	R	F-T	B,C	
p-Chlorotoluene	2238	B	S/P	2	2G	Cont	No	SP	R	F-T	B,C	4.14.1, 5.2.8
Chlorotoluenes (mixed isomers)	2238	A	S/P	2	2G	Cont	No	SP	R	F-T	B,C	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Coal tar naphtha solvent		B	S	3	2G	Cont	No	SP	R	F-T	A,D	
Creosote (coal tar)		(C)	S/P	3	2G	Open	No	St	O	No	B,D	
Creosote (wood)		A	S/P	2	2G	Open	No	St	O	No	B,D	4.14.1
Cresols (mixed isomers)	2076	A	S/P	2	2G	Open	No	St	O	No	B	4.14.1
Crotonaldehyde	1143	B	S/P	2	2G	Cont	No	SP	R	F-T	A	4.9, 4.13.1, 4.15.1, 4.17
Cyclohexane	1145	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1, 5.2.8
Cyclohexanol		C	P	3	2G	Open	No	St	O	No	A	5.2.6, 5.2.8
Cyclohexanone	1915	D	S	3	2G	Cont	No	SP	R	F-T	A	4.12.5
Cyclohexylamine	2357	C	S/P	3	2G	Cont	No	SP	R	F-T	A,D	4.12.1, 4.12.2
p-Cymene	2046	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Decene		B	P	3	2G	Cont	No	SP	R	F	B	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Decyl acrylate		A	S/P	2	2G	Open	No	St	O	No	D,A,C	4.10, 4.12.2, 4.14.1, 4.18.1, 4.18.2
Decyl alcohol (all isomers)		B	P	3	2G	Open	No	St	O	No	B	5.2.8 (p)
Dibutylamine		C	S/P	3	2G	Cont	No	SP	R	F-T	B,D	4.12.4
Dibutyl phthalate		A	P	2	2G	Open	No	St	O	No	B	4.14.1
o-Dichlorobenzene	1591	B	S/P	2	2G	Cont	No	St	R	T	B,D	4.12.5, 4.14.1
1,1-Dichloroethane	2362	B	S/P	3	2G	Cont	No	SP	R	F-T	B	4.17
Dichloroethyl ether	1916	B	S/P	2	2G	Cont	No	SP	R	F-T	A	4.12.5
2,2-Dichloroisopropyl ether	2490	C	S/P	2	2G	Cont	No	St	R	T	B,C,D	4.9, 4.12.5, 4.13.1, 4.14
2,4-Dichlorophenol	2021	A	S/P	2	2G	Cont	Dry	St	R	T	B,C,D	4.12.1, 4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
2,4-Dichlorophenoxyacetic acid, diethanolamine salt solution		(A)	S/P	3	2G	Open	No	St	O	No	No	14.12.1
2,4- Dichlorophenoxyacetic acid, dimethylamine salt (70% or less) solution		(A)	S/P	3	2G	Open	No	St	O	No	No	14.12.1
2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt, solution		(A)	S/P	3	2G	Open	No	St	O	No	No	14.12.1
1,2-Dichloropropane	1279	B	S/P	2	2G	Cont	No	SP	R	F-T	B	4.9
1,3-Dichloropropane		B	S/P	2	2G	Cont	No	SP	R	F-T	B	4.9
1,3-Dichloropropene	2047	B	S/P	2	2G	Cont	No	SP	C	F-T	B	4.9, 4.13, 4.14, 4.17
Dichloropropene/ Dichloropropane mixtures		B	S/P	2	2G	Cont	No	SP	C	F-T	B,C,D	4.9, 4.13, 4.14, 4.17
2,2-Dichloropropionic acid		D	S	3	2G	Cont	Dry	St	R	No	A	4.8.2, 4.8.4, 4.8.6 to 4.8.8, 4.12.6 (aluminium not permitted)
Diethanolamine		III	S	3	2G	Open	No	St	O	No	A	4.12.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Diethylamine	1154	C	S/P	3	2G	Cont	No	SP	R	F-T	A	4.12.1, 4.9, 4.17
Diethylaminoethanol	2686	C	S/P	3	2G	Cont	No	SP	R	F-T	A,D	4.12.1, 4.12.2
Diethylbenzene	2049	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Diethylene glycol methyl ether		C	P	3	2G	Open	No	St	O	No	A	
Diethylenetriamine	2079	(D)	S	3	2G	Open	No	St	O	No	A	4.12.2
Diethyl ether	1155	III	S	2	1G	Cont	Inert	SP	C	F-T	A	4.2, 4.11, 4.12.9, 4.14, 4.17
Di-(2-ethylhexyl) phosphoric acid	1902	C	S/P	3	2G	Open	No	St	O	No	B,C,D	4.12.2
Diethyl phthalate		C	P	3	2G	Open	No	St	O	No	B	
Diethyl sulphate	1594	(B)	S/P	2	2G	Cont	No	St	C	T	A,D	4.12.3, 4.14.1
Diglycidyl ether of Bisphenol A		B	P	3	2G	Open	No	St	O	No	B	
Diisobutylamine	2361	(C)	S/P	2	2G	Cont	No	SP	R	F-T	B,D	4.9.3, 4.12.1, 4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Diisobutylene	2050	B	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Diisobutyl phthalate		B	P	3	2G	Open	No	St	O	No	B	5.2.5
Diisopropanolamine		C	S/P	3	2G	Open	No	St	O	No	A	4.12.2, 5.2.6, 5.2.8
Diisopropylamine	1158	C	S/P	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.12.2, 4.14, 4.17
Diisopropylbenzene (all isomers)		A	P	2	2G	Open	No	St	O	No	B	4.14.1
Dimethylamine solution (45% or less)	1160	C	S/P	3	2G	Cont	No	SP	R	F-T	C,D	4.9, 4.12.1, 4.17
Dimethylamine solution (greater than 45% but not greater than 55%)	1160	C	S/P	2	2G	Cont	No	SP	C	F-T	A,C,D	4.9, 4.12.1, 4.13.1, 4.14, 4.17
Dimethylamine solution (greater than 55% but not greater than 65%)	1160	C	S/P	2	2G	Cont	No	SP	C	F-T	A,C,D	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.17
N,N-Dimethylcyclohexylamine	2264	C	S/P	2	2G	Cont	No	SP	R	F-T	A,C	4.9, 4.12.1, 4.13.1, 4.14.1
Dimethylethanolamine	2051	D	S	3	2G	Cont	No	SP	R	F-T	A,D	4.12.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Dimethylformamide	2265	D	S	3	2G	Cont	No	SP	R	F-T	A,D	
Dimethyl hydrogen phosphite			S	3	2G	Cont	No	St	R	T	A,D	4.9.1
Dimethyl phthalate		C	P	3	2G	Open	No	St	O	No	B	
Dinitrotoluene (molten)		B	S/P	2	2G (1)	Cont	No	St	C	T	B	4.9, 4.13.1, 4.14*, 5.2.5, 5.2.8, 5A.2.2 (m)
1,4-Dioxane	1165	D	S	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.14
Dipentene	2052	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Diphenyl ether		A	P	3	2G	Open	No	St	O	No	B	
Diphenylmethane diisocyanate	2489	(B)	S/P	2	2G	Cont	Dry	St[b]	C	T[b]	C[c] D	4.9, 4.12.5, 4.13.1, 4.14.1, 4.15.2, 5.2.7, 5.2.8, 5A.2.2
Diphenyl oxide/Diphenyl phenyl ether mixture		A	P	3	2G	Open	No	St	O	No	B	
Di-n-propylamine	2383	C	S/P	3	2G	Cont	No	SP	R	F-T	A	4.9.3, 4.12.2, 4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Dodecene, all isomers		B	P	3	2G	Open	No	St	O	No	B	
Dodecyl alcohol		B	P	3	2G	Open	No	St	O	No	B	5.2.5, 5.2.8 5A.2.2
Dodecylbenzene		C	P	3	2G	Open	No	St	O	No	B	5.2.8
Dodecyl diphenyl oxide disulphonate solution		B	S/P	3	2G	Open	No	St	O	No		5.2.5, 5.2.8
Dodecyl methacrylate		III	S	3	2G	Open	No	St	O	No	A,C	4.10
Dodecyl/Pentadecyl methacrylate mixture		III	S	3	2G	Open	No	St	O	No	A,C,D	4.10, 4.18.1, 4.18.2
Dodecyl phenol		A	P	1	2G	Open	No	St	O	No	B	4.14
Epichlorohydrin	2023	C	S/P	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.13.1, 4.14, 4.17
Ethanolamine	2491	D	S	3	2G	Open	No	St	O	F-T	A	4.12.2
2-Ethoxyethyl acetate	1172	C	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Ethyl acrylate	1917	B	S/P	2	2G	Cont	No	SP	R	F-T	A	4.10, 4.17, 4.18.1, 4.18.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Ethylamine		C	S/P	2	1G	Cont	No	SP	C	F-T	C,D	4.9, 4.11, 4.12.2, 4.17
Ethylamine solutions, (72% or less)	2270	C	S/P	2	2G	Cont	No	SP	C	F-T	A,C	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.17
Ethyl benzene	1175	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
N-Ethylbutylamine		(C)	S/P	3	2G	Cont	No	SP	R	F-T	A	4.9.3, 4.12.1, 4.14.1
N-Ethylcyclohexylamine		D	S	3	2G	Cont	No	SP	R	F-T	A,C	4.12.1, 4.14.1
Ethylene chlorohydrin	1135	C	S/P	2	2G	Cont	No	SP	C	F-T	D	4.9, 4.13.1, 4.14, 4.17
Ethylene cyanohydrin		(D)	S	3	2G	Open	No	St	O	No	A	
Ethylenediamine	1604	C	S/P	2	2G	Cont	No	SP	R	F-T	A	4.12.2, 5.2.8
Ethylene dibromide	1605	B	S/P	2	2G	Cont	No	St	C	T	No	4.9, 4.14.1, 4.17, 5.2.8
Ethylene dichloride	1184	B	S/P	2	2G	Cont	No	SP	R	F-T	B	4.12.4, 4.14.2
Ethylene oxide/Propylene oxide mixture with an ethylene content of not more than 30% by weight	2983	D	S	2	1G	Cont	Inert	SP	C	F-T	A,C	4.7, 4.9, 4.11, 4.14

a	b	c	d	e	f	g	h	i	j	k	l	m
2-Ethylhexyl acrylate		D	S	3	2G	Open	No	St	O	No	A	4.10, 4.18.1, 4.18.2
2-Ethylhexylamine	2276	B	S/P	2	2G	Cont	No	SP	R	F-T	A	4.9, 4.12.2
Ethylidene norbornene		B	S/P	3	2G	Cont	No	SP	R	F-T	B,C D	4.9.1, 4.12.4, 4.14.1, 4.15.1
Ethyl methacrylate	2277	(D)	S	3	2G	Cont	No	SP	R	F-T	B,D	4.10, 4.18.1, 4.18.2
2-Ethyl-3-propylacrolein		B	S/P	3	2G	Cont	No	SP	R	F-T	A	15.2.8
Ethyltoluene		(B)	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Fatty alcohols (C_{12}-C_{20})		B	P	3	2G	Open	No	St	O	No	B	5.2.5, 5.2.6
Formaldehyde solutions (45% or less)	1198[d]	C	S/P	3	2G	Cont	No	SP	R	F-T	A	4.15.1, 4.17[e]
Formic acid	1779	D	S	3	2G	Cont	No	SP	R	T	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.7, 4.17
Fumaric adduct of rosin, water dispersion		B	P	3	2G	Open	No	St	O	No	No	

a	b	c	d	e	f	g	h	i	j	k	l	m
Furfural	1199	C	S/P	3	2G	Cont	No	SP	R	F-T	A	4.15.1
Furfuryl alcohol	2874	C	P	3	2G	Open	No	St	O	No	A	
Glutaraldehyde solutions (50% or less)		D	S	3	2G	Open	No	St	O	No	No	4.15.1
Glycidyl ester of tridecylacetic acid		B	P	3	2G	Open	No	St	O	No	B	
Heptanol (all isomers) (q)		(C)	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Heptene (mixed isomers)		C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Heptyl acetate		(B)	P	3	2G	Open	No	St	O	No	B	
Hexamethylenediamine solution	1783	C	S/P	3	2G	Cont	No	St	R	T	A	4.12.2, 4.14.1, 5.2.8
Hexamethyleneimine	2493	C	S/P	2	2G	Cont	No	SP	R	F-T	A,C	4.12.1, 4.12.2
1-Hexene	2370	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Hexyl acetate	1233	B	P	3	2G	Cont	No	SP	R	F	B	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Hydrochloric acid	1789	D	S	3	1G	Cont	No	St	R	T	No	4.8, 4.17[f]
Hydrogen peroxide solutions (over 60% but not over 70%)	2015	C	S/P	2	2G	Cont	No	St	C	No	No	4.14.1, 4.20.1 to 4.20.14
Hydrogen peroxide solutions (over 8% but not over 60%)	2014 2984	C	S/P	3	2G	Cont	No	St	C	No	No	4.13.2, 4.14.1, 4.20.15, 4.20.27
2-Hydroxyethyl acrylate		B	S/P	2	2G	Cont	No	St	C	T	A	4.9, 4.10. 4.14.1, 4.18.1, 4.18.2
Isoamyl acetate	1104	C	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Isobutyl acetate	1213	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Isobutyl acrylate	2527	D	S	2	2G	Cont	No	SP	R	F-T	A	4.10, 4.18.1, 4.18.2
Isobutyraldehyde	2045	C	S/P	3	2G	Cont	No	SP	O	F-T	A	4.15.1
Isophorone diamine	2289	D	S	3	2G	Cont	No	St	R	T	A	4.12.2
Isophorone diisocyanate	2290	B	S/P	2	2G	Cont	Dry	St	C	T	C[c] D	4.9, 4.12.5, 4.13.1, 4.14.1, 4.15.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Isoprene	1218	C	S/P	3	2G	Cont	No	SP	R	F	B	4.10, 4.11, 4.18.1 4.18.2
Isopropanolamine		C	S/P	3	2G	Open	No	SP	O	F-T	A	4.12.2
Isopropylamine	1221	C	S/P	2	2G	Cont	No	SP	C	F-T	C,D	4.9, 4.11, 4.12.2, 4.14, 4.17
Isopropylbenzene	1918	B	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Isopropyl ether	1159	D	S	3	2G	Cont	Inert	SP	R	F	A	4.2.7, 4.10.3, 4.14.1
Isovaleraldehyde	2058	C	S/P	3	2G	Cont	Inert	SP	R	F-T	A	4.2.7, 4.15.1
Maleic anhydride	2215	D	S	3	2G	Cont	No	St	R	No	A^g C	
Mercaptobenzothiazol, sodium salt, solution		(B)	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 5.2.8
Mesityl oxide	1229	D	S	3	2G	Cont	No	SP	R	F-T	A	4.14.1
Methacrylic acid	2531	D	S	3	2G	Cont	No	St	R	T	A	4.10, 4.12.6, 4.18.1
Methacrylonitrile		(B)	S/P	2	2G	Cont	No	SP	C	F-T	A	4.9, 4.10, 4.12.4, 4.13.1, 4.14, 4.17

a	b	c	d	e	f	g	h	i	j	k	l	m
Methyl acrylate	1919	C	S/P	2	2G	Cont	No	SP	R	F-T	B	4.10, 4.17, 4.18.1, 4.18.2
Methylamine solutions, (42% or less)	1235	C	S/P	2	2G	Cont	No	SP	C	F-T	A,C,D	4.9, 4.12.1, 4.13.1, 4.14, 4.17
Methylamyl acetate	1233	(C)	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Methylamyl alcohol	2053	(C)	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Methyl amyl ketone	1110	(C)	P	3	2G	Cont	No	SP	R	F	A	4.14.1
Methylene chloride	1593	D	S	3	2G	Cont	No	St	R	T	No	
2-Methyl-6-ethyl-aniline		C	S/P	3	2G	Open	No	St	O	No	B,C,D	
2-Methyl-5-ethyl-pyridine	2300	(B)	S/P	3	2G	Open	No	St	O	No	D	4.12.4
Methyl formate	1243	D	S	2	2G	Cont	No	SP	R	F-T	A	4.9, 4.11, 4.14, 4.17
2-Methyl-2-hydroxy-3-butyne		III	S	3	2G	Cont	No	SP	R	F-T	A,C,D	4.12.8, 4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Methyl methacrylate	1247	D	S	2	2G	Cont	No	SP	R	F-T	B	4.10, 4.18.1, 4.18.2
2-Methyl-1-pentene	2288	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
2-Methylpyridine	2313	B	S/P	2	2G	Cont	No	SP	C	F	A,C	4.9.3, 4.12.4, 4.14 5.2.8
4-Methylpyridine	2313	B	S/P	2	2G	Cont	No	SP	C	F-T	A,C,D	4.9.3, 4.12.4, 4.14 5.2.8
N-Methyl-2-pyrrolidone		B	P	3	2G	Open	No	St	O	No	A	
Methyl salicylate		(B)	P	3	2G	Open	No	St	O	No	B	
alpha-Methylstyrene	2303	A	S/P	2	2G	Cont	No	SP	R	F-T	D	4.10, 4.14.1, 4.18.1 4.18.2
Morpholine	2054	D	S	3	2G	Cont	No	SP	R	F	A	4.12.2
Motor fuel anti-knock compounds	1649	A	S/P	2	1G	Cont	No	SP	C	F-T	C,B	4.6, 4.9, 4.13.2, 4.14 4.17
Naphthalene (molten)	2304	A	S/P	2	2G	Cont	No	SP	R	No	A,D	4.14.1
Neodecanoic acid		(B)	P	3	2G	Open	No	St	O	No	B	

a	b	c	d	e	f	g	h	i	j	k	l	m
Nitrating acid (mixture of sulphuric and nitric acid)	1796	(C)	S/P	2	2G	Cont	No	St	C	T	No	4.8, 4.13.1, 4.14, 4.15.2, 4.17
Nitric acid (70% and over)	2031 2032 h	C	S/P	2	2G	Cont	No	St	C	T	No	4.8, 4.14, 4.17
Nitric acid (less than 70%)	2031	C	S/P	2	2G	Cont	No	St	R	T	No	4.8, 4.14, 4.17
Nitrobenzene	1662	B	S/P	2	2G	Cont	No	St	C	T	D	4.9, 4.13, 4.14, 5.2.8
o-Nitrochlorobenzene	1578	B	S/P	2	2G	Cont	No	St	C	T	B,C,D	4.9, 4.13, 4.14, 5.2.5, 5.2.8, 5A.2.2
o-Nitrophenol (molten)	1663	B	S/P	2	2G	Cont	No	St	C	T	A,C,D	4.9, 4.14.1, 5.2.5 5.2.8, 5A.2.2
1- or 2-Nitropropane	2608	D	S	3	2G	Cont	No	SP	R	F-T	A	
Nitropropane (60%)/ Nitroethane (40%) mixture	1993	D	S	3	2G	Cont	No	SP	R	F-T	A,C (n)	4.12.4
(o- and p-) Nitro-toluenes	1664	C	S/P	2	2G	Cont	No	St	C	T	B	4.9, 4.13.1, 4.14, 5.2.8

a	b	c	d	e	f	g	h	i	j	k	l	m
Nonene		B	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Nonyl alcohol		C	P	3	2G	Open	No	St	O	No	B	
Nonylphenol		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Octanol (all isomers)		C	P	3	2G	Open	No	St	O	No	B	
Octene (all isomers)		B	P	3	2G	Cont.	No	SP	R	F	B	4.14.1
Olefins, straight chain mixtures		B	P	3	2G	Cont.	No	SP	R	F	B	4.14.1, 5.2.5, 5.2.8
alpha-Olefins (C_6-C_{18} mixtures)		B	P	3	2G	Cont.	No	SP	R	F	B	4.14.1, 5.2.5, 5.2.8
Oleum	1831	C	S/P	2	2G	Cont.	No	St	C	T	No	4.8.2 to 4.8.8, 4.9.1, 4.13.1, 4.14, 4.15.2, 4.17, 5.2.6
Paraldehyde	1264	C	S/P	3	2G	Cont.	No	SP	R	F	A	5.2.8
Pentachloroethane	1669	B	S/P	2	2G	Cont.	No	St	R	T	No	4.9, 4.13.1, 4.14.1
1,3-Pentadiene		C	S/P	3	2G	Cont.	No	SP	R	F-T	B	4.10, 4.18

a	b	c	d	e	f	g	h	i	j	k	l	m
n-Pentane	1265	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Pentene, all isomers		C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Perchloroethylene	1897	B	S/P	3	2G	Cont	No	St	R	T	No	4.9.1, 4.9.2
Phenol	2312	B	S/P	2	2G	Cont	No	St	C	T	A	4.9, 4.14, 5.2.5 5.2.8, 5A.2.2
1-Phenyl-1-xylyl ethane		C	P	3	2G	Open	No	St	O	No	B	
Phosphoric acid	1805	D	S	3	2G	Open	No	St	O	No	No	4.8.1 to 4.8.4, 4.8.6 to 4.8.8
Phosphorus, yellow or white	2447	A	S/P	1	1G	Cont	Pad + (vent or inert)	St	C	No	No	4.5, 4.14, 4.17
Phthalic anhydride	2214	C	S/P	3	2G	Cont	No	St	R	No	D	5.2.8
Pinene	2368	A	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Polyethylene polyamines	2734[i] 2735	C	S/P	3	2G	Open	No	St	O	No	A	4.12.2, 5.2.8
Polymethylene polyphenyl isocyanate	2206[i] 2207	D	S	2	2G	Cont	Dry	St	C	T[b]	C[c] D	4.9, 4.12.5, 4.14.1, 4.15.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Potassium hydroxide solution	1814	C	S/P	3	2G	Open	No	St	O	No	No	4.12.1 Copper, brass and bronze may be used, 5.2.8
n-Propanolamine		C	S/P	3	2G	Open	No	St	O	No	A,D	4.12.2, 5.2.8
beta-Propiolactone		D	S	2	2G	Cont	No	St	R	T	A	
Propionaldehyde	1275	D	S	3	2G	Cont	No	SP	R	F-T	A	4.13.1, 4.15.1, 4.17
Propionic acid	1848	D	S	3	2G	Cont	No	SP	R	F	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 4.17
Propionic anhydride	2496	C	S/P	3	2G	Cont	No	St	R	T	A	4.12.6
Propionitrile	2404	C	S/P	2	1G	Cont	No	SP	C	F-T	A,D	4.9, 4.13, 4.14, 4.17
n-Propylamine	1277	C	S/P	2	2G	Cont	Inert	SP	C	F-T	C,D	4.9, 4.12.2, 4.14, 4.17
Propylene dimer		(C)	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Propylene oxide	1280	D	S	2	2G	Cont	Inert	SP	C	F-T	A,C	4.7, 4.9.1, 4.11, 4.14
Propylene trimer		B	P	3	2G	Cont	No	SP	R	F	B	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Pyridine	1282	B	S/P	3	2G	Cont	No	SP	R	F	A	4.12.4
Rosin		A	P	3	2G	Open	No	St	O	No	B	
Rosin soap (disproportionated solution)		B	P	3	2G	Open	No	St	O	No	A	
Sodium borohydride, (15% or less)/Sodium hydroxide solution		C	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 5.2.6
Sodium chlorate solution, (50% or less)		III	S	3	2G	Open	No	St	O	No	No	4.14.1, 4.15.1, 4.21
Sodium dichromate solution, (70% or less)		B	S/P	2	2G	Open	No	St	C	No	No	4.9.3, 4.12.2, 4.14
Sodium hydrosulphide solution, (45% or less)	2949	B	S/P	3	2G	Cont	Vent or pad (gas)	St	R	T	No	4.15.1, 5.2.8
Sodium hydrosulphide Ammonium sulphide solution		B	S/P	2	2G	Cont	No	SP	C	F-T	A,C	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.15.1, 4.17, 4.18,

a	b	c	d	e	f	g	h	i	j	k	l	m
Sodium hydroxide solution	1824	D	S	3	2G	Open	No	St	O	No	No	4.12.1, Copper, brass and bronze may be used
Sodium hypochlorite solution, (15% or less)		B	S/P	3	2G	Cont	No	St	R	No	No	4.12.5, 4.15.1
Styrene monomer	2055	B	S/P	3	2G	Cont	No	SP	O	F	B	4.10, 4.12.4, 4.18.1, 4.18.2
Sulphur (molten)	2448	III	S	3	1G	Open	Vent or pad (gas)	SP	O	F-T	No	4.3
Sulphuric acid	1830	C	S/P	3	2G	Open	No	St	O	No	No	4.8, 4.15.2, 5.2.7, 5.2.8
Sulphuric acid, spent	1832	C	S/P	3	2G	Open	No	St	O	No	No	4.8, 4.15.2, 5.2.7, 5.2.8
Tall oil, crude and distilled		A	P	3	2G	Open	No	St	O	No	B	
Tall oil fatty acid (resin acids less than 20%)		(C)	P	3	2G	Open	No	St	O	No	B	
Tall oil soap (disproportionated solution)		B	P	3	2G	Open	No	St	O	No	A	

a	b	c	d	e	f	g	h	i	j	k	l	m
Tetrachloroethane	1702	B	S/P	3	2G	Cont	No	St	R	T	No	4.9, 4.13.1
Tetraethylenepentamine	2320	D	S	3	2G	Open	No	St	O	No	A	4.12.1
Tetrahydrofuran	2056	D	S	3	2G	Cont	No	SP	R	F-T	A,D	
Tetrahydronaphthalene		C	P	3	2G	Open	No	St	O	No	B	
Toluene	1294	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Toluenediamine	1709	C	S/P	2	2G	Cont	No	St	C	T	B,C,D	4.9, 4.12.1, 4.13.1, 4.14, 4.17
Toluene diisocyanate	2078	C	S/P	2	2G	Cont	Dry	St	C	F-T	C[C] D	4.9, 4.12.4, 4.13.1, 4.14, 4.15.2, 4.17, 5.2.8
o-Toluidine	1708	C	S/P	2	2G	Cont	No	St	C	T	A,C	4.9, 4.13.1, 4.14
Tributyl phosphate		B	P	3	2G	Open	No	St	O	No	B	

a	b	c	d	e	f	g	h	i	j	k	l	m
1,2,4-Trichlorobenzene	2321	B	S/P	2	2G	Cont	No	St	R	T	C	4.14.1, 5.2.8, 5A.2.2
1,1,1-Trichloroethane	2831	B	P	3	2G	Open	No	St	O	No	B	
1,1,2-Trichloroethane		B	S/P	3	2G	Cont	No	St	R	T	No	4.9.1
Trichloroethylene	1710	B	S/P	3	2G	Cont	No	St	R	T	No	4.9, 4.13.1, 4.15.1
1,2,3-Trichloropropane		B	S/P	2	2G	Cont	No	St	C	T	B,C,D	4.9, 4.13.1, 4.14
1,1,2-Trichloro-1,2,2-trifluoroethane		C	P	3	2G	Open	No	St	O	No	No	
Triethanolamine		D	S	3	2G	Open	No	St	O	No	A	4.12.1
Triethylamine	1296	C	S/P	2	2G	Cont	No	SP	R	F-T	B	4.9, 4.12.2, 4.17
Triethylbenzene		A	P	2	2G	Open	No	St	O	No	B	4.14.1
Triethylene tetramine	2259	D	S	3	2G	Open	No	St	O	No	A	4.12.1
Triethyl phosphite	2323		S	3	2G	Cont	No	SP	R	F-T	A,D	4.9.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Trimethylacetic acid		D	S	3	2G	Cont	No	St	R	No	A,C	4.8.2 to 4.8.8, 4.12.6
1,2,4-Trimethylbenzene		B	P	3	2G	Cont	No	SP	R	F	B	4.14.1
Trimethylhexamethylene diamine (2,2,4- and 2,4,4-isomers)	2327	(D)	S	3	2G	Open	No	St	O	No	A,C	4.12.1, 4.14.1
Trimethylhexamethylene diisocyanate (2,2,4- and 2,4,4-isomers)	2328	B	S/P	2	2G	Cont	Dry	St	C	T	A,C[c]	4.9, 4.13.1, 4.14.1, 4.15.2
2,2,4-Trimethyl-1, 3-Pentanediol-1-isobutyrate		C	P	3	2G	Open	No	St	O	No	B	
Trimethyl phosphite	2329		S	3	2G	Cont	No	SP	R	F-T	A,D	4.9.1, 4.14.1, 4.15.2
Tritolyl phosphate (containing less than 1% ortho-isomer)		A	P	2	2G	Open	No	St	O	No	B	4.14.1
Tritolyl phosphate, (containing 1% or more ortho-isomer)	2574[j]	A	S/P	1	2G	Cont	No	St	C	No	B	4.9.3, 4.14
Trixylyl phosphate		A	P	1	2G	Open	No	St	O	No	B	4.14

a	b	c	d	e	f	g	h	i	j	k	l	m
Turpentine	1299	B	P	3	2G	Cont	No	SP	R	F	B	4.14.1
1-Undecene		B	P	3	2G	Open	No	St	O	No	B	
Undecyl alcohol		B	P	3	2G	Open	No	St	O	No	B	5.2.5, 5.2.8, 5A.2.2r
Urea, ammonium nitrate solution, (containing aqua ammonia)		C	S/P	3	2G	Cont	No	SP	R	T	A	4.12.4, 4.12.9
n-Valeraldehyde	2058	D	S	3	2G	Cont	Inert	SP	R	F-T	A	4.2.7, 4.15.1
Vinyl acetate	1301	C	S/P	3	2G	Cont	No	SP	O	F	A	4.10, 4.18.1, 4.18.2
Vinyl ethyl ether	1302	C	S/P	2	1G	Cont	Inert	SP	C	F-T	A	4.2, 4.10, 4.11, 4.12.8, 4.14, 4.17, 4.18.1, 4.18.2
Vinylidene chloride	1303	B	S/P	2	2G	Cont	Inert	SP	R	F-T	B	4.10, 4.11, 4.12.5 4.17, 4.18.1, 4.18.2
Vinyl neodecanoate		C	S/P	3	2G	Open	No	St	O	No	B	4.10, 4.15.1, 4.18.1, 4.18.2
Vinyl toluene	2618	A	S/P	3	2G	Cont	No	SP	R	F	D	4.10, 4.12.1, 4.14.1, 4.18.1, 4.18.2

a	b	c	d	e	f	g	h	i	j	k	l	m
White spirit, low (15-20%) aromatic	1300	(B)	P	2	2G	Cont	No	SP	R	F	B	4.14.1
Xylene	1307	C	P	3	2G	Cont	No	SP	R	F	B	4.14.1, 5.2.8
Xylenol	2261	B	S/P	3	2G	Open	No	St	O	No	B	5.2.5, 5.2.8, 5A.2.2

a Provision 4.17 applies to ammonia aqueous, 28% or less but not below 10%.

b If the product carried contains flammable solvents such that the flashpoint is not exceeding 60°C, then special electrical systems and a flammable vapour detector are to be provided.

c Although water is suitable for extinguishing open air fires involving chemicals to which this footnote applies, water should not be allowed to contaminate closed tanks containing these chemicals because of the risk of hazardous gas generation.

d UN number 1198 only applies if flashpoint is below 60°C c.c.

e Provision 4.17 applies to formaldehyde solutions 45% or less, but not below 5%.

f Provision 4.17 applies to hydrochloric acid not below 10%.

g Dry chemical cannot be used because of the possibility of an explosion.

h UN number 2032 assigned to red fuming nitric acid.

i UN number depends on boiling point of substance.

j UN number assigned to this substance containing more than 3% of ortho-isomer.

k UN number only applies to 2-chloropropionic acid

l Dinitrotoluene should not be carried in deck tanks.

m Temperature sensors should be used to monitor the cargo pump temperature to detect overheating due to pump failures.

n Dry chemical should not be used as a fire-fighting medium

o UN number 2672 refers to 20-35%.

p Applies to n-Decyl alcohol only.

q Requirements are based on those isomers having a flashpoint of 60°C or less, some isomers have a flashpoint greater than 60°C, and therefore the requirements based on flammability would not apply to such isomers.

r Provision 5A.2.2 applies to 1-undecyl alcohol only.

CHAPTER VII - LIST OF CHEMICALS TO WHICH THE CODE DOES NOT APPLY*

The existing text of chapter VII is replaced by the following:

1 The following are products which are not considered to come within the scope of the Code. This list may be used as a guide in considering bulk carriage of products whose hazards have not yet been evaluated.

2 Although the products listed in this chapter fall outside the scope of the Code, the attention of Administrations is drawn to the fact that some safety precautions may be needed for their safe transportation. Accordingly Administrations should prescribe appropriate safety requirements.

Chapter VII	UN number
Acetone	1090
Alcohols (C_{13} and above)	-
Alkyl (C_9-C_{17}) benzenes	-
Aluminium sulphate solution	
Aminoethyl diethanolamine/ Aminoethyl ethanolamine, water solution	
n-Amyl alcohol	1105
sec-Amyl alcohol	1105
tert-Amyl alcohol	1105
Amyl alcohol, primary	1105
Butene Oligomer	
sec-Butyl acetate	1123
n-Butyl alcohol	1120
sec-Butyl alcohol	1120
tert-Butyl alcohol	1120

* The product names are not always identical with the names given in the various editions of the Bulk Chemical Code (resolution A.212(VII)) or the International Bulk Chemical Code (resolution MSC.4(48)).

Chapter VII	UN number
Butylene glycol	-
γ-Butyrolactone	-
Butyl stearate	-
Calcium alkyl salicylate	-
Calcium bromide solution	-
Calcium chloride solution	-
Caprolactam (molten or aqueous solutions)	-
Choline chloride solutions	-
Coconut oil fatty acid methyl ester	-
Dextrose solution	-
Diacetone alcohol	1148
Dialkyl (C_7-C_{13}) phthalates	-
Dicyclopentadiene	2048
Diethylene glycol	-
Diethylene glycol butyl ether	-
Diethylene glycol butyl ether acetate	-
Diethylene glycol dibutyl ether	-
Diethylene glycol diethyl ether	-
Diethylene glycol ethyl ether	-
Diethylene glycol ethyl ether acetate	-
Diethylene glycol methyl ether acetate	-
Diethylenetriamine pentaacetic acid pentasodium salt solution	-
Di-(2-ethyl hexyl) adipate	-
Di-(2-ethyl hexyl) phthalate	-
Diheptyl phthalate	-
Dihexyl phthalate	-

Chapter VII	UN number
Diisobutyl ketone	1157
Diisodecyl phthalate	-
Diisononyl adipate	-
Dinonyl phthalate (all isomers)	-
Diisooctyl phthalate	-
Diisopropyl naphthalene	-
2,2-Dimethyloctanoic acid	-
Dioctyl phthalate	-
Dipropylene glycol	-
Dipropylene glycol methyl ether	-
Diundecyl phthalate	-
Dodecane (all isomers)	-
2-Ethoxyethanol	1171
Ethyl acetate	1173
Ethyl acetoacetate	-
Ethyl alcohol	1170
Ethylcyclohexane	-
Ethylene carbonate	-
Ethylenediamine tetraacetic acid tetrasodium salt solution	-
Ethylene glycol	-
Ethylene glycol butyl ether	2369
Ethylene glycol butyl ether acetate	-
Ethylene glycol methyl butyl ether	-
Ethylene glycol methyl ether	1188
Ethylene glycol methyl ether acetate	1189
Ethylene glycol phenyl ether	-

Chapter VII	UN number
Ethylene glycol tert-butyl ether	-
Ethylene glycol phenyl ether/ Diethylene glycol phenyl ether mixture	-
2-Ethylhexanoic acid	-
Formamide	-
Ethylene/Vinyl acetate copolymer (emulsion)	-
Glycerin	-
Glycine, sodium salt, solution	-
Ground nut oil	-
n-Heptane	1206
Hexamethylene diamine adipate, (50% in water)	-
n-Hexane	1208
1-Hexanol	2282
Hexylene glycol	-
N-(Hydroxyethyl) ethylenediamine triacedic acid, trisodium salt, solution	-
Isoamyl alcohol	1105
Isobutyl alcohol	1212
Isobutyl formate	2393
Isododecane	-
Isopentane	1265
Isopentene	2371
Isophorone	-
Isopropyl acetate	1220
Isopropyl alcohol	1219
Lactic acid	-

Chapter VII	UN number
Latex: Styrene butadiene rubber latex Carboxylated styrene-butadiene copolymer	-
Lignin sulphonic acid, salt (low COD)	-
Magnesium chloride solution	-
Magnesium hydroxide slurry	-
3-Methoxy-1-butanol	-
3-Methoxyl butyl acetate	-
Methyl acetate	1231
Methyl alcohol	1230
Methyl tert-butyl ether	2398
Methyl ethyl ketone	1193
Methyl isobutyl ketone	1245
3-Methyl-3-methoxy butanol	-
3-Methyl-3-methoxy butyl acetate	-
Molasses	-
Nonane	1920
Oleic acid	-
Octane	1262
Olefins (C_{13} and above, all isomers)	-
alpha-Olefins (C_{16}-C_{18})	-
n-Paraffins (C_{10}-C_{20})	-
Paraffin wax	-
Petrolatum	-
Petroleum naphtha	1255
Polyaluminium chloride solution	-
Polybutene	-
Polyethylene glycol	-

Chapter VII	UN number
Polyethylene glycol dimethyl ether	-
Polypropylene glycol	-
Polypropylene glycol methyl ether	-
Polysiloxane	-
n-Propyl acetate	1276
n-Propyl alcohol	1274
Propylene glycol	-
Propylene glycol ethyl ether	-
Propylene glycol methyl ether	-
Propylene tetramer	2580
Sodium aluminosilicate slurry	-
Sulpholane	-
Tridecanol	-
Triethylene glycol	-
Triethylene glycol butyl ether	-
Triisopropanolamine	-
Trimethylol propane polyethoxylate	-
Tripropylene glycol	-
Tripropylene glycol monomethyl ether	-
Urea solution	
Urea, ammonium nitrate solution	-
Urea, ammonium phosphate solution	-
Urea resin solution	-
Vegetable oil (those not otherwise listed)	-
Vegetable protein hydrolized solution	-
Wine	-

1772E

APPENDIX

MODEL FORM OF CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

Existing form of the Certificate is replaced by the following:

CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

(Official seal)

Issued in pursuance of the

IMO CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK

(resolution MEPC 20(22))1/

under the authority of the Government of

....

(full official designation of country)

by ....

(full official designation of the competent person or organization recognized by the Administration)

Name of ship	Distinctive number or letters	Port of registry	Gross tonnage	Ship type (Code paragraph 2.2.4)2/

Date on which keel was laid or on which the ship was at a similar stage of construction, or (in the case of a converted ship) date on which conversion to chemical tanker was commenced: ....

Date on which the building contract was placed: ....

The Certificate should be drawn up in the official language of the issuing country. If the language used is neither English nor French, the text should include a translation into one of these languages.

THIS IS TO CERTIFY:

1 (i) That the ship has been surveyed in accordance with the provisions of section 1.6 of the Code;

(ii) that the survey showed that the construction and equipment of the ship:

*(a) complied with the relevant provisions of the Code applicable to ships referred to in 1.7.2;

*(b) complied with the provisions of the Code applicable to ships referred to in 1.7.3.

2 That the ship has been provided with a manual in accordance with the standards for procedures and arrangements as called for by Regulation 5, 5A and 8 of Annex II of MARPOL 73/78, and that the arrangements and equipment of the ship prescribed in the manual are in all respects satisfactory and comply with the applicable requirements of the said Standards;

3 That the ship is suitable for the carriage in bulk of the following products provided that all relevant operational provisions of the Code are observed

Products3/4/	Conditions of carriage5/6/ (tank numbers etc.)

* Continued on the annexed signed and dated sheet(s) numbered 1A

* Tank numbers referred to in this list are identified on the annexed signed and dated tank plan numbered 2A

4 That, in accordance with 1.7.3/2.2.5* the provisions of the Code are modified in respect of the ship in the following manner:

5 That the ship must be loaded:

*(a) in accordance with the loading conditions provided in the approved loading manual, stamped and dated .... and signed by a responsible officer of the Administration, or of an organization recognized by the Administration;

*(b) in accordance with the loading limitations appended to this Certificate.

Where it is required to load the ship other than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions should be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition.**

6 This certificate is valid until .... subject to surveys in accordance with 1.6 of the Code

Issued at .... 19..
(place of issue of Certificate)

The undersigned declares that he is duly authorized by the said Government to issue this Certificate.

....
(signature of official issuing the certificate and/or seal of issuing authority)

Notes on completion of Certificate:

1/ The Certificate can be issued only to ships entitled to fly the flags of States which are Parties to MARPOL 73/78.

2/ Ship type: Any entry under this column must relate to all relevant recommendations, e.g. an entry "Type II" should mean Type II in all respects prescribed by the Code. This column would not usually apply in the case of an existing ship and in such a case should be noted "See paragraph 1(ii)(b)."

---

* Delete as appropriate.

** Instead of being incorporated in the Certificate, this text may be appended to the Certificate if duly signed and stamped.

3/ Products: Products listed in Chapter VI of the Code, or which have been evaluated by the Administration in accordance with 1.8 of the Code, should be listed. In respect of the latter "new" products, any special requirements provisionally prescribed should be noted.

4/ Products: The list of products the ship is suitable to carry should include the noxious liquid substances of Category D which are not covered by the Code and should be identified as "Chapter VII Category D".

5/ Conditions of carriage: The limitations on the carriage of Category B or Category C substances under 5A.2 of the Code should also be indicated.

6/ Conditions of carriage: If a Certificate is issued to a ship which is modified in accordance with the provision of Regulation 1(12) of Annex II to MARPOL 73/78 the Certificate should indicate in the top of the table of products and conditions of carriage the following statement: "This ship is certificated to carry only pollution hazard chemicals"

ENDORSEMENT FOR ANNUAL AND INTERMEDIATE SURVEYS

THIS IS TO CERTIFY that at a survey required by 1.6 of the Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk, the ship was found to comply with the relevant provisions of the Code.

Annual survey: Signed: ....
(signature of duly authorized official)

Place: ....

Date: ....

(seal or stamp of the Authority, as appropriate)

Annual*/Intermediate* survey: Signed: ....
(signature of duly authorized official)

Place: ....

Date: ....

(seal or stamp of the Authority, as appropriate)

Annual*/Intermediate* survey: Signed: ....
(signature of duly authorized official)

Place: ....

Date: ....

(seal or stamp of the Authority, as appropriate)

Annual survey: Signed: ....
(signature of duly authorized official)

Place: ....

Date: ....

(seal or stamp of the Authority, as appropriate)

---

* Delete at appropriate

ATTACHMENT 1 TO THE INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

Continued list of products to those specified in Section 3, and their conditions of carriage

Products	Conditions of carriage (tank numbers, etc.)

Date ....
(as for Certificate)

....
(Signature of official issuing the Certificate and/or seal of issuing authority)

***

RESOLUTION MEPC.33(27)

adopted on 17 March 1989

ADOPTION OF AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING article 38(a) of the Convention on the International Maritime Organization concerning the function of the Committee conferred upon it by International Conventions for the Prevention and Control of Marine Pollution,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol"), which together specify the amendment procedure of the 1978 Protocol and confers upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

BEING DESIROUS of keeping the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code) up-to-date, and compatible with the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), as well as appendices II and III of Annex II of MARPOL 73/78,

NOTING FURTHER resolution MEPC 32(27) by which the Committee adopted amendments to the IBC Code, RECOGNIZING the need to bring the corresponding amendments to the BCH Code into force on the date on which the amendments to the IBC Code enter into force,

HAVING CONSIDERED, at its twenty-seventh session, the amendments to the BCH Code proposed by the Sub-Committee on Bulk Chemicals at its eighteenth session and circulated in accordance with article 16(2)(a) of the 1973 Convention,

1. ADOPTS in accordance with article 16(2)(d) of the 1973 Convention amendments to the BCH Code, the text of which is set out in the Annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on the date on which the conditions for the entry into force of the amendments to the IBC Code adopted by the Committee by resolution MEPC 32(27) are met, unless prior to that date, not less than one third of the Parties or the Parties, the combined merchant fleets of which constitute not less than fifty per cent of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objections to the amendments;

3. INVITES the Parties to note that in accordance with article 16(2)(g)(ii) of the 1973 Convention the amendments shall enter into force six months after their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1978 Protocol certified copies of the present resolution and the text of the amendments contained in the Annex;

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1978 Protocol copies of the resolution and its Annex.

ANNEX

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

1 Chapter III, Section E - FIRE PROTECTION: The introductory sentence is amended to read:

"Fire-extinguishing media determined to be effective for certain products are listed in column "l" in the table of chapter VI."

and the same sentence which appears in the Explanatory Notes to chapter VI under "Fire Protection" is deleted.

2 Regulation 3.14.2: The last sentence is amended to read: "Regular protein foams should not be used".

3 Regulation 4.4 Acetone cyanohydrin

.1 The words "and Lactonitrile solution (80% or less)" are added to the title.

.2 The first sentence is amended to read:

"Acetone cyanohydrin and Lactonitrile solution should ...".

4 New regulation 4.22 Octyl nitrates

New regulation 4.22 Octyl nitrates is added as follows:

"4.22 Octyl nitrates, all isomers

4.22.1

The carriage temperature of the cargo should be maintained below 100°C to prevent the occurrence of a self-sustaining. exothermic decomposition reaction.

4.22.2

The cargo may not be carried in independent pressure vessels permanently affixed to the vessel's deck unless:

.1 the tanks are sufficiently insulated from fire; and

.2 the vessel has a water deluge system for the tanks such that the cargo temperature is maintained below 100°C and the temperature rise in the tanks does not exceed 1.5°C/hour for a fire of 650°C (1200°F)."

5 Chapter VI - Explanatory note for fire protection:

.1 a footnote is added to "D: dry chemical", as follows:

"Dry chemical powder systems when used may require an additional water system for boundary cooling. This is normally provided in sufficient quantitites by the standard fire main system required by regulation II-2/4 of the 1974 SOLAS Convention as amended."

.2 A new note is added as follows:

"Further information on the suitability of fire-fighting media listed in column "l" of chapter VI may be found in column "l" of chapter 17 in the IBC Code."

6 Chapter VI - The Table

The Table of Summary of Minimum Requirements are replaced by the following:

Product name	UN number	Pollution category	Hazards	Ship type	Tank type	Tank vents	Tank environmental control	Electrical requirements	Gauging	Vapour detection	Fire protection	Special requirements
a	b	c	d	e	f	g	h	i	j	k	l	m
Acetic acid		D	S	3	2G	Cont.	No	SP	R	F	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 4.17
Acetic anhydride	1715	D	S	2	2G	Cont.	No	SP	R	F-T	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 4.17
Acetone cyanohydrin	1541	A	S/P	2	2G	Cont.	No	St	C	T	A	4.4, 4.9, 4.12.6, 4.13, 4.14, 4.17, 4.18
Acetonitrile	1648	III	S	2	2G	Cont.	No	SP	R	F-T	A	4.9
Acrylamide solution (50% or less)	2074	D	S	2	2G	Open	No	St	C	No	No	4.9.3, 4.10, 4.14.1, 4.15.1, 4.18.1
Acrylic acid	2218	D	S	3	2G	Cont.	No	SP	R	F-T	A	4.10, 4.12.6, 4.18.1
Acrylonitrile	1093	B	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.10, 4.12.3, 4.13.1, 4.14, 4.17
Adiponitrile	2205	D	S	3	2G	Cont.	No	St	R	T	A	
Alcohol (C12-C15) poly(1-3) ethoxylates		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Alcohol (C12-C15) poly(3-11) ethoxylates		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Alcohol (C6-C17)(secondary) poly(3-6) ethoxylates		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Alcohol (C6-C17)(secondary) poly(7-12) ethoxylates		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5, 5.2.8
Alkyl acrylate-vinyl pyridine copolymer in toluene		C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Alkyl benzene sulphonic acid	2584, 2586	C	S/P	3	2G	Open	No	St	O	No	B	5.2.6, 5.2.7
Alkyl benzene sulphonic acid, sodium salt solution		C	P	3	2G	Open	No	St	O	No	No	5.2.6 to 5.2.8
Allyl alcohol	1098	B	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.13.1, 4.14, 4.17
Allyl chloride	1100	B	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.13.1, 4.14, 4.17
Aluminium chloride (30% or less)/Hydrochloric acid (20% or less) solution		D	S	3	1G	Cont.	No	St	R	T	No	4.8, 4.17(f)
2-(2-Aminoethoxy) ethanol	3055	D	S	3	2G	Open	No	St	O	No	A,C,D	4.14.1, 4.12.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Aminoethyl ethanolamine		(D)	S	3	2G	Open	No	St	O	No	A	4.12.1
N-Aminoethylpiperazine	2815	D	S	3	2G	Cont.	No	St	R	T	A,C,D	4.12.2, 4.14.1
2-Amino-2-methyl-1-propanol (90% or less)		D	S	3	2G	Open	No	St	O	No	A	4.12.1
Ammonia aqueous (28% or less)	2672(o)	C	S/P	3	2G	Cont.	No	SP	R	T	C	4.12.4, 4.12.9, 4.17(a)
Ammonium nitrate solution (93% or less)		D	S	2	1G	Open	No	St	O	No	No	4.8.4, 4.8.6, 4.12.10, 4.13.2, 4.14.1, 4.19
Ammonium sulphide solution (45% or less)	2683	B	S/P	2	2G	Cont.	No	SP	C	F-T	A,C	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.15.1, 4.17, 4.18
Ammonium thiocyanate (25% or less)/Ammonium thiosulphate (20% or less) solution		(C)	P	3	2G	Open	No	St	O	No	No	
Ammonium thiosulphate solution (60% or less)		(C)	P	3	2G	Open	No	St	O	No	No	5.2.8
n-Amyl acetate	1104	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
sec-Amyl acetate	1104	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Amyl acetate, commercial	1104	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Aniline	1547	C	S/P	2	2G	Cont.	No	St	C	T	A	4.9, 4.13.1, 4.14
Aviation alkylates (C8 paraffins and iso-paraffins BPT 95 - 120°C)		(C)	P	3	2G	Cont.	No	SP	R	F	B	4.14.1
Benzene and mixtures having 10% benzene or more	1114(s)	C	S/P	3	2G	Cont.	No	SP	R	F-T	B	4.9.1, 4.13.1, 5.2.8
Benzene sulphonyl chloride	2225	D	S	3	2G	Cont.	No	St	R	T	B,D	4.12.1, 4.14.1
Benzyl acetate		C	P	3	2G	Open	No	St	O	No	A	
Benzyl alcohol	.	C	P	3	2G	Open	No	St	O	No	A	
Benzyl chloride	1738	B	S/P	2	2G	Cont.	No	St	C	T	B	4.9, 4.10, 4.13.1, 4.14, 4.17
Butene oligomer		B	P	3	2G	Open	No	St	O	No	A	4.14.1
n-Butyl acetate	1123	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
n-Butyl acrylate	2348	B	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.10,4.14.1,4.18.1,4.18.2
Butylamine (all isomers)	1125, 1214	C	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.9, 4.12.1, 4.12.2, 4.13.1, 4.14.1, 4.17
Butylbenzenes (all isomers)	2709	(A)	P	2	2G	Cont.	No	SP	R	F	A	4.14.1
Butyl benzyl phthalate		A	P	2	2G	Open	No	St	O	No	A	4.14.1
n-Butyl butyrate		(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Butyl/Decyl/Cetyl/Eicosyl methacrylate mixture		D	S	3	2G	Cont.	No	St	R	No	A,C,D	4.10, 4.18.1, 4.18.2
1,2-Butylene oxide	3022	C	S/P	3	2G	Cont.	Inert	SP	R	F	A,C	4.7.1, 4.7.2, 4.7.4, 4.7.5, 4.7.8 to 4.7.11, 4.7.13, 4.7.17, 4.7.19, 4.7.21, 4.14.1
n-Butyl ether	1149	C	S/P	3	2G	Cont.	Inert	SP	R	F-T	A,D	4.2.7, 4.9
Butyl methacrylate		D	S	3	2G	Cont.	No	SP	R	F-T	A,D	4.10, 4.18.1, 4.18.2
n-Butyraldehyde	1129	B	S/P	3	2G	Cont.	No	SP	O	F-T	A	4.14.1, 4.15.1
Butyric acid	2820	D	S	3	2G	Cont.	No	St	R	No	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6
Calcium alkyl salicylate		C	P	3	2G	Open	No	St	O	No	A	5.2.6, 5.2.7
Calcium hypochlorite solution (15% or less)		C	S/P	3	2G	Cont.	No	St	R	No	No	4.12.5, 4.15.1
Calcium hypochlorite solution (more than 15%)		B	S/P	3	2G	Cont.	No	St	R	No	No	4.12.5, 4.14.1, 4.15.1
Calcium naphthenate in mineral oil		A	P	3	2G	Open	No	St	O	No	A	4.14.1
Camphor oil	1130	B	S/P	2	2G	Cont.	No	SP	O	F	B	4.14.1
Carbolic oil		A	S/P	2	2G	Cont.	No	St	C	F-T	A	4.9, 4.14
Carbon disulphide	1131	B	S/P	2	1G	Cont.	Pad+Inert	use NONE	C	F-T	C	4.1, 4.9, 4.14, 4.17
Carbon tetrachloride	1846	B	S/P	3	2G	Cont.	No	St	C	T	No	4.9, 4.13.1, 4.14.1, 4.17

a	b	c	d	e	f	g	h	i	j	k	l	m
Cashew nut shell oil (untreated)		D	S	3	2G	Cont.	No	St	R	T	B	
Cetyl/Eicosyl methacrylate mixture		III	S	3	2G	Open	No	St	O	No	A,C,D	4.10, 4.18.1, 4.18.2
Chlorinated paraffins (C10-C13)		A	P	1	2G	Open	No	St	O	No	A	4.14
Chloroacetic acid (80% or less)	1750	C	S/P	2	2G	Cont.	No	St	C	No	No	4.8.2, 4.8.4, 4.8.6 to 4.8.8, 4.9.3, 4.12.6(z), 4.14, 5.2.8
Chlorobenzene	1134	B	S/P	2	2G	Cont.	No	SP	R	F-T	B	4.14.1
Chloroform	1888	B	S/P	3	2G	Cont.	No	St	R	T	No	4.9, 4.14.1, 4.17
Chlorohydrins (crude)		(D)	S	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.14
o-Chloronitrobenzene	1578	B	S/P	2	2G	Cont.	No	St	C	T	B,C,D	4.9, 4.13, 4.14, 5.2.5, 5.2.8, 5A.2.2
2- or 3-Chloropropionic acid	2511(k)	(C)	S/P	3	2G	Open	No	St	O	No	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 5.2.6 to 5.2.8
Chlorosulphonic acid	1754	C	S/P	1	2G	Cont.	No	St	C	T	No	4.8.2 to 4.8.8, 4.9, 4.14, 4.15.2, 4.17
m-Chlorotoluene	2238	B	S/P	3	2G	Cont.	No	SP	R	F-T	B,C	4.14.1
o-Chlorotoluene	2238	A	S/P	3	2G	Cont.	No	SP	R	F-T	B,C	4.14.1
p-Chlorotoluene	2238	B	S/P	2	2G	Cont.	No	SP	R	F-T	B,C	4.14.1, 5.2.8
Chlorotoluenes (mixed isomers)	2238	A	S/P	2	2G	Cont.	No	SP	R	F-T	B,C	4.14.1
Coal tar		A	S/P	2*	2G	Cont.	No	St	R	No	B,D	4.14.1
Coal tar naphtha solvent		B	S/P	3	2G	Cont.	No	SP	R	F-T	A,D	4.14.1
Coal tar pitch (molten)		D	S	3	1G	Cont.	No	St	R	No	B,D	4.14.1
Coconut oil fatty acid		C	P	3	2G	Open	No	St	O	No	A	5.2.6 to 5.2.8
Creosote (coal tar)		A	S/P	2	2G	Open	No	St	O	No	B,D	4.14.1
Creosote (wood)		A	S/P	2	2G	Open	No	St	O	No	B,D	4.14.1

*For ships constructed before the date of entry into force of the present amendments which are engaged solely on voyages between ports or terminals within the State the flag of which the ship is entitled to fly, the ship-type requirement applies ten years after entry into force of the amendments.

For ships constructed before the date of entry into force of the present amendments, which are engaged on voyages from, to or between port terminals within States other than the State the flag of which the ship is entitled to fly, the ship-type requirement applies five years after the entry into force of the amendments, provided that the ship satisfies all the following conditions:

1 the ship has been regularly engaged in the trade of coal tar for at least five years before the date of entry into force of the present amendments;
2 the ship is solely engaged on restricted voyages as determined by the Administration;
3 the Certificate of Fitness is endorsed to the effect that the ship is solely engaged in such restricted voyages, with the expiry date of the period of grace; and
4 the five year period of grace is agreed among the Governments concerned.

a	b	c	d	e	f	g	h	i	j	k	l	m
Cresols (all isomers)	2076	A	S/P	2	2G	Open	No	St	O	No	B	4.14.1
Cresylic acid, sodium salt solution		A	S/P	2	2G	Open	No	St	O	No	No	4.12.1, 4.14.1
Crotonaldehyde	1143	B	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.9, 4.13.1, 4.14.1, 4.15.1, 4.17
Cycloheptane	2241	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Cyclohexane	1145	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, 5.2.8
Cyclohexanol		C	P	3	2G	Open	No	St	O	No	A	5.2.6, 5.2.8
Cyclohexanone	1915	D	S	3	2G	Cont.	No	SP	R	F-T	A	4.12.5
Cyclohexyl acetate	2243	(B)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Cyclohexylamine	2357	C	S/P	3	2G	Cont.	No	SP	R	F-T	A,D	4.12.1, 4.12.2
1,3-Cyclopentadiene dimer (molten)		B	P	2	2G	Cont.	No	SP	R	F	A	4.14.1, 5.2.5, 5.2.8, 5A.2.2
Cyclopentane	1146	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Cyclopentene	2246	(B)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
p-Cymene	2046	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Decanoic acid		C	P	3	2G	Open	No	St	O	No	A	5.2.6 to 5.2.8
Decene		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Decyl acrylate		A	S/P	2	2G	Open	No	St	O	No	A,C,D	4.10, 4.12.2, 4.14.1, 4.18.1, 4.18.2
Decyl alcohol (all isomers)		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.8(p)
Dibutylamine		C	S/P	3	2G	Cont.	No	SP	R	F-T	B,D	4.12.4
Dibutyl phthalate		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Dichlorobenzenes (all isomers)		B	S/P	2	2G	Cont.	No	St	R	T	B,D	4.12.5, 4.14.1, 5.2.5(v), 5.2.8(w), 5A.2.2(x)
1,1-Dichloroethane	2362	B	S/P	3	2G	Cont.	No	SP	R	F-T	B	4.14.1, 4.17

a	b	c	d	e	f	g	h	i	j	k	l	m
Dichloroethyl ether	1916	B	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.12.5, 4.14.1
2,2-Dichloroisopropyl ether	2490	C	S/P	2	2G	Cont.	No	St	R	T	B,C,D	4.9, 4.12.5, 4.13.1, 4.14
Dichloromethane	1593	D	S	3	2G	Cont.	No	St	R	T	No	
2,4-Dichlorophenol	2021	A	S/P	2	2G	Cont.	Dry	St	R	T	B,C,D	4.12.1, 4.14.1
2,4-Dichlorophenoxyacetic acid, diethanolamine salt solution		A	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 4.14.1
2,4-Dichlorophenoxyacetic acid, dimethylamine salt solution (70% or less)		A	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 4.14.1
2,4-Dichlorophenoxyacetic acid, triisopropanolamine salt solution		A	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 4.14.1
1,2-Dichloropropane	1279	B	S/P	2	2G	Cont.	No	SP	R	F-T	B	4.9, 4.14.1
1,3-Dichloropropane		B	S/P	2	2G	Cont.	No	SP	R	F-T	B	4.9, 4.14.1
1,3-Dichloropropene	2047	B	S/P	2	2G	Cont.	No	SP	C	F-T	B	4.9, 4.13, 4.14, 4.17
Dichloropropene/Dichloropropane mixtures		B	S/P	2	2G	Cont.	No	SP	C	F-T	B,C,D	4.9, 4.13, 4.14, 4.17
2,2-Dichloropropionic acid		D	S	3	2G	Cont.	Dry	St	R	No	A	4.8.2, 4.8.4, 4.8.6 to 4.8.8, 4.12.6(z)
Diethanolamine		III	S	3	2G	Open	No	St	O	No	A	4.12.2
Diethylamine	1154	C	S/P	3	2G	Cont.	No	SP	R	F-T	A	4.9, 4.12.1, 4.17
Diethylaminoethanol	2686	C	S/P	3	2G	Cont.	No	SP	R	F-T	A,C	4.12.1, 4.12.2
Diethylbenzene	2049	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Diethylene glycol methyl ether		C	P	3	2G	Open	No	St	O	No	A	
Diethylenetriamine	2079	D	S	3	2G	Open.	No	St	O	No	A	4.12.2
Diethyl ether	1155	III	S	2	1G	Cont.	Inert	SP	C	F-T	A	4.2, 4.11, 4.12.9, 4.14, 4.17
Di-(2-ethylhexyl) phosphoric acid	1902	C	S/P	3	2G	Open	No	St	O	No	B,C,D	4.12.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Diethyl phthalate		C	P	3	2G	Open	No	St	O	No	A	
Diethyl sulphate	1594	(B)	S/P	2	2G	Cont.	No	St	C	T	A,D	4.12.3, 4.14.1
Diglycidyl ether of bisphenol A		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5
Diglycidyl ether of bisphenol F		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5
Di-n-hexyl adipate		B	P	3	2G	Open	No	St	O	No	A	4.14.1
Diisobutylamine	2361	(C)	S/P	2	2G	Cont.	No	SP	R	F-T	B,D	4.9.3, 4.12.1, 4.14.1
Diisobutylene	2050	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Diisobutyl phthalate		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5
Diisopropanolamine		C	S/P	3	2G	Open	No	St	O	No	A	4.12.2, 5.2.6 to 5.2.8
Diisopropylamine	1158	C	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.12.2, 4.14, 4.17
Diisopropylbenzene (all isomers)		A	P	2	2G	Open	No	St	O	No	A	4.14.1
N,N-Dimethylacetamide solution (40% or less)		D	S	3	2G	Cont.	No	St	R	T	B	4.9.1, 4.12.4, 4.13.1
Dimethyl adipate		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.8
Dimethylamine solution (45% or less)	1160	C	S/P	3	2G	Cont.	No	SP	R	F-T	C,D	4.9, 4.12.1, 4.17
Dimethylamine solution (greater than 45% but not greater than 55%)	1160	C	S/P	2	2G	Cont.	No	SP	C	F-T	A,C,D	4.9, 4.12.1, 4.13.1, 4.14, 4.17
Dimethylamine solution (greater than 55% but not greater than 65%)	1160	C	S/P	2	2G	Cont.	No	SP	C	F-T	A,C,D	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.17
N,N-Dimethylcyclohexylamine	2264	C	S/P	2	2G	Cont.	No	SP	R	F-T	A,C	4.9, 4.12.1, 4.13.1, 4.14.1
Dimethylethanolamine	2051	D	S	3	2G	Cont.	No	SP	R	F-T	A,D	4.12.2
Dimethylformamide	2265	D	S	3	2G	Cont.	No	SP	R	F-T	A,D	
Dimethyl glutarate		C	P	3	2G	Open	No	St	O	No	A	
Dimethyl hydrogen phosphite			S	3	2G	Cont.	No	St	R	T	A,D	4.9.1
Dimethyl octanoic acid		(C)	P	3	2G	Open	No	St	O	No	A	5.2.7, 5.2.8
Dimethyl phthalate		C	P	3	2G	Open	No	St	O	No	A	

a	b	c	d	e	f	g	h	i	j	k	l	m
Dimethyl succinate		C	P	3	2G	Open	No	St	O	No	A	5.2.8
Dinitrotoluene (molten)	1600	B	S/P	2	2G (1)	Cont.	No	St	C	T	A	4.9, 4.13.1, 4.14, 5.2.5, 5.2.8, 5A.2.2(m)
1,4-Dioxane	1165	D	S	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.14
Dipentene	2052	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Diphenyl		A	P	1	2G	Open	No	St	O	No	B	4.14
Diphenyl/Diphenyl ether mixtures		A	P	1	2G	Open	No	St	O	No	B	4.14
Diphenyl ether		A	P	3	2G	Open	No	St	O	No	A	4.14.1
Diphenyl ether/Diphenyl phenyl ether mixture		A	P	3	2G	Open	No	St	O	No	A	4.14.1
Diphenylmethane diisocyanate	2489	(B)	S/P	2	2G	Cont.	Dry	St (b)	C	T(b)	C(c),D	4.9, 4.12.5, 4.13.1, 4.14.1, 4.15.2, 5.2.5, 5.2.8, 5A.2.2
Diphenylol propane-epichlorohydrin resins		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5
Di-n-propylamine	2383	C	S/P	3	2G	Cont.	No	SP	R	F-T	A	4.9.3, 4.12.2, 4.14.1
Dodecene (all isomers)		(B)	P	3	2G	Open	No	St	O	No	A	4.14.1
Dodecyl alcohol		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5, 5.2.8, 5A.2.2
Dodecyl diphenyl ether disulphonate solution		B	S/P	3	2G	Open	No	St	O	No	No	4.14.1, 5.2.5, 5.2.8, 5A.2.2
Dodecyl methacrylate		III	S	3	2G	Open	No	St	O	No	A,C	4.10
Dodecyl/Pentadecyl methacrylate mixture		III	S	3	2G	Open	No	St	O	No	A,C,D	4.10, 4.18.1, 4.18.2
Dodecyl phenol		A	P	1	2G	Open	No	St	O	No	A	4.14
Drilling brines, containing Zinc salts		(A)	P	2	2G	Open	No	St	O	No	No	4.14.1
Epichlorohydrin	2023	C	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.13.1, 4.14, 4.17
Ethanolamine	2491	D	S	3	2G	Open	No	St	O	F-T	A	4.12.2
2-Ethoxyethyl acetate	1172	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Ethyl acrylate	1917	A	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.10, 4.14.1, 4.17, 4.18.1, 4.18.2
Ethylamine	1036	(C)	S/P	2	1G	Cont.	No	SP	C	F-T	C,D	4.9, 4.11, 4.12.2, 4.17
Ethylamine solutions (72% or less)	2270	(C)	S/P	2	2G	Cont.	No	SP	C	F-T	A,C	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.17
Ethyl amyl ketone	2271	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Ethylbenzene	1175	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
N-Ethylbutylamine		(C)	S/P	3	2G	Cont.	No	SP	R	F-T	A	4.9.3, 4.12.1, 4.14.1
Ethyl butyrate	1180	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Ethylcyclohexane		(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
N-Ethylcyclohexylamine		D	S	3	2G	Cont.	No	SP	R	F-T	A,C	4.12.1, 4.14.1
Ethylene chlorohydrin	1135	C	S/P	2	2G	Cont.	No	SP	C	F-T	D	4.9, 4.13.1, 4.14, 4.17
Ethylene cyanohydrin		(D)	S	3	2G	Open	No	St	O	No	A	
Ethylenediamine	1604	C	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.12.2, 5.2.8
Ethylene dibromide	1605	B	S/P	2	2G	Cont.	No	St	C	T	No	4.9, 4.14.1, 4.17, 5.2.8
Ethylene dichloride	1184	B	S/P	2	2G	Cont.	No	SP	R	F-T	B	4.12.4, 4.14
Ethylene glycol butyl ether acetate		(C)	P	3	2G	Open	No	St	O	No	A	
Ethylene glycol diacetate		C	P	3	2G	Open	No	St	O	No	A	
Ethylene oxide/Propylene oxide mixture with an Ethylene oxide content of not more than 30% in weight	2983	D	S	2	1G	Cont.	Inert	SP	C	F-T	A,C	4.7, 4.9, 4.11, 4.14
2-Ethylhexyl acrylate		B	S/P	3	2G	Open	No	St	O	No	A	4.10, 4.14.1, 4.18.1, 4.18.2
2-Ethylhexylamine	2276	B	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.9, 4.12.2, 4.14.1
Ethylidene norbornene		B	S/P	3	2G	Cont.	No	SP	R	F-T	B,C,D	4.9.1, 4.12.4, 4.14.1, 4.15.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Ethyl methacrylate	2277	(D)	S	3	2G	Cont.	No	SP	R	F-T	B,D	4.10, 4.18.1, 4.18.2
o-Ethylphenol		(A)	S/P	3	2G	Open	No	St	O	No	B	4.14.1
2-Ethyl-3-propylacrolein		(B)	S/P	3	2G	Cont.	No	SP	R	F-T	A	4.14.1, 5.2.8
Ethyltoluene		(B)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Ferric chloride solutions	2582	C	S/P	3	2G	Open	No	St	O	No	No	4.8, 4.14.1, 5.2.8
Ferric nitrate/Nitric acid solution		C	S/P	2	2G	Cont.	No	St	R	T	No	4.8, 4.14, 4.17
Formaldehyde solutions (45% or less)	1198(d) 2209	C	S/P	3	2G	Cont.	No	SP	R	F-T	A	4.15.1, 4.17(e), 5.2.8
Formic acid	1779	D	S	3	2G	Cont.	No	SP	R	T(t)	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.7, 4.17
Fumaric adduct of rosin, water dispersion		B	P	3	2G	Open	No	St	O	No	No	4.14.1, 5.2.5
Furfural	1199	C	S/P	3	2G	Cont.	No	SP	R	F-T	A	4.15.1
Furfuryl alcohol	2874	C	P	3	2G	Open	No	St	O	No	A	
Glutaraldehyde solutions (50% or less)		D	S	3	2G	Open	No	St	O	No	No	4.15.1
Glycidyl ester of C10 trialkylacetic acid		B	P	3	2G	Open	No	St	O	No	A	4.14.1
Heptane (all isomers)	1206	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Heptanol (all isomers) (q)	.	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Heptene (all isomers)		C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Heptyl acetate	.	(B)	P	3	2G	Open	No	St	O	No	A	4.14.1
Hexamethylenediamine solution	1783	C	S/P	3	2G	Cont.	No	St	R	T	A	4.12.2, 4.14.1, 5.2.8
Hexamethyleneimine	2493	C	S/P	2	2G	Cont.	No	SP	R	F-T	A,C	4.12.1, 4.12.2
Hexane (all isomers)	1208	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Hexene (all isomers)		(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Hexyl acetate	1233	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Hydrochloric acid	1789	D	S	3	1G	Cont.	No	St	R	T	No	4.8, 4.17(f)
Hydrogen peroxide solutions (over 8% but not over 60%)	2014, 2984	C	S/P	3	2G	Cont.	No	St	C	No	No	4.13.2, 4.14.1, 4.20.15 to 4.20.27

a	b	c	d	e	f	g	h	i	j	k	l	m
Hydrogen peroxide solutions (over 60% but not over 70%)	2015	C	S/P	2	2G	Cont.	No	St	C	No	No	4.14.1, 4.20.1 to 4.20.14
2-Hydroxyethyl acrylate		B	S/P	2	2G	Cont.	No	St	C	T	A	4.9, 4.10, 4.14.1, 4.18.1, 4.18.2
Isoamyl acetate	1104	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Isobutyl acetate	1213	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Isobutyl acrylate	2527	B	S/P	2	2G	Cont.	No	SP	R	F-T	A	4.10, 4.14.1, 4.18.1, 4.18.2
Isobutyraldehyde	2045	C	S/P	3	2G	Cont.	No	SP	O	F-T	A	4.15.1
Isophoronediamine	2289	D	S	3	2G	Cont.	No	St	R	T	A	4.12.2
Isophorone diisocyanate	2290	B	S/P	2	2G	Cont.	Dry	St	C	T	C(c),D	4.9, 4.12.5, 4.13.1, 4.14.1, 4.15.2
Isoprene	1218	C	S/P	3	2G	Cont.	No	SP	R	F	B	4.10, 4.11, 4.18.1, 4.18.2
Isopropanolamine		C	S/P	3	2G	Open	No	St	O	F-T	A	4.12.2, 5.2.7, 5.2.8
Isopropylamine	1221	C	S/P	2	2G	Cont.	No	SP	C	F-T	C,D	4.9, 4.11, 4.12.2, 4.14, 4.17
Isopropylbenzene	1918	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Isopropylcyclohexane		(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, 5.2.6, 5.2.7
Isopropyl ether	1159	D	S	3	2G	Cont.	Inert	SP	R	F	A	4.2.7, 4.10.3, 4.14.1
Isovaleraldehyde	2058	C	S/P	3	2G	Cont.	Inert	SP	R	F-T	A	4.2.7, 4.15.1
Lactonitrile solution (80% or less)		B	S/P	2	1G	Cont.	No	St	C	T	A,C,D	4.4, 4.9, 4.12.6, 4.13, 4.14, 4.17, 4.18, 5.2.5
Lauric acid		B	P	3	2G	Open	No	St	O	No	A	4.14.1,5.2.5,5.2.8,5A.2.2
Maleic anhydride	2215	D	S	3	2G	Cont.	No	St	R	No	A(g),C	
Mercaptobenzothiazol, sodium salt solution		B	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 4.14.1, 5.2.8

a	b	c	d	e	f	g	h	i	j	k	l	m
Mesityl oxide	1229	D	S	3	2G	Cont.	No	SP	R	F-T	A	4.14.1
Metam sodium solution		A	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 4.14.1
Methacrylic acid	2531	D	S	3	2G	Cont.	No	St	R	T	A	4.10, 4.12.6, 4.18.1
Methacrylonitrile	3079	(B)	S/P	2	2G	Cont.	No	SP	C	F-T	A	4.9, 4.10, 4.12.4, 4.13.1, 4.14, 4.17
Methyl acrylate	1919	B	S/P	2	2G	Cont.	No	SP	R	F-T	B	4.10, 4.14.1, 4.17, 4.18.1, 4.18.2
Methylamine solutions (42% or less)	1235	C	S/P	2	2G	Cont.	No	SP	C	F-T	A,C,D	4.9, 4.12.1, 4.13.1, 4.14, 4.17
Methylamyl acetate	1233	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Methylamyl alcohol	2053	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Methyl amyl ketone	1110	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Methyl butyrate	1237	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Methylcyclohexane	2296	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Methylcyclopentadiene dimer		(B)	P	3	2G	Cont.	No	SP	R	F	B	4.14.1
2-Methyl-6-ethyl aniline		C	S/P	3	2G	Open	No	St	O	No	B,C,D	
2-Methyl-5-ethyl pyridine	2300	(B)	S/P	3	2G	Open	No	St	O	No	D	4.12.4, 4.14.1
Methyl formate	1243	D	S	2	2G	Cont.	No	SP	R	F-T	A	4.9, 4.11, 4.14, 4.17
Methyl heptyl ketone		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
2-Methyl-2-hydroxy-3-butyne		III	S	3	2G	Cont.	No	SP	R	F-T	A,C,D	4.12.8, 4.14.1
Methyl methacrylate	1247	D	S	2	2G	Cont.	No	SP	R	F-T	B	4.10, 4.18.1, 4.18.2
2-Methyl-1-pentene	2288	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
2-Methylpyridine	2313	B	S/P	2	2G	Cont.	No	SP	C	F	A,C	4.9.3, 4.12.4, 4.14.1
4-Methylpyridine	2313	B	S/P	2	2G	Cont.	No	SP	C	F-T	A,C,D	4.9.3, 4.12.4, 4.14, 5.2.8
N-Methyl-2-pyrrolidone		B	P	3	2G	Open	No	St	O	No	A	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Methyl salicylate		(B)	P	3	2G	Open	No	St	O	No	A	4.14.1
alpha-Methylstyrene	2303	A	S/P	3	2G	Cont.	No	SP	R	F-T	D	4.10, 4.14.1, 4.18.1, 4.18.2
Morpholine	2054	D	S	3	2G	Cont.	No	SP	R	F	A	4.12.2
Motor fuel anti-knock compounds	1649	A	S/P	2	1G	Cont.	No	SP	C	F-T	B,C	4.6, 4.9, 4.13.2, 4.14, 4.17
Naphthalene (molten)	2304	A	S/P	2	2G	Cont.	No	SP	R	No	A,D	4.14.1
Naphthenic acids		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Neodecanoic acid		C	P	3	2G	Open	No	St	O	No	A	5.2.7
Nitrating acid (mixture of sulphuric and nitric acids)	1796	(C)	S/P	2	2G	Cont.	No	St	C	T	No	4.8, 4.13.1, 4.14, 4.15.2, 4.17
Nitric acid (less than 70%)	2031	C	S/P	2	2G	Cont.	No	St	R	T	No	4.8, 4.14, 4.17
Nitric acid (70% and over)	2031, 2032(h)	C	S/P	2	2G	Cont.	No	St	C	T	No	4.8, 4.14, 4.17
Nitrobenzene	1662	B	S/P	2	2G	Cont.	No	St	C	T	D	4.9, 4.13, 4.14, 5.2.8
o-Nitrophenol (molten)	1663	B	S/P	2	2G	Cont.	No	St	C	T	A,C,D	4.9, 4.14.1, 5.2.5, 5.2.8, 5A.2.2
1- or 2-Nitropropane	2608	D	S	3	2G	Cont.	No	SP	R	F-T	A	
Nitropropane (60%)/Nitroethane (40%) mixture		D	S	3	2G	Cont.	No	SP	R	F-T	A,C(n)	4.12.4
o- or p-Nitrotoluenes	1664	C	S/P	2	2G	Cont.	No	St	C	T	B	4.9, 4.13.1, 4.14, 5.2.8
Nonane (all isomers)	1920	(C)	P	3	2G	Cont.	No	SP	R	F	B,C	4.14.1
Nonene		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Nonyl alcohol (all isomers)		C	P	3	2G	Open	No	St	O	No	A	
Nonylphenol		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Nonyl phenol poly(4-12) ethoxylates		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5, 5.2.8, 5A.2.2(y)

a	b	c	d	e	f	g	h	i	j	k	l	m
Noxious liquid, N.F, (1) n.o.s. (trade name ..., contains ...) S.T.1, Cat.A*		A	P	1	2G	Open	No	St	O	No	A	4.14
Noxious liquid, F, (2) n.o.s. (trade name ..., contains ...) S.T.1, Cat.A*		A	P	1	2G	Cont.	No	SP	R	F	A	4.14
Noxious liquid, N.F, (3) n.o.s. (trade name ..., contains ...) S.T.2, Cat.A*		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Noxious liquid, F, (4) n.o.s. (trade name ..., contains ...) S.T.2, Cat.A*		A	P	2	2G	Cont.	No	SP	R	F	A	4.14.1
Noxious liquid, N.F, (5) n.o.s. (trade name ..., contains ...) S.T.2, Cat.B*		B	P	2	2G	Open	No	St	O	No	A	4.14.1, [5.2.5, 5.2.8]**
Noxious liquid, N.F, (6) n.o.s. (trade name ..., contains ...) S.T.2, Cat.B*, mp 15°C+		B	P	2	2G	Open	No	St	O	No	A	4.14.1, [5.2.5]**, 5.2.8, 5A.2.2
Noxious liquid, F, (7) n.o.s. (trade name ..., contains ...) S.T.2, Cat.B*		B	P	2	2G	Cont.	No	SP	R	F	A	4.14.1, [5.2.5, 5.2.8]**
Noxious liquid, F, (8) n.o.s. (trade name ..., contains ...) S.T.2, Cat.B*, mp 15°C+		B	P	2	2G	Cont.	No	SP	R	F	A	4.14.1, [5.2.5]**, 5.2.8, 5A.2.2
Noxious liquid, N.F, (9) n.o.s. (trade name ..., contains ...) S.T.3, Cat.A*		A	P	3	2G	Open	No	St	O	No	A	4.14.1
Noxious liquid, F, (10) n.o.s. (trade name ..., contains ...) S.T.3, Cat.A*		A	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Noxious liquid, N.F, (11) n.o.s. (trade name ..., contains ...) S.T.3, Cat.B*		B	P	3	2G	Open	No	St	O	No	A	4.14.1, [5.2.5,5.2.8]**
Noxious liquid, N.F, (12) n.o.s. (trade name ..., contains ...) S.T.3, Cat.B*, mp 15°C+		B	P	3	2G	Open	No	St	O	No	A	4.14.1,[5.2.5]**,5.2.8,5A.2.2
Noxious liquid, F, (13) n.o.s. (trade name ..., contains ...) S.T.3, Cat.B*		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, [5.2.5, 5.2.8]**

* In case of a specific n.o.s. cargo assessed as falling within this n.o.s. group that is carried on a ship, this entry, including the cargo's trade name and one or two principle components, should be provided in the shipping document. Abbreviations used mean:

N.F:	Flashpoint exceeding 60°C (closed cup test)	S.T:	Ship type
F:	Flashpoint not exceeding 60°C (closed cup test)	Cat.:	Pollution category
n.o.s.:	Not otherwise specified	m.p.:	Melting point

** For high viscosity or high melting point cargoes.

a	b	c	d	e	f	g	h	i	j	k	l	m
Noxious liquid, F, (14) n.o.s. (trade name ..., contains ...) S.T.3, Cat.B*, mp 15°C+		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, [5.2.5]**, 5.2.8, 5A.2.2
Noxious liquid, N.F, (15) n.o.s. (trade name ..., contains ...) S.T.3, Cat.C*		C	P	3	2G	Open	No	St	O	No	A	[5.2.6 to 5.2.8]**
Noxious liquid, F, (16) n.o.s. (trade name ..., contains ...) S.T.3, Cat.C*		C	P	3	2G	Cont.	No	SP	R	F	A	[5.2.6 to 5.2.8]**
Octane (all isomers)	1262	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Octanol (all isomers)		C	P	3	2G	Open	No	St	O	No	A	
Octene (all isomers)		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Octyl aldehydes	1191	(B)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, 5.2.8
Octyl nitrates (all isomers)		A	S/P	2	2G	Open	No	St	O	No	B	4.14.1, 4.18, 4.22
Olefin mixtures (C5-C7)		C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Olefin mixtures (C5-C15)		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
alpha-Olefins (C6-C18) mixtures		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, 5.2.5, 5.2.8
Oleum	1831	C	S/P	2	2G	Cont.	No	St	C	T	No	4.8.2 to 4.8.8, 4.9.1, 4.13.1, 4.14, 4.15.2, 4.17, 5.2.6, 5.2.7
Palm nut oil fatty acid		(C)	P	3	2G	Open	No	St	O	No	B	5.2.6 to 5.2.8
Paraldehyde	1264	C	S/P	3	2G	Cont.	No	SP	R	F	A	5.2.8
Pentachloroethane	1669	B	S/P	2	2G	Cont.	No	St	R	T	No	4.9, 4.13.1, 4.14.1
1,3-Pentadiene		C	S/P	3	2G	Cont.	No	SP	R	F-T	B	4.10, 4.18
Pentane (all isomers)	1265	(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Pentene (all isomers)		C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Perchloroethylene	1897	B	S/P	3	2G	Cont.	No	St	R	T	No	4.9.1, 4.9.2, 4.14.1
Phenol	2312	B	S/P	2	2G	Cont.	No	St	C	T	A	4.9, 4.14, 5.2.5, 5.2.8, 5A.2.2

* See footnote on page 19.

