

第 91/2014 號行政長官公告**Aviso do Chefe do Executivo n.º 91/2014**

中華人民共和國是國際海事組織的成員國及一九七四年十一月一日訂於倫敦的《國際海上人命安全公約》（下稱“公約”）的締約國；

一九九四年五月十七日至二十四日召開的公約締約國大會對公約作出修正，包括新增了關於“高速船安全措施”的第X章，使《國際高速船安全規則》的規定在該公約下對一九九六年一月一日或以後建造的高速船成為強制性規定；

國際海事組織海上安全委員會於一九九四年五月二十日透過第MSC.36 (63) 號決議通過了《國際高速船安全規則》，且該規則自一九九九年十二月二十日起適用於澳門特別行政區；

基於此，行政長官根據澳門特別行政區第3/1999號法律第六條第一款的規定，命令公佈包含上指規則的第MSC.36 (63) 號決議的中文及英文正式文本。

二零一四年十一月七日發佈。

行政長官 崔世安

Considerando que a República Popular da China é um Estado Membro da Organização Marítima Internacional e um Estado Contratante da Convenção Internacional para a Salvaguarda da Vida Humana no Mar (SOLAS), concluída em Londres em 1 de Novembro de 1974, adiante designada por Convenção;

Considerando igualmente que a Conferência SOLAS, realizada entre 17 e 24 de Maio de 1994, adoptou emendas à Convenção que, entre outras, incluem um novo capítulo X relativo a medidas de segurança para as embarcações de alta velocidade a fim de tornar as disposições do Código Internacional de Segurança para as Embarcações de Alta Velocidade obrigatórias nos termos da Convenção, para todas as embarcações construídas a partir de 1 de Janeiro de 1996, inclusive;

Considerando ainda que, em 20 de Maio de 1994, o Comité de Segurança Marítima da Organização Marítima Internacional, através da resolução MSC.36(63), adoptou o Código Internacional de Segurança das Embarcações de Alta Velocidade, e que tal Código entrou em vigor, em relação à Região Administrativa Especial de Macau, a partir de 20 de Dezembro de 1999;

O Chefe do Executivo manda publicar, nos termos do n.º 1 do artigo 6.º da Lei n.º 3/1999 da Região Administrativa Especial de Macau, a resolução MSC.36(63), que contém o referido Código, nos seus textos em línguas chinesa e inglesa.

Promulgado em 7 de Novembro de 2014.

O Chefe do Executivo, *Chui Sai On*.

第 MSC.36 (63) 號決議
(1994 年 5 月 20 日通過)
通過《國際高速船安全規則》

海上安全委員會，

憶及《國際海事組織公約》關於本委員會職能的第 28 (b) 條，

進一步憶及大會於 1977 年 11 月 14 日以 A.373 (X) 大會決議通過了《動力支承船安全規則》(DSC 規則)，以用於國際運輸中日益增多的水翼船和氣墊船之類的船舶，同時授權海上安全委員會在必要時對 DSC 規則進行修訂，

認識到新型高速船和高速船尺度的不斷發展，這些高速船並不一定是動力支承的，以及載貨高速船、運送大量乘客高速船的不斷發展或營運距離超過 DSC 規則允許的到底護地的距離，

進一步認識到 DSC 規則通過以來，需要改進海上安全標準並將其反映在高速船的設計、構造、設備和操作規定中，以便保持其發證和安全性與常規船舶相當，

注意到將提請 1994 年 5 月 17 日至 24 日召開的《1974 年國際海上人命安全公約》締約國大會通過對該公約的修正案，該修正案特別包括了新的第 X 章“高速船安全措施”，從而使《國際高速船安全規則 (HSC 規則)》在該公約下對所有 1996 年 1 月 1 日或以後建造的高速船成為強制性的規則，

考慮到第六十三屆會議審議了經過對《DSC 規則》的徹底修訂而制訂的《HSC 規則》的建議文本：

- 1 通過《HSC 規則》，其文本載於本決議的附則；
- 2 注意到根據所建議的《1974 年 SOLAS 公約》第 X 章，《HSC 規則》的修正案應按照該公約第 VIII 條關於適用於除第 I 章外的該公約附則的修正程序的規定予以通過、生效和實施。
- 3 要求秘書長將本決議的副本連同《HSC 規則》文本分發給本組織的成員國和非本組織成員國的所有《1974 年 SOLAS 公約》締約國政府；
- 4 建議各國政府對在本決議通過之後至可能將由 1994 年《SOLAS 公約》締約國大會通過的上述《1974 年 SOLAS 公約》修正案生效之前建造的高速船，本着自願原則應用本規則。

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國際高速船安全規則

序言

1 以常規船舶為基礎批准的國際公約以及其後應用的規定都已經有了很大的發展，但這些公約及發展所考慮的是常規船舶的建造和營運方式。歷來，船舶是採用鋼材建造的，並在營運方面所受控制很少。從事遠程國際航行的船舶只要申請檢驗並取得《船舶安全證書》，就可以在世界任何區域航行，而不受任何營運限制。只要船舶沒有發生嚴重事故，所有要做的就是《船舶安全證書》期滿前，申請主管機關檢驗合格，重新取得證書。

2 控制船舶的傳統方法不應被認為是保證船舶適當的安全水準唯一可行的方法，採用不同衡準的其他方法不一定就不能採用。多年來，已經開發了大量新設計的海船，並在營運。雖然它們不盡滿足適用於常規鋼船的國際公約的規定，但它們已經證明，在限制營運的氣象條件下，並按認可的維護和監督程序，從事有限航行，它們具有同等安全水準的營運能力。

3 本規則係由本組織於 1977 年通過的《動力支承船安全規則》（DSC）演變而成。本規則認識到依靠與特定航線、定期航行相關的基本設施能夠使高速船的安全性顯著提高，而常規船舶的安全原理是建立在船舶自身承受能力和船載的所有必需應急設備的基礎上的。為使本規則能在國際範圍內適用，本規則的制訂已考慮了現有高速船尺度和類型的增加，並考慮到有利於今後海上高速運輸的研究和發展。

4 本規則的安全原理是基於控制和減少風險以及一旦發生事故時被動保護的傳統原理。在評估安全性等效於現行公約時，應考慮艙

室佈置、主動式安全系統、營運限制、質量管理、人為因素工程等方面的風險控制。鼓勵採用數學分析法評估風險和確定安全措施의效能。

5 本規則考慮到高速船的排水量較常規船小，而這正是獲得快速和有競爭力的海上運輸的重要因素。因而，本規則允許使用非常規的造船材料，但必須保證其達到至少不低於常規船要求的安全標準。

6 本規則採用航速和體積的傅氏（Fr）數來定義高速船，以區別於其他常規船舶。

7 本規則的規定還考慮了因高速而可能引起的不同於常規船舶運輸的其他危險。因此，除了救生設備和撤離手段等常規要求外，還重點考慮一旦發生事故，如何將出現危險狀況的風險減小。高速船自身的某些優點，例如，排水量小導致相對排水量而言的較大儲備浮力，減少了《國際載重線公約》提到的某些危險。此外，本規則中較嚴格的航行和營運規定以及有關艙室設施的特殊規定，對於諸如高速航行發生碰撞可能會引起的危險後果起到抵消作用。

8 上述安全概念最初反映在《動力支承船安全規則》中。然而，高速船類型的新穎化和尺度的發展，致使造船業必須發展非動力支承的高速貨船、裝載大量乘客的高速客船或者航行範圍超出原規則的許可範圍的高速船。此外，需要將自 1977 年以來海上安全標準的改進反映在對原規則的修訂中，以保持與常規船舶的同等安全性。

9 為此確立了兩個不同的防護和救援概念。

10 概念之一是承認當初制訂《動力支承船安全規則》時已預見到的高速船。如能方便迅速地取得救援且限制載客總數，那麼可以允許減少被動防護和主動防護。這類船被稱為“受援船”，並且是在本規則中組成“A類客船”的基礎。

11 概念之二是承認了高速船進一步發展到較大的船舶。當不能迅速而方便地取得救援或者乘客總數不受限制時，對於這類船，還將提出附加的被動和主動的防護設施要求。這些附加要求是：船上提供安全避難處所、配備多套關鍵系統、增強水密和結構完整性以及充足的滅火能力。這類船舶屬“非受援船”，這是本規則中組成“貨船”和“B類客船”的基礎。

12 基於達到符合《國際海上人命安全公約》的船舶所能達到的等效安全程度的原則，已將本規則的上述兩個概念形成一個統一文件。如果新技術或新設計的採用，確能證明與嚴格使用本規則所達到的安全程度等效，則允許主管機關可正式承認此等效性。

13 主管機關在根據本規則考慮高速船的適用性時，應採用本規則的全部章節，這是很重要的，因為不符合本規則的任何部分均可能會引起不平衡性，對船舶、乘客和船員的安全產生不利的影響。基於同樣理由，現有船舶進行可能影響安全的改裝，應經主管機關批准。

14 在制定本規則時，已考慮了確保高速船不對環境的現有使用者造成不合理的負擔，或反過來，高速船不應因環境的現有使用者缺乏合理的寬容而遭受不必要的損失是有益的。無論兩者兼容的負擔多大，均不應完全由高速船承擔。

第 1 章 總則

1.1 通則

本規則應作為一整套綜合性的要求來使用。本規則對從事國際航行的高速船的設計和建造、應配設備以及營運和維修條件作出規定。本規則的基本目標是藉助於結構和設備標準以及嚴格控制高速船的營運條件達到與滿足《1974 年國際海上人命安全公約》（SOLAS 公約）和《1966 年國際載重線公約》（載重線公約）規定的常規船舶所具有的安全程度等同。

1.2 一般要求

使用本規則應滿足下列一般要求：

- .1 應完整地使用本規則；
- .2 高速船公司的經營者通過質量管理體系*對高速船的營運和維修實行嚴格的控制；
- .3 經營者必須保證只僱用具有在指定航線上操縱特定類型高速船資格的人員；
- .4 通過強制要求營運限制對航行距離及允許營運的最壞條件予以嚴格限制；
- .5 船舶在任何時候都應處於避難處合理的附近之處；
- .6 船舶在其營運區域內具有足夠的通信、氣象預報和維修設備；
- .7 在船舶擬營運的區域內有隨時可提供的合適的救助設備；

* 參見本組織大會以 A.741 (18) 號決議通過的《國際安全管理規則》。

- .8 失火危險較大的區域，如機器處所和特種處所，應採用耐火材料和滅火系統加以保護，以保證儘實際可能地遏制火焰蔓延並迅速撲滅；
- .9 提供將所有人員迅速並安全撤至救生艇筏內的設施；
- .10 所有乘客和船員都應有座位；
- .11 不設置乘客用的封閉式的臥鋪；
- .12 如果主管機關已作了綜合審查，認為船員居住艙室的防火安全措施和撤離程序是可行的話，則可以允許設置船員臥鋪。

1.3 適用範圍

- 1.3.1 本規則適用於從事國際航行的高速船。
- 1.3.2 本規則適用於：
 - .1 在其經營的航線上，滿載並以其營運航速航行至避難處不超過 4h 的高速客船；及
 - .2 在其經營的航線上，滿載並以其營運航速航行至避難處不超過 8h 的 500 總噸及以上的高速貨船。
- 1.3.3 除另有明文規定外，本規則不適用於下列船舶：
 - .1 軍用艦艇和運兵船；
 - .2 非機動船；
 - .3 製造簡陋的木船；
 - .4 非營業性的遊艇；

.5 漁船。

1.3.4 本規則不適用於定線航行於北美洲五大湖和航行於聖勞倫斯河東至羅歇爾角與安提科斯提島兩點間所繪的直線以及在安提科斯提島北面水域東至西經 63° 線的高速船。

1.3.5 本規則的適用應經主管機關批准，並得到船舶營運國家的認可。

1.4 定義

除另有明文規定外，就本規則而言所用術語定義如下，附加的定義補充在各章的通則中。

1.4.1 主管機關係指船旗國政府。

1.4.2 氣墊船（ACV）係指船舶不論在靜止或運動時，其重量的全部或絕大部分能被連續產生的氣墊所支承的船舶，這種船氣墊的有效程度取決於該船航行時船底離水面的高度。

1.4.3 輔機處所係指設有驅動發電機的輸出功率為 110 kW 及以下的內燃機、水噴淋器、消防泵、艙底泵等，加油站、總功率超過 800 kW 的配電板的諸處所，類似處所，以及通往這些處所的圍壁通道。

1.4.4 無火災危險或火災危險極小的輔機處所係指設置冷藏、穩定裝置、通風和空調機械、總功率 800 kW 及以下的配電板的諸處所，類似處所，以及通往這些處所的圍壁通道。

1.4.5 基地港係指在營運手冊中規定的專門港口，並備有：

- .1 任何時候都能與在港口或海上的該高速船保持連續的無線電通信設施；

- .2 能取得相應地區的可靠天氣預報並及時發送到所有營運中船舶的手段；
- .3 能為“A 類船舶”提供適當的救助設備和救生設備的渠道；以及
- .4 有適當設備，能為該船維修服務。

1.4.6 基地港國係指基地港所在的國家。

1.4.7 船寬 B 係指剛性水密船體的最大型寬，不包括船排水狀態（即提升和推進機械不工作）時設計水線處及以下的附體。

1.4.8 貨船係指客船外的其他高速船。這類船任意一艙破損後，其他未破損處所的主要功能和安全系統仍能維持正常狀態。

1.4.9 裝貨處所係指除特種處所外所有裝貨處所和通往這些處所的圍壁通道。

1.4.10 A 類船係指滿足下列條件的任一高速客船：

- .1 船旗國和港口國對營運的航線已經確認並確信，一旦船舶在該航線任何地點出事，有很大把握能在下列三者中最短時間內將所有乘客和船員安全救出：
 - 在最壞設想條件下為保護救生艇筏內的人員免于因暴露而造成體溫過低的時間；
 - 與該航線所處的環境條件和地理特點相適應的時間；
 - 4 h；以及
- .2 載客不超過 450 人。

1.4.11 B類船係指除 A類船以外的任何其他高速客船。這類船的機器和安全系統的佈置應在一旦發生破損事故，且艙內主要機械和安全系統失效時，該船仍能保持安全航行的能力。

1.4.12 持續有人操作的控制站係指船舶正常營運期間，總有一名負責的船員持續操作的控制站。

1.4.13 控制站係指設有無線電設備或航海設備或應急電源和應急配電板的處所，或防火記錄或防火控制設備集中的處所，或設置對船舶安全營運所必須的其他功能諸如推進控制、廣播設備和穩定系統的處所。

1.4.14 公約係指經修正的《1974年國際海上人命安全公約》。

1.4.15 船員起居艙室係指用於船員的處所，包括船員艙室、醫療室、辦公室、盥洗室、休息室及類似的處所。

1.4.16 臨界設計工況係指為設計目的而選取的限制特定條件，此時船舶應保持排水狀態。該條件應該比設想的最壞條件更惡劣一定程度，使船舶在殘存情況下提供足夠的安全性。

1.4.17 設計水線係指船舶的提升和推進機械不工作時，受第 2 章和第 3 章規定的限制，船舶最大營運重量所對應的水線。

1.4.18 排水狀態係指船舶不論在靜止或運動時，其全部或大部分重量由靜水力支承的一種狀態。

1.4.19 故障模式和影響分析 (FMEA) 係指按附錄 4 核查船舶的系統和設備以確定任何可能發生的故障或不適當的操作是否會導致危險的或災難性的後果。

1.4.20 襟翼係指組成水翼或氣翼上整體部分的或延伸的一個部件，用以調整該翼的水動或氣動升力。

1.4.21 閃點係指使用《國際海運危險貨物（IMDG）規則》規定的閉杯式儀器測得的閃點。

1.4.22 翼係指船舶航行時產生流體動升力的一塊翼狀板或三維結構物。

1.4.23 深浸水翼係指翼航時無割劃水面產生升力的部件的那種水翼。

1.4.24 高速船係指最大航速達到或超過下式的船舶：

$$3.7\triangleleft^{0.1667} \text{ m/s}$$

式中： \triangleleft — 對應的設計水線下的排水體積， m^3 。

1.4.25 水翼艇係指非排水狀態時由水翼產生的水動升力支承在水面以上的艇。

1.4.26 船長（L）係指船在排水狀態（即提升和推進機械不工作）時設計水線處及以下的剛性水密船體水下的總長，不包括附體。

1.4.27 空船重量係指無貨物，液艙（櫃）無燃油、滑油、壓載水、淡水、給養水，以及無消耗備品，無乘客、船員和他們所攜物品時的船舶排水量，以噸計。

1.4.28 機器處所係指設有總輸出功率 110 kW 以上的內燃機、發電機、燃油裝置、推進機械、主要電機的諸處所和類似的處所，以及通往這些處所的圍壁通道。

1.4.29 最大營運重量係指經主管機關允許的按預定狀態營運時達到的總重量。

1.4.30 最大航速係指船舶處在最大營運重量狀態，以最大持續推進功率在靜水中航行能達到的航速。

1.4.31 集合站係指船舶在緊急情況下，能夠使乘客集中，給與指令，以及必要時準備棄船的地方。乘客處所可以用作集合站，只要這些處所能容納所有乘客接受指令，並準備好棄船。

1.4.32 非排水狀態係指船舶處於正常航行時，其重量主要由非水靜力支承的狀態。

1.4.33 燃油裝置係指給燃油鍋爐輸送燃油的預處理裝置或向內燃機輸送加熱油的預處理裝置，還包括油壓大於 0.18 N/mm^2 的各種油壓力泵、濾器和加熱器等。

1.4.34 開敞車輛處所係指下列處所：

- .1 任何車輛所載乘客都能抵達的處所；
- .2 用於裝載油箱內帶有自用燃油的機動車輛的處所；且
- .3 該處所或者兩端敞開或者一端敞開，並通過在其側壁上或甲板頂部或上方設置的永久性開口，為整個處所提供有效而充足的自然通風。

1.4.35 操縱室係指執行船舶航行和控制的封閉區域。

1.4.36 操縱站係指操縱室內設有必需的航行、操縱和通信設施的限制區域，在此區域執行航行、操縱、通信、指揮、下達舵令和瞭望觀察等業務。

- 1.4.37 營運航速為最大航速的 90%。
- 1.4.38 組織係指國際海事組織。
- 1.4.39 乘客係指除下列人員之外的人員：
- .1 船長和船員或在船上以任何職務從事或參與該船業務的其他人員；及
 - .2 一周歲以下的兒童。
- 1.4.40 客船係指載客超過 12 人的船舶。
- 1.4.41 避難處係指船舶遭遇惡劣氣候對其安全構成危險時可提供庇護的任何天然或人工的遮蔽地區。
- 1.4.42 公共處所係指供乘客使用的處所，包括酒吧、樂池、吸煙室、主要座位區、娛樂室、餐廳、休息室、走廊、盥洗室和其他類似的永久性封閉處所。
- 1.4.43 服務處所係指諸如設有加熱食品的設備，但不帶有暴露熱表面的烹調設備的配膳室、儲存櫃、小賣部、儲藏室和行李間等封閉處所。
- 1.4.44 有義波高係指在給定時間內觀察到的三分之一最大波高的平均值。
- 1.4.45 特種處所係指用來裝載油箱內帶自用燃油的機動車輛的封閉處所。這些車輛可以駛進或駛出該處所，且有通道可供乘客出入。該處所還包括裝載貨物車輛的處所。