** For high viscosity or high melting point cargoes.

a	b	c	d	e	f	g	h	i	j	k	l	m
1-Phenyl-1-xylyl ethane		C	P	3	2G	Open	No	St	O	No	B	
Phosphoric acid	1805	D	S	3	2G	Open	No	St	O	No	No	4.8.1 to 4.8.4, 4.8.6 to 4.8.8
Phosphorus, yellow or white	1381, 2447	A	S/P	1	1G	Cont.	Pad+(Vent or Inert)	St	C	No	C	4.5, 4.14, 4.17
Phthalic anhydride (molten)	2214	C	S/P	3	2G	Cont.	No	St	R	No	D	5.2.6 to 5.2.8
Pinene	2368	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Polyethylene polyamines	2734(i) 2735	(C)	S/P	3	2G	Open	No	St	O	No	A	4.12.2, 5.2.8
Polyferric sulphate solution		(C)	S/P	3	2G	Open	No	St	O	No	A	4.12.10
Polymethylene polyphenyl isocyanate	2206(i) 2207	D	S	2	2G	Cont.	Dry	St (b)	C	T(b)	C(c),D	4.9, 4.12.5, 4.14.1, 4.15.2
Potassium hydroxide solution	1814	C	S/P	3	2G	Open	No	St	O	No	No	4.12.1(aa), 5.2.8
n-Propanolamine		C	S/P	3	2G	Open	No	St	O	No	A,D	4.12.2, 5.2.8
beta-Propiolactone		D	S	2	2G	Cont.	No	St	R	T	A	
Propionaldehyde	1275	D	S	3	2G	Cont.	No	SP	R	F-T	A	4.13.1, 4.15.1, 4.17
Propionic acid	1848	D	S	3	2G	Cont.	No	SP	R	F	A	4.8.2 to 4.8.4, 4.8.6 to 4.8.8, 4.12.6, 4.17
Propionic anhydride	2496	C	S/P	3	2G	Cont.	No	St	R	T	A	4.12.6
Propionitrile	2404	C	S/P	2	1G	Cont.	No	SP	C	F-T	A,D	4.9, 4.13, 4.14, 4.17
n-Propylamine	1277	C	S/P	2	2G	Cont.	Inert	SP	C	F-T	C,D	4.9, 4.12.2, 4.14, 4.17
n-Propylbenzene		(C)	P	3	2G	Cont.	No	St	R	F	A	4.14.1
Propylene dimer		(C)	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Propylene oxide	1280	D	S	2	2G	Cont.	Inert	SP	C	F-T	A,C	4.7, 4.9.1, 4.11, 4.14
Propylene tetramer	2850	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Propylene trimer	2057	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Pyridine	1282	D	S	3	2G	Cont.	No	SP	R	F	A	4.12.4, 4.14.1
Rosin		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5, 5.2.8, 5A.2.2
Rosin soap (Disproportionated) solution		B	P	3	2G	Open	No	St	O	No	A	4.14.1
Sodium borohydride (15% or less)/Sodium hydroxide solution		C	S/P	3	2G	Open	No	St	O	No	No	4.12.1, 5.2.6
Sodium chlorate solution (50% or less)	2428	III	S	3	2G	Open	No	St	O	No	No	4.14.1, 4.15.1, 4.21
Sodium dichromate solution (70% or less)		C	S/P	2	2G	Open	No	St	C	No	No	4.9.3, 4.12.2, 4.14
Sodium hydrogen sulphite solution (35% or less)	2693	D	S	3	2G	Open	No	St	O	No	No	
Sodium hydrosulphide solution (45% or less)	2949	B	S/P	3	2G	Cont.	Vent or Pad (gas)	St	R	T	No	4.14.1, 4.15.1, 5.2.8
Sodium hydrosulphide/Ammonium sulphide solution		B	S/P	2	2G	Cont.	No	SP	C	F-T	A,C	4.9, 4.11, 4.12.1, 4.13.1, 4.14, 4.15.1, 4.17, 4.18
Sodium hydroxide solution	1824	D	S	3	2G	Open	No	St	O	No	No	4.12.1(aa)
Sodium hypochlorite solution (15% or less)	1791	C	S/P	3	2G	Cont.	No	St	R	No	No	4.12.5, 4.15.1
Sodium nitrite solution	1500	B	S/P	2	2G	Open	No	St	O	No	No	4.9.3.(a), 4.9.3.(b), 4.14, 4.15.1
Sodium thiocyanate solution (56% or less)		(B)	P	3	2G	Open	No	St	O	No	No	4.14.1
Styrene monomer	2055	B	S/P	3	2G	Cont.	No	SP	O	F	B	4.10, 4.12.4, 4.14.1, 4.18.1, 4.18.2
Sulphur (molten)	2448	III	S	3	1G	Open	Vent or Pad (gas)	SP	O	F-T	No	4.3
Sulphuric acid	1830	C	S/P	3	2G	Open	No	St	O	No	No	4.8, 4.15.2, 5.2.7, 5.2.8
Sulphuric acid, spent	1832	C	S/P	3	2G	Open	No	St	O	No	No	4.8, 4.15.2, 5.2.7, 5.2.8

a	b	c	d	e	f	g	h	i	j	k	l	m
Tall oil (crude and distilled)		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5, 5.2.8, 5A.2.2
Tall oil fatty acid (resin acids less than 20%)		(C)	P	3	2G	Open	No	St	O	No	A	5.2.6 to 5.2.8
Tall oil soap (disproportionated) solution		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.5, 5.2.8
Tetrachloroethane	1702	B	S/P	3	2G	Cont.	No	St	R	T	No	4.9, 4.13.1, 4.14.1
Tetraethylene pentamine	2320	D	S	3	2G	Open	No	St	O	No	A	4.12.1
Tetrahydrofuran	2056	D	S	3	2G	Cont.	No	SP	R	F-T	A,D	
Tetrahydronaphthalene		C	P	3	2G	Open	No	St	O	No	A	
1,2,3,5-Tetramethylbenzene		(C)	P	3	2G	Open	No	St	O	No	A	
Toluene	1294	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Toluenediamine	1709	C	S/P	2	2G	Cont.	No	St	C	T	B,C,D	4.9, 4.12.1, 4.13.1, 4.14, 4.17, 5.2.6, 5.2.8
Toluene diisocyanate	2078	C	S/P	2	2G	Cont.	Dry	St	C	F-T	C(c),D	4.9, 4.12.4, 4.13.1, 4.14, 4.15.2, 4.17, 5.2.8
o-Toluidine	1708	C	S/P	2	2G	Cont.	No	St	C	T	A,C	4.9, 4.13.1, 4.14
Tributyl phosphate		B	P	3	2G	Open	No	St	O	No	A	4.14.1
1,2,4-Trichlorobenzene	2321	B	S/P	2	2G	Cont.	No	St	R	T	C	4.14.1, 5.2.8, 5A.2.2
1,1,1-Trichloroethane	2831	B	P	3	2G	Open	No	St	O	No	A	4.14.1
1,1,2-Trichloroethane		B	S/P	3	2G	Cont.	No	St	R	T	No	4.9.1, 4.14.1
Trichloroethylene	1710	B	S/P	3	2G	Cont.	No	St	R	T	No	4.9, 4.13.1, 4.14.1, 4.15.1
1,2,3-Trichloropropane		B	S/P	2	2G	Cont.	No	St	C	T	B,C,D	4.9, 4.13.1, 4.14
1,1,2-Trichloro-1,2,2-Trifluoroethane		C	P	3	2G	Open	No	St	O	No	No	
Tricresyl phosphate (containing less than 1% ortho-isomer)		A	P	2	2G	Open	No	St	O	No	A	4.14.1

a	b	c	d	e	f	g	h	i	j	k	l	m
Tricresyl phosphate (containing 1% or more ortho-isomer)	2574(j)	A	S/P	1	2G	Cont.	No	St	C	No	B	4.9.3, 4.14
Triethanolamine		D	S	3	2G	Open	No	St	O	No	A	4.12.1
Triethylamine	1296	C	S/P	2	2G	Cont.	No	SP	R	F-T	B	4.9, 4.12.2, 4.17
Triethylbenzene		A	P	2	2G	Open	No	St	O	No	A	4.14.1
Triethylenetetramine	2259	D	S	3	2G	Open	No	St	O	No	A	4.12.1
Triethyl phosphite	2323		S	3	2G	Cont.	No	SP	R	F-T	A,D	4.9.1
Trimethylacetic acid		D	S	3	2G	Cont.	No	St	R	No	A,C	4.8.2 to 4.8.8, 4.12.6
Trimethyl benzenes (all isomers)		B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Trimethylhexamethylenediamine (2,2,4- and 2,4,4-isomers)	2327	D	S	3	2G	Open	No	St	O	No	A,C	4.12.1, 4.14.1
Trimethylhexamethylene diisocyanate (2,2,4- and 2,4,4-isomers)	2328	B	S/P	2	2G	Cont.	Dry	St	C	T	A,C(c)	4.9, 4.13.1, 4.14.1, 4.15.2
2,2,4-Trimethyl-1,3-pentanediol-1-isobutyrate		C	P	3	2G	Open	No	St	O	No	A	
Trimethyl phosphite	2329		S	3	2G	Cont.	No	SP	R	F-T	A,D	4.9.1, 4.14.1, 4.15.2
Trixylyl phosphate		A	P	1	2G	Open	No	St	O	No	A	4.14
Turpentine	1299	B	P	3	2G	Cont.	No	SP	R	F	A	4.14.1
Undecanoic acid		(C)	P	3	2G	Open	No	St	O	No	A	5.2.6 to 5.2.8
1-Undecene		B	P	3	2G	Open	No	St	O	No	A	4.14.1
Undecyl alcohol		B	P	3	2G	Open	No	St	O	No	A	4.14.1, 5.2.8, 5A.2.2(r)
Urea/Ammonium nitrate solution (containing aqua ammonia)		C	S/P	3	2G	Cont.	No	SP	R	T	A	4.12.4, 4.12.9
n-Valeraldehyde	2058	D	S	3	2G	Cont.	Inert	SP	R	F-T	A	4.2.7, 4.15.1
Vinyl acetate	1301	C	S/P	3	2G	Cont.	No	SP	O	F	A	4.10, 4.18.1, 4.18.2
Vinyl ethyl ether	1302	C	S/P	2	1G	Cont.	Inert	SP	C	F-T	A	4.2, 4.10, 4.11, 4.12.8, 4.14, 4.17, 4.18.1, 4.18.2

a	b	c	d	e	f	g	h	i	j	k	l	m
Vinylidene chloride	1303	B	S/P	2	2G	Cont.	Inert	SP	R	F-T	B	4.10, 4.11, 4.12.5, 4.14.1, 4.17, 4.18.1, 4.18.2
Vinyl neodecanoate		B	S/P	3	2G	Open	No	St	O	No	B	4.10, 4.14.1, 4.15.1, 4.18.1, 4.18.2
Vinyltoluene	2618	A	S/P	3	2G	Cont.	No	SP	R	F	D	4.10, 4.12.1, 4.14.1, 4.18.1, 4.18.2
White spirit, low (15-20%) aromatic	1300	(B)	P	2	2G	Cont.	No	SP	R	F	A	4.14.1
Xylenes	1307	C	P	3	2G	Cont.	No	SP	R	F	A	4.14.1, 5.2.8(u)
Xylenol	2261	B	S/P	3	2G	Open	No	St	O	No	B	4.14.1, 5.2.8, 5A.2.2

7 Footnotes for the BCH Code:

a Provision 4.17 applies to Ammonia aqueous, 28% or less but not below 10%.

Ammonia aqueous (28% or less)

b If the product to be carried contains flammable solvents such that the flashpoint does not exceed 60°C c.c., then special electrical systems and a flammable vapour detector should be provided.

Diphenylmethane diisocyanate
Polymethylene polyphenyl isocyanate

c Although water is suitable for extinguishing open-air fires involving chemicals to which this footnote applies, water should not be allowed to contaminate closed tanks containing these chemicals because of the risk of hazardous gas generation.

Diphenylmethane diisocyanate
Isophorone diisocyanate
Polymethylene polyphenyl isocyanate
Toluene diisocyanate
Trimethylhexamethylene diisocyanate (2,2,4- & 2,4,4-isomers)

d UN No.1198 only applies if flashpoint is below 60°C c.c.

Formaldehyde solution (45% or less)

e Provision 4.17 applies to Formaldehyde solutions 45% or less, but not below 5%.

Formaldehyde solutions (45% or less)

f Provision 4.17 applies to Hydrochloric acid not below 10%.

Aluminum chloride (30% or less)/Hydrochloric acid (20% or less) solution
Hydrochloric acid

g Dry chemical cannot be used because of the possibility of an explosion.

Maleic anhydride

h UN No.2032 assigned to Red fuming nitric acid.

Nitric acid (70% and over)

i UN number depends on boiling point of substance.

Polyethylene polyamines
Polymethylene polyphenyl isocyanate

j UN number assigned to this substance containing more than 3% of ortho-isomer.

Tricresyl phosphate (containing 1% or more ortho-isomer)

k UN number only applies to 2-Chloropropionic acid.

2- or 3-Chloropropionic acid

l Dinitrotoluene should not be carried in deck tanks.

Dinitrotoluene (molten)

m Temperature sensors should be used to monitor the cargo pump temperature to detect overheating due to pump failures.

Dinitrotoluene (molten)

n Dry chemical should not be used as a fire-fighting medium.

Nitropropane (60%)/Nitroethane (40%) mixture

o UN No.2672 refers to 10-35% Ammonium solution.

Ammonia aqueous (28% or less)

p Applies to n-Decyl alcohol only.

Decyl alcohol (all isomers)

q Requirements are based on those isomers having a flashpoint of 60°C c.c., and therefore the requirements based on flammability would not apply to such isomers.

Heptanol (all isomers)

r Provision 5A.2.2 applies to 1-Undecyl alcohol only.

Undecyl alcohol

s UN No.1114 applies to Benzene.

Benzene and mixtures having 10% benzene or more

t Confined space should be tested for both Formic acid vapours and Carbon monoxide gas, a decomposition product.

Formic acid

u Applies to p-Xylene only.

Xylenes

v Applies to p-isomer and mixtures containing p-isomer viscosity of which is 25 mPa.S at 20°C.

Dichlorobenzenes (all isomers)

w Applies to p-isomer and mixtures containing p-isomer melting point of which is 0°C and above.

Dichlorobenzenes (all isomers)

x Applies to p-isomer and mixtures containing p-isomer melting point of which is 15°C and above.

Dichlorobenzenes (all isomers)

y Applies only to products with melting point of 15°C and above.

Nonyl phenol poly(4-12)ethoxylates

z Aluminium not permitted.

Chloroacetic acid (80% or less)
2,2-Dichloropropionic acid

aa Copper, Brass and Bronze may be used.

Potassium hydroxide solution
Sodium hydroxide solution

8 Chapter VII of the BCH Code should be replaced by the following:

"CHAPTER VII - LIST OF CHEMICALS TO WHICH THE CODE DOES NOT APPLY

1 The following are products which are not considered to come within the scope of the Code. This list may be used as a guide in considering bulk carriage of products whose hazards have not yet been evaluated.

2 Although the products listed in this chapter fall outside the scope of the Code, the attention of Administrations is drawn to the fact that some safety precautions may be needed for their safe transportation. Accordingly, Administrations should prescribe appropriate safety requirements.

EXPLANATORY NOTES

Product name (column a)	In some cases, the product names may not be identical with the names given in previous issues of the BCH Code or the IBC Code (for explanation see index of chemicals).
UN number (column b)	The number relating to each product shown in the recommendations proposed by the United Nations Committee of Experts on the Transport of Dangerous Goods. UN numbers, where available, are given for information only.
Pollution category (column c)	The letter D means the pollution category assigned to each product under Annex II of MARPOL 73/78. "III" means the product was evaluated and found to fall outside the categories A, B, C or D. Pollution category in brackets indicates that the product is provisionally categorized and that further data are necessary to complete the evaluation of their pollution hazards. Until the hazard evaluation is completed, the pollution category assigned is used.

a	b	c
Product name	UN number	Pollution Category for operational discharge (regulation 3 of Annex II)
Acetone	1090	III
Alcohols (C_{13} and above)	-	III
Alcoholic beverages, n.o.s.	3065	III
Alkyl (C_9-C_{17}) benzenes	-	(D)
Aluminium sulphate solution	-	D
Aminoethyldiethanolamine/ Aminoethylethanolamine solution	-	III
2-Amino-2-hydroxymethyl-1,3-propanediol solution (40% or less)	-	III
Ammonium sulphate solution	-	D
n-Amyl alcohol	1105	D
sec-Amyl alcohol	1105	D

a	b	c
tert-Amyl alcohol	1105	III
Amyl alcohol, primary	1105	D
Animal and fish oils, n.o.s. including: Cod liver oil Sperm oil	-	D
Apple juice	-	III
Behenyl alcohol		III
Benzene tricarboxylic acid, trioctyl ester	-	III
Brake fluid base mix: (Poly (2-8) alkylene (C_2-C_3) glycols/ Polyalkylene (C_2-C_{10}) glycols monoalkyl (C_1-C_4) ethers and their borate esters)1/	-	D
sec-Butyl acetate	1123	D
n-Butyl alcohol	1120	III
sec-Butyl alcohol	1120	III
tert-Butyl alcohol	1120	III
Butylene glycol	-	D
Butyl stearate	-	III

1/ Use "Brake fluid base mix" as a proper name on the shipping document.

a	b	c
gamma-Butyrolactone	-	D
Calcium carbonate slurry	-	III
Calcium hydroxide slurry	-	D
Calcium nitrate/Magnesium nitrate/ Potassium chloride solution		III
epsilon-Caprolactam (molten or aqueous solutions)	-	D
Cetyl/Stearyl alcohol		III
Chlorinated paraffins (C_{14}-C_{17}) (with 52% chlorine)		III
Choline chloride solutions	-	D
Clay slurry		III
Coal slurry		III
Coconut oil fatty acid methyl ester		D
Decahydronaphthalene	1147	(D)
Decylbenzene	-	D
Dextrose solution	-	III

a	b	c
Diacetone alcohol	1148	D
Dialkyl(C_7-C_{13}) phthalates	-	D
Diethylene glycol	-	III
Diethylene glycol butyl ether	-	III
Diethylene glycol butyl ether acetate	-	(D)
Diethylene glycol dibutyl ether	-	D
Diethylene glycol diethyl ether	-	III
Diethylene glycol ethyl ether	-	III
Diethylene glycol ethyl ether acetate	-	(D)
Diethylene glycol methyl ether acetate	-	(D)
Diethylenetriamine pentaacetic acid, pentasodium salt solution	-	III
Di-(2-ethylhexyl) adipate	-	D
Diheptyl phthalate	-	III

a	b	c
Dihexyl phthalate	-	III
1,4-Dihydro-9,10-dihydroxy anthracene, disodium salt solution	-	D
Diisobutyl ketone	1157	D
Diisodecyl phthalate	-	D
Diisononyl adipate	-	D
Diisooctyl phthalate	-	III
Diisopropyl naphthalene	-	D
2,2-Dimethylpropane-1,3-diol	-	(D)
Dinonyl phthalate	-	D
Dioctyl phthalate	-	III
Dipropylene glycol	-	III
Dipropylene glycol methyl ether	-	(D)
Ditridecyl phthalate	-	D
Diundecyl phthalate	-	D
Dodecane (all isomers)	-	III

a	b	c
Dodecenyl succinic acid, dipotassium salt solution	-	(D)
Dodecyl benzene	-	III
Drilling brines: Calcium bromide solution Calcium chloride solution Sodium chloride solution	-	III
2-Ethoxyethanol	1171	D
Ethyl acetate	1173	D
Ethyl acetoacetate	-	(D)
Ethyl alcohol	1170	III
Ethylene carbonate	-	III
Ethylenediamine tetraacetic acid, tetrasodium salt solution	-	D
Ethylene glycol	-	D
Ethylene glycol acetate	-	(D)
Ethylene glycol butyl ether	2369	III
Ethylene glycol tert-butyl ether	-	III
Ethylene glycol isopropyl ether	-	D
Ethylene glycol methyl butyl ether	-	D

a	b	c
Ethylene glycol methyl ether	1188	D
Ethylene glycol methyl ether acetate	1189	D
Ethylene glycol phenyl ether	–	D
Ethylene glycol phenyl ether/ Diethylene glycol phenyl ether mixture	–	D
Ethylene-vinyl acetate copolymer (emulsion)	–	III
2-Ethylhexanoic acid	–	D
Ethyl propionate	1195	D
Fatty acid (saturated C_{13} and above)	–	III
Ferric hydroxyethylethylene diamine triacetic acid, trisodium salt solution	–	D
Formamide	–	D
Glucose solution	–	III
Glycerine	–	III
Glycerol polyalkoxylate	–	III

a	b	c
Glyceryl triacetate	-	(III)
Glycine, sodium salt solution	-	III
Glyoxal solution (40% or less)	-	D
n-Heptanoic acid	-	D
Hexamethylenediamine adipate (50% in water)	-	D
Hexamethylene glycol	-	III
Hexamethylenetetramine solutions	-	D
Hexanoic acid	-	D
Hexanol	2282	D
Hexylene glycol	-	III
N-(Hydroxyethyl) ethylenediamine triacetic acid, trisodium salt solution	-	D
Isoamyl alcohol	1105	D
Isobutyl alcohol	1212	III
Isobutyl formate	2393	D
Isophorone	-	D

a	b	c
Isopropyl acetate	1220	III
Isopropyl alcohol	1219	III
Kaolin slurry	-	III
Lactic acid	-	D
Lard	-	III
Latex:		
Carboxylated styrene-butadiene copolymer		
Styrene-Butadiene rubber	-	III
Lignin sulphonic acid, sodium salt solution	-	III
Magnesium chloride solution	-	III
Magnesium hydroxide slurry	-	III
3-Methoxy-1-butanol	-	III
3-Methoxybutyl acetate	-	D
Methyl acetate	1231	III
Methyl acetoacetate	-	D
Methyl alcohol	1230	III

a	b	c
Methyl butenol	-	(D)
Methyl tert-butyl ether	2398	D
Methyl butyl ketone	-	D
Methyl butynol	-	D
Methyl ethyl ketone	1193	III
Methyl isobutyl ketone	1245	D
3-Methyl-3-methoxy butanol	-	III
3-Methyl-3-methoxy butyl acetate	-	III
Molasses	-	III
Naphthalene sulphonic acid/ Formaldehyde copolymer, sodium salt solution	-	D
Nitrilotriacetic acid, trisodium salt solution	-	D
Nonanoic acid (all isomers)	-	D
Nonyl methacrylate monomer	-	(D)

a	b	c
Noxious liquid, n.o.s. (17) (trade name ..., contains ...) Cat. D1/	-	D
Non-noxious liquid, n.o.s. (18) (trade name ..., contains ...) Appendix III1/	-	III
Octanoic acid (all isomers)	-	D
n-Octyl acetate	1262	D
Octyl decyl adipate	-	III
Olefins (C_{13} and above, all isomers)	-	III
alpha-Olefins (C_{13}-C_{18})	-	III
Oleic acid	-	D
Palm oil fatty acid methyl ester	-	D
Palm stearin	-	D
n-Paraffins (C_{10}-C_{20})	-	III

1/ In case of a specific n.o.s. (not otherwise specified) cargo assessed as falling within this n.o.s. group that is carried on a ship, this entry, including the cargo's trade name and one or two principle components, should be provided in the shipping document.

a	b	c
Paraffin wax	-	III
Pentaethylenehexamine	-	D
Pentanoic acid	-	D
Petrolatum	-	(III)
Polyaluminium chloride solution	-	III
Polybutene	-	III
Polyethylene glycol	-	III
Polyethylene glycol dimethyl ether	-	III
Polypropylene glycol	-	D
Polypropylene glycol methyl ether	-	III
Polysiloxane	-	III
n-Propyl acetate	1276	D
n-Propyl alcohol	1274	III
Propylene/Butylene copolymer	-	III
Propylene glycol	-	III
Propylene glycol ethyl ether	-	(D)

a	b	c
Propylene glycol methyl ether	-	(D)
Propylene glycol monoalkyl ether	-	(D)
Sodium aluminosilicate slurry	-	III
Sodium carbonate solution	-	D
Sodium silicate solution	-	D
Sorbitol solution	-	III
Sulpholane	-	D
Tallow	-	D
Tallow fatty acid	-	(D)
Tetraethylene glycol	-	III
Tridecane	-	III
Tridecanoic acid	-	(III)
Triethylene glycol	-	III
Triethylene glycol butyl ether	-	III
Triethylene glycol ethyl ether	-	(D)
Triethylene glycol methyl ether	-	(D)

a	b	c
Triisopropanolamine	-	III
Trimethylol propane polyethoxylate	-	D
Tripropylene glycol	-	III
Tripropylene glycol methyl ether	-	(D)
Urea/Ammonium mono- and di-hydrogen phosphate/Potassium chloride solution	-	(D)
Urea/Ammonium nitrate solution	-	D
Urea/Ammonium phosphate solution	-	D
Urea formaldehyde resin solution	-	III
Urea solution	-	III
Vegetable oil, n.o.s. including: Castor oil, Coconut oil, Corn oil, Cotton seed oil, Groundnut oil, Linseed oil, Olive oil, Palm nut oil, Palm oil, Rape seed oil, Rice bran oil, Safflower oil, Sesame oil, Soya bean oil, Sunflower oil, Tung oil	-	D
Vegetable protein solution (hydrolysed)	-	III
Water	-	III

"

RESOLUTION MEPC.41(29)

ADOPTION OF AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

(Harmonized System of Survey and Certification)

adopted on 16 March 1990

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38 of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO resolution MEPC.20(22) by which the Committee adopted the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code),

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention"), and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol"), which confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

RECALLING resolution 10 of the International Conference on Tanker Safety and Pollution Prevention, 1978, and resolution 4 of the International Conference on the Harmonized System of Survey and Certification, 1988, which recommended that IMO take the necessary action to introduce the harmonized system of survey and certification into various conventions and codes,

NOTING FURTHER resolution MEPC.39(29) by which the Committee adopted amendments to the Annex of the 1978 Protocol, introducing the harmonized system of survey and certification thereto,

HAVING CONSIDERED, at its twenty-ninth session, amendments to the BCH Code proposed and circulated in accordance with article 16(2)(a) of the 1973 Convention,

1. ADOPTS, in accordance with article 16(2)(d) of the 1973 Convention, amendments to the IBC Code, the text of which is set out in the Annex to the present resolution;

2. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1978 Protocol certified copies of the present resolution and the text of the amendments contained in the Annex;

3. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on the same date on which the amendments to the Annex to the 1978 Protocol adopted by the Committee by resolution MEPC.39(29) are accepted, unless, prior to that date, objections are communicated to the Organization as provided for in article 16(2)(f)(iii);

4. INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the amendments shall enter into force six months after their acceptance in accordance with paragraph 3 above;

5. REQUESTS the Secretary-General to inform all Parties when the conditions for the entry into force of both the 1988 SOLAS Protocol and the 1988 Load Line Protocol are met and, in conformity with article 16(8) of the Convention, when the amendments to the BCH Code contained in the Annex to the present resolution will enter into force;

6. FURTHER REQUESTS the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1978 Protocol copies of the resolution and its Annex, and to inform them when the amendments enter into force.

ANNEX

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

1.4 Definitions

A new definition should be added as follows:

"1.4.16.C "Anniversary date" means the day and the month of each year which will correspond to the date of expiry of the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk".

1.6 Survey requirements

The existing title is replaced by the following:

"Survey and certification"

The existing text of section 1.6 should be replaced by the following:

"1.6.1 Survey procedure

1.6.1.1 The survey of ships, so far as regards the enforcement of the provisions of the regulations and granting of exemptions therefrom, should be carried out by officers of the Administration. The Administration may, however, entrust the surveys either to surveyors nominated for the purpose or to organizations recognized by it.

1.6.1.2 The Administration nominating surveyors or recognizing organizations to conduct surveys should, as a minimum, empower any nominated surveyor or recognized organization to:

.1 require repairs to a ship; and

.2 carry out surveys if requested by the appropriate authorities of a port State.

The Administration should notify the Organization of the specific responsibilities of the nominated surveyors or recognized organizations and of the conditions of the authority delegated to them for circulation to the Contracting Governments.

1.6.1.3 When a nominated surveyor or recognized organization determines that the condition of the ship or its equipment does not correspond substantially with the particulars of the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, or is such that the ship is not fit to proceed to sea without danger to the ship, or persons on board, or without presenting unreasonable threat of harm to the marine environment, such surveyor or organization should immediately ensure that corrective action is taken and should in due course notify the Administration. If such corrective action is not taken, the Certificate should be withdrawn and the Administration should be notified immediately; and, if the ship is in a port of another Contracting Government, the appropriate authorities of the port State should also be notified immediately. When an officer of the Administration, a nominated surveyor or a recognized organization has notified the appropriate authorities of the port State, the Government of the port State concerned should give such officer, surveyor or organization any necessary assistance to carry out their obligations under this paragraph. When applicable, the Government of the port State concerned should take such steps as will ensure that the ship does not sail until it can proceed to sea or leave the port for the purpose of proceeding to the nearest appropriate repair yard available without danger to the ship or persons on board or without presenting an unreasonable threat of harm to the marine environment.

1.6.1.4 In every case, the Administration should guarantee the completeness and efficiency of the survey, and should undertake to ensure the necessary arrangements to satisfy this obligation.

1.6.2 Survey requirements

1.6.2.1 The structure, equipment, fittings, arrangements and material (other than items in respect of which a Cargo Ship Safety Construction Certificate, Cargo Ship Safety Equipment Certificate and Cargo Ship Safety Radio Certificate or Cargo Ship Safety Certificate are issued) of a chemical tanker should be subjected to the following surveys:

.1 an initial survey before the ship is put in service or before the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk is issued for the first time, which should include a complete examination of its structure, equipment, fittings, arrangements and material in so far as the ship is covered by the Code. This survey should be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code;

.2 a renewal survey at intervals specified by the Administration, but not exceeding 5 years, except where 1.6.6.2.2, 1.6.6.5, 1.6.6.6 or 1.6.6.7 is applicable. The renewal survey should be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code;

.3 an intermediate survey within 3 months before or after the second anniversary date or within 3 months before or after the third nniversary date of the Certificate which should take the place of one of the annual surveys specified in 1.6.2.1.4. The intermediate survey should be such as to ensure that the safety equipment and other equipment, and associated pump and piping systems fully comply with the applicable provisions of the Code and are in good working order. Such intermediate surveys should be endorsed on the Certificate issued under 1.6.4 or 1.6.5;

.4 an annual survey within 3 months before or after each anniversary date of the Certificate, including a general inspection of the structure, equipment, fittings, arrangements and material referred to in 1.6.2.1.1 to ensure that they have been maintained in accordance with 1.6.3 and that they remain satisfactory for the service for which the ship is intended. Such annual surveys should be endorsed on the Certificate issued under 1.6.4 or 1.6.5;

.5 an additional survey, either general or partial according to the circumstances, should be made when required after an investigation prescribed in 1.6.3.3, or whenever any important repairs or renewals are made. Such a survey should ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are satisfactory; and that the ship is fit to proceed to sea without danger to the ship or persons on board or without presenting unreasonable threat of harm to the marine environment.

1.6.3 Maintenance of conditions after survey

1.6.3.1 The condition of the ship and its equipment should be maintained to conform with the provisions of the Code to ensure that the ship will remain fit to proceed to sea without danger to the ship or persons on board or without presenting an unreasonable threat of harm to the marine environment.

1.6.3.2 After any survey of the ship under 1.6.2 has been completed, no change should be made in the structure, equipment, fittings, arrangements and material covered by the survey, without the sanction of the Administration, except by direct replacement.

1.6.3.3 Whenever an accident occurs to a ship or a defect is discovered, either of which affects the safety of the ship or the efficiency or completeness of its life-saving appliances or other equipment covered by the Code, the master or owner of the ship should report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible for issuing the Certificate, who should cause investigations to be initiated to determine whether a survey, as required by 1.6.2.1.5, is necessary. If the ship is in a port of another Contracting Government, the master or owner should also report immediately to the appropriate authorities of the port State and the nominated surveyor or recognized organization should ascertain that such a report has been made.

1.6.4 Issue or endorsement of Certificate of Fitness.

1.6.4.1 A Certificate called a Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, should be issued after an initial or renewal survey to a chemical tanker engaged in international voyages which complies with the relevant provisions of the Code.

1.6.4.2 The Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should be drawn up in the form corresponding to the model given in the appendix. If the language is neither English nor French, the text should include the translation into one of these languages.

1.6.4.3 The Certificate issued under provisions of this section should be available on board for examination at all times.

1.6.4.4 Notwithstanding any other provisions of the amendments to this Code adopted by the Marine Environment Protection Committee (MEPC) by resolution MEPC.41(29) and the Maritime Safety Committee (MSC) by resolution MSC.18(58), any Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk, which is current when these amendments enter into force, should remain valid until it expires under the terms of this Code prior to the amendments entering into force.

1.6.5 Issue or endorsement of Certificate of Fitness by another Government

1.6.5.1 A Party to MARPOL 73/78 may, at the request of another Party, cause a ship entitled to fly the flag of the other State to be surveyed and, if satisfied that the provisions of the Code are complied with, issue or authorize the issue of the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk to the ship, and, where appropriate, endorse or authorize the endorsement of the Certificate on board the ship in accordance with the Code. Any Certificate so issued should contain a statement to the effect that it has been issued at the request of the Government of the State whose flag the ship is entitled to fly.

1.6.6 Duration and validity of Certificate of Fitness

1.6.6.1 A Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should be issued for a period specified by the Administration which should not exceed 5 years.

1.6.6.2.1 Notwithstanding the provisions of 1.6.6.1, when the renewal survey is completed within 3 months before the expiry date of the existing Certificate, the new Certificate should be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing Certificate.

1.6.6.2.2 When the renewal survey is completed after the expiry date of the existing Certificate, the new Certificate should be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of expiry of the existing Certificate.

1.6.6.2.3 When the renewal survey is completed more than 3 months before the expiry date of the existing Certificate, the new Certificate should be valid from the date of completion of the renewal survey to a date not exceeding 5 years from the date of completion of the renewal survey.

1.6.6.3 If a Certificate is issued for a period of less than 5 years, the Administration may extend the validity of the Certificate beyond the expiry date to the maximum period specified in 1.6.6.1, provided that the surveys referred to in 1.6.2.1.3 and 1.6.2.1.4 applicable, when a Certificate is issued for a period of 5 years, are carried out as appropriate.

1.6.6.4 If a renewal survey has been completed and a new Certificate cannot be issued or placed on board the ship before the expiry date of the existing Certificate, the person or organization authorized by the Administration may endorse the existing Certificate and such a Certificate should be accepted as valid for a further period which should not exceed 5 months from the expiry date.

1.6.6.5 If a ship, at the time when a Certificate expires, is not in a port in which it is to be surveyed, the Administration may extend the period of validity of the Certificate but this extension should be granted only for the purpose of allowing the ship to complete its voyage to the port in which it is to be surveyed, and then only in cases where it appears proper and reasonable to do so. No Certificate should be extended for a period longer than 3 months, and a ship to which an extension is granted should not, on its arrival in the port in which it is to be surveyed, be entitled by virtue of such extension to leave that port without having a new Certificate. When the renewal survey is completed, the new Certificate should be valid to a date not exceeding 5 years from the date of expiry of the existing Certificate before the extension was granted.

1.6.6.6 A Certificate issued to a ship engaged on short voyages which has not been extended under the foregoing provisions of this section may be extended by the Administration for a period of grace of up to one month from the date of expiry stated on it. When the renewal survey is completed, the new Certificate should be valid to a date not exceeding 5 years from the date of expiry of the existing Certificate before the extension was granted.

1.6.6.7 In special circumstances, as determined by the Administration, a new Certificate need not be dated from the date of expiry of the existing Certificate as required by 1.6.6.2.2, 1.6.6.5 or 1.6.6.6. In these special circumstances, the new Certificate should be valid to a date not exceeding 5 years from the date of completion of the renewal survey.

1.6.6.8 If an annual or intermediate survey is completed before the period specified in 1.6.2, then:

.1 the anniversary date shown on the Certificate should be amended by endorsement to a date which should not be more than 3 months later than the date on which the survey was completed;

.2 the subsequent annual or intermediate survey required by 1.6.2 should be completed at the intervals prescribed by that section using the new anniversary date;

.3 the expiry date may remain unchanged provided one or more annual or intermediate surveys, as appropriate, are carried out so that the maximum intervals between the surveys prescribed by 1.6.2 are not exceeded.

1.6.6.9 A Certificate issued under 1.6.4 or 1.6.5 should cease to be valid in any of the following cases:

.1 if the relevant surveys are not completed within the periods specified under 1.6.2;

.2 if the Certificate is not endorsed in accordance with 1.6.2.1.3 or 1.6.2.1.4;

.3 upon transfer of the ship to the flag of another State. A new Certificate should only be issued when the Government issuing the new Certificate is fully satisfied that the ship is in compliance with the requirements of 1.6.3.1 and 1.6.3.2. In the case of a transfer between Parties, if requested within 3 months after the transfer has taken place, the Government of the Party whose flag the ship was formerly entitled to fly should, as soon as possible, transmit to the Administration copies of the Certificate carried by the ship before the transfer and, if available, copies of the relevant survey reports.

Appendix

MODEL FORM OF CERTIFICATE OF FITNESS FOR THE CARRIAGE
OF DANGEROUS CHEMICALS IN BULK

The existing Model Form of Certificate should be replaced by the following:

"CERTIFICATE OF FITNESS FOR THE CARRIAGE OF
DANGEROUS CHEMICALS IN BULK

(Official seal)

Issued under the provisions of the

CODE FOR THE CONSTRUCTION AND EQUIPMENT
OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK

(resolutions MEPC.20(22) and MSC.9(53), as amended
by resolutions MEPC.41(29) and MSC.18(58))

under the authority of the Government of

....
(full designation of country)

by ....
(full designation of the competent person or organization
recognized by the Administration)

Particulars of ship 1/

Name of ship ....

Distinctive number or letters ....

Port of registry ....

Gross tonnage ....

Ship type (Code paragraph 2.2.4) ....

IMO Number2/ ....

Date on which keel was laid or ship was at a
similar stage of construction or, (in the case
of a converted ship) date of which conversion to
a chemical tanker was commenced ....

Date on which the building contract was placed ....

The ship also complies fully with the following amendments to the Code:

....
....

The ship is exempted from compliance with the following provisions of the Code:

....
....

THIS IS TO CERTIFY:

1 That the ship has been surveyed in accordance with the provisions of 1.6 of the Code.

2 That the survey showed that the construction and equipment of the ship and the condition thereof are in all respects satisfactory and that the ship complies with the relevant provisions of the Code applicable to:

.1 ships referred to in 1.7.2 3/;

.2 ships referred to in 1.7.3 3/.

3 That the ship has been provided with a Manual in accordance with the Standards for Procedures and Arrangements as called for by regulations 5, 5A and 8 of Annex II of MARPOL 73/78, and that the arrangements and equipment of the ship prescribed in the Manual are in all respects satisfactory and comply with the applicable requirements of the said Standards.

4 That the ship is suitable for the carriage in bulk of the following products, provided that all relevant operational provisions of the Code are observed.

Products	Conditions of carriage (tank numbers, etc.)
Continued on attachment 1.3/ Tank numbers referred to in this list are identified on attachment 2.	

ENDORSEMENT FOR ANNUAL AND INTERMEDIATE SURVEYS

THIS IS TO CERTIFY that, at a survey required by 1.6.2 of the Code the ship was found to comply with the relevant provisions of the Code:

Annual survey: Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Annual/Intermediate3/ survey: Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Annual/Intermediate3/ survey: Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Annual survey: Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Annual/intermediate survey in accordance with 1.6.6.8.3

THIS IS TO CERTIFY that, at an annual/intermediate3/ survey in accordance with 1.6.6.8.3 of the Code, the ship was found to comply with the relevant provisions of the Code.

Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Endorsement to extend the Certificate if valid for less than 5 years where 1.6.6.3 applies

The ship complies with the relevant provisions of the Code, and this Certificate should, in accordance with 1.6.6.3 of the Code, be accepted as valid until ....

Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Endorsement where the renewal survey has been completed and 1.6.6.4 applies

The ship complies with the relevant provisions of the Code, and this Certificate should, in accordance with 1.6.6.4 of the Code, be accepted as valid until ....

Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Endorsement to extend the validity of the Certificate until reaching the port of survey or for a period of grace where 1.6.6.5/1.6.6.6 applies

This Certificate should, in accordance with 1.6.6.5/1.6.6.6 3/ of the Code, be accepted as valid until ....

Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

Endorsement for advancement of anniversary date where 1.6.6.8 applies

In accordance with 1.6.6.8 of the Code, the new anniversary date is ....

Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

In accordance with 1.6.6.8 of the Code, the new anniversary date is ....

Signed ....
(Signature of authorized official)

Place ....

Date ....

(Seal or stamp of the authority, as appropriate)

1/ Alternatively, the particulars of the ship may be placed horizontally in boxes.

2/ In accordance with resolution A.600(15) - IMO Ship Identification Number Scheme, this information may be included voluntarily.

3/ Delete as appropriate.

4/ Instead of being incorporated in the Certificate, this text may be appended to the Certificate if duly signed and stamped.

5/ Insert the date of expiry as specified by the Administration in accordance with 1.6.6.1 of the Code. The day and the month of this date correspond to the anniversary date as defined in 1.4.16C of the Code, unless amended in accordance with 1.6.6.8 of the Code.

ATTACHMENT 1

TO THE

CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

Continuation of the list of products specified in section 4, and conditions of their carriage

Products	Conditions of carriage (tank numbers,etc.)

Date.....................
(as for Certificate)

....
(Signature of official issuing the Certificate and/or seal or stamp of issuing authority)

ATTACHMENT 2

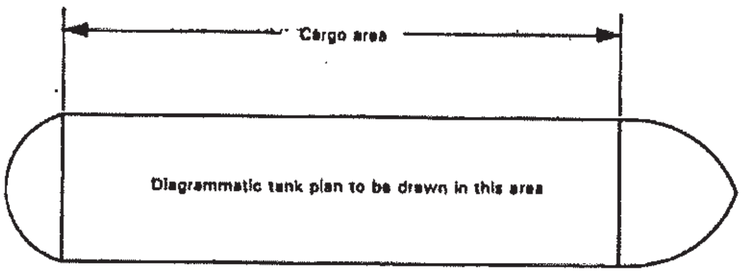
TO THE

CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

TANK PLAN (specimen)

Name of ship: ....

Distinctive number or letters: ....



Date.....................
(as for Certificate)

....
(Signature of official issuing the Certificate and/or seal or stamp of issuing authority)"

RESOLUTION MEPC.56(33)
(adopted on 30 October 1992)

ADOPTION OF AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Committee conferred upon it by international conventions for the prevention and control of marine pollution,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol"), which together specify the amendment procedure of the 1978 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

NOTING FURTHER resolution MEPC.55(33) by which the Committee adopted amendments to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code),

RECOGNIZING the need to bring the corresponding amendments to the BCH Code into force on the date on which the amendments to the IBC Code enter into force,

HAVING CONSIDERED, at its thirty-third session, the amendments to the BCH Code proposed by the Sub-Committee on Bulk Chemicals at its twenty-first session and circulated in accordance with article 16(2)(a) of the 1973 Convention,

1. ADOPTS in accordance with article 16(2)(d) of the 1973 Convention amendments to the BCH Code, the text of which is set out in the annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on the date on which the conditions for the entry into force of the amendments to the IBC Code adopted by the Committee by resolution MEPC.55(33) are met, unless, prior to that date, not less than one third of the Parties or the Parties, the combined merchant fleets of which constitute not less than fifty per cent of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objections to the amendments;

3. INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the amendments shall enter into force six months after their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1978 Protocol certified copies of the present resolution and the text of the amendments contained in the annex;

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1978 Protocol copies of the resolution and its annex.

ANNEX

AMENDMENTS TO THE BCH CODE

The existing text of the last sentence of 1.1 is amended by addition of the following words:

... of chapter 17 of the IBC Code.

The last two sentences of the existing text of 1.2.1 is amended to read as follows:

The Code is at present limited to the liquids shown in the summary of minimum requirements in chapter 17 of the IBC Code. Products that have been reviewed and determined not to present safety and pollution hazards to such an extent as to warrant application of the Code are found in chapter 18 of the IBC Code.

The existing text of 1.4.16A is replaced by the following:

Noxious liquid substance means any substance referred to in appendix II of Annex II of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) or provisionally assessed under the provisions of regulation 3(4) of that Annex as falling into category A, B, C or D.

The following new 1.4.16C is added after the existing 1.4.16B:

The IBC Code means the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk adopted by the Maritime Safety Committee and the Marine Environment Protection Committee of the Organization by resolutions MSC.4(48) and MEPC.19(22) respectively, as amended.

The existing text of 3.16.10(a) is replaced by the following:

filter type respiratory protection is unacceptable;

The following words are inserted after the third sentence of the existing text of 4.7.21:

Remote manual operation should be arranged such that remote starting of pumps supplying the water spray system and remote operation of any normally closed valves in the system can be carried out from a suitable location outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected.

The existing text of 4.10 is amended as follows:

4.10 Cargoes protected by additives

4.10.1 Certain cargoes with a reference in column 'm' in the table of chapter VI, by the nature of their chemical make-up, tend under certain conditions of temperature, exposure to air or contact with a catalyst, to undergo polymerization, decomposition, oxidation or other chemical changes. Mitigation of this tendency is carried out by introducing small amounts of chemical additives into the liquid cargo or by controlling the cargo tank environment.

4.10.2 No change.

4.10.3 Care should be taken to ensure that these cargoes are sufficiently protected to prevent deleterious chemical change at all times during the voyage. Ships carrying such cargoes should be provided with a certificate of protection from the manufacturer and kept during the voyage specifying:

.1 the name and amount of additive present;

.2 whether the additive is oxygen-dependent;

.3 date additive was put in the product and duration of effectiveness;

.4 any temperature limitations qualifying the additive's effective lifetime; and

.5 the action to be taken should the length of voyage exceed the effective lifetime of the additive.

4.10.4 Ships using the exclusion of air as the method of preventing oxidation of the cargo should comply with 2.19.3.

4.10.5 A product containing an oxygen-dependent additive should be carried without inertion.

4.10.6 As existing 4.10.5.

4.10.7 As existing 4.10.6.

New 4.23 is added as follows:

4.23 Temperature sensors

Temperature sensors should be used to monitor the cargo pump temperature to detect overheating due to pump failures.

Chapter VI

The existing text of Chapter VI is replaced by the following:

CHAPTER VI - SUMMARY OF MINIMUM REQUIREMENTS

The summary of minimum requirements of the products covered by the Code is set out in chapter 17 of the IBC Code.

For the purpose of application of the minimum requirements under this Code, the cross references in the IBC Code shown in the left hand column of the following table should be taken to mean references to the BCH Code shown in the right hand column. Where a reference is made in the BCH Code to column "m" in the table of chapter VI it should be taken to mean any of the columns "m", "n" and "o" in the table of chapter 17 of the IBC Code.

IBC/BCH CODES CROSS REFERENCES TO THE REQUIREMENTS

IBC Code chapter 17 items	IBC Code reference	BCH Code reference
Ship type (column e)		
1 = ship type 1	(2.1.2)	(2.2.4(a))
2 = ship type 2	(2.1.2)	(2.2.4(b))
3 = ship type 3	(2.1.2)	(2.2.4(c))
Tank type (column f)		
1 = independent tank	(4.1.1)	(2.3.2)
2 = integral tank	(4.1.2)	(2.3.1)
G = gravity tank	(4.1.3)	(2.4)
P = pressure tank	(4.1.4)	-
Tank environmental control (column h)		
Inert: inerting	(9.1.2.1)	(2.19.2(a))
Pad: liquid or gas	(9.1.2.2)	(2.19.2(b))
Dry: drying	(9.1.2.3)	(2.19.2(c))
Vent: natural or forced	(9.1.2.4)	(2.19.2(d))

IBC Code chapter 17 items	IBC Code reference	BCH Code reference
Electrical equipment (column i)		
NF: non-flammable product	(10.1.6)	Standard electrical system
Yes: Flashpoint exceeding 60°C (closed cup)	(10.1.6)	Standard electrical system
No: Product having a a flashpoint not exceeding 60°C (closed cup)	(10.1.6)	Special electrical systems
Gauging (column j)		
O: open gauging	(13.1.1.1)	Open device (3.9(a))
R: restricted gauging	(13.1.1.2)	Restricted device (3.9(b))
C: closed gauging	(13.1.1.3)	Closed device (3.9(c))
I: indirect gauging	(13.1.1.3)	Indirect device (3.9(d))
Materials and construction (column m)		
	N1	4.12.1
	N2	4.12.2
	N3	4.12.3
	N4	4.12.4
	N5	4.12.5
	N6	4.12.8
	N7	4.12.9
	N8	4.12.1, except copper and copper alloys may be used
	Z	-
	Y1	4.12.6
	Y2	4.12.7(a)
	Y3	4.12.7(b)
	Y4	4.12.10
	Y5	4.12.6 except aluminium is not permitted
Respiratory and eye protection (column n)	E: see 14.2.8	3.16.10

IBC Code chapter 17 items	IBC Code reference	BCH Code reference
Special requirements (column o)	15.1	4.4
	15.2	4.19
	15.3	4.1
	15.4	4.2
	15.5.1 - 13	4.20.1 - 14
	15.5.14 - 26	4.20.15 - 27
	15.6	4.6
	15.7	4.5
	15.8	4.7
	15.9	4.21
	15.10	4.3
	15.11	4.8
	15.12	4.9
	15.13	4.10
	15.14	4.11
	15.16	4.15
	15.17	4.13.1
	15.18	4.13.2
	15.19	4.14
	15.19.6	4.14.1
	15.20	4.22
	15.21	4.23
	16.2.6	5.2.5
	16.2.7	5.2.6
	16.2.8	5.2.7
	16.2.9	5.2.8
	16.6	4.18
	16A.2.2	5A.2.2

Chapter VII

The existing text of Chapter VII is replaced by the following:

CHAPTER VII - LIST OF CHEMICALS TO WHICH THE CODE DOES NOT APPLY

The list of chemicals which have been reviewed for their safety and pollution hazards and determined not to present hazards to such an extent as to warrant the application of the Code is set out in chapter 18 of the IBC Code.

New chapter VIII is added as follows:

CHAPTER VIII - TRANSPORT OF LIQUID CHEMICAL WASTES

8.1 Preamble

8.1.1 Maritime transport of liquid chemical wastes could present a threat to human health and to the environment.

8.1.2 Liquid chemical wastes should, therefore, be transported in accordance with relevant international conventions and recommendations and, in particular, in the case of maritime transport in bulk, with the requirements of this Code.

8.2 Definitions

For the purpose of this chapter:

8.2.1 "Liquid chemical wastes" are substances, solutions or mixtures, offered for shipment, containing or contaminated with one or more constituents which are subject to the requirements of this Code and for which no direct use is envisaged but which are carried for dumping, incineration or other methods of disposal other than at sea.

8.2.2 "Transboundary movement" means maritime transport of wastes from an area under the national jurisdiction of one country to or through an area under the national jurisdiction of another country, or to or through an area not under the national jurisdiction of any country, provided at least two countries are concerned by the movement.

8.3 Applicability

8.3.1 The requirements of this chapter are applicable to the transboundary movement of liquid chemical wastes in bulk by seagoing ships and should be considered in conjunction with all other requirements of this Code.

8.3.2 The requirements of this chapter do not apply to:

.1 wastes derived from shipboard operations which are covered by the requirements of MARPOL 73/78;

.2 liquid chemical wastes carried by ships engaged in the incineration of such wastes at sea which are covered by chapter 19 of the IBC Code; and

.3 substances, solutions or mixtures containing or contaminated with radioactive materials which are subject to the applicable requirements for radioactive materials.

8.4 Permitted shipments

8.4.1 Transboundary movement of wastes is permitted to commence only when:

.1 notification has been sent by the competent authority of the country of origin, or by the generator or exporter through the channel of the competent authority of the country of origin, to the country of final destination; and

.2 the competent authority of the country of origin, having received the written consent of the country of final destination stating that the wastes will be safely incinerated or treated by other methods of disposal, has given authorization for the movement.

8.5 Documentation

8.5.1 In addition to the documentation specified in 5.2 of this Code ships engaged in transboundary movement of liquid chemical wastes should carry on board a waste movement document issued by the competent authority of the country of origin.

8.6 Classification of liquid chemical wastes

8.6.1 For the purpose of the protection of the marine environment all liquid chemical wastes transported in bulk should be treated as category A noxious liquid substances, irrespective of the actual evaluated category.

8.7 Carriage and handling of liquid chemical wastes

8.7.1 Liquid chemical wastes should be carried in ships and cargo tanks in accordance with the minimum requirements for liquid chemical wastes specified in chapter 17 of the IBC Code, unless there are clear grounds indicating that the hazards of the wastes would warrant:

.1 carriage in accordance with the ship type 1 requirements; or

.2 any additional requirements of this Code applicable to the substance or, in case of a mixture, its constituent presenting the predominant hazard.

RESOLUTION MEPC.70(38)
adopted on 10 July 1996

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the function of the Committee conferred upon it by international conventions for the prevention and control of marine pollution,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the 1973 Convention (hereinafter referred to as the "1978 Protocol") which together specify the amendment procedure of the 1978 Protocol and confers upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

RECALLING ALSO resolution MEPC.20(22) by which it adopted the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code),

NOTING FURTHER resolution MEPC.69(38), by which the Committee adopted amendments to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code),

RECOGNIZING the need to bring the corresponding amendments into force on the date on which the amendments to the IBC Code enter into force,

HAVING CONSIDERED, at its thirty-eighth session, amendments to the BCH Code proposed and circulated in accordance with article 16(2)(a) of the MARPOL Convention,

1. ADOPTS, in accordance with article 16(2)(b) of the 1973 Convention, amendments to the BCH Code, the text of which is set out at Annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on 1 January 1998, unless prior to the date, not less than one-third of the Parties or the Parties, the combined merchant fleets of which constitute not less than fifty per cent of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objections to the amendments;

3. INVITES the Parties to note that in accordance with article 16(2)(g)(ii) of the 1973 Convention the amendments shall enter into force on 1 July 1998 in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1978 Protocol certified copies of the present resolution and the text of the amendments contained in the Annex; and

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1978 Protocol copies of the resolution and its Annex.

ANNEX

AMENDMENTS TO THE BCH CODE

1 New paragraph 4.18.4 is added to chapter IV as follows:

"4.18.4 In order to avoid elevated temperatures, this cargo should not be carried in deck tanks."

2 The cross reference between paragraphs 16.6 of the IBC Code and 4.18 of the BCH Code is replaced by the following:

IBC Code reference	BCH Code reference
16.6.1	4.18.1
16.6.2	4.18.2
16.6.3	4.18.3
16.6.4	4.18.4

RESOLUTION MEPC.80(43)

adopted on 1 July 1999

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the function of the Committee conferred upon it by international conventions for the prevention and control of marine pollution,

RECALLING ALSO resolution MEPC.20(22) by which it adopted the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code),

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol") which together specify the amendment procedure of the 1978 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78).

NOTING that the Maritime Safety Committee, at its seventieth session, considered and approved the proposed amendments to the BCH Code,

NOTING FURTHER resolution MEPC.79(43), by which the Committee adopted relevant amendments to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code),

RECOGNIZING the need to bring the amendments to the BCH Code into force on the date on which the relevant amendments to the IBC Code enter into force,

HAVING CONSIDERED the proposed amendments to the BCH Code circulated in accordance with article 16(2)(a) of the 1973 Convention,

1. ADOPTS, in accordance with artic le 16(2)(d) of the 1973 Convention, amendments to the BCH Code, the text of which is set out at Annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on 1 January 2002, unless prior to the date, not less than one-third of the Parties or the Parties, the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet, having communicated to the Organization their objections to the amendments;

3. INVITES the Parties to note that in accordance with article 16(2)(g)(ii) of the 1973 Convention the amendments shall enter into force on 1 July 2002 upon their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1978 Protocol certified copies of the present resolution and the text of the amendments contained in the Annex; and

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1978 Protocol copies of the resolution and its Annex.

AMENDMENTS TO THE BCH CODE

Chapter II Cargo containment

1 The following new paragraph 2.14.3 is added after the existing paragraph 2.14.2:

"2.14.3 The controlled tank venting systems as provided in paragraph 2.14.2 above should consist of a primary and a secondary means of allowing full flow relief of vapour to prevent over-pressure or under-pressure in the event of failure of one means. Alternatively, the secondary means may consist of pressure sensors fitted in each tank with a monitoring system in the ship's cargo control room or position from which cargo operations are normally carried out. Such monitoring equipment should also provide an alarm facility which is activated by detection of over-pressure or under-pressure conditions within a tank. Ships should comply with the requirements of this paragraph by the date of the first scheduled dry-docking after 1 July 2002, but not later than 1 July 2005. However, the Administration may approve relaxation of this paragraph for ships of less than 500 gross tonnage."

2 The existing paragraphs 2.14.3 and 2.14.4 are renumbered as paragraphs 2.14.4 and 2.14.5.

RESOLUTION MEPC.91(45)

adopted on 5 October 2000

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the function of the Committee conferred upon it by international conventions for the prevention and control of marine pollution,

RECALLING ALSO resolution MEPC.20(22) by which it adopted the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code),

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol") which together specify the amendment procedure of the 1978 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

NOTING that the Maritime Safety Committee, at its seventy-second session, considered and approved the proposed amendments to the BCH Code,

NOTING FURTHER resolution MEPC.90(45), by which the Committee adopted relevant amendments to the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code),

RECOGNIZING the need to bring the amendments to the BCH Code into force on the date on which the relevant amendments to the IBC Code enter into force,

HAVING CONSIDERED the proposed amendments to the BCH Code circulated in accordance with article 16(2)(a) of the 1973 Convention,

1. ADOPTS, in accordance with article 16(2)(d) of the 1973 Convention, amendments to the BCH Code, the text of which is set out at Annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on 1 January 2002, unless prior to the date, not less than one-third of the Parties or the Parties, the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet, having communicated to the Organization their objections to the amendments;

3. INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the amendments shall enter into force on 1 July 2002 upon their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1978 Protocol certified copies of the present resolution and the text of the amendments contained in the annex; and

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1978 Protocol copies of the resolution and its Annex.

ANNEX

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

CHAPTER II - CARGO CONTAINMENT

2.12 Cargo hoses carried aboard the ship

1 Existing section 2.12 is replaced by the following:

"**2.12 Ship's cargo hoses**

2.12.1 Paragraphs 2.12.2 to 2.12.4 apply to cargo hoses installed on board ships on or after 1 July 2002.

2.12.2 Liquid and vapour hoses used for cargo transfer should be compatible with the cargo carried and suitable for the cargo temperature.

2.12.3 Hoses subject to tank pressure or the discharge pressure of pumps should be designed for a bursting pressure not less than 5 times the maximum pressure the hose will be subject to during cargo transfer.

2.12.4 Each new type of cargo hose, complete with end-fittings, should be prototype-tested at a normal ambient temperature with 200 pressure cycles from zero to at least twice the specified maximum working pressure. After this cycle pressure test has been carried out, the prototype test should demonstrate a bursting pressure of at least 5 times its specified maximum working pressure at the extreme service temperature. Hoses used for prototype testing should not be used for cargo service. Thereafter, before being placed in service, each new length of cargo hose produced should be hydrostatically tested at ambient temperature to a pressure not less than 1.5 times its specified maximum working pressure but not more than two-fifths of its bursting pressure. The hose should be stencilled or otherwise marked with the date of testing, its specified maximum working pressure and, if used in services other than the ambient temperature services, its maximum and minimum service temperature, as applicable. The specified maximum working pressure should not be less than 10 bar gauge."

CHAPTER III - SAFETY EQUIPMENT AND RELATED CONSIDERATION

2 Existing paragraph 3.16.11 is replaced by the following:

"3.16.11 The ship should have on board medical first-aid equipment, including oxygen resuscitation equipment and antidotes for cargoes to be carried, based on the guidelines developed by the Organization."

CHAPTER IV - SPECIAL REQUIREMENTS

3 The existing text of section 4.1 is replaced by the following:

"4.1 Carbon disulphide

Carbon disulphide may be carried either under water pad or under suitable inert gas pad as specified in the following paragraphs.

Carriage under water pad

4.1.1 Provision should be made to maintain a water pad in the cargo tank during loading, unloading and transit. In addition, a suitable inert gas pad should be maintained in the ullage space during transit.

4.1.2 All openings should be in the top of the tank, above the deck.

4.1.3 Loading lines should terminate near the bottom of the tank.

4.1.4 A standard ullage opening should be provided for emergency sounding.

4.1.5 Cargo piping and vent lines should be independent of piping and vent lines used for other cargo.

4.1.6 Pumps may be used for discharging cargo, provided they are of the deepwell or hydraulically driven submersible types. The means of driving a deepwell pump should not present a source of ignition for carbon disulphide and should not employ equipment that may exceed a temperature of 80°C.

4.1.7 If a cargo discharge pump is used, it should be inserted through a cylindrical well extending from the tank top to a point near the tank bottom. A water pad should be formed in this well before attempting pump removal unless the tank has been certified as gas-free.

4.1.8 Water or inert gas displacement may be used for discharging cargo, provided the cargo system is designed for the expected pressure and temperature.

4.1.9 Safety relief valves should be of stainless steel construction.

4.1.10 Because of its low ignition temperature and close clearances required to arrest its flame propagation, only intrinsically safe systems and circuits should be permitted in the hazardous locations described in 10.2.3.

Carriage under suitable inert gas pad

4.1.11 Carbon disulphide should be carried in independent tanks with a design pressure of not less than 0.6 bar gauge.

4.1.12 All openings should be located on the top of the tank, above the deck.

4.1.13 Gaskets used in the containment system should be of a material which does not react with, or dissolve in, carbon disulphide.

4.1.14 Threaded joints should not be permitted in the cargo containment system, including the vapour lines.

4.1.15 Prior to loading, the tank(s) should be inerted with suitable inert gas until the oxygen level is 2% by volume or lower. Means should be provided to automatically maintain a positive pressure in the tank using suitable inert gas during loading, transport and discharge. The system should be able to maintain this positive pressure between 0.1 and 0.2 bar gauge, and should be remotely monitored and fitted with over/underpressure alarms.

4.1.16 Hold spaces surrounding an independent tank carrying carbon disulphide should be inerted by a suitable inert gas until the oxygen level is 2% or less. Means should be provided to monitor and maintain this condition throughout the voyage. Means should also be provided to sample these spaces for carbon disulphide vapour.

4.1.17 Carbon disulphide should be loaded, transported and discharged in such a manner that venting to the atmosphere does not occur. If carbon disulphide vapour is returned to shore during loading or to the ship during discharge, the vapour return system should be independent of all other containment systems.

4.1.18 Carbon disulphide should be discharged only by submerged deepwell pumps or by a suitable inert gas displacement. The submerged deepwell pumps should be operated in a way that prevents heat build-up in the pump. The pump should also be equipped with a temperature sensor in the pump housing with remote readout and alarm in the cargo control room. The alarm should be set at 80°C. The pump should also be fitted with an automatic shut-down device, if the tank pressure falls below atmospheric pressure during the discharge.

4.1.19 Air should not be allowed to enter the cargo tank, cargo pump or lines while carbon disulphide is contained in the system.

4.1.20 No other cargo handling, tank cleaning or deballasting should take place concurrent with loading or discharge of carbon disulphide.

4.1.21 A water spray system of sufficient capacity should be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling and the tank domes. The arrangement of piping and nozzles should be such as to give a uniform distribution rate of 10 $l/m^2/min$. Remote manual operation should be arranged such that remote starting of pumps supplying the water-spray system and remote operation of any normally closed valves in the system can be carried out from a suitable location outside the cargo area adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the areas protected. The water-spray system should be capable of both local and remote manual operation, and the arrangement should ensure that any spilled cargo is washed away. Additionally, a water hose with pressure to the nozzle when atmospheric temperature permits, should be connected ready for immediate use during loading and unloading operations.

4.1.22 No cargo tanks should be more than 98% liquid-full at the reference temperature (R).

4.1.23 The maximum volume (V_L) of cargo to be loaded in a tank should be:

$$V_L = 0.98\ V\ \frac{\rho_R}{\rho_L}$$

where:

V	=	volume of the tank
ρ_R	=	relative density of cargo at the reference temperature (R)
ρ_L	=	relative density of cargo at the loading temperature
R	=	reference temperature, i.e. the temperature at which the vapour pressure of the cargo corresponds to the set pressure of the pressure-relief valve.

4.1.24 The maximum allowable tank filling limits for each cargo tank should be indicated for each loading temperature which may be applied, and for the applicable maximum reference temperature, on a list approved by the Administration. A copy of the list should be permanently kept on board by the master.

4.1.25 Zones on open deck, or semi-enclosed spaces on open deck within three metres of a tank outlet, gas or vapour outlet, cargo pipe flange or cargo valve of a tank certified to carry carbon disulphide, should comply with the electrical equipment requirements specified for carbon disulphide in column "i", chapter 17. Also, within the specified zone, no other heat sources, like steam piping with surface temperatures in excess of 80°C should be allowed.

4.1.26 Means should be provided to ullage and sample the cargo without opening the tank or disturbing the positive suitable inert gas blanket.

4.1.27 The product should be transported only in accordance with a cargo handling plan that has been approved by the Administration. Cargo handling plans should show the entire cargo piping system. A copy of the approved cargo-handling plan should be available on board. The Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk should be endorsed to include reference to the approved cargo handling plan."

CHAPTER V - OPERATIONAL REQUIREMENTS

4 Existing paragraph 5.3.3 is replaced by the following:

"5.3.3 Officers should be trained in emergency procedures to deal with conditions of leakage, spillage or fire involving the cargo, based on the guidelines developed by the Organization, and a sufficient number of them should be instructed and trained in essential first aid for cargoes carried."

RESOLUTION MEPC.144(54)
(adopted on 24 March 2006)

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution,

RECALLING ALSO resolution MEPC.20(22) by which the Committee adopted the Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code),

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol") which together specify the amendment procedure of the 1978 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL 73/78),

CONSIDERING that it is highly desirable for the provisions of the BCH Code which are mandatory under MARPOL 73/78 and recommendatory from a safety standpoint, to remain identical, when adopted by the Marine Environment Protection Committee and the Maritime Safety Committee,

HAVING CONSIDERED the proposed amendments to the BCH Code,

1. ADOPTS, in accordance with article 16(2)(b), (c) and (d) of the 1973 Convention, the amendments to the BCH Code, the text of which is set out at the Annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments to the BCH Code shall be deemed to have been accepted on 1 February 2007 unless, prior to that date, not less than one-third of the Parties or Parties, the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objection to the amendments;

3. INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the amendments to the BCH Code shall enter into force on 1 August 2007 upon their acceptance in accordance with paragraph 2 above;

4. INVITES ALSO the Maritime Safety Committee to note this resolution and take action as appropriate;

5. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to MARPOL 73/78 certified copies of the present resolution and the text of the amendments to the BCH Code contained in the Annex; and

6. REQUESTS FURTHER the Secretary-General to transmit copies of the present resolution and its Annex to the Members of the Organization which are not Parties to MARPOL 73/78.

ANNEX

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

The BCH Code is amended as follows:

Preamble

1 The following new paragraph is added:

> "7 The Code has been revised to reflect the 2007 revision of MARPOL Annex II"

CHAPTER I
General

1.1 Purpose

2 In the second sentence, the words "as defined in regulation 1(1) of Annex II thereof" are deleted and the references to (Pollution Category) "A, B or C" are replaced by "X, Y or Z".

1.4 Definitions

3 Paragraph 1.4.16A is replaced by the following:

> "1.4.16A *Noxious Liquid Substance* means any substance indicated in the Pollution Category column of chapter 17 or 18 of the International Bulk Chemical Code, or the current MEPC.2/Circular or provisionally assessed under the provisions of regulation 6.3 of the amendments to the Annex of the Protocol of 1978 relative to the International Convention for the Prevention of Pollution from Ships, 1973, as falling into Category X, Y or Z."

4 In paragraph 1.4.16B the existing text is deleted and the word "Deleted" is inserted.

5 The paragraph number of the definition of "anniversary date" which was adopted as "1.4.16C" by resolution MEPC.41(29) is amended to read "1.4.16D".

1.7 Effective date

6 In the second sentence of paragraph 1.7.2, the reference to "regulation 1(12)" is replaced by "regulation 1.17".

1.8 New products

7 In the first sentence of paragraph 1.8, the reference to (Pollution Category) "A, B or C" is replaced by "X, Y or Z".

CHAPTER II
Cargo Containment

G – MATERIALS OF CONSTRUCTION

2.17 General

8 The existing text is replaced by the following:

"2.17.1 Structural materials used for tank construction, together with associated piping, pumps, valves, vents and their jointing materials, should be suitable at the temperature and pressure for the cargo to be carried in accordance with recognized standards. Steel is assumed to be the normal material of construction.

2.17.2 Where applicable, the following should be taken into account in selecting the material of construction:

.1 notch ductility at the operating temperature;

.2 corrosive effect of the cargo; and

.3 possibility of hazardous reactions between the cargo and the material of construction.

2.17.3 The shipper of the cargo is responsible for providing compatibility information to the ship operator and/or master. This must be done in a timely manner before transportation of the product. The cargo shall be compatible with all materials of construction such that:

.1 no damage to the integrity of the materials of construction is incurred; and

.2 no hazardous, or potentially hazardous reaction is created.

2.17.4 When a product is submitted to IMO for evaluation, and where compatibility of the product with materials referred to in paragraph 2.17 renders special requirements, the GESAMP/EHS Product Data Reporting Form shall provide information on the required materials of construction. These requirements shall be reflected in chapter IV and consequentially be referred to in *column o* of chapter 17 of the IBC Code. The reporting form shall also indicate if no special requirements are necessary. The producer of the product is responsible for providing the correct information."

2.18 Additional requirements

9 In paragraph 2.18, the existing text is deleted and the word "Deleted" is inserted.

CHAPTER III

Safety equipment and related considerations

E – FIRE PROTECTION

10 After the heading, the following words are inserted:

"(SOLAS regulations referred to in Part E mean, unless expressly provided otherwise, regulations in chapter II-2 of the International Convention for the Safety of Life at Sea, 1974 and its relevant amendments adopted before by resolution MSC.99(73))."

3.13 Fire safety arrangements

11 In paragraph 3.13.3, the existing text is deleted and the word "Deleted" is inserted.

12 The following new paragraph 3.13.5 is added:

"3.13.5 The following requirements in SOLAS chapter II-2, as adopted by MSC.99(73), should apply:

(a) regulations II-2/4.5.10.1.1 and 4.5.10.1.4 and a system for continuous monitoring of the concentration of flammable vapours shall be fitted on ships of 500 tons gross tonnage and over by the date of the first scheduled dry-docking after [the date of entry into force of the amendment], but not later than [3 years after the date of entry into force of the amendment]. Sampling points or detector heads should be located in suitable positions in order that potentially dangerous leakages are readily detected. When the flammable vapour concentration reaches a pre-set level which shall not be higher than 10% of the lower flammable limit, a continuous audible and visual alarm signal shall be automatically effected in the pump-room and cargo control room to alert personnel to the potential hazard. However, existing monitoring systems already fitted having a pre-set level not greater than 30% of the lower flammable limit may be accepted. Notwithstanding the above provisions, the Administration may exempt ships not engaged on international voyages from those requirements;

(b) regulations 13.3.4.2 to 13.3.4.5 and 13.4.3 should apply to ships of 500 tons gross tonnage and over;

(c) regulations in Part E of chapter II-2 of SOLAS Convention except regulations 16.3.2.2 and 16.3.2.3 thereof, should apply to ships, regardless of their sizes;

(d) where deep-fat cooking equipment is newly installed, regulation 10.6.4 should apply; and

(e) fire-extinguishing systems using Halon 1211, 1301, and 2402 and perfluorocarbons should not be newly installed as prohibited by regulation 10.4.1.3.".

F – PERSONAL PROTECTION

13 After the heading, the following words are inserted:

"(SOLAS regulations referred to in Part F mean, unless expressly provided otherwise, regulations in chapter II-2 of the International Convention for the Safety of Life at Sea, 1974 and its relevant amendments adopted before by resolution MSC.99(73))".

CHAPTER IV
Special requirements

4.12 Materials of construction

14 In paragraph 4.12, the existing text is deleted and the word "Deleted" is inserted.

4.15 Cargo contamination

15 In paragraph 4.15.1, the existing text is deleted and the word "Deleted" is inserted.

CHAPTER V
Operational requirements

5.2 Cargo information

16 In paragraph 5.2.5, the viscosity figure "25 mPa", which appears twice, is replaced with "50 mPa".

17 In paragraph 5.2.6, the existing text is deleted and the word "Deleted" is inserted.

18 In paragraph 5.2.7, the existing text is deleted and the word "Deleted" is inserted.

CHAPTER VA
Additional measures for the protection of the marine environment

19 The existing text is deleted and the word "Deleted" is inserted.

CHAPTER VI
Summary of minimum requirements

20 The IBC/BCH cross-references to the requirements under Materials of construction (column *m*) and the following cross-references under special requirements (column *o*) are deleted:

“IBC Code reference	BCH Code reference
15.16.1	4.15.1
16.2.7	5.2.6
16.2.8	5.2.7
16A.2.2	5A.2.2”

CHAPTER VIII
Transport of liquid chemical wastes

21 In paragraph 8.3.2.2 reference to “chapter 19” of the IBC Code is replaced by “chapter 20”.

APPENDIX

Model form of Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk

22 The existing form is replaced by the following:

"MODEL FORM OF CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

(*Official seal*)

Issued under the provisions of the

CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK
(resolutions MSC.9(53) and MEPC.20(22), as amended)

under the authority of the Government of

....

(*full official designation of country*)

by...

(*full designation of the competent person or organization recognized by the Administration*)

Particulars of ship[1]

Name of ship ....
Distinctive number or letters ....
Port of registry ....
Gross tonnage ....
Ship Type (Code paragraph 2.2.4) ....
IMO Number[2] ....

Date on which keel was laid or on which the ship was at a similar stage of construction or (in the case of a converted ship) date on which conversion to chemical tanker was commenced ....

The ship also complies fully with the following amendments to the Code:

....

....

[1] Alternatively, the particulars of the ship may be placed horizontally in boxes.

[2] In accordance with IMO ship identification number scheme adopted by the Organization by resolution A.600(15).

The ship is exempted from compliance with the following provisions of the Code:

....

....

THIS IS TO CERTIFY:

1 That the ship has been surveyed in accordance with the provisions of section 1.6 of the Code;

2 That the survey showed that the construction and equipment of the ship and the condition thereof are in all respects satisfactory and that the ship:

.1 complies with the relevant provisions of the Code applicable to ships referred to in 1.7.2;

.2 complies with the relevant provisions of the Code applicable to ships referred to in 1.7.3;

3 That the ship has been provided with a manual in accordance with Appendix 4 of MARPOL Annex II as called for by regulation 14 of the Annex, and that the arrangements and equipment of the ship prescribed in the Manual are in all respects satisfactory;

4 That the ship meets the requirements for the carriage in bulk of the following products, provided that all relevant operational provisions of the Code and MARPOL Annex II are observed:

Product	Conditions of carriage (tank numbers, etc.)	Pollution Category
Continued on attachment 1, additional signed and dated sheets[3] Tank numbers referred to in this list are identified on attachment 2, signed and dated tank plan.		

5 That, in accordance with 1.7.3/2.2.5[3], the provisions of the Code are modified in respect of the ship in the following manner:

....

6 That the ship must be loaded:

.1 in accordance with the loading conditions provided in the approved loading manual, stamped and dated .... and signed by a responsible officer of the Administration, or of an organization recognized by the Administration[3];

[3] Delete as appropriate.

.2 in accordance with the loading limitations appended to this Certificate[3].

Where it is required to load the ship other than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions should be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition[4].

This Certificate is valid until ....[5] subject to surveys in accordance with 1.6 of the Code.

Completion date of the survey on which this certificate is based: ....
(dd/mm/yyyy)

Issued at ....
(Place of issue of certificate)

.... *(Date of issue)*

.... *(Signature of authorized official issuing the certificate)*

(Seal or stamp of the authority, as appropriate)

Notes on completion of Certificate:

1 The Certificate can be issued only to ships entitled to fly the flags of States which are a Party to MARPOL 73/78.

2 Ship Type: Any entry under this column must relate to all relevant recommendations, e.g., an entry "Type 2" should mean Type 2 in all respects prescribed by the Code. This column would not usually apply in the cases of an existing ship and in such a case should be noted "see paragraph 2.2".

3 Products: Products listed in chapter 17 of the Code, or which have been evaluated by the Administration in accordance with 1.8 of the Code, should be listed. In respect of the latter "new" products, any special requirements provisionally prescribed should be noted.

4 Products: The list of products the ship is suitable to carry should include the noxious liquid substances of Category Z which are not covered by the Code and should be identified as "chapter 18 Category Z".

5 *deleted.*

---

[3] Delete as appropriate.

[4] Instead of being incorporated in the Certificate, this text may be appended to the Certificate if signed and stamped.

[5] Insert the date of expiry as specified by the Administration in accordance with 1.6.6.1 of the Code. The day and the month of this day correspond to the anniversary date as defined in 1.4.16D of the Code, unless amended in accordance with 1.6.6.8 of the Code.

6 Conditions of carriage: If a Certificate is issued to a ship which is modified in accordance with the provision of regulation 1(12) of MARPOL Annex II the Certificate should indicate in the top of the table of products and conditions of carriage the following statement: "This ship is certificated to carry only pollution hazard chemicals".

ENDORSEMENT FOR ANNUAL AND INTERMEDIATE SURVEYS

THIS IS TO CERTIFY that at a survey required by 1.6.2 of the Code the ship was found to comply with the relevant provisions of the Code.

Annual survey: Signed ....
(*Signature of duly authorized official*)
Place ....
Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

Annual/Intermediate[3] survey: Signed ....
(*Signature of duly authorized official*)
Place ....
Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

Annual/Intermediate[3] survey: Signed ....
(*Signature of duly authorized official*)
Place ....
Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

Annual survey: Signed ....
(*Signature of duly authorized official*)
Place ....
Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

[3] Delete as appropriate.

ANNUAL/INTERMEDIATE SURVEY IN ACCORDANCE WITH PARAGRAPH 1.6.6.8.3

THIS IS TO CERTIFY that, at an annual/intermediate[3] survey in accordance with paragraph 1.6.6.8.3 of the Code, the ship was found to comply with the relevant provisions of the Convention:

Signed ....
(Signature of duly authorized official)

Place ....

Date *(dd/mm/yyyy)* ....

(Seal or stamp of the Authority, as appropriate)

ENDORSEMENT TO EXTEND THE CERTIFICATE IF VALID FOR LESS THAN 5 YEARS WHERE PARAGRAPH 1.6.6.3 APPLIES

The ship complies with the relevant provisions of the Convention, and this Certificate shall, in accordance with paragraph 1.6.6.3 of the Code, be accepted as valid until ....

Signed ....
(Signature of duly authorized official)

Place ....

Date *(dd/mm/yyyy)* ....

(Seal or stamp of the Authority, as appropriate)

ENDORSEMENT WHERE THE RENEWAL SURVEY HAS BEEN COMPLETED AND PARAGRAPH 1.6.6.4 APPLIES

The ship complies with the relevant provisions of the Convention, and this Certificate shall, in accordance with paragraph 1.6.6.4 of the Code, be accepted as valid until ....

Annual survey:

Signed ....
(Signature of duly authorized official)

Place ....

Date *(dd/mm/yyyy)* ....

(Seal or stamp of the Authority, as appropriate)

---

[3] Delete as appropriate.

ENDORSEMENT TO EXTEND THE VALIDITY OF THE CERTIFICATE UNTIL REACHING THE PORT OF SURVEY OR FOR A PERIOD OF GRACE WHERE PARAGRAPH 1.6.6.5 OR 1.6.6.6 APPLIES

This Certificate shall, in accordance with paragraph 1.6.6.5/1.6.6.6[3] of the Code, be accepted as valid until ....