1.4.46 表面效應船 (SES) 是一種藉助永久浸在水中的硬結構可全部或部分地保持氣墊的氣墊船。

1.4.47 過渡狀態係指介於排水狀態和非排水狀態之間的狀態。

1.4.48 最壞預計工況係指船舶證書中規定的可從事計劃營運的該船的環境條件。應考慮諸如允許的最大風力、有義波高 (包括波長和浪向的不利組合)、最低氣溫、能見度、安全操作水深等最差條件參數, 以及主管機關認為在該區域營運的這種類型的高速船所需要的其他參數。

1.5 檢驗

1.5.1 每艘船舶都應作如下檢驗：

- .1 初次檢驗。每艘船投入營運之前或首次取得證書之前應進行該項檢驗。
- .2 換新檢驗。在主管機關規定的期間內, 但不超過 5 年, 船舶應進行該項檢驗, 適用 1.8.5 或 1.8.10 規定者除外。
- .3 定期檢驗。船舶證書到期周年日前後 3 個月內應進行該項檢驗; 和
- .4 附加檢驗。如有特別情況發生時的檢驗。

1.5.2 上述 1.5.1 中涉及的檢驗應按下列規定執行：

- .1 初次檢驗包括：
 - .1.1 對有關裝載、環境條件、航速和操縱性所作的假定和限制作出評估；

- .1.2 對根據計算、試驗、試航獲得的用以證明該設計是安全的種種數據作出評價；
 - .1.3 進行本規則所要求的故障模式和影響分析；
 - .1.4 檢查提供給船舶的各種手冊是否齊全；以及
 - .1.5 對船舶的結構、安全設備、無線電設備和其他裝置、屬具、佈置和材料作全面檢驗，以保證他們符合本規則的要求，並確信他們處於滿意的狀態和適合該船預定的服務；
- .2 換證檢驗和定期檢驗應對船體結構（包括船底外部和有關項目）、安全設備、無線電設備和 1.5.2.1 中所述的其他裝置作全面檢驗，以保證其符合本規則的要求，並確信其處於滿意的狀態和適合該船預定的服務。應在船舶處於脫離水面的合適狀態下對船底進行近觀檢驗，仔細檢查任何損壞或有問題的部位。
 - .3 按 1.7.3 規定進行調查並要求修理之後，或作了重大修理或更新之後，應根據實際情況進行普遍或部分的附加檢驗。該檢驗應保證所作的必要修理和更新是有效的，此修理和更新所採用的材料和工藝各方面均為滿意，且該船在各方面均能符合本規則的要求。
- 1.5.3 按上述 1.5.1.3 規定的定期檢驗應在《高速船安全證書》上簽署。
 - 1.5.4 為了執行本規則規定的要求，應由主管機關的官員承擔船舶檢查和檢驗。當然，主管機關也可授權為此目的而指定的驗船師或其認可的組織執行檢查和檢驗。

1.5.5 主管機關至少應授予執行 1.5.4 規定的檢查和檢驗的驗船師或被認可組織以下權限：

- .1 要求修理船舶；和
- .2 若港口國有關當局請求時，進行檢查和檢驗。

主管機關應通知本組織對其授權的驗船師或認可組織的具體職責和授權條件。

1.5.6 當被授權的驗船師或被認可的組織確定船舶的狀況或其裝備情況實際上與其證書不符時，或該船營運會危及船舶或船上人員的安全時，該驗船師或組織應保證其立即採取糾正措施，並及時通知主管機關。如果該糾正措施未予執行，則應撤銷其證書並立即通知主管機關；若船舶在別國政府的管轄區域內，則應立即通知該港口國的有關當局。港口國有關當局接到船舶主管機關的官員、授權驗船師或認可組織的通知後，港口國政府應為這些官員、授權的驗船師和認可組織提供必需的幫助，使其能按本節規定實施其職責。如可行，則有關港口國政府還應保證該船不應繼續投入營運，除非該船投入營運後不會給船舶或船上人員帶來危險。

1.5.7 主管機關在任何情況下都應充分保證檢查和檢驗的完整性和有效性，並應為履行此職責而作出必要的安排。

1.6 批准

船舶所有人有責任向主管機關提供充分的資料，使其能對船舶的設計特徵作出充分的評估。此外還特別推薦，船舶所有人、主管機關和港口國（如可能）在儘可能早的階段就開始進行接觸和討論，以便主管機關充分評估該船的設計，從而確定要使該船達到規定的安全程度應適用的附加要求或變通要求。

1.7 檢驗後狀況的維持

1.7.1 船舶及其設備的狀況應該始終保持符合本規則規定的狀況，以確保該船在各方面均適合營運，不會給船舶或船上人員帶來危險。

1.7.2 船舶在完成 1.5 規定的任何檢驗後，未經主管機關批准，已檢驗的結構、設備、屬具、佈置和材料均不得變更。

1.7.3 當船舶發生事故或發現缺陷，不論其是影響船舶的安全，還是影響到結構、設備屬具和材料的有效性和完整性，該船的船長或船舶所有人應及時報告負責的主管機關、指定的驗船師或認可組織，由主管機關指定的驗船師或認可組織進行調查，決定是否有必要進行 1.5 規定的檢驗。如果該船在另一國家政府管轄的地區，船長或船舶所有人還應立即向港口國有關當局報告。指定的驗船師或認可組織應查明上述報告是否已經作出。

1.8 高速船安全證書

1.8.1 完成船舶的初次檢驗或換證檢驗並確認該船符合本規則規定後，應頒發《高速船安全證書》。該證書應由主管機關或主管機關授權的任何個人或認可組織簽發或簽署，但無論由誰發，主管機關都應對證書完全負責。

1.8.2 公約締約國政府可應其他國家主管機關的要求對船舶進行檢驗。如認為該船符合規則要求，應按照本規則規定發給或授權發給或簽署（如適用）證書。如此簽發的證書務必載明是受船旗國政府的委託而簽發的。此項證書與按 1.8.1 所發證書具有同等效力，並受同樣的承認。

1.8.3 證書的格式見本規則附錄 1。若所用文字既非英文亦非法文，則證書內應附有英文或法文的譯文。

1.8.4 由主管機關簽發《高速船安全證書》的間隔期限，應不超過 5 年。

1.8.5 雖然 1.8.4 對簽發證書的間隔期作了規定，若在原證書到期之日前 3 個月內完成換證檢驗，則新證書應從該換證檢驗完成日起生效，有效期自原證書到期之日起不超過 5 年。

1.8.6 若在原證書到期之日後完成換證檢驗，則新證書應在換證檢驗完成日起生效，有效期自原證書到期之日起不超過 5 年。

1.8.7 若在原證書到期之日前超過 3 個月完成換證檢驗，則新證書應在換證檢驗完成日起生效，有效期自換證檢驗完成日起不超過 5 年。

1.8.8 若簽發證書的期限不滿 5 年，則主管機關可以對該證書的有效期展期至超出證書到期之日直至 1.8.4 規定的最大期限，只要所作的檢驗係按簽發 5 年期證書的要求進行即可。

1.8.9 若換證檢驗已完成，但新證書尚不能在原證書到期之日前換發或交到船上，則主管機關授權的個人或組織可以對原證書簽署展期。此證書被視作有效，其有效期自原證書到期之日起不應超過 5 個月。

1.8.10 若證書到期時船舶不在預定檢驗的港口，則主管機關可將該證書展期，但此展期僅以能使該船完成駛抵預定檢驗地點為限，而且僅在如此辦理時看來是適當和合理的情況下才行。此類證書展期不得超過 1 個月，而且獲得這樣展期的船舶，在抵達預定檢驗地點

後不得因獲上述展期而在未領到新證書之前駛離該地。新證書應在完成換證檢驗後發給並生效，有效期自獲得展期之前的原證書到期之日起不超過 5 年。

1.8.11 在特殊情況下，根據主管機關的決定，新證書不必按 1.8.6 或 1.8.10 所規定的原證書到期之日起計算有效期。在這種狀況下，新證書的有效期應為自完成換新檢驗之日起不超過 5 年。

1.8.12 若定期檢驗在 1.5 規定的期限之前完成，則

- .1 應修改證書上的周年日，以不超過此項檢驗完成之日以後 3 個月的某一日期為簽署日期；
- .2 1.5 規定的下次定期檢驗應以新的周年日計算在 1.5 規定的間隔期內完成；且
- .3 到期之日可以保持不變，只要進行了一次或多次定期檢驗，使 1.5.1.3 規定的檢驗之間最大間隔期未被超過。

1.8.13 在下列任一情況下按 1.8.1 或 1.8.2 簽發的證書應為失效：

- .1 在 1.5.1 規定的期限內未完成相應的檢驗；
- .2 未按 1.5.3 規定簽署證書；或
- .3 船舶變更船旗國時。只有當換發新證書的國家政府確認該船已滿足 1.7.1 和 1.7.2 的要求時，才換發新證書。若變更船旗後的 3 個月內，前一個船旗國政府如接到申請，應儘速將變更船旗前該船所攜證書的副本及有關檢驗報告（如備有時），送交該船的新的主管機關。

1.8.14 任何船舶除持有有效證書外，不得要求本規則賦予的各項特權。

1.9 高速船營運許可證書

1.9.1 高速船除具有《高速船安全證書》外，還應取得有效的《高速船營運許可證書》，才能從事商業性運輸。無《高速船營運許可證書》的高速船，可以從事不裝載乘客或貨物的航行。

1.9.2 《高速船營運許可證書》應由主管機關頒發，以證明該高速船符合 1.2.2 至 1.2.7 的要求，並規定了該高速船的營運條件，此種規定應以本規則第 18 章規定的航線操作手冊中的內容為基礎。

1.9.3 主管機關在頒發營運許可證書之前應諮詢各個港口國政府，以便獲得涉及該國家的各種營運條件的細節。主管機關應將那些強制性條件記入營運許可證書上，並且納入該船航線操作手冊中。

1.9.4 港口國政府為了查明該船的狀況與條件是否與其營運許可證書相符，可以對該船進行檢查並審核其文件資料。如在審核中發現缺陷，則該營運許可證書將停止有效，直到此類缺陷被糾正或採取其他解決方法。

1.9.5 1.8 的規定同樣適用於《高速船營運許可證書》的頒發和有效期限。

1.9.6 《高速船營運許可證書》的樣本見本規則附錄 2。若所用文字既非英文亦非法文，則文本中應包括這兩種文字之一的譯文。

1.10 控制

公約附則第 I/19 條規定除適用於按 1.8 要求頒發的《高速船營運安全證書》外，還應包括《高速船營運許可證書》。

1.11 等效

1.11.1 凡本規則要求船舶應裝設或配備的專門裝置、材料、設備或器具，或其型式，或本規則要求應制訂的任何專門規定，主管機關可准許該船裝設或配備任何其他的裝置、材料、設備或器具，或其型式，或採取任何其他措施，但須通過試驗或其他方法，經主管機關認定這些替代的裝置、材料、設備或器具，或其型式，或其他措施至少與本規則所要求者具有同等效能。

1.11.2 對於特殊設計的高速船，如滿足本規則任一規定為不切實際時，主管機關可允許採用變通要求，只要這種變通能達到等效的安全程度。該主管機關應將此替代的情況和理由通知本組織，然後由本組織通告各成員國。

1.12 應配備的資料

1.12.1 主管機關應確保經營該船的船公司經營部門已經為該船提供了手冊形式的充足資料和指導性文件，以使該船能進行安全營運和維護。這些手冊應包括航線操作手冊、船舶操縱手冊、維修手冊和船期表。應對上述資料作及時而必要的更新，使其切合最新情況。

1.12.2 上述手冊的內容至少應包括第 18 章所規定的資料，且應以該船船員能看懂的文字書寫。如果所用文字非英文，則至少應該提供一份航線操作手冊和船舶操縱手冊的英文本。

1.13 今後的發展

1.13.1 應承認當今高速船設計方面的研究和發展日新月異，新型高速船的不斷湧現與制訂本規則時所見到的面貌截然不同。本規則不限制這種新型設計的進展和開發，這一點十分重要。

1.13.2 某一設計或許不能符合本規則的規定，在這種情況下，主管機關應該確定本規則的規定對該設計能應用的範圍，必要時，制訂某些附加要求或變通要求，為該船提供一個等效安全標準。

1.13.3 主管機關在按本規則要求評估和批准等效時，應考慮上述兩點。

1.14 安全信息通告

1.14.1 當主管機關對涉及適用本規則的船舶事故作調查時，主管機關應將其官方報告的副本提交本組織，本組織將請各成員國注意此報告以便取得副本。

1.14.2 如在船舶營運實踐中暴露出結構或設備方面的缺陷影響到船舶設計的安全性時，船舶所有人應通知主管當局。

1.15 本規則的修訂

1.15.1 本規則將由本組織以最好不超過 4 年的間隔期予以審查，以便根據設計和技術的新發展而考慮對現有規定進行修改。

1.15.2 當主管機關認定新設計或新技術的成果可被採納時，該主管機關可將該成果的細節提交本組織，以便本組織在定期審查時考慮將其納入本規則中。

第 2 章 浮力、穩性與分艙

A 部分 一般規定

2.1 通則

2.1.1 船舶應具備：

- .1 在非排水狀態和過渡狀態營運時，足以保證安全的穩性和穩性系統；
- .2 在排水狀態營運時，完整和破損情況下，足以保證安全的浮力和穩性；和
- .3 一旦發生任何系統故障，足以保證船舶由非排水和過渡狀態安全轉至排水狀態的穩性。

2.1.2 計算穩性時應考慮結冰的影響。附錄 5 中給出了結冰允許量實際經驗的例子，作為主管機關的指南。

2.1.3 除另有明文規定者外，下列定義適用於本章和其他各章：

- .1 向下進水點係指當船處於完整或破損狀態下，橫傾至越過平衡角一個角度時，引起包括計入儲備浮力的處所可能發生浸水的任一開口。
- .2 全浸式水翼係指在翼航狀態下無割劃水面產生升舉力構件的水翼。
- .3 多體船係指以正常可以達到的縱傾或橫傾角營運時，具有貫入海面一個以上分離區域的剛性船體結構的船舶。
- .4 處所的滲透率係指處所能被水所佔體積的百分數。

- .5 圍裙係指用於儲存或劃分氣墊的向下延伸的柔性結構。
- .6 與結構有關的水密係指在完整或破損狀態水壓頭的作用下能防止水以任何方向可能通過該結構的能力。
- .7 風雨密係指在任何風浪情況下，甚至達到規定的臨界設計情況下，都不會有水滲入船內。

2.2 完整浮力

2.2.1 所有船舶均應在設計水線狀態下具有足夠的儲備浮力，以滿足本章的完整穩性和破損穩性要求。為允許該船舶在任何預期的狀態下運行，主管機關可以要求有更大的儲備浮力。只有滿足以下條件的艙室才能包括在儲備浮力的計算中：

- .1 水密的；
- .2 認為其結構尺寸和佈置足以保持其水密完整性的；和
- .3 位於基準面以下的。該基準面可以是水密甲板或由 2.2.3.1 所規定的用水密結構覆蓋的非水密甲板的等效結構。

2.2.2 應配備用以核查 2.2.1 所考慮艙室水密完整性的設備。

2.2.3 如果水進入 2.2.1.3 所規定基準面以上的結構會明顯影響船舶的穩性和浮力，則這些結構應：

- .1 具有足夠的強度來保持水密完整性，並設置水密關閉裝置；
或
- .2 具有足夠的排水裝置；或
- .3 等效的上述兩種措施的結合。

2.2.4 用於關閉風雨密結構界面上的開口的裝置應該是在所有營運狀態下都保持風雨密完整性的裝置。

2.3 排水狀態下的完整穩性

2.3.1 割劃式水翼船和（或）全浸式水翼船，在所有允許的裝載情況下，應具有足夠的穩性以符合附錄 6 的有關規定，尤其是當其承受該附錄 1.1.2 和 1.1.4 之中較大的傾側力矩時，應保持其橫傾角小於 10° 。

2.3.2 多體船在所有允許的裝載情況下，應符合附錄 7 的有關要求。

2.3.3 根據 2.3.4 要求，所有其他船舶在所有允許的裝載情況下，應符合以下衡準：

- .1 A.562 (14) 號決議（氣象衡準）；
- .2 當最大復原力臂（ GZ ）位於 $\theta=15^\circ$ 處時，至 $\theta=15^\circ$ 復原力臂曲線（ GZ 曲線）下面積應不小於 $0.07\text{m} \cdot \text{rad}$ ；當最大復原力臂位於 $\theta=30^\circ$ 或以上時，至 $\theta=30^\circ$ 復原力臂曲線下面積應不小於 $0.055 \text{ m} \cdot \text{rad}$ ；當最大復原力臂位於 $\theta=15^\circ$ 和 $\theta=30^\circ$ 之間，復原力臂曲線下相應的面積應不小於：

$$A=0.055+0.001(30^\circ-\theta_{\max}) \quad (\text{m} \cdot \text{rad})$$

式中： θ_{\max} 是復原力臂曲線達到最大值時的橫傾角（ $^\circ$ ）；

- .3 $\theta=30^\circ$ 和 $\theta=40^\circ$ 之間，或當進水角 θ_f^* 小於 40° 時， $\theta=30^\circ$ 和 θ_f 之間復原力臂曲線下的面積應不小於 $0.03 \text{ m} \cdot \text{rad}$ ；

* 在應用本衡準時，不會引起進一步浸水的小開口不必視作開啟的。

- .4 在橫傾角等於或大於 30° 處，復原力臂 GZ 應不小於 0.20 m；
- .5 最大復原力臂對應的橫傾角應不小於 15°；和
- .6 初穩心高度 GM 。應不小於 0.15 m。

2.3.4 如果船舶的特性不適合於應用 2.3.3 的規定，主管機關可以根據船舶類型和營運區域接受等效於 2.3.3 規定的其他衡準。

2.4 非排水狀態下的完整穩性

2.4.1 本節和 2.12 的要求適用的假定條件是任何設置的穩性系統完全有效運行。

2.4.2 應進行合適的計算或試驗，說明在批准的營運限制範圍內當運行在非排水和過渡狀態下，在船舶因回轉產生橫搖、縱傾、升沉或橫傾或其任何組合的干擾之後，將回到原來的狀態。

2.4.3 對系列船的首艘船和（或）其他船的橫搖穩性和縱搖穩性應在第 18 章和附錄 8 要求的營運安全性試航中作質量評定。此類試航的結果可以指明是否有必要實施營運限制。

2.4.4 如果船舶設置貫出水面的結構或附體，則應採取預防措施，防止在與浸沒水中或漂浮水面的物體碰撞後船舶出現危險的姿態或傾側和失去穩性。

2.4.5 在設計中，如果把定期利用氣墊變形作為控制船的一種輔助手段，或把定期利用氣墊向大氣排氣以操縱船舶，則應確定對墊升穩性的影響，並制定對利用船的速度或姿態的限度。

2.4.6 對設置柔性圍裙的氣墊船，應說明在營運狀態下圍裙保持穩固的情況。

2.5 過渡狀態下的完整穩性

2.5.1 在一般氣象情況直至預計的最惡劣情況下，從排水狀態轉為非排水狀態以及相反過程所用的時間應儘可能短，除非說明在此過渡期間穩性無實質性的減小。

2.5.2 水翼船應符合附錄 6 的有關規定。

2.6 破損後排水狀態下的浮力和穩性

2.6.1 本節的要求適用於所有允許的裝載情況。

2.6.2 為進行破損穩性計算，體積和表面滲透率一般應按下述計取：

處所	滲透率 (%)
貨物或儲物處所	60
起居處所	95
機器處所	85
液體艙櫃	0 或 95*
貨物車輛處所	90
空艙	95

* 視何者導致較嚴重的後果而定

2.6.3 儘管有 2.6.2 的規定，如果導致更不利的狀態，則滲透率應採用直接計算確定。如按照 2.6.2 導致較小不利的狀況，則也可採用直接計算確定滲透率。

2.6.4 主管機關可以同意在空艙利用低密度泡沫材料或其他介質提供浮力，條件是應提供足夠的證據表明任何此類推薦的介質是最合適的替代物，以及

- .1 如果是泡沫材料，應呈封閉網眼形，否則，應為不透水；
- .2 在營運狀態下結構牢固；
- .3 相對於與之接觸的結構材料，或相對於可能與該介質接觸的其他物質應是化學惰性的（參見 7.4.3.7）；和
- .4 應就地適當固定，並應易於搬移，以便檢查該空艙。

2.6.5 任何較 2.6.6 至 2.6.8 規定小的範圍破損，如適用時，對會導致更嚴重的情況者，也應予以檢查。破損的形狀應假定為一個平行六面體。

2.6.6 下列船側破損應假定發生在船舶周邊的任何位置：

- .1 破損的縱向範圍應為 $0.1 L$ 或 $3 \text{ m} + 0.03 L$ 或 11 m ，取最小者；
- .2 破損的橫向範圍應為 $0.2 B$ 或 $0.05 L$ 或 5 m ，取最小者。然而，如果船舶設置充氣圍裙或無浮力船側結構，則穿破橫向範圍應不小於主浮力船體或艙室結構寬度的 0.12 倍；和
- .3 破損的垂向範圍應取船的全深。

2.6.7 按 2.6.8 要求，底部破損應假定發生在如下船底的任何位置：

- .1 破損的縱向範圍應為 $0.1 L$ 或 $3 \text{ m} + 0.03 L$ 或 11 m ，取最小者；
- .2 破損的橫向範圍應為船底的全寬或 7 m ，取小者（見圖 2.6.7.2）；和
- .3 破損的垂向範圍應為 $0.02 B$ 或 0.5 m ，取小者。

2.6.8 對 B 類船，當破損位於船的前部 $0.5 L$ 內時，2.6.7 中規定的假定破損長度應增大 50%。

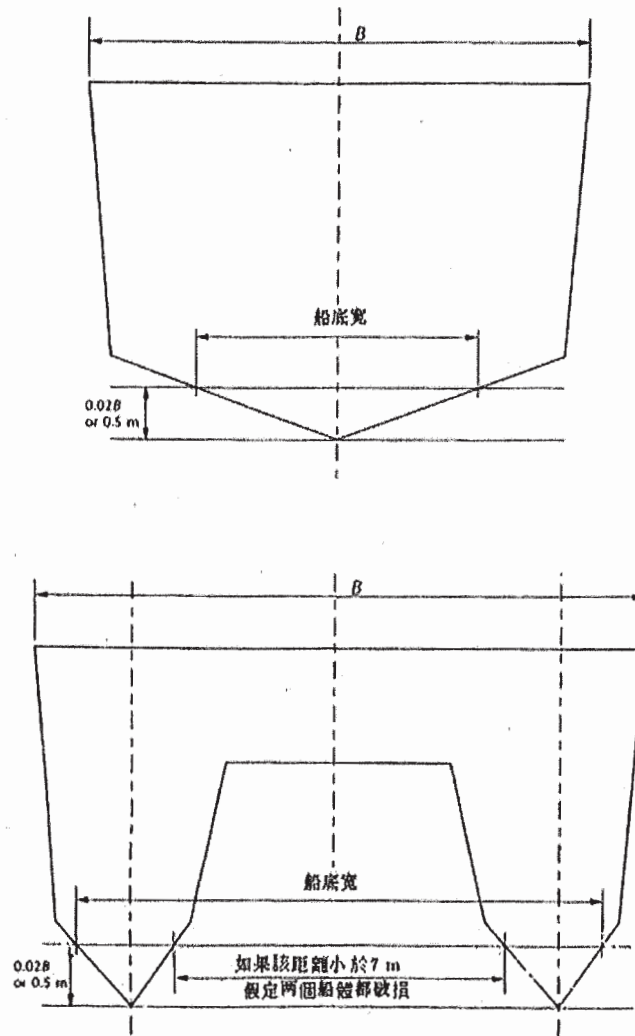


圖 2.6.7.2

2.7 傾斜試驗與穩性資料

2.7.1 每一艘建造完工的船舶均應作傾斜試驗，並確定其穩性要素。當不可能作出精確的傾斜試驗時，空船排水量和重心應由空船重量檢驗和精確的計算來確定。

2.7.2 船舶所有人應向船長提供符合本條規定的與船舶穩性有關的可靠資料。有關穩性的資料在送交船長以前應連同供留存的副本提交主管機關批准，並且當主管機關在任何特殊情況下有要求時，應將該附加文件以及修訂文件合在一起。

2.7.3 如果對船舶的任何改建會對提供給船長的穩性資料導致根本性影響，則還應提交修正的穩性資料。如有必要，船舶應重做傾斜試驗。

2.7.4 每項按本章要求進行的傾斜試驗或空船重量檢驗以及空船狀態特性計算的報告，均應連同供留存的副本提交主管機關批准。批准後的報告應由船舶所有人置於船上適當位置，由船長負責保管，並當主管機關在任何特殊情況下有要求時，該報告應和附加文件以及修訂文件合在一起。對平時得到的修正空船狀態細節，應由船長在計算船舶的穩性時進行應用，代替先前批准的資料。

2.7.5 當主管機關有要求時，傾斜試驗或空船重量檢驗後應把修正的穩性資料提供給船長。所提供的資料應與供留存的副本一起提交主管機關批准，當主管機關在任何特殊情況下有要求時，該資料應和附加文件及修訂文件合在一起。

2.7.6 說明符合本章要求的穩性資料應以穩性報告書形式編寫，該資料應一直存放在船上由船長負責保管。該資料應包括適用於該船的詳細數據，並應反映船舶的裝載情況和操作模式，標註出包括穩性橫交曲線中的任何封閉上層建築或甲板室以及臨界進水點和進水角。

2.7.7 每艘船舶均應在船首和船尾設有清晰標註吃水的水尺。如果吃水標誌不是位於易於讀出的地方或因為特殊業務造成的操作限制使得難以讀吃水標誌時，則船舶應設有一個可靠的指明吃水的系統，藉此能確定首、尾吃水。

2.7.8 船舶所有人或船舶建造者應確保能精確確定吃水標誌的所在位置，並確保該標誌永久性設置於船體上。在傾斜試驗之前，應向主管機關提供吃水標尺精度的說明。

2.8 裝載及穩性評定

船舶裝載完成後及每次航行離港之前，船長應測定船的縱傾和穩性，並且還應查明和記錄該船是否符合有關要求的穩性衡準。主管機關可以同意使用電子裝載和穩性計算機或為此目的的等效方法。

2.9 設計水線的標誌和記錄

設計水線應清晰地標註在船中部外側，並應記載在《高速船安全證書》上，該水線應採用符號 H 來識別。

B 部分 對客船的要求

2.10 通則

為考慮乘客重量對符合本章要求的影響，應採用下述資料：

- .1 每平方米分佈乘客 4 人；
- .2 每個乘客質量為 75 kg；
- .3 坐着的乘客的垂向重心在座椅以上 0.3 m 處；
- .4 站立的乘客的垂向重心在甲板以上 1.0 m 處；

- .5 應考慮乘客和行李是在乘客通常可以到達的任意處所；
- .6 乘客應分佈在集合站所在的一側船舷區域，並且因此導致乘客產生最不利的橫傾力矩。

2.11 排水狀態下的完整穩性

船舶應具有足夠的完整穩性，當船在靜水情況下，在所有允許的裝載狀態和可能產生的不可控制的乘客移動作用下所引起的偏離水平位置的傾側應不超過 10° 。

2.12 非排水狀態下的完整穩性

2.12.1 在靜水中由於乘客移動的影響和由於附錄 6 中 1.1.4 規定的橫向風壓引起的總橫傾角應不超過 10° 。

2.12.2 在所有的裝載狀態下，由於回轉引起的向外側橫傾應不超過 8° ，以及由於附錄 6 中 1.1.4 規定的橫向風壓和由於回轉引起向外側的總橫傾應不超過 12° 。

2.13 破損後排水狀態下的浮力和穩性

在 2.6.5 至 2.6.8 中詳細規定的任一假設破損情況之後，船舶在靜水中應具有足夠的浮力和正穩性，以同時確保：

- .1 在停止進水和達到平衡之後，最終水線位於任何可能發生進一步浸水的開口下緣 300 mm 以下；
- .2 船舶在任何方向偏離水平線的傾側角通常不超過 10° 。然而，如果這是明顯地不切實際的話，只要設有有效的防滑甲板表面和合適的諸如防滑孔、防滑條等支撐點，可允許船在破損後傾斜至 15° ，但能立即在 15 min 內減到 10° ；

- .3 從破損水線到船的殘存登乘位置，應有正值乾舷；
- .4 任何可能引起乘客艙室或脫險通道的進水不會明顯地阻礙乘客的撤離；
- .5 為組織撤離用的必要的基本應急設備、應急無線電、供電設備和廣播系統，保持易於到達和可操作；
- .6 多體船的剩餘穩性應符合附錄 7 中的相應衡準；和
- .7 任何其他船舶的剩餘穩性應滿足公約第 II-1/8 條的要求。

2.14 傾斜試驗和穩性資料

2.14.1 在不超過 5 年的定期間隔，對所有客船應進行空船重量檢驗，以核查空船排水量重心縱向位置有無任何變化。與批准的穩性資料相比較，只要發現或預見空船排水量的偏差超過 2%，或重心縱向位置的偏差超過 1% L ，則該客船應重做傾斜試驗。

2.14.2 按 2.7.1 編製的傾斜試驗空船重量檢驗的報告，以及隨後所作空船狀態詳細計算的報告，連同供留存的副本應提交主管機關批准。該批准的報告應由船舶所有人置於船上，並由船長負責保管，當主管機關在任何特殊情況下有要求時，該報告應與附加文件和修訂文件合在一起。平時得到修正的空船狀態詳細資料應由船長在計算船舶的穩性時使用，而代替先前批准的資料。

2.14.3 如主管機關有此要求，應在任何傾斜試驗或空船重量檢驗後，將修正的穩性資料提供給船長。所提供的資料應連同供留存的副本一起提交主管機關批准，並當主管機關在任何特殊情況下有要求時，該資料應與附加文件和修正文件合在一起。

C 部分 對貨船的要求

2.15 破損後排水狀態下的浮力和穩性

在 2.6.5 至 2.6.7 中詳細規定的任一假設破損情況之後，船舶在靜水中應具有足夠的浮力和正穩性，以同時確保：

- .1 在停止進水和達到平衡後，最終水線位於任何可能發生進一步進水的開口下緣 150 mm 以下；
- .2 船舶在任何方向偏離水平線的傾側角通常不超過 15°。然而，如果這是明顯不切實際的話，只要設有有效的防滑甲板表面和合適的諸如防滑孔、防滑條等支撐點，可允許在船舶破損後傾斜至 20°，但能立即在 15 min 內減少到 15°；
- .3 從破損水線到船的殘存登乘位置應有正值乾舷；
- .4 為組織撤離用的必要的應急設備、應急無線電、供電設備和廣播系統，保持易於到達和可操作；
- .5 多體船的剩餘穩性應符合附錄 7 中的相應衡準；和
- .6 任何其他船舶的剩餘穩性應滿足公約第 II-1/8 條的要求。

2.16 傾斜試驗

如果一艘船的空船重量檢驗、配重或其他說明表明其空船重量與該系列的另一艘船按 2.7.1 得到的空船重量相一致的話，則主管機關可以不要求按 2.7.1 規定做傾斜試驗。就此而言，一艘該系列的做過傾斜試驗的船與之比較時，處於 2.14.1 參數範圍內的船，均應被視作與該船十分相似。

第 3 章 結構

3.1 通則

本章涉及構成全船縱向強度和其他主要及其局部強度的船體和上層建築的各個構件，也涉及與船體和上層建築直接相連諸如水翼和圍裙的其他重要部件。

3.2 材料

按 3.1 中所述的用於船體和上層建築以及其他部件的材料應適宜於船舶的預定用途。

3.3 結構強度

結構應能承受許可運行的一切航行條件下作用在船上的靜、動載荷，而不致因這些載荷產生過量的變形和水密損失或妨礙船舶的安全航行。

3.4 周期性載荷

周期性載荷，包括由於船舶振動而產生的那些周期性載荷，不應：

- .1 損害在船舶預定服務年限或主管機關同意的服務年限內結構的完整性；
- .2 妨礙機器和設備的正常運行；以及
- .3 影響船員執行其職責的能力。

3.5 設計衡準

設計條件、設計載荷和安全係數的選擇，應與證書所載明的預定航行條件一致，並使主管機關滿意。

3.6 試驗

如主管機關認為必要時，應要求進行實尺度試驗，以確定所承受的載荷，注意到試驗表明結構計算載荷假定不足的結果。

第 4 章 艙室佈置與脫險措施

4.1 通則

4.1.1 乘客和船員艙室的設計和佈置，應使在船人員免受不利環境條件的影響，並在正常和應急情況下使在船人員受傷的危險性降至最低程度。

4.1.2 乘客可以進入的處所，不應設置控制開關、電氣設備、高溫部件和管道、旋轉機械或其他可能導致乘客受傷的設備，除非這些設備已適當遮蔽、隔離或以其他適宜方式保護起來。

4.1.3 乘客艙室不應設置操作控制設備，除非這些設備的保護和位置適當，船員在正常和應急情況下操作時，不會受到乘客的妨礙。

4.1.4 乘客和船員艙室的窗應具有足夠的強度，且與該船營運許可證書上註明的最壞設想條件相適應，窗玻璃應採用在破碎時不會裂成危險碎片的材料製造。

4.1.5 公共處所、船員艙室以及這些處所或艙室裏的設備，應設計成不論在船舶正常航行或發生故障或惡劣運行的情況下，在船舶正常和應急的啟動、停車和操縱時，每個人只要正確使用這些設施都不會受到傷害。

4.2 廣播和信息系統

4.2.1 應設置一套通用應急報警系統。所有的居住艙室、通常有船員工作的處所以及開敞甲板都應能聽到警報。警報的聲壓級至少高出正常航行情況下環境噪聲級 10 dB (A)，警報在觸發後，能持續作用至正常關閉或廣播系統廣播時暫停。

4.2.2 應設置一套廣播系統，該系統應能覆蓋乘客和船員能進入的所有區域、脫險通道和登乘救生艇筏的處所，並應在任意一艙進水或着火情況下，該系統的其他部分仍可操作。

4.2.3 所有客船均應設置所有就座乘客均能看見的照明或發光或視覺信息系統，以便向乘客通告安全措施。

4.2.4 藉助 4.2.3 的設施，船長在必要時將發佈指令，要求乘客“請坐好”，如果船長認為這樣將有利於保護乘客或當本規則附錄 3 表 1 所列的安全水準 2 被超過時，船長將發出這樣的指令。

4.2.5 應為每個乘客提供一份圖示，存放在每位乘客座位附近，表明全船所有出口、撤離路線、應急設備和救生設備的佈置及穿着救生衣的說明等。

4.3 設計加速度

4.3.1 對於客船除非採取了與乘客安全有關的特別預防措施，應避免在船舶重心縱向位置處產生超過 1.0g 的垂向運動的加速度。

4.3.2 對於客船應進行與安全有關的碰撞載荷設計，包括人員處於及撤離公共處所、船員生活艙室、脫險通道和通往救生設施、應急電源時的安全。確定碰撞載荷時，應考慮船舶尺度、類型、航速、排水量及建造材料等。碰撞設計是基於船舶以營運航速航行，船首與高出水線 2m 高度的垂直岩石相撞的假設。

4.3.3 上述 4.3.2 涉及的碰撞載荷應由下式確定：

$$g_{\text{coll}} = 1.2 \left(\frac{P}{g \cdot \Delta} \right)$$

式中： P ——載荷，應取下列兩式中的小者：

$$P=460 (M \cdot C_L)^{2/3} (E \cdot C_H)^{1/3} \text{ 和}$$

$$P=9000 \cdot M \cdot C_L [C_H (T+2)]^{1/2}$$

式中： M ——船體材料係數，根據船體材料取值：

$$M=1.3 \text{ (對於高強度鋼) ;}$$

$$M=1.00 \text{ (對於鋁合金) ;}$$

$$M=0.95 \text{ (對於低碳鋼) ;}$$

$$M=0.8 \text{ (對於玻璃鋼) ;}$$

C_L ——船長因素，可按下式計算：

$$C_L = \left(\frac{165 + L}{245} \right) \left(\frac{L}{80} \right)^{0.4}$$

C_H ——船高因數，按下表確定：

船舶類型	雙體船、水面效應船	單體船、水翼船	氣墊船
C_H	$T+2+f(D/2)/2D$	$T+2+f(D/2)/2D$	$f/4$
取 $f=0$	當 $T+2 < D-H_T$	$T+2 < D$ 時	--
取 $f=1$	當 $D > T+2 \geq D-H_T$	當 $T+2 \geq D$	當 $H_T > 2$
取 $f=2$	當 $T+2 \geq D$	--	當 $H_T \leq 2$ 時

E ——航速 V 時船舶的動能，按下式計算：

$$E = \frac{1}{2} \Delta \cdot V^2 \quad (\text{kN} \cdot \text{m})$$

其他符號定義如下：

L ——船長，m，見第一章定義；

D —型深，m，船中處龍骨下緣量至船體有效樑頂部；

T —全墊升氣墊船係指浮箱底至圍裙頂端的高度，負值， m ；對於水翼船係指船底龍骨在水表面以上的提升高度，負值， m ；其他船係指船中處龍骨下緣的吃水， m ；

H_T —雙體船和水面效應船係指隧道頂至船體有效樑頂端的最小高度，全墊升氣墊船係指型深 D ， m ；

Δ —排水量，取空船重量和最大營運重量的平均值， t ；

V —船舶營運航速， m/s ；

g —重力加速度，取 $g=9.806m/s^2$ 。

對於水翼船，如計算結果大於負加速度， g_{coll} 按下式計算：

$$g_{coll} = \left(\frac{F}{g \cdot \Delta} \right)$$

式中： F —營運水線處前水翼的失效載荷， kN 。

4.3.4 亦可按 4.3.2 所作的假設，通過船舶碰撞載荷分析確定碰撞負加速度，作為 4.3.3 規定的替代。如果碰撞加速度是通過 4.3.3 列出的公式和碰撞載荷分析兩種方法確定，則可取其中的小值作為碰撞負加速度值。