Signed ....
(*Signature of duly authorized official*)

Place ....

Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

ENDORSEMENT FOR ADVANCEMENT OF ANNIVERSARY DATE WHERE PARAGRAPH 1.6.6.8 APPLIES

In accordance with paragraph 1.6.6.8 of the Code, the new anniversary date is ....

Signed ....
(*Signature of duly authorized official*)

Place ....

Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

In accordance with paragraph 1.6.6.8, the new anniversary date is ....

Signed ....
(*Signature of duly authorized official*)

Place ....

Date (*dd/mm/yyyy*) ....

(*Seal or stamp of the Authority, as appropriate*)

[3] Delete as appropriate.

ATTACHMENT 1
TO THE
CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

Continued list of products to those specified in section 3, and their conditions of carriage.

Products	Conditions of carriage (tank numbers, etc.)	Pollution Category

Date ....

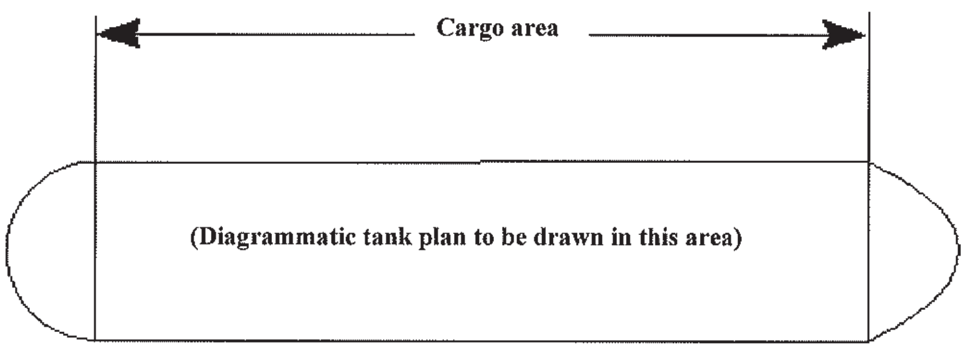
(*as for Certificate*) (*Signature of official issuing the Certificate and/or seal of issuing authority*)

ATTACHMENT 2
TO THE
CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK

TANK PLAN (specimen)

Name of ship: ....

Distinctive number or letters: ....



Date ....
(*as for Certificate*)

....
(*Signature of official issuing the Certificate and/or seal of issuing authority*)”

第MEPC.249（66）號決議

2014年4月4日通過

《散裝運輸危險化學品船舶構造與設備規則》（《散化規則》）修正案

（貨物圍護系統和適裝證書格式）

海上環境保護委員會，

憶及《國際海事組織公約》第三十八條第（一）款關於防止和控制船舶造成海洋污染的國際公約賦予海上環境保護委員會（本委員會）的職能，

還憶及本委員會以第MEPC.20（22）號決議通過的《散裝運輸危險化學品船舶構造與設備規則》（《散化規則》），

注意到《1973年國際防止船舶造成污染公約》（以下稱《1973年公約》)第16條和《1973年國際防止船舶造成污染公約1978年議定書》（以下稱《1978年議定書》）第VI條共同規定了《1978年議定書》的修正程序並賦予本組織的相關機構審議和通過《經1978年議定書修訂的1973年公約》（《防污公約》）修正案的職能，

考慮到根據《防污公約》具有強制性而在安全角度上具有建議性的《散化規則》，在海上環境保護委員會和海上安全委員會通過時需保持高度一致，

審議了穩性、載重線和漁船安全分委會在其第55次會議上制定的《散化規則》建議修正案，

1. 按照《1973年公約》第16（2）（b）、（c）和（d）條，**通過**《散化規則》修正案，其文本載於本決議附件；

2. 按照《1973年公約》第16（2）（f）（iii）條，**決定**該《散化規則》修正案將在2015年7月1日視為被接受，除非在此日期之前，有不少於三分之一的締約國或其合計商船隊佔世界商船隊總噸位不少於50%的締約國通知本組織其反對該修正案；

3. **請**各締約國注意，按照《1973年公約》第16（2）（g）（ii）條，該《散化規則》修正案在按上述第2段被接受後，將於2016年1月1日生效；

4. **還請**海上安全委員會注意本決議並酌情採取行動；

5. **要求**秘書長遵照《1973年公約》第16（2）（e）條，將本決議及其附件中《散化規則》修正案文本的核證無誤副本分發給所有《防污公約》締約國；

6. **進一步要求**秘書長將本決議及其附件的副本分發給非《防污公約》締約國的本組織會員國。

附件

《散裝運輸危險化學品船舶構造與設備規則》

（《散化規則》）修正案

第II章－貨物圍護系統

A部分－物理保護（液貨艙的位置；船舶穩性）

1 現有第2.2.1項由以下文字替代：

“2.2.1 通則：受本規則約束的船舶可按《1966年國際載重線公約》核定最小乾舷。但是，第2.2.4項的附加要求，考慮到任何液艙為空艙或部分裝載以及擬載運貨物的比重，應適用於任何實際裝載工況的許用營運吃水。

2.2.1.1 所有從事散裝化學品運輸的船舶均應備有裝載和穩性手冊，供船長獲得資料和指導。手冊應包含以下細節：液艙為滿艙和空艙或部分裝載的裝載工況，船上液艙的位置，載運的各零擔貨物的比重，以及關鍵裝載工況的任何壓載佈置。手冊應包含評估其他裝載工況的規定。

2.2.1.2 所有受本規則約束的船舶須在2016年1月1日或以後但不遲於2021年1月1日的初次計劃換證檢驗時，配備能進行完整和破損穩性要求的符合性驗證的、經主管機關參照本組織建議的性能標準認可的穩性儀：

.1 儘管有上述要求，對於2016年1月1日以前建造的船舶上配備的穩性儀，如能進行完整和破損穩性的符合性驗證並令主管機關滿意，則不必替換；和

.2 就根據《防污公約》附則II第16條的監督而言，主管機關應簽發一份穩性儀的認可文件。

2.2.1.3 主管機關可對下列船舶免除第2.2.1.2目的要求，但用於完整和破損穩性驗證的程序維持的安全程度應與按經批准工況進行裝載的安全程度相同。任何此類免除應在第1.6.3項所述的適裝證書上予以適當註明：

.1 從事專門業務的船舶，若其裝載改變量有限，以至於所有預計的裝載工況已在按照第2.2.1.1目提供給船長的穩性資料中經過批准；

.2 用主管機關認可的方法進行遠程穩性驗證的船舶；

.3 在批准的裝載工況範圍內裝載的船舶；或

.4 具有涵蓋一切適用的完整和破損穩性要求的經批准的限制性KG/GM曲線的船舶。

適裝證書

2 第6段由下列文字替代：

“6 船舶必須：

.1* 僅按照被驗證為符合完整和破損穩性要求的裝載工況進行裝載，該驗證須使用按照本規則第2.2.1.2目配備

的經認可的穩性儀；

.2* 如給予本規則第2.2.1.3目允許的免除並且未配備本規則第2.2.1.2目要求的經認可的穩性儀，須按照以下一種或多種經認可方法進行裝載：

(i) 按照經認可的裝載手冊所述的裝載工況，蓋章並註明日期……………….並由主管機關的負責人或主管機關認可的組織的負責人簽字；或

(ii) 按照使用經認可的方法………………..遠程驗證的裝載工況；或

(iii) 按照上述（i）提及的經認可的裝載手冊中界定的經批准工況範圍內的裝載工況；或

(iv) 按照使用上述（i）提及的經認可的裝載手冊所界定的經批准的臨界KG/GM數據所驗證的裝載工況；

.3* 按照本證書所附的裝載限制。

如要求不按照上述指導裝載船舶，則須將能證明提議的裝載工況合理性的必要計算資料提交發證主管機關，主管機關可書面授權採用所提議的裝載工況。

---

* 酌情刪去。”

RESOLUTION MEPC.249(66)

(Adopted on 4 April 2014)

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

(Cargo containment and Form of Certificate of Fitness)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution from ships,

RECALLING ALSO resolution MEPC.20(22) by which the Committee adopted the *Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code)*,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention") and article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol") which together specify the amendment procedure of the 1978 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 Protocol (MARPOL),

CONSIDERING that it is highly desirable for the provisions of the BCH Code which are mandatory under MARPOL and recommendatory from a safety standpoint, to remain identical, when adopted by the Marine Environment Protection Committee and the Maritime Safety Committee,

HAVING CONSIDERED proposed amendments to the BCH Code, developed by the Sub-Committee on Stability and Load Lines and on Fishing Vessels Safety, at its fifty-fifth session,

1 ADOPTS, in accordance with article 16(2)(b), (c) and (d) of the 1973 Convention, amendments to the BCH Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments to the BCH Code shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, not less than one third of the Parties or Parties, the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objection to the amendments;

3 INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the amendments to the BCH Code shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 INVITES ALSO the Maritime Safety Committee to note this resolution and take action as appropriate;

5 REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to MARPOL, certified copies of the present resolution and the text of the amendments to the BCH Code contained in the annex;

6 REQUESTS FURTHER the Secretary-General to transmit copies of the present resolution and its annex to the Members of the Organization which are not Parties to MARPOL.

ANNEX

AMENDMENTS TO THE CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING DANGEROUS CHEMICALS IN BULK (BCH CODE)

Chapter II – Cargo containment

Part A – Physical protection (Siting of cargo tanks; ship stability)

1 Existing subparagraph 2.2.1 is replaced by the following:

"2.2.1 General: Ships subject to this Code may be assigned the minimum freeboard permitted by the International Convention on Load Lines, 1966. The additional requirements in paragraph 2.2.4, taking into account any empty or partially filled tank as well as the specific gravities of cargoes to be carried, however, should govern the allowed operating draught for any actual condition of loading.

2.2.1.1 All ships engaged in the transport of chemicals in bulk should be supplied with loading and stability manuals for the information and guidance of the master. These manuals should contain details concerning the loaded conditions of full and empty or partially empty tanks, the position of these tanks in the ship, the specific gravities of the various parcels of cargoes carried, and any ballast arrangements in critical conditions of loading. Provisions for evaluating other conditions of loading should be contained in the manuals.

2.2.1.2 All ships subject to the Code shall be fitted with a stability instrument capable of verifying compliance with intact and damage stability requirements approved by the Administration at the first scheduled renewal survey of the ship, on or after 1 January 2016, but not later than 1 January 2021, having regard to the performance standards recommended by the Organization:

.1 notwithstanding the above, a stability instrument fitted on a ship constructed before 1 January 2016 need not be replaced provided it is capable of verifying compliance with intact and damage stability, to the satisfaction of the Administration; and

.2 for the purposes of control under regulation 16 of MARPOL Annex II, the Administration shall issue a document of approval for the stability instrument.

2.2.1.3 The Administration may waive the requirements of paragraph 2.2.1.2 for the following ships provided the procedures employed for intact and damage stability verification maintain the same degree of safety as being loaded in accordance with the approved conditions. Any such waiver shall be duly noted on the Certificate of Fitness referred to in paragraph 1.6.3:

.1 ships which are on a dedicated service, with a limited number of permutations of loading such that all anticipated conditions have been approved in the stability information provided to the master in accordance with the requirements of paragraph 2.2.1.1;

.2 ships where stability verification is made remotely by a means approved by the Administration;

.3 ships which are loaded within an approved range of loading conditions; or

.4 ships provided with approved limiting KG/GM curves covering all applicable intact and damage stability requirements.

Certificate of Fitness

2 Paragraph 6 is replaced with the following:

"6 That the ship must be loaded:

.1*** only in accordance with loading conditions verified compliant with intact and damage stability requirements using the approved stability instrument fitted in accordance with paragraph 2.2.1.2 of the Code;

.2*** where a waiver permitted by paragraph 2.2.1.3 of the Code is granted and the approved stability instrument required by paragraph 2.2.1.2 of the Code is not fitted, loading shall be made in accordance with one or more of the following approved methods:

(i) in accordance with the loading conditions provided in the approved loading manual, stamped and dated .... and signed by a responsible officer of the Administration, or of an organization recognized by the Administration; or

(ii) in accordance with loading conditions verified remotely using an approved means ....; or

(iii) in accordance with a loading condition which lies within an approved range of conditions defined in the approved loading manual referred to in (i) above; or

(iv) in accordance with a loading condition verified using approved critical KG/GM data defined in the approved loading manual referred to in (i) above;

.3*** in accordance with the loading limitations appended to this Certificate.

Where it is required to load the ship other than in accordance with the above instruction, then the necessary calculations to justify the proposed loading conditions shall be communicated to the certifying Administration who may authorize in writing the adoption of the proposed loading condition.

*** Delete as appropriate."

散裝運輸危險化學品船舶構造和設備規則

目錄

2.3 安裝

2.4 設計和建造

2.5 對各種物質的要求

C－船舶佈置

2.6 貨物分隔

2.7 起居處所

2.8 貨泵艙

2.9 進入液貨區域內空艙、液貨艙和其他處所的通道

D－貨物駁運

2.10 管路佈置

2.11 貨物駁運控制系統

2.12 船用貨物軟管

E－液艙透氣系統

2.13 一般要求

2.14 液艙透氣系統的類型

F－貨物溫度控制

2.15 一般要求

2.16 附加要求

G－構造材料

2.17 一般要求

2.18 附加要求

H－對液艙內的蒸氣空間以及液艙周圍的留空處所的環境控制

2.19 一般要求

2.20 對各種貨品的環境控制要求

2.21 壓載艙佈置

2.22 液貨區內處所的艙底水泵設置

2.23 泵和管路的識別

第 III 章 安全設備和相關措施

A－貨物裝卸處所的通風

3.1 裝卸貨作業期間經常進入的處所

3.2 不經常進入的處所

B－易燃貨物的電氣要求

3.3 一般要求

3.4 含有液貨艙或管路的處所的電器裝置

3.5 緊鄰液貨區域前部、後部或上部的圍閉處所內的電氣裝置

3.6 開敞甲板上的電氣裝置

3.7 連接

3.8 對各種貨品的電氣要求

C－測量

3.9 一般要求

3.10 對各種貨品的測量

D－蒸氣探測

3.11 一般要求

3.12 對各種貨品的要求

E－消防

3.13 消防安全佈置

3.14 液貨艙區域的消防佈置

3.15 對 1980 年 5 月 20 日以前建造的船舶的防火保護

F－人員保護

3.16 要求

G－液艙充注

3.17 一般要求

第 IV 章 特殊要求

4.1 二硫化碳

4.2 二乙醚

4.3 硫（熔融的）

4.4　丙酮氰醇及乳腈溶液（80%或低於 80%）

4.5　磷（黃磷或白磷）

4.6　內燃機燃油（含有烷基鉛）的防爆化合物

4.7　環氧丙烷及環氧乙烷/環氧丙烷混合物，而環氧乙烷的含量不超過 30%（按重量）

4.8　酸類

4.9　有毒貨品

4.10　由添加劑保護的貨物

4.11　在 37.8°C 時蒸氣壓力超過 1.033 kPa/cm^2 的貨物

4.12　構造材料

4.13　貨泵艙

4.14　溢流控制

4.15　貨物圍護系統

4.16　化學品貨物的樣品

4.17　呼吸防毒面具和眼睛防護設備

4.18　不得暴露於過熱狀態下的貨物

4.19　93%或以下的硝酸銨溶液

4.20　過氧化氫溶液

4.21　50%或 50%以下的氯酸鈉溶液

4.22 硝酸辛酯，所有異構物

4.23 溫度傳感器

第 V 章 操作要求

5.1 每個液貨艙的最大允許裝貨量

5.2 貨物資料

5.3 人員培訓

5.4 進入液貨艙

5.5 液貨艙的開口

5.6 貨艙的加熱盤管

5.7 附加操作要求

第 VA 章 保護海洋環境的附加措施

第 VI 章 最低要求一覽表

第 VII 章 不適用本規則的化學品清單

第 VIII 章 液體化學品廢棄物的運輸

8.1 前言

8.2 定義

8.3 適用範圍

8.4 允許的運輸

8.5 文件

8.6 液體化學品廢棄物的分類

8.7 液體化學品廢棄物的載運和裝卸

前言

1 《散裝運輸危險化學品船舶構造和設備規則》(BCH 規則)的目的是為安全散裝運輸危險及有毒化學品提供一個國際標準。在考慮到有關貨品性質的情況下，通過規定了此類運輸船舶(不論噸位大小)的建造標準，及其船上應配備的設備，以便使其對船舶、船員及環境所造成的危險減至最少。

2 本規則的基本原則是根據每艘化學品船所載貨物的危險程度指定其船型。每一該類貨品可具有一個或多個危險特性，包括易燃性、毒性和反應性及其意外釋放可能對環境造成的危險。

3 在制定本規則的整個過程中，人們認識到必須以完善的造船學和工程學原理、以及對本規則所列的各種貨品的危險性有徹底的了解作為基礎；且進一步認識到化學品船的設計不僅是一門複雜的技術，而且還在快速發展，所以本規則也不應保持不變。因此，國際海事組織(IMO)要考慮到經驗和技術的進一步發展，定期對本規則進行評審。

4 本規則的修正案中對新貨品及其載運條件的要求，在國際海事組織海上安全委員會(MSC)及海上環境保護委員會(MEPC)通過後，將分別根據 1974 年國際海上人命安全公約(SOLAS 74)第 VIII 條規定及 1973 年國際防止船舶造成污染公約(MARPOL 73/78)的第 16 條規定，在這些修正案生效之前，暫作建議案予以散發。

5 本規則的主要內容是船舶設計和設備。為了確保能安全運輸這些貨品，必須對整個系統作出評估。安全運輸這些貨品的其他重要

方面，如培訓、操作、交通控制和港口裝卸等事項，正由或將由國際海事組織進行進一步的考核。

6 本規則第 VI 章涉及化學品船的操作要求突出了其他章節中的適用條文，並提到了化學品船安全操作的其他重要方面。本規則對所述貨品的最低要求的一覽表見《國際散裝運輸危險化學品船舶構造和設備規則》（IBC Code）的第 17 章。IBC 和 BCH 規則的對照參考見本出版物的第 VI 章。

7 根據 MARPOL 附則 II 的 2007 年修訂版，本規則已進行了修訂。

第 I 章 總則

1.1 目的

本規則的目的，是對散裝運輸危險和有毒化學物質的船舶推薦適合的設計標準、構造標準及其他安全措施，借以減少對船舶、船員及環境造成的危險。按照 MARPOL 73/78，本規則僅適用於載運 X、Y 或 Z 類有毒液體物質的化學品船。且在《國際散裝運輸危險化學品船舶構造和設備規則》(IBC Code)第 17 章 C 欄中以 X、Y 或 Z 為標記。

1.2 適用範圍

1.2.1 貨品：本規則適用於除石油或類似的易燃貨品以外的危險和有毒的散裝化學品物質，貨品範圍如下：

（a）具有重大火災危險性的貨品，其危險程度超過石油貨品和類似的易燃貨品；

（b）除有易燃性外，還有其他重大危險性的貨品，或雖然沒有易燃性但有其他重大危險性的貨品；

（c）如意外釋放，存在對環境有危害的貨品。

目前，本規則對液體貨品的限制，見 IBC 規則第 17 章最低要求一覽表。經審查並確定其安全及污染危險的危害程度沒有達到需要實施本規則的貨品，見 IBC 規則第 18 章。

1.2.2 船舶：本規則僅限於對液貨船。

1.3 危險性

1.3.1 關於化學品和其他物質對人類生命造成的危害，本規則考慮如下：

（a）由化學品的閃點、沸點、爆炸極限和自燃溫度所確定的火災危險性。

（b）由下述情況確定的健康危險性：

（i）在乳化或具備蒸氣壓力的蒸氣狀態下，對皮膚產生刺激或有毒，或對眼、鼻、喉和肺的黏膜產生刺激或有毒；或

（ii）在液體狀態下對皮膚有刺激作用；或

（iii）經由皮膚吸收具有毒性，並應考慮致死濃度 LC50，口服致死濃度 LD50 和皮膚致死濃度 LD50 的數值。

（c）水污染危險性由對人的毒害、水溶性、揮發性、氣味或味覺、及比重來確定。

（d）空氣污染危險性由如下情況確定：

（i）緊急情況暴露限度（EEL）或致死濃度 LC50；

（ii）蒸氣壓力；

（iii）水溶性；

（iv）液態時的比重；

（v）蒸氣狀態時的相對密度。

（e）由與下列物質的反應性確定的反應危險性：

（i）其他化學品，或

（ii）水，或

（iii）化學品本身（包括聚合性）。

1.3.2 關於化學品和其他物質對海洋環境造成的危害，本規則考慮如下：

（a）對水生生物或人類健康產生危害或造成海洋食品腐壞的生物積聚；

（b）對生物資源的破壞；

（c）對人類健康的危害；和

（d）環境舒適程度的下降。

1.4 定義

1.4.1 本規則中的液體係指當溫度為 37.8°C 時，其蒸氣壓力不超過 2.8 kp/cm^2 的液體。

1.4.2 蒸氣壓力係指，液體上面的飽和蒸氣在規定溫度時，用 kp/cm^2 或毫米高汞柱（mmHg）表示的平衡壓力。

1.4.3 閃點係指貨品釋放的易燃蒸氣足以被點燃時的攝氏溫度。本規則列出“開杯”和“閉杯”兩個數值，指明兩種不同的測試裝置。

1.4.4 沸點係指液體的蒸氣壓力等於大氣壓力時的溫度。

1.4.5 爆炸範圍係指氣體或蒸氣濃度（在空氣中的體積百分比）達到出現點火源就會燃燒或爆炸的範圍。

1.4.6 比重係指某一物質的某一體積的重量，與同體積水的重量之比。對於可溶性有限的液體，其比重將表明該貨品是沉於水下或浮於

水上。

1.4.7 蒸氣密度係指相對密度，或在相同壓力和溫度下，某種蒸氣或氣體（沒有任何空氣）的重量與同體積空氣的重量之比。數值小於1，表示該蒸氣或氣體比空氣輕，數值大於1，表示該氣體比空氣重。

1.4.8 黏度係指液體內部上下平行兩層，當其中一層在另一層上面移動時產生的一種剪力。某一物質的絕對黏度是力的達因數，該力能使兩個面積為1 cm^2的平行表平面，以1 cm/s的速度作相對移動，而這個表平面是由1厘米厚的物質分層出來的。某一物質的運動黏度是絕對黏度與該物質在測試溫度下的密度之比。

1.4.9 腐蝕侵襲係指由於某一物質產生電化學反應，因而對環境具有破壞作用的特性。

1.4.10 貨泵艙係指本規則涉及的設有操作貨品的貨泵及其輔助設備的處所。

1.4.11 泵艙係指位於貨物區域內，設有用於操作壓載水及燃油的泵及其輔助設備的處所。

1.4.12 貨艙區域係指船上包括液貨艙和貨泵艙以及包括隔離艙、留空處所和相臨及位於上述處所之上的甲板區域。

1.4.13 隔離係指一貨物管系或貨物透氣系統不與另一貨物管系或貨物透氣系統相連接。

此種隔離可以用設計或操作的方法實現。操作方法不得在液貨艙內使用，而應採用下列型式中的一種實現隔離：

（a）拆去短管或閥並盲斷管端；

（b）佈置兩個串聯的盲法蘭，並設有探測這兩個盲法蘭之間的管內有否滲漏的裝置。

1.4.14 獨立係指管系或透氣系統根本不與另一系統相連接，並且也沒有任何設施可與其他系統進行潛在的連接。

1.4.15 對於環氧丙烷和環氧乙烷/環氧丙烷混合物（含有重量不超過 30%的環氧乙烷）（4.7 節），參考溫度係指在壓力釋放閥設定壓力時貨物蒸氣壓力下的溫度。

1.4.16 毒性極限

（a）口服致死劑量 LD50（口服）：即指口服時，使 50%受試對象死亡的劑量；

（b）皮膚致死劑量 LD50（皮膚）：即指作用於皮膚時，使 50%受試對象死亡的劑量；

（c）致死濃度 LC50（吸入）：即指吸入時，使 50%受試對象死亡的濃度。

1.4.16A 有毒液體物質係指在國際散裝化學品規則第 17 或 18 章中列入污染類別欄、或現行 MEPC.2/Circular 規定的或根據 1973 年國際防止船舶造成防污公約的 1987 議定書附則的修正案中 6.3 條規定臨時評定的 X、Y 或 Z 類的物質。

1.4.16B 已刪除。

1.4.16C 國際散化規則（IBC 規則）係指經國際海事組織海上安全委員會 MSC.4（48）決議和海上環境保護委員會 MEPC.19（22）決議分別修正通過的國際散裝運輸危險化學品船舶構造和設備規則。

1.4.17 凡引用本規則某一條款時，該條款下的所有規定均適用。

1.5 等效

1.5.1 對本規則要求船上應裝設或配備的特定的附件、材料、器具或儀器、或設備的型號，或應採取的任何特別措施，主管機關可允許在該船上裝設或配備任何其他的附件、材料、器具或儀器，或設備的型號，或採取任何其他的措施，但須通過試驗或其他方法，確定其至少與本規則要求者具有同等效能。

1.5.2 當主管機關准許以任何的附件、材料、器具、儀器、設備的部件、或其型號、或措施、程序、或佈置、或新穎設計或應用進行替代時，應將其細節連同驗證報告送交給 IMO，以便國際海事組織能將這些文件通告 MARPOL 73/78 的其他成員國和其他相關政府，供其官員參考。

1.6 檢驗要求

1.6.1 化學品船的構造、設備、附件、裝置和材料（但不包括簽發《貨船構造安全證書》、《貨船設備安全證書》、《貨船無線電安全證書》或《貨船無線電話安全證書》所需檢查的項目）應受到下列檢驗：

.1 初次檢驗。對此類檢驗，應在船舶投入營運前或在第 1 次簽發"散裝運輸危險化學品適裝證書"前進行。對於本規則範圍內的船舶，該檢驗應包括對結構、設備、附件、佈置和材料的全面檢查。初次檢驗時應確保結構、設備、附件、佈置和材料完全符合本規則中適用的規定。

.2 定期檢驗。其間隔由主管機關確定，但不得超過 5 年。定期檢驗應確保構造、設備、附件、裝置和材料均符合本規則適用的規定。

.3 中間檢驗。在《散裝運輸危險化學品適裝證書》的有效期內至少進行 1 次。如果在任何一個證書有效期內只進行 1 次中間檢驗，則檢驗應在證書有效期的中間日期前後 6 個月內進行。中間檢驗應確保安全設備、其他設備及有關的泵和管系符合本附則適用的規定，並處於良好工作狀態，對於這種檢驗，應在《散裝運輸危險化學品適裝證書》上進行簽署。

.4 年度檢驗。在《散裝運輸危險化學品適裝證書》簽發周年之日的前後 3 個月內進行。此年度檢驗應包括一個總體檢查，以確保構造、設備、附件、裝置和材料在各方面均滿足船舶預定的用途。對於這種檢驗，應在《散裝運輸危險化學品適裝證書》上進行簽署。

.5 附加檢驗。對此類檢驗，根據情況可以為總體的或局部的，並應在經過本章 1.6.2.3 規定的調查後有要求時進行，或在任何重大修理或更新時進行。此種檢驗時應確保必要的修理或更新行之有效，此種修理或更新的材料和工藝應是完全合格的，使船舶適於出海航行，不會對船舶或船上人員產生危險。

1.6.2 檢驗後狀況的維持

1.6.2.1 對船舶及其設備的狀況應予維持，使其符合本規則的規定，確保船舶適於出海航行，不會對船舶或船上人員產生危險。

1.6.2.2 在完成按本章規定的任何一次船舶檢驗後，非經主管機關許可，不得對檢驗範圍內的結構、設備、附件、佈置和材料做任何改變，但直接更換者除外。

1.6.2.3 每當船舶發生事故或發現缺陷從而影響船舶安全或船舶救生設備或本規則規定的其他設備的有效性和完整性時，則該船的船

長或船東應儘早向負責簽發有關證書的主管機關、指定驗船師或認可組織報告；該主管機關、驗船師或組織應進行調查，以確定是否需要進行本章 1.6.1.5 要求的檢驗。

1.6.3 適裝證書的簽發

1.6.3.1 在對符合本規則有關要求的從事國際航行的化學品液貨船進行了初次或定期檢驗後，應簽發 1 份《散裝運輸危險化學品適裝證書》，其標準格式列於本規則附件中。

1.6.3.2 按本節規定簽發的證書應存放於船上，以供隨時檢查。[①]

1.6.4 由另一國政府簽發或簽署適裝證書

1.6.4.1 應另一締約國政府的要求，可對懸掛另一締約國國旗的船舶進行檢驗；如確認該船符合本規則的規定，可向該船簽發或授權簽發證書，並如適當時，按本規則對船上的證書進行簽署或授權簽署。在所簽發的任何證書上應聲明：該證書係應船旗國政府要求予以簽發的。

1.6.5 適裝證書的期限和有效期

1.6.5.1 《散裝運輸危險化學品適裝證書》的有效期由主管機關確定，但從初次檢驗或從定期檢驗之日算起，不得超過 5 年。

1.6.5.2 證書期限為 5 年不得展期。

1.6.5.3 下列情況證書失效：

[①] 由 1.7.3 所有認可要求的放寬和/或在 2.2.5 中認可的特殊免除和任何替代措施應記錄在《適裝證書》的第 4 項下。如果需要，主管機關也可註明其他事項，諸如 1.5.1 所提到的內容。

.1 在 1.6.1 規定的期限內未進行檢驗；

.2 船舶變更船旗國時，只有當簽發新證書的政府完全確認該船是符合 1.6.2.1 和 1.6.2.2 的要求時，才可簽發新證書。當這種變更在締約國之間進行時，變更後的 12 個月內，如前一個船旗國政府接到請求，則儘快將該船在變更船旗國前所持有的證書副本和有關檢驗報告副本（如有）轉交該船新的主管機關。

1.7 生效日期

1.7.1 本規則的生效日期是 1972 年 4 月 12 日（本規則在國際海事組織大會以 A.212（VII）決議通過後 6 個月生效）。

1.7.2 本規則適用於生效日期後安放龍骨或處於相似建造階段或開始進行改建的船舶。此改建規定不適用於 MARPOL 73/78 附則 II 第 1.17 條所涉及的船舶改建。

1.7.3 本規則還應適用於載運本規則所述貨物的現有船舶。現有船舶應滿足本規則對貨物載運的要求，下面的情況除外：

（a）載運需 1 型船舶運輸的貨物的液貨艙應滿足 2.2.4（a）（iii）條；但主管機關可允許與 2.2.2（a）（ii）和 2.2.2（b）（iii）規定的距離有較小的差異存在。

（b）載運需 2 型船舶運輸的貨物的液貨艙應位於 2.2.2（c）規定的舷側最小破損範圍以外；主管機關可允許對此有較小的放寬要求。

（c）不必遵守 2.2.4（b）（ii）和 2.2.4（c）的要求。

（d）希望遵守 2.2.4（b）（iii）的要求，但要求的船邊和船底距離可以放寬，條件是現有 2 型船的液貨艙應位於距船底板至少 760 mm

以上。

（e）當現有化學品船從 3 型改為 2 型時，應滿足 2.2.4 的全部要求，除機器處所的破損殘存能力需由主管機關決定外。

（f）不期望完全符合 2.7.1 的規定。

1.8 新貨品

如認為擬載運的散裝液態危險化學品和 X、Y 和 Z 類有毒液體物質應進入本規則範圍內但目前尚未列入本規則第 VI 章最低要求一覽表，則主管機關應根據本規則的原則規定適當的載運條件，並將這些條件通知國際海事組織。《散裝化學品危險性評定標準》在這方面應提供指導。當定期修訂本規則時，這些建議將被考慮在內。

第 II 章貨物圍護系統

A[①] – 實體保護（貨艙位置、浮性及破艙穩性）

2.1 通則

散裝載運危險化學品的船舶，由於碰撞、擱淺或其他情況造成的破損，遲早可能會導致貨物無控制地逸出，這點不可忽視。因此，液貨艙相對於船舷和船底的位置（這將對貨物圍護系統免受外部損傷起到一定保護作用）以及船舶在這種破損後能保持浮力的程度應與可容忍的貨物逸出量相關，並應考慮到對環境造成危害的性質和嚴重程度。

2.1.1 使用的實體保護可分為三級。對於對環境危害最大的貨品需採用保護的最高標準 1 型，對於危害依次遞減的貨品應採用 2 型和 3 型保護。

2.1.2 不同類別貨品需要的實體保護等級見第 VI 章最低要求一覽表的 e 欄目。

2.1.3 如擬運輸一種以上的貨品，則對船舶破損殘存能力的要求應適用於最危險的貨品，但貨物圍護系統只需符合對各類化學品規定的最低要求。

2.2 船型

2.2.1 一般要求：對本規則適用的船舶可以勘定 1966 年國際載重線公約所允許的最小乾舷。但是所有實際裝載工況下所允許的營運吃

[①]如全部引用 IBC 規則第 2 章的規定，則可替代 A 部分的要求。

水應滿足 2.2.4 的附加要求，並考慮到所有空艙或部分裝載的情況以及所載運貨物的比重。為此目的，所有運輸散裝化學品的船舶應備有裝載手冊和穩性手冊，為船長提供參考和指導。這些手冊應包括液貨艙滿載和空艙或部分裝載的裝載工況、這些貨艙在船上的具體位置、所載運的不同貨物包的比重，以及在最危險裝載工況下的壓載佈置。

2.2.2 破損假定：在訂立有關液貨艙位置和船舶穩性的衡準時，有必要對假定破損進行規定並說明殘存條件和貨物圍護條件。假定破損情況要求按照下列規定。在這些情況下如果機器處所被視為可浸艙室，則將假定其滲透率為 0.85。其他可浸處所滲透率的確定應能反映對貨物、燃料或壓載的限制要求。這些限制要求應包含在提供給船長的資料中。

（a）碰撞破損

（i）	縱向範圍	$L^{\frac{2}{3}}/3$或 14.5 m，取較小者
（ii）	橫向範圍（在載重線水平面上，自舷側向船內垂直於中心線的方向向船內量取）	B/5 或 11.5 m，取較小者
（iii）	垂向範圍	自基線向上不予限制

（b）擱淺

		自船艏垂線起 0.3 L 內	船舶其他任何部分
（i）	縱向範圍	L/10	L/10 或 5 m，取較小者
（ii）	橫向範圍	B/6 或 10.0 m 取較小者	5 m
（iii）	垂向範圍 自基線量起	B/15 或 6 m，取較小者	

其中：對於船舶任何部分的 L 和 B（單位：m）及垂線見 1966 年國際載重線公約第 3 條的定義。

（c）較小的舷側破損

由於拖輪、棧橋造成的破損，應取：

橫向範圍（在最深載重線水平面上，自舷側向船內垂直於中心線的方向向船內量取）	760 mm

2.2.3 殘存假定：如船舶能保持穩定平衡的浮態，並滿足下列穩性衡準，則可認為船舶獲得了針對不同船型規定的破損殘存能力（見 2.2.4）。

（a）如果復原力臂曲線在平衡位置以外具有 20º 的最小範圍，且相應的剩餘復原力臂至少為 100 mm，則可認為最終浸水情況下的穩性合格。如果機艙棚在此水平上是水密的，則可考慮機艙棚周圍的艉部上層建築的未浸水容積，此時破損水線不應高於艉部上層建築甲板頂部中心線處的後端。

（b）最終浸水情況下的橫傾角不應超過 15º，只有當甲板的所有部分都未被浸沒時，17º 的橫傾角可以接受。對於長度小於 150 m 的船舶，如果能確定再小的限制角度不可能合理達到，且上述 2.2.3（a）所述其他所有規定均已符合，則主管機關可以接受不超過 25º 的橫傾角。

2.2.4 船型要求

（a）1 型船舶

（i）概述

1 型船舶用於運輸的貨品需要最大限度地採取防禦措施防止其逸漏。

（ii）船舶性能

船舶應能承受在其船長範圍內任何部位造成的碰撞破損(2.2.2(a))或擱淺破損（2.2.2（b)），並能按 2.2.3 規定獲得破損殘存能力。

（iii）液貨艙位置

需要用 1 型船舶運輸的貨物，其液貨艙應位於按 2.2.2（a)（ii）和 2.2.2（b)（iii）所述破損範圍之外，且其任何部位距船體外板都不應小於 760 mm。本要求不適用於作為稀釋洗艙污水的液艙。

（b）2 型船舶

（i）概述

2 型船舶用於運輸的貨品需要較大限度地採取防禦措施防止其逸漏。

（ii）船舶性能

(1)船長 150 m 及以下船舶應能承受在其船長範圍內除艉部機器處所的任一邊界艙壁外的任何部位造成的碰撞破損（2.2.2（a)）或擱淺破損（2.2.2（b)），並能按 2.2.3 規定獲得破損殘存能力。

(2)船長超過 150 m 的船舶應能承受在其船長範圍內的任何部位造成的碰撞破損（2.2.2（a)）或擱淺破損（2.2.2（b)），並能按 2.2.3 規定獲得破損殘存能力。

（iii）液貨艙位置

需要用 2 型船舶運輸的貨物，其液貨艙應位於按 2.2.2（b）（iii）和 2.2.2（c）所述破損範圍之外，且其任何部位距船體外板都不應小於 760 mm。本要求不適用於作為稀釋洗艙污水的液艙。

（c）3 型船舶

（i）概述

3 型船舶用於運輸的貨品具有足夠危害性，需採取適當的圍護措施以增強其在破損狀況下的殘存能力。

（ii）船舶性能

（1）船長 125 m 及以上的 3 型船舶應能承受在其船長範圍內除艉部機器處所的任一邊界艙壁以外的任何部位造成的碰撞破損（2.2.2（a））或擱淺破損（2.2.2（b）），並能按 2.2.3 規定獲得破損殘存能力。

（2）船長在 125 m 以下的 3 型船舶應能承受在其船長範圍內除艉部機器處所以外的任何部位造成的碰撞破損（2.2.2（a））或擱淺破損（2.2.2（b）），並能按 2.2.3 規定獲得破損殘存能力。此外，對於機器處所浸水後的船舶殘存能力應由主管機關確定。

（iii）液貨艙位置

無特別要求。

2.2.5 對小船的特殊考慮：如小船擬載運需要 1 型或 2 型圍護的貨物，且不能在所有方面都符合上述 2.2.4（a）（ii）和 2.2.4（b）（ii）的要求，只有在採取了能保持同樣安全程度的替代措施時，主管機關才可考慮予以特別免除。在批准業已獲得免除的船舶設計時，指定的替代措施的性質應清楚地加以說明，並通知該船將前往的各國主管機

關，且任何此類免除應在證書上正式註明（1.6）。

B－液艙類型

2.3 安裝

2.3.1 整體液艙：構成船體結構一部分的貨物圍護容器，以相同的方式與鄰近的船體結構一起承受相同的載荷。整體液艙是船體結構完整性所必需的。

2.3.2 獨立液艙：不是船體結構的一個連接部分的貨物圍護容器。建造和安裝獨立液艙是為了在所有可能時刻消除（或無論何種情況下最小化）因相鄰的船體結構受力或移動所引起的應力。

2.4 設計和建造

重力液艙：艙頂設計壓力不大於 0.7 kp/cm^2 的液艙。重力液艙可以是獨立液艙或整體液艙。應按主管機關的標準對重力液艙進行建造和試驗。

2.5 對各種物質的要求

對於各種物質的艙型要求（包括安裝和設計）見第 VI 章最低要求一覽表中的欄目中。

C－船舶佈置

2.6 貨物分隔

2.6.1 除本規則另有規定之外，應該用隔離艙、留空處所、貨泵艙、泵艙、空液艙、燃油艙或其他類似處所將本規則所適用的貨物與機器和鍋爐處所、起居處所、服務處所、飲用水艙和生活用品儲藏室分隔

開。

2.6.2 與其他貨物、殘餘物或混合物會起危險反應的貨物、貨物的殘餘物或含有該貨物的混合物，應：

（a）用隔離艙、留空處所、貨泵艙、泵艙、空液艙或彼此能相容的貨物將其與該類其他貨物分隔；

（b）具有獨立的且不通過裝有該類其他貨物的液貨艙的泵和管系，除非它們被包圍在隧道內；且

（c）具有獨立的液艙透氣系統。

2.6.3 貨物管路不應通過任何起居處所或機器處所，貨泵艙或泵艙除外。

2.6.4 適用本規則的貨物不應儲存於艏尖艙和艉尖艙內。

2.7 起居處所

2.7.1 起居處所不應位於液貨艙或泵艙上面，液貨艙不應位於起居處所的前端之後。[①]

2.7.2 為了防止危害性蒸氣的侵襲，應適當考慮與貨物管系和液艙透氣系統有關的通往起居處所和機器處所的空氣進口和開口的位置。

2.7.3 起居處所的門和通風口應位於甲板室兩側，距離甲板室前端和液貨區域向後至少 L/25（L 為船長）但不少於 3 m。但該距離不必超過 5 m。上述規定範圍內的位於前艙壁或沿甲板兩側的弦燈應為固

[①] 對本規則生效之前建造的化學品船，可參見 2.7.1 和 2.7.3 的統一解釋建議案。

定式。駕駛室的門和窗可位於上述範圍之內，但其設計應能確保對駕駛室進行快速和有效的氣密和蒸氣密關閉。拆除機器時用的由螺栓緊固的門板可位於上述規定的範圍之內。

2.8 貨泵艙

2.8.1 貨泵艙的佈置應確保在任何時候都能從扶梯平台或從艙底板不受限制地通過。

2.8.2 應設有能用救生繩提升昏迷人員的永久性裝置，在提升時應不受任何凸出物的阻礙。

2.8.3 貨泵艙的佈置應能讓穿着防護服的人員能不受限制地接近貨物裝卸所需的一切閥門。

2.8.4 在所有扶梯和平台上都應設有欄杆。

2.8.5 正常出入泵艙的扶梯不應垂直設置，而且應在適當間隔處設置平台。

2.8.6 在貨泵艙內應裝有能處理貨泵艙內貨泵和閥門的排泄物或任何可能的泄漏物的設施。供貨泵艙用的艙底管系應能從貨泵艙外進行操作。應設有一個或幾個污水艙，用以儲存受污染的艙底水或洗艙水。還應配備帶有標準聯接器的通岸接頭或其他設備，以便把污水輸送至岸上的污水艙。

2.8.7 泵的排放壓力錶應安裝在貨泵艙之外。

2.8.8 有關特定貨品的貨泵艙要求見第 VI 章最低要求一覽表的 m 欄。

2.9 進入液貨區域內空艙、液貨艙和其他處所的通道

2.9.1 液貨區域內空艙、液貨艙和其他處所通道的設置應能確保全面檢查的進行。

2.9.2 進入液貨艙的通道應直接通到開敞甲板。

2.9.3 對於以水平的開口、艙口或人孔作為出入口的通道，其尺寸應足以使攜帶呼吸器的人員上下扶梯而無阻礙。同時，還應設置一無障礙的開口，以便從該處所底部提升受傷人員，該開口的最小淨尺寸不得小於 600 mm×600 mm。

2.9.4 對於以垂向開口或供某處所的長度和寬度範圍內使用的人孔作為出入口的通道，其最小淨開口不得小於 600 mm×800 mm，且離船底板的高度不大於 600 mm，除非設有格柵或其他腳蹬。

2.9.5 在特殊情況下，主管機關也可批准較小尺寸的開口。

D－貨物駁運

2.10 管路佈置[①]

貨物管系的設計、佈置和製造應符合主管機關的標準，並考慮到下列規定。

2.10.1 所有管系構件的額定壓力應不小於該系統可能承受的最大壓力。如管系未裝有提供超壓保護的壓力釋放閥，或可能與其壓力釋放閥隔絕，則該管系的設計應能承受其在使用中遇到的最大壓力，同時應考慮到：

（a）45°C 時的貨物蒸氣壓力；

[①]對於經主管機關允許的船艏或船艉裝卸裝置，可參見 IBC 規則第 3.7 條規定。

（b）液貨艙的額定壓力；

（c）相關貨泵的最大排出壓力及其壓力釋放閥的設定值；和

（d）正常操作中管路能產生的最大靜水壓力。

2.10.2 應保護與液艙連接的管路接頭免受機械損傷和野蠻對待。除經認可的連接截止閥的管路接頭和膨脹接頭以外，貨物管路的接頭都應是焊接連接。

2.10.3 除非能保持對破艙保護所要求的距離（見 2.1 和 2.2），否則，貨物管路不得安裝在甲板以下的貨物圍護處所外側與船體外板之間，但是，如果管子損壞後，不會導致貨物外流，則可以減小上述距離，即只要能保持檢查所需的距離。

2.10.4 位於主甲板以下的貨物管路可以通過其所服務的液貨艙並穿過艙壁或穿過與液貨艙、壓載艙、空液艙、貨泵艙或泵艙相鄰接的（縱向或橫向的）共同周界，但是，在其所服務的液貨艙內，應裝有能在露天甲板上操作的截止閥，並且在萬一管路受損時，要確保貨物的相容性。作為例外，如果液貨艙與貨泵艙相鄰接時，在露天甲板上操作的截止閥可位於在貨泵艙一側的液貨艙艙壁上。但是在艙壁上的閥和貨泵之間應加裝一個閥。

主管機關可接受安裝在液貨艙外的全封閉液壓操縱閥，但該閥應滿足下列條件：

（a）被設計成無泄漏危險；

（b）被安裝在其所服務的液貨艙艙壁上；

（c）經適當保護，防止機械損傷；

（d）被安裝的位置與外板之間的距離應滿足所要求的破艙保護的距離；和

（e）能在露天甲板上對其操作。

2.10.5 在任何貨泵艙內，當由1台貨泵服務於1個以上液貨艙時，應在通往每個液貨艙的管路上安裝1個截止閥。

2.10.6 安裝在管隧內的貨物管路也應滿足2.10.4和2.10.5的要求。管隧應滿足對液貨艙有關結構、位置和通風的要求以及防止電氣危險的要求。當管路破損後應確保貨物的相容性。除了通往露天甲板和貨泵艙或泵艙的開口以外，在管隧上不得設有任何其他開口。

2.10.7 對穿過艙壁的貨物管路應佈置成能防止其在艙壁處產生過大的應力，並且不得使用以螺栓穿過艙壁的固定法蘭。

2.11 貨物駁運控制系統

2.11.1 為適當控制貨物，貨物駁運系統應滿足下述要求：

（a）在每個液貨艙的注入管路和排放管路上應設1個能手動操作的截止閥，該閥應位於靠近管子穿過液貨艙艙壁之處；如果採用獨立深井泵排放貨物，則不要求在該艙的排放管路上設置截止閥；

（b）在每個貨物軟管連接處應設1個截止閥；

（c）所有貨泵和類似設備均應有遙控關閉裝置。

2.11.2 對於在駁運或輸送本規則所規定的貨物時所必需的控制裝置，除本規則其他條文已涉及的貨泵艙內的控制裝置以外，均不得設置在露天甲板以下。

2.11.3 本規則第 17 章最低要求一覽表中的“o”欄內，列出了對某些貨品的附加的貨物駁運控制要求。

2.12 船用貨物軟管

2.12.1 第 2.12.2 至 2.12.4 條適用於在 2002 年 7 月 1 日或以後安裝於船上的貨物軟管。

2.12.2 駁運氣體和液體所用的軟管應與貨物相容，並應適合於貨物的溫度。

2.12.3 對於承受液貨艙壓力和貨泵排放壓力的軟管，其設計爆破壓力應不低於在駁運貨物期間軟管所要承受的最大壓力的 5 倍。

2.12.4 每一新型貨物軟管，連同其端部附件，應在正常環境溫度下進行 200 個從零至至少 2 倍於規定的最大工作壓力的壓力循環型式試驗。在已進行循環壓力試驗後，該型式試驗應演示證實在極端運行溫度下至少 5 倍於其規定的最大工作壓力的爆破壓力。不得將用於型式試驗的軟管用於貨物輸送。其後，對所生產的每一根新軟管，在投入使用之前，都應在環境溫度下進行靜水壓力試驗，其試驗壓力不小於規定的最大工作壓力的 1.5 倍，但也不必大於其爆破壓力的五分之二。應採用模板噴刷或其他方法在軟管上標出其試驗日期及規定的最大工作壓力。對於不是在環境溫度下使用的軟管，還應標出其可適用的最高和最低操作溫度。規定的最大工作壓力應不低於 10 bar 表壓力。

E－液艙透氣系統

2.13 一般要求

2.13.1

（a）在所有液貨艙中應設置適合於所載運貨物的透氣系統。液貨艙透氣系統的設計應能儘量減少貨物蒸氣在甲板集聚和進入起居和機器處所的可能性，同時還能儘量減少易燃蒸氣進入有點火源的其他處所的可能性。其設計還應儘量減少飛濺到甲板上的可能行。透氣口的佈置應能防止水進入液貨艙，同時，應能使蒸氣不受阻礙直接向上噴射排出。應配備設施，以確保任何液貨艙內的液壓頭不超過對該液貨艙的試驗壓頭。可允許採用適當的高液位報警裝置、溢流控制系統或溢流閥，再配以測量裝置和液貨艙的充裝程序等。

（b）當限制液貨艙過壓的裝置是基於高位報警器或自動關閉閥時，第 4.14 節適用。

2.13.2 對於裝有封閉式或限制式測量設備的液艙，應規定設有防火網（如設有時）時的透氣系統尺寸，以使在設計速率裝載時液艙不至超壓。特別是飽和貨物氣體在最大預計裝載速率下通過透氣系統排放時，液貨艙蒸氣空間與大氣壓之間的壓力差不應超過 0.2 kp/cm^2，或對於獨立液艙而言，不超過該艙的最大工作壓力。

2.13.3 任何裝設在透氣系統排放口的防火網應易於到達和取出，以便清洗。

2.13.4 應為透氣管路設有適當的泄放設施。

2.13.5 透氣管路如與抗腐蝕材料建成的液貨艙相連，或與按本規則要求的加有襯墊或塗層以裝卸特殊貨物的液貨艙相連，則該透氣管路也要同樣加有襯墊或塗層，或者用抗腐蝕材料製成。

2.14 液艙透氣系統的類型

2.14.1 開式透氣系統：係指在正常操作期間，除摩擦損失和裝有防火網外，對貨物蒸氣進出液貨艙的自由流動無任何限制的系統。開式透氣系統僅用於閃點在 60°C 以上且吸入時對人體健康無明顯危害的貨物。開式透氣系統可以由在每個液貨艙中單獨設置的透氣管構成，也可以在適當考慮到貨物分隔的情況下，將上述單獨透氣管組合成一個或幾個總管。但在任何情況下，在各個透氣管或總管上均不得設置截止閥。[①]

2.14.2 控制式透氣系統：係指在每一液貨艙內設置的壓力/真空釋放閥的系統，以限制液貨艙中的壓力或真空，且用於不許使用開式透氣系統的貨物。控制式液貨艙透氣系統可由在每個液貨艙中單獨設置的透氣管構成，在適當考慮到貨物分隔的情況下，也可將上述僅與壓力有關的單獨透氣管組合成一個或幾個總管。在任何情況下，不得在壓力/真空釋放閥的上面或下面設置截止閥。在某些操作條件下可以設有壓力/真空釋放閥的旁通裝置。透氣管出口在露天甲板上的高度應不小於 4 m，如其設在離縱向步橋 4 m 的範圍內，則其高度應在縱向步橋之上不小於 4 m。如設有經主管機關型式認可的高速透氣閥，且能將蒸氣/空氣混合物以至少 30 m/s 的出口速度向上自由噴射，則透氣口在甲板或縱向步橋以上的高度可視情況減到 3 m。透氣出口應設在離開起居、服務和機器處所及點火源的最近空氣進口或開口至少 10 m 處。易燃蒸氣的出口應設有易於更新的並有效的防火網或型式經認可的安全頂蓋。在設計 PV 閥、防火網及透氣頂蓋時，應適當考慮到惡劣天氣下貨物蒸氣凍結或結冰可能引起的這些裝置的堵塞。

[①] 對於關於在透氣管路中禁止使用截止閥的規定，應將其擴大到禁止使用所有的其他隔斷裝置，包括盲通法蘭和盲板法蘭。

2.14.3 上述 2.14.2 所述的控制式液貨艙透氣系統應包括主透氣裝置和輔助透氣裝置，當其中一個透氣裝置損壞時蒸氣可以完全釋放以防止造成過壓或欠壓。作為替代，輔助透氣裝置可包括安裝在每一液貨艙內的壓力傳感器，並在船舶貨物控制室或從通常的貨物作業位置裝設監控系統。該監控設備應設有探測到液貨艙內出現超壓或欠壓時應激活的報警設施。船舶應在 2002 年 7 月 1 日以後不遲於其首次計劃進塢日的時間滿足本條規定，但不能遲於 2005 年 7 月 1 日。

對於低於 500 總噸的船舶，主管機關可接受放寬本條規定。

2.14.4 開式和限制式裝置只能用於下列情況：

（a）本規則允許使用開式透氣時；

（b）設有能在操作測量裝置之前釋放艙內壓力的裝置時。

2.14.5 對各種貨品的透氣要求見本規則第 VI 章最低要求一覽表中的 g 欄和 m 欄。

F－貨物溫度控制

2.15 一般要求

2.15.1 如設有貨物加熱或冷卻系統，則對該系統的製造、安裝和試驗均應使主管機關滿意。溫度控制系統中使用的材料應適合於擬裝運的貨品。

2.15.2 用於對特定貨物進行加熱或冷卻的介質應為經認可的類型。應對加熱盤管或導管的表面溫度加以考慮，以避免因貨物局部過熱或過冷而產生危險的反應。另見 4.10.6。

2.15.3 在加熱或冷卻系統中應設有控制閥，以便隔斷每個液貨艙

的加熱或冷卻系統並可以用人工調節其流量。

2.15.4 在任何加熱或冷卻系統中均應配備裝置，以確保在任何情況下（系統已被排空者除外）均能保持該系統中的壓力高於液貨艙內貨物作用於該系統的最大壓頭。

2.15.5

（a）應設有測量貨物溫度的裝置。當過熱或過冷會導致危險情況發生時，應設有監測貨物溫度的報警系統。

（b）如第 VI 章最低要求一覽表中“j”欄內所示，當各物質要求限制式或封閉測量裝置時，測量貨物溫度的裝置應分別為限制式或閉式。

（c）限制式溫度測量裝置應符合 3.9（b）中對限制式測量裝置的定義。例如，可攜式溫度計安放在限制式表管內。

（d)閉式溫度測量裝置應符合 3.9(c)中對閉式測量裝置的定義。例如，遙控讀數式溫度計的傳感器安裝在液貨艙內。

2.15.6 當對可能產生巨大有毒蒸氣的貨品進行加熱或冷卻時，其加熱或冷卻介質應在下述循環管路中工作：

（a）除了用於其他貨物的加熱或冷卻系統外，循環管路應獨立於船上其他用途的系統，而且不進入機器處所；或

（b）循環管路應在裝運有毒貨品的液貨艙之外[①]；或

（c）在介質循環到船上其他用途的系統或進入機艙之前，應能對

[①]不適用於 1979 年 9 月 27 日以前建造的船舶。

其取樣檢查以檢查有無貨物存在。取樣設備應位於液貨艙區域內，並能檢測出任何已被加熱或已被冷卻的有毒貨品的存在。在對有毒貨物進行加熱和冷卻以前和之後還應遵守 5.6 的規定。

2.16 附加要求

對於某些貨品的附加要求見第 VI 章最低要求一覽表中的“m”欄。

G－構造材料

2.17 一般要求

2.17.1 用於液貨艙連同與其相關的管路、泵、閥門、透氣管及其接頭的構造材料應適合於所載貨物的溫度和壓力，並應符合公認的標準。通常的構造材料為鋼材。

2.17.2 選用構造材料時，根據需要應考慮下列要素：

.1 在作業溫度下的缺口韌性；

.2 貨物的腐蝕作用；和

.3 貨物與構造材料之間產生有害反應的可能性。

2.17.3 貨主應負責向操作人員和/或船長提供適用性信息，且必須在運輸貨品之前及時提供該信息。所裝運的貨品應適於所有構造材料，以確保：

.1 不會損壞船舶構造材料的完整性；和

.2 不會引起危險或潛在危險的反應。

2.17.4 將貨品提交國際海事組織評估時，或當 2.17 中所列材料的

貨品適用性需要特殊要求時，應在 GESAMP/EHS 貨品資料報告表中提供關於所需構造材料的信息。這些特殊要求應在第 IV 章中進行說明，並隨後在 IBC 規則第 17 章的“o”欄中提及。報告表格還應標明是否需要其他特殊要求。貨品生產者應負責提供正確信息。

2.18 附加要求

已刪除。

H－對液艙內的蒸氣空間以及液艙周圍的留空處所的環境控制

2.19 一般要求

2.19.1 對於液貨艙內的蒸氣空間以及在某些情況下液貨艙周圍空間，可要求其具有受特別控制的環境要求。

2.19.2 有以下四種不同控制方式：

（a）惰化法－用不助燃也不與貨物反應的氣體或蒸氣充入液貨艙及相關管系和液貨艙周圍空間（若本規則第 IV 章有規定時），並維持這種狀態；

（b）隔絕法－將液體、氣體或蒸氣充入液貨艙及相關管系（和液貨艙周圍空間，如有必要），使貨物與空氣隔絕並維持這種狀態；

（c）乾燥法－將乾燥氣體或蒸氣充入液貨艙及相關管系，以防止水或水汽接近貨物，並維持這種狀態；就本條而言，乾燥氣體或蒸氣指在大氣壓力下其露點為-40°C 或更低的氣體或蒸氣。

（d）通風法－進行強制通風或自然通風。

2.19.3 與 2.19.2（a），（b）和（c）相關的佈置要求如下：

（a）除非岸上有惰性氣體可供隨時使用，否則，在船上應攜帶或製造足夠的惰性氣體，以供在對液貨艙進行裝、卸貨時使用。此外，船上還應另外備有足夠的惰性氣體，以補償其航行途中的正常損耗。

（b）船上的惰性氣體系統應能使圍護系統內始終保持至少為 0.07 kPa/cm^2 的表壓力。此外，惰性氣體系統不得使液貨艙內的壓力升高到超過液貨艙的釋放閥的壓力設定值。

（c）採用隔絕法時，應設有供應隔絕介質的類似裝置，對此裝置的要求與上述（a）和（b）對惰性氣體供應裝置的要求相同。

（d）應設有能監測液面以上空間中的氣體覆蓋層的裝置，以確保維持其恰當的氣體狀態。

（e）當對易燃貨物採用惰化和/或隔絕裝置時，在惰性介質充入過程中，應儘量減少靜電荷的產生。

（f）當採用乾燥法並以乾燥氮氣作介質時，對乾燥介質供應裝置的要求應與上述（a）、（b）和（e）中的要求相同。如在所有液艙的空氣進口使用乾燥劑作乾燥介質時，在整個航行期間應攜帶足夠量的乾燥劑，並考慮到晝夜溫差和預計濕度。

2.20 對各種貨品的環境控制要求

對某些貨品的環境控制需求見第 VI 章最低要求一覽表中的“h”欄。

2.21 壓載艙佈置

2.21.1 為固定壓載艙服務的泵、壓載管路、透氣管路和類似設備應獨立於服務液貨艙的類似設備和液貨艙本身。鄰接液貨艙的固定壓

載艙的排放裝置應設在機艙和起居處所的外面。充裝設備可位於機艙內，但此類設備應能確保從艙頂部充注，同時，在充裝設備中應設置止回閥。

2.21.2 對液貨艙進行壓載充裝時，可以使用在甲板平面上服務於固定壓載艙的泵，但注入管路與液貨艙或液貨艙管路間應無固定連接，且在注入管路上應裝有止回閥。

2.22 液貨區內處所的艙底水泵設置

用於貨泵艙、泵艙、留空處所、污液艙、雙層底和類似處所的艙底水泵裝置應完全位於液貨區域內。但對於留空處所、雙層底艙和壓載艙，如果用雙層艙壁將其與裝有貨物或貨物殘餘物的液貨艙相隔開時，則為例外。

2.23 泵和管路的識別

在泵、閥和管路上，應設有區別標記，以識別它們的用途和它們所服務的液艙。

第 III 章　安全設備和相關措施

A－貨物裝卸處所的通風

3.1 裝卸貨作業期間經常進入的處所

3.1.1 一般要求

對貨泵艙和容納貨物裝卸設備的其他圍蔽處所以及進行貨物作業的類似處所均應裝設機械通風系統，且應能從上述處所的外部對該系統進行控制。應採取措施，以便在進入艙室並操作設備之前對上述處所進行通風。

3.1.2 機械通風系統

（a）對機械通風系統進氣口和排氣口的佈置應保證在該處所內有足夠的空氣流通，以避免有毒和/或易燃蒸氣（考慮其蒸氣密度）的積聚，同時應確保有足夠的氧氣，以便提供一個安全的工作環境。但無論如何，按處所的總容積計算，通風系統應具有每小時不小於 30 次的空氣交換能力。對於某些貨品，應按照 4.13 的規定，增加貨泵艙的通風率。

（b）通風系統應為固定型的，而且通常應為抽出式，並應能從花鐵板的上面和下面抽出空氣。在裝有驅動貨泵的電動機的艙室內，應設有正壓式通風系統。

（c）危險氣體處所的通風排氣管道應向上排放，其排氣口的位置與起居處所、服務處所、機器處所、控制站及其他無危險氣體處所的開口之間的水平距離至少為 10 m。

（d）對通風進氣口的佈置應儘量減小任何通風排氣口排出的危險蒸氣發生再循環的可能性。

（e）不應將通風管道穿過機艙、起居處所和工作處所或其他類似處所。

（f）如果船上裝運易燃貨品，則風扇應經主管機關認可，確保能在爆炸氣體下使用。

（g）對裝在船上的每一種風扇均應配有足夠的備件。

（h）在通風導管的外部開口處，應設置單個網孔面積不大於 13 mm^2 的保護網。

3.2 不經常進入的處所

對雙層底艙、隔離空艙、箱形龍骨、管隧、液貨艙處所以及可能積聚貨物的其他處所均應能進行通風，以確保有足夠的空氣防止有毒和/或可燃蒸氣的積聚並確保有足夠的氧氣以在進入前提供一個安全的環境。當上述處所內不設固定通風系統時，應備有經認可的移動式機械通風設備。

B－易燃貨物的電氣要求

3.3 一般要求

電氣裝置的安裝應儘可能將易燃貨物發生火災和爆炸的危險減至最小。應小心防止在可能有易燃蒸氣的區域產生着火源。

3.4 含有液貨艙或管路的處所的電器裝置

3.4.1 一般含有液貨艙或管路的處所不允許設有電氣裝置。

3.4.2 在液貨艙或包含液貨艙或管路的處所只能允許使用設計成本質安全的測量和監控設備。由主管機關考慮使用潛沒馬達和泵。

3.4.3 貨泵艙只允許使用設計成防爆型的照明設備。

3.5 緊鄰液貨區域前部、後部或上部的圍閉處所內的電氣裝置

3.5.1 任何電氣測量或監控設備應設計成本質安全型。

3.5.2 如設有強制通風的處所可以使用防爆型的電氣設備。

3.5.3 只有當一處所可視為非危險處所，且其進口和通風口的位置離透氣口和排氣口有一段安全距離時，該處所可使用帶有圍閉通風設計的電氣設備。

3.6 開敞甲板上的電氣裝置

3.6.1 貨物甲板上只能使用設計成防爆型的電氣設備。

3.6.2 除貨物甲板以外的甲板上可使用帶有圍閉通風設計的電氣設備，但是電氣設備的位置離透氣口、排氣口、液艙開口、管路法蘭或貨物閥門要有一段安全距離，且高於甲板一段安全高度。

3.7 連接

在獨立液貨艙與船體之間應進行電氣連接。

3.8 對各種貨品的電氣要求

對各種貨品的電氣要求見第 VI 章最低要求一覽表中的“i”欄。

C－測量

3.9 一般要求

液貨艙内應設有下列形式之一的液位測量裝置：

（a）開式裝置：通過液貨艙的開口，將測量儀錶放置於貨物或其蒸氣之中，例如空檔液位測量孔。

（b）限制式裝置：將此裝置伸入液貨艙内，使用時，允許少量貨物蒸氣或液體逸入大氣；不使用時，這種裝置是完全封閉的；其設計應確保在打開這種裝置時不致使艙内貨物（液體或氣霧）發生危險外溢。

（c）封閉式裝置：將此裝置伸入液貨艙内，成為封閉系統的一部分，而且能防止艙内貨物溢出，例如浮筒式系統、電子探頭、磁性探頭和帶有防護裝置的觀察器等。

（d）間接裝置：此裝置不用伸入液艙内，並獨立於液艙。間接測量裝置用於測量貨物數量，如貨物測重裝置、管路流量計等。

測量裝置應獨立於 4.14.2 所要求的設備，但對於 1982 年 9 月 27 日前建造的船舶除外，對於此類船舶，4.14.2 的要求可通過自動操作的截止閥得以滿足。

3.10 對各種貨品的測量

對於各種貨品的測量類型見第 VI 章最低要求一覽表的 j 欄。

D－蒸氣探測

3.11 一般要求[①]

3.11.1 對載運有毒和/或易燃貨品的船舶至少應配備 2 套專為該類蒸氣而設計並經校準的試驗儀器，如果這種儀器不能兼用於試驗毒性濃度和可燃濃度，則應各備有 2 套單獨的儀器。

3.11.2 蒸氣探測儀可以是可攜式的，也可以是固定式的。如果已安裝一個固定的探測系統，則至少還應備有 1 套可攜式探測儀。

3.12 對各種貨品的要求

對於各種貨品的蒸氣探測要求見第 VI 章最低要求一覽表的 k 欄。

E－消防

（除了另有說明外，E 部分提及的 SOLAS 條文係指 1974 國際海上人命安全公約及之前經 MSC.99（73）決議通過的相關修正案的第 II-2 章中的條文）

適合於特定貨品的滅火劑列於第 VI 章表中的 l 欄內。

3.13 消防安全佈置[②]

3.13.1 經修正的 1974 年 SOLAS 公約第 II-2 章對液貨船的要求，

[①] 當在最低要求一覽表裏已註明需要探測某些貨品的有毒蒸氣而沒有適用的探測設備時，主管機關可以免除對該船的探測要求，但在適裝證書上應作適當的記錄。在批准這一免除時，主管機關應考慮到適當增加呼吸用空氣供應量的必要性，並應在適裝證書上註明，以引起對第 5.4.1（b）條規定的注意。

[②] 經修正的 1974 年 SOLAS 公約第 II-2/1.1 和 1.2 條所定義的船舶應符合經修訂的該 3.13 條。其他所有化學品液貨船應符合本規則 1980 年版的第 3.13 條。

應適用於本規則所涉及的船舶，且無論其噸位大小，包括小於 500 總噸的船舶，但下列除外：

（a）第 60，61，62 和 63 條應不適用；

（b）第 56.2 條（即：對主貨物控制站位置的要求）無需適用；

（c）適用於貨船的第 4 條和第 7 條應適用，因為其可能適用 2,000 總噸及以上的貨船；

（d）第 3.14 條的規定應適用並替代第 61 條；和

（e）第 3.13.3 和 3.13.4 條規定應適用並替代第 63 條。

3.13.2 儘管有 3.13.1 的規定，但對於僅載運氫氧化鉀溶液、磷酸或氫氧化鈉溶液的船舶，如滿足了 1974 年 SOLAS 公約第 II-2 章 C 部分的要求，則不需要再滿足該章 D 部分的要求，但是第 53 條對此類船舶無需適用，且下列 3.13.3，3.13.4 和 3.14 條也無需適用。

3.13.3 已刪除。

3.13.4 如果能向主管機關證明要裝載的貨物不適宜採用二氧化碳或鹵化烴進行滅火，則可為貨泵艙設置一個固定壓力水霧或者高倍泡沫滅火系統。散裝危險化學品適裝證書中應反映出此特別要求。

3.13.5 經 MSC.99（73）通過的 SOLAS 第 II-2 章的下述要求應適用：

（a）對於 500 總噸及以上的船舶，在修正案生效後的不遲於其首次計劃進塢日的時間，且不遲於修正案生效之後 3 年，應配備第 II-2/4.5.10.1.1 和 4.5.10.1.4 條所要求的裝置和持續監測易燃蒸氣濃度的系統。採樣點和探測頭應設置在適當位置，以隨時探測到潛在的危

險泄漏。如果易燃蒸氣濃度達到預先設定的水平（應不高於易燃蒸氣下限的 10%），應在泵艙和貨物控制室能自動激發連續視聽報警信號，以引起有關人員對潛在危險的警覺。但是，如果已安裝的現有監控系統的預先設定水平不高於易燃蒸氣下限的 30%，則可以接受該系統。儘管有上述規定，對於非國際航線的船舶，主管機關可以免除上述要求。

（b）第 13.3.4.2 至 13.3.4.5 條和第 13.4.3 條應適用於 500 總噸及以上的船舶；

（c）無論船舶尺寸的大小，除第 6.3.2.2 和 6.3.2.3 條以外的 SOLAS 公約第 II-2 章 E 部分的規定應適用；

（d）如新裝有深油烹飪設備，則第 10.6.4 條應適用；和

（e）按第 10.4.1.3 條規定，禁止新安裝以鹵代烷 1211、1301 和 2402 以及全氟化碳作為滅火劑的滅火系統。

3.14 液貨艙區域的消防佈置①

3.14.1 所有船舶無論大小，應按下列要求設置固定甲板泡沫滅火系統。但對專門載運特定貨物②的船舶可採用主管機關滿意的替代消防設施予以保護，但該替代設施對船上所載貨品的有效程度應達到甲板泡沫系統對大多數易燃貨品的有效性。

3.14.2 只准提供一種類型的泡沫劑，該泡沫劑應對擬載運的最大可能數量的貨物有效。對於泡沫無效或與泡沫不相容的其他貨物，應

---

①在 1981 年 5 月 20 日及以後建造的船舶應符合本節規定。所有其他船舶應符合本規則 1977 年版本的規定。

②專門載運特定貨物係指專門載運限定貨物。

另設主管機關滿意的附加滅火裝置。不應使用普通蛋白泡沫。

3.14.3 用於輸送泡沫的裝置應能把泡沫輸送到整個液貨艙甲板區域，並且能把泡沫送入假定甲板已經破裂的任何液貨艙內。

3.14.4 對甲板泡沫系統應能簡便、迅速地進行操作，該系統的主控制站應設在液貨區域以外的適當位置，並應鄰近起居處所，以便當被保護區域發生火災時易於接近並對其進行操作。

3.14.5 泡沫液的供給速率應不小於下列規定中的最大值：

（a）按液貨艙甲板區域的面積計算，每平方米為 21/min。液貨艙甲板區域的面積是指船舶的最大寬度乘以總的液貨艙處所的縱向長度；

（b）按具有最大水平截面積的單個液貨艙的水平截面積計算，每平方米為 20 1/min；

（c）按最大的泡沫炮所保護的區域面積計算此區域係完全位於該泡沫炮的前方，每平方米為 101/min，但總量應不小於 1250 1/min，對於 4,000 載重噸以下的船舶，其泡沫炮的最小排量應經主管機關同意。

3.14.6 應提供足夠的泡沫濃縮液，以保證在使用按 3.14.5（a）、（b）和（c）中規定的泡沫液供給速率時，使產生泡沫的時間至少能持續 30 min。

3.14.7 由固定泡沫系統提供泡沫炮和泡沫槍噴射的泡沫。每具泡沫炮的排量至少應為 3.14.5（a）或（b）所要求的泡沫液供給速率的 50%。對於任何泡沫炮的排量，按被該泡沫炮所保護的甲板區域面積

計算，此甲板區域係完全位於該泡沫炮的前方，每平方米至少為 10 l/min，但排量應不小於 1250 l/min。對於 4,000 載重噸以下的船舶，泡沫炮的最小排量應經主管機關同意。

3.14.8 從泡沫炮到其前部的被保護區域最遠端的距離應不大於該泡沫炮在靜空氣中射程的 75%。

3.14.9 在尾樓前端的左右兩舷或面向液貨艙區域的起居處所的左右兩舷，應各裝一具泡沫炮和連接泡沫槍的軟管接頭。

3.14.10 應提供能在消防作業中操作靈活的泡沫槍，同時，該泡沫槍應能覆蓋泡沫炮所保護的屏蔽區域。任何泡沫槍的排量應不小於 400 l/min，且在靜空氣中的射程應不小於 15 m。每艘船舶所配備的泡沫槍數量應不小於 4 具。泡沫總管出口的數量和佈置應能使至少從兩具泡沫槍噴出的泡沫直接射至液貨艙甲板區域的任何部位。

3.14.11 在泡沫總管上應設置截止閥，當消防總管成為甲板泡沫系統的組成部分時，在消防總管上也應設置截止閥。應將這些截止閥設在任何泡沫炮的前方，以隔斷總管的破損管段。

3.14.12 按所需輸出量使用甲板泡沫系統時，應能同時按所需壓力從消防總管噴射出最低要求數量的水柱。

3.14.13 應設有適用於所裝貨品的手提式滅火設備，並保持其良好可用狀態。

3.14.14 應將所有點火源排除出可能存在易燃蒸氣的處所。

3.15 對 1980 年 5 月 20 日以前建造的船舶的防火保護[①]

[①]MSC 在其第 42 屆會議上提請各主管機關在考慮了經第 9 次修正案修訂的

3.15.1 在 1980 年 5 月 20 日以前簽訂建造合同的船舶，或如無建造合同但在 1980 年 11 月 20 日以前安放龍骨或處於類似建造階段的船舶，或交船日期在 1984 年 5 月 20 日以前的船舶，均應符合本節要求。

3.15.2 對於本規則所適用的所有船舶，無論其噸位大小，均應符合 1974 年 SOLAS 公約的第 II-2/52 條。貨泵艙還應受到滅火系統的保護，該滅火系統應經主管機關根據擬載運的貨物進行認可。[①]

3.15.3 應將所有點火源排除出可能存在易燃蒸氣的處所。

3.15.4 應為所有擬載運的貨品設置合適的滅火設備，並且這些設備應處於良好運轉狀態。

3.15.5 對於會產生易燃蒸氣的貨品，這些滅火設備應包含經主管機關根據擬載運的貨物進行認可的固定滅火系統。除非充分考慮到了靜電危險性，否則應避免使用 CO_2 和窒息性蒸氣系統。

F－人員保護

（除了另有說明外，F 部分提及的 SOLAS 條文係指 1974 國際海上人命安全公約及之前經 MSC.99(73)決議通過的其修正案的第 II-2 章中的條文）

3.16 要求

3.16.1 為保護從事裝卸作業的船員，船上應有合適的防護設備，

本規則 3.13 和 3.14 條的要求下，儘可能實際並合理地考慮對 BCH 規則第 9 次修正案的 3.15 條涉及的船舶，改善液貨艙滅火器的佈置。特別是當不能用泡沫替代化學乾粉滅火劑時，主管機關應考慮增加化學乾粉的數量。

[①]不適用於在 1983 年 6 月 14 日以及以後建造的船舶。

包括大圍裙、有長袖的特別手套、適用的鞋襪、用抗化學性材料製成的連衣褲工作服以及貼肉護目鏡和/或面罩等。用於保護人身的衣服和設備應圍罩人體全身皮膚，使全部人體受到保護。

3.16.2 工作服和防護設備應保存在易於到達處的專用儲存櫃內。除了新的和沒有被用過的設備及經徹底洗淨後沒有用過的設備外，這些設備均不應存放在起居處所內。如果能將存放此類設備的儲藏室與生活處所（例如臥室、過道、餐廳、浴室等）作適當地隔離，則主管機關也可批准在起居處所內設置存放此類設備的儲藏室。

3.16.3 在可能對人員產生危險的所有作業中，應使用防護設備。

3.16.4 當船舶載運有毒貨物時，船上應有足夠數量的（但不小於3整套）安全設備，每套設備應保證使人員能進入充滿氣體的艙室並在艙室內工作至少為 20 min。此類設備應是經修正的 1974 年 SOLAS 公約第 II-2/17 條所要求的設備的補充。[①]

3.16.5 一套完整的安全設備應包括：

（a）自吸式空氣呼吸器 1 具（不使用儲存的氧氣）；

（b）防護服、長靴、手套和貼肉防護目鏡；

（c）配有腰帶的鋼芯的救生繩索；和

（d）防爆燈。

3.16.6 空氣供給

（a）所有船舶應攜帶下列裝置中的任何一種：

[①]該規定適用於在 1983 年 6 月 14 日及以後建造的船舶。

（i）為 3.16.4 要求的每套呼吸器具配備 1 套充滿空氣的備用空氣瓶；

（ii）1 台能供應所需純度的高壓空氣的特種空氣壓縮機；

（iii）1 台能對用於 3.16.4 所要求的呼吸器的足夠多的備用空氣瓶進行充注的充氣閥箱；或（iv）[①]超過經修正的 1974 SOLAS 公約第 II-2/17 條的要求時，對於船上每具呼吸器配備的充滿空氣的備用空氣瓶，其總容量至少應達 6,000 l 的自由空氣。

（b）對於任何船舶而言，若對其貨泵艙載運的貨物在第 VI 章表中的 m 欄裏有 4.13.2 表示，或要求貨物配備有毒蒸氣探測設備但又未配備時，該船應具備下列設備中的任何一種：

（i）連接泵艙的低壓管系，該管系帶有軟管接頭適合 3.16.4 所要求的呼吸器使用。該系統應通過減壓裝置將足夠量的高壓空氣降壓，供 2 個人在氣體危險處所內至少工作 1 h 而不需使用呼吸器的氣瓶。應配備裝置，使特種空氣壓縮機能對固定空氣瓶再充氣；或

（ii）等量的備用瓶裝空氣，以替代低壓空氣管。

3.16.7 應至少有 1 套符合 3.16.5 要求的安全設備存放在貨泵艙附近易到達處且具有明顯標誌的合適儲藏櫃內，其他幾套安全設備也應存放在合適的、有明顯標誌的和易於到達的處所。

3.16.8 承擔相應職責的船員應對壓縮空氣設備進行檢查，至少為每月 1 次。專業人員應對該設備進行檢查和試驗，至少為每年 1 次。

3.16.9 適合於從貨泵艙等處所抬起受傷人員的擔架應放置在易於

[①]該規定適用於在 1983 年 6 月 14 日及以後建造的船舶。

到達的位置。

3.16.10 對於擬載運第 VI 章中最低要求一覽表 n 欄內有“4.17”標示的貨物的船舶，應為船上每個人員配備在應急逃生時使用的合適的呼吸防毒面具和眼睛防護設備，並應符合下列要求：

（a）不能使用過濾式的呼吸防毒面具；

（b）自給式呼吸器一般應具有至少為 15 min 的持續工作時間的能力；

（c）不得將應急逃生防毒面具用於消防或裝卸貨物的目的，並應對其作出有效的標誌。

3.16.11 應根據國際海事組織制定的指南 1，在船上設有醫療急救設備，包括氧氣復蘇設備和供所載貨物用的解毒劑。[①]

3.16.12 在甲板上方便的地方，應設置有合適標誌的能消除污染的淋浴和眼沖洗設備。這些設備應在所有環境條件下均能使用。

G－液艙充注

3.17 一般要求

在環境溫度下載運液體貨物的液貨艙，應充分考慮到所裝貨物可能達到的最高溫度，裝載時應避免在航行期間該液貨艙被液體漲滿。

第 IV 章　特殊要求

[①] 參見《危險貨物事故醫療急救指南》（MFAG），該指南建議了如何根據症狀救治傷員，並建議了適合救治傷員的設備和解毒劑。

4.1 二硫化碳

二硫化碳可根據以下要求的水墊或適當的惰性氣體氣墊之下載運。

在水墊下載運

4.1.1 在裝載、卸載和運輸期間，應對液貨艙採取措施以保持艙內有一層水墊。此外，在運輸期間，液貨艙液面以上的空間應保持有一層惰性氣體的氣墊。

4.1.2 所有開口應位於甲板以上的液貨艙頂部。

4.1.3 裝載管路的端部應接近液貨艙底部。

4.1.4 應備有標準的空檔間隙測量孔，以便用於應急測量。

4.1.5 貨物管路和透氣管路應獨立於其他貨物的管路和透氣管路。

4.1.6 可以用泵卸貨，但此種泵應為深井泵或液壓驅動的潛液泵。深井泵的驅動裝置不應產生能點燃二硫化碳的點火源，並且不得採用其溫度可能超過 80ºC 的設備。

4.1.7 如果採用卸貨泵，則應把它放入一個從艙頂伸到接近艙底的圓柱形圍阱。在打算把泵取出之前，圍阱內應形成一層水墊，除非能證明該液貨艙已無危險氣體。

4.1.8 如果貨物系統是按預計壓力和溫度進行設計的，則可用水或隋性氣體置換進行卸貨。

4.1.9 安全釋放閥應採用不鏽鋼製造。

4.1.10 由於二硫化碳的低着火溫度，需用較小的間隙阻止其火焰傳播，因而只允許在 10.2.3 所述危險位置設置本質安全型系統和電路。

在適當的惰性氣體的氣墊下載運

4.1.11 二硫化碳應裝載於設計壓力不小於 0.6 bar（表壓力）的獨立液貨艙中。

4.1.12 所有開口都應位於甲板以上的液貨艙頂部。

4.1.13 用於圍護系統的墊圈應使用不會與二硫化碳產生反應或溶解於二硫化碳的材料。

4.1.14 貨物圍護系統，包括蒸氣管路不允許使用螺紋連接。

4.1.15 裝載之前應在液貨艙內注入適當的惰性氣體直到氧氣體積為 2%或以下。裝載、運輸、卸載過程中應使用適當的惰性氣體自動保持液貨艙的正壓力。系統正壓力應保持在 0.1 和 0.2 bar（表壓力）之間，且應能夠遙控監測並裝有過壓/欠壓報警裝置。