4.3.5 應就船舶的實際類型註明已滿足 4.1.5 和 4.3.1 的規定，如附錄 8 所述。

4.3.6 在船舶正常營運條件和最壞設想條件中都應註明船舶運行的限制海況、營運航速和必要的減速。有關操作方面的資料應存放在

船上供使用，或者船上應設有一種能逐項檢查船舶運行性能的儀錶系統。該系統起碼應能測量船舶縱向重心附近處三個主軸方向的加速度。

4.4 艙室設計

4.4.1 高速船上公共處所和船員艙室的位置和設計，應使船舶在設計碰撞條件下乘客和船員不會受傷。為此，這些處所不應位於距船體有效樑頂前端的下列範圍內：

$$\frac{V^2}{20g_{coll}} \quad \text{m}$$

式中： V 和 g_{coll} 的定義見 4.3.3。 g_{coll} 不得取小於 3，亦不必取大於 12。

4.4.2 艙室應按表 4.4.2 給出的設計指南設計，並按附錄 9 規定執行，或採用其他已被證明能給與同等保護程度的方法進行設計。

表 4.4.2 設計指南概要*

設計等級 1： $g_{coll} < 3$
1 座椅/安全帶
1.1 低靠背或高靠背
1.2 座椅方向不受限制
1.3 允許設沙發
1.4 不要求設安全帶
2 一般允許設桌子
3 用包墊消除凸出物
4 公用電話間、酒吧等，無特別限制
5 行李，無特殊要求
6 大質量物品應繫固妥善，並限位
設計等級 2： $g_{coll} = 3 \sim 12$

* 其他方案如能達到等效安全等級亦可採用。

-
- 1 座椅/安全帶
 - 1.1 帶有保護性變形和填充物的高靠背
 - 1.2 朝前或朝後的座椅
 - 1.3 不允許設沙發作座椅
 - 1.4 座位前方無保護結構時應設圍腰安全帶
 - 2 允許設置有保護特性的桌子，並應作動力試驗
 - 3 用包墊消除凸出物
 - 4 公用電話間、酒吧等應設在艙壁後側或經認可的其他位置
 - 5 行李應放在前方有保護的位置
 - 6 大質量物品應繫固妥善，並限位
-

設計等級 3： $g_{coll} > 12$

- 1 座椅/安全帶
 - 1.1 帶有保護性變形和填充物的高靠背
 - 1.2 朝前或朝後的座椅
 - 1.3 不允許設沙發
 - 1.4 安全帶（當須取得所需的保護時）
 - 朝後座椅不設安全帶
 - 朝前座椅應設三點安全帶或肩套式安全帶
 - 2 不允許設桌子
 - 3 用包墊消除凸出物，並應經特別認可
 - 4 公共電話間、酒吧等的設置應經特別認可
 - 5 行李應放在前方有保護的位置，應經特別認可
 - 6 大質量物品應繫固妥善，並限位，應經特別認可
-

4.4.3 公共處所和操作人員艙室中的設備和行李應予以定位，並作妥善繫固，使其在 4.3.3 和 4.3.4 規定的設計碰撞加速度作用下仍能保持原位。

4.4.4 大質量設備如主機、輔機、墊升風機、傳動裝置、電力設備等的安裝，應通過計算證明能承受 4.3.3 和 4.3.4 規定的設計碰撞加速度而不致破壞。

4.4.5 座位、救生設備、具有相當質量的器件及其支承結構均應在載荷達到 4.3.3 和 4.3.4 規定的值時不產生任何形式的變形或移位，以致妨礙乘客迅速撤離。

4.4.6 任何通道的兩側應設置適宜的扶手，使乘客行走時能保持平穩。

4.5 座位設計

4.5.1 對船舶額定的每一位乘客和船員均應提供一個座位。

4.5.2 除 4.5.1 規定的座位外，另增加的座位不允許在危險的航行條件或潛在危險的氣候或海況下使用，這些座位不必滿足 4.5 和 4.6 的要求，但應按 4.4.5 的要求妥善繫固，且應清晰地標出不能在危險狀況下使用。

4.5.3 座椅安裝時應注意留有足夠的通道，使乘客能通往艙室的各個部位，尤其是不能妨礙任何重要應急設備和撤離設施的取用。

4.5.4 座椅及其附件和鄰近的結構的型式、設計及佈置應使船舶在遭遇 4.4.1 規定的碰撞設計載荷的假設危險後，乘客受傷的可能性最小，且能避免夾阻乘客。凡有危險的凸出物和堅硬的邊緣都應予消除或另包軟墊。

4.5.5 座椅、座椅安全帶、座椅佈置及座椅鄰近的部件（如桌子）均應按 4.3.3 規定的實際碰撞設計加速度進行設計。

4.5.6 所有座椅、座椅底及其和甲板的連接，應具有良好的吸收能量的功能，並應滿足附錄 9 的要求。

4.6 安全帶

4.6.1 對於所有按 4.3.3 規定算得的碰撞設計加速度 a_{coll} 超過 3g 的高速船，所有用於操縱船舶的座位都應設置可單手釋放的三點式或肩帶式的安全帶。

4.6.2 必要時，為獲得附錄 9 規定的保護性能，應為乘客座椅和船員座椅提供安全帶。

4.7 脫險出口和脫險設施

4.7.1 鑑於同樣理由，應為操縱艙室提供方便安全和快速的通道直達客艙。為了確保在應急情況下能立即得到船員的幫助，船員的艙室包括住室應設在那些有通道能使船員從船內方便、安全、迅速通往公共處所的地方。

4.7.2 船舶設計應能使所有在船人員在各種應急情況下，不論白天、黑夜，都可以安全撤離進入救生艇筏。所有在應急情況下可能使用的出口和救生設備的位置、撤離程序的可行性，以及全部乘客和船員撤離時所耗費的時間，都應進行驗證。

4.7.3 凡公共處所、撤離路線、出口、救生衣存放、救生艇筏存放以及登乘站都應清晰而永久性地標明，並按第 12 章規定予以照明。

4.7.4 凡供乘客或船員使用的圍蔽公共處所和類似的永久性圍蔽處所都應至少有兩個出口，分別設在該處所的相對兩端處，出口處應安全易達，且有通道直達正常登船點或離船點。

4.7.5 為提供火災時的庇護，公共處所可按 7.4.4.1 和 7.11.1 的規定進行分隔。

4.7.6 出口門不論白天黑夜應能裏、外均可操縱，且開閉裝置應顯明易見，操作便捷，具有足夠強度。

4.7.7 出口門的關閉、插銷、上鎖的佈置，應使有關船員通過直接觀察或通過指示器能清楚地知道出口門被關閉或處於安全操作狀態。外門的設計應能消除被冰或碎石卡住的可能性。

4.7.8 船上應有足夠數量的出口，使身穿認可救生衣的人員在應急情況（如撞船或失火）下，能容易而安全無阻地撤離船舶。

4.7.9 鄰近出口處應有供一名船員活動的足夠空間，以確保乘客迅速撤離。

4.7.10 所有出口及其開啟設施都應標明，使船上乘客和船外的救生人員都一目了然。還應提供足夠的標誌供船外的救助人員作指導。

4.7.11 凡提供從內部至出口的通道的踏板和梯子，應為剛性結構並永久定位，如必須藉助扶手才能使人員到達出口時，應設永久性的扶手，這種扶手應在船舶發生任何可能的橫傾或縱傾情況下都能適用。

4.7.12 應為每個人員提供至少兩條暢通無阻的脫險通道。脫險通道的安排應使撤離人員在任何可能發生的險情或應急情況下都能獲得足夠的撤離手段。脫險通道上應有主電源和應急電源供電的充足照明。

4.7.13 組成脫險通道的走道、門及梯道尺寸應使穿着救生衣的人員均能易於通過。脫險通道上不應有任何可能傷人、鈎住衣服、損壞救生衣或阻礙喪失活動能力的人員撤離的凸出物。

4.7.14 應設置足夠的指示牌，引導乘客通往出口。

4.7.15 為使撤離的乘客進入救生設備，船上的登乘站應有相應的設施，包括設置扶手、登乘甲板的防滑措施，以及沒有羊角、繫纜樁或類似裝置的足夠空間。

4.8 撤離時間

4.8.1 撤離設施的設計應使船舶在受控情況下能在撤離時間內撤離。撤離時間為 7.4.2 規定的較大失火危險區域結構防火時間 (*SFP*) 減去探測火情及滅火作業所需的 7 min 的三分之一時間，即：

$$\text{撤離時間} = \frac{SFP-7}{3} \quad \text{min}$$

式中：*SFP*——結構防火時間，min。

4.8.2 應制訂一份包括關鍵通路分析在內的撤離程序，供主管機關審查與之相關的防火絕緣圖時使用。該撤離程序還用以幫助船舶所有人和建造廠按 4.8.3 規定安排撤離演習。

撤離程序內容如下：

- .1 船長發出應急通知；
- .2 與基地港聯繫；
- .3 穿着救生衣；
- .4 救生艇筏和應急站人員就位；
- .5 關閉機器和燃油供給管路；
- .6 發出撤離命令；
- .7 降落救生艇筏、海上脫險系統和救助艇；
- .8 救生艇筏繫攏航行；
- .9 監視乘客；

- .10 乘客在監視下有秩序地撤離；
- .11 船員檢查所有乘客已全部離船；
- .12 船員撤離；
- .13 救生艇筏脫離大船；
- .14 救助艇（如有的話）集結救生艇筏。

4.8.3 按 4.8.1 要求的撤離時間能否達到，應通過實際演習予以驗證。該演習應在受控情況下並有主管機關人員在場時進行。對於客船，應用文件形式說明，並經主管機關核實。

4.8.4 在進行撤離演習時應考慮到緊急情況下當需要迅速撤離時有可能引起的質量移動或驚恐加速度的問題。撤離演習在無人下水的情況下進行，救生艇筏應在原來的存放位置，且按下列要求進行；

- .1 A 類客船的撤離時間應為第一次發出棄船通知直到最後一名人員已登上救生艇筏所耗費時間，並應包括乘客和船員穿着救生衣的時間。演習時，乘客分佈應按正常航行情況下任意分佈。
- .2 B 類客船和貨船的撤離時間應為發出棄船命令直到最後一名人員已登上救生艇筏所耗費時間，乘客和船員可以是已穿好救生衣，並作好撤離準備，且分佈在各個集合站。
- .3 所有船的撤離時間應包括救生艇筏投放、充氣膨脹和繫在船邊備用所必需的時間。

4.8.5 撤離時間應通過這樣一次撤離演習來考核，即按關鍵通路分析中指出的耗時較長一舷的出口和救生艇筏進行演習。演習時，乘客和船員僅使用該舷的出口和救生艇筏。

4.8.6 如在船上進行一半試驗不現實的話，主管機關可考慮進行使用關鍵通路的局部撤離試驗。該關鍵通路係關鍵通路分析中指出的最關鍵的那段通路。

4.8.7 撤離演習應在受控情況下遵照撤離計劃按下列狀態進行：

- .1 船舶浮在海面平靜的港內，所有機械和設備處於正常航行情況下運轉；
- .2 船內所有出口和門，均處於與正常航行情況時相同的狀態；
- .3 安全帶（如有的話）應該繫固；
- .4 所有乘客和船員的脫險通道在撤離時應無須有人入水。

4.8.8 對於客船，參加演習的人員應儘可能由具有正常健康狀況、身高、體重、不同性別和年齡的人員組成。

4.8.9 挑選參加演習的人員，除船員外不應是經過這種專門撤離演習訓練的人員。

4.8.10 所有新設計的高速船，以及撤離佈置與原先試驗過的有實質性差別的其他高速船，都應進行應急撤離演習。

4.8.11 作為發證基礎的首次撤離演習所遵循的專門撤離程序，連同4.8.2 包含的其他撤離程序，應包括在該船的操作手冊中。演習時，船內外都應錄像，該錄像帶將是 18.2 要求的培訓手冊的組成部分。

4.9 行李、備品、小賣部和貨艙

4.9.1 應考慮到佔居的艙室和可能產生的加速，採取措施防止行李、備品和貨艙內物品由於船舶運動而引起的移動。如僅僅採用堆

碼不切實際，則應採取限制行李、備品和貨物移動的適當措施。客艙內應設置存放乘客隨身攜帶行李的行李架和吊架，但要採取措施防止行李在任何可能發生的情況下掉落。

4.9.2 鑑於控制設備、電氣設備、高溫器件、管路等的損壞或故障有可能影響船舶安全營運，船舶航行時船員因工作之需要也可能要接近這些設施，所以這些設施不應設在行李艙、儲藏艙和貨物艙內，除非採取足夠的保護措施，使在艙內即使無意地裝卸物品或移動物品時都不會損壞艙內的這些設備、器件和管路。

4.9.3 若有必要，應在這些艙內設置限制裝載的耐久標誌。

4.9.4 考慮到船舶的用途，行李艙、貨艙和特種處所的外部開口的關閉裝置應為風雨密。

4.10 噪聲等級

4.10.1 船員艙和客艙的噪聲應儘可能輕微，以便能聽到廣播系統的廣播，一般不應超過 75 dB (A)。

4.10.2 操縱室的最大噪聲一般不應超過 65 dB (A)，使之能在室內通話，並與外部進行無線電通訊。

第 5 章 方向控制系統

5.1 通則

5.1.1 船舶應配備具有足夠強度和適當設計的方向控制裝置，該裝置應使船舶的首向和航向在主要工況和航速下能最大可能地獲得有效的控制，而無需在所有船速和證書核定的工況中藉助於不合適的人力，其性能應按附錄 8 的要求予以驗證。

5.1.2 可用來進行方向控制的裝置有：空氣舵或水舵、水翼、襟翼、可調距推進器或噴射器、偏艙控制孔或側推器、差動推進器，船舶的可變幾何形狀或其墊升系統部件，或這些裝置的組合。

5.1.3 就本章而言，方向控制系統包括任何操舵裝置或裝置組群、任何機械聯動裝置和所有動力或人力裝置、控制器和驅動系統。

5.1.4 應注意方向控制系統和穩定系統間相互作用的可能性。凡發生這種相互作用或設置有雙重用途的部件，當適用時，也應滿足 12.5 和第 16 及 17 章的要求。

5.2 可靠性

5.2.1 除諸如擱淺、碰撞或重大火災之類的緊急情況外，船舶在正常運行時，所有方向控制系統完全失效的可能性應極小。

5.2.2 設計中，採用動力部件組合動力驅動裝置或驅動系統實現正常方向控制時，除非設有替代系統，否則應備有驅動該裝置的輔助設施。

5.2.3 驅動方向控制裝置的輔助設施可以為人力驅動，但應經主管機關對船舶的尺度、設計和任何航速限制或其他可能是必要的參數加以考慮後，認為其適宜可行。

5.2.4 方向控制系統的構造，若適用，應使一個驅動裝置或系統內出現的單一故障不會導致任何一個其他裝置或系統不能工作或不能使船舶處於安全狀態。主管機關可以允許有短暫時間用於連接輔助控制裝置，只要船舶的設計使主管機關認為這種延遲不致危及船舶安全。5.2.5 故障模式和影響分析應將方向控制系統包括在內。

5.2.6 如有必要使船舶處於安全狀況，用於驅動方向控制裝置的動力裝置，包括要求直接推動前進或倒車的裝置，應能自動操作，並能在發生動力或其他故障後 5 s 內正確作出響應。備用電力系統可按 12.2 對輔助柴油發電機組或按 12.3.6 對應急柴油發電機組的起動時間來要求。

5.2.7 利用船舶的可變幾何形狀或船舶的墊升系統部件的方向控制系統，其構造應儘可能使得驅動聯動裝置或驅動系統的任何故障都不會嚴重危及船舶安全。

5.3 效用試驗

5.3.1 應當根據附錄 8 的效用試驗和驗證程序來規定任何方向控制系統的安全使用限度。

5.3.2 按附錄 8 所作的效用試驗應用於確定任何一個控制裝置發生不可控制完全偏差的情況下對船舶的安全運行所產生的任何不利影響。為確保該系統內的備用或保護裝置具有等效的安全性所必需的對船舶運行的任何限制，均應包括在船舶操縱手冊中。

5.4 控制位置

5.4.1 所有方向控制系統通常均應能在船舶操縱站內進行操縱。

5.4.2 若在其他位置也能操縱方向控制系統，則應在操縱站和這些其他位置之間佈置雙向通信設備。

5.4.3 足夠的指示器應設在操縱站和這些其他位置處，以供船舶操縱人員能驗證方向控制裝置對指令的反應是否正確，並且也能顯示任何異常反應或故障。操縱響應指示器或舵角指示儀應與方向控制系統無關。此種反饋和指示的邏輯應與其他警報和指示一致，以便在緊急狀況時操縱人員不致於混淆。

第 6 章 錨泊、拖曳及繫泊

6.1 通則

6.1.1 本章的主要假定是：高速船僅需配一隻錨供應急使用。

6.1.2 錨泊、拖曳、繫泊裝置及局部加強結構的佈置和設計，應使船員在執行錨泊、拖曳及繫泊作業時的風險最小。

6.1.3 所有錨泊設備、拖纜樁、繫纜樁、導纜孔、羊角和環眼螺栓的構造及其與船體的連接都應在達到設計載荷時不損及船舶的水密完整性。設計載荷和設定的任一方向限制均應記入船舶操縱手冊中。

6.2 錨泊

6.2.1 高速船至少應配置一個具有錨鏈或混合式的錨鏈索和收回裝置的錨。每艘高速船還應設置能適當和安全釋放錨及錨鏈索的裝置。

6.2.2 任一存放錨收回裝置的封閉處所的設計應遵循良好的工程實踐，以確保人員使用該裝置時沒有危險，尤其要注意這些處所入口的設施、走道、照明以及錨鏈和回收機械的保護。

6.2.3 在駕駛室與從事拋錨、起錨或釋放錨作業的人員間，應配置適當的雙向語音通信設備。

6.2.4 錨泊裝置設計時，應考慮到凡是錨鏈索有可能碰擦的任何表面（如錨鏈筒、船體障礙物）都不應使錨鏈索受到損傷和纏繞，且在所有操作情況下都能將錨固定妥善。

6.2.5 船體應該受到保護，使錨及錨鏈索在正常操作情況下損及船體結構的可能性減到最小。

6.3 拖曳

6.3.1 應配置適宜的裝置使船舶在最壞假設條件下能夠被拖曳。凡拖曳點為一個以上時，應配有適宜的平衡支索。

6.3.2 拖曳佈置應使任何有可能與拖索發生磨擦的表面（如導纜孔）具有足夠曲率半徑，以防拖索承載時受損。

6.3.3 船舶在被拖曳時的最大許用航速應記入操縱手冊中。

6.4 繫泊

6.4.1 應按需要設置適宜的導纜孔、帶纜樁和繫索。

6.4.2 繫索應有適宜的儲存處所，能取用方便，並予以固定，足以對抗較大的相對風速和加速度。

第 7 章 消防

A 部分 一般規定

7.1 通則

7.1.1 按船舶類型和潛在的火災危險，下列原則作為本章規定的基礎體現在相應的條文中：

- .1 船上任何艙室失火後，船舶的主要功能和安全系統，包括推進和控制、探火、報警以及未受影響區域的滅火能力得以維持；
- .2 B 類船舶乘客處所的分隔應確保任何艙室內的人員，在失火時能逃往備擇的安全區域或艙室；
- .3 以阻燃限界面進行分隔；
- .4 限制使用可燃材料以及着火時會發出煙霧和有毒氣體的材料；
- .5 火源區內失火的探測、抑制和撲滅；
- .6 脫險通道以及滅火通道的保護；以及
- .7 滅火設備的即刻可用性。