4.1.16 裝有二硫化碳的獨立液貨艙周圍的貨艙處所，應注入適當的惰性氣體直至氧氣體積為 2%或以下。整個營運期間應有監控和保持這種條件的措施，並可以取樣檢查這些處所的二硫化碳蒸氣。

4.1.17 裝載、運輸和卸載二硫化碳應防止其向外泄漏。如二硫化碳在裝載時回收到岸上或在卸載時回收到船上，則蒸氣回流系統應獨立於所有其他圍護系統。

4.1.18 只能使用浸沒的深井泵或通過適當的惰性氣體換置卸載二硫化碳。浸沒的深井泵應有在作業時防止熱量積聚的設施。該泵還應

在泵殼上安裝溫度傳感器，且在貨物控制室裝有溫度遙控讀數器和報警器，報警器應設定為 80°C。此外，泵還應設有自動關閉裝置，用以卸載中如液貨艙壓力低於大氣壓力時自動關閉。

4.1.19 液貨艙、貨泵或管路裏裝有二硫化碳時不允許空氣進入這些系統。

4.1.20 裝載或卸載二硫化碳期間不允許進行其他貨物裝卸、液貨艙清洗或壓載。

4.1.21 應設置具有足夠能量的水霧滅火系統，該水霧滅火系統應能有效地覆蓋設有裝載支管的周圍區域、露天甲板上與貨品裝卸有關的管路和液貨艙頂部氣室。管路和噴嘴的佈置應能使受保護的全部區域都得到均勻噴灑的水霧（噴灑率 10 l/m^2/min）。遙控手動操作裝置應設置在貨物區域外鄰近居住處所的合適位置，以便在受保護區域發生火災時能遙控啟動水霧系統的供水泵和遙控操作該系統中通常關閉的任何閥門。噴水系統進行就地和遙控手動操作，而且其佈置應確保能把任何泄漏的貨物沖洗掉。此外，在大氣溫度許可時，應將供水軟管與壓力噴嘴連接，以便在裝卸作業期間隨時即可使用。

4.1.22 在基準溫度（R）下，任何液貨艙可能裝載的貨物量均不得超過液貨艙容積的 98%。

4.1.23 液貨艙能裝載貨物的最大容積（VL）應按下式進行計算：

$$V_L = 0.98V\frac{\rho_R}{\rho_L}$$

式中：

V=液貨艙的容積；

ρ_R=基準溫度（R）時貨物的相對密度；

ρ_L=裝載溫度時貨物的相對密度；

R=基準溫度，即係指貨物蒸氣壓力與壓力釋放閥的設定壓力值相等時的溫度。

4.1.24 對於每一液貨艙在可適用的每一裝載溫度和可適用的最大基準溫度時的最大充裝極限，應在主管機關認可的表格上予以標明。該表格的副本應由船長永久保存在船上。

4.1.25 距液貨艙開口、氣體或蒸氣出口、貨物管法蘭或適於裝載二硫化碳的液貨艙貨物閥門 3 m 範圍內的開敞甲板區域，或開敞甲板上的半圍蔽處所，應符合 17 章第“i”欄所列關於二硫化碳的電器設備的要求。並且在此特定區域內的其他如蒸氣管道等熱源的表面溫度不可超過 80°C。

4.1.26 應設有測量液面上部的空間和進行貨物取樣的裝置，此設施無需打開液貨艙或不干擾惰性氣體適當的正壓氣層。

4.1.27 只有按照主管機關認可的貨物裝卸計劃才可運輸貨物。貨物裝卸計劃中應標明整個貨物管系；船上應保存 1 份經認可的貨物裝卸計劃的副本；在簽發“散裝運輸危險化學品適裝證書”時，還應依據經認可的裝卸計劃。

4.2 二乙醚

4.2.1 船舶航行期間液貨艙周圍的留空處所均應進行自然通風，除非該處所已被惰化。如果設有機械通風系統，所有鼓風機應為無火花型結構。不得將機械通風設備置於液貨艙周圍的留空處所內。

4.2.2 重力液貨艙的壓力釋放閥的調定值不得小於 0.2 kPa/cm^2。

4.2.3 如果按預計壓力設計貨物系統，則惰性氣體置換可用作從壓力艙卸貨。

4.2.4 在貨艙鄰近的圍蔽處所內，除了認可的固定照明用具外，不許安裝電氣設備。固定照明用具應經認可適用於二乙醚蒸氣。在露天甲板安裝電氣設備應符合本規則的要求。

4.2.5 為防止發生火災，在貨物區域內應採取措施，以避免產生任何點火源和/或熱源。

4.2.6 可以用泵卸貨，但這種泵的設計型式應能避免對泵軸的密封壓蓋產生液體壓力，或採用潛沒泵，並應適用於這種貨物。

4.2.7 液貨艙在裝載、卸載和運輸期間，應採取措施以使艙內保持惰性氣體氣墊。

4.3 硫（熔融的）

4.3.1 液貨艙通風

（a）在一切載運情況下，應對液貨艙通風使全部貨艙蒸氣空間內保持 H_2S（硫化氫）的濃度低於它的爆炸下限的一半，即體積在 1.85% 以下。

（b）如使用機械通風系統來使液貨艙內氣體保持低濃度，應裝有一個報警系統，當機械通風失效時報警。

（c）通風系統的設計和佈置，應能排除硫在該系統內的積存。

4.3.2 留空處所

（a）在鄰近液貨艙的留空處所的開口，其設計和裝置應能防止水、硫或貨物蒸氣進入。

（b）應裝有允許對留空處所內的蒸氣進行取樣和分析的接頭。

4.3.3 應具備貨物溫度控制裝置，以保證硫的溫度不超過 155°C。

4.4 丙酮氰醇及乳腈溶液（80%或低於 80%）

丙酮氰醇及乳腈溶液必須用無機酸加以穩定以防分解。製造廠應提供穩定證書，並列明：

（a）所加穩定劑的名稱和數量；

（b）穩定劑加入的日期及有效期；

（c）保證穩定劑有效期的溫度界限；

（d）航程超過穩定劑有效期時應採取的措施。

4.5 磷（黃磷或白磷）

4.5.1 磷在進行裝載、運輸和卸載的任何時候都必須使其處於最小深度為 760 mm 的水層之下。在卸載作業期間，應配備裝置用以確保水能佔據已卸去的磷的體積。從裝載磷的液貨艙排出的水，只能輸回到岸上的裝置。

4.5.2 應按設計的裝載工況，並考慮磷所處的深度、磷的相對比重和對磷的裝卸方法，對液貨艙進行設計並試驗至能至少高出該液貨艙艙頂 2.4 m 的水壓頭。

4.5.3 在設計液貨艙時，應考慮儘量減少液體磷與其水層之間的交界面積。

4.5.4 在水層液面上至少應保持1%艙容的空檔間隙。在液面空檔間隙內應充以惰性氣體，或用兩個具有不同高度通風帽的豎管進行自然通風，但豎管高出甲板至少為6 m，高出泵室頂至少為2 m。

4.5.5 液貨艙的所有開口都應位於艙的頂部，用於製造開口的附件和連接件的材料均應為能抵禦五氧化二磷的材料。

4.5.6 應在溫度不超過60ºC的條件下裝載磷。

4.5.7 液貨艙加熱裝置應位於液貨艙外，同時，應採用合適的溫度控制方法，以確保磷的溫度不超過60ºC。應裝設高溫報警器。

4.5.8 在所有液貨艙周圍的留空處所內，均應設有經主管機關認可的水淋系統。當發生磷逸出時，該系統能自動啟動。

4.5.9 應對4.5.8所述留空處所配備有效的機械通風裝置，若遇緊急情況應能迅速將其關閉。

4.5.10 裝卸磷作業應由船上中央系統予以控制，該系統除有高位報警器外，還應能保證液貨艙不會溢流，而且遇緊急情況時，能在船上或岸上對該系統進行操作，以迅速停止裝卸作業。

4.5.11 在貨物駁運中，應將甲板上的水龍帶與水源連接，並保持在整個作業中有水流通，以保證可以立刻用水沖洗任何漏逸的磷。

4.5.12 船、岸裝卸管路接頭應經主管機關認可。

4.6 內燃機燃油（含有烷基鉛）的防爆化合物

4.6.1 用於這種貨物的液貨艙，不能用來運輸任何其他貨物，但用於製造內燃機燃油含有烷基鉛的防爆化合物的貨品除外。

4.6.2 如果貨泵艙按照 4.13.2 的規定位於甲板平面上，則通風裝置應符合 4.13.1 的要求。

4.6.3 用於運輸這種貨物的液貨艙，除經主管機關認可外，不准許進入。

4.6.4 在允許人員進入貨泵艙或液貨艙周圍的留空處所之前，應進行空氣分析以測定含鉛量是否合格。

4.7 環氧丙烷及環氧乙烷/環氧丙烷混合物，而環氧乙烷的含量不超過 30%（按重量）

4.7.1 按本節規定運輸的貨品，不應含有乙炔。

4.7.2 （a）除非液貨艙已適當清洗，凡上三個航次中有一航次已裝過已知能產生催化聚合作用的貨物的液貨艙，不得裝運環氧丙烷或環氧乙烷/環氧丙烷混合物。已知能產生催化聚合作用的貨品如下：

（i）無機酸（如硫酸、鹽酸、硝酸）；

（ii）羧酸和酐（如甲酸、醋酸）；

（iii）鹵化羧酸（如氯醋酸）；

（iv）磺酸（如苯磺酸）；

（v）苛性鹼（如氫氧化鈉、氫氧化鉀）；

（vi）氨及氨溶液；

（vii）胺及胺溶液；

（viii）氧化物質。

（b）裝載前，應對液貨艙進行徹底和有效的清洗，以便清除液貨艙及其管路內前一次所裝貨物的所有痕跡，但前一次所裝貨物是環氧丙烷或環氧乙烷/環氧丙烷混合物者除外。在用非不鏽鋼建造的鋼質液貨艙內裝載氨時，應予特別注意。

（c）在任何情況下，應對液貨艙及其相關管路清洗程序的有效性進行試驗或檢查，以確定其不存在酸或鹼的物質痕跡，因為這些殘留痕跡在與環氧丙烷或環氧乙烷/環氧丙烷混合物接觸時，可能會產生危險情況。

（d）每當在液貨艙首次裝載環氧丙烷或環氧乙烷/環氧丙烷混合物之前，應進入液貨艙檢查，查明有否大量的鐵鏽沉澱物和明顯的結構缺陷。當液貨艙連續載運這些貨品時，則上述檢查的間隔期應不超過兩年。

（e）裝運環氧丙烷或環氧乙烷/環氧丙烷混合物的液貨艙應為鋼或不鏽鋼結構。

（f)對裝運環氧丙烷或環氧乙烷/環氧丙烷混合物的液貨艙及其附屬管路系統進行徹底清洗或惰氣驅氣以後，該液貨艙仍可裝運其他貨物。

4.7.3 （a）對於所有閥門、法蘭、附件和附屬設備，其型式必須適用於環氧丙烷或環氧乙烷/環氧丙烷混合物，並應採用鋼或不鏽鋼或主管機關所接受其他材料。所有材料的化學成份，應在製造之前提交主管機關認可。對於閥門的閥盤或閥盤面、閥座和其他摩損部分，應採用含鉻不少於 11%的不鏽鋼製造。

（b）對於所有墊圈，應採用不會與環氧丙烷或環氧乙烷/環氧丙

烷混合物起反應，不會溶解於這些貨品，也不會降低這些貨品的自燃溫度、耐火以及具有足夠力學性能的材料製造。墊圈接觸貨物的一面應為聚四氟乙烯（PTFE）或按其惰性具有同樣安全程度的材料。主管機關可以接受具有聚四氟乙烯填料或類似氟化聚合物作為填充物的螺旋纏繞不鏽鋼製件。

（c）如果使用絕緣和填料，其材料應不會與環氧丙烷或環氧乙烷/環氧丙烷混合物起反應、不會溶解於這些貨品以及不會降低這些貨品的自燃溫度。

（d）下列材料一般不宜用作裝載環氧丙烷或環氧乙烷/環氧丙烷混合物的圍護系統中的墊圈、填料和類似用途，若要使用，須在主管機關批准之前對其進行試驗：

（i）氯丁橡膠或天然橡膠（如其與這些貨品接觸時）；

（ii）石棉或與石棉混合使用的黏結料；

（iii）含有鎂氧化物的材料，如礦物棉。

4.7.4 在貨物液體和蒸氣的管路中，禁止使用螺紋連接。

4.7.5 應將裝載和卸載的管路延伸至距液貨艙底部或任何聚液井底部 100 mm 之內。

4.7.6 （a）用於載有環氧丙烷或環氧乙烷/環氧丙烷混合物的液貨艙的圍護系統應設有由閥門控制的蒸氣回路接頭。

（b）在裝卸環氧丙烷或環氧乙烷/環氧丙烷混合物時，不能使液貨艙與大氣相通；在對液貨艙進行裝載期間，如需將蒸氣輸回到岸上接收設備時，則應將連接用於該貨品的圍護系統的蒸氣回路系統與所

有其他圍護系統的蒸氣回路系統分開。

（c）液貨艙在進行卸貨作業期間，其壓力必須保持在 0.7 kPa/cm^2 的表壓力。

4.7.7 在對液貨艙進行卸貨時，只能使用深井泵、液壓操作的潛沒泵或惰性氣體置換法。在對每一貨泵進行佈置時，應確保在泵的排出管路被關閉或阻塞時不致於使貨品產生很大的熱量。

4.7.8 對於載運環氧丙烷或環氧乙烷/環氧丙烷混合物的液貨艙，其透氣管應獨立於載運其他貨品的液貨艙的透氣管。應配備當液貨艙無通向大氣的開口時能進行取樣的設施。

4.7.9 在用於裝卸環氧丙烷或環氧乙烷/環氧丙烷混合物的貨物軟管上應標明"駁運環氧烷專用"。

4.7.10 與載運環氧丙烷的整體重力液貨艙相鄰的液貨艙、留空處所和其他圍蔽處所均應裝載相容的貨物（4.7.2 中規定的貨物是作為不相容貨物的例子）或被所充的合適惰性氣體惰化。應對設有獨立液貨艙的任何貨艙處所進行惰化。應在被惰化的處所和液貨艙中監測環氧丙烷和氧氣。這些處所內的含氧量均應保持在 2%以下。便攜式取樣設備應符合要求。

4.7.11 當貨泵或管系內存有環氧丙烷或環氧乙烷/環氧丙烷混合物時，在任何情況下均應禁止空氣進入該貨泵或管系。

4.7.12 在拆卸岸上管路之前，對於液體和蒸氣管路內的壓力，應通過設在裝貨端管上的閥門予以釋放。不准將從這些管路中流出的液體和蒸氣排入大氣。

4.7.13 可以在壓力液貨艙或獨立重力液貨艙或整體重力液貨艙內載運環氧丙烷。對於環氧乙烷/環氧丙烷混合物，應在獨立重力液貨艙或壓力液貨艙內載運。設計液貨艙時應考慮能使其承受在對貨物的裝載、運輸和卸載中預計會遇到的最大壓力。

4.7.14 （a）用於載運環氧丙烷且其設計壓力小於 0.5 kPa/cm^2（表壓力）的液貨艙及用於載運環氧乙烷/環氧丙烷混合物且其設計壓力小 1.2 kPa/cm^2（表壓力）的液貨艙均應具有冷卻系統，以保持貨物的溫度低於基準溫度（見 1.4.15）。

（b）對於營運於有限航區或從事有限時間航行的船舶，主管機關可免除對設計壓力小於 0.6 kPa/cm^2（表壓力）的液貨艙的製冷要求，但在此種情況下，應考慮對該液貨艙採取絕熱措施。在適裝證書的載運條件中應標明該船允許營運的航區和年限。

4.7.15

（a）任何冷卻系統均應能保持艙內液體溫度低於在圍護壓力下液體的沸點溫度，至少應配備能根據液貨艙內的溫度變化進行自動調節的兩套完整的冷卻裝置；對每套裝置應配齊正常作業時所必需的輔助設備，還應能對其控制系統進行人工操作，應設有報警器，用於指出溫度控制的故障；每個冷卻系統應能足以保持液體貨物的溫度低於該系統的基準溫度（見 1.4.15）。

（b）另一種方案是設 3 套冷卻裝置，其中任何 2 套裝置應能足以保持液體溫度低於基準溫度（見 1.4.15）。

（c）當用單壁將冷卻介質與環氧丙烷或環氧乙烷/環氧丙烷混合物隔開時，該冷卻介質應為不會與這些貨品起反應的介質。

（d）環氧丙烷或環氧乙烷/環氧丙烷混合物禁止使用加壓冷卻系統。

4.7.16 壓力釋放閥的設定壓力應不小於 0.2 kPa/cm^2（表壓力），對於載運環氧丙烷的壓力液貨艙，其壓力釋放閥的設定值應不大於 7.0 kPa/cm^2（表壓力），而對於載運環氧乙烷/環氧丙烷混合物的壓力式液貨艙，其壓力釋放閥的設定值應不大於 5.3 kPa/cm^2（表壓力）。

4.7.17 （a）應將用於裝載環氧丙烷或環氧乙烷/環氧丙烷混合物的液貨艙的管系與所有其他液艙（包括空液艙）的管系隔離（見 1.4.13 的定義），若用於液貨艙的裝載管系並非獨立的（見 1.4.14 的定義），則可拆去短管、閥或其他管段，並在這些位置上安裝盲板法蘭，以達到所需的管系分隔；該所需的分隔適用於所有液體和蒸氣管系、液體和蒸氣通風管路以及任何其他可能的連接管路，例如公用惰性氣體供給管路等。

（b）只有按照主管機關認可的貨物裝卸計劃才可運輸環氧丙烷或環氧乙烷/環氧丙烷混合物。對於所擬定的每種裝載佈置，應在單獨的貨物裝卸計劃中予以標明；在貨物裝卸計劃中應標明整個貨物管系和需要符合上述管系分隔要求時的盲板法蘭的安裝位置；船上應保存 1 份經認可的貨物裝卸計劃的副本；在簽發“散裝運輸危險化學品適裝證書”時，還應依據經認可的裝卸計劃。

（c）每當船舶在首次裝載環氧丙烷或環氧乙烷/環氧丙烷混合物之前以及在裝運過其他貨品後仍然轉為裝載這些貨品之前，均應從港口當局承認的負責人員處獲得能證明該船業已達到所需管系分隔的證書，並將其存於船上，在盲板法蘭和管路法蘭的每個接頭處均應裝設金屬線，並由船上的負責人員對其鉛封，以保證盲板法蘭不被無意

拆移。

4.7.18

（a）在基準溫度下，任何液貨艙所能裝載的貨物量均不得超過液貨艙容積的 98%（見 1.4.15）。

（b）液貨艙能裝載貨物的最大容積（VL）應按下式進行計算：

$$V_L = 0.98V\frac{d_R}{d_L}$$

式中 V_L=液貨艙載運的最大容積；

V=液貨艙的容積；

d_R=貨物在基準溫度時的相對密度（見 1.4.15）；

d_L=裝載溫度和裝載壓力下貨物的相對密度。

（c）對於每一液貨艙在可適用的每一裝載溫度和可適用的最大基準溫度時的最大充裝極限，應在主管機關認可的表格上予以標明。該表格的副本應由船長永久保存在船上。

4.7.19 貨物應在合適的氮氣保護層之下載運。應裝有自動補充氮氣的系統，以便在由於環境條件或對製冷系統的不正確操作而致使貨品溫度下降時，能夠防止液貨艙的壓力不致低於 0.07 kPa/cm^2（表壓力）。船上應提供充足的氮氣，以便滿足自動壓力控制的需要。用於保護層的氮應為工業用純質的氮（其容積純度為 99.9%）。通過減壓閥連接液貨艙的一組氮氣瓶可滿足上述“自動”的要求。

4.7.20 在裝載前後均應對液貨艙的蒸氣空間進行測試，以保證其含氧量按容積計為 2%或以下。

4.7.21 應設置具有足夠能量的水霧滅火系統，該水霧滅火系統應能有效地覆蓋設有裝載支管的周圍區域以及露天甲板上的與貨品裝卸有關的管路和液貨艙的頂部。對管路和噴嘴的佈置應能保證 10 $l/m^2/min$ 的均勻噴灑率。應能對該水霧系統進行就地和遠距離的人工操作，而且應將其佈置成能把任何泄漏的貨物沖洗掉。遙控手動操作裝置應設置在貨物區域外鄰近居住處所的合適位置，以便在受保護區域發生火災時能遙控啟動水霧系統的供水泵和遙控操作該系統中通常關閉的任何閥門。噴水系統進行就地和遙控手動操作，而且其佈置應確保能把任何泄漏的貨物沖洗掉。此外，在大氣溫度許可時，應將供水軟管與壓力噴嘴連接，以便在裝卸作業期間隨時即可使用。

4.7.22 在貨物駁運時使用的每個貨物軟管接頭處，都應配備一個能控制關閉速率的遙控截止閥。

4.8 酸類

4.8.1 不得將船體外板用作裝載礦物酸的液貨艙的周界。

4.8.2 主管機關可以考慮關於採用抗腐蝕材料作為鋼質液貨艙和有關的管系襯裏的建議。襯裏的彈性應不低於其支承周界板的彈性。

4.8.3 除非液貨艙是完全採用抗腐蝕材料建造的，或者在液貨艙內裝有經認可的襯裏，否則在決定艙壁厚度時應考慮其受貨物腐蝕的影響。

4.8.4 在裝卸集管的連接法蘭處應設有可移動的防護罩，以防貨物噴出的危險；此外，還應設有溢流盤，以防貨物滴漏到甲板上。

4.8.5 由於在裝載這些酸類物質時會出現產生氫的危險，不允許在鄰近液貨艙的封閉處所內設有電氣設備或其他火源。

4.8.6 對於受本節要求約束的貨物，除應符合 2.6 的分隔要求外，尚須將其與燃油艙隔開。

4.8.7 應配備合適的儀器，以探測貨物是否漏逸到鄰近處所。

4.8.8 貨泵艙的艙底泵裝置及排放裝置均應為由抗腐蝕材料製成的。

4.9 有毒貨品

4.9.1 液貨艙透氣系統排放口的位置應符合下列規定：

（a）在露天甲板以上的高度為 B/3 或 6 m，取大者，對於甲板液貨艙，其高度為從通道步橋量起；

（b）如透氣管設在距步橋 6 m 範圍內，則其排放口的高度應為在前後步橋以上不小於 6 m；且

（c）與通向起居和服務處所的任何開口或空氣入口之間的距離應不小於 15 m；

（d）如適用時，透氣管的高度可減至距甲板或前後方向步橋以上 3 m，但在透氣管上應設置經主管機關認可的高速透氣閥，該閥應能將蒸氣和空氣的混合物以至少 30 m/s 的出口速度向上無阻擋地噴出。

4.9.2 液貨艙的透氣系統應配備能使其蒸氣回路與岸上裝置相連接的接頭。

4.9.3 對於此類貨品：

（a）不得在鄰接燃油艙的液貨艙內儲存；

（b）應具有獨立的管系；且

（c）應將液貨艙的透氣系統與裝載無毒貨品的液貨艙的透氣系統分開。

4.9.4 液貨艙壓力釋放閥的調定壓力的最小值應為 0.2 kPa/cm^2。但是，對於以前經認可的裝載有毒貨品的現有船舶，其液貨艙壓力釋放閥的調定壓力的最小值應儘量接近 0.2 kPa/cm^2，並考慮到液貨艙的尺度。

4.10 由添加劑保護的貨物

4.10.1 對於在第 VI 章表中的 m 欄內列出的某些貨物，按其化學構成的性質，在某些溫度、暴露於空氣或與催化劑接觸的條件下，可能會發生聚合、分解、氧化或其他的化學變化。通過在液體貨物中加入少量化學添加劑或通過控制液貨艙的環境，可緩和這種趨向。

4.10.2 設計用於載運這些貨物的船舶時，應考慮排除液貨艙和貨物裝卸系統內的任何結構材料或污染物對貨物起催化作用或破壞抑制劑的可能性。

4.10.3 應注意對這些貨物進行有效保護，以在整個航行期間能防止貨物發生有害的化學變化。載運這種貨物的船舶應備有製造商提供的保護證書，並在航行期間將其保存在船上，該證書應註明下列事項：

.1 所用添加劑的名稱和數量；

.2 添加劑是否需依賴氧氣；

.3 將添加劑加入貨品的日期及添加劑的有效期；

.4 確保添加劑有效期的任何溫度界限；和

.5 航行期超過添加劑有效期時應採取的措施。

4.10.4 使用排除空氣作為防止貨物氧化的方法的船舶應符合 2.19.3 的要求。

4.10.5 含有依賴氧的添加劑的貨品在裝載時不需惰化。

4.10.6 設計透氣系統時應考慮該系統能消除由於化學聚合物增多而造成的阻塞，透氣設備的型式應符合能定期檢查其使用性能的要求。

4.10.7 通常以熔化狀態載運的貨物，其結晶或凝固可能會導致液貨艙所裝貨物中的部分抑制劑消失。隨後的重新熔化可能產生無抑制液體的積囊，同時還會出現聚合的危險。為防止這種情況，應保證貨物在任何時候和在液貨艙的任何部分都不會產生全部或局部的結晶或凝固。任何所需的加熱裝置應能保證不使液貨艙內任何部分的貨物被過分加熱至可能產生危險的聚合反應的程度。若蒸氣盤管溫度可能導致貨物被過分加熱時，應採用間接的低溫加熱系統。

4.11 在 37.8°C 時蒸氣壓力超過 1.033 kPa/cm^2 的貨物

4.11.1 除非液貨艙經特別設計能經受貨物的蒸氣壓力，否則應採取措施保持貨物的溫度在大氣壓力下低於其沸點溫度。

4.11.2 應設有能在裝載作業時把排出的氣體輸回岸上的管路接頭。

4.11.3 應對每個液貨艙均配備 1 隻壓力錶，用以指示貨物上面的蒸氣空間中的壓力。

4.11.4 如對貨物進行冷卻時，則應在每個液貨艙的頂部和底部設置溫度計。

4.12 構造材料

已刪除。

4.13 貨泵艙

4.13.1 如 3.1.2 所述的通風系統，應根據該處所的總容積具有至少每小時換氣 45 次的最低能力。通風系統的排氣導管距通向起居處所的開口、通風系統的進口、工作區域或其他類似處所至少應為 10 m，同時還應高出液貨艙甲板至少為 4 m。

4.13.2 應將貨泵設置在液貨艙內，或者貨泵艙應位於甲板平面上。應要求主管機關對低於甲板的貨泵艙給予特殊考慮。

4.14 溢流控制（選擇 1）

作為測量裝置要求的補充，本節規定適用於第 VI 章最低要求一覽表中的“m”欄內列有特定要求的貨物。

4.14.1 高位報警器：液貨艙應設置報警器，用來指示液貨艙裝載過滿的緊急危險。應採取措施在裝貨之前對該報警器進行試驗。

4.14.2 液貨艙溢流控制

（a）應設置一個能滿足如下要求的系統：

（i）該系統應是自動的、不依賴於人工介入或控制、並為主管機關所接受，以保證液貨艙在裝貨時不會溢流到甲板或舷外；

（ii)在液貨艙的正常裝載程序不能制止液位超過正常滿載狀態時，

該系統即應開始工作；

（iii）該系統應獨立於 4.14.1 所要求的高位報警器操作。

（b）如該系統包含能防止液貨艙溢流的自動關閉閥，則該閥應按下述要求操作：

（i）總的關閉時間，以秒計，即從開始發出信號到完全關閉閥門的時間間隔，不應超過：

$$\frac{3600U}{LR}$$

式中：

U=在發出液位信號時液貨艙內液面以上空間的容積，m^3；

LR=船岸雙方協議的最大裝載率（m^3/h），見（ii）（3）。

（ii）

（1）船上應保存關於閥門特性的資料，包括關閉次數，應能對該次數進行驗證和疊加。

（2）自動閥關閉時不應振動。

（3）裝載率（LR）的計算應將閥門關閉所產生的壓力波動限制在可接受程度，並考慮裝貨軟管或貨臂及船岸的管路系統。

（4）在誤操作或系統動力故障情況下，該閥門應能“安全失效”。除非該系統包含的蓄電源足以操作該系統所有閥門至少兩次，或者警報顯示為系統故障或主電源故障，否則這一般表明該閥門不能達到關閉位置。安全失效的關閉時間不應小於正常關閉時間。

（c）當船舶設置符合本節要求的速閉閥進行本節不適用的貨品的作業時，經主管機關同意，可採取措施使閥門與系統隔離。這種措施可以是完全拆除閥門或安裝帶有可拆裝管路的曲管或盲板組成的轉換系統。本節描述的任何自動系統的故障及相應的系統恢復應記入船舶操作日誌中。

4.14 溢流控制（選擇 2）

作為測量裝置要求的補充，本節規定適用於第 VI 章最低要求一覽表中的“m”欄內列有特定要求的貨物。

4.14.1 高位報警器：在液貨艙內應設置能示明液貨艙內液位到達正常滿載時的聽覺和視覺高位報警器。該高位報警系統應獨立於 3.9 和 4.14.2 所要求設置的設備。

4.14.2 液貨艙溢流控制：應設置一個能滿足如下要求的系統：

（a）在液貨艙的正常裝載程序不能制止液位超過正常滿載狀態時，該系統即應開始工作；

（b）該系統應能向船上操作人員發出聽覺和視覺報警；

（c）如有必要，該系統應提供相繼關閉岸泵和/或閥門及關閉船上閥門的一致信號。對於信號以及泵和閥門的關閉，可由操作人員予以控制。在任何情況下，裝載率 LR（m^3/h）不應超過：

$$\frac{3600U}{t}$$

式中：U 係在發出液位信號時液貨艙內液面以上空間的容積，m^3；

t 係從發出信號到貨物完全停止注入液貨艙所需的時間。此時

間應為下述每一相繼動作所需時間的總和：

操作人員對信號的響應；

停泵；和

關閉閥門。

當用於安全裝載的任何重要系統不運行時，應能立即停止所有裝載作業。

4.14.3 在裝載作業前應能對液位報警器進行試驗。當用於安全裝載的任何重要系統出現動力故障時，應能向有關操作人員報警。

4.15 貨物圍護系統

已刪除。

4.16 化學品貨物的樣品

4.16.1 須保存在船上的貨物樣品應儲存在位於貨物區域內的指定處所，或在特殊情況下，可將其存放在主管機關認可的其他處所。

4.16.2 儲存處所應符合下列要求：

（a）應具有分隔的格柵，以防這些瓶子在海上航行時移動；

（b）其材料應能完全抵禦擬儲存的各種液體；

（c）應配備合適的通風裝置。

4.16.3 相互之間起危險反應的樣品不得緊靠在一起儲存。

4.16.4 在船上保留樣品的時間不應超過所需的時間。

4.17 呼吸防毒面具和眼睛防護設備

對於第 VI 章最低要求一覽表“m”欄中所列的參照本節的內容，3.16.10 條規定應適用。

4.18 不得暴露於過熱狀態下的貨物

4.18.1 當液貨艙或附屬管路內的貨物在受到局部的過分加熱後，若可能產生危險的反應，諸如聚合、分解、熱不穩定性或放出氣體等，則應將這些貨物與溫度高於其初始反應溫度的其他貨品適當分開裝運。

4.18.2 應對載運上述貨物的液貨艙內的加熱盤管予以盲斷或採用等效措施，以保障貨品的安全。

4.18.3 未經絕緣的甲板液貨艙不得載運熱過敏貨品。

4.18.4 為了避免溫度升高，該貨物不得裝運在甲板液貨艙內。

4.19 93%或以下的硝酸銨溶液

4.19.1 硝酸銨溶液至少應含有質量百分比濃度為 7%的水。對該溶液在以 10 份水與 1 份溶液（按重量）進行稀釋時，酸度（PH）應在 5.0 和 7.0 之間。該溶液中所含的氯化物離子和鐵離子均不應超過 10 ppm，並不得含有其他雜質。

4.19.2 用於裝載硝酸銨溶液的液貨艙和設備應獨立於裝載其他貨物或易燃貨品的液貨艙和設備。不得使用那些在營運中或在發生故障時會將可燃物品（如潤滑油）釋放至貨物中的設備。液貨艙不得用海水壓載。

4.19.3 除主管機關明確表示同意外，不得在以前裝過其他貨物的液貨艙內裝運硝酸銨溶液，但能將液貨艙及其設備清洗至主管機關滿

意者除外。

4.19.4 液貨艙加熱系統中熱交換介質的溫度不能超過 160ºC。在該加熱系統中應設有控制裝置，使散裝貨物的平均溫度保持在 140ºC。報警裝置應設定在 145ºC 和 150ºC 時高溫報警及在 125ºC 時低溫報警。當熱交換介質的溫度超過 160ºC 時，也應報警。溫度報警裝置及控制器應位於駕駛室內。

4.19.5 如果散裝貨物的平均溫度達到145ºC，則應取出貨物試樣，並以 10 份蒸餾水或軟水對 1 份貨物試樣（按重量）進行稀釋，應用具有精確測量範圍的試紙或試棒確定其酸度。應每隔 24 h 測量一次酸度，一旦酸度（PH）低於 4.2，則應將氨氣注入貨物，直到酸度（PH）達到 5.0 為止。

4.19.6 應設有能將氨氣注入貨物的固定裝置。該裝置的控制器應位於駕駛室內。為此對船上的每 1000 t 硝酸銨溶液應備有 300 kg 氨。

4.19.7 貨泵應為離心式深井泵或水封閉離心泵。

4.19.8 透氣管上應設有經認可的風雨帽蓋，以防阻塞。此種帽蓋應便於檢查和清洗。

4.19.9 凡是與硝酸銨溶液接觸過的液貨艙、管路和設備，只有在徹底清除其所有硝酸銨的痕跡後，方可進行熱作業。

4.19.10 作為裝載此種貨品的條件，1983 年 6 月 14 日以後建造或改建的船舶應完全符合本規則的要求。

4.20 過氧化氫溶液

濃度為 60%以上但不超過 70%的過氧化氫溶液（按重量）。

4.20.1 只能用專用船載運濃度為60%以上但不超過70%的過氧化氫溶液，且該船不得載運其他貨物。

4.20.2 液貨艙及其相關設備應採用純鋁（99.5%）或全不鏽鋼（如304、304L、316、316L、316Ti）製造液貨艙及其設備，並按認可的程序對其進行鈍化。甲板上的管路不得使用鋁材料。用於製造圍護系統的所有非金屬材料應不能與過氧化氫起化學反應，也不能有助於過氧化氫的分解。

4.20.3 泵艙不得用於貨物駁運作業。

4.20.4 液貨艙與燃油艙或裝有易燃或可燃材料的其他處所之間應用隔離艙加以分隔。

4.20.5 對擬載運過氧化氫的液貨艙不得用海水進行壓載。

4.20.6 在液貨艙的頂部和底部應設置感溫器。駕駛室內應設有溫度遙測讀出器及連續監測器。如液貨艙內溫度超過35ºC時，應在駕駛室內發出聽覺和視覺報警。

4.20.7 在與液貨艙鄰接的留空處所內應設有固定式氧氣監測器（或氣體取樣管路），以探測是否有貨物泄漏到這些處所內。駕駛室內也應設有遙測讀出器，連續監測器（如果採用氣體取樣管路，則可同意採用間歇取樣）以及類似用於感溫器的聽覺和視覺報警裝置。如在這些留空處所內氧濃度超過30%容積濃度時，應發出聽覺和視覺報警。應配備兩個可攜式氧氣監測器作為備用裝置。

4.20.8 為防止發生無法控制的分解，應設置貨物投棄系統，以便將分解的貨物排放到船外。如果在5 h內每小時貨物溫升率超過2ºC/h，或者艙內溫度超過40ºC時，應將該貨物投棄。

4.20.9 液貨艙的透氣系統應具有用於正常控制透氣的壓力/真空釋放閥和用於應急透氣的安全膜或類似裝置，以防因無法控制的貨物分解導致液貨艙壓力迅速升高。應根據液貨艙的設計壓力、液貨艙的尺寸和預計的貨物分解率確定安全膜的尺寸。

4.20.10 應設置固定式噴水系統，以便稀釋並洗掉溢漏在甲板上的任何濃縮的過氧化氫溶液。水霧所覆蓋的區域應包括支管/軟管接頭和用於載運過氧化氫溶液的專用液貨艙的頂部。最小噴灑率應符合下列標準：

（a）應在貨品溢漏後的 5 min 內將其原來的濃度稀釋到 35%（按質量計）；

（b）對於溢漏率和估計的溢漏量，應根據預計的最大裝卸率、液貨艙溢流或管路/軟管破損時停止貨物流動所需的時間以及從貨物控制站或駕駛室啟動稀釋水噴灑裝置所需的時間予以確定。

4.20.11 過氧化氫應進行穩定處理，以防分解。製造廠應提供穩定證書，載明：

（a）所加穩定劑的名稱和數量；

（b）穩定劑加入日期與有效期；

（c）確保穩定劑有效期的溫度界限；

（d）航程超過穩定劑有效期時應採取的措施。

4.20.12 只有那些在 25°C 時具有每年 1%的最大分解率的過氧化氫溶液才准於載運。應將託運人用以說明貨品符合這一標準的證書送交船長並將其保存在船上。製造商應派技術代表上船監察駁運操作，

所派代表應具有試驗過氧化物穩定性的能力。技術代表應向船長證明，貨物是在穩定狀況下裝載的。

4.20.13 對涉及貨物裝卸作業的每一位船員均應配備能抵禦過氧化氫溶液的防護衣。防護服應包括不易燃的連衣褲工作服、合適的手套、靴子和眼睛防護裝置。

4.20.14 作為裝載此種貨品的條件，1983 年 6 月 14 日以後建造或改建的船舶應完全符合本規則的要求。

濃度為 8%以上但不超過 60%的過氧化氫溶液（按重量）。

4.20.15 不得將船體外板作為裝載本品的液貨艙的任何周界。

4.20.16 在載運過氧化氫前，先應徹底和有效地清除液貨艙中以前所裝貨物的痕跡及貨物蒸氣或壓載水。對液貨艙的檢驗、清洗、鈍化和裝載的程序應按海安會通函 MSC/Circ.394 的要求。船上應有一份表明該通函要求的程序已予以遵守的證書。對於國內短途航行的船舶，主管機關可免除其鈍化要求。為確保過氧化氫的安全載運，還應特別注意下列要求。

（a）載運過氧化氫時不得同時裝運其他貨物；

（b）裝運過過氧化氫的液貨艙在按海安會通函 MSC/Circ.394 規定的程序對其進行清洗後可用於裝運其他貨物；

（c）設計液貨艙時應考慮儘量減少艙內構件、免設艙底排放系統、卸空後艙內不得留有液貨，以及易於對艙內進行外觀檢查。

4.20.17 液貨艙及其設備應採用純鋁(99.5%)或全不鏽鋼(如 304、304L、316、316L、316Ti）製造。不得用鋁製造甲板上的管路。用於

製造圍護系統的所有非金屬材料應不能與過氧化氫起化學反應，也不能有助於過氧化氫的分解。

4.20.18 液貨艙與燃油艙或含有與過氧化氫不相容材料的其他處所之間應用隔離艙加以分隔。

4.20.19 在液貨艙的頂部和底部應設置感溫器。駕駛室內應設有溫度遙測讀出器及連續監測器。如液貨艙內溫度超過 35°C 時，應在駕駛室內發出聽覺和視覺報警。

4.20.20 在與液貨艙鄰接的留空處所內應設有固定式氧氣監測器（或氣體取樣管路），以探測是否有貨物泄漏到這些處所內。還應測出由於氧氣聚集使可燃性增大的危險情況。駕駛室內也應設有遙測讀出器、連續監測器（如果採用氣體取樣管路，則可同意採用間歇取樣）以及類似用於感溫器的聽覺和視覺報警裝置。如在這些留空處所內氧濃度超過 30%的容積濃度時，應發出聽覺和視覺報警。應配備兩個可攜式氧氣監測器，以作為備用裝置。

4.20.21 為防止發生無法控制的分解，應設置貨物投棄系統，以便將分解貨物排放到船外。如果在 5 h 內每小時貨物溫升率超過 2°C/h，或者艙內溫度超過 40°C 時，應將該貨物投棄。

4.20.22 帶濾網的液貨艙的透氣系統應具有用於正常控制透氣的壓力/真空釋放閥，同時還應具有用於應急透氣的裝置，以防因無法控制的貨物分解（見 4.20.21）而引起液貨艙壓力迅速升高。透氣系統的設計應使海水不能進入液貨艙內，甚至在嚴重海況時也應如此。應根據液貨艙的設計壓力和液貨艙的尺寸確定所需的應急透氣的能力。

4.20.23 應設置固定式噴水系統，以便稀釋並洗掉溢漏在甲板上的任何濃縮的過氧化氫溶液。水霧所覆蓋的區域應包括支管/軟管接頭和用於載運過氧化氫溶液的專用液貨艙的頂部。最小噴灑率應符合下列標準：

（a）應在貨品溢漏後的 5 min 內將其原來的濃度稀釋到 35%（按重量）；

（b）對於溢漏率和估計的溢漏量，應根據預計的最大裝卸率、液貨艙溢流或管路/軟管破損時停止貨物流通所需的時間以及從貨物控制站或駕駛室啟動稀釋水噴灑裝置所需的時間予以確定。

4.20.24 過氧化氫應予以穩定，以防分解。製造廠應提供穩定證書，載明：

（a）所加穩定劑的名稱與數量；

（b）穩定劑加入日期與有效期；

（c）確保穩定劑有效期的溫度界限；

（d）航行途中貨品變為不穩定時應採取的措施。

4.20.25 只能載運那些在 25°C 時具有每年 1%的最大分解率的過氧化氫溶液。應將託運人用以說明貨品符合這一標準的證書送交船長並將其保存在船上。製造商應派技術代表上船監察駁運操作，所派代表應有試驗過氧化物穩定性的能力。技術代表應向船長證明，貨物是在穩定狀況下裝載的。

4.20.26 對涉及貨物裝卸作業的每一位船員均應配備能抵禦過氧化氫溶液的防護衣。防護衣應包括不易燃的連衣褲工作服、合適的手

套、靴子和眼睛防護裝置。

4.20.27 在駁運過氧化氫作業時，應將與駁運有關的管系與所有其他管系分離，在用於駁運過氧化氫的軟管上應標明“駁運過氧化氫專用”。

4.21 50%或 50%以下的氯酸鈉溶液

4.21.1 裝過本貨品的液貨艙及其附屬設備，只有經過徹底的清洗或惰氣驅氣後，才能裝運其他貨物。

4.21.2 一旦發生本貨品泄漏時，應立即將所有泄漏的液體徹底洗掉，不得延緩。為使火災危險減至最小，不允許使泄漏物乾透。

4.22 硝酸辛酯，所有異構物

4.22.1 該貨物的運輸溫度應保持在 100ºC 以下，以防其發生自激放熱分解反應。

4.22.2 貨物不可固定在船舶甲板上的獨立壓力容器內進行載運，除非：

.1 液貨艙與火有效隔絕；和

.2 船上設置用於液貨艙的水淹浸系統，使貨物溫度保持在 100ºC 以下，並且當失火溫度為 650ºC 時，液貨艙內的溫升不超過 1.5ºC/h。

4.23 溫度傳感器

應使用溫度傳感器監視貨泵的溫度，以探測由於泵的故障造成的過熱溫度。

第 V 章 操作要求

5.1 每個液貨艙的最大允許裝貨量

5.1.1 需在 1 型船舶內載運的貨物，其貨物量在任一液貨艙內均不得超過 1,250 m^3。

5.1.2 需在 2 型船舶內載運的貨物，其貨物量在任一液貨艙內均不得超過 3,000 m^3。

5.2 貨物資料

5.2.1 在本規則所適用的每艘船上，均應備有本規則的副本，或備有納入本規則規定的船旗國規則。

5.2.2 船上應備有安全載運散裝貨物所必需的資料，並可供所有有關人員使用。該資料應包括一份貨物積載圖，其存放於易於到達處，標明船上的所有貨物，包括所載運的每一種危險化學品：

（a）對貨物安全圍護所需的物理和化學性能（包括反應性）的詳細說明書；

（b）發生溢漏或滲漏時應採取的措施；

（c）防止人員意外接觸的措施；

（d）消防程序和滅火劑；

（e）用於貨物駁運、液貨艙清洗、除氣和壓載的程序；和

（f）對需要按 4.4 和 4.10 節的要求分別進行穩定或抑制的貨物，如未能提供 4.4 和 4.10.3 所要求的證書，則應拒絕載運該貨物。

5.2.3 如未能得到安全運輸該貨物所需的足夠資料，則應拒絕載運該貨物。

5.2.4 對凡能放出覺察不到的劇毒蒸氣的貨物，除非在貨物中放入能覺察到的添加劑，否則不得進行運輸。

5.2.5 如第 VI 章表中的“m”欄內涉及本段時，應在貨運單據中詳細標明該貨物在 20ºC 時的黏度，而在 20ºC 時如該貨物的黏度超過 50 mPa.s 時，則應在貨運單據中詳細標明該貨物在其黏度為 50 mPa.s 時的溫度。

5.2.6 已刪除。

5.2.7 已刪除。

5.2.8 如第 VI 章表中的“m”欄內涉及本段時，應在貨運單據中標明該貨物的熔點。

5.3 人員培訓

5.3.1 所有使用防護設備的人員均應經過適當的培訓，並接受在應急情況下與其職責相應的必要的操作程序基本培訓。

5.3.2 從事貨物作業的人員應進行貨物裝卸程序的適當培訓。

5.3.3 根據國際海事組織制定的指南[①]，高級船員應進行關於應急措施方面的培訓，以處理貨物的泄漏、溢出或火災事故，同時還應對他們中相當部分的人員在用於所載貨物的主要急救方法方面進行教

[①] 參見《危險貨物事故醫療急救指南》（MFAG），該指南建議了如何根據症狀救治傷員，並建議了適合救治傷員的設備和解毒劑。還參見 STCW 規則 A、B 部分的有關規定。

授和培訓。

5.4 進入液貨艙

5.4.1 人員不得進入液貨艙以及這些液貨艙周圍的留空處所、貨物裝卸處所或其他封閉處所，除非：

（a）該艙室有毒蒸氣已排除，並且不缺少氧氣；或

（b）人員已穿戴呼吸器具和其他必要的防護設備，並且整個作業是在一位負責的高級船員的密切監視下進行的。

5.4.2 對於僅有易燃危險的處所，只有在一位負責的高級船員的密切監視下，人員才能准予進入。

5.5 液貨艙的開口

在裝卸和運載會產生易燃和/或有毒蒸氣的貨物時，或在卸去這種貨物後進行壓載時，或在裝載這種貨物時，應使液貨艙的艙蓋保持關閉。在裝載任何有危害性的貨物時，液貨艙的艙蓋、液貨位測量和觀察孔、液貨艙的清洗出入口蓋只有在必要時才可開啟。

5.6 貨艙的加熱盤管

如用2.15.6（c）中所述的方法對可能含有毒貨品的液貨艙進行加熱或冷卻時，不僅要在有毒貨品加熱或冷卻開始的時候對盤管進行測試，而且要在載運未加熱或未冷卻的有毒貨品之後使用盤管的第一時間對盤管進行測試。

5.7 附加操作要求

附加操作要求見在本規則以下各段：

2.6.1、2.6.2（a）和（b）、2.6.4、2.15.2、2.21.1、2.21.2、3.11.1、3.11.2、3.16、3.17、4.1.1、4.1.7、4.1.8、4.2.7、4.3.1、4.4、4.51、4.54、4.5.6、4.5.11、4.6.1、4.6.3、4.6.4、4.7.1、4.7.2、4.7.6、4.7.8、4.7.9、4.7.10、4.7.11、4.7.12、4.7.13、4.7.15、4.7.17、4.7.18、4.7.19、4.7.20、4.7.21、4.7.22、4.8.4、4.8.5、4.8.6、4.9.3（a）、4.10.1、4.10.3、4.10.6、4.18、4.19.2、4.19.3、4.19.5、4.19.6、4.19.9、4.20.3、4.20.5、4.20.8、4.20.12、4.20.15、4.20.16、4.20.21、4.20.25、4.20.27、4.21.1、4.21.2。

第 VA 章　保護海洋環境的附加措施

已刪除。

第 VI 章　最低要求一覽表

本規則所涉及貨品的最低要求一覽表見 IBC 規則第 17 章。

為方便應用本規則的各最低要求，下表左欄中的 IBC 規則與右欄中的 BCH 規則相對應。如 BCH 規則中標明參見第 VI 章的 m 欄，則意指 IBC 規則第 17 章中的 m，R 或 o 欄。

IBC/BCH 規則有關最低要求的對照參考

IBC 規則第 17 章項目	IBC 規則對照參考[①]	BCH 規則對照參考[②]
船型（e 欄）		
1=船型 1	（2.1.2）	（2.2.4（a））
2=船型 2	（2.1.2）	（2.2.4（b））
3=船型 3	（2.1.2）	（2.2.4（c））
艙型（f 欄）		
1=獨立液貨艙	（4.1.1）	（2.3.2）
2=整體液貨艙	（4.1.2）	（2.3.1）
G=重力液貨艙	（4.1.3）	（2.4）
P=壓力液貨艙	（4.1.4）	—
液貨艙環境控制（h 欄）		
Inert：惰性法	（9.1.2.2）	（2.19.2（a））
Pad：用液體或氣體作隔	（9.1.2.2）	（2.19.2（b））

[①] 圓括號中的數字係指該章節號引自 IBC 規則第 17 章中的說明。

[②] 圓括號中的數字係指對應於 IBC 規則相同章節的 BCH 章節號。

絕的方法 Dry：乾燥法 Vent：自然或強力通風法	（9.1.2.3） （9.1.2.4）	（2.19.2（c）） （2.19.2（d））
電氣設備 （i 欄）		
NF：非易燃貨品 Yes：閃點超過 60°C（閉杯）	（10.1.6） （10.1.6）	標準電氣系統
電氣設備（i 欄）續		
No：閃點不超過 60°C 的產品（閉杯）	（10.1.6）	特殊電氣系統
測量（j 欄）		
O：開式測量 R：限制式測量 C：閉式測量 I：間接測量	（13.1.1.1） （13.1.1.2） （13.1.1.3） （13.1.1.3）	開式裝置（3.9（a）） 限制式裝置（3.9（b）） 閉式裝置（3.9（c）） 間接裝置（3.9（d））
呼吸防毒面具和眼睛防護設備（n 欄）		
	E：見 14.2.8	3.16.10
特殊要求（o 欄）	15.1 15.2 15.3 15.4 15.5.1－13 15.5.14－26	4.4 4.19 4.1 4.2 4.20.1－14 4.20.15－27

	15.6	4.6
	15.7	4.5
	5.8	4.7
	15.9	4.21
	15.10	4.3
	15.11	4.8
	15.12	4.9
	15.13	4.10
	15.14	4.11
	15.16.2	4.15.2
	15.17	4.13.1
	18.18	4.13.2
	18.19	4.14
	15.19.6	4.14.1
	15.20	4.22
	15.21	4.23
	16.2.6	5.2.5
	16.2.9	5.2.8
	16.6	4.18.1
	16.6.1	4.18.1*
	16.6.2	4.18.2*
	16.6.3	4.18.3*
	16.6.4	4.18.4*

*這些修正經海上環境保護委員會於 1996 年 7 月 10 日以 MEPC.70（38）決議通過，並於 1998 年 7 月 1 日生效。

第 VII 章 不適用本規則的化學品清單

對其安全和污染危害性已進行過審查並已確定其危害性尚不足以列入本規則適用範圍的化學品清單見 IBC 規則的第 18 章。

第 VIII 章 液體化學品廢棄物的運輸

8.1 前言

8.1.1 海上運輸液體化學品廢棄物可能會對人類健康和環境構成威脅。

8.1.2 對液體化學品廢棄物的運輸應按照有關的國際公約和建議，特別是在海上進行散裝運輸時，更應符合本規則的要求。

8.2 定義

就本章而言：

8.2.1 液體化學品廢棄物係指被提供載運的、且其所含的或被污染的一種或多種成份是受本規則要求約束的物質、溶液或混合物，同時認為它們已無直接用途，對其進行載運是為了能在除海上以外的地方對其進行傾倒、焚燒或其他方式的處理。

8.2.2 跨境運輸係指對廢棄物所進行的海上運輸，即從一個國家管轄的區域到或通過另一個國家管轄的區域，或者到或通過沒有任何國家管轄的區域，但此種運輸至少應涉及兩個國家。

8.3 適用範圍

8.3.1 本章的要求適用於使用海船以散裝形式對液體化學品廢棄物進行的跨境運輸，同時，對本規則的所有其他要求也應一併考慮；

8.3.2 本章的要求不適用於：

.1 MARPOL 73/78 要求所涉及的由船上作業所產生的廢棄物；

.2 IBC規則第20章所涉及的在海上從事焚燒廢棄物的船舶所載運的液體化學品廢棄物；和

.3 含有放射性物質或被放射性物質污染的物質、溶液或混合物，且這些物質均受到有關放射性物質適用要求的約束。

8.4 允許的運輸

8.4.1 僅在下述情況下才能允許對廢棄物進行跨境運輸：

.1 始發國主管當局，或者廢棄物的產生者或出口者通過始發國主管當局，已向最終目的地國發出通知書；和

.2 始發國主管當局在獲得最終目的地國關於表明能將廢棄物安全地進行焚燒或將以其他方式對廢棄物進行處理的書面許可後，批准了這種運輸。

8.5 文件

8.5.1 除本規則5.2中所規定的文件外，從事液體化學品廢棄物跨境運輸的船舶應備有始發國主管當局簽發的廢棄物運輸文件。

8.6 液體化學品廢棄物的分類

8.6.1 為保護海洋環境，對於所有散裝運輸的液體化學品廢棄物，無論其實際被評估的類別如何，均應作為X類有毒液體物質處置。

8.7 液體化學品廢棄物的載運和裝卸

8.7.1 應按IBC規則第17章中規定的對液體化學品廢棄物的最低要求，使用船舶及液貨艙載運液體化學品廢棄物，除非有明確的理由表明由於廢棄物的危害性而必須符合下列要求：

.1 按須用1型船舶進行載運的要求；或

.2 按本規則中適用於該物質或其主要成份具有危害性的混合物的任何附加要求。

第 42/2017 號行政長官公告

國際海事組織海上環境保護委員會於二零零八年十月十日在第五十八屆會議上，透過第MEPC.177（58）號決議通過了《船用柴油發動機氮氧化物排放控制技術規則》（《氮氧化物技術規則》）的修正案，該修正案於二零一零年七月一日在國際法律秩序上生效，包括對中華人民共和國及澳門特別行政區生效；

此外，上述委員會於二零一二年三月二日在第六十三屆會議上，透過第MEPC.217（63）號決議通過了《修正〈經1978年議定書修訂的1973年國際防止船舶造成污染公約〉的1997年議定書》附則的修正案，該修正案於二零一三年八月一日在國際法律秩序上生效，包括對中華人民共和國及澳門特別行政區生效；

基於此，行政長官根據第3/1999號法律《法規的公佈與格式》第六條第一款的規定，命令公佈國際海事組織海上環境保護委員會下列決議的中文及英文正式文本：

——二零零八年十月十日通過的、包含《船用柴油發動機氮氧化物排放控制技術規則》（《2008年氮氧化物技術規則》）修正案的第MEPC.177（58）號決議；

——二零一二年三月二日通過的、包含《修正〈經1978年議定書修訂的1973年國際防止船舶造成污染公約〉的1997年議定書》附則修正案（《防污公約》附則VI和《2008年氮氧化物技術規則》的修正案）的第MEPC.217（63）號決議。

《修正〈經1978年議定書修訂的1973年國際防止船舶造成污染公約〉的1997年議定書》（《防污公約》1997年議定書）涵蓋了包含《氮氧化物技術規則》的《防污公約》附則VI。該議定書公佈於二零一六年十一月二十三日第四十七期《澳門特別行政區公報》第二組副刊。

二零一七年七月二十四日發佈。

行政長官 崔世安

Aviso do Chefe do Executivo n.º 42/2017

Considerando que, em 10 de Outubro de 2008, na sua 58.ª sessão, o Comité para a Protecção do Meio Marinho da Organização Marítima Internacional, através da resolução MEPC.177(58), adoptou emendas ao Código Técnico sobre o Controlo de Emissões de Óxidos de Azoto Provenientes de Motores Diesel Marítimos (Código Técnico NO_x), e que tais emendas entraram em vigor na ordem jurídica internacional, incluindo a República Popular da China e a sua Região Administrativa Especial de Macau, em 1 de Julho de 2010;

Considerando igualmente que, em 2 de Março de 2012, na sua 63.ª sessão, o mesmo Comité, através da resolução MEPC.217(63), adoptou emendas ao Anexo do Protocolo de 1997 que altera a Convenção Internacional para a Prevenção da Poluição por Navios, 1973, tal como modificada pelo Protocolo de 1978 a ela relativo, e que tais emendas entraram em vigor na ordem jurídica internacional, incluindo a República Popular da China e a sua Região Administrativa Especial de Macau, em 1 de Agosto de 2013;

O Chefe do Executivo manda publicar, nos termos do n.º 1 do artigo 6.º da Lei n.º 3/1999 (Publicação e formulário dos diplomas) os textos autênticos em línguas chinesa e inglesa das seguintes resoluções do Comité para a Protecção do Meio Marinho da Organização Marítima Internacional:

— Resolução MEPC.177(58), adoptada em 10 de Outubro de 2008, que contém emendas ao Código Técnico sobre o Controlo de Emissões de Óxidos de Azoto Provenientes de Motores Diesel Marítimos (Código Técnico NO_x 2008);

— Resolução MEPC.217(63), adoptada em 2 de Março de 2012, que contém emendas ao Anexo do Protocolo de 1997 que altera a Convenção Internacional para a Prevenção da Poluição por Navios, 1973, tal como modificada pelo Protocolo de 1978 a ela relativo (emendas ao Anexo VI da MARPOL e ao Código Técnico NO_x 2008);

O Protocolo de 1997 que altera a Convenção Internacional para a Prevenção da Poluição por Navios, 1973, tal como modificada pelo Protocolo de 1978 a ela relativo (MARPOL PROT 1997), o qual incorpora o Anexo VI da MARPOL que, por sua vez, integra o Código Técnico NO_x, encontra-se publicado no Suplemento do *Boletim Oficial da Região Administrativa Especial de Macau* n.º 47, II Série, de 23 de Novembro de 2016.

Promulgado em 24 de Julho de 2017.

O Chefe do Executivo, *Chui Sai On*.

第 MEPC.177（58）號決議

2008 年 10 月 10 日通過

船用柴油發動機氮氧化物排放控制技術規則修正案

（2008 年氮氧化物技術規則）

海上環境保護委員會，

憶及《國際海事組織公約》關於防止和控制海洋污染國際公約賦予海上環境保護委員會（本委員會）的職能之第 38（a）條，

注意到《1973 年國際防止船舶造成污染公約》（以下簡稱“1973 年公約”）第 16 條和《〈1973 年國際防止船舶造成污染公約〉1978 年議定書》（以下簡稱“1978 年議定書”）第 VI 條，以及修訂《經 1978 年議定書修訂的〈1973 年國際防止船舶造成污染公約〉》的 1997 年議定書（以下簡稱“1997 年議定書”）第 4 條，共同規定了 1997 年議定書的修正程序並賦予本組織的適當機構審議和通過經 1978 年議定書和 1997 年議定書修正的 1973 年公約修正案之職能，

還注意到 1997 年議定書將標題為《防止船舶造成大氣污染規則》的附則 VI（以下簡稱“附則 VI”）增加到了 1973 年公約中，

進一步注意到《防污公約》附則 VI 第 13 條使《船用柴油發動機氮氧化物排放控制技術規則》（氮氧化物技術規則）在該附則下具有強制性，

審議了《氮氧化物技術規則》修正草案，

1. 根據 1973 年公約第 16（2）（d）條，**通過**《氮氧化物技術規則》的修正案，正文列於本決議附件中；

2. **決定**，根據 1973 年公約第 16（2）（f）（iii）條，本修正案將於 2010 年 1 月 1 日視為獲接受，除非在此日期之前，有不少於三分之一的當事國或合計商船噸位不少於世界商船隊總噸位 50%的當事國正式向本組織提出反對本修正案；

3. **提請**各當事國注意，根據 1973 年公約第 16（2）（g）（ii）條，該修正案在根據上述第 2 段獲接受後，將於 2010 年 7 月 1 日生效；

4. **要求**秘書長，依照 1973 年公約第 16（2）（e）條，將本決議和載於附件中的修正案案文的核正無誤副本分發給經 1978 年議定書和 1997 年議定書修訂的 1973 年公約的所有當事國；

5. **進一步要求**秘書長將本決議及其附件的副本分發給經 1978 年議定書和 1997 年議定書修正的 1973 年公約非當事國的所有本組織會員；

6. **邀請**《防污公約》附則 VI 各當事國和其他成員國政府提請船舶所有人、船舶經營人、造船廠、船用柴油發動機製造商和其他感興趣組織注意本《氮氧化物技術規則》修正案。

2008 年氮氧化物技術規則

船用柴油發動機氮氧化物排放控制技術規則

目 錄

第 7 章－現有發動機的發證

附錄

附錄 I － EIAPP 證書格式

附錄 II － 船用柴油發動機檢驗和發證流程圖

附錄 III － 確定船用柴油發動機排放氣體成分的分析儀的技術規範

附錄 IV － 分析和測量儀器的校準

附錄 V － 母型機試驗報告及實驗數據

－ 第 1 節－母型機試驗報告

－ 第 2 節－要列入技術檔案中的母型機試驗數據

附錄 VI － 廢氣質量流量計算（碳平衡法）

附錄 VII － 發動機參數檢查方法的檢查清單

附錄 VIII － 直接測量和監測法的實施

引 言

2008 年氮氧化物技術規則

1997 年 9 月 26 日，《經 1978 年議定書修訂的〈1973 年國際防止船舶造成污染公約〉》（MARPOL73/78）當事國大會以大會決議 2 通過了《船用柴油發動機氮氧化物排放控制技術規則》（《氮氧化物技術規則》）。《防污公約》附則 VI－《防止船舶造成空氣污染規則》於 2005 年 5 月 19 日生效後，該附則第 13 條所適用的所有船用柴油發動機均須符合本規則的規定。2005 年 7 月，環保會第 53 屆會議同意對《防污公約》附則 VI 和《氮氧化物技術規則》進行修訂。2008 年 10 月，環保會第 58 屆會議完成了審議，本版本的《氮氧化物技術規則》（以下簡稱本規則）就是該過程的結果。

作為一般性的背景信息，在燃燒過程中形成氮氧化物的前體是氮和氧。這些成分一起構成柴油發動機吸入空氣的 99%。在燃燒過程中氧氣將被消耗，多餘氧氣的數量是柴油發動機運轉的空氣/燃料比的函數。氮在燃燒過程中大多未起反應；但有很小一部分將被氧化形成多種形式的氮氧化物。可形成的氮氧化物（NO_X）包括一氧化氮（NO）和二氧化氮（NO_2），其數量主要是火焰或燃燒溫度的函數，以及存在於燃料中有機氮（如果存在）數量的函數，氮氧化物的形成還是氮和多餘氧氣在柴油發動機燃燒過程中暴露在高溫下的時間的函數。換句話說，燃燒溫度越高（如高峰值壓力、高壓縮比、高供油比率等），形成的氮氧化物數量就越大。通常低速柴油發動機所形成的氮氧化物量比高速機要大。氮氧化物能引起酸化，形成對流層臭氧，營養富集等不良環境影響，並加劇了對全球健康的不利影響。

本規則旨在為船用柴油發動機的試驗、檢驗和發證定出強制性程序，以使柴油發動機製造廠、船舶所有人和主管機關能夠確保所有適用的船用柴油發動機符合附則 VI 第 13 條規定的相關氮氧化物排放限值。在認識到難於精確確定船用柴油發動機實際加權平均氮氧化物排放量的情況下，制定了一系列簡單實用的要求，其中對確保符合氮氧化物排放允許值的措施做出了定義。

鼓勵各主管機關在能夠於適當控制條件下進行精確試驗的試驗台上，對船用推進系統和輔助柴油發動機的排放性能進行評估。本規則的一個重要特點就是在這個初始階段確保符合附則 VI 第 13 條。之後的船上試驗，其範圍和精確度將不可避免地受到限制，其目的應為推理或推斷排放性能和證實柴油發動機的安裝、操作和維護遵循了製造廠的技術規範，以及任何調整或改裝未降低製造廠初次試驗和發證時確定的排放性能。

縮寫、下標和符號

下列表 1、2、3 和 4 概述了本規則，包括附錄 III 中的分析儀器的技術規範、附錄 IV 中的分析儀器的校準要求、第 5 章和附錄 VI 中的氣體質量流量計算公式中所用的縮寫、下標和符號以及第 6 章有關船上核實檢驗數據所用的符號。

.1 表 1：代表本規則中所述的柴油發動機氣體排放以及校準和量程氣體中的化學成分的符號；

.2 表 2：用於本規則附錄 III 中規定的柴油發動機氣體排放測量的分析儀的縮寫；

.3 表 3：用於本規則第 5 章、第 6 章、附錄 IV 和附錄 VI 中的術語和變量的符號及下標；及

.4 表 4：用於本規則第 5 章、第 6 章和附錄 VI 中的燃料成分符號。

表 1

化學成分的符號和縮寫

符號	定義
CH_4	甲烷
C_3H_8	丙烷
CO	一氧化碳
CO_2	二氧化碳
HC	碳氫化合物
H_2O	水
NO	一氧化氮
NO_2	二氧化氮
NO_x	氮氧化物
O_2	氧

表 2

柴油發動機氣體排放測量分析儀的縮寫

（參閱本規則附錄 III）

CLD	化學熒光探測器
ECS	電化傳感器
HCLD	加熱式化學熒光探測器
HFID	加熱式火焰離子探測器
NDIR	非彌散紅外分析儀
PMD	順磁探測器
ZRDO	二氧化鋯傳感器

表 3

術語和變量的符號及下標

（參閱本規則第 5 章、第 6 章、附錄 IV 和附錄 VI）

符號	術語	單位
A/F_{st}	空氣與燃料的理論配比值	1
c_x	廢氣濃度（成分的後綴命名，d＝乾或 w＝濕）	ppm %（V/V）
E_{CO2}	NO_X 分析儀的 CO_2 抑制	%
E_{H2O}	NO_X 分析儀的水抑制	%
E_{NOx}	NO_X 轉換器的效率	%
E_{O2}	氧分析儀修正係數	1
λ	過量空氣係數kg乾空氣/（kg燃料・A/Fst）	1
f_a	試驗條件參數	1
f_c	碳係數	1
f_{fd}	乾基廢氣流量計算的燃料特定係數	1
f_{fw}	濕基廢氣流量計算的燃料特定係數	1
H_a	吸入空氣的絕對濕度，（g 水/kg 乾空氣）	g/kg
H_{SC}	增壓空氣濕度	g/kg
i	代表個別模式的下標	1
k_{hd}	柴油發動機 NO_X 的濕度修正係數	1
k_{wa}	吸入空氣的乾對濕修正係數	1
k_{wr}	原始廢氣的乾對濕修正係數	1
n_d	發動機轉速	min^{-1}
n_{turb}	渦輪增壓器轉速	min^{-1}
$\%O_2I$	HC 分析儀氧干擾百分比	%
p_a	在測量 p_b 和 R_a 的同一位置測量的吸入空氣溫度確定的	kPa

符號	術語	單位
	發動機吸入空氣飽和蒸氣壓力	
p_b	總大氣壓力	kPa
p_C	增壓空氣壓力	kPa
p_r	分析系統冷卻槽之後的水汽壓力	kPa
p_s	乾燥大氣壓力，由以下公式確定： $p_s = p_b - R_a \cdot p_a/100$	kPa
p_{SC}	增壓空氣的飽和蒸氣壓力	kPa
P	未修正的制動功率	kW
P_{aux}	僅為試驗而安裝但 ISO 14396 不要求的輔機吸收的的總標稱功率	kW
P_m	試驗條件下柴油發動機試驗轉速下的最大實測功率或標稱功率	kW
q_{mad}	乾基吸入空氣質量流量	kg/h
q_{maw}	濕基吸入空氣質量流量	kg/h
q_{mew}	濕基廢氣質量流量	kg/h
q_{mf}	燃料質量流量	kg/h
q_{mgas}	個別氣體排放質量流量	g/h
R_a	吸入空氣的相對濕度	%
r_h	碳氫化合物響應係數	1
ρ	密度	kg/m^3
s	燃料齒條位置	
T_a	發動機進口處確定的吸入空氣溫度	K
T_{caclin}	增壓空氣冷卻器，冷卻劑進口溫度	℃
$T_{caclout}$	增壓空氣冷卻器，冷卻劑出口溫度	℃
T_{Exh}	廢氣溫度	℃
T_{Fuel}	燃油溫度	℃
T_{Sea}	海水溫度	℃
T_{SC}	增壓空氣溫度	K
T_{SCRef}	增壓空氣参照溫度	K
u	廢氣成分和廢氣密度比率	1
W_F	加權因數	1

表 4

燃料成分的符號

符號	定義	
w_{ALF}	燃料的氫含量	%m/m
w_{BET}	燃料的碳含量	%m/m
w_{GAM}	燃料的硫含量	%m/m
w_{DEL}	燃料的氮含量	%m/m
w_{EPS}	燃料的氧含量	%m/m
α	摩爾比率（H/C）	1

第 1 章
總　則

1.1　目的

1.1.1　本《船用柴油發動機氮氧化物排放控制技術規則》，以下稱本規則的目的為定出船用柴油發動機的試驗、檢驗和發證要求，以確保其符合附則 VI 第 13 條的氮氧化物（NO_x）排放限值。本規則中所引用的規則條款均指附則 VI。

1.2　適用範圍

1.2.1　本規則適用於所有已安裝或設計並擬安裝在附則 VI 和第 13 條適用的任何船上的輸出功率大於 130 kW 的船用柴油發動機。就第 5 條關於檢驗和發證要求而言，本規則僅涉及柴油發動機符合 NO_x 排放限值的適用要求。

1.2.2　就本規則的適用而言，各主管機關有權委託經授權的組織代行本規則要求的主管機關的全部職能*。在任何情況下，主管機關對檢驗和發證負全部責任。

1.2.3　就本規則而言，如能證明柴油發動機在初次發證、年度、中間和換證檢驗和其他要求的檢驗時其 NO_x 加權排放在限值之內，則該柴油發動機須被認為符合第 13 條的適用 NO_x 排放限值。

---

* 參見第 A.739(18)號決議通過的《代表主管機關的組織的授權指南》和第 A.789(19)號決議通過的《被認可組織代表主管機關執行檢驗和發證職責的規範》。

1.3 定義

1.3.1 *氮氧化物（NO_X）排放*係指氮氧化物總排放量，按二氧化氮加權排放總量計算，並以本規則所規定的相關試驗循環和測量方法確定。

1.3.2 船用柴油發動機的*實質性改裝*係指：

.1 對於 2000 年 1 月 1 日或以後建造的船上所安裝的發動機而言，*實質性改裝*係指：可能造成發動機超出列於第 13 條規定的適用排放限值的任何發動機改裝。用技術檔案中規定的部件進行不改變排放性能的發動機構件常規更換，不論是一部分還是多部分部件更換，均不視為“實質性改裝”。

.2 對於 2000 年 1 月 1 日以前建造的船上所安裝的發動機而言，*實質性改裝*係指增加了 6.3 所述的簡單測試方法確定的發動機現有排放特性，使其超出 6.3.11 規定的允許值的任何改裝。這些改變包括，但不限於，其運作或技術參數（例如：改變凸輪軸、燃油噴射系統、空氣系統、燃燒室構造，或發動機定時校準）的改變。就本附則第 13.2 條的適用而言，符合第 13.7.1.1 條的經證明的認可方法的安裝，及符合第 13.7.1.2 條的發證，不被視為實質性改裝。

1.3.3 *構件*係指影響氮氧化物排放功能的互換性部件，由其設計/部件號標識。

1.3.4 *設定*係指對影響發動機氮氧化物排放性能的可調整部分的調整。

1.3.5 *操作值*係指發動機日誌中所載與氮氧化物排放性能有關的柴油發動機數據，如氣缸峰值壓力、排氣溫度等。這些數據均為載荷控制。

1.3.6 *EIAPP 證書*係指與氮氧化物排放相關的發動機國際防止空氣污染證書。

1.3.7 *IAPP 證書*係指國際防止空氣污染證書。

1.3.8 *主管機關*的含義與《73 防污公約》第 2 章第（5）款相同。

1.3.9 *船上氮氧化物核實程序*係指由發動機證書申請方制訂並經主管機關認可，在所要求的初次發證檢驗或換證、年度或中間檢驗時，在船上使用的可包括設備要求的程序，以證實符合本規則的任何要求。

1.3.10 *船用柴油發動機*係指第 13 條適用的，以液體或雙燃料運行的任何往復式內燃機，包括加壓器/混合系統（如適用）。

如果發動機擬通常以氣體模式運轉，即主要燃料為氣體及少量的液體引燃燃料，僅此運轉模式須滿足第 13 條的要求。如果發生故障造成氣體供應受限而使用純液體燃料運轉，須對駛往下個港口進行故障修理的航次予以免除。

1.3.11 *額定功率*係指第 13 條和本規則適用的船用柴油發動機的銘牌及技術檔案中載明的最大持續額定輸出功率。

1.3.12 *額定轉速*係指船用柴油發動機銘牌及技術檔案中載明的在額定功率輸出時的每分鐘的曲軸轉數。

1.3.13 *制動功率*係指，發動機僅設有在試驗台上運轉所必需的標準輔助設備時，在曲軸或其等效處測量的實測功率。

1.3.14 *船上狀態*係指發動機：

.1 安裝在船上並與其驅動的實際設備相連接；及

.2 處於執行該設備功能的運行狀態。

1.3.15 *技術檔案*係指符合本規則第 2.4 條，含有包括發動機構件和設定值在內的，會影響發動機氮氧化物排放的所有參數細節的記錄。

1.3.16 *發動機參數記錄簿*係指與《發動機參數檢查法》共用、記錄包括構件和發動機的設定值等可能影響發動機氮氧化物排放的所有參數變化的文件。

1.3.17 *認可方法*係指應用於特定發動機或一系列發動機、確保其符合第 13.7 條所述的適用氮氧化物限值的方法。

1.3.18 *現有發動機*係指第 13.7 條所適用的的發動機。

1.3.19 *認可方法檔案*係指描述認可方法及其檢驗方式的文件。

第 2 章
檢驗和發證

2.1 通則

2.1.1 凡 1.2 中規定的船用柴油發動機，除本規則另有規定外，均須接受下列檢驗：

.1 前期發證檢驗，此檢驗須保證所設計和裝備的發動機符合第 13 條規定的氮氧化物排放限值。如經檢驗合格，主管機關須簽發發動機國際防止空氣污染（EIAPP）證書。

.2 初次發證檢驗，此檢驗須在發動機安裝上船後但尚未投入使用之前進行。該檢驗須保證安裝上船的發動機包括前期發證後的任何改裝和/或調整（如適用）符合第 13 條規定的氮氧化物排放限值。該檢驗，作為船舶初次檢驗的一部分，完成後可向船舶初次簽發《國際防止空氣污染（IAPP）證書》或對船舶有效 IAPP 證書予以修正以反映出安裝了新發動機。

.3 換證、年度和中間檢驗，此類檢驗須為第 5 條要求的船舶檢驗的一部分，以確保發動機繼續完全符合本規則的要求。

.4 發動機初次發證檢驗，此種檢驗須在每次對發動機進行了第 13 條定義的重大改裝後在船上進行，以確保發動機符合第 13 條的適用氮氧化物排放限值。在此之後，如適用，將簽發 EIAPP 證書和修正 IAPP 證書。

2.1.2 為符合 2.1.1 中規定的各種檢驗和發證要求，本規則包含了下列供發動機製造廠、造船廠或船舶所有人酌情選用的測量、計算、試驗或核實發動機氮氧化物排放的方法：

.1 符合第 5 章要求的前期發證檢驗試驗台試驗；

.2 符合第 5 章全部試驗台要求的對未經前期發證的發動機在船上進行的前期發證檢驗和初次發證檢驗的合併試驗；

.3 按照 6.2 規定，使用技術檔案規定的構件數據、發動機設定值和發動機性能數據，在初次、換證、年度和中間檢驗時確認前期發證的發動機或自最近一次檢驗後對氮氧化物關鍵構件、設定值和操作值進行過改裝或調整的發動機，符合要求的船上發動機參數檢查方法；

.4 需要時，按照 6.3 規定，在換證、年度和中間檢驗時確認符合要求或初次發證檢驗時確認已獲前期發證的柴油發動機符合要求的船上簡化測量法；或

.5 按照 6.4 的規定，僅在換證、年度和中間檢驗時確認符合要求的船上直接測量和監測法。

2.2 發動機前期發證程序

2.2.1 除 2.2.2 和 2.2.4 允許者外，每台船用柴油發動機（單發動機）在船上安裝前須：

.1 予以調整，以符合適用的氮氧化物排放限值；

.2 根據本規則第 5 章規定的程序在試驗台上對氮氧化物排放進行測量；

.3 由主管機關進行前期發證，以簽發 EIAPP 證書為證。

2.2.2 依據主管機關的認可，對系列化生產的發動機的前期發證可採用發動機族或組的概念（見第 4 章）。在此情況下，僅要求對發動機組或發動機族的母型機進行 2.2.1.2 中規定的試驗。

2.2.3 獲得發動機前期發證的方法是讓主管機關：

.1 證實試驗台上進行的發動機試驗；

.2 核實所有經過試驗的發動機，包括在發動機族或發動機組內交付的發動機（如適用），符合適用的氮氧化物限值；及

.3 如適用，核實所選母型機可代表該發動機族或發動機組。

2.2.4 有些柴油發動機因其尺寸、構造和交貨計劃，不能在試驗台上進行前期發證測試。在此情況下，發動機製造廠、船舶所有人和造船廠須向主管機關申請進行船上試驗（見 2.1.2.2）。申請者必須向主管機關證明該船上試驗完全滿足本規則第 5 章規定的試驗台程序的所有要求。這種檢驗僅對單機或由母型機所代表的發動機組可以接受，但對發動機族的發證不得接受。如果初次檢驗在船上進行，且無任何有效的前期發證試驗，則無論如何不允許有任何可能的測量偏差。對於在船上進行發證試驗以取得 EIAPP 證書的發動機，須採用與在試驗台上進行前期發證試驗相同的程序。

2.2.5 *氮氧化物減少裝置*

.1 如在 EIAPP 證書中包括氮氧化物減少裝置，該裝置須被認為是發動機的一個構件並且其存在須記錄於到發動機技術檔案中。前期發證試驗時，須對裝有氮氧化物減少裝置的發動機進行試驗。

.2 如果因前期發證試驗時未能滿足所要求的排放值而安裝氮氧化物減少裝置，為使該組合獲得 EIAPP 證書，對發動機包括所安裝的減少裝置須重新試驗以表明符合適用的氮氧化物排放限值。但在此情況下，該組合可按 6.3 所述的簡化測量方法重新試驗。在任何情況下均不得給予 6.3.11 中給出的容許偏差。

.3 如果按 2.2.5.2 使用簡化測量方法核實氮氧化物減少裝置的有效性，該試驗報告須作為前期發證試驗報告的附件，表明發動機本身不能滿足所要求的排放值。兩份報告均須提交主管機關，兩次試驗的 2.4.1.5 中詳述的試驗報告數據，均須包括在發動機技術檔案中。

.4 根據 2.2.5.2 作為符合要求證實程序一部分而使用的簡化測量方法僅對發動機和氮氧化物減少裝置組合的有效性證實可以接受，對發動機族或發動機組發證則不可接受。

.5 在 2.2.5.1 和 2.2.5.2 所述的兩種情況下，該氮氧化物減少裝置連同設備運行時獲得的排放值和主管機關要求的其他記錄須一同包括在 EIAPP 證書中。發動機的技術

檔案也須包括該裝置的船上氮氧化物核實程序，以確保該設備正確運行。

.6 儘管有 2.2.5.3 和 2.2.5.4 的規定，主管機關可依據本組織有待制訂的導則對氮氧化物減少裝置予以批准。

2.2.6 如因構件設計改變需要確立新的發動機族或發動機組但無可用母型機，發動機製造廠可向主管機關申請使用對適用試驗循環的各特定模式作出修改後的以前獲取的母型機試驗數據，以得到氮氧化物排放值的相應變化。在此情況下，用於確定修改排放數據的發動機須按 4.4.6.1、4.4.6.2 和 4.4.6.3 的要求對應於以前使用的母型機。如果多於一個構件需要改變，由此變化引起的複合效果由單獨一套試驗結果予以證實。

2.2.7 對於發動機族或發動機組內發動機的前期發證，須按照主管機關制定的程序，為母型機和在該發證下生產的每一台成員發動機簽發 EIAPP 證書，以伴隨發動機安裝於該主管機關管轄下的船舶上的整個使用期。

2.2.8 *發動機製造國主管機關簽發證書*

.1 如果船上將安裝的發動機在該船舶主管機關的國家之外製造，則船舶主管機關可要求發動機生產國的主管機關檢驗該發動機。如果能滿意地認定第 13 條的適用要求已按照本規則得到滿足，發動機製造國的主管機關須簽發或授權簽發 EIAPP 證書。