7.1.2 本章規定適用於下述條件：

- .1 探明失火後，船員能立即投入滅火行動，把火情通報給基地港並準備使乘客逃往其他可能的安全區域或艙室，或者必要時撤離乘客。

- .2 建議不使用閃點低於 43°C 的燃油，但只要符合 7.5.1 至 7.5.6 的要求，閃點不低於 35°C 的燃油可以用於燃氣輪機；
- .3 根據本規則第 18 章和第 19 章的要求對船舶進行維修保養。
- .4 不允許設置諸如電影院、夜總會和類似處所的圍閉處所，但是不帶明火烹調設施的小吃部是允許的。如要設廚房，則應滿足公約第 II-2 章的全部要求。
- .5 只要符合公約第 II-2/53 和 54 條的相應要求，可以允許運輸危險品。
- .6 除非有負責消防安全的船員陪同，乘客在航行途中不得進入車輛處所。只有被授權的船員才能在航行途中進入裝貨處所。

7.2 定義

7.2.1 阻火分隔係指由符合以下規定的艙壁和甲板組成的分隔：

- .1 它們應由符合 7.2.1.2 至 7.2.1.6 要求的具有隔熱或阻燃性質的不燃或阻燃材料製成。
- .2 它們應有適當的加強。
- .3 它們的構造應在相應的防火時間範圍內，能防止煙及火焰通過。
- .4 需要時，它們應在相應的防火時間範圍內，仍具有承受負載的能力。

- .5 它們應有這樣的溫度特性，使在相應的防火時間範圍內，背火面的平均溫度較初始溫度的溫升不大於 139°C，而且包括任何接頭在內的任一點的溫升不超過 180°C。
- .6 應要求按原型艙壁和甲板的試驗程序進行一次試驗，以滿足上述要求。

7.2.2 阻燃材料係指在下述方面其性能能滿足本組織制訂的標準*的材料：

- .1 具有低播焰性；
- .2 考慮到艙室內家具起火的危險性，其發熱量應有限制；
- .3 考慮到火災蔓延至鄰近艙室的危險性，應限制熱釋放率；以及
- .4 所產生的煙氣不應對船上人員構成危險。

7.2.3 局部火負荷係指將由本組織制定的符合 7.2.2.2 規定的有關標準**，適用於被認為是必要的艙壁、隔壁和天花板襯裏的表面材料及其支撐結構。

7.2.4 不燃材料係指某種材料加熱至約 750°C 時，既不燃燒，亦不發出足量的造成自燃的易燃蒸氣。這是通過規定的試驗程序***確定的，並使主管機關滿意。任何其他材料均為可燃材料。

* 本組織將進一步制訂標準。

** 參見國際標準化組織頒佈的 ISO 9705 “整體房間耐火試驗”及 ISO 5660 “耐火試驗—對火的反應—建築成品的熱釋放率”。

*** 參見本組織大會以 A.472 ((XII)) 號決議通過的《鑑定船用材料為不燃性的試驗方法的改進建議》。

7.2.5 標準耐火試驗係指將需要試驗的艙壁、甲板或其他結構的試樣置於試驗爐內，按規定的試驗方法，根據本組織制訂的標準*進行的試驗。

7.2.6 凡是出現鋼或其他等效材料字樣的地方，等效材料係指任何不燃材料，由於本身性能或者在隔熱物保護下，經過標準耐火試驗後，在結構性和完整性上與鋼具有同等性能（例如沒有適當隔熱材料的鋁合金）。

7.2.7 低播焰性係指所述表面能有效地限制火焰蔓延，應根據本組織制訂的試驗程序**予以確定。

7.2.8 煙密或能防止煙氣通過係指用不燃或阻燃材料製成的分隔，能阻止煙氣通過。

7.3 處所用途的分類

7.3.1 根據失火危險程度對處所用途所作的分類，應適用如下分組：

.1 較大失火危險區域係指表 7.4-1 和表 7.4-2 中的 A 類，包括下列處所：

- 機器處所；
- 開敞車輛處所；
- 裝有危險貨物的處所；

* 參見本組織大會以 A.754 (18) 號決議通過的《關於“ A ”，“ B ”和“ F ”級分隔耐火試驗程序的建議》。

** 參見本組織大會以 A.653 (16) 號決議通過的《關於艙壁、天花板和甲板終飾材料表面可燃性耐火試驗程序的建議》。

- 特種處所；
 - 裝有易燃液體的儲藏室。
- .2 中等失火危險區域係指表 7.4-1 和 7.4-2 中的 B 類，包括下列處所：
- 輔機處所，定義見 1.4.3；
 - 裝有酒精體積濃度不超過 24% 的包裝飲料的保稅儲藏室；
 - 船員起居處所；
 - 服務處所。
- .3 較小失火危險區域係指表 7.4-1 和表 7.4-2 中的 C 類，包括下列處所：
- 輔機處所，定義見 1.4.4；
 - 貨物處所；
 - 燃油櫃艙室；
 - 公共處所；
 - 箱櫃、空艙和幾乎沒有或無着火危險的區域。
- .4 控制站係指表 7.4-1 和表 7.4-2 中的 D 類，定義見 1.4.13。
- .5 撤離站和外部脫險通道係指表 7.4-1 和表 7.4-2 中的 E 類，包括下列區域：
- 用作脫險通道的外部梯道和開敞甲板；

- 外部和內部集合站；
- 作為救生艇筏登乘與降落地點的開敞甲板處所和圍閉游步甲板處所；
- 上層建築和甲板室的舷側界面，其範圍自救生筏和撤離滑道的登乘區下方的舷側一直至營運狀態下最輕載水線為止。

.6 “開敞處所”係指表 7.4-1 和表 7.4-2 中的 F 類，包括下列區域：

- 除撤離站和外部脫險通道以及控制站以外的開敞處所。

表 7.4-1 客船作為分隔的艙壁和甲板的結構防火時間

	A	B	C	D	E	F
較大失火危險 區域 A	60 1,2	30 1	3 1,8	3,4 1	3 1	- 1,7
中等失火危險 區域 B		30 2	3 8	3,4 60	3 30	- 3
較小失火危險 區域 C			3 3	3,4 30 8	3 3	- 3
控制站 D				3,4 3,4	3 3,4	- 3
撤離站和脫險 通道 E					3 3	- 3
開敞處所 F						-

表 7.4-2 貨船作為分隔的艙壁和甲板的結構防火時間

	A	B	C	D	E	F
較大失火危險 區域 A	60 1,2 60 1,2	30 60 1	3 60 1,8	3,4 60 1	3 60 1	- 60 1,7
中等失火危險 區域 B		6,2 6,2	3 6	3,4 60	3 6	- 3
較小失火危險 區域 C			3 3	3,4 30 8	3 3	- 3
控制站 D				3,4 3,4	3 3, 4	- 3
撤離站和脫險 通道 E					3 3	- 3
開敞處所 F						- -

註：斜線每一邊的數字表示為相應分隔每邊的保護方式要求的結構防火保護時間。

- 1 特種處所甲板的上一面不必保護。
- 2 在相鄰處所分類字母相同且有註 2 的地方，如主管機關認為沒有必要時，其間不必設置艙壁或甲板，例如兩個儲藏室間不必設置艙壁。然而，儘管機器處所和特種處所屬相同類別，其間還應設置艙壁。
- 3 除要求用不燃材料或阻燃材料構成煙密分隔外，沒有其他結構防火要求。
- 4 同時為輔機處所的控制站應具有 30 min 結構防火能力。
- 5 表中只有一個“-”符號的地方，對其材料或限界面完整性沒有特別要求。
- 6 在標準耐火試驗的第一個 30 min 內，對分隔的溫升不予要求，而 30 min 內應能阻止煙氣和火焰通過。

- 7 採用鋼結構時，阻燃分隔不必符合 7.2.1.5 的要求。
- 8 採用鋼結構時，空艙附近的阻燃分隔不必符合 7.2.1.5 的要求。

7.4 結構防火

7.4.1 主結構

7.4.1.1 無論是何種結構材料，下述要求適用於所有船舶。分隔的艙壁和甲板的結構防火時間應根據表 7.4-1 和 7.4-2 的要求，且結構防火時間都要求在 60 min 內提供保護，見 4.8.1。若 4.8.1 中 A 類船舶和貨船採用較短的結構防火時間，這樣 7.4.2.2 和 7.4.2.3 規定的時間可以按比例修改。在任何情況下，結構防火時間不得短於 30 min。

7.4.1.2 在應用表 7.4-1 和 7.4-2 時，必須注意每類的名稱只是典型的舉例而不是限制性的。在確定符合相鄰處所限界面的合適的防火完整性標準時，如果對處所的分類有疑問時，則應按有關類別中具有最嚴格的限界面要求的處所來處理。

7.4.1.3 船體、上層建築、結構艙壁、甲板、甲板室和立柱應以認可的具有足夠結構性能的不燃材料建造。只要符合本章要求（包括本組織制訂的確定溫度升高時複合材料結構強度的試驗程序*），可以允許採用其他阻燃材料。

7.4.2 阻火分隔

7.4.2.1 較大失火危險區域和中等失火危險區域應使用符合 7.2.1 要求的阻火分隔進行圍閉，任何這種分隔的免除不致影響船舶安全者除外。這些要求不必適用於那些在輕載條件下與水接觸的結構部件，但是對於與水接觸的船體溫度的影響以及熱從與水接觸的任何無隔熱結構傳到水面以上有隔熱結構的影響，應予特別注意。

* 參見本組織以 MSC.45（（65））號決議通過的《高速船耐火分隔試驗程序》。

7.4.2.2 中等失火危險區域的阻火艙壁和甲板應能通過 30 min 的標準耐火試驗，而較大失火危險區域的阻火艙壁和甲板應能通過 60 min 的標準耐火試驗，按 7.4.1.1 要求設置者除外。

7.4.2.3 較大失火危險區域和中等失火危險區域內的主要承載結構，應佈置成分佈載荷，以在其暴露於火焰中時，能在適用的防火保護時間內不致使船體和上層建築發生坍塌，同時承載結構還應符合 7.4.2.4 和 7.4.2.5 的要求。

7.4.2.4 若 7.4.2.3 中規定的結構為鋁合金材料製造，則其隔熱層應使其構芯溫度在 7.4.1.1 和 7.4.2.2 規定的時間內不超過環境溫度以上 200°C。

7.4.2.5 如果 7.4.2.3 中的結構由可燃材料製成，其隔熱層應保證在進行按本組織制訂的複合材料標準耐火試驗時，經過 7.4.1.1 和 7.4.2.3 中所規定的時間後，溫度不會升至使結構破壞造成承載能力受損的程度。

7.4.2.6 所有阻火分隔上的門和門框以及其關閉時的固緊裝置的結構，應能與其所在的艙壁具有同等的防禦煙和火焰侵入的能力。鋼質水密門不必隔熱。另外，對因管路、管隧、控制裝置、電纜或其他目的造成的阻火分隔的貫穿，應進行適當的佈置並提供必要的試驗以使防火完整性不致於降低。

7.4.3 可燃材料的使用限制

7.4.3.1 不屬於阻火分隔的所有獨立分隔、天花板和襯板應用不燃材料或阻燃材料製成。

7.4.3.2 如果隔熱層位於可能與可燃液體或其蒸氣接觸的地方，其表面應能防止這種液體或其蒸氣的滲入。連同防潮層和黏潔劑的隔熱層的暴露表面應具有低播焰性。

7.4.3.3 公共處所和船員起居處所的家具和裝飾應符合下述規定：

- .1 除了熱值不超過 45 MJ/m²的可燃飾面可用於這些物品的暴露表面上外，所有家具應完全用認可的不燃或阻燃材料製成；
- .2 諸如椅子、沙發、桌子之類的所有其他家具，其框架應以不燃材料或阻燃材料製成；
- .3 所有帷幔、窗簾和其他懸掛的編織材料，其阻擋火焰蔓延的能力應符合本組織制訂的標準^{*}；
- .4 所有裝飾性墊套家具阻止火焰蔓延的能力應符合本組織制訂的標準^{**}；
- .5 所有床上用品應符合本組織制訂的標準^{***}；
- .6 所有甲板終飾材料應符合本組織制定的標準^{****}。

7.4.3.4 作為最低標準，下述表面應以低播焰性材料製成：

- .1 走廊和梯道環圍內以及所有起居處所、服務處所和控制站的艙壁、圍壁和天花板襯板的暴露表面。

^{*} 參見指本組織大會以 A.471 (12) 號決議通過的《關於垂直懸掛紡織品和薄膜阻止火焰的試驗方法的建議》以及本組織大會以 A.563 (14) 號決議通過的關於該建議的修正。

^{**} 參見本組織大會以 A.652 (16) 號決議通過的《關於裝潢家具耐火試驗程序的建議》。

^{***} 參見本組織大會以 A.688 (17) 號決議通過的《關於床上用品可燃性耐火試驗程序的建議》。

^{****} 參見本組織大會以 A.653 (16) 號決議通過的《關於艙壁、天花板和甲板終飾材料表面可燃性耐火試驗程序的建議》以及本組織大會以 A.687 (16) 號決議通過的《關於甲板基層敷料可燃性耐火試驗程序的建議》。

.2 起居處所、服務所處和控制站內隱蔽或不能到達的處所。

7.4.3.5 任何隔熱和隔聲材料，如果不滿足 7.2.1 或 7.2.2 的要求則應為不燃材料。

7.4.3.6 建造船舶的材料，應根據本組織制訂的標準進行試驗，以認定其在暴露於火焰中時不會散發出足以危及人員安全健康的煙氣和有毒氣體。

7.4.3.7 採用低密度可燃材料建造以提供浮力的空艙，應根據表 7.4-1 和表 7.4-2 的要求用阻火分隔加以保護，免遭鄰近的失火危險區域的殃及。同時，該處所及其關閉裝置應為氣密，但應與大氣連通。

7.4.3.8 在允許吸煙的艙室內，應提供合適的不燃材料製的煙灰缸。在不允許吸煙的艙室，應張貼適當的告示。

7.4.3.9 排氣管的佈置應使着火危險降至最小程度。為此排氣系統應予以隔熱，並且與排氣系統相鄰的艙室和結構，或那些可能會受正常運行或緊急情況下廢氣溫升影響的地方，應以不燃材料建造或以不燃材料圍蔽和隔熱，以抵衡高溫。

7.4.3.10 排氣支管和管路的設計和佈置應使廢氣能得以安全排放。

7.4.4 佈置

7.4.4.1 服務於兩層以上起居甲板的內部梯道，應在每一層甲板均以不燃材料或阻燃材料製成的煙密分隔進行環圍，若該梯道僅服務於兩層甲板，則應至少在一層甲板採用這種環圍，若梯道全部位於公共處所內，則不需要環圍。

7.4.4.2 升降機圍井的設置應能防止煙和火焰從一層甲板蔓延至另一層甲板，並應設置關閉裝置以能控制氣流及煙氣的流通。

7.4.4.3 在起居處所、服務處所、控制站、走廊和梯道內，封閉在天花板、鑲板或襯板後面的空隙，應用緊密安裝的且間距不大於 14 m 的擋風條作適當分隔。

7.5 燃油和其他可燃液體油櫃和系統

7.5.1 裝有燃油和其他可燃液體的油櫃應與乘客、船員和行李艙室以氣密環圍或有適當通風和排水的隔離空艙分隔。

7.5.2 燃油櫃不應位於較大失火危險區域內或與其相鄰。然而只要油櫃由鋼或其他等效材料製成，可以在這種區域內存放閃點不低於 60°C 的可燃液體。

7.5.3 在破損情況下會使油從儲存櫃、沉澱櫃或日用油櫃泄出的所有管子，應在油櫃上直接安裝旋塞或閥門，並能在此類油櫃所在的處所發生火災時，能從該處所處將其關閉。

7.5.4 輸送可燃液體的管路、閥和連接接頭應用鋼材或符合標準*的等效材料製成，其強度和防火完整性應與它的工作壓力和所在處所相適應。只要可行應避免使用撓性管。

7.5.5 輸送可燃液體的管路、閥和連接接頭的佈置應儘可能遠離發動機裝置的熱表面或空氣入口、電氣裝置和其他潛在的着火源，並應進行適當佈置和圍蔽以使滲漏的燃油與這些着火源接觸的可能性保持最小。

* 參見本組織大會以 A.753 (18) 號決議通過的《船舶使用塑料管材指南》。

7.5.6 禁止使用閃點低於 35°C 的燃油。對使用閃點低於 43°C（但不低於 35°C）燃油的船舶，其燃油的儲存、輸送和使用的佈置應顧及使用這種燃油可能引起的在着火和爆炸危險時，能保證船舶及船上人員的安全，其佈置除了符合 7.5.1 至 7.5.5 的要求外，還應符合下述要求：

- .1 用於儲存該類燃油的油櫃應位於機器處所以外且距離船殼板和船底板、甲板和艙壁不小於 760 mm；
- .2 其佈置應防止任何燃油櫃或者燃油系統的任何部件（包括注油管）超壓。任何安全閥和空氣管或溢流管應通向主管機關認為安全的地點；
- .3 燃油櫃所在處所應使用排風機並提供每小時換氣不少於 6 次。該風機應能避免可燃氣體混合物引燃的可能性。在進風和出風口應裝有合適的金屬濾網護罩。排氣出口應引向主管機關認為安全的地點。該類處所的入口處應張貼“禁止吸煙”的告示；
- .4 不能應用接地配電系統，但接地的本質安全電路除外；
- .5 在可能發生燃油泄漏的所有處所（包括通風系統）應採用合適的認可安全型*電氣設備。在該類處所應僅安裝操作所必需的電氣設備和附件；
- .6 在每一個燃油管路通過的處所，應安裝固定式氣體探測裝置，同時在持續有人值班的控制站內安裝報警裝置；
- .7 必要時，每一個燃油櫃應安裝油盤或油槽，以收集任何可能從該類油櫃中泄漏的燃油；

* 參見國際電工委員會的建議案，特別是第 92 號出版物《船舶電氣設備》。

- .8 所有油櫃應設有安全有效的油位測量裝置。測量管不能終止於可能會引燃從測量管內溢出燃油的處所內，特別不能終止於乘客和船員處所。禁止使用玻璃管液面計。任何油櫃上的其他測量裝置也可以接受，如果測量裝置出現故障和過量注入時不會引起燃油溢出和如果這些測量裝置不需要在油櫃頂部以下穿孔。
- .9 在加油操作時，船上和加油站附近不應有乘客，並應張貼足夠數量的“禁止吸煙”和“禁止明火”的告示。船與岸的燃油接頭應為封閉型，並在加油時妥善地接地。
- .10 佈置有非整體式燃油櫃的處所內的探火和滅火系統，應符合 7.7.1 至 7.7.4 的要求。
- .11 加油應採用認可的加油設施進行，在航線操縱手冊中應予詳細說明，在加油站應提供下述防火設備：
 - .11.1 適宜的泡沫施放設施，包括泡沫炮和能以每分鐘不少於 500 L 速率連續供給 10 min 泡沫溶液的泡沫支管；
 - .11.2 總容量不少於 50 kg 的乾粉滅火器；
 - .11.3 總容量不少於 16 kg 的 CO₂ 滅火器。

7.6 通風

7.6.1 所有通風系統的主進風口和出風口應能在通風處所之外加以關閉。此外，通向較大失火危險區的開口，應能從連續有人值班控制站進行關閉。

7.6.2 所有風機應能在其所服務處所以及其所安裝處外部加以關閉。服務於較大失火危險區的風機應能從連續有人值班的控制站進行操作。機器處所內動力通風停止裝置應與其他處所內通風的停止裝置分開。

7.6.3 較大失火危險區域和用作集合站點的主乘客處所應有獨立的通風系統和通風導管。用於較大失火危險區域的通風導管不應通過較大失火危險區域。

7.6.4 如有必要，當通風導管通過阻火或煙密分隔時，該分隔附近應安裝故障安全型自動關閉擋火閘。該分隔與擋火閘之間的導管應為鋼質或其他等效材料製成，且其隔熱要求應與阻火分隔的標準相同。

7.6.5 當通風系統通過甲板時，其佈置應使該甲板的阻火分隔的有效性不會因此而降低，並應採取預防措施以減少煙氣和高溫氣體從一層甲板通過該通風系統擴散至另一層甲板的可能性。

7.6.6 所有安裝於阻火分隔或煙密分隔上的擋火閘，應能從分隔的每一邊進行人工關閉，且能從連續有人值班的控制站進行遙控關閉。

7.7 探火和滅火系統

7.7.1 較大失火危險區域和中等失火危險區域及其他不常有人起居處所中的圍閉處所，如盥洗室、梯道環圍和走廊，應設有認可型自動煙氣探測系統和手動操作呼叫點，以能在控制站顯示所有正常運行條件下發生失火的位置。主推進機器室還應設置煙氣探測之外的其他探測器，並通過電視攝像頭從操作艙室對其進行監視。起居

處所、服務處所和根據需要的控制處所內應遍佈手動操作呼叫點。在這些處所和較大失火危險區域的每一個出入口處均應安裝一個手動操作呼叫點。

7.7.2 固定式探火和失火報警系統應符合下述要求：

7.7.2.1 一般要求

- .1 任何具有手動操作呼叫點的固定探火和失火報警系統應能在任何時候立即動作；
- .2 應對系統操作所必需的電源和電路在斷電或故障時作監控（如合適時）。故障發生時，應在控制板上發出聲、光故障信號，這一信號應與失火信號有區別；
- .3 供固定探火和失火報警系統操作時使用的電氣設備的電源應不少於兩套，其中一套應為應急電源。應由專用的獨立饋電線供電。這些饋電線應接至位於或鄰近於探火系統控制板上的自動轉換開關；
- .4 探測器和手動操作呼叫點應分成若干分區，任何探測器或手動操作呼叫點動作時，應在控制板和指示裝置上發出聲、光火警信號。若在 2 min 內該信號未被引起注意，則應向所有船員起居處所和服務處所、控制站以及機器處所自動發出聲響報警。這一聲響報警系統不必作為探測系統的組成部分；
- .5 控制板應位於駕駛室或主防火控制站內；
- .6 指示裝置應表明已經動作的探測器或手動操作呼叫點所在的分區。至少有一套裝置應位於負責的船員在航行中和在港內

任何時候都容易到達的地點，船舶處於非營運狀態時除外。
如控制板位於非操作艙室內，則一套指示裝置應裝在操作艙室內；

- .7 在每一指示裝置上或其附近應清楚地表示該裝置所保護的處所和分區的位置；
- .8 若探火系統不具備遙控逐一識別每一探測器之功能，一般不允許在起居處所、服務處所和控制站內的一個分區超過一層甲板，但包含圍閉梯道的區域除外。為避免延誤識別火源，每一分區所包括的圍閉處所的數量應予限制，並由主管機關決定。在任何情況下，每一分區的圍閉處所不得多於 50 個。如果探測系統配有遙控識別的探測器，則探測分區可覆蓋幾層甲板，且所服務的圍閉處所數目不受限制；
- .9 對於客船，如果探測系統不能遙控和逐一識別每個探測器，一個分區的探測器不應用於船舶左右兩舷或多於一層甲板的處所，也不超過 7.11.1 規定的一個區域。但是，如果主管機關確信船舶的防火並不因此而減弱，可以允許這種分區的探測器用於船舶的左右兩舷和多於一層甲板。對配有逐一識別探測器的客船，一個分區的探測器所服務的處所可同時包括船舶的左右兩舷及幾層甲板；
- .10 服務於控制站、服務處所或起居處所的一個分區的探測器，不應包括有較大失火危險的機器處所；
- .11 探測器應通過熱、煙或其他燃燒產物、火焰或任何這些因素的組合而動作。主管機關可考慮採用能通過其他因素動作而

顯示出早期火災的探測器，但其靈敏度應不低於前述那些探測器。火焰探測器只能同感煙或感溫探測器一起使用；

- .12 應備有適當的說明書及試驗和維修用的備件；
- .13 應定期用設備對探測系統的功能進行測試。方法是用設備產生一定溫度的熱空氣或煙霧或具有一定密度和尺寸的漂浮微粒或其他與早期火焰有關的現象，以使探測器有新反應。所有探測器應為這樣一種型式的探測器，即其能夠試驗其正確運行，並恢復正常監視功能而無須更換任何部件；
- .14 除了可以允許在控制板上關閉防火門和類似功能外，探火系統不應用於任何其他目的；
- .15 具有區域編址識別功能的探火系統應按如下要求佈置：
 - .1 失火時，探測回路損壞部位不得超過 1 個；
 - .2 應採取必要措施以確保發生在回路中的任何故障（例如：失電、短路、接地），將不會導致整個回路失效；
 - .3 整個佈置應能使該系統在發生故障（電氣、電子、訊息）後，能夠恢復到最初的配置狀態；
 - .4 最先發出的火災報警信號，應不妨礙任何其他探測器激發另外的火災報警信號。

7.7.2.2 安裝要求

- .1 手動操作呼叫點應遍佈起居處所、服務處所和控制站。在每一出口處應安裝一個手動操作呼叫點。在每一層甲板走廊內的手動操作呼叫點，應便於到達，並使走廊的任何一處與手動操作呼叫點的距離不大於 20 m；

- .2 應在所有梯道、走廊和起居處所內的脫險通道安裝感煙探測器。應考慮在通風管道內安裝專用的感煙探測器；
- .3 如果要求在 .2 規定以外的其他處所安裝固定式探火和失火報警系統，則在每一此類處所內應至少安裝一個符合 7.7.2.1.11 規定的探測器；
- .4 探測器的佈置應能發揮其最佳性能。應避免靠近橫樑和通風導管或有將會影響其性能的氣流的位置以及有衝擊或物理損壞可能性的位置。一般位於頂部的探測器應至少距艙壁 0.5 m；
- .5 探測器的最大間距應符合下表：

探測器類型	每一探測器控制的最大探測面積	兩個探測器中心間的最大間距	距艙壁的最大距離
感溫式	37 m ²	9 m	4.5 m
感煙式	74 m ²	11 m	5.5 m

根據證實探測器特性的試驗資料，主管機關可以要求或允許其他間距；

- .6 系統的電線應避免佈置在較大失火危險的機器處所和其他較大失火危險的圍閉處所，但有必要在此類處所配置探火和失火報警或接通到相應的電源者除外。

7.7.2.3 設計要求

- .1 系統和設備應妥善設計，以能承受船上通常發生的電壓變化和瞬時波動、環境溫度變化、振動、潮濕、衝擊、碰撞和腐蝕；

- .2 按 7.7.2.2.2 要求的感煙探測器應經驗證，在煙密度超過每米 12.5% 的減光率前應動作，但超過每米 2% 的減光率前不應動作。安裝於其他處所內的感煙探測器應在主管機關認為滿意的靈敏度極限內動作。要考慮到避免探測器不靈敏或過於靈敏的情況；
- .3 感溫探測器應經驗證，當溫度以每分鐘不大於 1°C 的速率升高時，在空氣溫度超過 78°C 前應動作，但在超過 54°C 之前不應動作。溫升率更大時，感溫探測器應在溫度極限內動作而與其不靈敏或過於靈敏無關；
- .4 經主管機關同意，在乾燥室或環境溫度一般偏高的類似處所內，感溫探測器動作的許可溫度可以較該類處所的頂部甲板最高溫度增加 30°C。
- .5 按 7.7.2.1.11 要求的火焰探測器應具有足夠的靈敏度以能區別火焰和明亮的背景，並應具有一個故障信號識別系統。

7.7.3 周期性無人值班機器處所的固定式探火和失火報警系統應符合下述要求：

- .1 探火系統的設計和探測器的佈置，應在上述處所的任何部位及在機器正常工作狀況和環境溫度範圍內所需的通風變化情況下，當開始失火時，能迅速地探出火災徵兆。除高度受到限制的處所和特別適宜使用的情況外，不允許僅使用感溫探測器的探火系統。該探火系統應能發出與其他非火災系統報警相區別的聲、光報警信號，並且這些報警信號設置點應足夠地多，以保證駕駛室和負責的輪機員能聽到和看到該報警

信號。當駕駛室無人值班時，應能在負責船員的值班處所發出報警。

- .2 系統安裝後，應在不同的機器運行工況和通風條件下進行試驗。

7.7.4 較大失火危險區域應用認可的可從控制站進行操縱的足以使火災熄滅的固定式滅火系統進行保護。該系統應能進行就地人工控制和從持續有人值班的控制站進行遙控。

7.7.5 對使用氣體作為滅火劑的船舶，氣體的量應足以提供兩次獨立的施放。第二次施放應只能在被保護處所的外部進行人工施放。若該處所裝有第二套固定滅火設施，則不要求上述第二次施放。

7.7.6.1 固定式滅火系統應符合下述要求：

- .1 主管機關認為本身或在使用條件下，將會影響地球臭氧層的滅火劑和（或）所釋放的有毒氣體足以危及人身安全的滅火劑不應使用；
- .2 向被保護處所輸送滅火劑所必需的管路應在其控制閥上清楚地標明該管路通向何處。在氣瓶和集合管之間的施放管路上應裝有止回閥。應採取適當措施防止由於疏忽把滅火劑輸往任何其他處所；
- .3 滅火劑分配管路的佈置和噴嘴的位置應使滅火劑得以均勻施放；
- .4 應具有關閉所有開口的設施，以避免空氣進入被保護處所或氣體從裏面逸出。

- .5 在任何處所中，空氣瓶內含有的自由空氣量如因失火而釋放在該處所內將會嚴重影響固定式滅火系統的有效性，則主管機關應要求額外增加滅火劑量。
- .6 對經常有人員在內部工作或出入的處所，應設有施放滅火劑的自動發出聲響警報裝置，它應在滅火劑施放前一段適當的時間發出警報。
- .7 固定式氣體滅火系統的控制裝置，應能易於接近和操作簡便，且應成組地安裝於儘可能少的處所，其所在位置應不致為被保護處所的火災所切斷。考慮到人員的安全，在每一處所應備有指導該系統操作的說明書；
- .8 不允許採用自動釋放滅火劑的裝置；
- .9 如果要求滅火劑量能保護一個以上處所時，則可供使用的滅火劑量不必大於被保護的任一處所中所需的最大數量；
- .10 用於儲存滅火劑的壓力容器應按 7.7.6.1.13 的要求置於被保護處所的外面；
- .11 應備有供船員安全地檢查容器內滅火劑儲量的設施；
- .12 儲存滅火劑的容器和附屬的壓力部件，應考慮到其位置和營運中可能遇到的最高環境溫度，並按主管機關同意的常用壓力規則來設計；
- .13 當滅火劑儲存在被保護處所外面時，該儲存室應位於安全和隨時可到達的地方，並應有有效的通風。這種儲存室最好應能從開敞甲板上進入，且在任何情況下均應與被保護處所分

開。出入口的門應向外開啟，且這儲存室和毗連圍閉處所之間構成限界面的艙壁和甲板，包括門和關閉其任何開口的其他設施，均應為氣密。這種儲存室應被視作控制站；

.14 該系統的備件應儲存於船上或基地港。

7.7.6.2 CO₂ 系統

- .1 對裝貨處所，除另有規定外，所備的 CO₂ 量應足以放出體積至少等於該船最大裝貨處所總容積 30% 的自由氣體；
- .2 對機器處所，所備的 CO₂ 的量應足以放出至少等於下列兩者中較大值的自由氣體：
 - .2.1 被保護的最大機器處所總容積的 40%，此容積算至機艙棚的一個水平面為止，在這個水平面上，機艙棚的水平面積等於或小於從雙層底頂至機艙棚最底部分的中點處水平截面面積的 40%；或
 - .2.2 被保護的最大機器處所包括機艙棚在內的全部容積的 35%；對小於 2000 總噸的貨船，上述百分數可分別減至 35% 和 30%；如兩個或兩個以上的機器處所未完全隔開，應視作一個處所。
- .3 這裏所指的 CO₂，自由氣體的容積應以 0.56 m³/kg 計算；
- .4 機器處所的固定管路系統應能使 85% 的氣體能在 2 min 內注入該處所；
- .5 應設置兩套獨立的控制裝置，以將 CO₂ 釋放至被保護處所，並確保報警裝置的動作。其中，一套控制裝置應用於將氣體

從所儲存的容器中排出，另一套控制裝置應用於開啟安裝在將氣體輸送至被保護處所的管路上的閥；

- .6 兩套控制裝置應佈置在一個施放箱內，在該箱的特定部位應設醒目標記。如果控制施放箱平時用鎖鎖住，則其鑰匙應置於佈置在控制箱附近的設有玻璃面板的盒子內。

7.7.7 控制站、起居處所和服務處所應配備適用類型的手提式滅火器。應備有至少 5 具手提式滅火器，且應佈置在易於獲取處以便即刻可用。另外在每個機器處所入口處至少應配備 1 具適於機器處所滅火的滅火器。

7.7.8 消防泵及相應附屬設備或其等效滅火系統應按如下要求配備：

- .1 至少應設 2 台獨立動力驅動泵。每台泵應至少為 10.3.5 和 10.3.6 規定的艙底泵排量的三分之二，但不得小於 25 m³/h。每台消防泵應能向 .4 要求的消防栓同時提供足夠數量和壓力的消防水；
- .2 泵的佈置應使在任一艙失火的情況下，不會導致所有消防泵同時失去作用；
- .3 在機器處所內設有 1 台或數台消防泵時，則應在機器處所之外易於到達並站得住的位置裝設隔離閥，使機器處所內的消防總管能與機器處所外的消防總管隔斷。消防總管應佈置成當隔離閥關閉時，船上的所有消火栓（上述機器處所內的除外）能由置於該機器處所外的 1 台消防泵通過不進入該處所的管子供給消防用水；

- .4 消防栓的佈置應使來自 2 個不同消防栓通過 2 處消防水帶噴出的水柱能射至船舶的任何地點，其中 1 股僅用單根消防水帶。特種處所消防栓的佈置應使來自 2 個不同消防栓通過單根消防水帶噴出的 2 股水柱，能射至該處所內的任何地點；
- .5 消防水帶應由耐腐蝕材料製成，其最大長度應經主管機關認可。消防水帶及其必要附件和工具，應存放在消防栓附近的明顯部位備用。所有內部處所的消防水帶應永久地與消防栓連接，每個消防栓應按 .4 條的要求備有 1 根消防水帶；
- .6 每根消防水帶應配備帶有關閉裝置的認可型兩用水槍（即水霧/水柱型）。

7.8 特種處所的保護

7.8.1 結構性保護

- .1 特種處所的限界面應根據表 7.4-1 和表 7.4-2 的要求進行隔熱。若有要求，特種處所的承重甲板只需在其下部進行隔熱；
- .2 在駕駛室應設有能顯示通向或來自特種處所的門的關閉與否的指示器。

7.8.2 固定式滅火系統*

每一特種處所，應設有人工操作的認可的固定式壓力水霧系統，此系統應能保護該處內任何甲板和車輛平台的所有部分，但主管機關可以允許使用任何類型固定式滅火系統，只要此系統業已在某一特種處所內作過模擬流動汽油火災的全面試驗，證明其對上述處所內可能發生的失火的控制效果並不低於壓力水霧滅火系統。

* 參見本組織大會以 A.123 (V) 號決議通過的《關於特種處所設置固定滅火系統的建議》。

7.8.3 巡邏和探火

7.8.3.1 在特種處所內應保持連續的消防巡邏制度，除非設有符合 7.7.2 要求的認可型固定式探火和失火報警系統，並配有電視監控系統。固定式探火系統應具有迅速探明失火的能力。探測器的間距和位置應在考慮到通風和其他有關因素影響的情況下進行調試。

7.8.3.2 根據需要在特種處所內應遍設手動操作呼叫點，且其中一個應位於此類處所的出口附近。

7.8.4 滅火設備

7.8.4.1 每一特種處所內應設有：

- .1 至少 3 具水霧槍；
- .2 手提式泡沫槍裝置，它應包括 1 具能以消防水帶連接於消防總管的吸入式空氣泡沫槍，連同 1 隻至少能裝 20 L 發泡液的可攜式容器和 1 隻備用容器。泡沫槍應至少能產生 $1.5 \text{ m}^3/\text{min}$ 適合於撲滅油類火災的有效泡沫。船上應至少備有供特種處所使用的 2 套手提式泡沫槍裝置；以及
- .3 手提式滅火器的佈置應使特種處所內任意一點到達 1 具滅火器的步行距離不大於 15 m，且每個此類處所的入口處至少應設有 1 具手提式滅火器。

7.8.5 通風系統

7.8.5.1 特種處所應設有有效的動力通風系統，在航行途中足以提供每小時至少 10 次換氣。在碼頭進行裝卸車輛操作時，則應提供每小時 20 次的換氣。該類處所的動力通風系統應與其他通風系統完全隔

開，且在處所內裝有車輛時能連續運行。服務於特種處所的通風導管應進行有效的密封，且應使每個該類處所相互隔離。通風系統應能在該類處所外部進行控制。

7.8.5.2 通風應佈置成能避免空氣分層及空氣囊的形成。

7.8.5.3 操作艙室應設有指示裝置，以顯示所需通風量的任何損失或減小。

7.8.5.4 考慮到天氣和海況，通風系統應設有失火時可迅速切斷並能有效關閉的裝置。

7.8.5.5 通風導管，包括擋火閘，應用鋼或其他等效材料製成。

7.8.6 排水孔、艙底泵和排水

7.8.6.1 考慮到固定式壓力水霧系統工作時會引起甲板上大量積水，因而導致嚴重的穩性損失，應裝設流水口，以保證上述積水能迅速直接排出舷外。另外，泵和排水設施應滿足第 10 章的要求。

7.8.7 防止易燃氣體着火

7.8.7.1 在可能積聚爆炸性氣體的任何裝有車輛的甲板和平台，除了開有足夠大小的孔使汽油蒸氣能向下滲透以外，可能構成可燃蒸氣着火源的設備，特別是電氣設備和電纜應裝設於甲板或平台以上至少 450 mm 處。安裝於甲板或平台以上大於 450 mm 的電氣設備，應為密閉型且能防止火星逸出。然而，若為了船舶安全必須使電氣設備和電纜安裝於甲板或平台以上不足 450 mm，則此類電氣設備與電纜應為認可型的，能在爆炸性汽油與空氣混合物中使用。