.2 證書副本和檢驗報告副本各 1 份須儘快送交提出要求的主管機關。

.3 如此簽發的證書須含有 1 份聲明，說明此證書係應主管機關要求而簽發。

2.2.9 本規則附錄 II 中的相關流程圖，提供了有關本規則第 2 章所述船用柴油發動機前期檢驗和發證指南。如有不一致，以第 2 章文本為準。

2.2.10 EIAPP 證書的格式範本作為附錄 I 附於本規則之後。

2.3 發動機的發證程序

2.3.1 對於製造廠的原技術規範未做調整或改裝的發動機，有效的 EIAPP 證書應足以證明其符合適用的氮氧化物排放限值。

2.3.2 發動機安裝於船上後，須確定其經過何種程度的會影響氮氧化物排放的進一步改裝和/或調整。因此在發動機安裝於船上之後但簽發 IAPP 證書之前，須檢驗其改裝情況並且採用船上氮氧化物核實程序及 2.1.2 中所述方法之一予以核准。

2.3.3 有些發動機在前期發證後，需要做最後的性能調整或改裝。在此情況下，可以使用發動機組的概念以保證發動機仍符合適用限值。

2.3.4 凡安裝於船上的船用柴油發動機須備有 1 份技術檔案。該技術檔案須由發動機發證申請方提供並經主管機關認可，並要求伴隨發動機的整個船上使用期。技術檔案須包括 2.4.1 中所述資料。

2.3.5 如安裝並需要氮氧化物減少裝置以符合氮氧化物排放限值，便於核實符合第 13 條要求的可選手段之一是符合 6.4 的直接測

量和監測方法。但是，根據所用裝置的技術可能性，經主管機關認可，也可以監測其他相關參數。

2.3.6 如為符合氮氧化物要求而引進一種附加物質如氨、尿素、蒸氣、水、燃料添加劑等，則須提供監測此物質消耗的方法。技術檔案須提供足夠的資料以便能夠使用一種便捷方法證明該附加物質的消耗與達到符合適用的氮氧化物限值的目的相一致。

2.3.7 在使用符合 6.2 的發動機參數檢查方法核實符合性時，如前期發證後對發動機進行了任何調整或改裝，則 1 份該調整或改裝的完整記錄須記載在發動機參數記錄簿上。

2.3.8 如所有安裝於船上的發動機經核查仍保持在技術檔案記錄的參數、構件和可調整特徵之內，則須認為發動機在第 13 條規定的適用氮氧化物限值內運行。在此情況下，如本附則其他所有適用要求均獲滿足，則應為該船舶簽發 IAPP 證書。

2.3.9 如果任何調整或改裝超出技術檔案規定的認可限值，只有通過下列方法之一核實氮氧化物總體排放性能處於規定的限值之內，方可簽發 IAPP 證書：符合 6.3 的簡化船上測量；或參照表明該調整或改裝未超出適用氮氧化物排放限值的有關發動機組認可的試驗台試驗。在初次發動機檢驗之後的檢驗中，可選用經主管機關認可的符合 6.4 的直接測量和監測方法。

2.3.10 對於已獲得 EIAPP 證書的發動機，主管機關可根據本規則自行決定省略或減少所有船上檢驗部分。但是，對於發動機族或發動機組（如適用）中的至少 1 個氣缸和/或 1 台發動機必須完成全部船上檢驗，並且僅在所有其他氣缸和/或發動機預期與被檢驗的發動機和/

或氣缸運作相同時方可省略。對已裝構件檢查，主管機關可對船上的備件進行該部分檢驗作為替代，但是該備件應能代表已裝構件。

2.3.11 本規則附錄 II 的流程圖，提供了本規則第 2 章所述船用柴油發動機初次、換證、年度和中間檢驗時的檢驗和發證指南。如有不一致，以第 2 章文本為準。

2.4 技術檔案和船上氮氧化物核實程序

2.4.1 為使主管機關能夠進行 2.1 中所述發動機檢驗，2.3.4 所要求的技術檔案須最低限度包括下列資料：

.1 列明影響氮氧化物排放的構件、設定值和操作值，包括任何氮氧化物減少裝置或系統；

.2 列明發動機構件的可允許調整或替代的整個範圍；

.3 有關發動機性能包括其額定轉速和額定功率的全部記錄；

.4 根據第 6 章規定，在船上核實檢驗中的證明符合氮氧化物排放限值的船上氮氧化物核實程序體系；

.5 本規則附錄 V 第 2 節所述母型機相關試驗數據副本 1 份；

.6 如適用，對屬於發動機組或族的 1 台發動機的劃定和限定；

.7 按照規範在發動機上使用時將使發動機繼續符合適用的氮氧化物排放限值的備件/部件的規範；以及

.8 EIAPP 證書（如適用）。

2.4.2 作為一般原則，船上氮氧化物核實程序須能使驗船師易於判定發動機是否仍符合第 13 條的適用要求。同時，不得過於繁複以致不當延誤船舶或需要對某一特定發動機的特性有深入的了解或需要船上所沒有的專門測量裝置。

2.4.3 船上氮氧化物核實程序須為下列方法之一：

.1 符合 6.2 的發動機參數檢查方法以核定發動機構件、設定值和操作值沒有偏離發動機技術檔案的規定；

.2 符合 6.3 的簡化測量方法；或

.3 符合 6.4 的直接測量和監測方法。

2.4.4 當考慮何種船上氮氧化物核實程序應包括在發動機技術檔案中以在所要求的船上核實檢驗（發動機的初次船上檢驗除外）中核實發動機是否符合氮氧化物排放限值時，6.1 中所列 3 種船上氮氧化物核實程序的任何一種均適用。但是，與所用方法相關的程序要經主管機關認可。如方法與原經認可的技術檔案中規定的核實程序方法不同，該方法程序須增為技術檔案的修正案或者添為技術檔案所述程序的替代方法。此後船舶所有人可選擇使用技術檔案中經認可的何種方法證明符合要求。

2.4.5 除經主管機關認可的發動機製造廠規定並包括在技術檔案中用於發動機初次發證的方法外，船舶所有人須可以選擇符合 6.4 的氮氧化物排放直接測量法。該測量數據可以為涵蓋發動機運作全程與發動機的其他操作數據一同定期抽樣記錄的形式，或者為連續監測和數據儲存的結果。數據必須是現時的（最近 30 天之內）並且必須使

用本規則中列舉的試驗程序獲取。這些監測記錄須在船上保存 3 個月以備當事國按第 10 條進行核查。須按照船上操作手冊中經認可的程序，對數據根據環境條件和燃料規格進行校正，並對測量設備是否校準和運作正確進行檢查。如裝有影響氮氧化物排放的廢氣後處理裝置，測量點必須位於該裝置的下游。

第 3 章

氮氧化物排放標準

3.1 船用柴油發動機氮氧化物最大允許排放限值

3.1.1 氮氧化物最大允許排放限值按其適用於第 13 條第 3、4、5.1.1 和 7.4 段中給出。根據本規則中的程序測量和計算出的氮氧化物加權排放總量（修正至小數點後第一位）須等於或小於對應於發動機額定轉速的適用計算值。

3.1.2 當發動機按照 5.3 使用試驗燃油運轉時，氮氧化物排放總量（以二氧化氮加權排放總量計）須採用本規則規定的試驗循環和測量方法確定。

3.1.3 按第 13 條第 3、4 或 5.1.1 段中所適用的公式計算出的發動機廢氣排放限值和實際計算出的發動機廢氣排放值（修正至小數點後第一位）須在發動機的 EIAPP 證書中予以標明。如果發動機是發動機族或發動機組的成員發動機，須將相關母型機的排放值與該發動機族或發動機組的適用限值進行比較。此限值須為按第 13 條第 3、4 或 5.1.1 段，以該發動機族或發動機組應涵蓋的最高發動機轉速為基礎的該發動機族或發動機組的限值，（不考慮該發動機 EIAPP 證書標明的母型機額定轉速或該特定發動機的額定轉速）。

3.1.4 如發動機按第 13 條第 5.1.1 段予以驗證，則在各模式點的具體排放量不得超過適用的氮氧化物排放限值的 50%，但下列除外：

.1 3.2.5 規定的 D2 試驗循環的 10%模式點。

.2 3.2.6 規定的 C1 試驗循環的 10%模式點。

.3 3.2.6 規定的 C1 試驗循環的空轉模式點。

3.2 所應用的試驗循環和加權因數

3.2.1 對每一台發動機或發動機組或發動機族的母型機，須使用 3.2.2 至 3.2.6 中規定的一個或多個相關試驗循環核實是否符合第 13 條規定中適用的氮氧化物排放限值。

3.2.2 用於船舶主推進包括柴油電力驅動的恆速船用柴油發動機，須按照表 1 應用 E2 試驗循環。

3.2.3 與可控螺距螺旋槳相連的發動機，無論其組合曲線如何，須按照表 1 應用 E2 試驗循環。

表 *1*

應用於“恆速主推進”的試驗循環

（包括柴油-電力驅動和所有可控螺距螺旋槳裝置）

試驗循環類型 E2	轉速	100%	100%	100%	100%*
	功率	100%	75%	50%	25%
	加權因數	0.2	0.5	0.15	0.15

3.2.4 按推進器原理運轉的主、輔發動機，須按照表 2 應用 E3 試驗循環。

表 *2*

應用於“按推進器原理運轉的主、輔發動機”的試驗循環

試驗循環類型 E3	轉速	100%	91%	80%	63%
	功率	100%	75%	50%	25%
	加權因數	0.2	0.5	0.15	0.15

3.2.5 恆速輔發動機，須按照表 3 應用 D2 試驗循環。

表 3

應用於“恆速輔發動機”的試驗循環

試驗循環類型 D2	轉速	100%	100%	100%	100%	100%
	功率	100%	75%	50%	25%	10%
	加權因數	0.05	0.25	0.3	0.3	0.1

3.2.6 上述未包括的變速、變載荷輔發動機，須按照表 4 應用 C1 試驗循環。

---

* 在一些特殊情況下，包括擬應用 E2 的大缸徑發動機，由於其振動質量和構造，發動機在標定轉速下低載荷運轉有損壞重要部件的風險。在此情況下，發動機製造廠須向主管機關提出申請，對表 1 中試驗循環的 25%功率模式點，就發動機轉速作出修改。但是，調整後的 25%功率時的發動機轉速須儘可能接近發動機製造廠建議的和主管機關認可的額定發動機轉速。試驗循環的適用加權因數須保持不變。

表 4

應用於“變速、變載荷輔發動機”的試驗循環

試驗循環類型 C1	轉速	額定				中間			空轉
	扭矩	100%	75%	50%	10%	100%	75%	50%	0%
	加權因數	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15

3.2.7　試驗循環 C1 中給出的扭矩值是代表着在一給定的試驗模式下，在給定轉速下，所要求的扭矩和最大可能扭矩之比的百分比。

3.2.8　試驗循環 C1 的中間轉速須由製造廠申報，並考慮到下列要求：

.1　對於設計在一定轉速範圍中在滿負荷扭矩曲線上運行的發動機，所申報的最大扭矩轉速，如果出現於額定轉速的 60%至 75%之間，須為中間轉速。

.2　如所申報的最大扭矩轉速小於額定轉速的 60%，則中間轉速須為額定轉速的 60%。

.3　如所申報的最大扭矩轉速大於額定轉速的 75%，則中間轉速須為額定轉速的 75%。

.4　對於未設計成在穩定狀態下在一定轉速範圍中在滿負荷扭矩曲線上運行的發動機，中間轉速將典型地處於最大額定轉速的 60%至 70%之間。

3.2.9　如果發動機製造廠請求對已經按照 3.2.2 至 3.2.6 中規定的不同試驗循環核准過的發動機應用新的試驗循環，則也許不需要因新的應用對發動機再完成全部發證過程。在此情況下，發動機製造廠可以將第一次發證試驗的具體模式下的測量結果，使用新的試驗循環的相應加權因數，用以計算新的試驗循環應用的加權排放總量，通過此重新計算證明符合排放限值。

第 4 章

系列化生產的發動機認可：發動機族和發動機組的概念

4.1 通則

4.1.1 為避免對每台發動機進行證明其符合氮氧化物的排放限值的發證測試，可採用兩種認可的概念之一，即發動機族或發動機組概念。

4.1.2 發動機族概念可用於任何系列化生產的發動機，通過其設計已證明具有類似的氮氧化物排放特性，按原樣使用，及，在船上安裝中，毋需進行任何會對氮氧化物的排放造成不利影響的調整或改裝。

4.1.3 發動機組概念可用於具有相似用途的小系列生產的發動機，在船上安裝或使用過程中需做輕微調整和改裝。

4.1.4 發動機製造廠最初可自行決定發動機是否要屬於發動機族或發動機組的概念。通常，應用的類型須基於在試驗台試驗後，對發動機是否將要，及在多大程度上進行改裝。

4.2 文件

4.2.1 所有發證文件必須完整並酌情由經正式授權的當局適當地蓋章。該文件還須包括所有條款和條件，包括備件的更換，以確保發動機保持符合適用的氮氧化物排放限值。

4.2.2 對發動機族或發動機組中的發動機，發動機參數檢查方法所要求的文件規定於 6.2.2 中。

4.3 發動機族概念的運用

4.3.1 發動機族概念在保證發動機族中的所有發動機均符合認可要求的同時，提供了減少須交付認可試驗的發動機數量的可能性。在發動機族的概念中，以 1 台母型機代表具有相似排放特點和設計的發動機。

4.3.2 系列生產並且不打算進行改裝的發動機可以納入發動機族概念。

4.3.3 母型機的選擇程序須為所選擇的發動機具有對氮氧化物排放水平產生最不利影響的特點。該發動機通常在該發動機族的所有發動機中具有最高的氮氧化物排放水平。

4.3.4 製造廠根據試驗和技術判斷，須提議哪些發動機屬於發動機族，哪些發動機產生最高的氮氧化物排放，以及應選出哪個發動機進行發證試驗。

4.3.5 主管機關須對發動機族中的母型機選擇進行發證認可審查，並須可以選擇一台不同的發動機進行認可檢驗或產品合格試驗以確信發動機族中的所有發動機符合適用的氮氧化物排放限值。

4.3.6 發動機族概念允許通過可調整零件對發動機進行微量調整。備有可調整零件的船用柴油發動機必須符合對在實際可及範圍內的任何調整的全部要求。如果某一零件為永久性封焊的或其他在通常情況下不可及的零件，則不能視為可調整零件。主管機關可要求將可調整零件調整到發證或在用試驗的可調整範圍內的任何規格以確定是否符合要求。

4.3.7 在對發動機族給予認可之前，主管機關須採取必要措施核實已作出適當安排以確保對產品合格的有效控制。這可包括，但不限於：

.1 氮氧化物關鍵部件或建議作為發動機族的標識號與這些部件的圖紙編號（及修改狀況，如適用）之間的關係；

.2 主管機關在檢驗時核實用於生產氮氧化物關鍵部件的圖紙與為界定該發動機族而確立的圖紙是否一致的方法；

.3 圖紙修正控制措施。如製造廠提議對界定一發動機族的氮氧化物關鍵部件圖紙的修改可在發動機的服務期限內進行時，則產品合格保證體系需展示修改將，或將不影響氮氧化物排放時，要採用的程序。這些程序須包括圖紙編號的分配、對氮氧化物關鍵部件的標識標誌的影響以及向負責原發動機族認可的主管機關提供經修改的圖紙的規定。如這些修改可能影響氮氧化物的排放，則評估或核實母型機性能須採用的方法連同與通知主管機關有關的要採取的後續行動須一起予以說明，及，如必要，在這些改裝投入服務前，申報新的母型機；

.4 業已實施的確保提供給經認證的發動機的任何氮氧化物關鍵部件的備件將與經認可的技術檔案中所列明的一致，因而將按界定該發動機族的圖紙生產的程序；或

.5 經主管機關認可的等效措施。

4.3.8 *發動機族選擇指南*

4.3.8.1 發動機族須由該發動機族中所有發動機共同的基本特性予以界定。某些情況下參數間會有相互作用；這些影響也必須得到考慮，以確保僅具有相似排放特性的發動機方可包括在一個發動機族

中，例如，在某些發動機上，由於所用的增壓空氣或燃料系統，氣缸數量可成為相關參數，但對其他設計，廢氣排放特性可能與氣缸數或構形無關。

4.3.8.2 發動機製造廠負責從其不同型號的發動機中選出可包括在一個發動機族中的發動機。下列基本特性而非規格須是一個發動機族中的所有發動機所共有的：

.1 燃燒循環

— 二衝程循環

— 四衝程循環

.2 冷卻介質

— 空氣

— 水

— 油

.3 單個氣缸排量

— 在總差異範圍 15%之內

.4 氣缸數量及氣缸構形

— 僅在某些情況下適用，例如與廢氣清潔裝置相聯時

.5 空氣抽吸方法

— 自然抽吸

— 增壓

.6 燃料類型

— 蒸餾/殘餘燃油

— 雙燃料

.7 燃燒室

— 開式燃燒室

— 分開燃燒室

.8 閥和開孔，構形、尺寸和數量

— 氣缸頭

— 氣缸壁

.9 燃料系統類型

— 泵線噴射器

— 串聯

— 分配器

— 單一元件

— 單元噴射器

— 氣體閥

.10 其他特性

— 廢氣再循環

— 水/乳液噴射

— 空氣噴射

— 增壓冷卻系統

— 廢氣後處理

— 還原催化劑

— 氧化催化劑

— 熱反應器

— 顆粒捕捉器。

4.3.8.3 如果發動機包含其他被認為能影響氮氧化物廢氣排放的特徵，則這些特徵必須在選擇包括在發動機族中的發動機時予以認定和考慮。

4.3.9 *發動機族的母型機選擇指南*

4.3.9.1 用於氮氧化物測量的母型機選擇方法須經主管機關同意並認可。該方法須基於所選擇的發動機具有根據經驗已知會產生以克每千瓦小時（g/kWh）表示的最高氮氧化物排放量的發動機特徵和特性。這需要對發動機族中的發動機有詳盡的了解。在某些情況下，主管機關會斷定，對另外一台發動機進行實驗能更好地體現該發動機族的最差氮氧化物排放率。因此，主管機關可以根據該發動機族的發動機中表明具有最高氮氧化物排放水平的特徵，選擇另一台發動機進行試驗。如果在發動機族的發動機範圍中包含其他可能被認為影響氮氧化物排放的可變特徵，這些特徵也必須在母型機選擇中予以認定和考慮。

4.3.9.2 母型機須具有所適用試驗循環的最高排放值。

4.3.10 *發動機族的發證*

4.3.10.1 證書須包括一份由發動機製造廠制定和保管並經主管機關批准的清單，該清單中列有同一發動機族中的所有發動機及其規格，其操作條件限制和可允許的發動機調整細節和限度。

4.3.10.2 根據本規則須為發動機族的一成員發動機簽發一張前期證書或 EIAPP 證書，證明母型機符合第 13 條中規定的適用氮氧化物限

值。如果成員發動機的前期發證需要測量性能值，須按照本規則附錄 IV 中 1.3 的要求校準測量用設備。

4.3.10.3 如果在本規則規定的最惡劣條件下對發動機族的母型機進行試驗和氣體排放測量並證實符合 3.1 中給出的適用的最大允許排放限值，和試驗及氮氧化物測量結果須記錄在簽發給該特定母型機及該發動機族的所有成員機的 EIAPP 證書中。

4.3.10.4 如果兩個或以上主管機關同意接受彼此的 EIAPP 證書，則由其中一個主管機關發證的整個發動機族須得到與原發證主管機關簽定協議的其他主管機關的接受，協議中另有規定者除外。按該協議簽發的證書須被視為該發動機族證書所包括的所有發動機均符合特定氮氧化物排放要求的初步證據。如經證實所安裝的發動機未經改裝並且其調整在發動機族證書所允許的限度之內，則不需要對符合第 13 條規定做進一步證實。

4.3.10.5 如果發動機族的母型機根據本規則允許之外的其他標準或不同試驗循環予以認證，則製造廠必須向主管機關證明適當試驗循環下的氮氧化物加權平均排放在本規則和第 13 條的有關限值內，之後主管機關方可簽發 EIAPP 證書。

4.4 發動機組概念的應用

4.4.1 發動機組的發動機通常需要調整或改裝以適合船上運作條件，但這些調整或改裝不得導致氮氧化物排放超過第 13 條的適用限值。

4.4.2 發動機組概念還提供了減少對生產或使用中的發動機的改裝進行認可試驗的可能性。

4.4.3 發動機組概念通常可適用於具有 4.4.6 規定的相同設計特徵的任何發動機型，但在試驗台測試後允許單機改裝或調整。發動機組內的發動機範圍和母型機的選擇須經主管機關同意和認可。

4.4.4 如發動機製造廠或其他方要求應用發動機組概念，主管機關須考慮給予發證認可。如果發動機所有人無論有無發動機製造廠的技術支持，決定對其擁有船隊中許多相似發動機進行改裝，發動機所有人可以申請發動機組證書。發動機組可基於測試台上一台作為試驗發動機的母型機。典型應用為相似運作條件下相似柴油發動機的相似改裝。如除發動機製造廠之外的其他方申請發動機證書，發動機證書的申請方承擔本規則其他部分給出的發動機製造廠的責任。

4.4.5 在對系列化生產的發動機給予初始發動機組認可前，主管機關須採取必要措施核實已做出適當安排以確保對產品合格的有效控制。4.3.7 中的要求在細節上做出必要修正後，適用於本節。對於在簽發 EIAPP 證書後，為船上發動機改裝而建立的發動機組，此要求可能沒有必要。

4.4.6 *發動機組選擇指南*

4.4.6.1 除 4.3.8 中為發動機族定義的參數之外，發動機組可按基本特性和規格界定。

4.4.6.2 發動機組中的發動機須共有的參數和規格如下：

.1 缸內徑和衝程尺寸；

.2 增壓和排氣系統的方法和設計特點：

— 恆壓；

— 脈衝系統；

.3 增壓空氣冷卻系統方法：

— 有/無增壓空氣冷卻器；

.4 影響氮氧化物排放的燃燒室設計特點；

.5 可確定影響氮氧化物排放的基本特徵的燃料噴射系統、活塞和噴射凸輪的設計特點；及

.6 額定轉速下的額定功率。發動機功率（kW/氣缸）和/或額定轉速的允許範圍由製造廠申報並經主管機關認可。

4.4.6.3 如果 4.4.6.2 所要求的標準並非預期發動機組內所有發動機所共有，則一般可認為那些發動機不屬同一個發動機組。但是，如那些標準中僅一項不是預期發動機組中所有發動機所共有，則發動機組可予接受。

4.4.7 *發動機組中可允許的調整或改裝指南*

4.4.7.1 經有關當事國同意及主管機關認可，在發動機組的前期發證或最後試驗台測量之後，符合發動機組概念的輕微調整和改裝可以允許，如果：

.1 對與排放有關的發動機參數和/或發動機船上氮氧化物核實程序的規定和/或發動機製造廠提供的數據的檢查證實經調整或改裝的發動機符合適用的氮氧化物排放限值。發動機試驗台上氮氧化物排放結果可作為核查發動機組中發動機的船上調整或改裝的一種選擇而加以接受；或

.2 船上測量證實經調整或改裝的發動機符合適用的氮氧化物排放限值。

4.4.7.2 發動機組內可以允許的調整和改裝實例（但不限於這些實例）如下：

.1 針對船上條件：

— 為補償燃料性質差異對噴射定時的調整，
— 為最大氣缸壓力對噴射定時的調整，
— 對氣缸間燃料輸送差異的調整。

.2 針對性能，對下列部件進行的改裝：

— 渦輪增壓器，
— 噴射泵部件，
— 柱塞規格，
— 輸送閥規格，
— 噴嘴，
— 凸輪輪廓，
— 進氣和/或排氣閥，
— 噴射凸輪，
— 燃燒室。

4.4.7.3 上述試驗台試驗後的改裝實例涉及到發動機整個使用壽命中的部件或發動機性能的重大改進。這是發動機組概念存在的主要原因之一。主管機關在收到申請之後，可將對一台發動機（可能是試驗發動機）進行的表明該改裝對氮氧化物排放水平造成的影響驗證試驗

結果，接受為該發動機組內的所有發動機的試驗結果，而不要求對發動機組的每台成員發動機進行發證測量。

4.4.8 *發動機組的母型機選擇指南*

4.4.8.1 母型機的選擇須符合 4.3.9 中的適用標準。並非總能以與大批量生產發動機（發動機族）相同的方式從小批量生產的發動機中選出母型機。第一台訂購的發動機可被登記為母型機。此外在前期發證試驗中，如果母型機未調整至發動機製造廠定義的發動機組的參照或最大允許運作條件（可包括但不限於：最大燃燒壓力、壓縮壓力、排氣背壓、增壓空氣溫度），所測定的氮氧化物排放值須根據其他代表性發動機的排放敏感度測試修正至所定義的參照和最大允許條件。經修正的參照條件下的加權平均氮氧化物排放值須在 EIAPP 證書附件的 1.9.6 中標明。在任何情況下參照條件公差的影響不得導致排放值超過第 13 條要求的適用的氮氧化物排放限值。用於選擇代表發動機組的母型機的方法、參照值和應用的公差須經主管機關同意和認可。

4.4.9 *發動機組的發證*

4.4.9.1 4.3.10 中的要求，在細節上作出必要修正後，適用於本節。

第 5 章

試驗台氮氧化物排放的測量程序

5.1 通則

5.1.1 此程序須應用於船用柴油發動機的每一次初始認可試驗而不論其試驗地點（2.1.2.1 和 2.1.2.2 所述試驗方法）。

5.1.2 本章規定了確定氮氧化物廢氣排放加權平均值所需往復式內燃機在穩定狀態下的氣體排放測量和計算方法。

5.1.3 由於確定排放值需要進行一組多元單項測量而並非僅獲得單一測量值，所以許多下述程序為實驗室方法的詳細闡述。因此，所獲結果不僅取決於發動機和試驗方法並同樣地取決於測量程序。

5.1.4 本章包括作為試驗台測量程序的試驗和測量方法、試驗運行和試驗報告。

5.1.5 原則上，在排放試驗過程中，發動機須以與其船上應用相同的方式配備輔助設備。

5.1.6 對於本規則範圍內的許多發動機類型，發動機運行時會安裝的輔助設備在製造和發證時可能不會得知。因此，所標示的排放基於 1.3.13 所定義的制動功率。

5.1.7 當不適合在 5.2.3 規定的條件下試驗發動機時，例如，如果發動機和傳動裝置構成一個整體單元，發動機僅可在裝妥其他輔助設備後進行試驗。在這種情況下，功率計的設置須按照 5.2.3 和 5.9 確定。輔助設備損耗須不超過最大實測功率的 5%。超過 5%的損耗須在試驗前經有關主管機關認可。

5.1.8 所有容量和容積流量率須與 273K（0℃）和 101.3kPa 相關。

5.1.9 除另有規定外，本章要求的所有測量結果、試驗數據或計算須按照 5.10 記錄在發動機試驗報告中。

5.1.10 本規則中提到的“增壓空氣”一詞同樣適用於掃氣。

5.2 試驗條件

5.2.1 *發動機族認可的試驗條件參數和試驗有效性*

5.2.1.1 須測量發動機吸入空氣的絕對溫度 T_a（以 K 表示），須根據以下公式測量或計算乾燥大氣壓力 p_s，以 kPa 表示：

$$p_s = p_b - 0.01 \cdot R_a \cdot p_a$$

p_a 按公式（10）確定

5.2.1.2 對於自然進氣和機械增壓發動機，f_a 參數須根據以下公式確定：

$$f_a = \left(\frac{99}{p_s}\right) \cdot \left(\frac{T_a}{298}\right)^{0.7} \quad (1)$$

5.2.1.3 對於有或無吸入空氣冷卻的渦輪增壓發動機，f_a 參數須根據以下公式確定：

$$f_a = \left(\frac{99}{p_s}\right)^{0.7} \cdot \left(\frac{T_a}{298}\right)^{1.5} \quad (2)$$

5.2.1.4 對於承認發動機族認可有效的試驗，參數 f_a 須為：

$$0.93 \le f_a \le 1.07 \quad (3)$$

5.2.2 *具有增壓空氣冷卻的發動機*

5.2.2.1 冷卻介質溫度和增壓空氣溫度須予以記錄。

5.2.2.2 所有發動機按照擬定的船上安裝配置後，必須能夠在 25℃環境海水溫度下於第 13 條的適用氮氧化物排放限值內運轉。此參照溫度，須根據下列適用於具體安裝的增壓空氣冷卻安排加以考慮：

.1 發動機增壓空氣冷卻器直接海水冷卻。須證實增壓空氣冷卻器冷卻劑的進口溫度為 25℃時符合適用的氮氧化物限值。

.2 發動機增壓空氣冷卻器中間淡水冷卻。須證實增壓空氣冷卻系統在與 25℃的環境海水溫度相對應的冷卻劑進口設計溫度下運行時，符合適用的氮氧化物限值。

*註：*以上（.1）中所述直接海水冷卻系統的母型機試驗證明符合要求，不能證明本節所要求的在使用中間淡水冷卻安排所必有的更高增壓空氣溫度機制下符合要求。

.3 對於安裝的增壓空氣冷卻器不含直接或間接海水冷卻，如散熱器冷卻的淡水系統、氣/氣增壓空氣冷卻器，須證實發動機和增壓空氣冷卻系統在 25℃空氣溫度下按製造廠的規定運行時，符合適用的氮氧化物限值。

5.2.2.3 是否符合第 13 條規定的適用的氮氧化物排放限值，須使用製造廠所規定和證明的增壓空氣參照溫度（T_{SCRef}）通過試驗或，適用時，計算加以證實。

5.2.3 *功率*

5.2.3.1 具體排放量測量的基礎是 1.3.11 和 1.3.13 定義的未經修正的制動功率。發動機須與發動機運行所需的輔助設備（例如：風扇、水泵等）一同提交。如在測試台上無法或不適宜安裝輔助設備，則其功耗須加以確定並從測定的發動機功率中扣除。

5.2.3.2 發動機上可能安裝的非運行必需的輔助設備可在試驗時拆除。另參閱 5.1.5 和 5.1.6。

5.2.3.3 如果輔助設備未拆除，其試驗轉速下的功耗須加以確定，以計算功率計的設定值，但輔助設備與發動機構成單一整體的發動機除外（例如：空氣冷卻發動機的冷卻風扇）。

5.2.4 *發動機空氣進氣系統*

5.2.4.1 須使用發動機空氣進氣系統或試驗車間系統，所呈現的空氣進氣限制為乾淨空氣濾清器在額定功率和滿載荷的轉速時，製造廠規定的最大值的±300Pa 以內。

5.2.4.2 如果發動機配有一體化空氣進氣系統，則須在試驗時使用。

5.2.5 *發動機排氣系統*

5.2.5.1 須使用發動機排氣系統或試驗車間系統，所呈現的背壓為在額定功率和滿載荷的轉速時，製造廠規定的最大值的±650Pa 以內。排氣系統須符合 5.9.3 中的廢氣取樣要求。

5.2.5.2 如果發動機配有一體化排氣系統，則須在試驗時使用。

5.2.5.3 如果發動機配有廢氣後處理裝置，其排氣管直徑須與包含廢氣後處理裝置的展開部分開端進口上游至少 4 倍於管直徑之處所使用的管直徑相同。從排氣總管法蘭或渦輪增壓器出口至廢氣後處理裝

置的距離須與船上構形相同，或位於製造廠的距離規格之內。排氣背壓或限制須遵循上述同一標準並可使用閥門調定。

5.2.5.4 如試驗台的裝置妨礙按照要求調整排氣背壓，對氮氧化物排放的影響應由該製造廠予以證明，並在主管機關認可後，對排放值相應地做出必要修正。

5.2.6 *冷卻系統*

5.2.6.1 須使用具有足夠容量的發動機冷卻系統以維持製造廠規定的發動機正常運作溫度。

5.3 試驗燃油

5.3.1 燃油特性會影響發動機廢氣排放；特別是，一些燃油結合氮在燃燒中會轉換成氮氧化物。因此，試驗所用燃油的特性須予以確定並記錄。如使用參照燃油，則須提供該燃油的參照號碼或規格及分析。

5.3.2 試驗用燃油的選擇取決於試驗的目的。如果沒有適合的參照燃油，建議使用 ISO 8217：2005 規定的具有適合該發動機類型的性質的 DM 級蒸餾船用燃料。如果沒有 DM 級船用燃料，須使用與 ISO 8217：2005 相符的 RM 級殘油燃油。對燃油的所有構成成分須進行必要的分析，以明確其規格及確定其 DM 或 RM 級別。母型機試驗時使用的燃油須在試驗中取樣。

5.3.3 燃油溫度須符合製造廠的建議。燃油溫度須在燃料噴射泵進口處或按照製造廠的規定測量，並且溫度和測量點須予以記錄。

5.3.4 以液體燃料為引燃燃料的雙燃料發動機須使用最大液體和氣體燃料比進行試驗。燃料的液體部分須符合 5.3.1、5.3.2 和 5.3.3。

5.4 測量設備和測量數據

5.4.1 交付試驗的發動機所排放的氣體成分須按本規則附錄 III 所述方法測量，該附錄闡述了氣體排放的建議分析系統。

5.4.2 其他系統或分析儀，如果能得出與 5.4.1 中所提到的設備等效的結果，經主管機關認可，可被接受。為確立等效，經使用公認國家或國際標準驗證合格的建議替代系統或分析儀，用於測量柴油發動機的廢氣排放濃度時，就 5.4.1 所援引的要求而言，能得出等效結果。

5.4.3 對於引入新系統，等效的確定須基於 ISO 5725-1 和 ISO 5725-2 或其他類似的公認標準中闡述的重複性和再現性的計算。

5.4.4 本規則不包含流量、壓力和溫度測量設備的詳細資料，而僅在本規則附錄 IV 的 1.3.1 中給出了此類設備進行排放試驗所需精度要求。

5.4.5 *功率計規格*

5.4.5.1 須採用具有適當性能可完成 3.2 所述的適合的試驗循環的發動機功率計。

5.4.5.2 扭矩和轉速測量儀器須使軸功率測量精度在給定範圍之內。可能需要附加計算。

5.4.5.3 測量設備的精度須不超過本規則附錄 IV 的 1.3.1 中給出的允許偏差。

5.5 廢氣流量測定

5.5.1 廢氣流量須採用 5.5.2，5.5.3 或 5.5.4 中規定的方法之一予以測定。

5.5.2 *直接測量方法*

5.5.2.1 該方法通過流量嘴或等效的測量系統直接測量廢氣流量，並且須符合公認的國際標準。

註： 直接氣體流量測量是一項困難的任務。須採取預防措施避免將會導致排放值錯誤的測量錯誤。

5.5.3 *空氣和燃料測量方法*

5.5.3.1 採用空氣和燃料測量方法確定廢氣排放流量的方法須根據公認的國際標準進行。

5.5.3.2 該方法對空氣流量和燃料流量進行測量。須使用具有本規則附錄 IV 中 1.3.1 所定義的精確度的空氣流量表和燃料流量表。

5.5.3.3 廢氣流量須作如下計算：

$$q_{\mathrm{mew}} = q_{\mathrm{maw}} + q_{\mathrm{mf}} \qquad (4)$$

5.5.3.4 空氣流量表須符合本規則附錄 IV 的精確度規範，CO_2 分析儀須滿足本規則附錄 III 的技術規範，且整個系統須符合本規則附錄 IV 的廢氣流量的精確度規範。

5.5.4 *燃料流量和碳平衡法*

5.5.4.1 該方法採用本規則附錄 VI 規定的碳平衡法根據燃料消耗、燃料成分和廢氣濃度進行廢氣質量流量計算。

5.6 發動機相關參數和其他基本參數測試儀的允許偏差

5.6.1 所有測量儀的校準，包括本規則附錄 IV 中詳述的測量儀和為了確定發動機的氮氧化物排放性能，例如測量汽缸峰值或增壓空氣

壓力而額外需要的測量儀的校準，須符合主管機關認可的標準和本規則附錄 IV 的 1.3.1 中列出的要求。

5.7 確定氣體成分的分析儀

5.7.1 確定氣體成分的分析儀須滿足本規則附錄 III 的規定。

5.8 分析儀的校準

5.8.1 用於發動機氣體排放測量的分析儀須按照本規則附錄 IV 的要求校準。

5.9 試驗運行

5.9.1 *通則*

5.9.1.1 對建議取樣和分析系統的詳細描述包含在 5.9.2 至 5.9.4 和本規則附錄 III 中。由於不同的結構可產生相同的結果，所以不要求完全一致。可使用附加構件，如儀器、閥、螺線管、泵和開關提供補充資料及協調構件系統的功能。如主管機關同意，對維持某些系統的精確性所不需要的其他構件可以排除，只要該排除基於良好的技術判斷。

5.9.1.2 進氣限制（自然進氣發動機）或增壓空氣壓力（渦輪增壓發動機）和廢氣背壓的處理須分別符合 5.2.4 和 5.2.5 的要求。

5.9.1.3 對於增壓發動機，進氣限制條件須以乾淨空氣進氣濾清器，及增壓系統在母型機試驗結果所代表，為該發動機族或發動機組申報或確立的範圍內運作為條件。

5.9.2 *主要廢氣成分：CO、CO_2、HC、NO_X 和 O_2*

5.9.2.1 確定原始廢氣中氣體排放的分析系統須以使用 5.4 中規定的分析儀為基礎。

5.9.2.2 對於原始廢氣所有成分的試樣可以使用一隻取樣管或用兩隻位置緊靠在一起並內部分至不同分析儀的取樣管採集。必須當心不要在分析系統的任何部位發生廢氣成分（包括水和硫酸）凝結。

5.9.2.3 這些分析儀的規格和校準須分別符合本規則附錄 III 和 IV。

5.9.3 *氣體排放物的取樣*

5.9.3.1 氣體排放物取樣管須安裝在發動機、渦輪增壓器或最後一個後處理裝置（取最下游者）的出口之後至少 10 倍於排氣管直徑之處，但同時至少在廢氣系統出口上游 0.5m 或 3 倍於排氣管直徑（取大者）之處。對於位置無法滿足上述規格的短廢氣系統，取樣管的替代位置須由主管機關認可。

5.9.3.2 碳氫化合物取樣管處的廢氣溫度須至少為 190℃，與碳氫化合物取樣管分離的其他氣體測量取樣管處須至少為 70℃。

5.9.3.3 對於帶有多路支管廢氣管的多氣缸發動機，取樣管進口須位於足夠下游之處，以確保試樣能代表從所有氣缸排出的平均廢氣排放。對於帶有不同支管組的多氣缸發動機，允許分別從每組廢氣管處取樣並計算平均廢氣排量。另外，允許從一組中取樣以代表平均廢氣排量，條件是能向主管機關證明其他組的排放是相同的。經主管機關認可，已表明和上述方法相關聯的其他方法可以採用。廢氣排放計算，須採用總廢氣質量排量。

5.9.3.4 廢氣取樣系統須按本規則附錄 IV 的第 4 節進行泄漏試驗。

5.9.3.5 如果廢氣成分受到任何廢氣後處理系統的影響，則廢氣試樣必須在該設備的下游取得。

5.9.3.6 取樣管入口位置須能避免吸入廢氣系統中為冷卻、調節或降低噪音而注入的水。

5.9.4 *分析儀的檢查*

5.9.4.1 排放分析儀須按本規則附錄 IV 的第 6 節置零及設定量程。

5.9.5 *試驗循環*

5.9.5.1 發動機須按照 3.2 定義的試驗循環進行試驗，這考慮到發動機應用的不同。

5.9.6 *試驗順序*

5.9.6.1 完成 5.9.1 至 5.9.5 的程序後，須開始試驗順序。發動機須按照 3.2 定義的適用試驗循環以任何順序進行每一種模式的運行。

5.9.6.2 在實驗循環的每一種模式的初轉換期之後，除低速空轉時須在製造廠申報的公差之內，指定轉速須維持在額定轉速的±1%或±3min^{-1}（取大者）之間。指定扭矩須加以維持，使整個測量期間的平均扭矩在發動機額定轉速下的額定扭矩的±2%之間。

5.9.7 *分析儀響應*

5.9.7.1 當穩定時，在試驗和所有零位和量程響應檢查過程中分析儀的輸出須使用數據採集系統或條圖記錄器進行記錄。分析廢氣時的記錄時間須不小於 10 分鐘，每次零位和量程響應檢查時須不小於 3 分鐘。數據採集系統須使用每分鐘至少三次的取樣頻率。所測定的 CO、HC 和 NO_x 濃度須使用 ppm 或等效方式記錄並至少精確到最接近整數

位。所測定的 CO_2 和 O_2 濃度須使用%或等效方式記錄並精確到不少於小數點後兩位。

5.9.8 *發動機狀況*

5.9.8.1 各模式點下發動機的轉速、負荷及其他重要參數須在發動機穩定之後測量。廢氣流量須予以測量或計算並記錄。

5.9.9 *分析儀複查*

5.9.9.1 排放試驗後，須使用零位氣體和測量前使用的相同量程氣體對分析儀的零位和量程響應進行複查。如果滿足以下條件，則須認定試驗合格：

.1 試驗前、後零位氣體響應差異低於初始量程氣體濃度的2%；及

.2 在試驗前、後量程氣體響應差異低於初始量程氣體濃度的 2%。

5.9.9.2 對按 5.9.7 記錄的分析儀響應不得進行零位和量程漂移校正。

5.10 試驗報告

5.10.1 對建立發動機族或發動機組而測試的每台單機或母型機，發動機製造廠須為其準備一份試驗報告，內容須包括能全面確定發動機性能和進行氣體排放計算的必要數據，包括本規則附錄 V 第 1 節規定的數據。試驗報告的正本須由製造廠存檔保管，一份經核准的真實副本須由主管機關存檔保管。

5.11 氣體排放數據評估

5.11.1 對於氣體排放評估，須對每種模式的至少最後 60s 記錄的數據作平均，每種模式中 CO、CO_2、HC、NO_X 和 O_2 的濃度須根據平均記錄數據和相應零位和量程檢查數據確定。CO_2 和 O_2 的平均結果須精確到不少於小數點後兩位（以%表示），CO、HC 和 NO_X 須至少精確到最接近整數位（以 ppm 表示）。

5.12 氣體排放計算

5.12.1 試驗報告的最後結果須按下列 5.12.2 至 5.12.6 中的步驟確定。

5.12.2 *廢氣流量的確定*

5.12.2.1 每種模式的廢氣流量率（q_{mew}）須按照 5.5.2 至 5.5.4 中所述的方法之一確定。

5.12.3 *乾/濕修正*

5.12.3.1 如排放未按濕度基礎測量，則須根據下列公式將所測濃度轉換成濕度基礎：

$$C_{\mathrm{w}} = K_{\mathrm{w}} \cdot C_{\mathrm{d}} \qquad (5)$$

5.12.3.2 對於原始廢氣：

.1 完全燃燒，按 5.5.2 的直接測量方法或 5.5.3 的空氣和燃料測量方法確定廢氣流量時，須使用下列公式：

$$K_{\mathrm{WR1}} = \left(1 - \frac{1.2442 \cdot H_a + 111.19 \cdot W_{\mathrm{ALF}} \cdot \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}}}{7773.4 + 1.2442 \cdot H_a + \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}} \cdot f_{\mathrm{fw}} \cdot 1000}\right) \cdot 1.008 \qquad (6)$$

或

$$k_{\mathrm{wT1}} = \left(1 - \frac{1.2442 \cdot H_{\mathrm{a}} + 111.19 \cdot w_{\mathrm{ALF}} \cdot \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}}}{773.4 + 1.2442 \cdot H_{a} + \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}} \cdot f_{\mathrm{fw}} \cdot 1000} \right) \Big/ \left(1 - \frac{p_{\mathrm{r}}}{p_{\mathrm{b}}} \right) \qquad (7)$$

式中

$$f_{fw} = 0.055594 \cdot w_{ALF} + 0.0080021 \cdot w_{DEL} + 0.0070046 \cdot w_{EPS} \qquad (8)$$

H_a 係指以 g（水）/kg（乾空氣）表示的吸入空氣的絕對濕度

註： 可通過相對濕度測量、露點測量、蒸氣壓力測量或乾/濕球測量，運用普遍接受的公式，計算出 H_{a}。

$$H_{\mathrm{a}} = 6.22 \cdot p_{\mathrm{a}} \cdot R_{\mathrm{a}} / (p_{\mathrm{b}} - 0.01 \cdot R_{\mathrm{a}} \cdot p_{\mathrm{a}}) \qquad (9)$$

式中：

p_{a}＝吸入空氣的飽和蒸氣壓力，kPa

$$p_{\mathrm{a}} = (4.856884 + 0.2660089 \cdot t_{\mathrm{a}} + 0.01688919 \cdot t_{\mathrm{a}}^2 - 7.477123 \cdot 10^{-5} \cdot t_{\mathrm{a}}^3 + 8.10525 \cdot 10^{-6} \cdot t_{\mathrm{a}}^4 - 3.115221 \cdot 10^{-8} \cdot t_{\mathrm{a}}^5) \cdot (101.32/760) \qquad (10)$$

式中：

t_{a}= 吸入空氣溫度，℃；$t_{\mathrm{a}} = T_{\mathrm{a}} - 273.15$

p_{b}= 總大氣壓力，kPa

p_{r}= 分析系統冷卻槽後的水汽壓力，kPa

p_{r}= 0.76kPa，冷卻槽溫度 3℃

.2 不完全燃燒，在一個或多個模式點 CO 大於 100ppm 或 HC 大於 100ppmC，按 5.5.2 的直接測量方法或 5.5.3 的

空氣和燃料測量方法及任何情況下使用 5.5.4 的碳平衡法確定廢氣流量時，須使用下列公式：

註：（11）和（13）中 CO 和 CO2 濃度的單位是%。

$$k_{\mathrm{wT2}} = \frac{1}{1 + a \cdot 0.005 \cdot (c_{\mathrm{co2d}} + c_{\mathrm{cod}}) - 0.01 \cdot c_{\mathrm{H2d}} + k_{\mathrm{w2}} - \frac{p_{\mathrm{r}}}{p_{\mathrm{b}}}} \qquad (11)$$

式中：

$$a = 11.9164 \cdot \frac{w_{\mathrm{ALF}}}{w_{\mathrm{BET}}} \qquad (12)$$

$$c_{\mathrm{H2d}} = \frac{0.5 \cdot a \cdot c_{\mathrm{COd}} \cdot (c_{\mathrm{COd}} + c_{\mathrm{CO2d}})}{c_{\mathrm{COd}} + 3 \cdot c_{\mathrm{CO2d}}} \qquad (13)$$

$$k_{\mathrm{w2}} = \frac{1.608 \cdot H_{\mathrm{a}}}{1000 + (1.608 \cdot H_{\mathrm{a}})} \qquad (14)$$

5.12.3.3 對於吸入空氣：

$$k_{\mathrm{wa}} = 1 - k_{\mathrm{w2}} \qquad (15)$$

5.12.4 *氮氧化物濕度和溫度修正*

5.12.4.1 由於氮氧化物的排放取決於環境空氣狀況，所以氮氧化物濃度須使用 5.12.4.5 或 5.12.4.6 中的適用系數進行環境空氣溫度和濕度修正。

5.12.4.2 除參照溫度 25℃下 10.71g/kg 外，不得使用其他濕度參照值。

5.12.4.3 其他修正公式如證明正確、有效，並經主管機關認可，可以使用。

5.12.4.4 增壓空氣中注入水或蒸氣（空氣加濕）被視作排放控制手段，因此濕度修正中不做考慮。增壓冷卻器中凝結的水會改變增壓空氣的濕度，因此濕度修正中須作考慮。

5.12.4.5 壓燃式發動機：

$$k_{\mathrm{hd}}=\frac{1}{1-0.0182\cdot\left(H_{\mathrm{a}}-10.71\right)+0.0045\cdot\left(T_{\mathrm{a}}-298\right)} \qquad (16)$$

式中：

T_a= 空氣濾清器進口的空氣溫度，K

H_a= 空氣濾清器進口的吸入空氣濕度，克水（g）/每千克乾空氣（kg）

5.12.4.6 具有中間空氣冷卻器的壓燃式發動機須使用下列替代公式：

$$k_{\mathrm{hd}}=\frac{1}{1-0.012\cdot\left(H_{\mathrm{a}}-10.71\right)-0.00275\cdot(T_{\mathrm{a}}-298)+0.00285\cdot(T_{\mathrm{SC}}-T_{\mathrm{SCRef}})} \qquad (17)$$

式中：

T_{SC} 係指增壓空氣溫度；

T_{SCRef} 係指 5.2.2 規定的對應於海水溫度 25℃的每個模式點的增壓空氣溫度。

T_{SCRef} 須由製造廠規定。

為考慮增壓空氣的濕度，須增加下列因素：

H_{SC}= 增壓空氣濕度，克水（g）/每千克乾空氣（kg），其中：

H_{SC}= $6.22\cdot psc\cdot 100/$（pc-psc）

式中：

p_{SC}= 增壓空氣的飽和蒸氣壓力，kPa

p_C= 增壓空氣壓力，kPa

但是，如果 $H_a \geq H_{SC}$，須使用 H_{SC} 替代公式（17）中的 H_a。

5.12.5 *排放質量流量的計算*

5.12.5.1 每種模式原始廢氣中各成分的排放質量流量須使用按 5.11.1 獲取的測量濃度、表 5 中的適用 u_{gas} 值和 5.5 中的廢氣質量流量按照 5.12.5.2 計算出。

表 5

原始廢氣的系數 u_{gas} 和燃料特定參數

氣體		NO_X	CO	HC	CO_2	O_2
ρ_{gas}	kg/m^3	2.053	1.250	*	1.9636	1.4277
	ρ_e**	系數 u_{gas}***				
燃油	1.2943	0.001586	0.000966	0.000479	0.001517	0.001103

* 取決於燃料

** ρ_e 為廢氣的正常密度。

*** λ=2 時，濕空氣，273K，101.3kPa

表 5 中的 u 值基於理想的氣體特性。

5.12.5.2 須使用以下公式：

$$q_{mgas} = u_{gas} \cdot c_{gas} \cdot q_{mew} \cdot k_{hd} (對NO_X) \tag{18}$$

$$q_{mgas} = u_{gas} \cdot c_{gas} \cdot q_{mew} \cdot k_{hd} (對其他氣體) \tag{18a}$$

式中：

q_{mgas}=個別氣體排放質量流量，g/h

u_{gas}=廢氣成分密度和廢氣密度比率，見表 5

c_{gas}=原始廢氣中各成分的濃度，ppm，濕基

q_{mew}=廢氣質量流量，kg/h，濕基

k_{hd}=NO_x 濕度修正系數

註： 對於 CO_2 和 O_2 測量，濃度通常以%報告。應用公式 18a 時，濃度須以 ppm 表示。1.0%=10000ppm。

5.12.5.3 對於氮氧化物的計算，須使用按 5.12.4 確定的濕度修正系數 k_{hd}。

5.12.5.4 測量的濃度如不是以濕度基礎測量，須按 5.12.3 轉換成濕度基礎。

5.12.6 *具體排放量計算*

5.12.6.1 所有單獨成分的排量須按照下列公式計算

$$\text{gas}_x = \frac{\sum_{i=1}^{i=n}(q_{\text{mgasi}} \cdot W_{\text{Fi}})}{\sum_{i=1}^{i=n}(p_{\text{i}} \cdot W_{\text{Fi}})} \qquad (19)$$

式中：

$$p = p_{\text{m}} + p_{\text{aux}} \qquad (20)$$

和

q_{mgas} 係指個別氣體排放質量流量

P_m 係指單獨模式的測定功率

P_{aux} 係指單獨模式的安裝到發動機上的輔助設備功率。

5.12.6.2 上述計算中使用的加權因數和模式數目（n）須符合 3.2 的規定。

5.12.6.3 按公式（19）得出的發動機平均加權氮氧化物排放值須和第 13 條中適用排放限值相比較，以確定發動機是否符合要求。

第 6 章

船上驗證符合氮氧化物排放限值的程序

6.1 通則

6.1.1 獲得前期證書的發動機安裝到船上後，每台船用柴油發動機須按照 2.1.1.2 到 2.1.1.4 的規定，進行船上核實檢驗以驗證該發動機繼續符合第 13 條規定的適用氮氧化物排放限值。這種符合驗證須用下列方法之一確定：

.1 按照 6.2 規定的發動機參數檢查法驗證發動機的構件，設定值和操作值未偏離發動機技術檔案中的技術規範；

.2 符合 6.3 的簡化測量法；或

.3 符合 6.4 的直接測量和監測法。

6.2 發動機參數檢查方法

6.2.1 *一般要求*

6.2.1.1 滿足下述條件的發動機適合發動機參數檢查法：

.1 業已得到試驗台前期證書（EIAPP 證書）的發動機及按照 2.2.4 進行初次發證檢驗後得到證書（EIAPP 證書）的發動機；及

.2 上次檢驗後，指定的構件和可調特性業經改裝或調整的發動機。

6.2.1.2 當柴油發動機設計成在適用的氮氧化物排放限值內運轉時，很可能在其船上使用壽命內氮氧化物的排放限值不會改變。但是

對發動機的調整或改裝就可能使適用的氮氧化物排放限值被突破。因此，須採用發動機的參數檢查方法驗證發動機是否仍在適用的氮氧化物排放限值之內運轉。

6.2.1.3 發動機構件的檢查，包括設定值和發動機操作值的檢查旨在提供一種推斷發動機排放性能的簡易手段，以驗證未經或業經微小調整或改裝的發動機仍符合適用的氮氧化物排放限值。如果需對一些操作值進行測定，所用測量設備的校準須符合本規則附錄 IV 的要求。

6.2.1.4 上述檢查旨在提供一種方便方法，確定發動機按照製造廠的技術規範進行正確調整，並處於與主管機關證明與第 13 條中的適用的規定相符的初次發證相一致的調整狀態。

6.2.1.5 如果使用電子發動機控制系統，須對照原設定值予以評估以確保適當參數運行於建造時設定的限值之內。

6.2.1.6 為了評估是否符合第 13 條，並非總需要測量氮氧化物排放量以了解未配備後處理裝置的發動機是否符合適用的氮氧化物排放限值。只要了解發動機現狀和初次發證時特定的構件、校準或參數調整的狀況一致就可能足夠。如果發動機參數檢查方法的結果顯示該發動機符合適用的氮氧化物排放限值，可對該發動機重新發證而毋需氮氧化物直接測量。

6.2.1.7 對於配備氮氧化物減少裝置的發動機，作為參數檢查的組成部分，有必要對該裝置的運轉進行檢查。

6.2.2 *發動機參數檢查方法的文件*

6.2.2.1　每台船用柴油發動機均須備有 2.3.4 要求的技術檔案，列明影響廢氣排放的發動機構件、設定值或操作值，並須經核查以確保符合要求。

6.2.2.2　發動機的技術檔案須包括與氮氧化物排放性能相關，在發動機前期發證或船上發證時（取先者）指定的發動機構件、可調特性及參數的所有適用的資料。

6.2.2.3　根據特定的發動機的具體設計，各種影響氮氧化物排放的船上改裝和調整是可能而且常見的。這包括下列發動機參數：

.1　噴射定時；

.2　噴嘴；

.3　噴油泵；

.4　燃油凸輪；

.5　共軌系統的噴油壓力；

.6　燃燒室；

.7　壓縮比；

.8　渦輪增壓器類型和構造；

.9　增壓空氣冷卻器，增壓空氣預熱器；

.10　閥定時；

.11　氮氧化物抑制設備“水噴射”；

.12　氮氧化物抑制設備“乳化的燃料”（燃料水乳化液）；

.13　氮氧化物抑制設備“廢氣再循環”；

.14　氮氧化物抑制設備“選擇性催化還原”；或

.15　主管機關規定的其他參數。

6.2.2.4 根據發動機發證申請方的建議和主管機關的認可，依據特定的發動機和具體的設計，發動機的實際技術檔案可以包含少於第6.2.2.3節所論述的構件和/或參數。

6.2.2.5 對某些參數存在不同的檢驗可能性。經主管機關認可及在發動機發證申請方的支持下，船舶所有人可以選擇適合的方法。本規則附錄VII給出的發動機參數檢查法檢查清單中所列的任何一種或一組方法均足以證明符合要求。

6.2.2.6 包含在發動機技術檔案中的有關發動機構件改裝的技術文件，須包括改裝的細節及其對氮氧化物排放的影響，並須在進行改裝時提供。從該發動機組概念適用範圍內的晚期發動機獲得的試驗台數據，可以接受。

6.2.2.7 船舶如配有需接受發動機參數檢查法檢查的船用柴油發動機，其船舶所有人或船舶負責人須在船上保存下列有關船上氮氧化物核實程序的文件：

.1 記錄關於發動機構件和設定值的所有變化，包括相同部件更換或認可範圍內的調整的發動機參數記錄簿；

.2 發動機發證申請方提交並經主管機關認可的發動機指定構件和設定值參數清單和/或發動機載控操作值文件；及

.3 對任何發動機指定構件進行了改裝時，發動機構件改裝技術文件。

6.2.2.8 任何影響特定發動機參數的改變，包括調整、發動機部件的更換和改裝，其說明須在發動機參數記錄簿上按時間順序予以記錄。

上述說明須輔以用以評估發動機氮氧化物排放量的任何其他有用數據。

6.2.3 *發動機參數檢查方法的程序*

6.2.3.1 發動機參數檢查方法須用下列 2 個程序進行：

.1 除其他檢查外，須對發動機參數進行文件檢查，包括發動機參數記錄簿檢查以並驗證發動機參數在發動機技術檔案規定的許可範圍之內；及

.2 如必要，除進行文件檢查外，須對發動機構件及可調特性進行實際檢查。然後須參照文件檢查的結果，驗證發動機可調特性在發動機技術檔案所規定的許可範圍內。

6.2.3.2 驗船師須能夠選擇對 1 個或所有被列明的構件、設定值或操作值進行檢查以確保未經或業經微小調整或改裝的發動機符合適用的氮氧化物排放限值並確保按照 2.4.1.7 的規定，僅使用了符合經核准的規格的構件。如果調整和/或改裝參照技術檔案中的技術規範，則須為發動機發證申請方建議並經主管機關認可的範圍之內。

6.3 簡化測量方法

6.3.1 *一般要求*

6.3.1.1 本節規定的下列簡化試驗和測量程序僅適用於需要時在船上進行的確認試驗、及換證檢驗、年度檢驗和中間檢驗。各首次試驗台上發動機試驗均須按照第 5 章規定的程序進行。由於船舶在冷/熱和乾/濕氣候下航行，而這會造成氮氧化物排放變化，因此按照 5.12.4 對環境空氣濕度和溫度進行修正至關重要。

6.3.1.2 為了使船上確認試驗和船上換證檢驗、年度檢驗和中間檢驗獲得有意義的結果，作為最低的要求，須按照適當試驗循環對氮氧化物和二氧化碳的氣體排放濃度予以測量。計算中所使用的加權因數（W_F）和模式數目（n）須符合 3.2。

6.3.1.3 須測量發動機扭矩和轉速。但為簡化程序，為船上核實而測量發動機有關參數的儀器，其容許偏差（見 6.3.7）不同於在試驗台試驗方法中所允許的容許偏差。如直接測量扭矩有困難，可採用經發動機發證申請方推薦並經主管機關認可的任何其他方法估算制動功率。

6.3.1.4 在實際情況下，發動機一旦裝於船上，經常不再可能測量燃油消耗。為簡化船上程序，發動機前期發證試驗台試驗的燃油消耗測量結果可以接受。在這種情況下，特別是對於殘餘燃油（根據 ISO 8217：2005 的 RM 級燃油）的運轉，須對相應的估算誤差進行估算。因為計算中所用的燃油流量（q_{mf}）必須與試驗中抽取的燃油試樣所確定的燃油成分相關聯，所以須對試驗台試驗測定的 q_{mf} 就試驗台和試驗燃油之間的任何淨熱值差異進行修正。此誤差對最終排放造成的影響須加以計算，並與排放測量的結果一同報告。

6.3.1.5 除另有規定外，所有本章要求的測量結果、試驗數據或計算，均須按照 5.10 的要求記錄於在發動機試驗報告中。

6.3.2 *須測量和記錄的發動機參數*

6.3.2.1 表 6 列出了在船上核實程序中須予以測量和記錄的發動機參數。

表 6

須測量和記錄的發動機參數

符號	參數	量綱
H_a	絕對濕度（發動機吸入空氣水分質量與乾燥空氣質量之比）	g/kg
$n_{d,i}$	發動機轉速（循環中第*i*次模式時）	min^{-1}
$n_{turb,i}$	渦輪增壓器轉速（如適用）（循環中第*i*次模式時）	min^{-1}
p_b	總大氣壓力（在ISO 3046-1，1995中：p_x=P_x=現場環境總壓力）	kPa
$p_{C,i}$	增壓空氣冷卻器後的增壓空氣壓力（循環中第*i*次模式時）	kPa
P_i	制動功率（循環中第*i*次模式時）	kW
$q_{mf,i}$	燃油流量（循環中第*i*次模式時）	kg/h
s_i	燃料齒條位置（每個氣缸，如適用）（循環中第*i*次模式時）	
T_a	空氣入口處吸入空氣溫度（在ISO 3046-1，1995中：T_x=TT_x=現場環境熱力空氣溫度）	K
$T_{SC,i}$	增壓空氣冷卻器後的增壓空氣溫度（如適用）（循環中第*i*次模式時）	K
T_{caclin}	增壓空氣冷卻器，冷卻劑進口溫度	℃
$T_{caclout}$	增壓空氣冷卻器，冷卻劑出口溫度	℃
$T_{Exh,i}$	取樣點的廢氣溫度（循環中第*i*次模式時）	℃
T_{Fuel}	發動機前的燃油溫度	℃
T_{Sea}	海水溫度	℃

6.3.3 *制動功率*

6.3.3.1 船上氮氧化物試驗中，獲得所要求數據的能力問題特別地與制動功率相關。雖然對直連齒輪箱的情況在第 5 章（5.1.7）中給予了考慮，但是，正如在船上所能看到的，發動機在許多應用中的佈置，由於沒有明確的主軸因而無法進行扭矩測量（如通過專門安裝的應變

儀獲得扭矩測量值）。在這裏主要是發電機，但發動機還可能與泵，液壓裝置，壓縮機等連接。

6.3.3.2 驅動 6.3.3.1 中所列機器的發動機，在安裝到船上與功率消耗裝置永久連接之前的建造階段，一般均已用水力測功器進行過試驗。對發電機來說，採用電壓和電流測量及製造廠申報的發電機效率，應不成問題。對按推進器原理運轉的設備來講，可採用已知的轉速功率曲線以及有保證的從自由端或利用例如凸輪軸轉速的速比，測量發動機轉速的能力。

6.3.4 *試驗燃油*

6.3.4.1 一般來說，所有排放測量均須在發動機使用 ISO 8217：2005，DM 級船用柴油運轉時進行。

6.3.4.2 為了避免造成船舶所有人不能接受的負擔，根據發動機發證申請方的建議和主管機關的認可，確認試驗測量或重新檢驗測量可允許發動機使用 ISO 8217：2005，RM 級殘餘燃油運行。在這種情況下，燃油結合氮和燃油的點火性能可能會對發動機的氮氧化物排放有影響。

6.3.5 *氣體排放的取樣*

6.3.5.1 5.9.3 所述的一般要求亦須適用於船上測量。

6.3.5.2 所有發動機的船上安裝，須使得這些試驗可以安全地進行並且對發動機有最少的干擾。船上須提供廢氣取樣的合適佈置和獲得所要求的數據的能力。所有發動機的排氣管均須設置一個易於接近的標準取樣點。取樣點接頭法蘭的實例在本規則附錄 VIII 第 5 節中給出。

6.3.6 *測量設備和須測量的數據*

6.3.6.1 氣體污染物的排放須採用第 5 章所述方法予以測量。

6.3.7 *發動機有關參數和其他重要參數測量儀器的允許偏差*

6.3.7.1 本規則附錄 IV 的第 1.3 節中的表 3 和 4 列出了船上驗證程序過程中用於測量發動機有關參數和其他重參數的儀器的允許偏差。

6.3.8 *氣體成分的確定*

6.3.8.1 須採用第 5 章所述分析測量設備和方法。

6.3.9 *試驗循環*

6.3.9.1 船上所用的試驗循環須與 3.2 所規定的適用試驗循環相符。

6.3.9.2 發動機在船上並非總有可能按照 3.2 所規定的試驗循環運行，但基於發動機製造廠的建議並經主管機關認可的試驗程序須儘可能接近 3.2 所確定的程序。因此，這種情況下的測定值可能無法與試驗台試驗結果直接比較，因為測定值在很大程度上取決於試驗循環。

6.3.9.3 如果船上測量點的數目與試驗台試驗測量點數目不同，考慮到 6.4.6 的規定，測量點和加權因數須符合發動機發證申請方的建議並經主管機關認可。

6.3.10 *氣體排放計算*

6.3.10.1 考慮到簡化測量程序的特殊要求，須採用第 5 章規定的計算程序。

6.3.11 *容許偏差*

6.3.11.1 由於船上應用本章簡化測量程序時可能出現偏差，可接受適用限值 10%的容許偏差，但僅適用於確認試驗、換證檢驗、年度檢驗和中間檢驗。

6.3.11.2 發動機氮氧化物排放可隨燃油點火性能和燃油結合氮而改變。如沒有燃燒過程中點火性能影響氮氧化物形成的充分資料且燃油結合氮轉換率也取決於發動機的效率，對於以 RM 級燃油（ISO 8217：2005）進行的船上試驗運轉，可以允許 10%的容許偏差，但船上進行的前期發證試驗沒有容許偏差。對於所使用的燃油，須對其碳、氫、氮、硫的成分，以及在 ISO 8217：2005 的範圍內，對任何其他成分進行分析以明確其規格。

6.3.11.3 對船上簡化測量及使用 ISO 8217：2005 標準的 RM 級殘餘燃油所准許的總容許偏差不得超過適用限值的 15%。

6.4 直接測量和監測方法

6.4.1 *一般要求*

6.4.1.1 換證、年度和中間檢驗時，船上核實可使用下述直接測量和監測程序。

6.4.1.2 與廢氣的處理和接近、測量設備以及鋼瓶裝純氣體和校準氣體的儲存和使用相關的安全問題須予以適當注意。取樣位置和通道腳手架須能確保監測安全並且不干擾發動機。

6.4.2 *排放種類測量*

6.4.2.1 船上氮氧化物測量須至少包括氮氧化物（$NO+NO_2$）氣體排放濃度的測量。

6.4.2.2 如廢氣質量流量按照本規則附錄 VI 的碳平衡法確定，須同時測量二氧化碳。另外也可測量一氧化碳、碳氫化合物和氧。

6.4.3 *發動機性能測量*

6.4.3.1 表 7 列出了船上氮氧化物監測時在每個模式點須測量或計算和記錄的發動機性能參數。

表 7

須測量和記錄的發動機參數

符號	**參數**	**量綱**
n_d	發動機轉速	min^{-1}
p_C	接收器增壓空氣壓力	kPa
P	制動功率（如同以下規定）	kW
P_{aux}	輔機功率（如相關）	kW
T_{sc}	接收器增壓空氣溫度（如適用）	K
T_{caclin}	增壓空氣冷卻器冷卻劑進口溫度（如適用）	℃
$T_{caclout}$	增壓空氣冷卻器冷卻劑出口溫度（如適用）	℃
T_{Sea}	海水溫度（如適用）	℃
q_{mf}	燃油流量（如同以下規定）	kg/h

6.4.3.2 界定發動機操作條件所需的其他發動機設定值，如廢氣門、增壓空氣旁通、渦輪增壓器的狀態，須予以確定和記錄。

6.4.3.3 氮氧化物減少裝置的設定值和操作條件須予以確定和記錄。

6.4.3.4 如果直接測量功率有困難，可使用主管機關認可的任何其他方法估算未經修正的制動功率。確定制動功率的可行方法包括，但不限於：

.1 與 6.3.3 相符的間接測量；或

.2 從諾模圖估算。

6.4.3.5 燃油流量（實際消耗率）須按下列方式確定：

.1 直接測量；或

.2 於 6.3.1.4 相符的試驗台數據。

6.4.4 *環境條件測量*

6.4.4.1 表 8 列出了船上氮氧化物監測時在每個模式點須測量或計算和記錄的環境條件參數。

表 8

須測量和記錄的環境條件參數

符號	參數	量綱
H_a	絕對濕度（發動機吸入空氣水分質量與乾燥空氣質量之比）	g/kg
p_b	總大氣壓力（在 ISO 3046-1，1995 中：p_x=P_x=現場環境總壓力）	kPa
T_a	空氣入口溫度（在 ISO 3046-1，1995 中：T_x=TT_x=現場環境熱力空氣溫度）	K

6.4.5 發動機性能和環境條件監測設備

6.4.5.1 發動機性能和環境條件監測設備須依照製造廠的建議安裝和維護，以使本規則附錄 IV 中 1.3 節和表 3 和表 4 中有關允許偏差的要求得到滿足。

6.4.6 *試驗循環*

6.4.6.1 發動機在船上並非總有可能按照規定的試驗循環運行，但經主管機關認可的試驗程序須儘可能接近 3.2 規定的程序。因此，這種

情況下的測定值可能不能與試驗台試驗結果直接比較，因為測定值在很大程度上取決於試驗循環。

6.4.6.2 在 E3 試驗循環下，如實際螺旋槳曲線與 E3 曲線不同，所用載荷點須使用該循環相關模式給出的發動機轉速或相應的平均有效壓力（MEP）或平均指示壓力（MIP）予以設定。

6.4.6.3 如果船上測量點的數目與試驗台測量點數目不同，則測量點數目和相關的經修改的加權因數須由主管機關認可。

6.4.6.4 對於 6.4.6.3，如果應用 E2、E3 或 D2 試驗循環，則須使用 3.2 中規定的組合標定加權因數大於 0.5 的最少量的載荷點。

6.4.6.5 對於 6.4.6.3，如果應用 C1 試驗循環，則對每個額定、過渡和空轉部分須至少使用一個載荷點。如果船上測量點的數目與試驗台測量點數目不同，則每個載荷點的標定加權因數須按比例增加以總和取整（1.0）。

6.4.6.6 關於 6.4.6.3 的應用，有關載荷點的選擇和經修改的加權因數指南見本規則附錄 VIII 第 6 節。

6.4.6.7 為證明符合要求而使用的實際載荷點須在模式點額定功率 ±5%之內，但如果是 100%載荷，範圍須是+0-10%。例如，75%載荷點的可接受範圍須為額定功率的 70%-80%。

6.4.6.8 在每個選定的載荷點（空轉除外），並在最初轉換期之後（如適用），發動機功率須以 10 分鐘的間隔期在 5%偏差係數（%C.O.V.）內的載荷設定點予以保持。此偏差係數的計算實例見本規則附錄 VIII 第 7 節。

6.4.6.9 關於 C1 試驗循環，空轉轉速限度須申報，並經主管機關認可。

6.4.7 *試驗條件參數*

6.4.7.1 5.2.1 規定的試驗條件參數不適用於船上氮氧化物監測。任何現行環境條件下的數據均可接受。

6.4.8 *分析儀使用性能*

6.4.8.1 分析設備須按製造廠的建議操作。

6.4.8.2 測量前須檢查零位和量程值，必要時須對分析儀進行調整。

6.4.8.3 測量後須核實分析儀的零位和量程值在 5.9.9 的許可範圍內。

6.4.9 *排放計算數據*

6.4.9.1 在試驗過程和所有響應檢查（零位和量程）過程中分析儀的輸出須予以記錄。該數據須記錄在 1 台條圖記錄器或其他型式的數據記錄裝置上。數據記錄精度須符合 5.9.7.1 的要求。

6.4.9.2 對於氣體排放評估，須對每個載荷點的 10 分鐘穩定取樣間隔的至少 1Hz 圖形讀數作平均。NO_X 和 CO_2（如要求）和 CO、HC 及 O_2（可選）的平均濃度須根據平均圖形讀數和相應的校準數據確定。

6.4.9.3 上述的 10 分鐘期內，須至少記錄排放濃度、發動機性能和環境條件數據。

6.4.10 *廢氣流量*

6.4.10.1 廢氣流量須按下列方式確定：

.1 按照 5.5.2 或 5.5.3；或

.2 按照 5.5.4 和本規則附錄 VI，不測量類設為零，c_{CO2d} 設為 0.03%。

6.4.11 *燃油成分*

6.4.11.1 為了計算濕氣體質量流量 q_{mf}，燃油成分須按下列方式之一確定：

.1 分析得出的燃油成分，碳、氫、氮和氧（可採用默認氧值）；或

.2 表 9 的默認值。

表 9

默認燃油參數

	碳	氫	氮	氧
	w_{BET}	w_{ALF}	w_{DEL}	w_{EPS}
蒸餾燃油 （ISO 8217：2005，DM 級）	86.2%	13.6%	0.0%	0.0%
殘餘燃油 （ISO 8217：2005，RM 級）	86.1%	10.9%	0.4%	0.0%

6.4.12 *乾/濕修正*

6.4.12.1 如果排放未按濕度基礎測量，則須根據下列方式將氣體排放濃度轉換成濕度基礎：

.1 水成分的直接測量；或

.2 根據 5.12.3 計算的乾/濕修正。

6.4.13 *氮氧化物濕度和溫度修正*

6.4.13.1 氮氧化物濕度和溫度修正須符合 5.12.4。須標明參照增壓空氣溫度（T_{SCRef}）並經主管機關認可。T_{SCRef} 值須以 25℃ 海水溫度為參照，在 T_{SCRef} 值的應用中須按實際海水溫度留出餘量。

6.4.14 *排放流量和具體排放量的計算*

6.4.14.1 排放流量和具體排放量的計算須符合 5.12.5 和 5.12.6。

6.4.15 *限值和容許公差*

6.4.15.1 在應用 6.4.6.3 時，經主管機關認可，對獲取的排放值須作如下修正：

$$\text{經修正的 } gas_x = gas_x \cdot 0.9 \qquad (21)$$

6.4.15.2 須酌情使用排放值 gas_x 或經修正的 gas_x 和第 13 條規定的的氮氧化物排放限值以及 6.3.11.1、6.3.11.2 和 6.3.11.3 的容許偏差值進行比較以核實發動機繼續符合第 13 條的要求。

6.4.16 *證明符合要求的數據*

6.4.16.1 在換證檢驗、年度檢驗和中間檢驗時或按 1.3.2 做了實質性改裝後，需要求證明符合要求。根據 2.4.5，數據必須是現時的；即 30 天內的。數據須在船上保存至少三個月。這些時間段須被看作是船舶在營運的時期。30 天內的數據可在一次試驗序列中從全部所要求的載荷點收集，或者當發動機載荷與 6.4.6 的要求相符的兩個或更多的不同時機獲取。

6.4.17 *認可格式*

6.4.17.1 直接測量和監測方法須記錄在船上監測手冊中。船上監測手冊須提交主管機關認可。船上監測手冊的認可參照須填入 EIAPP 證書附件第 3 節。如該方法在首次簽發 EIAPP 證書後獲得認可，即在前期發證檢驗之後，主管機關可簽發新的 EIAPP 證書，並對附件第 3 節中的細節作出適當修正。

6.4.18 *設備和方法的檢驗*

6.4.18.1 對直接測量和監測方法的檢驗須考慮但不限於：

.1 通過所要求的測量而獲得和產生的數據；以及

.2 獲取數據的方式，考慮到 6.4.14 要求的船上監測手冊中提供的資料。

第 7 章

現有發動機的發證

7.1 如現有發動機須符合第 13.7 條，負責獲得排放證書的實體須向認可主管機關申請發證。

7.2 如果對認可方法的認可申請中包括排放測量和計算，則須符合第 5 章的要求。

7.3 從一台發動機獲取的排放和性能數據可表明能適用於一系列發動機。

7.4 為符合第 13.7 條所採取的經認可的方法須包括該經認可的方法之檔案副本，且要求該副本須伴隨發動機的整個船上使用期限。

7.5 發動機船上核實程序的描述須包括在經認可的方法之檔案中。

7.6 經認可的方法安裝後，須按照經認可的方法之檔案進行檢驗。如檢驗證實符合要求，主管機關須對船舶的 IAPP 證書做出相應修改。

附錄 I

EIAPP 證書格式

（參閱《2008 年氮氧化物技術規則》2.2.10）

發動機國際防止空氣污染證書

本證書係根據經 2008 年 MEPC.176（58）號決議修正的修訂《經 1978 年議定書修訂的〈1973 年國際防止船舶造成污染公約〉》的 1997 年議定書（以下簡稱本公約）的規定，

經…………………………………………………………………國政府授權，

（國家全稱）

由……………………………………………………………………………簽發。

（經按本公約規定授權的適任組織或個人全稱）

發動機製造廠	型號	序號	試驗循環	額定功率（kW）和轉速（rpm）	發動機認可號

茲證明：

1　上述船用柴油發動機已按照本公約附則 VI 定為強制性的《2008 年船用柴油發動機氮氧化物排放控制技術規則》的要求進行了前期發證檢驗；及

2　前期發證檢驗表明，在其船上安裝和/或運行之前，該發動機，其構件、可調特性及技術檔案完全符合本公約附則 VI 第 13 條的適用規定。

在本政府管轄下的船舶上安裝，並按照本公約附則 VI 第 5 條的規定接受檢驗的發動機使用期內，本證書有效。

簽發於：

………………………………………………………………………………………

（簽發證書地點）

（年/月/日）：………………　　　　………………………………………

（簽發日期）　　　　*（經正式授權的發證官員簽字）*

（主管當局蓋章或鋼印）

發動機國際防止空氣污染證書（EIAPP 證書）附頁

結構、技術檔案及核實方法記錄

註：

1 本記錄及其附件須永久附於 EIAPP 證書之後。EIAPP 證書須伴隨該柴油發動機整個使用壽命並須一直保存在船上。

2 本記錄須至少為英文、法文或西班牙文。如果還使用了發證國的官方文字，在出現爭議或不一致時，以發證國的官方文字為準。

3 除另有明文規定外，本記錄所述各條係指本公約附則 VI 的各條，發動機的技術檔案和核實方法的要求係指《2008 年氮氧化物技術規則》中的強制性要求。

1 發動機資料

1.1 製造廠名稱和地址……………………………………………………

1.2 發動機製造地點…………………………………………………………

1.3 發動機製造日期…………………………………………………………

1.4 前期發證檢驗地點……………………………………………………

1.5 前期發證檢驗日期……………………………………………………

1.6 發動機類型及型號……………………………………………………

1.7 發動機序號…………………………………………………………………

1.8 如適用，該發動機是一台：母型機 或下列發動機族 或發動機組 的成員機 …………………………

1.9 單機或發動機族/發動機組的詳細資料：……………………………

1.9.1 認可參考………………………………………………………………

1.9.2 額定功率（kW）及額定轉速（rpm）值或範圍……………………

1.9.3 試驗循環……………………………………………………………

1.9.4 母型機試驗燃油規格………………………………………………

1.9.5 適用的氮氧化物排放限值（g/kWh），第 13.3、13.4 或 13.5 條（不適用者刪除）……………………………………………………

1.9.6 母型機排放值（g/kWh）……………………………………………

2 技術檔案資料

按照《2008 年氮氧化物技術規則》第 2 章的要求，技術檔案是 EIAPP 證書的重要組成部分且必須一直伴隨發動機的整個使用壽命並一直保存在船上。

2.1 技術檔案標識號/認可號……………………………………………

2.2 技術檔案認可日期…………………………………………………

3 船上氮氧化物核實程序技術規範

《2008 年氮氧化物技術規則》第 6 章所要求的船上氮氧化物核實程序技術規範是 EIAPP 證書的重要組成部分且必須一直伴隨發動機的整個使用壽命並一直保存在船上。