7.8.7.2 電氣設備及電纜如果安裝在排氣通風導管內，則應為能在易爆炸的汽油和空氣混合物中使用的認可型的，任何排氣導管的出口，在考慮了其他可能的着火源後，應設在一個安全的地點。

7.9 其他

7.9.1 船上應有供船長和船員參考的永久地展示的防火控制圖，應清楚地表明每層甲板的如下地點：控制站；船上由阻火分隔圍閉的區域連同失火報警、探火系統；自動噴水器裝置；固定式和手提式滅火設備；通往船上各種艙室和甲板通道；通風系統，包括對主風機的控制、擋火閘的位置和服務於每一區域通風機的識別號碼；國際通岸接頭的位置（如有時）及 7.5.3，7.6.2，7.7.1 和 7.7.4 中指出的所有控制裝置的位置。該防火控制圖*所用文字應為船旗國的官方文字。然而，若該文字不是英文或法文，則應譯成英文或法文。

7.9.2 防火控制圖或包括此圖的手冊的副本，應永久地存放在甲板室以外具有永久標記的水密套內，供岸上消防人員參考。

7.9.3 阻火分隔的開口

7.9.3.1 除裝貨處所、特種處所、儲藏室和行李室之間的艙口以及這些處所和露天甲板之間的艙口以外，所有開口應具有永久設置的關閉裝置，且其阻火能力應與其所處的分隔同樣有效。

7.9.3.2 每扇門應能從艙壁的任一側由一個人開啟或關閉。

7.9.3.3 較大失火危險區域和梯道環圍限界面上的防火門應符合下述要求：

* 參見本組織大會以 A.654 (16) 號決議通過的《船舶防火控制識別符號》。

- .1 門應為自閉型，且能在向關閉方向反向傾斜至 3.5° 仍能關閉。在船舶處於正浮狀態時，該門的大致關閉均勻速率，應不快於 40 s，也不慢於 10 s。
- .2 遙控滑動門或動力操作的門應設有報警裝置，該裝置應在門開始移動前至少 5 s 但不超過 10 s 發出警報聲響且一直持續到門完全關閉為止。在關閉過程中碰到物體能再次開啟的門，應設計成使再次開啟後足以產生至少 0.75 m 但不必大於 1 m 的無阻通道。
- .3 所有的門應能從連續有人值班的控制站或同時或分組地進行遙控和自動釋放，並也可以從門的兩側單獨釋放。在連續有人值班的控制站內的防火控制顯示屏板上，應能顯示出每扇遙控門是否已被關閉。門的釋放機械裝置應設計成在控制系統和中央電源損壞時，門能自動關閉。釋放開關應具有通—斷功能，以防止系統自動復位。不允許使用不能由控制站脫開的門背鉤。
- .4 動力操作門所用的蓄能器應位於門的附近，以便門至少能就地完成 10 次全開和全關動作。
- .5 裝有保持防火完整性所需壓緊裝置的雙頁門，其壓緊裝置應在門被釋放後自動地起作用。
- .6 直接通往特種處所的動力門和自動關閉的門不必裝有 .2 和 .3 中要求的報警和遙控釋放裝置。

7.9.3.4 面向開敞處所的阻火分隔外部限界面的完整性要求，不適用於玻璃隔板、窗和舷窗。同樣，面向開敞處所的阻火分隔完整性要求不適用於上層建築和甲板室的外部門。

7.10 消防員裝備

7.10.1 除了 A 類客船以外的所有船舶應備有至少 2 套符合 7.10.3 要求的消防員裝備。

7.10.1.1 另外，對 B 類客船，設有乘客處所和服務處所的甲板，按其乘客處所和服務處所的總長度或這種甲板如多於一層，按其最大的乘客處所和服務處所的總長度，每 80 m 或其零數應配備 2 套消防員裝備和 2 套個人配備，每套包括 7.10.3.1.1 至 7.10.3.1.3 規定的項目。

7.10.1.2 對 B 類客船，每副呼吸器應設有 1 具水霧槍，並存放於呼吸器相鄰處。

7.10.1.3 主管機關可根據船舶的大小和類型額外增加個人裝備和呼吸器的數量。

7.10.2 消防員裝備和個人配備，應儲存於易於到達和即刻可用之處，如所配備消防員裝備或個人配備多於 1 套時，其儲存的位置應儘量遠離。在客船上，應在任一控制站可獲得至少 2 套消防員裝備和 1 套個人裝備。

7.10.3 消防員裝備的組成：

.1 個人配備，包括：

.1.1 防護服，其材料應能保護皮膚不受火焰的熱輻射，並不受蒸汽和燃氣的灼傷和燙傷，其外表應為防水型；

.1.2 消防靴和手套，由橡膠或其他不導電材料製成；

.1.3 1 頂能有效抵禦撞擊的剛性消防頭盔；

- .1.4 1 盞認可型的安全燈(手提式),其照明時間至少為 3 h;
- .1.5 1 把消防斧。
- .2 認可的呼吸器,其型式可為下列之一:
 - .2.1 1 具裝有適宜的空氣泵和一段空氣軟管的防煙頭盔或防煙面具,其空氣軟管長度應足夠從開敞甲板到達貨艙或機器處所的任一部分,且不受艙口或門口的妨礙。如為符合此項要求,空氣軟管所需長度超過 36 m 時,則應用自給式壓縮空氣呼吸器替代或由主管機關確定其他替代辦法;
 - .2.2 1 具自給式壓縮空氣呼吸器,其筒內空氣儲存量至少為 1200 L,或可供使用時間至少為 30 min 的其他自給式呼吸器。船上還應配備足夠數量的對所備呼吸器適用的備用充氣器。
- .3 每具呼吸器應配有足夠長度與強度的耐火救生繩 1 根,此繩應能用彈簧卡鉤繫在呼吸器的背帶上,或系在一條分開的腰帶上,使在拉曳救生繩時防止呼吸器脫開。

B 部分 對客船要求

7.11 佈置

- 7.11.1 B 類客船的公共處所應按下述要求分區:
 - .1 應至少分為兩個區域,每個區域的平均長度不應超過 40 m。
 - .2 各個區域中應有一個備擇的安全區域,供其他區域內人員在失火情況下撤離至內。該備擇安全區域應用延伸至上下甲板

的不燃和阻燃材料製成的煙密分隔與其他乘客區域隔開。如在緊急情況下，該備擇安全區域能夠容納額外數量的乘客，則該安全區域可以作為另一乘客區域。

- .3 備擇的安全區域應儘可能位於所服務的乘客區域附近。每一乘客區域應至少有兩個儘可能遠離的出口通向該備擇區域。脫險通道應使所有乘客和船員能從該安全區域安全地撤離。

7.11.2 A 類客船不必分區。

7.11.3 控制站、救生設備存放點、脫險通道和救生艇的登乘點儘可能不位於較大失火危險區域和中等失火危險區域附近。

7.12 通風

起居處所每一區域的通風，應能從連續有人值班控制站進行獨立控制。

7.13 固定式噴水器系統

7.13.1 公共處所和服務處所、除裝有可燃液體以外的儲存處所以及類似處所，應使用符合本組織制訂標準的固定式噴水器系統保護。人工操作的噴水器系統應分成適當大小的區域，並且每一區域所設的閘門、噴水泵的啟動和報警裝置應能從兩個儘量分開的處所進行操作，其中之一應為連續有人值班控制站。對 B 類客船，噴水器系統不得服務於一個以上由 7.11 所要求的處所。

7.13.2 每一操作站應展示系統圖。應採取適當的佈置以排乾該系統工作時所放出的水。

C 部分 對貨船要求

7.14 控制站

控制站、救生設備存放點、脫險通道和救生艇筏的登乘點應位於船員起居處所附近。

7.15 貨物處所

除了開敞甲板區域或冷藏裝貨處所以外的貨物處所應設有符合 7.7.2 要求的認可型自動煙氣探測系統，以能在控制站顯示出裝置在所有正常操作條件下的失火位置，並且應使用符合 7.7.6.1 要求能從控制站操作的認可型固定式快速反應滅火系統保護。

第 8 章 救生設備與裝置

8.1 通則與定義

8.1.1 救生設備和裝置的配備應能滿足 4.7 和 4.8 關於棄船的要求。

8.1.2 除非本規則另有規定，本章中救生設備與裝置的要求應滿足公約第 III 章 C 部分提出的詳細要求，並經主管機關認可。

8.1.3 在救生設備與裝置予以認可之前，主管機關應確認該救生設備與裝置滿足：

- .1 按國際海事組織建議加以試驗，證實其符合本章的要求；^{*}
或
- .2 在主管機關滿意的情況下，成功地經受實質上等效於該項建議所規定的試驗。

8.1.4 在新穎救生設備或裝置予以認可之前，主管機關應確認該項設備或裝置滿足：

- .1 提供至少等效於本章規定的安全標準，並按國際海事組織的建議予以鑑定和試驗；^{**}或
- .2 在主管機關滿意的情況下，成功地經受實質上等效於該項建議的鑑定和試驗。

8.1.5 在接受主管機關原先未予認可的救生設備與裝置之前，主管機關應證實該救生設備與裝置符合本章的要求。

^{*} 參見本組織大會以 A.689 (17) 號決議通過的《救生設備的試驗建議》。

^{**} 參閱本組織大會以 A.520 (13) 號決議通過的《原型新救生設備與裝置的鑑定、試驗與認可實施規則》。

8.1.6 除非本規則另有規定，本章所要求的救生設備的詳細技術要求未列入公約第 III 章 C 部分者，應滿足主管機關的要求。

8.1.7 主管機關應要求救生設備經受必要的產品試驗，以確保這些救生設備按已認可的原型設備的同一標準進行製造。

8.1.8 主管機關採用的認可程序還應包括保持認可或撤銷認可的條件。

8.1.9 主管機關應確定容易老化的救生設備的使用期限。該類救生設備應標明確定其年限的方法或必須更換的日期。

8.1.10 除另有規定外，本章內的定義如下：

- .1 探測係指幸存者或救生艇筏位置的測定。
- .2 登乘梯係指設置在救生艇筏登乘站以供安全進入降落下水後的救生艇筏的梯子。
- .3 登乘站係指登乘救生艇筏的地方。登乘站如有足夠的場地並能安全進行各種集合行動則可以兼作集合地點。
- .4 自由漂浮下水係指救生艇筏從下沉中的船舶自動脫開並立即可用的下水方法。
- .5 下水係指載足全部乘員和屬具的艇筏在船上脫開並在沒有任何制約裝置的情況下任其下降到海面的救生艇筏下水方法。
- .6 救生服係指減少在冷水中穿着該服人員體熱損失的保護服。
- .7 氣脹式設備係指依靠非剛性的充氣室作浮力，而且在使用前通常保持不充氣狀態的設備。

- .8 充氣設備係指依靠非剛性的充氣室作浮力，而且無論何時均保持充氣備用狀態的設備。
- .9 降落設備或裝置係指將救生艇筏或救助艇從其存放位置安全地轉移到水上的工具。
- .10 海上撤離系統（MES）係指用來迅速把大量乘員通過通道從登乘站轉移到漂浮平台再登乘到相連的救生艇筏或直接登入相連的救生艇筏的設備。
- .11 新穎救生設備或裝置係指具有本章規定沒有充分述及的新特徵，但提供同等的或更高的安全標準的救生設備或裝置。
- .12 救助艇係指為救助遇險人員及集結救生艇筏而設計的艇。
- .13 拯救係指把幸存者安全尋回。
- .14 逆向反光材料係指以相反方向反射射入光束的材料。
- .15 救生艇筏係指從棄船時候起能維持遇險人員生命的艇筏。
- .16 保溫用具係指採用低導熱率的防水材料製成的袋子或衣服。

8.2 通信

8.2.1 船舶應配備下列無線電救生設備：

- .1 所有的高速客船和 500 總噸及以上的高速貨船應至少配備 3 具雙向 VHF 無線電話設備。這類設備的性能應不低於國際海事組織認可的標準*；

* 參見本組織大會以 A.605 (15) 號決議通過的《救生艇筏用手提式雙向 VHF 無線電話設備的性能標準建議》。

- .2 所有的高速客船和 500 總噸及以上的高速貨船的每舷應至少配備 1 具雷達應答器，這類雷達應答器的性能應不低於國際海事組織認可的標準。^{*}雷達應答器應存放在能迅速移到任何一隻救生艇筏上去的位置，或者每艘救生艇筏都應放置 1 具雷達應答器。

8.2.2 船舶應配備下列船上通信與報警系統：

- .1 船舶應配備 1 套固定式或手提式應急設備或兩者兼備，供船上應變控制站、集合站和登乘站以及要害部位之間的雙向通信聯繫使用。
- .2 船舶應配備一套符合公約第 III/50 條要求的通用應急報警系統，以供召集乘客與船員至集合站和採取應變部署表所列行動之用。該系統應由公共廣播系統或其他適當通信設施進行補充。該系統應能在駕駛室操作。

8.2.3 信號設備

8.2.3.1 所有船舶應在操縱室永久配備 1 盞便攜式白晝信號燈，該信號燈不應依靠船舶的主電源。

8.2.3.2 船舶應至少配備 12 支符合公約第 III/35 條要求的火箭降落傘火焰信號，並應將其存放在操縱室或其附近。

8.3 個人救生設備

8.3.1 在正常的工作情況下，如果乘客或船員可以到達露天甲板，應在船的兩舷各配備至少 1 隻能從操縱室和從其存放處及附近快速

^{*} 參閱本組織大會以 A.697 (17) 號決議通過的《用於搜尋和救助作業的救生艇筏雷達應答器的性能標準建議》。

釋放的救生圈，該救生圈應配有一盞自亮燈和 1 具自發煙霧信號。自發煙霧信號裝置的放置和繫固措施應確保其不會由於船舶碰撞或擱淺產生的加速度而鬆脫或自行放射。

8.3.2 在船舶的每個正常出口附近至少設置 1 隻救生圈，並在乘客和船員易於到達的每層露天甲板，應至少設置 2 隻救生圈。

8.3.3 船舶的每個正常出口附近設置的救生圈應裝有不少於 30 m 長的浮式救生索。

8.3.4 至少總數一半的救生圈應設有自亮燈，這些設有自亮燈的救生圈應不包括 8.3.3 要求的裝有浮式救生索的救生圈。

8.3.5 船上每一人員應配備 1 件符合公約第 III/32.1 或 III/32.2 條要求的救生衣，另外還應：

- .1 配備船上乘客人數至少 10% 的兒童救生衣，或為每個兒童配備 1 件救生衣，取其大者；
- .2 每艘客船還應配備不少於船上總人數 5% 的救生衣，這些救生衣應存放於甲板上或集合站的顯眼之處；
- .3 還應配供值班人員使用和供遠置的救生艇筏站及救助艇站使用的足夠數量的救生衣；且
- .4 所有救生衣都應具有符合公約第 III/32.3 條要求的燈。

8.3.6 救生衣應放置在容易到達之處，其位置應有明顯標誌。

8.3.7 船舶應為每位救助艇艇員配備 1 件適當規格的符合公約第 III/33 條要求的救生服。

8.3.8 應為每個應變部署表中被指派為負責將乘客登乘到救生艇筏的海上撤離系統的人員配備 1 件救生服或抗暴露服。如果船舶固定在溫暖氣候航區航行，則經主管機關批准，可免配上述救生服或抗暴露服。

8.4 應變部署表、應變須知與手冊

8.4.1 船上每一人員應配備 1 份應急情況下必須遵守的明確的須知。

8.4.2 應將符合公約第 III/53 條要求的應變部署表張貼在全船各顯眼之處，包括控制室、機艙和各船員起居處所。

8.4.3 應將用適當文字書寫的圖例和應變須知張貼在公眾場所，並將其集合站、其他乘客處所及每張座椅附近明顯地展示，向乘客通告如下內容：

- .1 其集合站；
- .2 應變時必須採取的行動；
- .3 救生衣的穿着方法。

8.4.4 每艘客船應設有乘客集合站，該站應：

- .1 設在登乘站附近，並可使所有乘客易於到達登乘站，與登乘站設在同一地點者除外；同時
- .2 有足夠的集合和指揮乘客用的寬敞場地。

8.4.5 在每間船員餐室和文娛室，應配有一份符合 18.2.3 要求的訓練手冊。

8.5 操作須知

8.5.1 應在救生艇筏及其降落控制器的上面或附近，設置告示或標誌並應：

- .1 用圖解說明該控制器的用途及其操作程序，並提出有關須知或注意事項；
- .2 在使用應急照明時，容易被看清；
- .3 使用符合本組織要求的符號*。

8.6 救生艇筏的存放

8.6.1 救生艇筏應牢固地存放於乘客艙室之外，並儘可能與乘客處所及登乘站靠近，其存放應使每隻救生艇筏能以一種簡單的方式安全地降落，並且在降落過程中和降落後，救生艇筏能繫留在船邊。繫繩的長度及佈置應使救生艇筏保持適當位置以便人員登乘。當出口處有多於一艘救生艇筏使用時，主管機關可以允許使用可調節的繫繩，所有繫繩的繫纜裝置的強度應滿足能在疏散過程中救生艇筏的位置保持不變。

8.6.2 救生艇筏的存放應使在船上其存放位置及附近位置處能解除繫繩裝置，在控制室及附近位置上也可解除。

8.6.3 如可行，救生艇筏應按相等容量佈置在船的兩舷。

8.6.4 氣脹式救生筏應儘可能在降落過程中開始充氣。當不便對筏進行自動充氣時（如當救生筏參與海上撤離系統時），救生筏的佈置

* 參見本組織大會以 A.760 (18) 號決議通過的《與救生設備和裝置有關的符號》。

應能滿足 4.8.1 規定的撤離時間限制。

8.6.5 救生艇筏應在各種操作狀態下以及在受到第 2 章所述的損壞後浸水的各種狀態下能夠降落，然後從指定的登乘站登乘。

8.6.6 救生艇筏降落站的位置，應特別注意與螺旋槳或噴水推進器及船體陡斜懸空部分保持距離，以確保安全降落。

8.6.7 在準備和降落過程中，救生艇筏以及供其降落的水面應有足夠的照明，供給該照明系統的主電源及應急電源應符合第 12 章的要求。

8.6.8 應採取措施避免在降落時船舶任何排水進入救生艇筏。

8.6.9 每艘救生艇筏的存放應：

- .1 使該救生艇筏及其存放佈置均不干擾任一其他降落站的任一其他救生艇筏或救助艇的操作；
- .2 處在持續的備用狀態；
- .3 配齊裝備；
- .4 如可行，存放在安全和有遮蔽的地方，並加以保護，免受火災和爆炸引起的損害。

8.6.10 每 1 隻救生筏存放時，其首纜應固定地繫在船上，並應設有符合公約第 III/38.6 條要求的自由漂浮裝置，使救生筏在高速船沉沒時，儘可能自由漂浮，如果是氣脹式救生筏，應能自動充氣。

8.6.11 救助艇的存放應：

- .1 使救助艇處於在 5 min 以內能降落下水的持續備用狀態；

- .2 在適宜於降落並回收的地方；
- .3 使救助艇及其存放佈置均不干擾任一其他降落站的任一救生艇筏的操作。

8.6.12 救助艇和救生艇筏應牢固地繫在甲板上，至少能經受住由於實船的水平碰撞而產生的載荷以及在存放位置的垂直設計載荷。

8.7 救生艇筏和救助艇的登乘與回收佈置

8.7.1 登乘站應設在從起居處所及工作處所易於到達之處，如果指定集合站不在乘客處所，則該集合站應設在從乘客處所易於到達之處，登乘站也應設在從集合站易於到達之處。