3.1 發動機參數檢查法：

3.1.1 標識號/認可號………………………………………………………

3.1.2 認可日期……………………………………………………………

3.2 直接測量和監測法：

3.2.1 標識號/認可號………………………………………………………

3.2.2 認可日期……………………………………………………………

作為替代，可使用符合《2008 年氮氧化物技術規則》的 6.3 的簡化測量方法。

簽發於：

……………………………………………………………………………………………

（簽發證書地點）

（年/月/日）：……………… ……………………………………

（簽發日期） *（正式授權發證官員簽字）*

（主管當局蓋章或鋼印）

附錄 II

船用柴油發動機檢驗和發證流程圖

（參閱《2008 年氮氧化物技術規則》2.2.9 和 2.3.11）

本附錄的圖 1、圖 2 和圖 3 給出了本規則第 2 章闡述的符合船用柴油發動機檢驗和發證的指南：

圖 1： 製造廠設施中前期發證檢驗

圖 2： 船上初次檢驗

圖 3： 船上換證、年度或中間檢驗

註：這些流程圖並未顯示第 13.7 條要求的現有發動機發證標準。

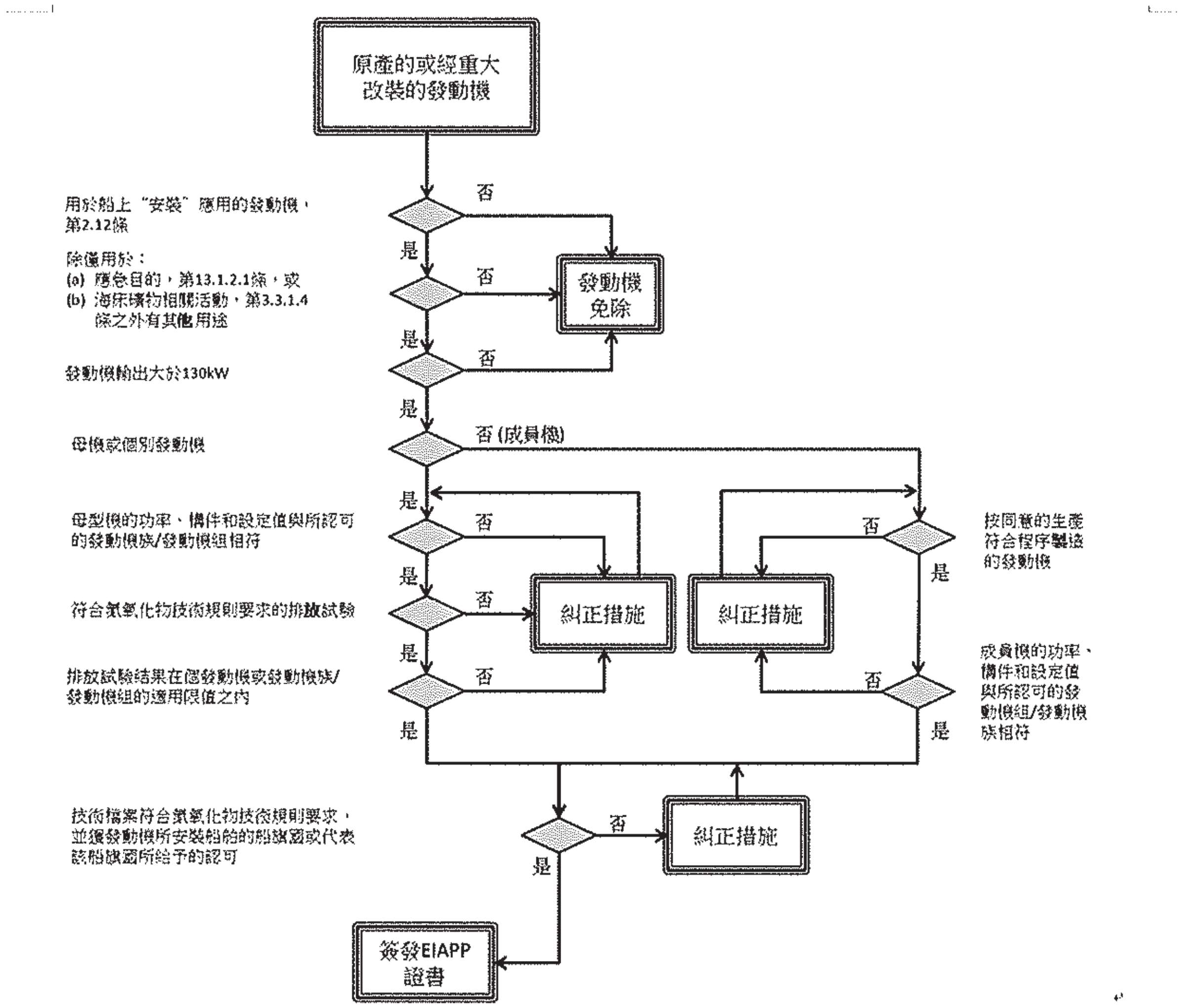


圖 1-製造廠設施中前期發證檢驗

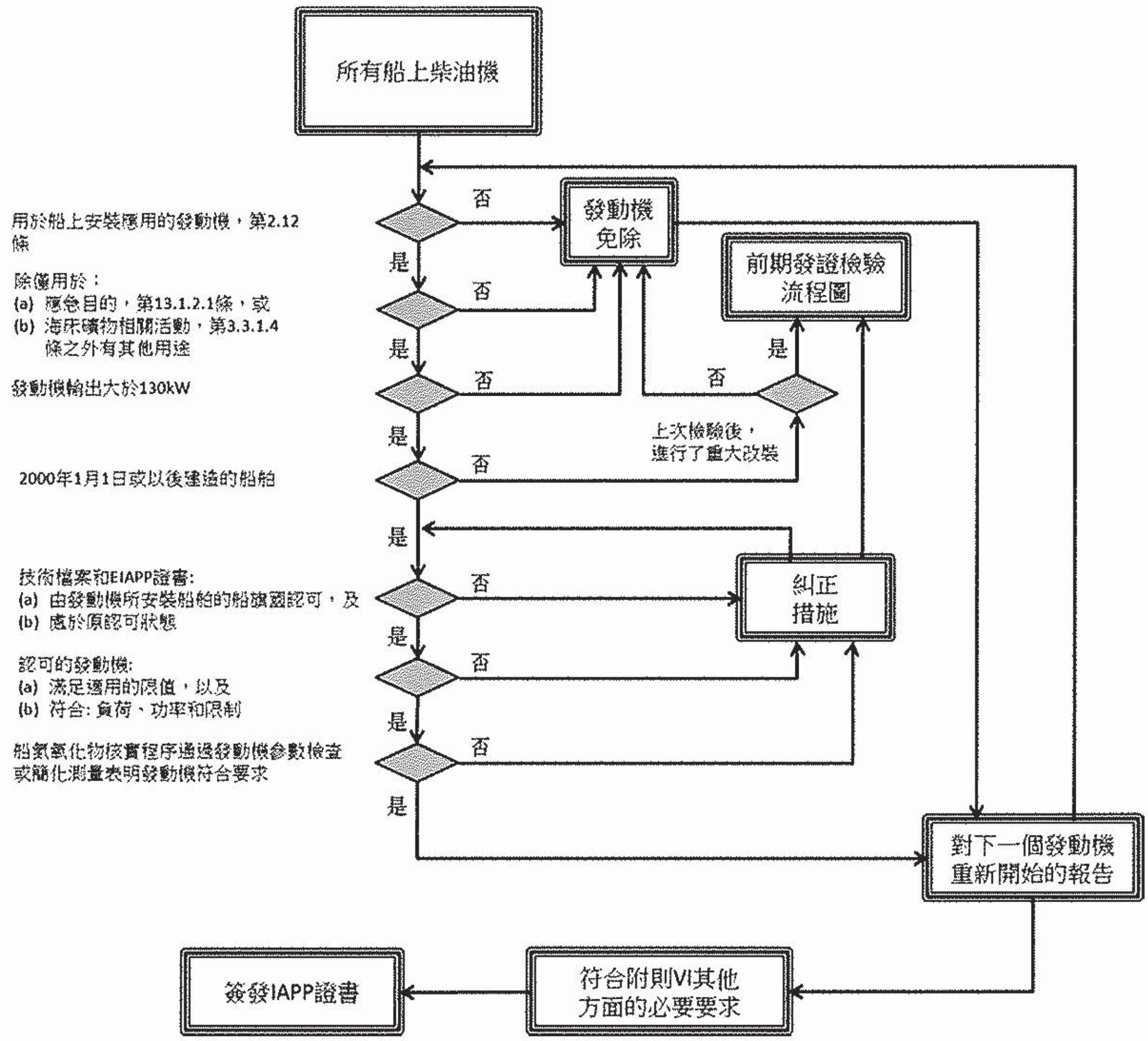

所有船上柴油機
用於船上安裝應用的發動機，第2.12條
否
是
發動機免除
除僅用於：
(a) 應急目的，第13.1.2.1條，或
(b) 海床礦物相關活動，第3.3.1.4條之外有其他用途
前期發證檢驗流程圖
發動機輸出大於130kW
上次檢驗後，進行了重大改裝
2000年1月1日或以後建造的船舶
技術檔案和EIAPP證書：
(a) 由發動機所安裝船舶的船旗國認可，及
(b) 處於原認可狀態
糾正措施
認可的發動機：
(a) 滿足適用的限值，以及
(b) 符合：負荷、功率和限制
船氮氧化物核實程序通過發動機參數檢查或簡化測量表明發動機符合要求
對下一個發動機重新開始的報告
簽發IAPP證書
符合附則VI其他方面的必要要求

圖 2-船上初次檢驗

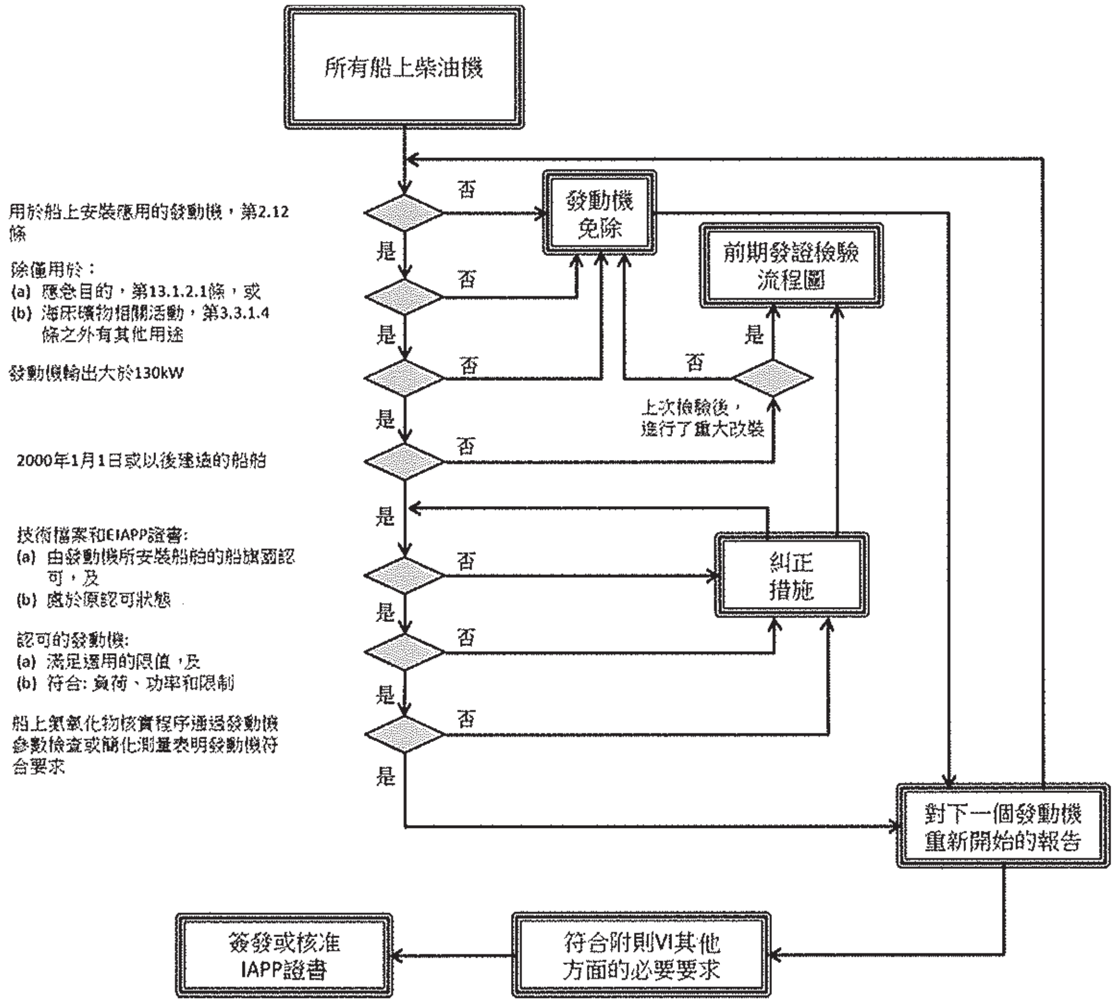


圖 3-船上換證、年度或中間檢驗

附錄 III

用於確定船用柴油發動機排放氣體成分的分析儀技術規範

（參閱《2008 年氮氧化物技術規則》第 5 章）

1 通則

1.1 用於確定 CO、CO_2、NO_X、HC 和 O_2 濃度的廢氣分析系統中所包括的構成部分見圖 1。取樣氣道上的所有構件須維持各系統的規定溫度。

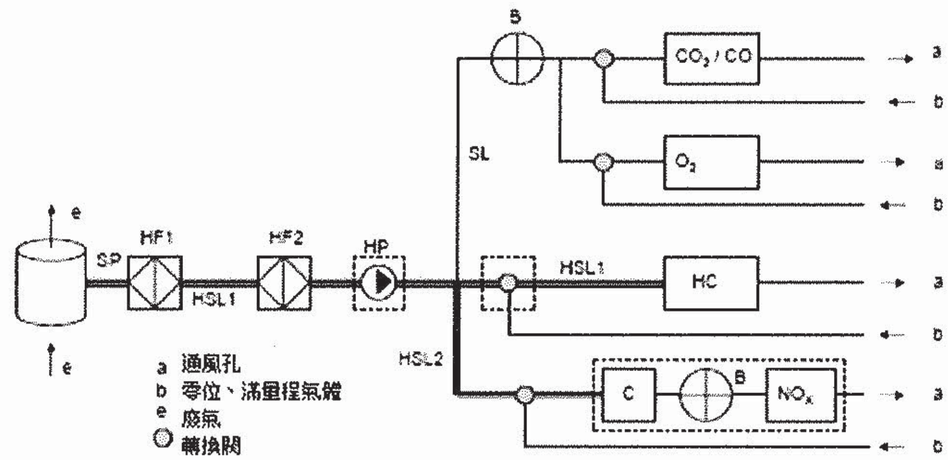


圖 1-廢氣分析系統的佈置

1.2 廢氣分析系統須包括下列部件。根據本規則第 5 章，經主管機關認可的等效佈置和部件可以接受。

.1 SP－原始廢氣取樣管

一末端封閉的不鏽鋼多孔直管。內直徑須不大於取樣管路的內直徑。管壁厚度不應大於 1 毫米。在 3 個不同徑

向平面內須至少有 3 個孔，其大小能夠對大致相同流量進行取樣。

原始廢氣所有成分的試樣可以使用 1 隻取樣管或用 2 隻位置極為接近並內部分至不同分析儀的取樣管採集。

註：如果廢氣脈動或發動機震動可能影響取樣管，經主管機關認可，壁厚可增大。

.2 HSL1－加熱取樣管路

取樣管路通過單一取樣管向分離點和 HC 分析儀提供氣體試樣。取樣管路須由不鏽鋼或聚四氟乙烯（PTFE）製成，其內直徑至少為 4 毫米，至多為 13.5 毫米。

取樣管處的廢氣溫度須不低於 190℃。取樣點至分析儀的廢氣溫度須使用加熱過濾器和管壁溫度為 190℃±10℃的加熱傳輸管路予以維持。

如果取樣管處的廢氣溫度高於 190℃，管壁溫度須維持在 180℃以上。

在加熱的過濾器和 HC 分析儀之前須維持 190℃±10℃的氣體溫度。

.3 HSL2－加熱氮氧化物取樣管路

取樣管路須由不鏽鋼或 PTFE 製成，如使用冷卻裝置 B，至轉換器 C 前，如不使用冷卻裝置 B，至分析儀前，管壁溫度須維持在 55℃至 200℃度。

.4 HF1－加熱預過濾器（可選）

所要求的溫度與 HSL1 相同。

.5 HF2－加熱過濾器

過濾器須在分析儀之前從氣體試樣中濾出任何固體顆粒。溫度須與 HSL1 的溫度相同。過濾器須按需更換。

.6 HP－加熱取樣泵（可選）

泵須加熱至 HSL1 的溫度。

.7 SL－CO、CO_2 和 O_2 取樣管路

管路須由 PTFE 或不鏽鋼製成，可加熱或不加熱。

.8 CO_2/CO－二氧化碳和一氧化碳分析儀

無彌散紅外（NDIR）吸收。可為不同的分析儀，或單個分析儀裝置中整合兩項功能。

.9 HC－碳氫化合物分析儀

加熱式火焰離子探測器（HFID）。溫度須保持在 180℃至 200℃。

.10 NO_X－氮氧化物分析儀

化學熒光探測器（CLD）或加熱式化學熒光探測器（HCLD）。如使用 HCLD，溫度須保持在 55℃至 200℃。

註：在所示佈置中氮氧化物以乾基測量。氮氧化物也可以濕基測量，在此情況下分析儀須為 HCLD 型式。

.11 C－轉換器

在 CLD 或 HCLD 中進行分析之前，須使用轉換器將 NO_2 催化還原成 NO。

.12 O_2－氧分析儀

順磁探測器（PMD）、二氧化鋯傳感器（ZRDO）或電化傳感器（ECS）。

註：在所示佈置中 O_2 以乾基測量。O_2 也可以濕基測量，在此情況下分析儀須為 ZRDO 型式。

.13 B－冷卻裝置

冷卻和冷凝廢氣試樣中的水分。冷卻器的溫度須通過冰或製冷機維持在 0℃ 至 4℃。如果水分通過冷凝去除，須在脫水器內或下游監測氣體試樣的溫度或露點。氣體試樣的溫度或露點不得超過 7℃。

1.3 分析儀須具有與所測廢氣成分濃度所需精度相稱的測量範圍（見 1.6 和本規則 5.9.7.1）。建議分析儀的操作須使所測量的濃度落在滿刻度的 15%和 100%之間，滿刻度係指所用的測量範圍。

1.4 如果滿刻度是 155ppm（或 ppmC）或更少，或如果使用在滿刻度的 15%以下具有足夠的精確度和清晰度讀數系統（計算機，數據記錄器），在滿刻度 15%以下的濃度也可以接受。在這種情況下須進行補充校準以確保校準曲線精確度。

1.5 設備的電磁兼容性（EMC）須能將附加誤差減至最低限度。

1.6 精確度

1.6.1 定義

ISO 5725-1：1994/Cor1：1998，測試方法與結果的精確度（正確度與精密度）－第 1 部分：基本原理與定義，技術勘誤 1。

ISO 5725-2：1994，測試方法與結果的精確度（正確度與精密度）－第 2 部分：測定標準測試方法的重複性和可再現性的基本方法。

1.6.2 分析儀與標定校準點的偏差不得超過整個測量範圍（零位除外）讀數的±2%，或者滿刻度的±0.3%（取大者）。精確度須按本規則附錄 IV 第 5 節的校準要求確定。

1.7 精密度

精密度，定義為對校準或量程氣體的 10 次重複響應的標準偏差的 2.5 倍，對於每個用於 100ppm（或 ppm C）以上的範圍，須不超過滿刻度濃度的±1%或對於每個用於 100ppm（或 ppm C）以下的範圍，須不超過±2%。

1.8 噪聲

分析儀對零位和校準或量程氣體在任一 10 秒期間內的峰間響應，不得超過所有所用範圍滿刻度的 2%。

1.9 零位漂移

零位響應的定義為 30 秒間隔期內對零位氣體的平均響應(包括噪聲）。1 小時期間內的零位響應漂移須小於所用最低範圍滿刻度的 2%。

1.10 量程漂移

量程響應的定義為在 30 秒間隔期內對量程氣體的平均響應（包括噪聲）。在最低使用範圍 1 小時期間內的量程響應漂移須小於所用最低範圍滿刻度的 2%。

2 氣體乾燥

廢氣可乾測或濕測。如使用，須使用對測量氣體成分影響最小的氣體乾燥裝置。用化學乾燥劑從試樣中除去水分的方法是不能接受的。

3 分析儀

3.1 至 3.5 節闡述了應使用的測量原則。待測量的氣體須用下列儀器予以分析。對非線性分析儀，允許使用線性化電路。

3.1 一氧化碳（CO）分析

一氧化碳分析儀須為無彌散紅外（NDIR）吸收型。

3.2 二氧化碳（CO_2）分析

二氧化碳分析儀須為無彌散紅外（NDIR）吸收型。

3.3 碳氫化合物（HC）分析

碳氫化合物分析儀須為加熱式火焰離子探測器（HFID）型，並對探測器、閥門、管路和相關部件加熱使氣體溫度維持在 190℃±10℃。

3.4 氮氧化物（NO_X）分析

如果為乾基測量，氮氧化物分析儀須為化學熒光探測器（CLD）或配有 NO_2/NO 轉換器的加熱式化學熒光探測器（HCLD）。

如果為濕基測量，須採用保持在 55℃以上的配有轉換器的 HCLD，但要水淬檢查合格(見本規則附錄 IV 第 9.2.2 節)。對於 CLD 和 HCLD，乾測時至轉換器和濕測時至分析儀的氣道管壁溫度須維持在 55℃至 200℃。

3.5 氧（O_2）分析

氧分析儀須為順磁性探測器（PMD），二氧化鋯型（ZRDO）或電化傳感器型（ECS）。

附錄 IV

分析和測量儀器的校準

（參閱《2008 年氮氧化物技術規則》第 5 和 6 章）

1 引言

1.1 用以測量發動機參數的每一台分析儀須按照本附錄的要求儘可能經常地進行校準。

1.2 除另有明文規定外，所有本附錄所要求的測量結果、試驗數據或計算須按本規則 5.10 節的規定記錄在發動機試驗報告中。

1.3 *測量儀器的精確度*

1.3.1 所有測量儀器的校準須符合表 1、2、3 和 4 中列出的要求且須符合主管機關認可的標準。主管機關可要求附加的發動機測量，所使用的附加測量儀器須符合適當的偏差標準和校準有效期限。

1.3.2 儀器須作如下校準：

.1 時間間隔不得大於表 1、2、3 和 4 規定的間隔期；或

.2 符合替代的校準程序和有效期限，但相關提議須在試驗前提交主管機關並獲認可。

註： 表 1、2、3 和 4 中給出的偏差係指最終記錄值，包括數據獲取系統在內。

表 *1*

試驗台上發動機相關參數測量

儀器的允許偏差和校準有效期

編號	測量儀器	允許偏差	校準有效期（月）
1	發動機轉速	讀數的±2%或發動機最大值的±1%（取大者）	3
2	扭矩	讀數的±2%或發動機最大值的±1%（取大者）	3
3	功率 （直接測量）	讀數的±2%或發動機最大值的±1%（取大者）	3
4	燃料消耗	發動機最大值的±2%	6
5	空氣消耗	讀數的±2%或發動機最大值的±1%（取大者）	6
6	廢氣流量	讀數的±2.5%或發動機最大值的±1.5%（取大者）	6

表 2

試驗台上其他重要參數測量

儀器的允許偏差和校準間隔期

編號	測量儀器	允許偏差	校準有效期（月）
1	溫度≤327℃	±2℃絕對值	3
2	溫度＞327℃	讀數的±1%	3
3	廢氣壓力	±0.2kPa絕對值	3
4	增壓空氣壓力	±0.3kPa絕對值	3
5	大氣壓力	±0.1kPa絕對值	3
6	其他壓力≤1000kPa	±20kPa絕對值	3
7	其他壓力＞1000kPa	讀數的±2%	3
8	相對濕度	±3%絕對值	1

表 3

已獲前期發證的發動機船上發動機

相關參數測量儀器的允許偏差和校準有效期

編號	測量儀器	允許偏差	校準有效期（月）
1	發動機轉速	發動機最大值的±2%	12
2	扭矩	發動機最大值的±5%	12
3	功率（直接測量）	發動機最大值的±5%	12
4	燃料消耗	發動機最大值的±4%	12
5	空氣消耗	發動機最大值的±5%	12
6	廢氣流量	發動機最大值的±5%	12

表 *4*

已獲前期發證的發動機船上其他重要

參數測量儀器的允許偏差和校準有效期

編號	測量儀器	允許偏差	校準有效期（月）
1	溫度≤327℃	±2℃絕對值	12
2	溫度＞327℃	±15℃絕對值	12
3	廢氣壓力	發動機最大值的±5%	12
4	增壓空氣壓力	發動機最大值的±5%	12
5	大氣壓力	讀數的±0.5%	12
6	其他壓力	讀數的±5%	12
7	相對濕度	±3%絕對值	6

2 校準氣體和零位與量程檢查氣體

須遵守所有校準氣體和零位與量程檢查氣體的安全儲存期限。生產廠聲明的校準氣體和零位與量程檢查氣體的有效期須予以記錄。

2.1 *純氣體（包括零位檢查氣體）*

2.1.1 所要求的氣體純度根據下列污染限度確定。須具有下列氣體：

.1 純化氮（污染：≤l ppm C，≤l ppm CO，≤400 ppm CO_2，≤0.1 ppm NO）；

.2 純化氧（純度＞容積 99.5%的氧含量）；

.3 氫氦混和氣（40±2%氫，其餘為氦），（污染：≤l ppm C，≤400 ppm CO_2）；以及

.4 純化合成空氣（污染：≤1 ppm C，≤1 ppm CO，≤400 ppm CO_2，≤0.1 ppm NO，（氧含量在容積 18-21%之間）。

2.2 *校準和量程氣體*

2.2.1 須具有下列化學成分構成的混合氣體：

.1 CO 和純化氮；

.2 NO_X 和純化氮（本校準氣體所含 NO_2 的總量不得超過 NO 含量的 5%）；

.3 O_2 和純化氮；

.4 CO_2 和純化氮；以及

.5 CH_4 和純化合成空氣或 C_3H_8 和純化合成空氣。

註：允許氣體之間不起反應的其他氣體組合。

2.2.2 校準和量程氣體的實際濃度須在標定值±2%之內。所有校準氣體的濃度須以容積為基礎給出（容積百分比或容積 ppm）。

2.2.3 用作校準和量程的氣體還可通過精密混合裝置（氣體分隔器）用純化氮或純化合成空氣稀釋方法獲得。混合裝置的精確度須使得混合的校準氣體的濃度精確在±2%的範圍之內。該精確度表明用於混合的基礎氣體的精確度須至少為±1%並符合國家或國際氣體標準。對每個包含混合裝置的校準須在滿刻度的 15%和 50%之間進行核實。另外可使用線性性質的儀器檢查混合裝置，如使用 NO 氣體進行 CLD 測量。儀器量程值須通過量程氣體與儀器直接連接進行調節。須按所使用的設定值檢查混合裝置，標定值須與儀器的測定濃度相比

較。各點的差別須在標定值的±1%之內。曾用同一氣體分隔器線性化的氣體分析儀不得用來進行該氣體分隔器的線性檢查。

2.2.4 氧干擾檢查氣體須含有碳氫化合物為 350 ppmC±75 ppmC 的丙烷或甲烷。該濃度須通過對全部碳氫化合物加雜質的色譜分析或動態排氣限定至校準氣體的公差濃度。氮須為平衡氧的主要稀釋劑。所要求的混合列於表 5 中。

表 5

氧干擾檢查氣體

O_2 濃度	平衡
21（20 至 22）	氮
10（9 至 11）	氮
5（4 至 6）	氮

3 分析儀和取樣系統的操作程序

分析儀操作程序須遵循儀器製造廠的啟動和操作說明。4 到 9 節所給出的最低要求須包括在內。

4 泄漏試驗

4.1 須進行系統泄漏試驗，測試管探頭須與排氣系統脫開並且塞住端口。開啟分析儀泵，初步穩定期之後，所有流量表的讀數須為零。如不是零，須檢查取樣管路並消除缺陷。

4.2 真空端的最大許可泄漏率須為系統被檢查部分使用流量的 0.5%。分析儀流量和旁通流量可用以估算使用流量。

4.3 另一方法是在取樣管路的起點採用從零位至量程氣體的濃度步進改變。如在適當的時間以後，讀數表上顯示的濃度低於導入的濃度，即表明有校準或泄漏問題。

4.4 其他佈置如經主管機關認可，可以接受。

5 校準程序

5.1 *儀器裝配*

儀器裝配須經校準，並用標準氣體檢查校準曲線。須使用與廢氣取樣時相同的氣體流量。

5.2 *預熱時間*

預熱時間須遵循分析儀製造廠的建議。如未規定，建議至少對分析儀預熱 2 個小時。

5.3 *NDIR 和 HFID 分析儀*

如必要，須按需調校 NDIR 分析儀。HFID 的火焰須按需優化。

5.4 *校準*

5.4.1 各常用操作範圍須經校準。分析儀用於測試之前 3 個月內或做出影響校準的系統修理或更改時須經校準，或遵循 1.3.2.2 的要求。

5.4.2 須採用純淨合成空氣（或氮），將 CO，CO_2，NO_X 和 O_2 的分析儀置零。須採用純淨合成空氣將 HFID 分析儀置零。

5.4.3 須向分析儀中注入適當的校準氣體，記錄其數值並依之制定校準曲線。

5.5 *制定校準曲線*

5.5.1 一般導則

5.5.1.1 校準曲線須通過從零至排放試驗預期最高值的操作範圍內間距大致相等的（除零以外）至少 6 個校準點加以制定。

5.5.1.2 校準曲線用最小二乘法計算。可使用最優線性或非線性等式。

5.5.1.3 校準點與最小二乘法最優線的差異須不超過讀數的±2%或滿刻度的±0.3%（取大者）。

5.5.1.4 必要時須重新檢查零位設定並重複校準程序。

5.5.1.5 如能表明替代校準方法（如：計算機，電子控制範圍開關等）具有等效精確度，則這些替代校準方法經主管機關認可後可以被採用。

6 校準驗證

6.1 每次分析前，須根據下列程序對各常用操作範圍進行檢查：

.1 須用零位氣體和標定值大於測量範圍滿刻度 80%的量程氣體檢查校準；及

.2 對所考慮的 2 個點，如其值與申報的參照值的差異不超過滿刻度的±4%，則可修改調整參數。如非如此，須按照上述 5.5 的規定制定新的校準曲線。

7 NO_X 轉換器的效率試驗

用於將 NO_2 轉換成 NO 的轉換器，其效率須根據下述 7.1 至 7.10 進行試驗。

7.1 *試驗裝置*

使用圖 1 所示的試驗裝置和下述程序，須用臭氧發生器對轉換器的效率進行試驗。

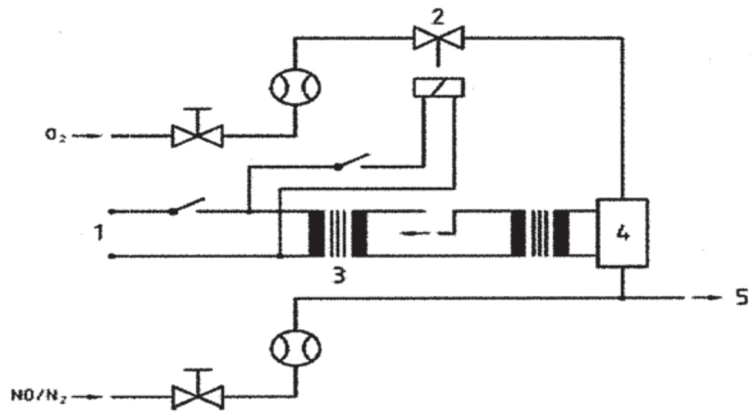


圖 *1*－二氧化氮轉換器效率裝置原理圖

1	交流電	4	臭氧發生器
2	電磁閥	5	至分析儀
3	自耦調壓器		

7.2 *校準*

須在最通用的操作範圍內按照製造廠的技術規範，使用零位氣體和量程氣體（其 NO 含量須佔操作範圍的約 80%且混和氣體的 NO_2 濃度小於 NO 濃度的 5%）對 CLD 和 HCLD 進行校準。氮氧化物分析儀必須置於 NO 模式使量程氣體不通過轉換器。所顯示的濃度須予以記錄。

7.3 *計算*

須按下列方式計算氮氧化物轉換器的效率：

3. $$E_{\mathrm{NOx}} = \left(1 + \frac{a-b}{c-d}\right) \cdot 100 \qquad (1)$$

式中：

a = 符合下述 7.6 要求的氮氧化物濃度

b = 符合下述 7.7 要求的氮氧化物濃度

c = 符合下述 7.4 要求的一氧化氮濃度

d = 符合下述 7.5 要求的一氧化氮濃度

7.4 *氧的加入*

7.4.1 經由一個 T 型附件，將氧氣或零空氣連續不斷地加入到氣流中直至所顯示的濃度約小於上述 7.2 所給定的指示校準濃度的 20%時為止。該分析儀必須置於一氧化氮模式。

7.4.2 對所示濃度（c）須予以記錄。在整個過程中臭氧發生器必須處於關閉狀態。

7.5 *臭氧發生器的啟動*

然後須啟動臭氧發生器產生足量的臭氧，以使一氧化氮濃度降至約為上述 7.2 所給定的校準濃度的 20%（最小 10%）。所示的濃度（d）須予以記錄。分析儀須置於一氧化氮模式。

7.6 *NO_X 模式*

然後須將一氧化氮分析儀轉換到氮氧化物模式，使得混和氣體（由 NO，NO_2，O_2 和 N_2 構成）通過轉換器。所示濃度（a）須予以記錄。分析儀須置於氮氧化物模式。

7.7 *關閉臭氧發生器*

然後關閉臭氧發生器。上述 7.6 所述的混合氣體通過轉換器進入探測器。所示濃度（*b*）須予以記錄。分析儀置於氮氧化物模式。

7.8 *一氧化氮模式*

在臭氧發生器關閉狀態下轉換到一氧化氮模式，同時還須切斷氧氣或合成空氣氣流。分析儀的氮氧化物讀數與按照上述 7.2 規定所測定的數值的偏差不得大於±5%。分析儀必須置於一氧化氮模式。

7.9 *試驗間隔期*

每次校準氮氧化物分析儀之前，均須對轉換器的效率進行試驗。

7.10 *效率要求*

轉換器的效率不得小於 90%。

8 HFID 的調整

8.1 *探測器響應的優化*

8.1.1 HFID 須按照儀器製造廠的規定進行調整。須使用含有丙烷的空氣量程氣體對最通用的操作範圍的響應進行優化。

8.1.2 當燃料和空氣流量設定於製造廠的建議值時，須將 350±75 ppmC 的量程氣體導入分析儀。給定燃油流量的響應須根據量程氣體和零位氣體的響應之差加以確定。該燃料流量須在製造廠技術規範之上和之下予以增量調整。這些燃料流量的量程和零位響應需加以記錄。量程和零位響應之間的差別須予以標繪，並對燃料流量按曲線的密集面進行調整。此係初始的流量設定，根據 8.2 和 8.3 的碳氫化合物響應係數和氧干擾檢查的結果可能需要進一步優化。

8.1.3 如果氧干擾或碳氫化合物響應係數不能滿足下述規範，空氣流量須在製造廠技術規範之上和之下予以增量調整（8.2 和 8.3 的每一流量）。

8.1.4 經主管機關認可，可使用替代程序進行優化。

8.2 *碳氫化合物響應係數*

8.2.1 須按第 5 節使用含有丙烷的空氣和純化合成氣體校準分析儀。

8.2.2 初次使用分析儀之前和較大使用間隔之後，須對響應係數加以確定。某一特定種類的碳氫化合物的響應係數（r_h）為 HFID ppmC 讀數和以 ppmC 表示的氣瓶中氣體濃度的比率。

8.2.3 試驗氣體的濃度水平須能給出滿刻度的約 80%的響應。濃度的已知精確度須為以按容積表示的比重測定標準為參照的±2%之內。此外，氣瓶須在 25℃±5℃的溫度下進行 24 小時的預處理。

8.2.4 使用的試驗氣體和建議的相對響應係數範圍如下：

— 甲烷和純淨合成氣體 $1.00 \leq r_h \leq 1.15$

— 丙烯和純淨合成氣體 $0.90 \leq r_h \leq 1.1$

— 甲苯和純淨合成氣體 $0.90 \leq r_h \leq 1.1$

這些數值與丙烷和純淨合成氣體的 r_h 值為 1 相對應。

8.3 *氧干擾檢查*

8.3.1 初次使用分析儀之前和較大使用間隔之後，須對氧干擾檢查加以確定。

8.3.2 須選擇氧干擾檢查氣體位於上 50%的範圍。進行試驗時爐的溫度須按要求設置。氧干擾氣體的規定在 2.2.4 中。

.1 分析儀須置零。

.2 分析儀須用 21%氧混合氣體設定量程。

.3 須重新檢查零位響應。如果變化超過滿刻度（FS）的 0.5%，須重複 8.3.2.1 和 8.3.2.2。

.4 須導入 5%和 10%的氧干擾檢查氣體。

.5 須重新檢查零位響應。如果變化超過滿刻度的±1%，須重複試驗。

.6 對步驟.4 中的每一混合氣體須按如下公式計算氧干擾（$\%O_2I$）：

$$\%O_2I = \frac{(B - \text{分析儀響應})}{B} \cdot 100 \qquad (2)$$

式中：

分析儀響應為（A 的 $A/\%FS$）·（B 的%FS）

式中：

A = 8.3.2.2 所用量程氣體的碳氫化合物濃度，ppmC（百萬分之一升）

B = 8.3.2.4 所用氧干擾檢查氣體的碳氫化合物濃度（ppmC）

$$(ppmC) = \frac{A}{D} \qquad (3)$$

D = A 引起的分析儀響應的滿刻度百分比

.7 試驗前所要求的全部氧干擾檢查氣體的氧氣干擾（$\%O_2I$）%須小於±3.0%。

.8 如果氧干擾大於 3.0%，空氣流量須在製造廠技術規範之上和之下予以增量調整，對每一流量重複 8.1。

.9 如果調整空氣流之後氧干擾大於±3.0%，須改變燃料流量及此後的取樣流量，對每一新設定值重複 8.1。

.10 如果氧干擾仍然大於±3.0%，在試驗之前須修理或更換分析儀、HFID 燃料或燃燒器空氣。然後使用修理或更換的儀器或氣體重複本條。

9 CO，CO_2，NO_X 和 O_2 分析儀的干擾效應

除被分析的氣體外，其他氣體可能以多種方式干擾讀數。如果干擾氣體和被測量的氣體具有相同但程度較小的效應，則在 NDIR 和 PMD 儀器中發生正干擾。在 NDIR 儀器中由於干擾氣體增寬被測量氣體的吸收帶，和在 CLD 儀器中由於干擾氣體抑制發散均發生負干擾。下述 9.1 和 9.2 的干擾檢查須在分析儀初次使用前和較大使用間隔之後進行，但至少一年一次。

9.1 CO 分析儀的干擾檢查

水和 CO_2 可干擾 CO 分析儀的性能。因此，濃度為試驗中所用最大操作範圍滿刻度 80%到 100%的 CO_2 量程氣體，須在室溫下從水中氣泡式通過，並記錄分析儀的響應。對於使用範圍大於或等於

300 ppm 者，分析儀的響應不得大於滿刻度的 1%，而低於 300 ppm 者，則不得大於 3 ppm。

9.2 *氮氧化物分析儀抑制檢查*

對 CLD（和 HCLD）分析儀有影響的二種氣體是 CO_2 和水蒸氣。對這些氣體的抑制響應與其濃度成正比，因此，需要以試驗方法來確定在試驗過程中最高預期濃度下的抑制。

9.2.1 CO_2 抑制檢查

9.2.1.1 具有濃度為最大操作範圍滿刻度的 80%到 100%的 CO_2 量程氣體須通過 NDIR 分析儀，將該 CO_2 值記錄為 A。然後用 NO 量程氣體將它稀釋到約 50%且通過 NDIR 和（H）CLD，將該 CO_2 和 NO 值分別記錄為 B 和 C。然後關閉 CO_2，僅讓 NO 量程氣體通過（H）CLD，將該 NO 值記錄為 D。

9.2.1.2 對抑制須作如下計算：

$$E_{\mathrm{CO2}} = \left[1 - \left(\frac{(C \cdot A)}{(D \cdot A) - (D \cdot B)}\right)\right] \cdot 100 \qquad (4)$$

式中：

A = 用 NDIR 測量的未經稀釋的 CO_2 濃度，容積百分比；

B = 用 NDIR 測量的經稀釋的 CO_2 濃度，容積；

C = 用（H）CLD 測量的經稀釋的 NO 濃度，ppm；以及

D = 用（H）CLD 測量的未經稀釋的 NO 濃度，ppm。

9.2.1.3 稀釋和量化 CO_2 和 NO 量程氣體值的替代方法，如動態混和/調合法，亦可採用。

9.2.2 水抑制檢查

9.2.2.1 這種檢查僅適用於濕氣體濃度測量。水抑制計算須考慮到試驗過程中水蒸氣對NO量程氣體的稀釋以及混合氣體的水蒸氣濃度與期望值的比例。

9.2.2.2 濃度為正常操作範圍滿刻度 80%到 100%的 NO 量程氣體須通過 HCLD 並將該 NO 值記錄為 D。之後，該 NO 量程氣體須在 25℃±5℃的室溫下從水中水泡式通過後再通過 HCID，將該 NO 值記錄為 C。水溫須予確定並記錄為 F。與發泡水的溫度（F）相應的混和氣體的飽和蒸氣壓力須予以確定並記錄為 G。混合氣體的水蒸氣濃度（H 以%表示）須按下式進行計算：

$$H = 100 \cdot \left(\frac{G}{P_b} \right) \qquad (5)$$

預期稀釋的 NO 滿量程氣體（在水蒸氣中）濃度（D_e）須按下式進行計算：

$$D_e = D \cdot \left(1 - \frac{H}{100} \right) \qquad (6)$$

對於柴油發動機的廢氣，在試驗過程中預期的最大廢氣水濃度（用%），須在燃料的原子 H/C 比為 1.8/1 的假定條件下，根據廢氣中最大 CO_2 濃度（A）作如下估算：

$$H_m = 0.9 \cdot A \qquad (7)$$

並記錄 H_m。

9.2.2.3 水抑制須按下式計算：

$$E_{H2O} = 100 \cdot \left(\frac{D_e - C}{D_e} \right) \cdot \left(\frac{H_m}{H} \right) \qquad (8)$$

式中：

D_e = 預期經稀釋的 NO 濃度，ppm；

C = 經稀釋的 NO 濃度，ppm；

H_m = 最大水蒸氣濃度，%；和

H = 實際水蒸氣濃度，%。

註： 本項檢查中，NO 量程氣體包含最小的 NO_2 濃度很重要，因為在抑制計算中，對 NO_2 的水中吸收未做考慮。

9.2.3 最大允許抑制

最大允許抑制須為：

.1 根據 9.2.1 的 CO_2 抑制：滿刻度的 2%

.2 根據 9.2.2 的水抑制：滿刻度的 3%。

9.3 *O_2 分析儀干擾*

9.3.1 由氧氣以外的氣體造成的 PMD 分析儀的儀器響應是相當小的，普通廢氣成分的氧當量示於表 6 之中。

表 *6*

氧當量

氣體	O2 當量%
二氧化碳（CO2）	-0.623
一氧化碳（CO）	-0.354

一氧化氮（NO）	+44.4
二氧化氮（NO2）	+28.7
水（H2O）	-0.381

9.3.2 對實測的氧濃度須用下列公式進行修正：

$$E_{O2} = \frac{\left(O_2\text{當量} \cdot c_{\text{觀測}}\right)}{100} \qquad (9)$$

9.3.3 對於 ZRDO 和 ECS 分析儀，氧以外的氣體造成的儀器干擾，須按照製造廠的建議和良好的技術操作進行校正。電氣化學傳感器須針對 CO_2 和 NO_X 的干擾進行校正。

附錄 V

母型機試驗報告和實驗數據

（參照《2008 年氮氧化物技術規則》2.4.1.5 和 5.10）

第 1 節-母型機試驗報告-見本規則 5.10

排放試驗報告編號……….. **表 1/5**

發動機：	
製造廠	
機型	
發動機族或發動機組標識	
序號	
額定轉速	rpm
額定功率	kW
中間轉速	rpm
中間轉速的最大扭矩	Nm
靜態噴射定時	壓縮空氣度（deg）在止點前
電子噴射控制	否： 是：
可變噴射定時	否： 是：
可變渦輪增壓器幾何構形	否： 是：
氣缸內徑	mm
衝程	mm
標稱壓縮比	
額定功率下平均有效壓力	kPa
額定功率下最大氣缸壓力	kPa
氣缸數目和排列	數目： V型： 直列：
輔助設備	
規定的環境條件：	
最高海水溫度	℃
最高增壓空氣溫度，如適用	℃
冷卻系統規格中間冷卻器	否： 是：
冷卻系統規格增壓空氣級	
低/高溫冷卻系統設定點	/ ℃
最大進口壓降	kPa
最大排氣背壓	kPa

燃油規格				
燃油溫度	℃			
排放試驗結果：				
循環				
氮氧化物				g/kWh
試驗標識				
日期/時間				
試驗場地/試驗台				
試驗編號				
驗船師				
報告日期和地點				
簽字				

排放試驗報告編號……… **發動機族資料** **表 2/5**

發動機族/發動機組資料（通用規範）	
燃燒循環	2衝程循環/4衝程循環
冷卻介質	空氣/水
氣缸排列	僅在設有廢氣濾清裝置時才要求填寫
進氣方法	自然進氣/增壓
船上使用的燃料類型	蒸餾/蒸餾或重燃油/雙燃料
燃燒室	開敞式燃燒室/分隔式燃燒室
閥口佈置	氣缸頭/氣缸壁
閥口尺寸和數目	
燃油系統類型	

其他特性：	
廢氣再循環	否/是
水噴射/乳化	否/是
空氣噴射	否/是
增壓冷卻系統	否/是
排氣後處理	否/是
排氣後處理類型	
雙燃料	否/是

發動機族/發動機組資料（試驗台試驗的母型機選擇）				
族/組標識				
增壓方法				
增壓空氣冷卻系統				
母型機選擇標準	最高NO_X排放值			
氣缸數				
每個氣缸最大額定功率				
額定轉速				
噴射定時（範圍）				
選擇的母型機				母型機
試驗循環				

排放試驗報告編號........ 試驗台資料 表 3/5

排氣管	
直徑	mm
長度	m
隔熱層	否： 是：
取樣器位置	

測量設備					
	製造廠	型號	測量範圍	校準	
				量程氣體濃度	校準偏差
分析儀					
NO_X分析儀			ppm		%
CO分析儀			ppm		%
CO_2分析儀			%		%
O_2分析儀			%		%
HC分析儀			ppmC		%
轉速			rpm		%
扭矩			Nm		%
功率，如適用			kW		%
燃油流量					%
空氣流量					%
排氣流量					%
溫度					
增壓空氣冷卻劑進口			℃		℃
廢氣			℃		℃
進氣口空氣			℃		℃
增壓空氣			℃		℃
燃油			℃		℃
壓力					
廢氣			kPa		kPa
增壓空氣			kPa		kPa
大氣			kPa		kPa
蒸氣壓力					
吸入空氣			kPa		%

濕度					
吸入空氣			%		%

燃油特性

燃油種類				
燃油性能:			燃油成分分析:	
密度	ISO 3675	Kg/m^3	碳	%m/m
黏度	ISO 3104	mm^2/s	氫	%m/m
水	ISO 3733	%V/V	氮	%m/m
			氧	%m/m
			硫	%m/m
			（低熱值）LHV/Hu	MJ/kg

排放試驗報告編號……. **環境和氣體排放數據表** **表 4/5**

模式		1	2	3	4	5	6	7	8	9	10
功率/扭矩	%										
轉速	%										
模式開始時間											

環境數據											
大氣壓力	kPa										
進氣溫度	℃										
進氣濕度	g/kg										
進氣相對濕度*	%										
相對濕度傳感器處的空氣溫度*	℃										
進氣乾球溫度*	℃										
進氣濕球溫度*	℃										
試驗條件參數，fa											

氣體排放數據										
NO_X 濃度 乾/濕 ppm										
CO 濃度 ppm										
CO_2 濃度 %										
O_2 濃度 乾/濕 %										
HC 濃度 ppmC										
NO_X 濕度修正係數，k_{hd}										
乾/濕修正係數，k_{wr}										
NO_X 質量流量 kg/h										
CO 質量流量 kg/h										
CO_2 質量流量 kg/h										
O_2 質量流量 kg/h										
HC 質量流量 kg/h										
NO_X 比值 g/kWh										

* 如適用

排放試驗報告編號……. **發動機試驗數據** **表 5/5**

模式		1	2	3	4	5	6	7	8	9	10
功率/扭矩	%										
轉速	%										
模式開始時間											

發動機數據											
轉速	rpm										
輔機功率	kW										
功率計設定值	kW										
功率	kW										
平均有效壓力	kPa										
燃料齒條	mm										
未修正的燃油耗量	g/kWh										
燃油流量	kg/h或m^3/hr*										
空氣流量	kg/h										
排氣流量（q_{mew}）	kg/h										
排氣溫度	℃										
排氣背壓	kPa										
增壓空氣進口冷卻劑溫度	℃										
增壓空氣出口冷卻劑溫度	℃										
增壓空氣溫度	℃										
增壓空氣參照溫度	℃										
增壓空氣壓力	kPa										
燃油溫度	℃										

* 如適用

第 2 節－技術檔案中包括的母型機試驗數據－見本規則 2.4.1.5

發動機族/發動機組參照		
母型機		
型號/類型		
指定額定功率	kW	
指定額定轉速	rpm	

母型機試驗燃油		
參照燃料標號		
ISO 8217：2005 等級（DM 或 RM）		
碳	%m/m	
氫	%m/m	
硫	%m/m	
氮	%m/m	
氧	%m/m	
水	%V/V	

測量數據（母型機）									
功率/扭矩	%								
轉速	%								
模式點		1	2	3	4	5	6	7	8
發動機性能									
功率	kW								
轉速	rpm								
燃料流量	kg/h								
吸入空氣流量（濕/乾）	kg/h								
廢氣流量	kg/h								
吸入空氣溫度	℃								
增壓空氣溫度	℃								
增壓空氣參照溫度	℃								
增壓空氣壓力	kPa								
用於排放修正的附加參數（詳細說明）									
環境條件									
大氣壓力	kPa								
吸入空氣相對濕度（RH）	%								
RH 傳感器空氣溫度*	℃								
吸入空氣乾球溫度*	℃								
吸入空氣濕球溫度*	℃								
吸入空氣絕對濕度*	g/kg								

排放濃度									
NO_X 濕/乾	ppm								
CO_2	%								
O_2 濕/乾	%								
CO	ppm								
HC	ppmC								
計算數據（母型機）									
吸入空氣濕度	g/kg								
增壓空氣濕度	g/kg								
試驗條件參數，f_a									
乾/濕修正係數，k_{wr}									
NO_X 濕度修正係數，k_{hd}									
廢氣流量	kg/h								
NO_X 排放流量	k/h								
附加排放修正係數（詳細說明）	g/kWh								
NO_X 排放	g/kWh								

試驗循環					
排放值	g/kWh				

* 如適用。

附錄 VI

廢氣質量流量計算（碳平衡法）

（參閱《2008 年氮氧化物技術規則》第 5 章）

1 引言

1.1 本附錄論述了以廢氣濃度測量和對燃料消耗的了解為基礎的廢氣質量流量計算。符號和術語說明及碳平衡測量方法公式中所用變量均概述於本規則引言中。

1.2 除另有規定外，本附錄所要求的全部計算結果均須按照本規則 5.10 記錄在發動機試驗報告中。

2 碳平衡方法，一步計算程序

2.1 本方法為以燃料消耗、燃料成分和廢氣濃度為條件的廢氣質量計算。

2.2 濕基的廢氣質量流量：

$$q_{\mathrm{mew}} = q_{\mathrm{mf}}\left(\left(\frac{\dfrac{1.4\cdot\left(w_{\mathrm{BET}}\cdot w_{\mathrm{BET}}\right)}{\left(\dfrac{\left(1.4\cdot w_{\mathrm{BET}}\right)}{f_{\mathrm{c}}}+\left(w_{\mathrm{ALF}}\cdot 0.08936\right)-1\right)\cdot\dfrac{1}{1.293}+f_{\mathrm{fd}}}}{f_{\mathrm{c}}\cdot f_{\mathrm{c}}}+\left(w_{\mathrm{ALF}}\cdot 0.08936\right)-1\right)\cdot\left(1+\frac{H_a}{1000}\right)+1\right) \quad (1)$$

式中

f_{fd} 根據公式（2），f_{c} 根據公式（3）確定

H_a 係指吸入空氣的絕對濕度，g（水）/kg（乾空氣）。但如 $H_a \geq H_{SC}$，在公式（1）中須用 H_{SC} 代替 H_a。

註：　可使用普遍接受的公式從相對濕度測量、露點測量、蒸氣壓力測量或乾/濕球測量中推算出 Ha。

2.3　乾廢氣的燃料特定常量 f_{fd} 須通過燃料成分燃燒附加容積的相加計算出：

$$f_{fd} = -0.055593 \cdot w_{ALF} + 0.008002 \cdot w_{DEL} + 0.0070046 \cdot w_{EPS} \qquad (2)$$

2.4　根據公式（3），碳係數 f_c：

$$f_c = \left(c_{CO2d} - c_{CO2ad}\right) \cdot 0.5441 + \frac{c_{COd}}{18522} + \frac{c_{HCw}}{17355} \qquad (3)$$

式中：

c_{CO2d} = 原始廢氣中的乾 CO_2 濃度，%

c_{CO2ad} = 環境空氣中的乾 CO_2 濃度，%=0.03%

c_{COd} = 原始廢氣中的乾 CO 濃度，ppm

c_{HCw} = 原始廢氣中的濕 HC 濃度，ppm。

附錄 VII

發動機參數檢查方法的檢查清單

（參閱《2008 年氮氧化物技術規則》6.2.2.5）

1 下列某些參數，有着一種以上的可行檢驗方法。在這種情況下，作為指南，下列方法的任何一種或一組均可充分表明符合要求。經主管機關認可，在發動機發證申請方的支持下，船舶所有人可以對適用方法做出選擇。

.1 “噴射定時”參數

.1 燃油凸輪位置（如凸輪不可調整，單個凸輪或凸輪軸），

— 選擇（根據設計）：凸輪和泵驅動裝置之間的頂桿位置，

— 套筒計量泵的選擇：可變噴射定時（VTT）指數和凸輪位置或套筒位置，或

— 其他套筒計量裝置；

.2 某些燃油齒條位置的供油起點（動壓力測量）；

.3 某些負荷點噴油閥的開啟，例如，用霍爾傳感器或加速傳感器；

.4 增壓空氣壓力，燃燒峰值壓力，增壓空氣溫度，廢氣溫度的載控操作值與氮氧化物相關曲線顯示圖相比較。此外，須確保壓縮比與初次驗證值相一致（見 1.7）。

*註：*為評估實際定時，有必要根據試驗台氮氧化物的測量結果，了解滿足排放限值的允許限度或甚至顯示定時對氮氧化物影響的曲線圖。

.2 “噴油嘴”參數：

.1 技術要求和構件標識號；

.3 “噴油泵”參數：

.1 構件標識號（說明柱塞和套筒的設計）；

.4 “燃油凸輪”參數：

.1 構件標識號（說明形狀）；

.2 某一燃油齒條位置的供油起點和終點（動壓力測量）；

.5 “噴油壓力”參數：

.1 僅對共軌系統：齒軌中載控壓力，氮氧化物相關曲線顯示圖；

.6 "燃燒室" 參數：

.1 氣缸頭和活塞頭的構件標識號；

.7 "壓縮比" 參數：

.1 檢查實際間隙；

.2 檢查活塞桿或連桿的墊片；

.8 "增壓器型式和構造" 參數：

.1 型式和規格（標識號）；

.2 載控增壓空氣壓力，氮氧化物相關曲線顯示圖；

.9 "增壓空氣冷卻器、增壓空氣加熱器" 參數：

.1 型號和規格；

.2 按參照條件修正後的載控增壓空氣溫度，氮氧化物相關曲線顯示圖；

.10 "閥定時" 參數（僅針對下死點（BDC）前具有進氣閥關閉裝置的四衝程發動機）：

.1 凸輪位置；

.2 檢查實際定時；

.11 “水噴射”參數（用於評價：顯示對氮氧化物影響的曲線圖）：

.1 載控水耗（監測）；

.12 “乳化燃油”參數（用於評價：顯示對氮氧化物影響的曲線圖）：

.1 載控燃油齒條位置（監測）；

.2 載控水耗（監測）；

.13 “廢氣再循環”參數（用於評價：顯示對氮氧化物影響的曲線圖）：

.1 再循環廢氣與載控質量流量（監測）；

.2 新鮮空氣與再循環廢氣的混和氣體，即“掃氣”中的 CO_2 濃度（監測）；

.3 “掃氣”中的 O_2 濃度（監測）；

.14 “選擇性催化還原”參數（SCR）：

.1 載控還原劑質量流量（監測）以及對 SCR 之後的 NO_X 濃度附加定期檢查（用於評價：顯示對 NO_X 影響的曲線圖）。

2 對具有無反饋控制的選擇性催化還原（SCR）的發動機，可選用的 NO_X 測量（定期抽查或監測）有助於表明無論環境條件或燃油質量是否造成原始排放的不同，SCR 的有效性仍然和發證時的狀況一致。

附錄 VIII

直接測量和監測法的實施

（參閱《2008 年氮氧化物技術規則》6.4）

1 電氣設備：材料和設計

1.1 電氣設備須用耐久、阻燃和耐潮的材料製成，使其在裝設的環境中及可能承受的溫度下不會劣化。

1.2 電氣設備的設計須使有可能接地的導電部分得到意外接觸保護。

2 分析設備

2.1 *分析儀*

2.1.1 須使用下列儀器對廢氣進行分析。非線性分析儀，允許使用線性化電路。其他系統或分析儀，如果取得與下述設備等效的結果，經主管機關認可，可以接受：

.1 氮氧化物（NO_X）分析

氮氧化物分析儀須為化學熒光探測器（CLD）或加熱式化學熒光探測器（HCLD）型。為 NO_X 測量取樣的廢氣在通過 NO_2 至 NO 的轉換器之前須保持在露點溫度之上。

*註：*對於原始廢氣，如果發動機使用 ISO 8217：2005 DM 級燃料，此溫度須大於 60℃；如果使用 ISO 8217：2005 RM 級燃料，此溫度須大於 140℃。

.2 二氧化碳（CO_2）分析

如要求，二氧化碳分析儀須為非彌散紅外（NDIR）吸收型。

.3 一氧化碳（CO）分析

如要求，一氧化碳分析儀須為（NDIR）吸收型式。

.4 碳氫化合物（HC）分析

如要求，碳氫化合物分析儀須為加熱式火焰離子探測器（HFID）型。為 HC 測量取樣的廢氣從取樣點至探測器的溫度須保持在 190℃±10℃。

.5 氧（O_2）分析

如要求，氧分析儀須為順磁探測器（PMD）、二氧化鋯傳感器（ZRDO）或電化傳感器（ECS）型。

2.2 *分析儀技術規範*

2.2.1 分析儀技術規範須與本規則附錄 III 的 1.6、1.7、1.8、1.9 和 1.10 一致。

2.2.2 分析儀範圍須使測量的排放值位於所用範圍的 15%至 100%之間。

2.2.3 分析儀須按照製造廠的建議進行安裝和維護以滿足本規則附錄 III 中 1.7、1.8、1.9 和 1.10 以及附錄 IV 中第 7 和第 9 節的要求。

3 純氣體和校準氣體

3.1 所要求的純氣體和校準氣體須符合本規則附錄 IV 的 2.1 和 2.2。所申報的的濃度須符合國家和/或國際標準。校準氣體須符合分析設備製造廠的建議。

3.2 分析儀量程氣體須處於分析儀所定量程刻度的 80%至 100%之間。

4 氣體取樣和傳輸系統

4.1 廢氣試樣須能代表從發動機所有氣缸排出的平均廢氣排放。氣體取樣系統須符合本規則 5.9.3。

4.2 廢氣試樣須從管直徑 10%至 90%內的區域抽取。

4.3 為了利於取樣管的安裝，第 5 節給出了取樣點接頭法蘭實例。

4.4 須按照分析設備製造廠的建議維持 NO_X 測量的廢氣試樣，以防止水或酸冷凝造成的 NO_2 損失。

4.5 氣體試樣不得用化學乾燥劑乾燥。

4.6 須能按照分析設備製造廠的建議驗證氣體取樣系統無進入滲漏。

4.7 須在所用取樣點附近設有附加取樣點以便利系統質量控制檢查。

5 取樣點接頭法蘭

5.1 以下為通用取樣點接頭法蘭實例，該法蘭須位於使用直接測量和監測法證實符合要求的每一發動機的排氣管上的合宜之處。

規格	尺寸
外徑	160 mm
內徑	35 mm
法蘭厚度	9 mm
螺栓圈直徑 1	130 mm
螺栓圈直徑 2	65 mm
法蘭槽口	直徑 12 mm 的孔 4 個，等距離分佈在上述螺栓圈直徑上。2 個螺栓圈直徑的孔在相同半徑對齊。在內外螺栓圈直徑孔之間的法蘭開槽口，槽口寬 12 mm
螺栓和螺帽	4 套，要求的直徑和長度
法蘭須以鋼製成，表面平整。	

5.2 法蘭須設置在與排氣管直徑對齊的以適當規格材料製成的短管上。短管長度須不超過凸出排氣管覆層所需的長度，但須足以進入法蘭的內側。短管須予以絕緣。短管須中止於可接觸到的位置，附近沒有會干擾取樣管和相關附件就位或裝設的阻礙物。

5.3 不使用時，短管須用鋼製無孔法蘭和適當耐熱材料製成的墊圈封閉。取樣法蘭和封閉無孔法蘭不使用時，須用易於移除和適當耐熱材料加以覆蓋，以防意外接觸。

6 選擇載荷點和經修改的加權因數

6.1 按照本規則 6.4.6.4，對於 E2、E3 或 D2 試驗循環，載荷點的最少數目須使本規則 3.2 規定的組合標定加權因數大於 0.5。

6.2 按照 6.1，E2 和 E3 試驗循環有必要使用 75%載荷點加上其他一個或多個載荷點。D2 試驗循環，須使用 25%或 50%載荷點加上一個或多個載荷點以使組合標定加權因數大於 0.5。

6.3 以下實例為一些載荷點的可能組合，可與各經修改的加權因數共用：

.1 E2 和 E3 試驗循環

功率	100%	75%	50%	25%
標定加權因數	0.2	0.5	0.15	0.15
選項 A	0.29	0.71		
選項 B		0.77	0.23	
選項 C	0.24	0.59		0.18
加上可取得組合標定加權因數大於 0.5 的的其他組合。因此使用 100% + 50% + 25%載荷點是不夠的。				

.2 D2 試驗循環

功率	100%	75%	50%	25%	10%
標定加權因數	0.05	0.25	0.3	0.3	0.1
選項 D			0.5	0.5	
選項 E		0.45		0.55	
選項 F		0.38	0.46		0.15
選項 G	0.06	0.28	0.33	0.33	
加上可取得組合標定加權因數大於 0.5 的的其他組合。因此使用 100% + 50% + 10%載荷點是不夠的。					

6.4 對於 C1 試驗循環，每個額定、過渡和空轉部分須至少使用一個載荷點。以下實例為載荷點的一些可能組合，可與各經修改的加權因數一起使用：

.1 C1 試驗循環

轉速	額定				過渡			空轉
扭矩	100%	75%	50%	10%	100%	75%	50%	0%
標定加權因數	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15
選項 H		0.38			0.25			0.38
選項 I				0.29		0.29		0.43
選項 J	0.27	0.27					0.18	0.27
選項 K	0.19	0.19	0.19	0.13		0.13		0.19
加上包括每個額定、過渡和空轉轉速的至少一個載荷點的其他組合。								

6.5 經修改的加權因數計算實例：

.1 對給定的載荷點，經修改的加權因數須計算如下：

y%載荷 ＝ 載荷 y 時的標定加權因數・（1/（獲取數據的各載荷點的載荷因數之和））

.2 對選項 A：

75%載荷：修改值計算為：0.5・（1/（0.5+0.2））=0.71

100%負荷：修改值計算為：0.2・（1/（0.5+0.2））=0.29

.3 對選項 F：

75%載荷：修改值計算為：0.25・（1/（0.25+0.3＋0.1））=0.38

.4 經修改的加權因數精確至小數點後兩位。但是，本規則公式（19）所用的值須取整。因此，在上述選項 F 中，經修改的加權因數示為 0.38 雖然精確值為 0.384615……。因此，在經修改的加權因數實例中，由於四捨五入的原因顯示值（精確至小數點後兩位）的總和可能不是 1.00。

7 功率設定點穩定性的確定

7.1 為了確定設定點穩定性，功率偏差係數須在 10 分鐘間隔期內計算，且取樣率至少為 1-Hz。結果須小於或等於百分之五（5%）。

7.2 計算偏差係數的公式如下：

$$Ave = \frac{1}{N}\sum_{j=1}^{N} x_{j} \qquad (1)$$

$$S.D. = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - Ave)^2} \qquad (2)$$

$$\%C.O.V. = \frac{S.D.}{Ave} \cdot 100 \le 5\% \qquad (3)$$

式中：

%C.O.V.	功率偏差係數，%
S.D.	標準偏差
Ave	平均
N	取樣數據點總數目
x_i，x_j	功率數據點的第 i，j 個值，kW
I	標準偏差公式的下標變量
J	平均公式的下標變量

RESOLUTION MEPC.177(58)

Adopted on 10 October 2008

AMENDMENTS TO THE TECHNICAL CODE ON CONTROL OF EMISSION OF NITROGEN OXIDES FROM MARINE DIESEL ENGINES

(NO_x Technical Code 2008)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee (the Committee) conferred upon it by international conventions for the prevention and control of marine pollution,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention"), article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol") and article 4 of the Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (herein after referred to as the "1997 Protocol"), which together specify the amendment procedure of the 1997 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 and 1997 Protocols,

NOTING ALSO that, by the 1997 Protocol, Annex VI, entitled Regulations for the Prevention of Air Pollution from Ships (hereinafter referred to as "Annex VI"), is added to the 1973 Convention,

NOTING FURTHER regulation 13 of MARPOL Annex VI, which makes the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (NO_x Technical Code) mandatory under that Annex,

HAVING CONSIDERED the draft amendments to the NO_x Technical Code,

1. ADOPTS, in accordance with article 16(2)(d) of the 1973 Convention, the amendments to the NO_x Technical Code, as set out at Annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on 1 January 2010, unless prior to that date, not less than one-third of the Parties or Parties the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objection to the amendments;

3. INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the said amendments shall enter into force on 1 July 2010 upon their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1973 Convention, as modified by the 1978 and 1997 Protocols, certified copies of the present resolution and the text of the amendments contained in the Annex;

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1973 Convention, as modified by the 1978 and 1997 Protocols, copies of the present resolution and its Annex;

6. INVITES the Parties to MARPOL Annex VI and other Member Governments to bring the amendments to the NO_x Technical Code to the attention of shipowners, ship operators, shipbuilders, marine diesel engine manufacturers and any other interested groups.

NO_x Technical Code 2008

Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines

Contents

APPENDICES

Introduction

NO_x Technical Code 2008

On 26 September 1997, the Conference of Parties to the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78) adopted, by Conference resolution 2, the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (NO_x Technical Code). Following the entry into force, on 19 May 2005, of MARPOL Annex VI – Regulations for the Prevention of Air Pollution from Ships, each marine diesel engine to which regulation 13 of that Annex applies must comply with the provisions of this Code. MEPC 53 in July 2005 agreed to the revision of MARPOL Annex VI and the NO_x Technical Code. That review was concluded at MEPC 58 in October 2008 and this version of the NO_x Technical Code, hereunder referred to as the Code, is an outcome of that process.

As general background information, the precursors to the formation of nitrogen oxides during the combustion process are nitrogen and oxygen. Together these compounds comprise 99% of the engine intake air. Oxygen will be consumed during the combustion process, with the amount of excess oxygen available being a function of the air/fuel ratio under which the engine is operating. The nitrogen remains largely unreacted in the combustion process; however, a small percentage will be oxidized to form various oxides of nitrogen. The nitrogen oxides (NO_x) that can be formed include nitric oxide (NO) and nitrogen dioxide (NO_2), while the amounts are primarily a function of flame or combustion temperature and, if present, the amount of organic nitrogen available from the fuel. NO_x formation is also a function of the time the nitrogen and the excess oxygen are exposed to the high temperatures associated with the diesel engine's combustion process. In other words, the higher the combustion temperature (e.g., high-peak pressure, high-compression ratio, high rate of fuel delivery, etc.), the greater the amount of NO_x formation. A slow-speed diesel engine, in general, tends to have more NO_x formation than a high-speed engine. NO_x has an adverse effect on the environment, causing acidification, formation of tropospheric ozone and nutrient enrichment, and contributes to adverse health effects globally.

The purpose of this Code is to provide mandatory procedures for the testing, survey and certification of marine diesel engines that will enable engine manufacturers, shipowners and Administrations to ensure that all applicable marine diesel engines comply with the relevant limiting emission values of NO_x as specified within regulation 13 of Annex VI. The difficulties of establishing, with precision, the actual weighted average NO_x emission of marine diesel engines in service on ships have been recognized in formulating a simple, practical set of requirements in which the means to ensure compliance with the allowable NO_x emissions are defined.

Administrations are encouraged to assess the emissions performance of marine propulsion and auxiliary diesel engines on a test bed where accurate tests can be carried out under properly controlled conditions. Establishing compliance with regulation 13 of Annex VI at this initial stage is an essential feature of this Code. Subsequent testing on board the ship may inevitably be limited in scope and accuracy, and its purpose shall be to infer or deduce the emission performance and to confirm that engines are installed, operated and maintained in accordance with the manufacturer's specifications and that any adjustments or modifications do not detract from the emissions performance established by initial testing and certification by the manufacturer.

Abbreviations, subscripts and symbols

Tables 1, 2, 3 and 4 below summarize the abbreviations, subscripts and symbols used throughout this Code, including specifications for the analytical instruments in appendix III, calibration requirements for the analytic instruments contained in appendix IV, the formulae for calculation of gas mass flow as contained in chapter 5 and appendix VI of this Code and the symbols used in respect of data for onboard verification surveys in chapter 6.

.1 Table 1: symbols used to represent the chemical components of diesel engine gas emissions and calibration and span gases addressed throughout this Code;

.2 Table 2: abbreviations for the analysers used in the measurement of gas emissions from diesel engines as specified in appendix III of this Code;

.3 Table 3: symbols and subscripts of terms and variables used in chapter 5, chapter 6, appendix IV and appendix VI of this Code; and

.4 Table 4: symbols for fuel composition used in chapter 5 and chapter 6 and appendix VI of this Code.

Table 1
Symbols and abbreviations for the chemical components

Symbol	**Definition**
CH_4	Methane
C_3H_8	Propane
CO	Carbon monoxide
CO_2	Carbon dioxide
HC	Hydrocarbons
H_2O	Water
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Nitrogen oxides
O_2	Oxygen

Table 2
Abbreviations for Analysers for measurement of diesel engine gaseous emissions
(refer to appendix III of this Code)

CLD	Chemiluminescent detector
ECS	Electrochemical sensor
HCLD	Heated chemiluminescent detector
HFID	Heated flame ionization detector
NDIR	Non-dispersive infrared analyser
PMD	Paramagnetic detector
ZRDO	Zirconium dioxide sensor

Table 3
Symbols and subscripts for terms and variables
(refer to chapter 5, chapter 6, appendix IV and appendix VI of this Code)

Symbol	Term	Unit
A/F_{st}	Stoichiometric air to fuel ratio	1
c_x	Concentration in the exhaust (with suffix of the component nominating, d=dry or w=wet)	ppm/% (V/V)
E_{CO2}	CO_2 quench of NO_x analyser	%
E_{H2O}	Water quench of NO_x analyser	%
E_{NOx}	Efficiency of NO_x converter	%
E_{O2}	Oxygen analyser correction factor	1
λ	Excess air factor: kg dry air/(kg fuel · A/F_{st})	1
f_a	Test condition parameter	1
f_c	Carbon factor	1
f_{fd}	Fuel-specific factor for exhaust flow calculation on dry basis	1
f_{fw}	Fuel-specific factor for exhaust flow calculation on wet basis	1
H_a	Absolute humidity of the intake air (g water / kg dry air)	g/kg
H_{SC}	Humidity of the charge air	g/kg
i	Subscript denoting an individual mode	1
k_{hd}	Humidity correction factor for NO_x for diesel engines	1
k_{wa}	Dry to wet correction factor for the intake air	1
k_{wr}	Dry to wet correction factor for the raw exhaust gas	1
n_d	Engine speed	min^{-1}
n_{turb}	Turbocharger speed	min^{-1}
$\%O_2I$	HC analyser percentage oxygen interference	%
p_a	Saturation vapour pressure of the engine intake air determined using a temperature value for the intake air measured at the same physical location as the measurements for p_b and R_a	kPa
p_b	Total barometric pressure	kPa
p_C	Charge air pressure	kPa
p_r	Water vapour pressure after cooling bath of the analysis system	kPa
p_s	Dry atmospheric pressure calculated by the following formula: $p_s = p_b - R_a \cdot p_a / 100$	kPa
p_{SC}	Saturation vapour pressure of the charge air	kPa
P	Uncorrected brake power	kW
P_{aux}	Declared total power absorbed by auxiliaries fitted for the test and not required by ISO 14396	kW
P_m	Maximum measured or declared power at the test engine speed under test conditions	kW

Symbol	Term	Unit
q_{mad}	Intake air mass flow rate on dry basis	kg/h
q_{maw}	Intake air mass flow rate on wet basis	kg/h
q_{mew}	Exhaust gas mass flow rate on wet basis	kg/h
q_{mf}	Fuel mass flow rate	kg/h
q_{mgas}	Emission mass flow rate of individual gas	g/h
R_a	Relative humidity of the intake air	%
r_h	Hydrocarbon response factor	1
ρ	Density	kg/m^3
s	Fuel rack position	
T_a	Intake air temperature determined at the engine intake	K
T_{caclin}	Charge air cooler, coolant inlet temperature	°C
$T_{caclout}$	Charge air cooler, coolant outlet temperature	°C
T_{Exh}	Exhaust gas temperature	°C
T_{Fuel}	Fuel oil temperature	°C
T_{Sea}	Seawater temperature	°C
T_{SC}	Charge air temperature	K
T_{SCRef}	Charge air reference temperature	K
u	Ratio of exhaust component and exhaust gas densities	1
W_F	Weighting factor	1

Table 4
Symbols for fuel composition

Symbol	Definition	Unit
w_{ALF}	H content of fuel	% m/m
w_{BET}	C content of fuel	% m/m
w_{GAM}	S content of fuel	% m/m
w_{DEL}	N content of fuel	% m/m
w_{EPS}	O content of fuel	% m/m
α	molar ratio (H/C)	1

Chapter 1

General

1.1 Purpose

1.1.1 The purpose of this Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines, hereunder referred to as the Code, is to specify the requirements for the testing, survey and certification of marine diesel engines to ensure they comply with the nitrogen oxides (NO_x) emission limits of regulation 13 of Annex VI. All references to regulations within this Code refer to Annex VI.

1.2 Application

1.2.1 This Code applies to all marine diesel engines with a power output of more than 130 kW that are installed, or are designed and intended for installation, on board any ship subject to Annex VI and to which regulation 13 applies. Regarding the requirements for survey and certification under regulation 5, this Code addresses only those requirements applicable to an engine's compliance with the applicable NO_x emission limit.

1.2.2 For the purpose of the application of this Code, Administrations are entitled to delegate all functions required of an Administration by this Code to an organization authorized to act on behalf of the Administration. In every case, the Administration assumes full responsibility for the survey and certificate.

1.2.3 For the purpose of this Code, an engine shall be considered to be operated in compliance with the applicable NO_x limit of regulation 13 if it can be demonstrated that the weighted NO_x emissions from the engine are within those limits at the initial certification, annual, intermediate and renewal surveys and such other surveys as are required.

1.3 Definitions

1.3.1 *Nitrogen Oxide (NO_x) emissions* means the total emission of nitrogen oxides, calculated as the total weighted emission of NO_2 and determined using the relevant test cycles and measurement methods as specified in this Code.

1.3.2 *Substantial modification* of a marine diesel engine means:

.1 For engines installed on ships constructed on or after 1 January 2000, *substantial modification* means any modification to an engine that could potentially cause the engine to exceed the applicable emission limit set out in regulation 13. Routine replacement of engine components by parts specified in the technical file that do not alter emission characteristics shall not be considered a "substantial modification" regardless of whether one part or many parts are replaced.

.2 For engines installed on ships constructed before 1 January 2000, *substantial modification* means any modification made to an engine that increases its existing emission characteristics established by the simplified measurement method as described in 6.3 in excess of the allowances set out in 6.3.11. These changes include, but are not limited to, changes in its operations or in its technical parameters (e.g., changing camshafts, fuel injection systems, air systems, combustion chamber configuration, or timing calibration of the engine). The installation of a certified approved method pursuant to regulation 13.7.1.1 or certification pursuant to regulation 13.7.1.2 is not considered to be a substantial modification for the purpose of the application of regulation 13.2 of the Annex.

1.3.3 *Components* are those interchangeable parts that influence the NO_x emissions performance, identified by their design/parts number.

1.3.4 *Setting* means adjustment of an adjustable feature influencing the NO_x emissions performance of an engine.

1.3.5 *Operating values* are engine data, such as cylinder peak pressure, exhaust gas temperature, etc., from the engine log that are related to the NO_x emission performance. These data are load-dependent.

1.3.6 The *EIAPP Certificate* is the Engine International Air Pollution Prevention Certificate which relates to NO_x emissions.

1.3.7 The *IAPP Certificate* is the International Air Pollution Prevention Certificate.

1.3.8 *Administration* has the same meaning as article 2, subparagraph (5) of MARPOL 73.

1.3.9 *Onboard NO_x verification procedures* mean a procedure, which may include an equipment requirement, to be used on board at initial certification survey or at the renewal, annual or intermediate surveys, as required, to verify compliance with any of the requirements of this Code, as specified by the applicant for engine certification and approved by the Administration.

1.3.10 *Marine diesel engine* means any reciprocating internal combustion engine operating on liquid or dual fuel, to which regulation 13 applies, including booster/compound systems if applied.

Where an engine is intended to be operated normally in the gas mode, i.e. with the main fuel gas and only a small amount of liquid pilot fuel, the requirements of regulation 13 have to be met only for this operation mode. Operation on pure liquid fuel resulting from restricted gas supply in cases of failures shall be exempted for the voyage to the next appropriate port for the repair of the failure.

1.3.11 *Rated power* means the maximum continuous rated power output as specified on the nameplate and in the technical file of the marine diesel engine to which regulation 13 and this Code apply.

1.3.12 *Rated speed* is the crankshaft revolutions per minute at which the rated power occurs as specified on the nameplate and in the technical file of the marine diesel engine.

1.3.13 *Brake power* is the observed power measured at the crankshaft or its equivalent, the engine being equipped only with the standard auxiliaries necessary for its operation on the test bed.

1.3.14 *Onboard conditions* mean that an engine is:

.1 installed on board and coupled with the actual equipment that is driven by the engine; and

.2 under operation to perform the purpose of the equipment.

1.3.15 A *technical file* is a record containing all details of parameters, including components and settings of an engine, that may influence the NO_x emission of the engine, in accordance with 2.4 of this Code.

1.3.16 A *record book of engine parameters* is the document used in connection with the engine parameter check method for recording all parameter changes, including components and engine settings that may influence NO_x emission of the engine.

1.3.17 An *approved method* is a method for a particular engine, or a range of engines, which, when applied to the engine, will ensure that the engine complies with the applicable NO_x limit as detailed in regulation 13.7.

1.3.18 An *existing engine* is an engine that is subject to regulation 13.7.

1.3.19 An *approved method file* is a document which describes an approved method and its means of survey.

Chapter 2

Surveys and certification

2.1 General

2.1.1 Each marine diesel engine specified in 1.2, except as otherwise permitted by this Code, shall be subject to the following surveys:

.1 A pre-certification survey that shall be such as to ensure that the engine, as designed and equipped, complies with the applicable NO_x emission limit contained in regulation 13. If this survey confirms compliance, the Administration shall issue an Engine International Air Pollution Prevention (EIAPP) Certificate.

.2 An initial certification survey that shall be conducted on board a ship after the engine is installed but before it is placed in service. This survey shall be such as to ensure that the engine, as installed on board the ship, including any modifications and/or adjustments since the pre-certification, if applicable, complies with the applicable NO_x emission limit contained in regulation 13. This survey, as part of the ship's initial survey, may lead to either the issuance of a ship's initial International Air Pollution Prevention (IAPP) Certificate or an amendment of a ship's valid IAPP Certificate reflecting the installation of a new engine.

.3 Renewal, annual and intermediate surveys, that shall be conducted as part of a ship's surveys required by regulation 5, to ensure the engine continues to comply fully with the provisions of this Code.

.4 An initial engine certification survey that shall be conducted on board a ship every time a major conversion, as defined in regulation 13, is made to an engine to ensure that the engine complies with the applicable NO_x emission limit contained in regulation 13. This will result in the issue, if applicable, of an EIAPP Certificate and the amendment of the IAPP Certificate.

2.1.2 To comply with the various survey and certification requirements described in 2.1.1, there are methods included in this Code from which the engine manufacturer, shipbuilder or shipowner, as applicable, can choose to measure, calculate, test or verify an engine for its NO_x emissions, as follows:

.1 test-bed testing for the pre-certification survey in accordance with chapter 5;

.2 onboard testing for an engine not pre-certificated for a combined pre certification and initial certification survey in accordance with the full test-bed requirements of chapter 5;

.3 onboard engine parameter check method, using the component data, engine settings and engine performance data as specified in the technical file, for confirmation of compliance at initial, renewal, annual and intermediate surveys for pre-certified engines or engines that have undergone modifications or adjustments to NO_x critical components, settings and operating values, since they were last surveyed, in accordance with 6.2;

.4 onboard simplified measurement method for confirmation of compliance at renewal, annual and intermediate surveys or confirmation of pre-certified engines for initial certification surveys, in accordance with 6.3 when required; or

.5 onboard direct measurement and monitoring method for confirmation of compliance at renewal, annual and intermediate surveys only, in accordance with 6.4.

2.2 Procedures for pre-certification of an engine

2.2.1 Prior to installation on board, every marine diesel engine (individual engine), except as allowed by 2.2.2 and 2.2.4, shall:

.1 be adjusted to meet the applicable NO_x emission limit,

.2 have its NO_x emissions measured on a test bed in accordance with the procedures specified in chapter 5 of this Code, and

.3 be pre-certified by the Administration, as documented by issuance of an EIAPP Certificate.

2.2.2 For the pre-certification of serially manufactured engines, depending on the approval of the Administration, the engine family or the engine group concept may be applied (see chapter 4). In such a case, the testing specified in 2.2.1.2 is required only for the parent engine(s) of an engine family or engine group.

2.2.3 The method of obtaining pre-certification for an engine is for the Administration to:

.1 certify a test of the engine on a test bed;

.2 verify that all engines tested, including, if applicable, those to be delivered within an engine family or engine group, meet the applicable NO_x limit; and

.3 if applicable, verify that the selected parent engine(s) is representative of an engine family or engine group.

2.2.4 There are engines that, due to their size, construction and delivery schedule, cannot be pre-certified on a test bed. In such cases, the engine manufacturer, shipowner or shipbuilder shall make application to the Administration requesting an onboard test (see 2.1.2.2). The applicant must demonstrate to the Administration that the onboard test fully meets all of the requirements of a test-bed procedure as specified in chapter 5 of this Code. Such a survey may be accepted for an individual engine or for an engine group represented by the parent engine only, but it shall not be accepted for an engine family certification. In no case shall an allowance be granted for possible deviations of measurements if an initial survey is carried out on board a ship without any valid pre-certification test. For engines undergoing an onboard certification test, in order to be issued with an EIAPP Certificate, the same procedures apply as if the engine had been pre-certified on a test bed.

2.2.5 NO_x reducing devices

.1 Where an NO_x-reducing device is to be included within the EIAPP certification, it must be recognized as a component of the engine and its presence shall be recorded in the engine's technical file. The engine shall be tested, at the pre-certification test, with the NO_x-reducing device fitted.

.2 In those cases where an NO_x-reducing device has been fitted due to failure to meet the required emission value at the pre-certification test, in order to receive an EIAPP Certificate for this assembly, the engine, including the reducing device, as installed, must be re-tested to show compliance with the applicable NO_x emission limit. However, in this case, the assembly may be re-tested in accordance with the simplified measurement method in accordance with 6.3. In no case shall the allowances given in 6.3.11 be granted.

.3 Where, in accordance with 2.2.5.2, the effectiveness of the NO_x reducing device is verified by use of the simplified measurement method, that test report shall be added as an adjunct to the pre-certification test report that demonstrated the failure of the engine alone to meet the required emission value. Both test reports shall be submitted to the Administration, and test report data, as detailed in 2.4.1.5, covering both tests shall be included in the engine's technical file.

.4 The simplified measurement method used as part of the process to demonstrate compliance in accordance with 2.2.5.2 may only be accepted in respect of the engine and NO_x-reducing device on which its effectiveness was demonstrated, and it shall not be accepted for engine family or engine group certification.

.5 In both cases as given in 2.2.5.1 and 2.2.5.2, the NO_x-reducing device shall be included on the EIAPP Certificate together with the emission value obtained with the device in operation and all other records as required by the Administration. The engine's technical file shall also contain onboard NO_x verification procedures for the device to ensure it is operating correctly.

.6 Notwithstanding 2.2.5.3 and 2.2.5.4, an NO_x-reducing device may be approved by the Administration taking into account guidelines to be developed by the Organization.

2.2.6 Where, due to changes of component design, it is necessary to establish a new engine family or engine group but there is no available parent engine, the engine builder may apply to the Administration to use the previously obtained parent engine test data modified at each specific mode of the applicable test cycle so as to allow for the resulting changes in NO_x emission values. In such cases, the engine used to determine the modification emission data shall correspond in accordance with the requirements of 4.4.6.1, 4.4.6.2 and 4.4.6.3 to the previously used parent engine. Where more than one component is to be changed the combined effect resulting from those changes is to be demonstrated by a single set of test results.

2.2.7 For pre-certification of engines within an engine family or engine group, an EIAPP Certificate shall be issued in accordance with procedures established by the Administration to the parent engine(s) and to every member engine produced under this certification to accompany the engines throughout their life whilst installed on ships under the authority of that Administration.

2.2.8 *Issue of certification by the Administration of the country in which the engine is built*

.1 When an engine is manufactured outside the country of the Administration of the ship on which it will be installed, the Administration of the ship may request the Administration of the country in which the engine is manufactured to survey the engine. Upon satisfaction that the applicable requirements of regulation 13 are complied with pursuant to this Code, the Administration of the country in which the engine is manufactured shall issue or authorize the issuance of the EIAPP Certificate.

.2 A copy of the certificate(s) and a copy of the survey report shall be transmitted as soon as possible to the requesting Administration.

.3 A certificate so issued shall contain a statement to the effect that it has been issued at the request of the Administration.

2.2.9 Guidance in respect of the pre-certification survey and certification of marine diesel engines, as described in chapter 2 of this Code, is given in the relevant flowchart in appendix II of this Code. Where discrepancies exist, the text of chapter 2 takes precedence.

2.2.10 A model form of an EIAPP Certificate is attached as appendix I to this Code.

2.3 Procedures for certification of an engine

2.3.1 For those engines that have not been adjusted or modified relative to the original specification of the manufacturer, the provision of a valid EIAPP Certificate should suffice to demonstrate compliance with the applicable NO_x limits.

2.3.2 After installation on board, it shall be determined to what extent an engine has been subjected to further adjustments and/or modifications that could affect the NO_x emission. Therefore, the engine, after installation on board, but prior to issuance of the IAPP Certificate, shall be inspected for modifications and be approved using the onboard NO_x verification procedures and one of the methods described in 2.1.2.

2.3.3 There are engines that, after pre-certification, need final adjustment or modification for performance. In such a case, the engine group concept could be used to ensure that the engine still complies with the applicable limit.

2.3.4 Every marine diesel engine installed on board a ship shall be provided with a technical file. The technical file shall be prepared by the applicant for engine certification and approved by the Administration, and is required to accompany an engine throughout its life on board ships. The technical file shall contain the information as specified in 2.4.1.

2.3.5 Where an NO_x-reducing device is installed and needed to comply with the NO_x limits, one of the options providing a ready means for verifying compliance with regulation 13 is the direct measurement and monitoring method in accordance with 6.4. However, depending on the technical possibilities of the device used, subject to the approval of the Administration, other relevant parameters could be monitored.

2.3.6 Where, for the purpose of achieving NO_x compliance, an additional substance is introduced, such as ammonia, urea, steam, water, fuel additives, etc., a means of monitoring the consumption of such substance shall be provided. The technical file shall provide sufficient information to allow a ready means of demonstrating that the consumption of such additional substances is consistent with achieving compliance with the applicable NO_x limit.

2.3.7 Where the engine parameter check method in accordance with 6.2 is used to verify compliance, if any adjustments or modifications are made to an engine after its pre-certification, a full record of such adjustments or modifications shall be recorded in the engine's record book of engine parameters.

2.3.8 If all of the engines installed on board are verified to remain within the parameters, components, and adjustable features recorded in the technical file, the engines should be accepted as performing within the applicable NO_x limit specified in regulation 13. In this case, provided all other applicable requirements of the Annex are complied with, an IAPP Certificate should then be issued to the ship.

2.3.9 If any adjustment or modification is made which is outside the approved limits documented in the technical file, the IAPP Certificate may be issued only if the overall NO_x emission performance is verified to be within the required limits by: onboard simplified measurement in accordance with 6.3; or, reference to the test-bed testing for the relevant engine group approval showing that the adjustments or modifications do not exceed the applicable NO_x emission limit. At surveys after the initial engine survey, the direct measurement and monitoring method in accordance with 6.4, as approved by the Administration, may alternatively be used.

2.3.10 The Administration may, at its own discretion, abbreviate or reduce all parts of the survey on board, in accordance with this Code, to an engine that has been issued an EIAPP Certificate. However, the entire survey on board must be completed for at least one cylinder and/or one engine in an engine family or engine group, if applicable, and the abbreviation may be made only if all the other cylinders and/or engines are expected to perform in the same manner as the surveyed engine and/or cylinder. As an alternative to the examination of fitted components, the Administration may conduct that part of the survey on spare parts carried on board provided they are representative of the components fitted.

2.3.11 Guidance in respect of the survey and certification of marine diesel engines at initial, renewal, annual and intermediate surveys, as described in chapter 2 of this Code, is given in the flowcharts in appendix II of this Code. Where discrepancies exist, the text of chapter 2 takes precedence.

2.4 Technical file and onboard NO_x verification procedures

2.4.1 To enable an Administration to perform the engine surveys described in 2.1, the technical file required by 2.3.4 shall, at a minimum, contain the following information:

.1 identification of those components, settings and operating values of the engine that influences its NO_x emissions including any NO_x-reducing device or system;

.2 identification of the full range of allowable adjustments or alternatives for the components of the engine;

.3 full record of the relevant engine's performance, including the engine's rated speed and rated power;

.4 a system of onboard NO_x verification procedures to verify compliance with the NO_x emission limits during onboard verification surveys in accordance with chapter 6;

.5 a copy of the relevant parent engine test data, as given in section 2 of appendix V of this Code;

.6 if applicable, the designation and restrictions for an engine that is an engine within an engine family or engine group;

.7 specifications of those spare parts/components that, when used in the engine, according to those specifications, will result in continued compliance of the engine with the applicable NO_x emission limit; and

.8 the EIAPP Certificate, as applicable.

2.4.2 As a general principle, onboard NO_x verification procedures shall enable a surveyor to easily determine if an engine has remained in compliance with the applicable requirements of regulation 13. At the same time, it shall not be so burdensome as to unduly delay the ship or to require in-depth knowledge of the characteristics of a particular engine or specialist measuring devices not available on board.

2.4.3 The onboard NO_x verification procedure shall be one of the following methods:

.1 engine parameter check method in accordance with 6.2 to verify that an engine's component, setting and operating values have not deviated from the specifications in the engine's technical file;

.2 simplified measurement method in accordance with 6.3; or

.3 direct measurement and monitoring method in accordance with 6.4.

2.4.4 When considering which onboard NO_x verification procedures should be included in an engine's technical file to verify whether an engine complies with the applicable NO_x emission limit during the required onboard verification surveys, other than at an engine's initial onboard survey, any of the three onboard NO_x verification procedures as specified in 6.1 may be applied. However, the procedures associated with the method applied are to be approved by the Administration. If the method differs from the verification procedure method specified in the technical file as originally approved, the procedure of the method needs to be either added as an amendment to the technical file or appended as an alternative to the procedure given in the technical file. Thereafter the shipowner may choose which of the methods approved in the technical file is to be used to demonstrate compliance.

2.4.5 In addition to the method specified by the engine manufacturer and given in the technical file, as approved by the Administration for the initial certification in the engine, the shipowner shall have the option of direct measurement of NO_x emissions in accordance with 6.4. Such data may take the form of spot checks logged with other engine operating data on a regular basis and over the full range of engine operation or may result from continuous monitoring and data storage. Data must be current (taken within the last 30 days) and must have been acquired using the test procedures cited in this Code. These monitoring records shall be kept on board for three months for verification purposes by a Party in accordance with regulation 10. Data shall also be corrected for ambient conditions and fuel specification, and measuring equipment must be checked for correct calibration and operation, in accordance with the approved procedures given in the onboard operating manual. Where exhaust gas after-treatment devices are fitted that influence the NO_x emissions, the measuring point(s) must be located downstream of such devices.

Chapter 3

Nitrogen oxides emission standards

3.1 Maximum allowable NO_x emission limits for marine diesel engines

3.1.1 The maximum allowable NO_x emission limit values are given by paragraphs 3, 4, 5.1.1 and 7.4 of regulation 13 as applicable. The total weighted NO_x emissions, as measured and calculated, rounded to one decimal place, in accordance with the procedures in this Code, shall be equal to or less than the applicable calculated value corresponding to the rated speed of the engine.

3.1.2 When the engine operates on test fuel oils in accordance with 5.3, the total emission of nitrogen oxides (calculated as the total weighted emission of NO_2) shall be determined using the relevant test cycles and measurement methods as specified in this Code.

3.1.3 An engine's exhaust emissions limit value, given from the formulae included in paragraph 3, 4 or 5.1.1 of regulation 13 as applicable, and the actual calculated exhaust emissions value, rounded to one decimal place for the engine, shall be stated on the engine's EIAPP Certificate. If an engine is a member engine of an engine family or engine group, it is the relevant parent engine emission value that is compared to the applicable limit value for that engine family or engine group. The limit value given here shall be the limit value for the engine family or engine group based on the highest engine speed to be included in that engine family or engine group, in accordance with paragraph 3, 4 or 5.1.1 of regulation 13, irrespective of the rated speed of the parent engine or the rated speed of the particular engine as given on the engine's EIAPP certificate.

3.1.4 In the case of an engine to be certified in accordance with paragraph 5.1.1 of regulation 13 the specific emission at each individual mode point shall not exceed the applicable NO_x emission limit value by more than 50% except as follows:

.1 The 10% mode point in the D2 test cycle specified in 3.2.5.

.2 The 10% mode point in the C1 test cycle specified in 3.2.6.

.3 The idle mode point in the C1 test cycle specified in 3.2.6.

3.2 Test cycles and weighting factors to be applied

3.2.1 For every individual engine or parent engine of an engine family or engine group, one or more of the relevant test cycles specified in 3.2.2 to 3.2.6 shall be applied for verification of compliance with the applicable NO_x emission limit contained in regulation 13.

3.2.2 For constant-speed marine diesel engines for ship main propulsion, including diesel electric drive, test cycle E2 shall be applied in accordance with table 1.

3.2.3 For an engine connected to a controllable pitch propeller, irrespective of combinator curve, test cycle E2 shall be applied in accordance with table 1.

Table 1

Test cycle for "Constant-speed main propulsion" application
(including diesel-electric drive and all controllable-pitch propeller installations)

Test cycle type E2	Speed	100%	100%	100%	100%*
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

3.2.4 For propeller-law-operated main and propeller-law-operated auxiliary engines, test cycle E3 shall be applied in accordance with table 2.

Table 2

Test cycle for
"Propeller-law-operated main and propeller-law-operated auxiliary engine" application

Test cycle type E3	Speed	100%	91%	80%	63%
	Power	100%	75%	50%	25%
	Weighting factor	0.2	0.5	0.15	0.15

3.2.5 For constant-speed auxiliary engines, test cycle D2 shall be applied in accordance with table 3.

Table 3

Test cycle for "Constant-speed auxiliary engine" application

Test cycle type D2	Speed	100%	100%	100%	100%	100%
	Power	100%	75%	50%	25%	10%
	Weighting factor	0.05	0.25	0.3	0.3	0.1

3.2.6 For variable-speed, variable-load auxiliary engines, not included above, test cycle C1 shall be applied in accordance with table 4.

Table 4

Test cycle for "Variable-speed, variable-load auxiliary engine" application

Test cycle type C1	Speed	Rated				Intermediate			Idle
	Torque	100%	75%	50%	10%	100%	75%	50%	0%
	Weighting factor	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15

* There are exceptional cases, including large bore engines intended for E2 applications, in which, due to their oscillating masses and construction, engines cannot be run at low load at nominal speed without the risk of damaging essential components. In such cases, the engine manufacturer shall make application to the Administration that the test cycle as given in table 1 above may be modified for the 25% power mode with regard to the engine speed. The adjusted engine speed at 25% power, however, shall be as close as possible to the rated engine speed, as recommended by the engine manufacturer and approved by the Administration. The applicable weighting factors for the test cycle shall remain unchanged.

3.2.7 The torque figures given in test cycle C1 are percentage values that represent for a given test mode the ratio of the required torque to the maximum possible torque at this given speed.

3.2.8 The intermediate speed for test cycle C1 shall be declared by the manufacturer, taking into account the following requirements:

.1 For engines that are designed to operate over a speed range on a full load torque curve, the intermediate speed shall be the declared maximum torque speed if it occurs between 60% and 75% of rated speed.

.2 If the declared maximum torque speed is less than 60% of rated speed, then the intermediate speed shall be 60% of the rated speed.

.3 If the declared maximum torque speed is greater than 75% of the rated speed, then the intermediate speed shall be 75% of rated speed.

.4 For engines that are not designed to operate over a speed range on the full load torque curve at steady state conditions, the intermediate speed will typically be between 60% and 70% of the maximum rated speed.

3.2.9 If an engine manufacturer applies for a new test cycle application on an engine already certified under a different test cycle specified in 3.2.2 to 3.2.6, then it may not be necessary for that engine to undergo the full certification process for the new application. In this case, the engine manufacturer may demonstrate compliance by recalculation, by applying the measurement results from the specific modes of the first certification test to the calculation of the total weighted emissions for the new test cycle application, using the corresponding weighting factors from the new test cycle.

Chapter 4

Approval for serially manufactured engines: engine family and engine group concepts

4.1 General

4.1.1 To avoid certification testing of every engine for compliance with the NO_x emission limits, one of two approval concepts may be adopted, namely the engine family or the engine group concept.

4.1.2 The engine family concept may be applied to any series-produced engines that, through their design, are proven to have similar NO_x emission characteristics, are used as produced and, during installation on board, require no adjustments or modifications that could adversely affect the NO_x emissions.

4.1.3 The engine group concept may be applied to a smaller series of engines produced for similar engine application and that require minor adjustments and modifications during installation or in service on board.

4.1.4 Initially the engine manufacturer may, at its discretion, determine whether engines should be covered by the engine family or engine group concept. In general, the type of application shall be based on whether the engines will be modified, and to what extent, after testing on a test bed.

4.2 Documentation

4.2.1 All documentation for certification must be completed and suitably stamped by the duly authorized Authority as appropriate. This documentation shall also include all terms and conditions, including replacement of spare parts, to ensure that an engine is maintained in compliance with the applicable NO_x emission limit.

4.2.2 For an engine within an engine family or engine group, the required documentation for the engine parameter check method is specified in 6.2.2.

4.3 Application of the engine family concept

4.3.1 The engine family concept provides the possibility of reducing the number of engines that must be submitted for approval testing, while providing safeguards that all engines within the engine family comply with the approval requirements. In the engine family concept, engines with similar emission characteristics and design are represented by a parent engine.

4.3.2 Engines that are series-produced and not intended to be modified may be covered by the engine family concept.

4.3.3 The selection procedure for the parent engine is such that the selected engine incorporates those features that will most adversely affect the NO_x emission level. This engine, in general, shall have the highest NO_x emission level among all of the engines in the engine family.

4.3.4 On the basis of tests and engineering judgement, the manufacturer shall propose which engines belong to an engine family, which engine(s) produce the highest NO_x emissions, and which engine(s) should be selected for certification testing.

4.3.5 The Administration shall review for certification approval the selection of the parent engine within the engine family and shall have the option of selecting a different engine, either for approval or production conformity testing, in order to have confidence that all engines within the engine family comply with the applicable NO_x emission limit.

4.3.6 The engine family concept does allow minor adjustments to the engines through adjustable features. Marine diesel engines equipped with adjustable features must comply with all requirements for any adjustment within the physically available range. A feature is not considered adjustable if it is permanently sealed or otherwise not normally accessible. The Administration may require that adjustable features be set to any specification within its adjustable range for certification or in-use testing to determine compliance with the requirements.

4.3.7 Before granting an engine family approval, the Administration shall take the necessary measures to verify that adequate arrangements have been made to ensure effective control of the conformity of production. This may include, but is not limited to:

.1 the connection between the NO_x critical component part or identification numbers as proposed for the engine family and the drawing numbers (and revision status if applicable) defining those components;

.2 the means by which the Administration will be able, at the time of a survey, to verify that the drawings used for the production of the NO_x critical components correspond to the drawings established as defining the engine family;

.3 drawing revision control arrangements. Where it is proposed by a manufacturer that revisions to the NO_x critical component drawings defining an engine family may be undertaken through the life of an engine, then the conformity of production scheme would need to demonstrate the procedures to be adopted to cover the cases where revisions will, or will not, affect NO_x emissions. These procedures shall cover drawing number allocation, effect on the identification markings on the NO_x critical components and the provision for providing the revised drawings to the Administration responsible for the original engine family approval. Where these revisions may affect the NO_x emissions the means to be adopted to assess or verify performance against the parent engine performance are to be stated together with the subsequent actions to be taken regarding advising the Administration and, where necessary, the declaration of a new parent engine prior to the introduction of those modifications into service;

.4 the implemented procedures that ensure any NO_x critical component spare parts supplied to a certified engine will be identified as given in the approved technical file and hence will be produced in accordance with the drawings as defining the engine family; or

.5 equivalent arrangements as approved by the Administration.

4.3.8 *Guidance for the selection of an engine family*

4.3.8.1 The engine family shall be defined by basic characteristics that must be common to all engines within the engine family. In some cases there may be interaction of parameters; these effects must also be taken into consideration to ensure that only engines with similar exhaust emission characteristics are included within an engine family, e.g., the number of cylinders may become a relevant parameter on some engines due to the charge air or fuel system used, but with other designs, exhaust emissions characteristics may be independent of the number of cylinders or configuration.

4.3.8.2 The engine manufacturer is responsible for selecting those engines from their different models of engines that are to be included in an engine family. The following basic characteristics, but not specifications, shall be common among all engines within an engine family:

.1 combustion cycle:
- 2-stroke cycle
- 4-stroke cycle

.2 cooling medium:
- air
- water
- oil

.3 individual cylinder displacement:
- to be within a total spread of 15%

.4 number of cylinders and cylinder configuration:
- applicable in certain cases only, e.g., in combination with exhaust gas cleaning devices

.5 method of air aspiration:
- naturally aspirated
- pressure charged

.6 fuel type:
- distillate/residual fuel oil
- dual fuel

.7 combustion chamber
- open chamber
- divided chamber

.8 valve and porting, configuration, size and number:
- cylinder head
- cylinder wall

.9 fuel system type:
- pump-line-injector
- in-line
- distributor
- single element
- unit injector
- gas valve

.10 miscellaneous features:
- exhaust gas re-circulation
- water/emulsion injection
- air injection
- charge cooling system
- exhaust after-treatment
- reduction catalyst
- oxidation catalyst
- thermal reactor
- particulates trap.

4.3.8.3 If there are engines that incorporate other features that could be considered to affect NO_x exhaust emissions, these features must be identified and taken into account in the selection of the engines to be included in the engine family.

4.3.9 *Guidance for selecting the parent engine of an engine family*

4.3.9.1 The method of selection of the parent engine for NO_x measurement shall be agreed to and approved by the Administration. The method shall be based upon selecting an engine that incorporates engine features and characteristics that, from experience, are known to produce the highest NO_x emissions expressed in grams per kilowatt hour (g/kWh). This requires detailed knowledge of the engines within the engine family. Under certain circumstances, the Administration may conclude that the worst case NO_x emission rate of the engine family can best be characterized by testing a second engine. Thus, the Administration may select an additional engine for test based upon features that indicate that it may have the highest NO_x emission levels of the engines within that engine family. If the range of engines within the engine family incorporate other variable features that could be considered to affect NO_x emissions, these features must also be identified and taken into account in the selection of the parent engine.

4.3.9.2 The parent engine shall have the highest emission value for the applicable test cycle.

4.3.10 *Certification of an engine family*

4.3.10.1 The certification shall include a list, to be prepared and maintained by the engine manufacturer and approved by the Administration, of all engines and their specifications accepted under the same engine family, the limits of their operating conditions and the details and limits of engine adjustments that may be permitted.

4.3.10.2 A pre-certificate, or EIAPP Certificate, shall be issued for a member engine of an engine family in accordance with this Code that certifies that the parent engine meets the applicable NO_x limit specified in regulation 13. Where member engine pre-certification requires the measurement of some performance values, the calibration of the equipment used for those measurements shall be in accordance with the requirements of 1.3 of appendix IV of this Code.

4.3.10.3 When the parent engine of an engine family is tested and gaseous emissions measured under the most adverse conditions specified within this Code and confirmed as complying with the applicable maximum allowable emission limits as given in 3.1, the results of the test and NO_x measurement shall be recorded in the EIAPP Certificate issued for the particular parent engine and for all member engines of the engine family.

4.3.10.4 If two or more Administrations agree to accept each other's EIAPP Certificates, then an entire engine family, certified by one of these Administrations, shall be accepted by the other Administrations which entered into that agreement with the original certifying Administration, unless the agreement specifies otherwise. Certificates issued under such agreements shall be acceptable as prima facie evidence that all engines included in the certification of the engine family comply with the specific NO_x emission requirements. There is no need for further evidence of compliance with regulation 13 if it is verified that the installed engine has not been modified and the engine adjustment is within the range permitted in the engine family certification.

4.3.10.5 If the parent engine of an engine family is to be certified in accordance with an alternative standard or a different test cycle than allowed by this Code, the manufacturer must prove to the Administration that the weighted average NO_x emissions for the appropriate test cycles fall within the relevant limit values under regulation 13 and this Code before the Administration may issue an EIAPP Certificate.

4.4 Application of the engine group concept

4.4.1 Engine group engines normally require adjustment or modification to suit the onboard operating conditions, but these adjustments or modifications shall not result in NO_x emissions exceeding the applicable limits in regulation 13.

4.4.2 The engine group concept also provides the possibility for a reduction in approval testing for modifications to engines in production or in service.

4.4.3 In general, the engine group concept may be applied to any engine type having the same design features as specified in 4.4.6, but individual engine adjustment or modification after test-bed measurement is allowed. The range of engines in an engine group and choice of parent engine shall be agreed to and approved by the Administration.

4.4.4 The application for the engine group concept, if requested by the engine manufacturer or another party, shall be considered for certification approval by the Administration. If the engine owner, with or without technical support from the engine manufacturer, decides to perform modifications on a number of similar engines in the owner's fleet, the owner may apply for an engine group certification. The engine group may be based on a parent engine that is a test engine on the test bench. Typical applications are similar modifications of similar engines in similar operational conditions. If a party other than the engine manufacturer applies for engine certification, the applicant for the engine certification takes on the responsibilities of the engine manufacturer as elsewhere given within this Code.

4.4.5 Before granting an initial engine group approval for serially produced engines, the Administration shall take the necessary measures to verify that adequate arrangements have been made to ensure effective control of the conformity of production. The requirements of 4.3.7 apply *mutatis mutandis* to this section. This requirement may not be necessary for engine groups established for the purpose of engine modification on board after an EIAPP Certificate has been issued.

4.4.6 *Guidance for the selection of an engine group*

4.4.6.1 The engine group may be defined by basic characteristics and specifications in addition to the parameters defined in 4.3.8 for an engine family.

4.4.6.2 The following parameters and specifications shall be common to engines within an engine group:

.1 bore and stroke dimensions;

.2 method and design features of pressure charging and exhaust gas system:
- constant pressure;
- pulsating system;

.3 method of charge air cooling system:
- with/without charge air cooler;

.4 design features of the combustion chamber that effect NO_x emission;

.5 design features of the fuel injection system, plunger and injection cam that may profile basic characteristics that effect NO_x emission; and

.6 rated power at rated speed. The permitted ranges of engine power (kW/cylinder) and/or rated speed are to be declared by the manufacturer and approved by the Administration.

4.4.6.3 Generally, if the criteria required by 4.4.6.2 are not common to all engines within a prospective engine group, then those engines may not be considered as an engine group. However, an engine group may be accepted if only one of those criteria is not common for all of the engines within a prospective engine group.

4.4.7 *Guidance for allowable adjustment or modification within an engine group*

4.4.7.1 Minor adjustments and modifications in accordance with the engine group concept are allowed after pre-certification or final test-bed measurement within an engine group upon agreement of the parties concerned and approval of the Administration, if:

.1 an inspection of emission-relevant engine parameters and/or provisions of the onboard NO_x verification procedures of the engine and/or data provided by the engine manufacturer confirm that the adjusted or modified engine complies with the applicable NO_x emission limit. The engine test-bed results in respect of NO_x emissions may be accepted as an option for verifying onboard adjustments or modifications to an engine within an engine group; or

.2 onboard measurement confirms that the adjusted or modified engine complies with the applicable NO_x emission limit.

4.4.7.2 Examples of adjustments and modifications within an engine group that may be permitted, but are not limited to those described below:

.1 For onboard conditions, adjustment of:
- injection timing for compensation of fuel property differences,
- injection timing for maximum cylinder pressure,
- fuel delivery differences between cylinders.

.2 For performance, modification of:
- turbocharger,
- injection pump components,
- plunger specification,
- delivery valve specification,
- injection nozzles,
- cam profiles,
- intake and/or exhaust valve,
- injection cam,
- combustion chamber.

4.4.7.3 The above examples of modifications after a test-bed trial concern essential improvements of components or engine performance during the life of an engine. This is one of the main reasons for the existence of the engine group concept. The Administration, upon application, may accept the results from a demonstration test carried out on one engine, possibly a test engine, indicating the effects of the modifications on NO_x emissions that may be accepted for all engines within that engine group without requiring certification measurements on each member engine of the engine group.

4.4.8 *Guidance for the selection of the parent engine of an engine group*

4.4.8.1 The selection of the parent engine shall be in accordance with the criteria in 4.3.9, as applicable. It is not always possible to select a parent engine from small-volume production engines in the same way as the mass-produced engines (engine family). The first engine ordered may be registered as the parent engine. Furthermore at the pre-certification test where a parent engine is not adjusted to the engine-builder-defined reference or maximum tolerance operating conditions (which may include, but not limited to, maximum combustion pressure, compression pressure, exhaust back pressure, charge air temperature) for the engine group, the measured NO_x emission values shall be corrected to the defined reference and maximum tolerance conditions on the basis of emission sensitivity tests on other representative engines. The resulting corrected average weighted NO_x emission value under reference conditions is to be stated in 1.9.6 of the Supplement to the EIAPP Certificate. In no case is the effect of the reference condition tolerances to result in an emission value that would exceed the applicable NO_x emission limit as required by regulation 13. The method used to select the parent engine to represent the engine group, the reference values and the applied tolerances shall be agreed to and approved by the Administration.

4.4.9 *Certification of an engine group*

4.4.9.1 The requirements of 4.3.10 apply *mutatis mutandis* to this section.

Chapter 5

Procedures for NO_x emission measurements on a test bed

5.1 General

5.1.1 This procedure shall be applied to every initial approval testing of a marine diesel engine regardless of the location of that testing (the methods described in 2.1.2.1 and 2.1.2.2).

5.1.2 This chapter specifies the measurement and calculation methods for gaseous exhaust emissions from reciprocating internal-combustion engines under steady-state conditions, necessary for determining the average weighted value for the NO_x exhaust gas emission.

5.1.3 Many of the procedures described below are detailed accounts of laboratory methods, since determining an emissions value requires performing a complex set of individual measurements, rather than obtaining a single measured value. Thus, the results obtained depend as much on the process of performing the measurements as they depend on the engine and test method.

5.1.4 This chapter includes the test and measurement methods, test run and test report as a procedure for a test-bed measurement.

5.1.5 In principle, during emission tests, an engine shall be equipped with its auxiliaries in the same manner as it would be used on board.

5.1.6 For many engine types within the scope of this Code, the auxiliaries which may be fitted to the engine in service may not be known at the time of manufacture or certification. It is for this reason that the emissions are expressed on the basis of brake power as defined in 1.3.13.

5.1.7 When it is not appropriate to test the engine under the conditions as defined in 5.2.3, e.g., if the engine and transmission form a single integral unit, the engine may only be tested with other auxiliaries fitted. In this case the dynamometer settings shall be determined in accordance with 5.2.3 and 5.9. The auxiliary losses shall not exceed 5% of the maximum observed power. Losses exceeding 5% shall be approved by the Administration involved prior to the test.

5.1.8 All volumes and volumetric flow rates shall be related to 273 K (0°C) and 101.3 kPa.

5.1.9 Except as otherwise specified, all results of measurements, test data or calculations required by this chapter shall be recorded in the engine's test report in accordance with 5.10.

5.1.10 References in this Code to the term "charge air" apply equally to scavenge air.

5.2 Test conditions

5.2.1 *Test condition parameter and test validity for engine family approval*

5.2.1.1 The absolute temperature T_a of the engine intake air expressed in Kelvin shall be measured, and the dry atmospheric pressure p_s, expressed in kPa, shall be measured or calculated as follows:

$$p_s = p_b - 0.01 \cdot R_a \cdot p_a$$

p_a according to formula (10)

5.2.1.2 For naturally aspirated and mechanically pressure charged engines the parameter f_a shall be determined according to the following:

$$f_a = \left(\frac{99}{p_s}\right) \cdot \left(\frac{T_a}{298}\right)^{0.7} \qquad (1)$$

5.2.1.3 For turbocharged engines with or without cooling of the intake air the parameter f_a shall be determined according to the following:

$$f_a = \left(\frac{99}{p_s}\right)^{0.7} \cdot \left(\frac{T_a}{298}\right)^{1.5} \qquad (2)$$

5.2.1.4 For a test to be recognized as valid for engine family approval, the parameter f_a shall be such that:

$$0.93 \leq f_a \leq 1.07 \qquad (3)$$

5.2.2 *Engines with charge air cooling*

5.2.2.1 The temperature of the cooling medium and the charge air temperature shall be recorded.

5.2.2.2 All engines when equipped as intended for installation on board ships must be capable of operating within the applicable NO_x emission limit of regulation 13 at an ambient seawater temperature of 25°C. This reference temperature shall be considered in accordance with the charge air cooling arrangement applicable to the individual installation as follows:

.1 Direct seawater cooling to engine charge air coolers. Compliance with the applicable NO_x limit shall be demonstrated with a charge air cooler coolant inlet temperature of 25°C.

.2 Intermediate freshwater cooling to engine charge air coolers. Compliance with the applicable NO_x limit shall be demonstrated with the charge air cooling system operating with the designed in service coolant inlet temperature regime corresponding to an ambient seawater temperature of 25°C.

Note: Demonstration of compliance at a parent engine test for a direct seawater cooled system, as given by (.1) above, does not demonstrate compliance in accordance with the higher charge air temperature regime inherent with an intermediate freshwater cooling arrangement as required by this section.

.3 For those installations incorporating no seawater cooling, either direct or indirect, to the charge air coolers, e.g., radiator-cooled freshwater systems, air/air charge air coolers, compliance with the applicable NO_x limit shall be demonstrated with the engine and charge air cooling systems operating as specified by the manufacturer with 25°C air temperature.

5.2.2.3 Compliance with the applicable NO_x emission limit as defined by regulation 13 shall be demonstrated either by testing or by calculation using the charge air reference temperatures (T_{SCRef}) specified and justified by the manufacturer, if applicable.

5.2.3 *Power*

5.2.3.1 The basis of specific emissions measurement is uncorrected brake power as defined in 1.3.11 and 1.3.13. The engine shall be submitted with auxiliaries needed for operating the engine (e.g., fan, water pump, etc.). If it is impossible or inappropriate to install the auxiliaries on the test bench, the power absorbed by them shall be determined and subtracted from the measured engine power.

5.2.3.2 Auxiliaries not necessary for the operation of the engine and that may be mounted on the engine may be removed for the test. See also 5.1.5 and 5.1.6.

5.2.3.3 Where auxiliaries have not been removed, the power absorbed by them at the test speeds shall be determined in order to calculate the dynamometer settings, except for engines where such auxiliaries form an integral part of the engine (e.g., cooling fans for air cooled engines).

5.2.4 *Engine air inlet system*

5.2.4.1 An engine air intake system or a test shop system shall be used presenting an air intake restriction within ± 300 Pa of the maximum value specified by the manufacturer for a clean air cleaner at the speed of rated power and full-load.

5.2.4.2 If the engine is equipped with an integral air inlet system, it shall be used for testing.

5.2.5 *Engine exhaust system*

5.2.5.1 An engine exhaust system or a test shop system shall be used that presents an exhaust backpressure within ± 650 Pa of the maximum value specified by the manufacturer at the speed of rated power and full load. The exhaust system shall conform to the requirements for exhaust gas sampling, as set out in 5.9.3.

5.2.5.2 If the engine is equipped with an integral exhaust system, it shall be used for testing.

5.2.5.3 If the engine is equipped with an exhaust after-treatment device, the exhaust pipe shall have the same diameter as found in-use for at least 4 pipe diameters upstream to the inlet of the beginning of the expansion section containing the after-treatment device. The distance from the exhaust manifold flange or turbocharger outlet to the exhaust after-treatment device shall be the same as in the onboard configuration or within the distance specifications of the manufacturer. The exhaust backpressure or restriction shall follow the same criteria as above, and may be set with a valve.

5.2.5.4 Where test-bed installation prevents adjustment to the exhaust gas backpressure as required, the effect on the NO_x emissions shall be demonstrated by the engine builder and, with the approval of the Administration, the emission value duly corrected as necessary.

5.2.6 *Cooling system*

5.2.6.1 An engine cooling system with sufficient capacity to maintain the engine at normal operating temperatures prescribed by the manufacturer shall be used.

5.3 Test fuel oils

5.3.1 Fuel oil characteristics may influence the engine exhaust gas emission; in particular, some fuel-bound nitrogen can be converted to NO_x during combustion. Therefore, the characteristics of the fuel oil used for the test are to be determined and recorded. Where a reference fuel oil is used, the reference code or specifications and the analysis of the fuel oil shall be provided.

5.3.2 The selection of the fuel oil for the test depends on the purpose of the test. If a suitable reference fuel oil is not available, it is recommended to use a DM-grade (distillate) marine fuel specified in ISO 8217:2005, with properties suitable for the engine type. In case a DM-grade fuel oil is not available, a RM-grade (residual) fuel oil according to ISO 8217:2005 shall be used. The fuel oil shall be analysed for its composition of all components necessary for a clear specification and determination of DM- or RM-grade. The nitrogen content shall also be determined. The fuel oil used during the parent engine test shall be sampled during the test.

5.3.3 The fuel oil temperature shall be in accordance with the manufacturer's recommendations. The fuel oil temperature shall be measured at the inlet to the fuel injection pump, or as specified by the manufacturer, and the temperature and location of measurement recorded.

5.3.4 Dual fuel engines using liquid fuel as pilot fuel shall be tested using maximum liquid to gas fuel ratio. The liquid fraction of the fuel shall comply with 5.3.1, 5.3.2 and 5.3.3.

5.4 Measurement equipment and data to be measured

5.4.1 The emission of gaseous components by the engine submitted for testing shall be measured by the methods described in appendix III of this Code that describe the recommended analytical systems for the gaseous emissions.

5.4.2 Other systems or analysers may, subject to the approval of the Administration, be accepted if they yield equivalent results to that of the equipment referenced in 5.4.1. In establishing equivalency it shall be demonstrated that the proposed alternative systems or analysers would, as qualified by using recognized national or international standards, yield equivalent results when used to measure diesel engine exhaust emission concentrations in terms of the requirements referenced in 5.4.1.

5.4.3 For introduction of a new system the determination of equivalency shall be based upon the calculation of repeatability and reproducibility, as described in ISO 5725-1 and ISO 5725-2, or any other comparable recognized standard.

5.4.4 This Code does not contain details of flow, pressure, and temperature measuring equipment. Instead, only the accuracy requirements of such equipment necessary for conducting an emissions test are given in 1.3.1 of appendix IV of this Code.

5.4.5 *Dynamometer specification*

5.4.5.1 An engine dynamometer with adequate characteristics to perform the appropriate test cycle described in 3.2 shall be used.

5.4.5.2 The instrumentation for torque and speed measurement shall allow the measurement accuracy of the shaft power within the given limits. Additional calculations may be necessary.

5.4.5.3 The accuracy of the measuring equipment shall be such that the maximum permissible deviations given in 1.3.1 of appendix IV of this Code are not exceeded.

5.5 Determination of exhaust gas flow

5.5.1 The exhaust gas flow shall be determined by one of the methods specified in 5.5.2, 5.5.3 or 5.5.4.

5.5.2 *Direct measurement method*

5.5.2.1 This method involves the direct measurement of the exhaust flow by flow nozzle or equivalent metering system and shall be in accordance with a recognized international standard.

Note: Direct gaseous flow measurement is a difficult task. Precautions shall be taken to avoid measurement errors which will result in emission value errors.

5.5.3 *Air and fuel measurement method*

5.5.3.1 The method for determining exhaust emission flow using the air and fuel measurement method shall be conducted in accordance with a recognized international standard.

5.5.3.2 This involves measurement of the air flow and the fuel flow. Air flow-meters and fuel flow-meters with an accuracy defined in 1.3.1 of appendix IV of this Code shall be used.

5.5.3.3 The exhaust gas flow shall be calculated as follows:

$$q_{mew} = q_{maw} + q_{mf} \qquad (4)$$

5.5.3.4 The air flow-meter shall meet the accuracy specifications of appendix IV of this Code, the CO_2 analyser used shall meet the specifications of appendix III of this Code, and the total system shall meet the accuracy specifications for the exhaust gas flow as given in appendix IV of this Code.

5.5.4 *Fuel flow and carbon balance method*

5.5.4.1 This involves exhaust mass flow rate calculation from fuel consumption, fuel composition and exhaust gas concentrations using the carbon balance method, as specified in appendix VI of this Code.

5.6 Permissible deviations of instruments for engine-related parameters and other essential parameters

5.6.1 The calibration of all measuring instruments including both the measuring instruments as detailed under appendix IV of this Code and additional measuring instruments required in order to define an engine's NO_x emission performance, for example the measurement of peak cylinder or charge air pressures, shall be traceable to standards recognized by the Administration and shall comply with the requirements as set out in 1.3.1 of appendix IV of this Code.

5.7 Analysers for determination of the gaseous components

5.7.1 The analysers to determine the gaseous emissions shall meet the specifications as set out in appendix III of this Code.

5.8 Calibration of the analytical instruments

5.8.1 Each analyser used for the measurement of an engine's gaseous emissions shall be calibrated in accordance with the requirements of appendix IV of this Code.

5.9 Test run

5.9.1 *General*

5.9.1.1 Detailed descriptions of the recommended sampling and analysing systems are contained in 5.9.2 to 5.9.4 and appendix III of this Code. Since various configurations may produce equivalent results, exact conformance with these figures is not required. Additional components, such as instruments, valves, solenoids, pumps, and switches, may be used to provide additional information and coordinate the functions of the component systems. Other components which are not needed to maintain the accuracy on some systems may, with the agreement of the Administration, be excluded if their exclusion is based upon good engineering judgement.

5.9.1.2 The treatment of inlet restriction (naturally aspirated engines) or charge air pressure (turbo-charged engines) and exhaust back pressure shall be in accordance with 5.2.4 and 5.2.5 respectively.

5.9.1.3 In the case of a pressure charged engine, the inlet restriction conditions shall be taken as the condition with a clean air inlet filter and the pressure charging system working within the bounds as declared, or to be established, for the engine family or engine group to be represented by the parent engine test result.

5.9.2 *Main exhaust components: CO,* CO_2*, HC,* NO_x *and* O_2

5.9.2.1 An analytical system for the determination of the gaseous emissions in the raw exhaust gas shall be based on the use of analysers given in 5.4.

5.9.2.2 For the raw exhaust gas, the sample for all components may be taken with one sampling probe or with two sampling probes located in close proximity and internally split to the different analysers. Care must be taken that no condensation of exhaust components (including water and sulphuric acid) occurs at any point of the analytical system.

5.9.2.3 Specifications and calibration of these analysers shall be as set out in appendices III and IV of this Code, respectively.

5.9.3 *Sampling for gaseous emissions*

5.9.3.1 The sampling probes for the gaseous emissions shall be fitted at least 10 pipe diameters after the outlet of the engine, turbocharger, or last after-treatment device, whichever is furthest downstream, but also at least 0.5 m or 3 pipe diameters upstream of the exit of the exhaust gas system, whichever is greater. For a short exhaust system that does not have a location that meets both of these specifications, an alternative sample probe location shall be subject to approval by the Administration.

5.9.3.2 The exhaust gas temperature shall be at least 190°C at the HC sample probe, and at least 70°C at the sample probes for other measured gas species where they are separate from the HC sample probe.

5.9.3.3 In the case of a multi-cylinder engine with a branched exhaust manifold, the inlet of the probe shall be located sufficiently far downstream so as to ensure that the sample is representative of the average exhaust emissions from all cylinders. In the case of a multi-cylinder engine having distinct groups of manifolds, it is permissible to acquire a sample from each group individually and calculate an average exhaust emission. Alternatively, it would also be permissible to acquire a sample from a single group to represent the average exhaust emission provided that it can be justified to the Administration that the emissions from other groups are identical. Other methods, subject to the approval of the Administration, that have been shown to correlate with the above methods may be used. For exhaust emission calculation, the total exhaust mass flow shall be used.

5.9.3.4 The exhaust gas sampling system shall be leakage tested in accordance with section 4 of appendix IV of this Code.

5.9.3.5 If the composition of the exhaust gas is influenced by any exhaust after-treatment system, the exhaust gas sample shall be taken downstream of that device.

5.9.3.6 The inlet of the probe shall be located as to avoid ingestion of water that is injected into the exhaust system for the purpose of cooling, tuning or noise reduction.

5.9.4 *Checking of the analysers*

5.9.4.1 The emission analysers shall be set at zero and spanned in accordance with section 6 of appendix IV of this Code.

5.9.5 *Test cycles*

5.9.5.1 An engine shall be tested in accordance with the test cycles as defined in 3.2. This takes into account the variations in engine application.

5.9.6 *Test sequence*

5.9.6.1 After the procedures in 5.9.1 to 5.9.5 have been completed, the test sequence shall be started. The engine shall be operated in each mode, in any order, in accordance with the appropriate test cycles defined in 3.2.

5.9.6.2 During each mode of the test cycle after the initial transition period, the specified speed shall be held within ± 1% of the rated speed or ± 3 min^{-1}, whichever is greater, except for low idle, which shall be within the tolerances declared by the manufacturer. The specified torque shall be held so that the average over the period during which the measurements are being taken is within ± 2% of the rated torque at the engine's rated speed.

5.9.7 *Analyser response*

5.9.7.1 When stabilized, the output of the analysers shall be recorded both during the test and during all zero and span response checks, using a data acquisition system or a strip chart recorder. The recording period shall not be less than 10 minutes when analysing exhaust gas or not less than 3 minutes for each zero and span response check. For data acquisition systems, a minimum sampling frequency of 3 per minute shall be used. Measured concentrations of CO, HC and NO_x are to be recorded in terms of, or equivalent to, ppm to at least the nearest whole number. Measured concentrations of CO_2 and O_2 are to be recorded in terms of, or equivalent to, % to not fewer than two decimal places.

5.9.8 *Engine conditions*

5.9.8.1 The engine speed, load and other essential parameters shall be measured at each mode point only after the engine has been stabilized. The exhaust gas flow shall be measured or calculated and recorded.

5.9.9 *Re-checking the analysers*

5.9.9.1 After the emission test, the zero and span responses of the analysers shall be re-checked using a zero gas and the same span gas as used prior to the measurements. The test shall be considered acceptable if:

.1 the difference between the responses to the zero gas before and after the test is less than 2% of the initial span gas concentration; and

.2 the difference between the responses to the span gas before and after the test is less than 2% of the initial span gas concentration.

5.9.9.2 Zero- and span-drift correction shall not be applied to the analyser responses recorded in accordance with 5.9.7.

5.10 Test report

5.10.1 For every individual engine or parent engine tested to establish an engine family or engine group, the engine manufacturer shall prepare a test report that shall contain the necessary data to fully define the engine performance and enable calculation of the gaseous emissions including the data as set out in section 1 of appendix V of this Code. The original of the test report shall be maintained on file with the engine manufacturer and a certified true copy shall be maintained on file by the Administration.

5.11 Data evaluation for gaseous emissions

5.11.1 For the evaluation of the gaseous emissions, the data recorded for at least the last 60 seconds of each mode shall be averaged, and the concentrations of CO, CO_2, HC, NO_x and O_2 during each mode shall be determined from the averaged recorded data and the corresponding zero and span check data. The averaged results shall be given in terms of % to not fewer than two decimal places for CO_2 and O_2 species and in terms of ppm to at least the nearest whole number for CO, HC and NO_x species.

5.12 Calculation of the gaseous emissions

5.12.1 The final results for the test report shall be determined by following the steps in 5.12.2 to 5.12.6.

5.12.2 *Determination of the exhaust gas flow*

5.12.2.1 The exhaust gas flow rate (q_{mew}) shall be determined for each mode in accordance with one of the methods described in 5.5.2 to 5.5.4.

5.12.3 *Dry/wet correction*

5.12.3.1 If the emissions are not measured on a wet basis, the measured concentration shall be converted to a wet basis according to the following formulae:

$$c_{\mathrm{w}} = k_{\mathrm{w}} \cdot c_{\mathrm{d}} \qquad (5)$$

5.12.3.2 For the raw exhaust gas:

.1 Complete combustion where exhaust gas flow is to be determined in accordance with direct measurement method in 5.5.2 or air and fuel measurement method in 5.5.3 either of the following formulae shall be used:

$$k_{\mathrm{wr1}} = \left(1 - \frac{1.2442 \cdot H_{\mathrm{a}} + 111.19 \cdot w_{\mathrm{ALF}} \cdot \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}}}{773.4 + 1.2442 \cdot H_{a} + \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}} \cdot f_{\mathrm{fw}} \cdot 1000} \right) \cdot 1.008 \qquad (6)$$

or

$$k_{\mathrm{wr1}} = \left(1 - \frac{1.2442 \cdot H_{\mathrm{a}} + 111.19 \cdot w_{\mathrm{ALF}} \cdot \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}}}{773.4 + 1.2442 \cdot H_{\mathrm{a}} + \frac{q_{\mathrm{mf}}}{q_{\mathrm{mad}}} \cdot f_{\mathrm{fw}} \cdot 1000} \right) \Bigg/ \left(1 - \frac{p_{\mathrm{r}}}{p_{\mathrm{b}}} \right) \qquad (7)$$

with:

$$f_{fw} = 0.055594 \cdot w_{ALF} + 0.0080021 \cdot w_{DEL} + 0.0070046 \cdot w_{EPS} \quad (8)$$

H_a is the absolute humidity of intake air, in g water per kg dry air

Note: H_a may be derived from relative humidity measurement, dewpoint measurement, vapour pressure measurement or dry/wet bulb measurement using the generally accepted formulae.

$$H_a = 6.22 \cdot p_a \cdot R_a / (p_b - 0.01 \cdot R_a \cdot p_a) \quad (9)$$

where:

p_a = saturation vapour pressure of the intake air, kPa

$$p_a = (4.856884 + 0.2660089 \cdot t_a + 0.01688919 \cdot t_a^2 - 7.477123 \cdot 10^{-5} \cdot t_a^3 + 8.10525 \cdot 10^{-6} \cdot t_a^4 - 3.115221 \cdot 10^{-8} \cdot t_a^5) \cdot (101.32 / 760) \quad (10)$$

with:

t_a = temperature of the intake air, °C ; $t_a = T_a - 273.15$
p_b = total barometric pressure, kPa
p_r = water vapour pressure after cooling bath of the analysis system, kPa
p_r = 0.76 kPa for cooling bath temperature 3°C

.2 Incomplete combustion, CO more than 100 ppm or HC more than 100 ppmC at one or more mode points, where exhaust gas flow is determined in accordance with direct measurement method 5.5.2, air and fuel measurement method 5.5.3 and in all cases where the carbon-balance method 5.5.4 is used – the following equation shall be used:

Note: The unit for the CO and CO_2 concentrations in (11) and (13) is %.

$$k_{wr2} = \frac{1}{1 + \alpha \cdot 0.005 \cdot (c_{CO2d} + c_{COd}) - 0.01 \cdot c_{H2d} + k_{w2} - \frac{p_r}{p_b}} \quad (11)$$

with:

$$\alpha = 11.9164 \cdot \frac{w_{ALF}}{w_{BET}} \quad (12)$$

$$c_{H2d} = \frac{0.5 \cdot \alpha \cdot c_{COd} \cdot (c_{COd} + c_{CO2d})}{c_{COd} + 3 \cdot c_{CO2d}} \quad (13)$$

$$k_{w2} = \frac{1.608 \cdot H_a}{1000 + (1.608 \cdot H_a)} \quad (14)$$

5.12.3.3 For the intake air:

$$k_{wa} = 1 - k_{w2} \quad (15)$$

5.12.4 *NO_x correction for humidity and temperature*

5.12.4.1 As the NO_x emission depends on ambient air conditions, the NO_x concentration shall be corrected for ambient air temperature and humidity with the factors in accordance with 5.12.4.5 or 5.12.4.6 as applicable.

5.12.4.2 Other reference values for humidity instead of 10.71 g/kg at the reference temperature of 25°C shall not be used.

5.12.4.3 Other correction formulae may be used if they can be justified, validated and are approved by the Administration.

5.12.4.4 Water or steam injected into the charge air (air humidification) is considered an emission control device and shall therefore not be taken into account for humidity correction. Water that condensates in the charge cooler will change the humidity of the charge air and therefore shall be taken into account for humidity correction.

5.12.4.5 For compression ignition engines:

$$k_{hd} = \frac{1}{1 - 0.0182 \cdot (H_a - 10.71) + 0.0045 \cdot (T_a - 298)} \quad (16)$$

where:

T_a = the temperature of the air at the inlet to the air filter in K;
H_a = the humidity of the intake air at the inlet to the air filter in g water per kg dry air.

5.12.4.6 For compression ignition engines with intermediate air cooler the following alternative equation shall be used:

$$k_{hd} = \frac{1}{1 - 0.012 \cdot (H_a - 10.71) - 0.00275 \cdot (T_a - 298) + 0.00285 \cdot (T_{SC} - T_{SCRef})} \quad (17)$$

where:

T_{SC} is the temperature of the charge air;
T_{SCRef} is the temperature of the charge air at each mode point corresponding to a seawater temperature of 25°C as specified in 5.2.2. T_{SCRef} is to be specified by the manufacturer.

To take the humidity in the charge air into account, the following consideration is added:

H_{SC} = humidity of the charge air, g water per kg dry air in which:
$H_{SC} = 6.22 \cdot p_{SC} \cdot 100 / (p_C - p_{SC})$

where:

p_{SC} = saturation vapour pressure of the charge air, kPa
p_C = charge air pressure, kPa

However if $H_a \geq H_{SC}$, then H_{SC} shall be used in place of H_a in formula (17).

5.12.5 *Calculation of the emission mass flow rates*

5.12.5.1 The emission mass flow rate of the respective component in the raw exhaust gas for each mode shall be calculated in accordance with 5.12.5.2 from the measured concentration as obtained in accordance with 5.11.1, the applicable u_{gas} value from table 5 and the exhaust gas mass flow rate in accordance with 5.5.

Table 5

Coefficient u_{gas} and fuel-specific parameters for raw exhaust gas

Gas		NO_x	CO	HC	CO_2	O_2
ρ_{gas} kg/m^3		2.053	1.250	*	1.9636	1.4277
	ρ_e **	Coefficient u_{gas} ***				
Fuel oil	1.2943	0.001586	0.000966	0.000479	0.001517	0.001103

* depending on fuel

** ρ_e is the normal density of the exhaust gas

*** at $\lambda = 2$, wet air, 273 K, 101.3 kPa

Values for u given in table 5 are based on ideal gas properties.

5.12.5.2 The following formulae shall be applied:

$$q_{mgas} = u_{gas} \cdot c_{gas} \cdot q_{mew} \cdot k_{hd} \text{ (for } NO_x) \tag{18}$$

$$q_{mgas} = u_{gas} \cdot c_{gas} \cdot q_{mew} \text{ (for other gases)} \tag{18a}$$

where:

q_{mgas} = emission mass flow rate of individual gas, g/h
u_{gas} = ratio between density of exhaust component and density of exhaust gas, see table 5
c_{gas} = concentration of the respective component in the raw exhaust gas, ppm, wet
q_{mew} = exhaust mass flow, kg/h, wet
k_{hd} = NO_x humidity correction factor

Note: In the case of CO_2 and O_2 measurement, the concentration will normally be reported in terms of %. With regard to the application of formula 18a, these concentrations will need to be expressed in ppm. 1.0 % = 10000 ppm.

5.12.5.3 For the calculation of NO_x, the humidity correction factor k_{hd} as determined according to 5.12.4 shall be used.

5.12.5.4 The measured concentration shall be converted to a wet basis according to 5.12.3 if not already measured on a wet basis.

5.12.6 *Calculation of the specific emission*

5.12.6.1 The emission shall be calculated for all individual components in accordance with the following:

1. $$\text{gas}_x = \frac{\sum_{i=1}^{i=n} \left(q_{\text{mgasi}} \cdot W_{\text{Fi}} \right)}{\sum_{i=1}^{i=n} \left(P_{\text{i}} \cdot W_{\text{Fi}} \right)} \qquad (19)$$

where:

2. $$P = P_{\text{m}} + P_{\text{aux}} \qquad (20)$$

and

q_{mgas} is the mass flow of individual gas;
P_{m} is the measured power of the individual mode;
P_{aux} is the power of the auxiliaries fitted to the engine of the individual mode.

5.12.6.2 The weighting factors and the number of modes (n) used in the above calculation shall be according to the provisions of 3.2.

5.12.6.3 The resulting average weighted NO_x emission value for the engine as determined by formula (19) shall then be compared to the applicable emission limit given in regulation 13 to determine if the engine is in compliance.

Chapter 6

Procedures for demonstrating compliance with NO_x emission limits on board

6.1 General

6.1.1 After installation of a pre-certificated engine on board a ship, every marine diesel engine shall have an onboard verification survey conducted as specified in 2.1.1.2 to 2.1.1.4 to verify that the engine continues to comply with the applicable NO_x emission limit contained in regulation 13. Such verification of compliance shall be determined by using one of the following methods:

.1 engine parameter check method in accordance with 6.2 to verify that an engine's component, settings and operating values have not deviated from the specifications in the engine's technical file;

.2 simplified measurement method in accordance with 6.3; or

.3 direct measurement and monitoring method in accordance with 6.4.

6.2 Engine parameter check method

6.2.1 *General*

6.2.1.1 Engines that meet the following conditions shall be eligible for an engine parameter check method:

.1 engines that have received a pre-certificate (EIAPP Certificate) on the test bed and those that received a certificate (EIAPP Certificate) following an initial certification survey in accordance with 2.2.4; and

.2 engines that have undergone modifications or adjustments to the designated engine components and adjustable features since they were last surveyed.

6.2.1.2 When a diesel engine is designed to run within the applicable NO_x emission limit, it is most likely that within the marine life of the engine, the NO_x emission limit may be adhered to. The applicable NO_x emission limit may, however, be contravened by adjustments or modification to the engine. Therefore, an engine parameter check method shall be used to verify whether the engine is still within the applicable NO_x emission limit.

6.2.1.3 Engine component checks, including checks of settings and an engine's operating values, are intended to provide an easy means of deducing the emissions performance of the engine for the purpose of verification that an engine with no, or minor, adjustments or modifications complies with the applicable NO_x emission limit. Where the measurement of some operating values is required, the calibration of the equipment used for those measurements shall be in accordance with the requirements of appendix IV of this Code.

6.2.1.4 The purpose of such checks is to provide a ready means of determining that an engine is correctly adjusted in accordance with the manufacturer's specification and remains in a condition of adjustment consistent with the initial certification by the Administration as being in compliance with regulation 13 as applicable.

6.2.1.5 If an electronic engine management system is employed, this shall be evaluated against the original settings to ensure that appropriate parameters are operating within "as-built" limits.

6.2.1.6 For the purpose of assessing compliance with regulation 13, it is not always necessary to measure the NO_x emissions to know that an engine, not equipped with an after-treatment device, is likely to comply with the applicable NO_x emission limit. It may be sufficient to know that the present state of the engine corresponds to the specified components, calibration or parameter adjustment state at the time of initial certification. If the results of an engine parameter check method indicate the likelihood that the engine complies with the applicable NO_x mission limit, the engine may be re-certified without direct NO_x measurement.

6.2.1.7 For an engine equipped with a NO_x-reducing device, it will be necessary to check the operation of the device as part of the engine parameter check method.

6.2.2 *Documentation for an engine parameter check method*

6.2.2.1 Every marine diesel engine shall have a technical file as required in 2.3.4 that identifies the engine's components, settings or operating values that influence exhaust emissions and must be checked to ensure compliance.

6.2.2.2 An engine's technical file shall contain all applicable information, relevant to the NO_x emission performance of the engine, on the designated engine's components, adjustable features and parameters at the time of the engine's pre-certification or onboard certification, whichever occurred first.

6.2.2.3 Dependent on the specific design of the particular engine, different onboard NO_x-influencing modifications and adjustments are possible and usual. These include the engine parameters as follows:

.1 injection timing,
.2 injection nozzle,
.3 injection pump,
.4 fuel cam,
.5 injection pressure for common rail systems,
.6 combustion chamber,
.7 compression ratio,
.8 turbocharger type and build,
.9 charge air cooler, charge air pre-heater,
.10 valve timing,
.11 NO_x abatement equipment "water injection",
.12 NO_x abatement equipment "emulsified fuel" (fuel water emulsion),
.13 NO_x abatement equipment "exhaust gas recirculation",
.14 NO_x abatement equipment "selective catalytic reduction", or
.15 other parameter(s) specified by the Administration.

6.2.2.4 The actual technical file of an engine may, based on the recommendations of the applicant for engine certification and the approval of the Administration, include less components and/or parameters than discussed in section 6.2.2.3 depending on the particular engine and the specific design.

6.2.2.5 For some parameters, different survey possibilities exist. As approved by the Administration, the shipowner, supported by the applicant for engine certification, may choose what method is applicable. Any one of, or a combination of, the methods listed in the checklist for the engine parameter check method given in appendix VII of this Code may be sufficient to show compliance.

6.2.2.6 Technical documentation in respect of engine component modification for inclusion in an engine's technical file shall include details of that modification and its influence on NO_x emissions, and it shall be supplied at the time when the modification is carried out. Test-bed data obtained from a later engine that is within the applicable range of the engine group concept may be accepted.

6.2.2.7 The shipowner or person responsible for a ship equipped with a marine diesel engine required to undergo an engine parameter check method shall maintain on board the following documentation in relation to the onboard NO_x verification procedures:

.1 a record book of engine parameters for recording all changes, including like-for-like replacements, and adjustments within the approved ranges made relative to an engine's components and settings;

.2 an engine parameter list of an engine's designated components and settings and/or the documentation of an engine's load-dependent operating values submitted by an applicant for engine certification and approved by the Administration; and

.3 technical documentation of an engine component modification when such a modification is made to any of the engine's designated engine components.

6.2.2.8 Descriptions of any changes affecting the designated engine parameters, including adjustments, parts replacements and modifications to engine parts, shall be recorded chronologically in the record book of engine parameters. These descriptions shall be supplemented with any other applicable data used for the assessment of the engine's NO_x emissions.

6.2.3 *Procedures for an engine parameter check method*

6.2.3.1 An engine parameter check method shall be carried out using the two procedures as follows:

.1 a documentation inspection of engine parameter(s) shall be carried out in addition to other inspections and include inspection of the record book of engine parameters and verification that engine parameters are within the allowable range specified in the engine's technical file; and

.2 an actual inspection of engine components and adjustable features shall be carried out as necessary. It shall then be verified, also referring to the results of the documentation inspection, that the engine's adjustable features are within the allowable range specified in the engine's technical file.

6.2.3.2 The surveyor shall have the option of checking one or all of the identified components, settings or operating values to ensure that the engine with no, or minor, adjustments or modifications complies with the applicable NO_x emission limit and that only components of the approved specification, as given by 2.4.1.7, are being used. Where adjustments and/or modifications in a specification are referenced in the technical file, they must fall within the range recommended by the applicant for engine certification and approved by the Administration.

6.3 Simplified measurement method

6.3.1 *General*

6.3.1.1 The following simplified test and measurement procedure specified in this section shall be applied only for onboard confirmation tests and renewal, annual and intermediate surveys when required. Every first engine testing on a test bed shall be carried out in accordance with the procedure specified in chapter 5. Corrections for ambient air humidity and temperature in accordance with 5.12.4 are essential, as ships are sailing in cold/hot and dry/humid climates, which may cause a difference in NO_x emissions.

6.3.1.2 To gain meaningful results for onboard confirmation tests and onboard renewal, annual and intermediate surveys, as an absolute minimum, the gaseous emission concentrations of NO_x and CO_2 shall be measured in accordance with the appropriate test cycle. The weighting factors (W_F) and the number of modes (n) used in the calculation shall be in accordance with 3.2.

6.3.1.3 The engine torque and engine speed shall be measured but, to simplify the procedure, the permissible deviations of instruments (see 6.3.7) for measurement of engine-related parameters for onboard verification purposes are different from those permissible deviations allowed under the test-bed testing method. If it is difficult to measure the torque directly, the brake power may be estimated by any other means recommended by the applicant for engine certification and approved by the Administration.

6.3.1.4 In practical cases, it is often impossible to measure the fuel oil consumption once an engine has been installed on board a ship. To simplify the procedure on board, the results of the measurement of the fuel oil consumption from an engine's pre-certification test-bed testing may be accepted. In such cases, especially concerning residual fuel oil operation (RM-grade fuel oil according to ISO 8217:2005), an estimation with a corresponding estimated error shall be made. Since the fuel oil flow rate used in the calculation (q_{mf}) must relate to the fuel oil composition determined in respect of the fuel sample drawn during the test, the measurement of q_{mf} from the test-bed testing shall be corrected for any difference in net calorific values between the test bed and test fuel oils. The consequences of such an error on the final emissions shall be calculated and reported with the results of the emission measurement.

6.3.1.5 Except as otherwise specified, all results of measurements, test data or calculations required by this chapter shall be recorded in the engine's test report in accordance with 5.10.

6.3.2 *Engine parameters to be measured and recorded*

6.3.2.1 Table 6 lists the engine parameters that shall be measured and recorded during onboard verification procedures.

Table 6

Engine parameters to be measured and recorded

Symbol	Parameter	Dimension
H_a	Absolute humidity (mass of engine intake air water content related to mass of dry air)	g/kg
$n_{d,i}$	Engine speed (at the i^{th} mode during the cycle)	min^{-1}
$n_{turb,i}$	Turbocharger speed (if applicable) (at the i^{th} mode during the cycle)	min^{-1}
p_b	Total barometric pressure (in ISO 3046-1, 1995: p_x = Px = site ambient total pressure)	kPa
$p_{C,i}$	Charge air pressure after the charge air cooler (at the i^{th} mode during the cycle)	kPa
P_i	Brake power (at the i^{th} mode during the cycle)	kW
$q_{mf,i}$	Fuel oil flow (at the i^{th} mode during the cycle)	kg/h
s_i	Fuel rack position (of each cylinder, if applicable) (at the i^{th} mode during the cycle)	
T_a	Intake air temperature at air inlet (in ISO 3046-1, 1995: T_x = TTx = site ambient thermodynamic air temperature)	K
$T_{SC,i}$	Charge air temperature after the charge air cooler (if applicable) (at the i^{th} mode during the cycle)	K
T_{caclin}	Charge air cooler, coolant inlet temperature	°C
$T_{caclout}$	Charge air cooler, coolant outlet temperature	°C
$T_{Exh,i}$	Exhaust gas temperature at the sampling point (at the i^{th} mode during the cycle)	°C
T_{Fuel}	Fuel oil temperature before the engine	°C
T_{Sea}	Seawater temperature	°C

6.3.3 *Brake power*

6.3.3.1 The point regarding the ability to obtain the required data during onboard NO_x testing is particularly relevant to brake power. Although the case of directly coupled gearboxes is considered in chapter 5 (5.1.7), an engine, as may be presented on board, could, in many applications, be arranged such that the measurements of torque (as obtained from a specially installed strain gauge) may not be possible due to the absence of a clear shaft. Principal in this context would be generators, but engines may also be coupled to pumps, hydraulic units, compressors, etc.

6.3.3.2 The engines driving the machinery given in 6.3.3.1 would typically have been tested against a water brake at the manufacture stage prior to the permanent connection of the power consuming unit when installed on board. For generators it should not pose a problem to use voltage and amperage measurements together with a manufacturer's declared generator efficiency. For propeller-law-governed equipment, a declared speed power curve may be applied together with ensured capability to measure engine speed, either from the free end or by ratio of, for example, the camshaft speed.

6.3.4 *Test fuel oils*

6.3.4.1 Generally all emission measurements shall be carried out with the engine running on marine diesel fuel oil of an ISO 8217:2005, DM-grade.

6.3.4.2 To avoid an unacceptable burden to the shipowner, the measurements for confirmation tests or re-surveys may, based on the recommendation of the applicant for engine certification and the approval of the Administration, be allowed with an engine running on residual fuel oil of an ISO 8217:2005, RM-grade. In such a case the fuel-bound nitrogen and the ignition quality of the fuel oil may have an influence on the NO_x emissions of the engine.

6.3.5 *Sampling for gaseous emissions*

6.3.5.1 The general requirements described in 5.9.3 shall be also applied for onboard measurements.

6.3.5.2 The installation on board of all engines shall be such that these tests may be performed safely and with minimal interference to the engine. Adequate arrangements for the sampling of the exhaust gas and the ability to obtain the required data shall be provided on board a ship. The uptakes of all engines shall be fitted with an accessible standard sampling point. An example of a sample point connecting flange is given in section 5 of appendix VIII of this Code.

6.3.6 *Measurement equipment and data to be measured*

6.3.6.1 The emission of gaseous pollutants shall be measured by the methods described in chapter 5.

6.3.7 *Permissible deviation of instruments for engine-related parameters and other essential parameters*

6.3.7.1 Tables 3 and 4 contained in section 1.3 of appendix IV of this Code list the permissible deviation of instruments to be used in the measurement of engine-related parameters and other essential parameters during onboard verification procedures.

6.3.8 *Determination of the gaseous components*

6.3.8.1 The analytical measuring equipment and the methods described in chapter 5 shall be applied.

6.3.9 *Test cycles*

6.3.9.1 Test cycles used on board shall conform to the applicable test cycles specified in 3.2.

6.3.9.2 Engine operation on board under a test cycle specified in 3.2 may not always be possible, but the test procedure shall, based on the recommendation of the engine manufacturer and approval by the Administration, be as close as possible to the procedure defined in 3.2. Therefore, values measured in this case may not be directly comparable with test-bed results because measured values are very much dependent on the test cycles.

6.3.9.3 If the number of measuring points on board is different than those on the test bed, the measuring points and the weighting factors shall be in accordance with the recommendations of the applicant for engine certification and approved by the Administration, taking into account the provisions of 6.4.6.

6.3.10 *Calculation of gaseous emissions*

6.3.10.1 The calculation procedure specified in chapter 5 shall be applied, taking into account the special requirements of this simplified measurement procedure.

6.3.11 *Allowances*

6.3.11.1 Due to the possible deviations when applying the simplified measurement procedures of this chapter on board a ship, an allowance of 10% of the applicable limit value may be accepted for confirmation tests and renewal, annual and intermediate surveys only.

6.3.11.2 The NO_x emission of an engine may vary depending on the ignition quality of the fuel oil and the fuel-bound nitrogen. If there is insufficient information available on the influence of the ignition quality on the NO_x formation during the combustion process and the fuel-bound nitrogen conversion rate also depends on the engine efficiency, an allowance of 10% may be granted for an onboard test run carried out on an RM-grade fuel oil (ISO 8217:2005), except that there will be no allowance for the pre-certification test on board. The fuel oil used shall be analysed for its composition of carbon, hydrogen, nitrogen, sulphur and, to the extent given in ISO 8217:2005, any additional components necessary for a clear specification of the fuel oil.

6.3.11.3 In no case shall the total granted allowance for both the simplification of measurements on board and the use of residual fuel oil of an ISO 8217:2005, RM-grade fuel oil, exceed 15% of the applicable limit value.

6.4 Direct measurement and monitoring method

6.4.1 *General*

6.4.1.1 The following direct measurement and monitoring procedure may be applied for onboard verification at renewal, annual and intermediate surveys.

6.4.1.2 Due attention is to be given to the safety implications related to the handling and proximity of exhaust gases, the measurement equipment and the storage and use of cylindered pure and calibration gases. Sampling positions and access staging shall be such that this monitoring may be performed safely and will not interfere with the engine.

6.4.2 *Emission species measurement*

6.4.2.1 Onboard NO_x monitoring includes, as an absolute minimum, the measurement of gaseous emission concentrations of NO_x (as $NO + NO_2$).

6.4.2.2 If exhaust gas mass flow is to be determined in accordance with the carbon balance method in accordance with appendix VI of this Code, then CO_2 shall also be measured. Additionally CO, HC and O_2 may be measured.

6.4.3 *Engine performance measurements*

6.4.3.1 Table 7 lists the engine performance parameters that shall be measured, or calculated, and recorded at each mode point during onboard NO_x monitoring.

Table 7
Engine parameters to be measured and recorded

Symbol	Parameter	Dimension
n_d	Engine speed	min^{-1}
p_C	Charge air pressure at receiver	kPa
P	Brake power (as specified below)	kW
P_{aux}	Auxiliary power (if relevant)	kW
T_{sc}	Charge air temperature at receiver (if applicable)	K
T_{caclin}	Charge air cooler, coolant inlet temperature (if applicable)	°C
$T_{caclout}$	Charge air cooler, coolant outlet temperature (if applicable)	°C
T_{Sea}	Seawater temperature (if applicable)	°C
q_{mf}	Fuel oil flow (as specified below)	kg/h

6.4.3.2 Other engine settings necessary to define engine-operating conditions, e.g., waste-gate, charge air bypass, turbocharger status, shall be determined and recorded.

6.4.3.3 The settings and operating conditions of any NO_x-reducing devices shall be determined and recorded.

6.4.3.4 If it is difficult to measure power directly, uncorrected brake power may be estimated by any other means as approved by the Administration. Possible methods to determine brake power include, but are not limited to:

.1 indirect measurement in accordance with 6.3.3; or

.2 by estimation from nomographs.

6.4.3.5 The fuel oil flow (actual consumption rate) shall be determined by:

.1 direct measurement; or

.2 test-bed data in accordance with 6.3.1.4.

6.4.4 *Ambient condition measurements*

6.4.4.1 Table 8 lists the ambient condition parameters that shall be measured, or calculated, and recorded at each mode point during onboard NO_x monitoring.

Table 8

Ambient condition parameters to be measured and recorded

Symbol	Parameter	Dimension
H_a	Absolute humidity (mass of engine intake air water content related to mass of dry air)	g/kg
p_b	Total barometric pressure (in ISO 3046-1, 1995: p_x=P_x=site ambient total pressure)	kPa
T_a	Temperature at air inlet (in ISO 3046-1, 1995: T_x=TT_x=site ambient thermodynamic air temperature)	K

6.4.5 *Engine performance and ambient condition monitoring equipment*

6.4.5.1 The engine performance and ambient condition monitoring equipment shall be installed and maintained in accordance with manufacturers' recommendations such that requirements of section 1.3 and tables 3 and 4 of appendix IV of this Code are met in respect of the permissible deviations.

6.4.6 *Test cycles*

6.4.6.1 Engine operation on board under a specified test cycle may not always be possible, but the test procedure, as approved by the Administration, shall be as close as possible to the procedure defined in 3.2. Therefore, values measured in this case may not be directly comparable with test-bed results because measured values are very much dependant on the test cycle.

6.4.6.2 In the case of the E3 test cycle, if the actual propeller curve differs from the E3 curve, the load point used shall be set using the engine speed, or the corresponding mean effective pressure (MEP) or mean indicated pressure (MIP), given for the relevant mode of that cycle.

6.4.6.3 Where the number of measuring points on board is different from those on the test bed, the number of measurement points and the associated revised weighting factors shall be approved by the Administration.

6.4.6.4 Further to 6.4.6.3, where the E2, E3 or D2 test cycles are applied, a minimum of load points shall be used of which the combined nominal weighting factor, as given in 3.2, is greater than 0.5.

6.4.6.5 Further to 6.4.6.3, where the C1 test cycle is applied, a minimum of one load point shall be used from each of the rated, intermediate and idle speed sections. If the number of measuring points on board is different from those on the test bed, the nominal weighting factors at each load point shall be increased proportionally in order to sum to unity (1.0).

6.4.6.6 With regard to the application of 6.4.6.3, guidance in respect of the selection of load points and revised weighting factors is given in section 6 of appendix VIII of this Code.

6.4.6.7 The actual load points used to demonstrate compliance shall be within ± 5% of the rated power at the modal point except in the case of 100% load, where the range shall be +0 to −10%. For example, at the 75% load point the acceptable range shall be 70% – 80% of rated power.

6.4.6.8 At each selected load point, except idle, and after the initial transition period (if applicable), the engine power shall be maintained at the load set point within a 5% coefficient of variance (%C.O.V.) over a 10-minute interval. A worked example of the coefficient of variance calculation is given in section 7 of appendix VIII of this Code.

6.4.6.9 Regarding the C1 test cycle, the idle speed tolerance shall be declared, subject to the approval of the Administration.

6.4.7 *Test condition parameter*

6.4.7.1 The test condition parameter specified in 5.2.1 shall not apply to onboard NO_x monitoring. Data under any prevailing ambient condition shall be acceptable.

6.4.8 *Analyser in-service performance*

6.4.8.1 Analysing equipment shall be operated in accordance with manufacturer's recommendations.

6.4.8.2 Prior to measurement, zero and span values shall be checked and the analysers shall be adjusted as necessary.

6.4.8.3 After measurement, analyser zero and span values shall be verified as being within that permitted by 5.9.9.

6.4.9 *Data for emission calculation*

6.4.9.1 The output of the analysers shall be recorded both during the test and during all response checks (zero and span). These data shall be recorded on a strip chart recorder or other types of data recording devices. Data recording precision shall be in accordance with 5.9.7.1.

6.4.9.2 For the evaluation of the gaseous emissions, a 1-Hertz minimum chart reading of a stable 10-minute sampling interval of each load point shall be averaged. The average concentrations of NO_x, and, if required CO_2, and, optionally, CO, HC and O_2, shall be determined from the averaged chart readings and the corresponding calibration data.

6.4.9.3 As a minimum, emission concentrations, engine performance and ambient condition data shall be recorded over the aforementioned 10-minute period.

6.4.10 *Exhaust gas flow rate*

6.4.10.1 Exhaust gas flow rate shall be determined:

.1 in accordance with 5.5.2 or 5.5.3; or

.2 in accordance with 5.5.4 and appendix VI of this Code, with not measured species set to zero and c_{CO2d} set to 0.03%.

6.4.11 *Fuel oil composition*

6.4.11.1 Fuel oil composition, to calculate gas mass flow wet, q_{mf}, shall be provided by one of the following:

.1 fuel oil composition, carbon, hydrogen, nitrogen and oxygen, by analysis (default oxygen value may be adopted); or

.2 default values as given in table 9.

Table 9
Default fuel oil parameters

	Carbon	Hydrogen	Nitrogen	Oxygen
	w_{BET}	w_{ALF}	w_{DEL}	w_{EPS}
Distillate fuel oil (ISO 8217:2005, DM grade)	86.2%	13.6%	0.0%	0.0%
Residual fuel oil (ISO 8217:2005, RM grade)	86.1%	10.9%	0.4%	0.0%

6.4.12 *Dry/wet correction*

6.4.12.1 If not already measured on a wet basis, the gaseous emissions concentrations shall be converted to a wet basis according to:

.1 direct measurement of the water component; or

.2 dry/wet correction calculated in accordance with 5.12.3.

6.4.13 *NO_x correction for humidity and temperature*

6.4.13.1 NO_x correction for humidity and temperature shall be in accordance with 5.12.4. The reference charge air temperature (T_{SCRef}) shall be stated and approved by the Administration. The T_{SCRef} values are to be referenced to 25°C seawater temperature and in the application of the T_{SCRef} value due allowance shall be made for the actual seawater temperature.

6.4.14 *Calculation of emission flow rates and specific emissions*

6.4.14.1 The calculation of emission flow rates and specific emissions shall be in accordance with 5.12.5 and 5.12.6.

6.4.15 *Limit value and allowances*

6.4.15.1 In the case of the application of 6.4.6.3 the emission value obtained shall, subject to the approval of the Administration, be corrected as follows:

$$\text{Corrected gas}_x = \text{gas}_x \cdot 0.9 \quad (21)$$

6.4.15.2 The emission value, gas_x or corrected gas_x as appropriate, shall be compared to the applicable NO_x emission limit value as given in regulation 13 together with the allowance values as given in 6.3.11.1, 6.3.11.2 and 6.3.11.3 in order to verify that an engine continues to comply with the requirements of regulation 13.

6.4.16 *Data for demonstrating compliance*

6.4.16.1 Compliance is required to be demonstrated at renewal, annual and intermediate surveys or following a substantial modification as per 1.3.2. In accordance with 2.4.5, data are required to be current; that is within 30 days. Data are required to be retained on board for at least three months. These time periods shall be taken to be when the ship is in operation. Data within that 30-day period either may be collected as a single test sequence across the required load points or may be obtained on two or more separate occasions when the engine load corresponds to that required by 6.4.6.

6.4.17 *Form of approval*

6.4.17.1 The direct measurement and monitoring method shall be documented in an onboard monitoring manual. The onboard monitoring manual shall be submitted to the Administration for approval. The approval reference of that onboard monitoring manual shall be entered under section 3 of the supplement to the EIAPP Certificate. The Administration may issue a new EIAPP Certificate, with the details in section 3 of the supplement duly amended, if the method is approved after the issue of the first EIAPP Certificate, i.e. following the pre-certification survey.

6.4.18 *Survey of equipment and method*

6.4.18.1 The survey of the direct measurement and monitoring method shall take into account, but is not limited to:

.1 the data obtained and developed from the required measurements; and

.2 the means by which those data have been obtained, taking into account the information given in the onboard monitoring manual, as required by 6.4.14.

Chapter 7

Certification of an existing engine

7.1 Where an existing engine is to comply with regulation 13.7, then the entity responsible for obtaining emissions certification shall apply to the approving Administration for certification.

7.2 Where an application for approved method approval includes gaseous emission measurements and calculations, those are to be in accordance with chapter 5.

7.3 Emission and performance data obtained from one engine may be shown to apply to a range of engines.

7.4 The approved method for achieving compliance with regulation 13.7 shall include a copy of the approved method file that is required to accompany the engine throughout its life on board ship.

7.5 A description of the engine's onboard verification procedure shall be included in the approved method file.

7.6 After installation of the approved method, a survey shall be conducted in accordance with the approved method file. If this survey confirms compliance, the Administration shall amend the ship's IAPP Certificate accordingly.

Appendix I

Form of EIAPP Certificate

(Refer to 2.2.10 of the NO_x Technical Code 2008)

ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE

Issued under the provisions of the Protocol of 1997, as amended by resolution MEPC.176(58) in 2008, to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 related thereto (hereinafter referred to as "the Convention") under the authority of the Government of:

....

(full designation of the country)

by ....

(full designation of the competent person or organization authorized under the provisions of the Convention)

Engine manufacturer	Model number	Serial number	Test cycle(s)	Rated power (kW) and speed (rpm)	Engine approval number

THIS IS TO CERTIFY:

1 That the above-mentioned marine diesel engine has been surveyed for pre-certification in accordance with the requirements of the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines 2008 made mandatory by Annex VI of the Convention; and

2 That the pre-certification survey shows that the engine, its components, adjustable features, and technical file, prior to the engine's installation and/or service on board a ship, fully comply with the applicable regulation 13 of Annex VI of the Convention.

This certificate is valid for the life of the engine subject to surveys in accordance with regulation 5 of Annex VI of the Convention, installed in ships under the authority of this Government.

Issued at:

....

(Place of issue of certificate)

(dd/mm/yyyy) ....

(Date of issue) *(Signature of duly authorized official issuing the certificate)*

(Seal or stamp of the authority, as appropriate)

SUPPLEMENT TO ENGINE INTERNATIONAL AIR POLLUTION PREVENTION CERTIFICATE (EIAPP CERTIFICATE)

RECORD OF CONSTRUCTION, TECHNICAL FILE AND MEANS OF VERIFICATION

Notes:

1 This Record and its attachments shall be permanently attached to the EIAPP Certificate. The EIAPP Certificate shall accompany the engine throughout its life and shall be available on board the ship at all times.

2 The Record shall be at least in English, French or Spanish. If an official language of the issuing country is also used, this shall prevail in case of a dispute or discrepancy.

3 Unless otherwise stated, regulations mentioned in this Record refer to regulations of Annex VI of the Convention and the requirements for an engine's technical file and means of verifications refer to mandatory requirements from the revised NO_x Technical Code 2008.

1 Particulars of the engine

1.1 Name and address of manufacturer ....
1.2 Place of engine build ....
1.3 Date of engine build ....
1.4 Place of pre-certification survey ....
1.5 Date of pre-certification survey ....
1.6 Engine type and model number ....
1.7 Engine serial number ....
1.8 If applicable, the engine is a parent engine ☐ or a member engine ☐ of the following engine family ☐ or engine group ☐ ....
1.9 Individual engine or engine family/engine group details:
1.9.1 Approval reference ....
1.9.2 Rated power (kW) and rated speed (rpm) values or ranges ....
1.9.3 Test cycle(s) ....
1.9.4 Parent engine(s) test fuel oil specification ....
1.9.5 Applicable NO_x emission limit (g/kWh), regulation 13.3, 13.4, or 13.5.1 (delete as appropriate) ....
1.9.6 Parent engine(s) emission value (g/kWh) ....

2 Particulars of the technical file

The technical file, as required by chapter 2 of the NO_x Technical Code 2008, is an essential part of the EIAPP Certificate and must always accompany an engine throughout its life and always be available on board a ship.

2.1 Technical file identification/approval number ....
2.2 Technical file approval date ....

3 Specifications for the onboard NO_x verification procedures

The specifications for the onboard NO_x verification procedures, as required by chapter 6 of the NO_x Technical Code 2008, are an essential part of the EIAPP Certificate and must always accompany an engine through its life and always be available on board a ship.

3.1 Engine parameter check method:
3.1.1 Identification/approval number ....
3.1.2 Approval date ....
3.2 Direct measurement and monitoring method:
3.2.1 Identification/approval number ....
3.2.2 Approval date ....

Alternatively the simplified measurement method in accordance with 6.3 of the NO_x Technical Code 2008 may be utilized.

Issued at:

....
(Place of issue of certificate)

(dd/mm/yyyy) ....
(Date of issue)

....
(Signature of duly authorized official issuing the certificate)

(Seal or stamp of the authority, as appropriate)

Appendix II

Flowcharts for survey and certification of marine diesel engines
(Refer to 2.2.9 and 2.3.11 of the NO_x Technical Code 2008)

Guidance for compliance with survey and certification of marine diesel engines, as described in chapter 2 of this Code, is given in figures 1, 2 and 3 of this appendix:

Figure 1: Pre-certification survey at the manufacturer's facility

Figure 2: Initial survey on board a ship

Figure 3: Renewal, annual or intermediate survey on board a ship

Note: These flowcharts do not show the criteria for the certification of an existing engine as required by regulation 13.7.

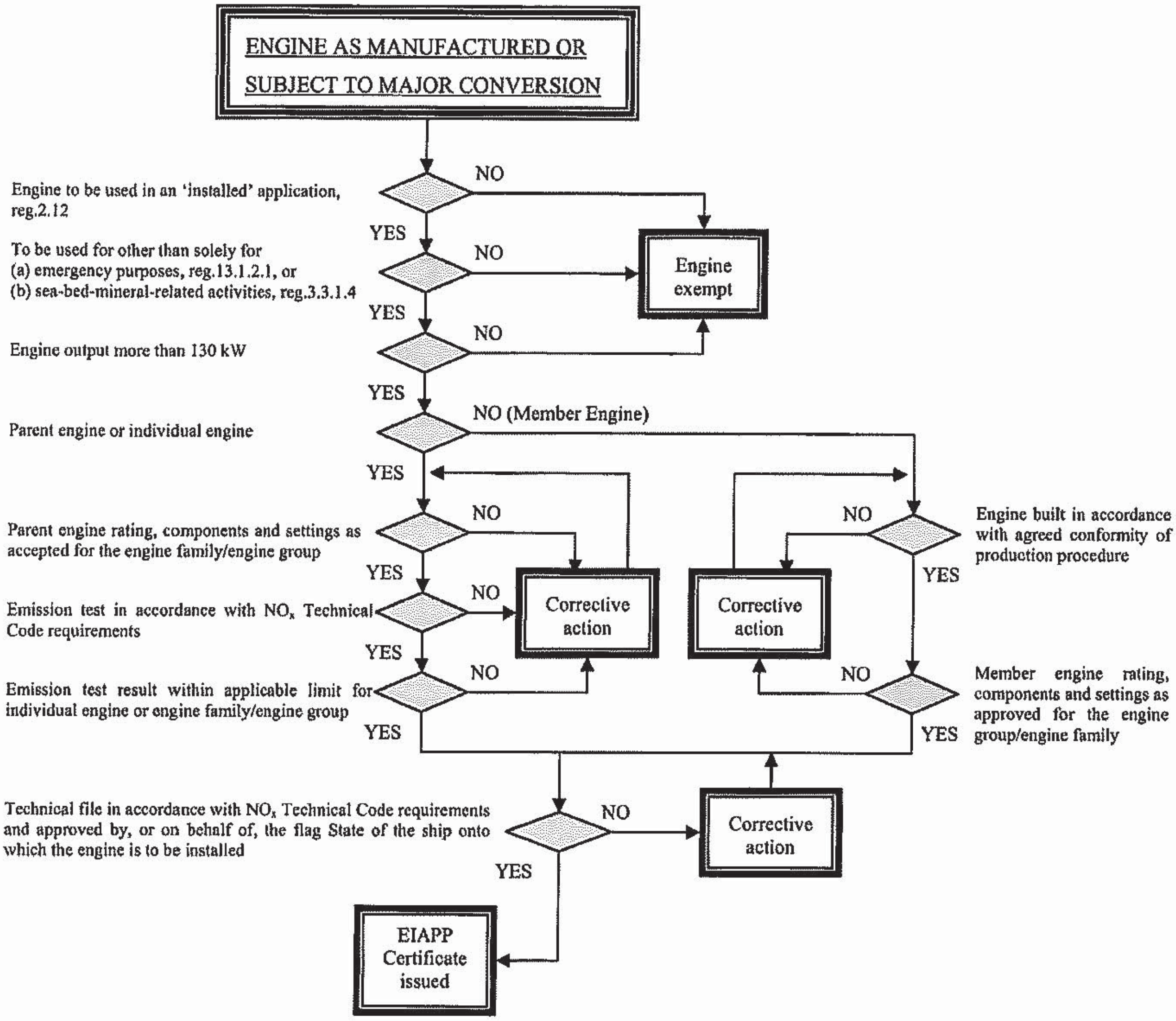


Figure 1 – Pre-certification survey at the manufacturer's facility

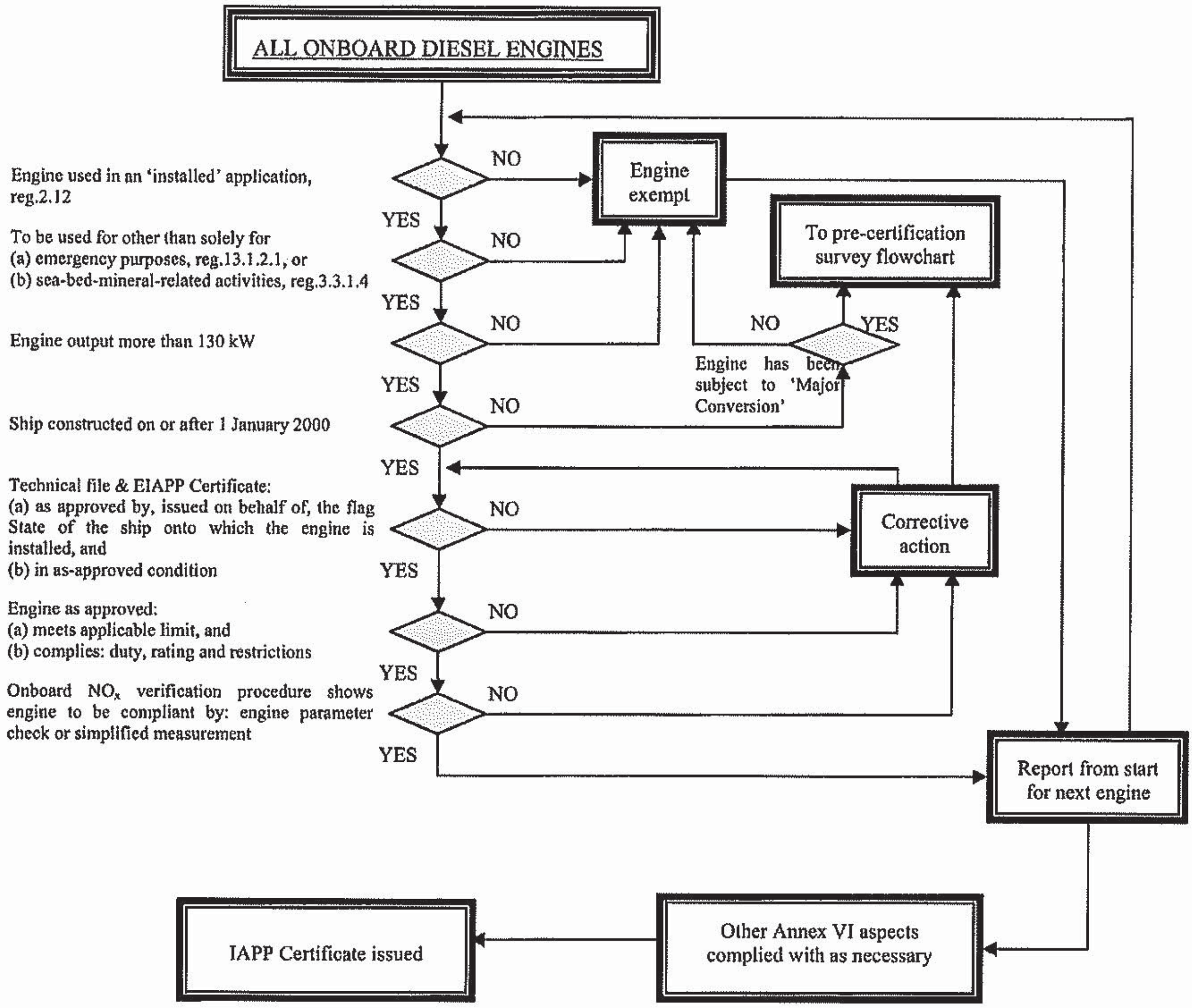


Figure 2 – Initial survey on board a ship

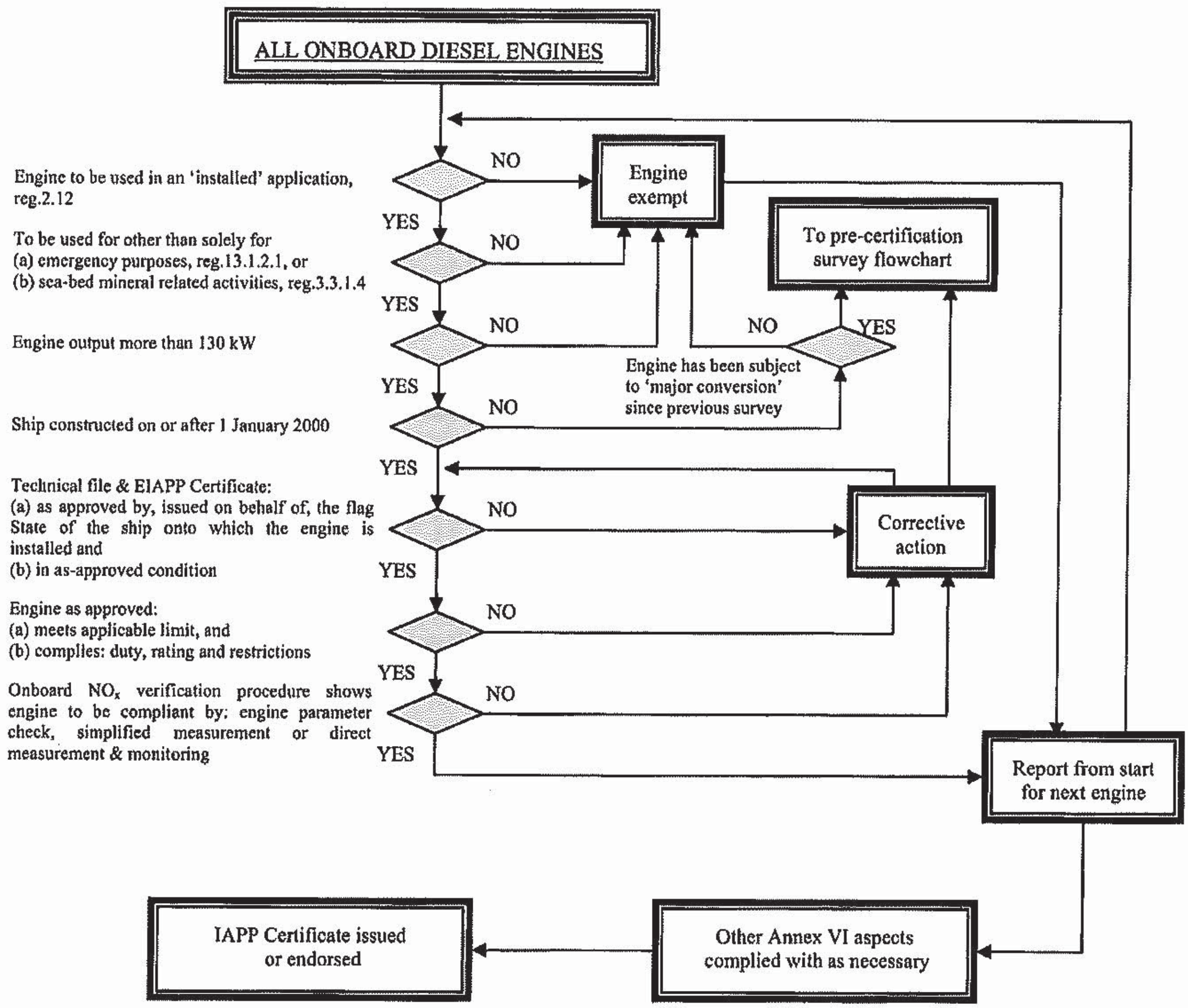


Figure 3 – Renewal, annual or intermediate survey on board a ship

Appendix III

Specifications for analysers to be used in the determination of gaseous components of marine diesel engine emissions

(Refer to chapter 5 of the NO_x Technical Code 2008)

1 General

1.1 The components included in an exhaust gas analysis system for the determination of the concentrations of CO, CO_2, NO_x, HC and O_2 are shown in figure 1. All components in the sampling gas path must be maintained at the temperatures specified for the respective systems.

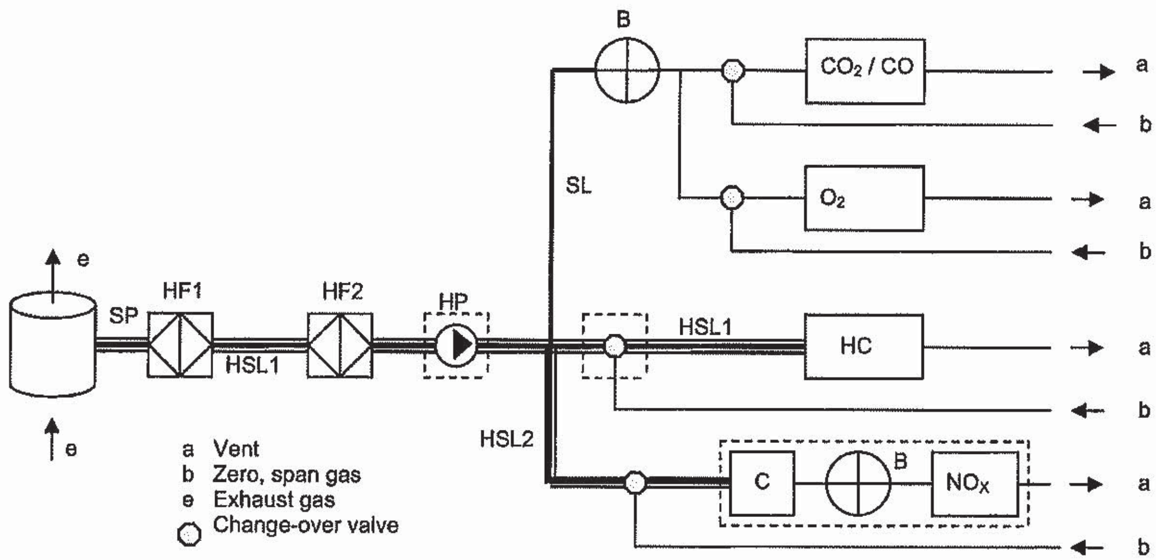


Figure 1 – Arrangement of exhaust gas analysis system

1.2 An exhaust gas analysis system shall include the following components. In accordance with chapter 5 of this Code equivalent arrangements and components may, subject to approval by the Administration, be accepted.

.1 SP – Raw exhaust gas sampling probe

A stainless steel, straight, closed-end, multi-hole probe. The inside diameter shall not be greater than the inside diameter of the sampling line. The wall thickness of the probe should not be greater than 1 mm. There should be a minimum of three holes in three different radial planes sized to sample approximately the same flow.

For the raw exhaust gas, the sample for all components may be taken with one sampling probe or with two sampling probes located in close proximity and internally split to the different analysers.

Note: If exhaust pulsations or engine vibrations are likely to affect the sampling probe, the wall thickness of the probe may be enlarged subject to the approval of the Administration.

.2 HSL1 – Heated sampling line

The sampling line provides a gas sample from a single probe to the split point(s) and the HC analyser. The sampling line shall be made of stainless steel or polytetrafluoroethylene (PTFE) and have a 4 mm minimum and a 13.5 mm maximum inside diameter.

The exhaust gas temperature at the sampling probe shall not be less than 190°C. The temperature of the exhaust gas from the sampling point to the analyser shall be maintained by using a heated filter and a heated transfer line with a wall temperature of 190°C ± 10°C.

If the temperature of the exhaust gas at the sampling probe is above 190°C, a wall temperature greater than 180°C shall be maintained.

Immediately before the heated filter and the HC analyser a gas temperature of 190°C ± 10°C shall be maintained.

.3 HSL2 – Heated NO_x sampling line

The sampling line shall be made of stainless steel or PTFE and maintain a wall temperature of 55°C to 200°C, up to the converter C when using a cooling unit B, and up to the analyser when a cooling unit B is not used.

.4 HF1 – Heated pre-filter (optional)

The required temperature shall be the same as for HSL1.

.5 HF2 – Heated filter

The filter shall extract any solid particles from the gas sample before the analyser. The temperature shall be the same as for HSL1. The filter shall be changed as necessary.

.6 HP – Heated sampling pump (optional)

The pump shall be heated to the temperature of HSL1.

.7 SL – Sampling line for CO, CO_2 and O_2

The line shall be made of PTFE or stainless steel. It may be heated or unheated.

.8 CO_2/CO – Carbon dioxide and carbon monoxide analysers

Non-dispersive infrared (NDIR) absorption. Either separate analysers or two functions incorporated into a single analyser unit.

.9 HC – Hydrocarbon analyser

Heated flame ionization detector (HFID). The temperature shall be kept at 180°C to 200°C.

.10 NO_x – Nitrogen oxides analyser

Chemiluminescent detector (CLD) or heated chemiluminescent detector (HCLD). If a HCLD is used, it shall be kept at a temperature of 55°C to 200°C.

Note: In the arrangement shown NO_x is measured on a dry basis. NO_x may also be measured on a wet basis in which case the analyser shall be of the HCLD type.

.11 C – Converter

A converter shall be used for the catalytic reduction of NO_2 to NO prior to analysis in the CLD or HCLD.

.12 O_2 – Oxygen analyser

Paramagnetic detector (PMD), zirconium dioxide (ZRDO) or electrochemical sensor (ECS).

Note: In the arrangement shown O_2 is measured on a dry basis. O_2 may also be measured on a wet basis in which case the analyser shall be of the ZRDO type.

.13 B – Cooling unit

To cool and condense water from the exhaust sample. The cooler shall be maintained at a temperature of 0°C to 4°C by ice or refrigerator. If water is removed by condensation, the sample gas temperature or dew point shall be monitored either within the water trap or downstream. The sample gas temperature or dew point shall not exceed 7°C.

1.3 The analysers shall have a measuring range appropriate for the accuracy required to measure the concentrations of the exhaust gas components (see 1.6) and 5.9.7.1 of this Code. It is recommended that the analysers be operated such that the measured concentration falls between 15% and 100% of full scale, where full scale refers to the measurement range used.

1.4 If the full-scale value is 155 ppm (or ppmC) or less, or if read-out systems (computers, data loggers) that provide sufficient accuracy and resolution below 15% of full scale are used, concentrations below 15% of full scale are also acceptable. In this case, additional calibrations are to be made to ensure the accuracy of the calibration curves.

1.5 The electromagnetic compatibility (EMC) of the equipment shall be such as to minimize additional errors.

1.6 Accuracy

1.6.1 Definitions

ISO 5725-1: 1994/Cor 1: 1998, Accuracy (trueness and precision) of measurement methods and results – Part 1: General principles and definitions, Technical Corrigendum 1.

ISO 5725-2: 1994, Accuracy (trueness and precision) of measurement methods and results – Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method.

1.6.2 An analyser shall not deviate from the nominal calibration point by more than ± 2% of the reading over the whole measurement range except zero, or ± 0.3% of full scale, whichever is larger. The accuracy shall be determined according to the calibration requirements laid down in section 5 of appendix IV of this Code.

1.7 Precision

The precision, defined as 2.5 times the standard deviation of 10 repetitive responses to a given calibration or span gas, shall be not greater than ± 1% of full-scale concentration for each range used above 100 ppm (or ppmC) or ± 2% of each range used below 100 ppm (or ppmC).

1.8 Noise

The analyser peak-to-peak response to zero and calibration or span gases over any 10-second period shall not exceed 2% of full scale on all ranges used.

1.9 Zero drift

Zero response is defined as the mean response, including noise, to a zero gas during a 30-second time interval. The drift of the zero response during a one-hour period shall be less than 2% of full scale on the lowest range used.

1.10 Span drift

Span response is defined as the mean response, including noise, to a span gas during a 30-second time interval. The drift of the span response during a one-hour period shall be less than 2% of full scale on the lowest range used.

2 Gas drying

Exhaust gases may be measured wet or dry. A gas-drying device, if used, shall have a minimal effect on the composition of the measured gases. Chemical dryers are not an acceptable method of removing water from the sample.

3 Analysers

Sections 3.1 to 3.5 describe the measurement principles to be used. The gases to be measured shall be analysed with the following instruments. For non-linear analysers, the use of linearizing circuits is permitted.

3.1 Carbon monoxide (CO) analysis

The carbon monoxide analyser shall be of the non-dispersive infrared (NDIR) absorption type.

3.2 Carbon dioxide (CO_2) analysis

The carbon dioxide analyser shall be of the non-dispersive infrared (NDIR) absorption type.

3.3 Hydrocarbon (HC) analysis

The hydrocarbon analyser shall be of the heated flame ionization detector (HFID) type with detector, valves, pipe-work and associated components heated so as to maintain a gas temperature of 190°C ± 10°C.

3.4 Nitrogen oxides (NO_x) analysis

The nitrogen oxides analyser shall be of the chemiluminescent detector (CLD) or heated chemiluminescent detector (HCLD) type with an NO_2/NO converter, if measured on a dry basis. If measured on a wet basis, a HCLD with converter maintained above 55°C shall be used, provided the water quench check (see section 9.2.2 of appendix IV of this Code) is satisfied. For both CLD and HCLD, the sampling path shall be maintained at a wall temperature of 55°C to 200°C up to the converter for dry measurement, and up to the analyser for wet measurement.

3.5 Oxygen (O_2) analysis

The oxygen analyser shall be of the paramagnetic detector (PMD), zirconium dioxide (ZRDO) or electrochemical sensor (ECS) type.

Appendix IV

Calibration of the analytical and measurement instruments
(Refer to chapters 5 and 6 of the NO_x Technical Code 2008)

1 Introduction

1.1 Each analyser used for the measurement of an engine's parameters shall be calibrated as often as necessary in accordance with the requirements of this appendix.

1.2 Except as otherwise specified, all results of measurements, test data or calculations required by this appendix shall be recorded in the engine's test report in accordance with section 5.10 of this Code.

1.3 *Accuracy of measuring instruments*

1.3.1 The calibration of all measuring instruments shall comply with the requirements as set out in tables 1, 2, 3 and 4 and shall be traceable to standards recognized by the Administration. Additional engine measurements may be required by the Administration, and such additional measuring instruments used shall comply with the appropriate deviation standard and calibration validity period.

1.3.2 The instruments shall be calibrated:

.1 in time intervals not greater than as given in tables 1, 2, 3 and 4; or

.2 in accordance with alternative calibration procedures and validity periods subject to such proposals being submitted in advance of the tests and approved by the Administration.

Note: The deviations given in tables 1, 2, 3, and 4 refer to the final recorded value, which is inclusive of the data acquisition system.

Table 1
Permissible deviations and calibration validity periods of instruments for engine-related parameters for measurements on a test bed

No.	Measurement instrument	Permissible deviation	Calibration validity period (months)
1	Engine speed	± 2% of reading or ± 1% of engine's maximum value, whichever is larger	3
2	Torque	± 2% of reading or ± 1% of engine's maximum value, whichever is larger	3

No.	Measurement instrument	Permissible deviation	Calibration validity period (months)
3	Power (where measured directly)	± 2% of reading or ± 1% of engine's maximum value, whichever is larger	3
4	Fuel consumption	± 2% of engine's maximum value	6
5	Air consumption	± 2% of reading or ± 1% of engine's maximum value, whichever is larger	6
6	Exhaust gas flow	± 2.5% of reading or ± 1.5% of engine's maximum value, whichever is larger	6

Table 2

Permissible deviations and calibration interval periods of instruments for other essential parameters for measurements on a test bed

No.	Measurement instrument	Permissible deviation	Calibration validity period (months)
1	Temperatures ≤ 327°C	± 2°C absolute	3
2	Temperatures > 327°C	± 1% of reading	3
3	Exhaust gas pressure	± 0.2 kPa absolute	3
4	Charge air pressure	± 0.3 kPa absolute	3
5	Atmospheric pressure	± 0.1 kPa absolute	3
6	Other pressures ≤ 1000 kPa	± 20 kPa absolute	3
7	Other pressures > 1000 kPa	± 2% of reading	3
8	Relative humidity	± 3% absolute	1

Table 3
Permissible deviations and calibration validity periods of instruments for engine-related parameters for measurements on board a ship when the engine is already pre-certified

No.	Measurement instrument	Permissible deviation	Calibration validity period (months)
1	Engine speed	± 2% of engine's maximum value	12
2	Torque	± 5% of engine's maximum value	12
3	Power (where measured directly)	± 5% of engine's maximum value	12
4	Fuel consumption	± 4% of engine's maximum value	12
5	Air consumption	± 5% of engine's maximum value	12
6	Exhaust gas flow	± 5% of engine's maximum value	12

Table 4
Permissible deviations calibration validity period of instruments for other essential parameters for measurements on board a ship when the engine is already pre-certified

No.	Measurement instrument	Permissible deviation	Calibration validity period (months)
1	Temperatures ≤ 327°C	± 2°C absolute	12
2	Temperatures > 327°C	± 15°C absolute	12
3	Exhaust gas pressure	± 5% of engine's maximum value	12
4	Charge air pressure	± 5% of engine's maximum value	12
5	Atmospheric pressure	± 0.5% of reading	12
6	Other pressures	± 5 % of reading	12
7	Relative humidity	± 3% absolute	6

2 Calibration gases and zero and span check gases

The shelf life of all calibration gases and span and zero check gases shall be respected. The expiry date of the calibration gases and the zero and span check gases, stated by the manufacturer, shall be recorded.

2.1 *Pure gases (including zero check gases)*

2.1.1 The required purity of the gases is defined by the contamination limits given below. The following gases shall be available:

.1 purified nitrogen (contamination $\leq$ 1 ppmC, $\leq$ 1 ppm CO, $\leq$ 400 ppm CO_2, $\leq$ 0.1 ppm NO);

.2 purified oxygen (purity > 99.5% volume O_2);

.3 hydrogen-helium mixture (40 ± 2% hydrogen, balance helium), (contamination $\leq$ 1 ppmC, $\leq$ 400 ppm CO_2); and

.4 purified synthetic air (contamination $\leq$ 1 ppmC, $\leq$ 1 ppm CO, $\leq$ 400 ppm CO_2, $\leq$ 0.1 ppm NO (oxygen content 18% – 21% volume).

2.2 *Calibration and span gases*

2.2.1 Mixtures of gases having the following chemical compositions shall be available:

.1 CO and purified nitrogen;

.2 NO_x and purified nitrogen the amount of NO_2 contained in this calibration gas shall not exceed 5% of the NO content);

.3 O_2 and purified nitrogen;

.4 CO_2 and purified nitrogen; and

.5 CH_4 and purified synthetic air or C_3H_8 and purified synthetic air.

Note: Other gas combinations are allowed provided the gases do not react with one another.

2.2.2 The true concentration of a calibration and span gas must be within ± 2% of the nominal value. All concentrations of calibration and span gases shall be given on a volume basis (volume per cent or volume ppm).

2.2.3 The gases used for calibration and span may also be obtained by means of precision blending devices (gas dividers), diluting with purified N_2 or with purified synthetic air. The accuracy of the mixing device must be such that the concentration of the blended calibration gases is accurate to within ±2%. This accuracy implies that primary gases used for blending must be known to an accuracy of at least ±1%, traceable to national or international gas standards. The verification shall be performed at between 15 and 50% of full scale for each calibration incorporating a blending device. Optionally, the blending device may be checked with an instrument that by nature is linear, e.g., using NO gas with a CLD. The span value of the instrument shall be adjusted with the span gas directly connected to the instrument. The blending device shall be checked at the used settings and the nominal value shall be compared to the measured concentration of the instrument. This difference shall in each point be within ±1% of the nominal value. This linearity check of the gas divider shall not be performed with a gas analyser that was previously linearized with the same gas divider.

2.2.4 Oxygen interference check gases shall contain propane or methane with 350 ppmC ± 75 ppmC hydrocarbon. The concentration shall be determined to calibration gas tolerances by chromatographic analysis of total hydrocarbons plus impurities or by dynamic bleeding. Nitrogen shall be the predominant diluent with the balance oxygen. Blends required are listed in table 5.

Table 5

Oxygen interference check gases

O_2 concentration	Balance
21 (20 to 22)	Nitrogen
10 (9 to 11)	Nitrogen
5 (4 to 6)	Nitrogen

3 Operating procedure for analysers and sampling system

The operating procedure for analysers shall follow the start-up and operating instructions of the instrument manufacturer. The minimum requirements given in sections 4 to 9 shall be included.

4 Leakage test

4.1 A system leakage test shall be performed. The probe shall be disconnected from the exhaust system and the end plugged. The analyser pump shall be switched on. After an initial stabilization period all flow meters shall read zero. If not, the sampling lines shall be checked and the fault corrected.

4.2 The maximum allowable leakage rate on the vacuum side shall be 0.5% of the in-use flow rate for the portion of the system being checked. The analyser flows and bypass flows may be used to estimate the in-use flow rates.

4.3 Another method is the introduction of a concentration step change at the beginning of the sampling line by switching from zero to span gas. If after an adequate period of time the reading shows a lower concentration compared to the introduced concentration, this points to calibration or leakage problems.

4.4 Other arrangements may be acceptable subject to approval of the Administration.

5 Calibration procedure

5.1 *Instrument assembly*

The instrument assembly shall be calibrated and the calibration curves checked against standard gases. The same gas flow rates shall be used as when sampling exhaust.

5.2 *Warming-up time*

The warming-up time shall be according to the recommendations of the analyser's manufacturer. If not specified, a minimum of two hours is recommended for warming up the analysers.

5.3 *NDIR and HFID analysers*

The NDIR analyser shall be tuned, as necessary. The HFID flame shall be optimized as necessary.

5.4 *Calibration*

5.4.1 Each normally used operating range shall be calibrated. Analysers shall be calibrated not more than 3 months before being used for testing or whenever a system repair or change is made that can influence calibration, or as per provided for by 1.3.2.2.

5.4.2 Using purified synthetic air (or nitrogen) the CO, CO_2, NO_x and O_2 analysers shall be set at zero. The HFID analyser shall be set to zero using purified synthetic air.

5.4.3 The appropriate calibration gases shall be introduced to the analysers, the values recorded, and the calibration curve established accordingly.

5.5 *Establishment of the calibration curve*

5.5.1 General Guidance

5.5.1.1 The calibration curve shall be established by at least 6 calibration points (excluding zero) approximately equally spaced over the operating range from zero to the highest value expected during emissions testing.

5.5.1.2 The calibration curve shall be calculated by the method of least-squares. A best-fit linear or non-linear equation may be used.

5.5.1.3 The calibration points shall not differ from the least-squares best-fit line by more than ± 2% of reading or ± 0.3% of full scale, whichever is larger.

5.5.1.4 The zero setting shall be rechecked and the calibration procedure repeated, if necessary.

5.5.1.5 If it can be shown that alternative calibration methods (e.g., computer, electronically controlled range switch, etc.) can give equivalent accuracy, then these alternatives may be used subject to the approval by the Administration.

6 Verification of the calibration

6.1 Each normally used operating range shall be checked prior to each analysis in accordance with the following procedure:

.1 the calibration shall be checked by using a zero gas and a span gas whose nominal value shall be more than 80% of full scale of the measuring range; and

.2 if, for the two points considered, the value found does not differ by more than ± 4% of full scale from the declared reference value, the adjustment parameters may be modified. If this is not the case, a new calibration curve shall be established in accordance with 5.5 above.

7 Efficiency test of the NO_x converter

The efficiency of the converter used for the conversion of NO_2 into NO shall be tested as given in 7.1 to 7.10 below.

7.1 *Test set-up*

Using the test set-up as schematically shown in figure 1 and the procedure below, the efficiency of converter shall be tested by means of an ozonator.

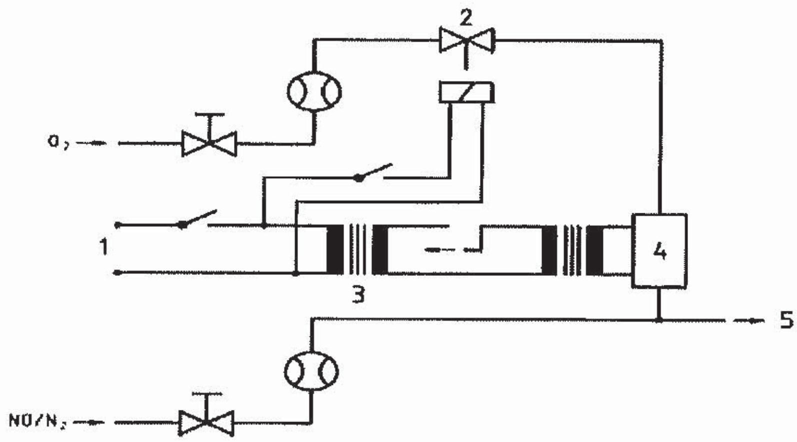


Figure 1 – Schematic representation of NO_2 converter efficiency device

1	AC	4	Ozonator
2	Solenoid valve	5	To analyser
3	Variac		

7.2 *Calibration*

The CLD and the HCLD shall be calibrated in the most common operating range following the manufacturer's specifications using zero and span gas (the NO content of which must amount to about 80% of the operating range and the NO_2 concentration of the gas mixture to less than 5% of the NO concentration). The NO_x analyser must be in the NO mode so that the span gas does not pass through the converter. The indicated concentration shall be recorded.

7.3 *Calculation*

The efficiency of the NO_x converter shall be calculated as follows:

3. $$E_{NOx} = \left(1 + \frac{a-b}{c-d}\right) \cdot 100 \qquad (1)$$

where:

a = NO_x concentration according to 7.6 below
b = NO_x concentration according to 7.7 below
c = NO concentration according to 7.4 below
d = NO concentration according to 7.5 below.

7.4 *Adding of oxygen*

7.4.1 Via a T-fitting, oxygen or zero air is added continuously to the gas flow until the concentration indicated is about 20% less than the indicated calibration concentration given in 7.2 above. The analyser must be in the NO mode.

7.4.2 The indicated concentration (*c*) shall be recorded. The ozonator must be kept deactivated throughout the process.

7.5 *Activation of the ozonator*

The ozonator shall then be activated to generate enough ozone to bring the NO concentration down to about 20% (minimum 10%) of the calibration concentration given in 7.2 above. The indicated concentration (*d*) shall be recorded. The analyser must be in the NO mode.

7.6 *NO_x mode*

The NO analyser shall then be switched to the NO_x mode so that the gas mixture (consisting of NO, NO_2, O_2 and N_2) now passes through the converter. The indicated concentration (*a*) shall be recorded. The analyser must be in the NO_x mode.

7.7 *Deactivation of the ozonator*

The ozonator is then deactivated. The mixture of gases described in 7.6 above passes through the converter into the detector. The indicated concentration (*b*) shall be recorded. The analyser is in the NO_x mode.

7.8 *NO mode*

Switched to NO mode with the ozonator deactivated, the flow of oxygen or synthetic air shall also be shut off. The NO_x reading of the analyser shall not deviate by more than 5% from the value measured according to 7.2 above. The analyser must be in the NO mode.

7.9 *Test interval*

The efficiency of the converter shall be tested prior to each calibration of the NO_x analyser.

7.10 *Efficiency requirement*

The efficiency of the converter shall not be less than 90%.

8 Adjustment of the HFID

8.1 *Optimization of the detector response*

8.1.1 The HFID shall be adjusted as specified by the instrument manufacturer. A propane in air span gas shall be used to optimize the response on the most common operating range.

8.1.2 With the fuel and air flow rates set at the manufacturer's recommendations, a 350 ± 75 ppmC span gas shall be introduced to the analyser. The response at a given fuel flow shall be determined from the difference between the span gas response and the zero gas response. The fuel flow shall be incrementally adjusted above and below the manufacturer's specification. The span and zero response at these fuel flows shall be recorded. The difference between the span and zero response shall be plotted and the fuel flow adjusted to the rich side of the curve. This is the initial flow rate setting, which may need further optimization depending on the results of the hydrocarbon response factors and the oxygen interference check according to 8.2 and 8.3.

8.1.3 If the oxygen interference or the hydrocarbon response factors do not meet the following specifications, the air flow shall be incrementally adjusted above and below the manufacturer's specifications, 8.2 and 8.3 for each flow.

8.1.4 The optimization may optionally be conducted using alternative procedures subject to the approval of the Administration.

8.2 *Hydrocarbon response factors*

8.2.1 The analyser shall be calibrated using propane in air and purified synthetic air, according to 5.

8.2.2 Response factors shall be determined when introducing an analyser into service and after major service intervals. The response factor (r_h) for a particular hydrocarbon species is the ratio of the HFID ppmC reading to the gas concentration in the cylinder expressed in terms of ppmC.

8.2.3 The concentration of the test gas must be at a level to give a response of approximately 80% of full scale. The concentration must be known to an accuracy of ± 2% in reference to a gravimetric standard expressed in volume. In addition, the gas cylinder must be preconditioned for 24 hours at a temperature of 25°C ± 5°C.

8.2.4 The test gases to be used and the recommended relative response factor ranges are as follows:

– Methane and purified synthetic air $1.00 \leq r_h \leq 1.15$
– Propylene and purified synthetic air $0.90 \leq r_h \leq 1.1$
– Toluene and purified synthetic air $0.90 \leq r_h \leq 1.1$.

These values are relative to a r_h of 1 for propane and purified synthetic air.

8.3 *Oxygen interference check*

8.3.1 The oxygen interference check shall be determined when introducing an analyser into service and after major service intervals.

8.3.2 A range shall be chosen where the oxygen interference check gases will fall in the upper 50%. The test shall be conducted with the oven temperature set as required. The oxygen interference gases are specified in 2.2.4.

.1 The analyser shall be zeroed.

.2 The analyser shall be spanned with the 21% oxygen blend.

.3 The zero response shall be re-checked. If it has changed more than 0.5% of full scale (FS) steps 8.3.2.1 and 8.3.2.2 shall be repeated.

.4 The 5% and 10% oxygen interference check gases shall be introduced.

.5 The zero response shall be rechecked. If it has changed more than ± 1% of full scale, the test shall be repeated.

.6 The oxygen interference (%O_2I) shall be calculated for each mixture in step .4 as follows:

$$\%O_2I = \frac{(B - analyser\,response)}{B} \cdot 100 \qquad (2)$$

where:

analyser response is (A/% FS at A) · (%FS at B)

where:

A = hydrocarbon concentration in ppmC (microlitres per litre) of the span gas used in 8.3.2.2

B = hydrocarbon concentration (ppmC) of the oxygen interference check gases used in 8.3.2.4

$$(ppmC) = \frac{A}{D} \qquad (3)$$

D = percentage of full scale analyser response due to A.

.7 The % of oxygen interference (%O_2I) shall be less than ± 3.0% for all required oxygen interference check gases prior to testing.

.8 If the oxygen interference is greater than ± 3.0%, the air flow above and below the manufacturer's specifications shall be incrementally adjusted, repeating 8.1 for each flow.

.9 If the oxygen interference is greater than ± 3.0% after adjusting the air flow, the fuel flow, and thereafter the sample flow shall be varied, repeating 8.1 for each new setting.

.10 If the oxygen interference is still greater than ± 3.0%, the analyser, HFID fuel, or burner air shall be repaired or replaced prior to testing. This clause shall then be repeated with the repaired or replaced equipment or gases.

9 Interference effects with CO, CO_2, NO_x and O_2 analysers

Gases other than the one being analysed can interfere with the reading in several ways. Positive interference occurs in NDIR and PMD instruments where the interfering gas gives the same effect as the gas being measured, but to a lesser degree. Negative interference occurs in NDIR instruments by the interfering gas broadening the absorption band of the measured gas, and in CLD instruments by the interfering gas quenching the radiation. The interference checks in 9.1 and 9.2 shall be performed prior to an analyser's initial use and after major service intervals, but at least once per year.

9.1 *CO analyser interference check*

Water and CO_2 can interfere with the CO analyser performance. Therefore, a CO_2 span gas having a concentration of 80% to 100% of full scale of the maximum operating range used during testing shall be bubbled through water at room temperature and the analyser response recorded. The analyser response must not be more than 1% of full scale for ranges equal to or above 300 ppm or more than 3 ppm for ranges below 300 ppm.

9.2 *NO_x analyser quench checks*

The two gases of concern for CLD (and HCLD) analysers are CO_2 and water vapour. Quench responses to these gases are proportional to their concentrations, and therefore require test techniques to determine the quench at the highest expected concentrations experienced during testing.

9.2.1 CO_2 quench check

9.2.1.1 A CO_2 span gas having a concentration of 80% to 100% of full scale of the maximum operating range shall be passed through the NDIR analyser and the CO_2 value recorded as *A*. It shall then be diluted approximately 50% with NO span gas and passed through the NDIR and (H)CLD, with the CO_2 and NO values recorded as *B* and *C*, respectively. The CO_2 shall then be shut off and only the NO span gas be passed through the (H)CLD and the NO value recorded as *D*.

9.2.1.2 The quench shall be calculated as follows:

$$E_{CO2} = \left[1 - \left(\frac{(C \cdot A)}{(D \cdot A) - (D \cdot B)}\right)\right] \cdot 100 \tag{4}$$

where:

A = the undiluted CO_2 concentration measured with NDIR in percentage by volume;
B = the diluted CO_2 concentration measured with NDIR in percentage by volume;
C = the diluted NO concentration measured with (H)CLD in ppm; and
D = the undiluted NO concentration measured with (H)CLD in ppm.

9.2.1.3 Alternative methods of diluting and quantifying of CO_2 and NO span gas values such as dynamic mixing/blending, can be used.

9.2.2 Water quench check

9.2.2.1 This check applies to wet gas concentration measurements only. Calculation of water quench must consider dilution of the NO span gas with water vapour and scaling of water vapour concentration of the mixture to that expected during testing.

9.2.2.2 An NO span gas having a concentration of 80% to 100% of full scale of the normal operating range shall be passed through the HCLD and the NO value recorded as D. The NO span gas shall then be bubbled through water at a temperature of 25°C ± 5°C and pass through the HCLD and the NO value recorded as C. The water temperature shall be determined and recorded as F. The mixture's saturation vapour pressure that corresponds to the bubbler water temperature (F) shall be determined and recorded as G. The water vapour concentration (H in %) of the mixture shall be calculated as follows:

$$H = 100 \cdot \left(\frac{G}{p_b} \right) \tag{5}$$

The expected diluted NO span gas (in water vapour) concentration (D_e) shall be calculated as follows:

$$D_e = D \cdot \left(1 - \frac{H}{100} \right) \tag{6}$$

For diesel engine exhaust, the maximum exhaust water concentration (in %) expected during testing shall be estimated, under the assumption of a fuel atom H/C ratio of 1.8/1, from the maximum CO_2 concentration A in the exhaust gas as follows:

$$H_m = 0.9 \cdot A \tag{7}$$

and H_m is recorded.

9.2.2.3 The water quench shall be calculated as follows:

$$E_{H2O} = 100 \cdot \left(\frac{D_e - C}{D_e} \right) \cdot \left(\frac{H_m}{H} \right) \tag{8}$$

where:

D_e = the expected diluted NO concentration in ppm;
C = the diluted NO concentration in ppm;
H_m = the maximum water vapour concentration in %; and
H = the actual water vapour concentration in %.

Note: It is important that the NO span gas contains minimal NO_2 concentration for this check, as absorption of NO_2 in water has not been accounted for in the quench calculations.

9.2.3 Maximum allowable quench

The maximum allowable quench shall be:

.1 CO_2 quench according to 9.2.1: 2% of full scale.
.2 Water quench according to 9.2.2: 3% of full scale.

9.3 *O_2 analyser interference*

9.3.1 Instrument response of a PMD analyser caused by gases other than oxygen is comparatively slight. The oxygen equivalents of the common exhaust gas constituents are shown in table 6.

Table 6
Oxygen equivalents

Gas	O_2 equivalent %
Carbon dioxide (CO_2)	– 0.623
Carbon monoxide (CO)	– 0.354
Nitric oxide (NO)	+ 44.4
Nitrogen dioxide (NO_2)	+ 28.7
Water (H_2O)	– 0.381

9.3.2 The observed oxygen concentration shall be corrected by the following formula:

$$E_{O2} = \frac{\left(Equivalent\ O_2 \cdot c_{\text{observed}}\right)}{100} \qquad (9)$$

9.3.3 For ZRDO and ECS analysers, instrument interference caused by gases other than oxygen shall be compensated in accordance with the manufacturer's recommendations and with good engineering practice. Electrochemical sensors shall be compensated for CO_2 and NO_x interference.

Appendix V

Parent engine test report and test data
(Refer to 2.4.1.5 and 5.10 of the NO_x Technical Code 2008)

Section 1 – Parent engine test report – see 5.10 of the Code

Emissions test report No. .... **Sheet 1/5**

Engine			
Manufacturer			
Engine type			
Engine family or engine group identification			
Serial number			
Rated speed			rpm
Rated power			kW
Intermediate speed			rpm
Maximum torque at intermediate speed			Nm
Static injection timing			deg CA BTDC
Electronic injection control	No:	Yes:	
Variable injection timing	No:	Yes:	
Variable turbocharger geometry	No:	Yes:	
Bore			mm
Stroke			mm
Nominal compression ratio			
Mean effective pressure, at rated power			kPa
Maximum cylinder pressure, at rated power			kPa
Cylinder number and configuration	Number:	V:	In-line:
Auxiliaries			
Specified ambient conditions:			
Maximum seawater temperature			°C
Maximum charge air temperature, if applicable			°C
Cooling system spec. intermediate cooler	No:	Yes:	
Cooling system spec. charge air stages			
Low/high temperature cooling system set points	/		°C
Maximum inlet depression			kPa
Maximum exhaust back pressure			kPa
Fuel oil specification			
Fuel oil temperature			°C

Emissions test results:				
Cycle				
NO_x				g/kWh
Test identification				
Date/time				
Test site/bench				
Test number				
Surveyor				
Date and place of report				
Signature				

Emissions test report No. .... Engine family information Sheet 2/5

Engine family/engine group information (common specifications)	
Combustion cycle	2-stroke cycle/4-stroke cycle
Cooling medium	Air/Water
Cylinder configuration	Required to be written, only if the exhaust cleaning devices are applied
Method of aspiration	Natural aspired/Pressure charged
Fuel type to be used on board	Distillate/distillate or heavy fuel/dual
Combustion chamber	Open chamber/Divided chamber
Valve port configuration	Cylinder head/Cylinder wall
Valve port size and number	
Fuel system type	

Miscellaneous features:	
Exhaust gas recirculation	No/Yes
Water injection/emulsion	No/Yes
Air injection	No/Yes
Charge cooling system	No/Yes
Exhaust after-treatment	No/Yes
Exhaust after-treatment type	
Dual fuel	No/Yes

Engine family/engine group information (selection of parent engine for test-bed test)					
Family/group identification					
Method of pressure charging					
Charge air cooling system					
Criteria of the selection of parent engine	Highest NO_x emission value				
Number of cylinders					
Max. rated power per cylinder					
Rated speed					
Injection timing (range)					
Selected parent engine					Parent
Test cycle(s)					

Emissions test report No. .... **Test cell information** **Sheet 3/5**

Exhaust pipe	
Diameter	mm
Length	m
Insulation	No: Yes:
Probe location	

Measurement equipment					
	Manufacturer	Model	Measurement ranges	Calibration	
				Span gas conc.	Deviation of calibration
Analyser					
NO_x Analyser			ppm		%
CO Analyser			ppm		%
CO_2 Analyser			%		%
O_2 Analyser			%		%
HC Analyser			ppmC		%
Speed			rpm		%
Torque			Nm		%
Power, if applicable			kW		%
Fuel flow					%
Air flow					%
Exhaust flow					%
Temperatures					
Charge air coolant inlet			°C		°C
Exhaust gas			°C		°C
Inlet air			°C		°C
Charge air			°C		°C
Fuel			°C		°C
Pressures					
Exhaust gas			kPa		kPa
Charge air			kPa		kPa
Atmospheric			kPa		kPa
Vapour pressure					
Intake air			kPa		%
Humidity					
Intake air			%		%

Fuel characteristics

Fuel type				
Fuel properties:			**Fuel elemental analysis:**	
Density	ISO 3675	kg/m^3	Carbon	% m/m
Viscosity	ISO 3104	mm^2/s	Hydrogen	% m/m
Water	ISO 3733	% V/V	Nitrogen	% m/m
			Oxygen	% m/m
			Sulphur	% m/m
			LHV/Hu	MJ/kg

Emissions test report No. .... **Ambient and gaseous emissions data** **Sheet 4/5**

Mode		1	2	3	4	5	6	7	8	9	10
Power/torque	%										
Speed	%										
Time at beginning of mode											

Ambient data											
Atmospheric pressure	kPa										
Intake air temperature	°C										
Intake air humidity	g/kg										
Relative humidity (RH) of intake air*	%										
Air temperature at RH sensor*	°C										
Dry bulb temperature of intake air*	°C										
Wet bulb temperature of intake air*	°C										
Test condition parameter, *fa*											

Gaseous emissions data:										
NO_x concentration dry/wet ppm										
CO concentration ppm										
CO_2 concentration %										
O_2 concentration dry/wet %										
HC concentration ppmC										
NO_x humidity correction factor, k_{hd}										
Dry/wet correction factor, k_{wr}										
NO_x mass flow kg/h										
CO mass flow kg/h										
CO_2 mass flow kg/h										
O_2 mass flow kg/h										
HC mass flow kg/h										
NO_x specific g/kWh										

* As applicable.

Emissions test report No. .... **Engine test data** **Sheet 5/5**

Mode		1	2	3	4	5	6	7	8	9	10
Power/torque	%										
Speed	%										
Time at beginning of mode											

Engine data											
Speed	rpm										
Auxiliary power	kW										
Dynamometer setting	kW										
Power	kW										
Mean effective pressure	kPa										
Fuel rack	mm										
Uncorrected spec. fuel consumption	g/kWh										
Fuel flow	kg/h or m^3/h*										
Air flow	kg/h										
Exhaust flow (q_{mew})	kg/h										
Exhaust temperature	°C										
Exhaust back pressure	kPa										
Charge air coolant temperature in	°C										
Charge air coolant temperature out	°C										
Charge air temperature	°C										
Charge air reference temperature	°C										
Charge air pressure	kPa										
Fuel oil temperature	°C										

* As applicable.

Section 2 – Parent engine test data to be included in the technical file – see 2.4.1.5 of the Code

Engine family/engine group reference		
Parent engine		
Model/type		
Nominated rated power	kW	
Nominated rated speed	rpm	

Parent engine test fuel oil		
Reference fuel designation		
ISO 8217: 2005 grade (DM or RM)		
Carbon	% m/m	
Hydrogen	% m/m	
Sulphur	% m/m	
Nitrogen	% m/m	
Oxygen	% m/m	
Water	% V/V	

Measured data (parent engine)									
Power/torque	%								
Speed	%								
Mode point		1	2	3	4	5	6	7	8
Engine performance									
Power	kW								
Speed	rpm								
Fuel flow	kg/h								
Intake air flow (wet/dry)	kg/h								
Exhaust gas flow	kg/h								
Intake air temperature	°C								
Charge air temperature	°C								
Charge air reference temperature	°C								
Charge air pressure	kPa								
Additional parameter(s) used for emission corrections (specify)									
Ambient conditions									
Atmospheric pressure	kPa								
Relative humidity (RH) of intake air	%								
Air temperature at RH sensor*	°C								
Dry bulb temperature of intake air*	°C								
Wet bulb temperature of intake air*	°C								
Absolute humidity of intake air*	g/kg								

Emission concentrations									
NO_x wet/dry	ppm								
CO_2	%								
O_2 wet/dry	%								
CO	ppm								
HC	ppmC								
Calculated data (parent engine)									
Intake air humidity	g/kg								
Charge air humidity	g/kg								
Test condition parameter, f_a									
Dry/wet correction factor, k_{wr}									
NO_x humidity correction factor, k_{hd}									
Exhaust gas flow rate	kg/h								
NO_x emission flow rate	kg/h								
Additional emission correction factor(s) (specify)	g/kWh								
NO_x emission	g/kWh								

Test cycle					
Emission value	g/kWh				

* As applicable.

Appendix VI

Calculation of exhaust gas mass flow (carbon-balance method)
(Refer to chapter 5 of the NO_x Technical Code 2008)

1 Introduction

1.1 This appendix addresses the calculation of the exhaust gas mass flow based on exhaust gas concentration measurement, and on the knowledge of fuel consumption. Symbols and descriptions of terms and variables used in the formulae for the carbon-balance measurement method are summarized in the introduction of this Code.

1.2 Except as otherwise specified, all results of calculations required by this appendix shall be reported in the engine's test report in accordance with 5.10 of this Code.

2 Carbon balance method, 1-step calculation procedure

2.1 This method involves exhaust mass calculation from fuel consumption, fuel composition and exhaust gas concentrations.

2.2 Exhaust gas mass flow rate on wet basis:

$$q_{mew} = q_{mf} \cdot \left(\left(\frac{\dfrac{1.4 \cdot (w_{BET} \cdot w_{BET})}{\left(\dfrac{(1.4 \cdot w_{BET})}{f_c} + (w_{ALF} \cdot 0.08936) - 1 \right) \cdot \dfrac{1}{1.293} + f_{fd}}}{f_c \cdot f_c} + (w_{ALF} \cdot 0.08936) - 1 \right) \cdot \left(1 + \frac{H_a}{1000} \right) + 1 \right) \quad (1)$$

with:

f_{fd} according to equation (2), f_c according to equation (3).
H_a is the absolute humidity of intake air, in gram water per kg dry air. However, if $H_a \geq H_{SC}$, then H_{SC} shall be used in place of H_a in formula (1).

Note: H_a may be derived from relative humidity measurement, dewpoint measurement, vapour pressure measurement or dry/wet bulb measurement using the generally accepted formulae.

2.3 The fuel-specific constant f_{fd} for the dry exhaust shall be calculated by adding up the additional volumes of the combustion of the fuel elements:

$$f_{fd} = -0.055593 \cdot w_{ALF} + 0.008002 \cdot w_{DEL} + 0.0070046 \cdot w_{EPS} \quad (2)$$

2.4 Carbon factor f_c according to equation (3):

$$f_c = (c_{CO2d} - c_{CO2ad}) \cdot 0.5441 + \frac{c_{COd}}{18522} + \frac{c_{HCw}}{17355} \qquad (3)$$

with

c_{CO2d} = dry CO_2 concentration in the raw exhaust, %

c_{CO2ad} = dry CO_2 concentration in the ambient air, % = 0.03%

c_{COd} = dry CO concentration in the raw exhaust, ppm

c_{HCw} = wet HC concentration in the raw exhaust, ppm.

Appendix VII

Checklist for an engine parameter check method
(Refer to 6.2.2.5 of the NO_x Technical Code 2008)

1 For some of the parameters listed below, more than one survey possibility exists. In such cases, as a guideline, any one of, or a combination of, the below-listed methods may be sufficient to show compliance. As approved by the Administration, the shipowner, supported by the applicant for engine certification, may choose which method is applicable.

.1 parameter "injection timing":

.1 Fuel cam position (individual cam or camshaft if cams are not adjustable):

- optional (dependent on design): position of a link between the cam and the pump drive,
- optional for sleeve-metered pumps: variable injection timing (VIT) index and cam position or position of the barrel, or
- other sleeve-metering device;

.2 start of delivery for certain fuel rack positions (dynamic pressure measurement);

.3 opening of injection valve for certain load points, e.g., using a Hall sensor or acceleration pick-up;

.4 load-dependent operating values for charge air pressure, combustion peak pressure, charge air temperature, exhaust gas temperature versus graphs showing the correlation with NO_x. Additionally, it shall be ensured that the compression ratio corresponds to the initial certification value (see 1.7).

Note: To assess the actual timing, it is necessary to know the allowable limits for meeting the emission limits or even graphs showing the influence of timing on NO_x, based on the test-bed measurement results.

.2 parameter "injection nozzle":

.1 specification and component identification number;

.3 parameter "injection pump":

.1 component identification number (specifying plunger and barrel design);

.4 parameter "fuel cam":

.1 component identification number (specifying shape);

.2 start and end of delivery for a certain fuel rack position (dynamic pressure measurement);

.5 parameter "injection pressure":

.1 only for common-rail systems: load-dependent pressure in the rail, graph showing correlation with NO_x;

.6 parameter "combustion chamber":

.1 component identification numbers for the cylinder head and piston head;

.7 parameter "compression ratio":

.1 check for actual clearance;

.2 check for shims in piston rod or connecting rod;

.8 parameter "turbocharger type and build":

.1 model and specification (identification numbers);

.2 load-dependent charge air pressure, graph showing the correlation with NO_x;

.9 parameter "charge air cooler, charge air heater":

.1 model and specification;

.2 load-dependent charge air temperature corrected to reference conditions, graph showing the correlation with NO_x;

.10 parameter "valve timing" (only for 4-stroke engines with inlet valve closure before bottom dead centre (BDC)):

.1 cam position;

.2 check actual timing;

.11 parameter "water injection" (for assessment: graph showing influence on NO_x):

.1 load-dependent water consumption (monitoring);

.12 parameter "emulsified fuel" (for assessment: graph showing influence on NO_x):

.1 load-dependent fuel rack position (monitoring);

.2 load-dependent water consumption (monitoring);

.13 parameter "exhaust gas recirculation" (for assessment: graph showing influence on NO_x):

.1 load-dependent mass flow of recirculated exhaust gas (monitoring);

.2 CO_2 concentration in the mixture of fresh air and recirculated exhaust gas, i.e. in the "scavenge air" (monitoring);

.3 O_2 concentration in the "scavenge air" (monitoring);

.14 parameter "selective catalytic reduction" (SCR):

.1 load-dependent mass flow of reducing agent (monitoring) and additional periodical spot checks on NO_x concentration after SCR (for assessment: graph showing influence on NO_x).

2 For engines with selective catalytic reduction (SCR) without feedback control, optional NO_x measurement (periodical spot checks or monitoring) is useful to show that the SCR efficiency still corresponds to the state at the time of certification regardless of whether the ambient conditions or the fuel quality led to different raw emissions.

Appendix VIII

Implementation of the direct measurement and monitoring method
(Refer to 6.4 of the NO_x Technical Code 2008)

1 Electrical equipment: materials and design

1.1 Electrical equipment shall be constructed of durable, flame-retardant, moisture-resistant materials that are not subject to deterioration in the installed environment and at the temperatures to which the equipment is likely to be exposed.

1.2 Electrical equipment shall be designed such that current carrying parts with potential to earth are protected against accidental contact.

2 Analysing equipment

2.1 *Analysers*

2.1.1 The exhaust gases shall be analysed with the following instruments. For non-linear analysers, the use of linearizing circuits is permitted. Other systems or analysers may be accepted, subject to the approval of the Administration, provided they yield equivalent results to that of the equipment referenced below:

.1 Nitrogen oxides (NO_x) analysis

The nitrogen oxides analyser shall be of the chemiluminescent detector (CLD) or heated chemiluminescent detector (HCLD) type. The exhaust gas sampled for NO_x measurement shall be maintained above its dewpoint temperature until it has passed through the NO_2-to-NO converter.

Note: In the case of raw exhaust gas this temperature shall be greater than 60°C if the engine is fuelled with ISO 8217: 2005 DM-grade type fuel and greater than 140°C if fuelled with ISO 8217: 2005 RM-grade type fuel.

.2 Carbon dioxide (CO_2) analysis

When required, the carbon dioxide analyser shall be of the non-dispersive infrared (NDIR) absorption type.

.3 Carbon monoxide (CO) analysis

When required, the carbon monoxide analyser shall be of the (NDIR) absorption type.

.4 Hydrocarbon (HC) analysis

When required, the hydrocarbon analyser shall be of the heated flame ionization detector (HFID) type. The exhaust gas sampled for HC measurement shall be maintained at 190°C ±10°C from the sample point to the detector.

.5 Oxygen (O_2) analysis

When required, the oxygen analyser shall be of the paramagnetic detector (PMD), zirconium dioxide (ZRDO) or electrochemical sensor (ECS) type.

2.2 *Analyser specifications*

2.2.1 The analyser specifications shall be consistent with 1.6, 1.7, 1.8, 1.9 and 1.10 of appendix III of this Code.

2.2.2 The analyser range shall be such that the measured emission value is within 15% – 100% of the range used.

2.2.3 The analysing equipment shall be installed and maintained in accordance with manufacturers' recommendations in order to meet the requirements of 1.7, 1.8, 1.9, and 1.10 of appendix III of this Code and sections 7 and 9 of appendix IV of this Code.

3 Pure and calibration gases

3.1 Pure and calibration gases, as required, shall comply with 2.1 and 2.2 of appendix IV of this Code. Declared concentrations shall be traceable to national and/or international standards. Calibration gases shall be in accordance with the analysing equipment manufacturers' recommendations.

3.2 Analyser span gases shall be between 80% – 100% of the analyser scale being spanned.

4 Gas sampling and transfer system

4.1 The exhaust gas sample shall be representative of the average exhaust emission from all the engine's cylinders. The gas sampling system shall comply with 5.9.3 of this Code.

4.2 The exhaust gas sample shall be drawn from a zone within 10% to 90% of the duct diameter.

4.3 In order to facilitate the installation of the sampling probe, an example of a sample point connection flange is given in section 5.

4.4 The exhaust gas sample for NO_x measurement shall be maintained so as to prevent NO_2 loss via water or acid condensation in accordance with analysing equipment manufacturers' recommendations.

4.5 The gas sample shall not be dried by chemical driers.

4.6 The gas sampling system shall be capable of being verified to be free of ingress leakage in accordance with analysing equipment manufacturers' recommendations.

4.7 An additional sample point adjacent to that used shall be provided to facilitate quality control checks on the system.

5 Sample point connection flange

5.1 The following is an example of a general purpose sample point connection flange, which shall be sited, as convenient, on the exhaust duct of each engine for which it may be required to demonstrate compliance by means of the direct measurement and monitoring method.

Description	Dimension
Outer diameter	160 mm
Inner diameter	35 mm
Flange thickness	9 mm
Bolt circle diameter 1	130 mm
Bolt circle diameter 2	65 mm
Flange slots	4 holes, each 12 mm diameter, equidistantly placed on each of the above bolt circle diameters. Holes on the two bolt circle diameters to be aligned on same radii. Flange to be slotted, 12 mm wide, between inner and outer bolt circle diameter holes.
Bolts and nuts	4 sets, diameter and length as required.
Flange shall be of steel and be finished with a flat face.	

5.2 The flange shall be fitted to a stub pipe of suitable gauge material aligned with the exhaust duct diameter. The stub pipe shall be no longer than necessary to project beyond the exhaust duct cladding, sufficient to enable access to the far side of the flange. The stub pipe shall be insulated. The stub pipe shall terminate at an accessible position free from nearby obstructions that would interfere with the location or mounting of a sample probe and associated fittings.

5.3 When not in use, the stub pipe shall be closed with a steel blank flange and a gasket of suitable heat resisting material. The sampling flange, and closing blank flange, when not in use, shall be covered with a readily removable and suitable heat resistant material that protects against accidental contact.

6 Selection of load points and revised weighting factors

6.1 As provided for by 6.4.6.4 of this Code, in the case of the E2, E3 or D2 test cycles, the minimum number of load points shall be such that the combined nominal weighting factors, as given in 3.2 of this Code, are greater than 0.5.

6.2 In accordance with 6.1, for the E2 and E3 test cycles it would be necessary to use the 75% load point plus one or more other load points. In the case of the D2 test cycle, either the 25% or 50% load point shall be used plus either one or more load points such that the combined nominal weighting factor is greater than 0.5.

6.3 The examples below give some of the possible combinations of load points that may be used together with the respective revised weighting factors:

.1 E2 and E3 test cycles

Power	100%	75%	50%	25%
Nominal weighting factor	0.2	0.5	0.15	0.15
Option A	0.29	0.71		
Option B		0.77	0.23	
Option C	0.24	0.59		0.18
Plus other combinations that result in a combined nominal weighting factor greater than 0.5. Hence use of the 100% + 50% + 25% load points would be insufficient.				

.2 D2 test cycle

Power	100%	75%	50%	25%	10%
Nominal weighting factor	0.05	0.25	0.3	0.3	0.1
Option D			0.5	0.5	
Option E		0.45		0.55	
Option F		0.38	0.46		0.15
Option G	0.06	0.28	0.33	0.33	
Plus other combinations that result in a combined nominal weighting factor greater than 0.5. Hence use of the 100% + 50% + 10% load points would be insufficient.					

6.4 In the case of the C1 test cycle, as a minimum, one load point from each of the rated, intermediate and idle speed sections shall be used. The examples below give some of the possible combinations of load points that may be used together with the respective revised weighting factors:

.1 C1 test cycle

Speed	Rated				Intermediate			Idle
Torque	100%	75%	50%	10%	100%	75%	50%	0%
Nominal weighting factor	0.15	0.15	0.15	0.1	0.1	0.1	0.1	0.15
Option H		0.38			0.25			0.38
Option I				0.29		0.29		0.43
Option J	0.27	0.27					0.18	0.27
Option K	0.19	0.19	0.19	0.13		0.13		0.19
Plus other combinations incorporating at least one load point at each of rated, intermediate and idle speeds.								

6.5 Examples of calculation of revised weighting factors:

.1 For a given load point, revised weighting factors shall be calculated as follows:

y% load = nominal weighting factor at load y · (1/(sum of the load factors for load points where data were acquired))

.2 For Option A:

75% load: revised value is calculated as: 0.5 · (1/(0.5 + 0.2)) = 0.71
100% load: revised value is calculated as: 0.2 · (1/(0.5 + 0.2)) = 0.29

.3 For Option F:

75% load: revised value is calculated as: 0.25 · (1/(0.25 + 0.3 + 0.1)) = 0.38

.4 The revised weighting factors are shown to two decimal places. However, the values to be applied to equation (19) of this Code shall be to the full precision. Hence in the Option F case above the revised weighting factor is shown as 0.38 although the actual calculated value is 0.384615……. Consequently, in these examples of revised weighting factors the summation of the values shown (to two decimal places) may not sum to 1.00 due to rounding.

7 Determination of power set point stability

7.1 To determine set point stability, the power coefficient of variance shall be calculated over a 10-minute interval, and the sampling rate shall be at least 1-Hz. The result shall be less than or equal to five per cent (5%).

7.2 The formulae for calculating the coefficient of variance are as follows:

$$Ave = \frac{1}{N}\sum_{j=1}^{N} x_j \tag{1}$$

$$S.D. = \sqrt{\frac{1}{N-1}\sum_{i=1}^{N}(x_i - Ave)^2} \tag{2}$$

$$\%C.O.V. = \frac{S.D.}{Ave} \cdot 100 \leq 5\% \tag{3}$$

where:

%C.O.V.	power coefficient of variance in %
S.D.	standard deviation
Ave	average
N	total number of data points sampled
x_i, x_j	i^{th}, j^{th} value of power data point in kW
i	index variable in standard deviation formula
j	index variable in average formula.

第 MEPC.217（63）號決議

（2012 年 3 月 2 日通過）

《經 1978 年議定書修訂的〈1973 年國際防止船舶造成污染公約〉的 1997 年議定書》附則的修正案

（《防污公約》附則 VI 中港口接收設施的區域性安排和《2008 年氮氧化物技術規則》中設有選擇性催化還原系統的船用柴油機的發證）

海上環境保護委員會，

憶及《國際海事組織公約》第 38（a）條關於國際防止和控制海上污染公約賦予海上環境保護委員會的職能，

注意到《1973 年國際防止船舶造成污染公約》（以下稱《1973 年公約》）第 16 條，《〈1973 年國際防止船舶造成污染公約〉1978 年議定書》（以下稱《1978 年議定書》）第 VI 條，以及《經 1978 年議定書修訂的〈1973 年國際防止船舶造成污染公約〉的 1997 年議定書》（以下稱《1997 年議定書》）第 4 條共同規定的《1997 年議定書》的修正程序和賦予本組織的相關機構審議並通過經 1978 年和 1997 年議定書修訂的《1973 年公約》修正案的職能，

注意到《1973 年公約》以《1997 年議定書》納入了附則 VI《防止船舶造成空氣污染規則》(以下稱“附則 VI”),

進一步注意到《防污公約》附則 VI 第 13 條使《船用柴油機氮氧化物排放控制技術規則》(《氮氧化物技術規則》)在該附則下成為強制性規則,

還注意到第 MEPC.176(58)號決議通過的經修訂的附則 VI 和第 MEPC.177(58)號決議通過的《2008 年氮氧化物技術規則》已於 2010 年 7 月 1 日生效,

審議了經修訂的附則 VI 和《2008 年氮氧化物技術規則》的修正案草案,

1. 按照《1973 年公約》第 16(2)(d)條,**通過**附則 VI 和《2008 年氮氧化物技術規則》的修正案,其文本載於本決議附件;

2. 按照《1973 年公約》第 16(2)(f)(iii)條,**決定**該修正案於 2013 年 2 月 1 日須視為被接受,除非在該日期前,有不少於三分之一的締約國或商船合計噸位不少於世界商船總噸位 50%的締約國通知本組織其反對該修正案;

3. **請**各締約國注意,按照《1973 年公約》第 16(2)(g)(ii)條,該修正案須在按上述第 2 段被接受後,於 2013 年 8 月 1 日生效;

4. **要求**秘書長遵照《1973 年公約》第 16(2)(e)條,將本決議及其附件中的修正案文本的核證無誤副本發送給經 1978 年和 1997 年議定書修訂的《1973 年公約》的所有締約國;

5. **進一步要求**秘書長將本決議及其附件的副本發送給非經 1978 年和 1997 年議定書修訂的《1973 年公約》締約國的本組織會員國。

附件

《防污公約》附則 VI 和《2008 年氮氧化物技術規則》的修正案

《防污公約》附則 VI 的修正案：

1 *在第 17 條中新增第 1 之 2 款：*

第 1 之 2 款 當由於環境獨特而區域性安排是滿足本條第 1 款要求的唯一可行途徑時，發展中小島國可通過該安排來滿足這些要求。參加區域性安排的締約國須考慮到本組織制定的導則，制定一個《區域接收設施計劃》。

參加該安排的各締約國政府須與本組織協商，將下列內容周知本公約的締約國：

.1 《區域接收設施計劃》如何將導則考慮在內；

.2 確定的“區域船舶廢物接收中心”的詳情；和

.3 設施有限港口的詳情。

《2008 年氮氧化物技術規則》的修正案：

2 *現有第 2.2.4 款由下文替代：*

“2.2.4 未在試驗台上進行前期發證試驗的發動機

.1 有些發動機由於其尺寸、構造和交貨計劃的原因，不能在試驗台上進行前期發證測試。在這種情況下，發動機製造廠、船東或造船廠須向主管機關申請在船上進行試驗（見第 2.1.2.2 款）。申請方必須向主管機關證明該船上試驗完全滿足本規則第 5 章規定的試驗台程序的所有要求。如果初次檢驗在船上進行，且無任何有效的前期發證試驗，則無論如何不允許有任何可能的測量偏差。對於在船上進行發證試驗以取得柴油機國際防止空氣污染（EIAPP）證書的發動機，應採用與在試驗台上進行前期發證試驗相同的程序，並符合第 2.2.4.2 款的限制範圍。

.2 前期發證檢驗程序僅對單機或由母型機所代表的發動機組可以接受，但不宜接受為對發動機族的發證。”

3 *第 2.2.5.1 款由下文替代：*

“.1 如擬將氮氧化物減少裝置納入柴油機國際防止空氣污染（EIAPP）證書中，則必須將其視為發動機的一個構件並應在發動機技術案卷內記錄此構件的存在。須對裝有氮氧化物減少裝置的發動機進行試驗，除非經主管機關批准，由於技術和實際原因不宜進行組合試驗且不能使用第 2.2.4.1 款中規定的程序。在後一種情況下，須執行適用的試驗程序，組合發動機/氮氧化物減少裝置須經主管機關參照本組織制定的導則予以認可並進行前期發證試驗。但是，該前期發證試驗應符合第 2.2.4.2 款的限制範圍。”

RESOLUTION MEPC.217(63)
Adopted on 2 March 2012

AMENDMENTS TO THE ANNEX OF THE PROTOCOL OF 1997 TO AMEND THE INTERNATIONAL CONVENTION FOR THE PREVENTION OF POLLUTION FROM SHIPS, 1973, AS MODIFIED BY THE PROTOCOL OF 1978 RELATING THERETO

(Regional arrangements for port reception facilities under MARPOL Annex VI and Certification of marine diesel engines fitted with Selective Catalytic Reduction systems under the NO_x Technical Code 2008)

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution,

NOTING article 16 of the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1973 Convention"), article VI of the Protocol of 1978 relating to the International Convention for the Prevention of Pollution from Ships, 1973 (hereinafter referred to as the "1978 Protocol") and article 4 of the Protocol of 1997 to amend the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (hereinafter referred to as the "1997 Protocol"), which together specify the amendment procedure of the 1997 Protocol and confer upon the appropriate body of the Organization the function of considering and adopting amendments to the 1973 Convention, as modified by the 1978 and 1997 Protocols,

NOTING that, by the 1997 Protocol, Annex VI entitled Regulations for the Prevention of Air Pollution from Ships was added to the 1973 Convention (hereinafter referred to as "Annex VI"),

NOTING FURTHER regulation 13 of MARPOL Annex VI which makes the Technical Code on Control of Emission of Nitrogen Oxides from Marine Diesel Engines (NO_x Technical Code) mandatory under that Annex,

NOTING ALSO that both the revised Annex VI adopted by resolution MEPC.176(58) and the NO_x Technical Code 2008 adopted by resolution MEPC.177(58) entered into force on 1 July 2010,

HAVING CONSIDERED draft amendments to the revised Annex VI and the NO_x Technical Code 2008,

1. ADOPTS, in accordance with article 16(2)(d) of the 1973 Convention, the amendments to Annex VI and the NO_x Technical Code 2008, the text of which is set out in thet annex to the present resolution;

2. DETERMINES, in accordance with article 16(2)(f)(iii) of the 1973 Convention, that the amendments shall be deemed to have been accepted on 1 February 2013, unless prior to that date, not less than one third of the Parties or Parties the combined merchant fleets of which constitute not less than 50 per cent of the gross tonnage of the world's merchant fleet, have communicated to the Organization their objection to the amendments;

3. INVITES the Parties to note that, in accordance with article 16(2)(g)(ii) of the 1973 Convention, the said amendments shall enter into force on 1 August 2013 upon their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with article 16(2)(e) of the 1973 Convention, to transmit to all Parties to the 1973 Convention, as modified by the 1978 and 1997 Protocols, certified copies of the present resolution and the text of the amendments contained in the annex;

5. REQUESTS FURTHER the Secretary-General to transmit to the Members of the Organization which are not Parties to the 1973 Convention, as modified by the 1978 and 1997 Protocols, copies of the present resolution and its annex.

ANNEX

AMENDMENTS TO MARPOL ANNEX VI AND THE NO_X TECHNICAL CODE 2008

Amendments to MARPOL Annex VI

1 *New paragraph 1bis is added to regulation 17:*

1*bis* Small Island Developing States may satisfy the requirements in paragraph 1 of this regulation through regional arrangements when, because of those States' unique circumstances, such arrangements are the only practical means to satisfy these requirements. Parties participating in a regional arrangement shall develop a Regional Reception Facilities Plan, taking into account the guidelines developed by the Organization.

The Government of each Party participating in the arrangement shall consult with the Organization for circulation to the Parties of the present Convention:

.1 how the Regional Reception Facilities Plan takes into account the Guidelines;

.2 particulars of the identified Regional Ships Waste Reception Centres; and

.3 particulars of those ports with only limited facilities.

Amendments to the NO_X Technical Code 2008

2 *Existing paragraph 2.2.4 is replaced by the following:*

"2.2.4 *Engines not pre-certified on a test-bed*

.1 There are engines which, due to their size, construction and delivery schedule, cannot be pre-certified on a test-bed. In such cases, the engine manufacturer, shipowner or shipbuilder shall make application to the Administration requesting an onboard test (see 2.1.2.2). The applicant must demonstrate to the Administration that the onboard test fully meets all of the requirements of a test-bed procedure as specified in chapter 5 of this Code. In no case shall an allowance be granted for possible deviations of measurements if an initial survey is carried out on board a ship without any valid pre-certification test. For engines undergoing an onboard certification test, in order to be issued with an EIAPP Certificate, the same procedures apply as if the engine had been pre-certified on a test-bed, subject to the limitations given in paragraph 2.2.4.2.

.2 This pre-certification survey procedure may be accepted for an Individual Engine or for an Engine Group represented by the Parent Engine only, but it shall not be accepted for an Engine Family certification."

3 *Paragraph 2.2.5.1 is replaced by the following:*

".1 Where a NO_x-reducing device is to be included within the EIAPP certification, it must be recognized as a component of the engine, and its presence shall be recorded in the engine's Technical File. The engine shall be tested with the NO_x-reducing device fitted unless, due to technical and practical reasons, the combined testing is not appropriate and the procedures specified in paragraph 2.2.4.1 cannot be applied, subject to approval by the Administration. In the latter case, the applicable test procedure shall be performed and the combined engine/NO_x-reducing device shall be approved and pre-certified by the Administration taking into account guidelines developed by the Organization. However, this pre-certification is subject to the limitations given in paragraph 2.2.4.2."

二零一七年七月二十五日於行政長官辦公室

辦公室主任　柯嵐

Gabinete do Chefe do Executivo, aos 25 de Julho de 2017. — A Chefe do Gabinete, *O Lam*.

印務局
Imprensa Oficial
每份售價 $550.00
PREÇO DESTE NÚMERO $550,00