8.7.2 撤離路線、出口和登乘點應符合 4.7 的要求。

8.7.3 通向集合站和登乘站的走道、梯道及出口應給與足夠的照明，供給該照明系統的主電源及應急電源應符合第 12 章的要求。

8.7.4 如沒有配備吊艇架降落的救生艇筏，為了避免人員登乘救生艇筏時進入水中，應設置海上撤離系統或等效的撤離設備。該海上撤離系統或等效的撤離設備應在各種操縱狀態下，以及在受到第 2 章所述的損壞後浸水的各種狀態下能使人員登乘到救生艇筏上。

8.7.5 只要救生艇筏和救助艇的登乘佈置在船舶允許運營的海況下以及在所有未損壞及規定損壞的條件下發生的縱、橫傾時是有效的，且水線與指定登乘位置間的乾舷不大於 1.5 m，主管機關可接受人員直接登上救生筏的安排。

8.7.6 救助艇登乘裝置應能從救助艇存放位置直接登乘和降落，並且當其載滿全體人員及設備時，能迅速回收。

8.7.7 在每個海上撤離系統登乘站都應設有 1 把安全刀。

8.8 拋繩設備

船舶應配備 1 具符合公約第 III/49 條要求的拋繩設備。

8.9 使用準備狀態、維護保養與檢查

8.9.1 使用準備狀態

船舶在離港前及在整個航行期間，船上一切救生設備應處於正常狀態，並立即可用。

8.9.2 維護保養

8.9.2.1 應備有符合公約第 III/52 條要求的救生設備船上維護保養須知，並應按須知進行保養。

8.9.2.2 主管機關可以同意用包含公約第 III/52 條要求的船上維護保養程序計劃表來代替 8.9.2.1 所規定的須知。

8.9.3 吊艇索的保養

應將降落用的吊艇索的兩索端掉轉，間隔期不超過 30 個月，因吊索老化而有必要時，或在不超過 5 年的間隔期中，應予換新，取其較早者。

8.9.4 備件與修理設備

應配備救生設備及其易損或易耗和必須定期更換部件的備件和修理設備。

8.9.5 每周檢查

每周應進行下列的試驗和檢查：

- .1 所有救生艇筏、救助艇及降落設備作外觀檢查，以確保立即可用；
- .2 只要環境溫度在起動發動機所規定的最低溫度以上，所有救助艇的發動機應進行正車和倒車運轉，總時間不少於 3 min；
- .3 通用應急報警系統試驗。

8.9.6 月度檢查

每月應用公約第 III/52.1 條所規定的核對表來檢查救生設備，包括救生艇筏屬具，確保完整無缺，並處於良好狀態。檢查報告應載入航海日誌。

8.9.7 氣脹式救生筏、氣脹式救生衣及充氣救助艇的檢修

8.9.7.1 每隻氣脹式救生筏、每件氣脹式救生衣及海上撤離系統的檢修應滿足：

- .1 間隔期限不得超過 12 個月，如不切實際時，主管機關可展期 1 個月。
- .2 應在認可的檢修站進行檢修，該檢修站應能勝任檢修工作，備有正規的檢修器具，並僅僱用受過正規訓練的工作人員。*

8.9.8 所有充氣式救助艇的修理和維護保養，應按照製造廠的說明書進行。可以在船上進行應急修理，但是應在認可的檢修站完成正

* 參閱本組織大會以 A.761 (18) 號決議通過的《氣脹式救生筏檢修站認可條件建議》。

式的檢修。

8.9.9 靜水壓力釋放器的定期檢修

靜水壓力釋放器的檢修應滿足：

- .1 間隔期不得超過 12 個月，如不切實際時，主管機關可展期 1 個月；
- .2 在檢修站進行檢修，該檢修站應能勝任檢修該裝置，備有正規的檢修器具，並僅僱用受過正規訓練的工作人員。

8.10 救生艇筏與救助艇

8.10.1 所有船舶應配備：

- .1 至少 2 艘經檢驗合格的能夠容納不少於船上總人數 100% 的救生艇筏；
- .2 此外，還應配備經檢驗合格的能足夠容納不少於船上總人數 10% 的救生艇筏；
- .3 應配備經檢驗合格的在任何一隻救生艇筏掉失或不能使用時，能夠容納船上所有人員的救生艇筏；
- .4 應至少配備 1 艘用於拯救水上人員的救助艇。當船舶載客 450 名以上時，應在每舷至少配備 1 艘這樣的救助艇；
- .5 對於長度小於 20 m 的船舶可以不配備救助艇，但需滿足下列所有要求：
 - .5.1 船舶的佈置應能救起水上無助人員；
 - .5.2 在駕駛台上能觀察對水上無助人員的救助工作；和

- .5.3 船舶應有足夠的機動性，以便在能想像的最壞條件下接近和救起落水人員。
- .6 除了以上.4 和.5 規定外，船舶還應配備足夠數量的救助艇，確保供船上全體人員棄船時使用；
 - .6.1 每艘救助艇所需集結的符合 8.10.1.1 規定的救生筏應不多於 9 隻；或
 - .6.2 如果主管機關對救助艇同時拖曳一對救生筏的能力表示滿意，則每艘救助艇所需集結的符合 8.10.1.1 規定的救生筏應不多於 12 隻；且
 - .6.3 船舶能在 4.8 規定的時間內撤離所有人員。

8.10.2 鑑於航區的遮蔽特性以及營運區域的氣候條件，主管機關認為合適的話，可以允許 A 類高速船使用符合附錄 10 的要求的開敞式兩面可用氣脹式救生筏，作為公約第 III/39 或 III/40 條規定的救生筏的替代方案。

第 9 章 輪機

A 部分 一般規定

9.1 通則

9.1.1 機器以及與主機與輔機動力設備有關的管系和附件，其設計和構造應適於它們的用途，且其安裝和防護和應對運動部件、高溫表面以及其他可能的危險進行適當的考慮，以便把對船上人員產生的危險降低到最小程度。在設計中，應對結構材料、擬選設備的用途、使用的工作條件以及船上的環境條件加以注意。

9.1.2 所有溫度超過 220°C 的表面，如果系統發生故障，會導致易燃液體射擊該表面，則這些表面應包覆隔熱層。隔熱層應採用抗易燃液體及其蒸氣滲透的材料。

9.1.3 應對單一的主要推進部件的可靠性予以特別考慮，並可要求一個足以提供高速船適航航速的分離的推進動力源，尤其是在非常規佈置的情況下，更應如此。

9.1.4 應提供手段，以保證即使主要輔機之一不能工作時，也能使推進機械的正常運行得以維持或恢復。應對下列裝置的故障予以特別考慮：

- .1 主發電機；
- .2 發動機燃油供應系統；
- .3 潤滑油壓力源；
- .4 水壓力源；

.5 起動或控制用空氣壓縮機和空氣瓶；

.6 控制推進主機包括調距槳所用的液壓、氣動或電動裝置。

但是，出於全面的安全考慮，可以同意從正常運轉工況部分降低推進能力。

9.1.5 應提供手段，以便在沒有外部幫助的情況下，確保能使機械裝置從“癱船”狀態投入運轉。

9.1.6 所有受內壓的機器部件、液壓、氣動和其他系統及其附件，在第一次投入運行之前，均應經適當的試驗，包括壓力試驗。

9.1.7 應採取措施，以便於對推進主機和輔助機械包括鍋爐和壓力容器進行清潔、檢查和維修。

9.1.8 安裝在高速船上的機械的可靠性應適合該船的用途。

9.1.9 對於那些在類似場合中使用合格，但在細節方面不完全符合本規則規定的機械，主管機關可同意採用，但應確認：

.1 此類機械的設計、構造、試驗、安裝和規定的維修都適合於其在海上環境的用途；

.2 此類機械能達到同等安全水平。

9.1.10 故障模式及影響分析應包括機械系統及其控制裝置。

9.1.11 製造廠提供適用的必要資料，諸如操作條件和限制等要素，以確保機器的正確安裝。

9.1.12 推進主機以及高速船的推進和安全所必要的所有輔機機械，應如同安裝在高速船上那樣，設計成在高速船正浮和靜態向任一舷

橫傾至不超過 15°，以及動態向任一舷橫搖至不超過 22.5°，並同時首尾動態縱搖 7.5° 的情況下，均能工作。主管機關在考慮了高速船的類型、尺度和服務條件後，可以允許對這些度數作變更。

9.1.13 所有鍋爐和壓力容器及其管系的設計和製造，應適合其預定的用途，並應予以妥善安裝和防護，以便把它們對船上人員造成的危險降至最低限度。應特別注意製造中所用的材料以及在運轉時的工作壓力和溫度下，必須提供具有超過材料正常應力的適當安全裕量。每台鍋爐、壓力容器及其管系，都應設有防止使用中超壓的適當裝置，並在投入使用之前進行液壓試驗，且適當時，以後定期以適當高於工作壓力的試驗壓力進行液壓試驗。

9.1.14 應設有裝置，以保證萬一任何液體冷卻系統發生故障，能被迅速地監測到並予以報警（光和聲）並採取措施，使上述故障對系統所服務的機器所產生的影響減少到最低程度。

9.2 發動機（通則）

9.2.1 發動機應設有關於轉速、溫度、壓力及其他運行參數的適當的安全監測和控制裝置，對機器的控制應在高速船操縱室內進行。B 類高速船和高速貨船應在機器處所內或其附近設有附加機器控制裝置。機器設備應適合於操作管理，例如在無人值班機器處所*內，包括自動探火系統、艙底水報警系統、遙控機器儀錶和報警系統。對於連續有人值班的機器處所，上述規定可以按照主管機關的要求加以變更。

9.2.2 應防止發動機超速、潤滑油失壓，冷卻介質斷流和高溫、運

* 參見公約第 II-1 章 E 部分。

動部件故障和超負荷等，除了有完全斷裂或爆炸的危險外，安全裝置不得在沒有預先報警的情況下導致停機。上述安全裝置應能進行試驗。

9.2.3 應設有兩個從操縱室操縱的獨立快速停機裝置，在任何運轉工況下均可使用，但不必要求發動機上裝置雙份執行器。

9.2.4 發動機的主要零部件應具有足夠的強度，以承受正常運轉的熱力和動力工況。發動機在轉速或溫度超過正常數值但未超出保護裝置所設定的限度情況下進行限制性操作時，不應損壞。

9.2.5 發動機設計，應使發生火災或爆炸的危險降至最低限度，並符合第 7 章的防火要求。

9.2.6 應採取措施，將所有過量的燃料和油類排放至安全地點，以避免火災危險。

9.2.7 應採取措施，儘可能保證發動機驅動系統的故障，不致過分影響主要部件的完整性。

9.2.8 在所有可預見的運轉情況下，機器處所通風裝置的能力均應滿足需要。若適當時，通風裝置應確保發動機起動前將封閉的發動機艙室強制通風到大氣壓力。

9.2.9 任何發動機的安裝，應避免引起高速船內的過大振動。

9.3 燃氣輪機

9.3.1 燃氣輪機應設計成能在海洋環境中運轉，並在直到獲准使用和最高穩定轉速的整個運轉範圍內，不應出現喘振或危險的不穩定現象。渦輪裝置的佈置，應保證其在可能發生過大振動、停車或喘

振的任何轉速範圍之內不能連續運轉。

9.3.2 燃氣輪機的設計和安裝，應使壓氣機或渦輪機葉片任何可能的脫落不致危及該高速船、其他機械、高速船上的乘客或任何其他人員。

9.3.3 關於燃氣輪機在誤起動或停車後可能直入噴管內部或排氣系統內的燃料，9.2.6 的要求同樣適用。

9.3.4 渦輪機應儘可能加以防護，防止可能吸入工作環境中的沾染物而受到損壞。應提供建議性的沾染物最大濃度的適用資料。應採取措施，防止鹽垢在壓氣機和渦輪機上積聚，必要時，還要防止進氣口結冰。

9.3.5 萬一軸或薄弱部件發生故障時，其斷裂端不應直接傷害高速船乘員，也不應因高速船或其系統的損壞而危及乘員。必要時，可以裝設保護裝置以滿足上述要求。

9.3.6 每台發動機均應設有應急超速停車裝置，如可能，該裝置應直接與每根轉子軸連接。

9.3.7 當設有隔音罩時，應把燃氣發生器和高壓油管完全包圍，並設有隔音罩探火和滅火系統。

9.3.8 製造廠提出的對渦輪機裝置萬一失靈防止危險情況發生的自動安全裝置的詳細資料，應與故障模式和影響分析報告一起提供。

9.3.9 製造廠應對機殼的堅固性提供證明。中間冷卻器和熱交換器的每側應分別進行液壓試驗。

9.4 主推進及重要輔助柴油機

9.4.1 任何主柴油機推進系統都應具有滿意的扭轉振動和其他振動特性，該特性應由對從發動機直至推進器的系統及其部件進行單獨的以及綜合的扭轉和其他振動分析所證實。

9.4.2 高壓燃油泵和燃油噴嘴之間的所有外部高壓供油管路，均應設有能容納破損的高壓油管所漏出燃油的防護套管系統。該套管系統應包括一個漏油收集裝置和高壓管破損報警裝置。

9.4.3 缸徑 200 mm 或曲柄箱容積 0.6 m³ 及以上的柴油機，均應設有足夠釋放面積的認可型曲柄箱防爆安全閥。該安全閥應設有裝置，以確保其排出氣體受到控制，從而把傷害人員的可能性降至最低限度。

9.4.4 潤滑油系統的佈置，應在所有運轉轉速下均能有效潤滑，並應對高速船在所有的縱、橫傾情況和運動程度下必須保持滑油吸入和避免溢出予以適當的考慮。

9.4.5 考慮到柴油機內潤滑油的循環速率，應設有裝置，以保證萬一潤滑油壓力或潤滑油液位降低到安全值以下時，能觸發聲光報警裝置，同時，還應將柴油機轉速自動降低到安全數值，而僅在將導致完全損壞、着火或爆炸的情況下，才觸發自動停車。

9.4.6 若柴油機採用壓縮空氣起動、換向或控制時，空氣壓縮機、空氣瓶和空氣起動系統的佈置，應使火災或爆炸的危險降至最低限度。

9.5 傳動裝置

9.5.1 傳動裝置應具有足夠的強度和剛度，以承受運轉中可能出現的最不利的複合載荷而不超過材料的許用應力。

9.5.2 軸系、軸承以及緊固件的設計，應能使其在軸轉速直到原動機設計的超速停車設定轉速的 105%範圍內的任何轉速下，不致發生危險的回旋和過大的振動。

9.5.3 傳動裝置的強度和製造，應使其在整個使用壽命期間，在使用中可能出現的交變載荷作用下，產生危險的疲勞斷裂的可能性極其微小。應通過適當的試驗以及足夠低應力的設計，結合使用抗疲勞材料和適當的施工設計，以證明上述要求得到滿足。若在傳動裝置的某些轉速下發生的扭轉振動或其他振動可能導致發生故障，而這些轉速在高速船的正常運轉中並不使用，則這種情況可以允許存在，但應作為限制條件在高速船操縱手冊中予以記錄。

9.5.4 若傳動裝置中設有離合器時，離合器的正常接合不應在傳動裝置或所驅動的部件中造成過度的應力。任何離合器的誤操作不應在傳動裝置或所驅動的部件中產生危險的高應力。

9.5.5 應採取預防措施，以使傳動裝置任何零件或所驅動部件發生故障時，不致造成可能危及高速船或其乘員的損壞。

9.5.6 若潤滑液供應故障或潤滑液失壓可能導致危險情況時，則應採取措施，似便能在適當時間內向操作船員顯示上述故障，使其能在危險情況出現之前，儘快採取合適的行動。

9.6 推進和墊升裝置

9.6.1 本節各項要求以下列前提為基礎：

- .1 推進裝置和墊升裝置可以是分立的，也可以合併為單一的推進和墊升裝置。推進裝置可以是空氣螺旋槳或水螺旋槳或噴水推進器，並且這些要求適用於各類高速船。

- .2 推進裝置係指直接提供推進力的裝置，包括機器設備以及主要用來提供推進力的任何導管、槳葉、流體進口和噴嘴等。
- .3 本節中的墊升裝置係指直接提高空氣壓力並主要是為氣墊船提供墊升力的機器設備。

9.6.2 推進和墊升裝置應具有足夠的強度和剛度，其設計參數、計算書以及必要的試驗應能確定該裝置運轉期間可能出現的載荷的能力，對此，應向高速船頒發證書，以確保發生災難性故障的可能性極其微小。

9.6.3 設計推進裝置和墊升裝置時，應適當考慮腐蝕裕量、不同材料間的電解作用以及在自然環境中運轉時遭受水霧、碎片、鹽分、泥沙、結冰等作用而產生的侵蝕或空泡腐蝕等影響。

9.6.4 如適合時，推進裝置和墊升裝置的設計參數和試驗，應適當考慮由於導管堵塞可能產生的任何壓力、固定載荷和交變載荷、外部載荷以及操縱/換向時裝置的使用和旋轉部件的軸向位置等。

9.6.5 應採取適當措施，以確保：

- .1 使碎片或異物的吸入降至最低限度；
- .2 使軸系或旋轉部件傷害人員的可能性降至最低限度；
- .3 必要時，營運中應能安全地進行檢查和清除碎片。

B 部分 對高速客船的要求

9.7 B 類高速船獨立推進裝置

B 類高速船至少應設有 2 套獨立的推進裝置，以在 1 台發動機

或其支持系統發生故障時，不致造成另外的發動機或發動機系統失效，並應在機器處所內或機器處所附近設有附加的機器控制裝置。

9.8 B 類高速船返回避難港口的措施

當任一艙室發生火災或其他災禍時，B 類高速船應能維持重要機器和控制裝置的正常運轉和操作能力，以保證能依靠其自身動力返回避難港口。

C 部分 對高速貨船的要求

9.9 主要機器設備和控制裝置

當任一艙室發生火災或其他事故時，高速貨船應能維持重要機器和控制裝置的正常運轉和控制能力，但不要求能依靠其自身動力返回避難地點。

第 10 章 輔機系統

A 部分 一般規定

10.1 通則

10.1.1 液體系統的製造和佈置，應確保高速船在所有工況所規定的流速和壓力下有安全和足夠的流量，同時應使任一液體系統的中斷或泄漏造成電力系統損壞、火災或爆炸的可能性極其微小，並應注意避免管子泄漏或破損後易燃液體濺落在高溫表面上。

10.1.2 液體系統任何部分的最高許可工作壓力，不得大於考慮了材料的許用應力後所確定的設計壓力。若系統中某些部件（如閥或附件）的最高許可工作壓力低於管子或管路的計算值時，則應把該系統的壓力限制在上述各部件最高許可工作壓力中的最低值。每一個可能受到高於其最高許可工作壓力作用的系統均應有適當的安全裝置加以保護。

10.1.3 艙櫃和管系應經壓力試驗，其試驗壓力應保證在受試項目工作壓力以上有一定的安全裕度。對任何儲存櫃或容器的試驗，均應考慮溢流狀態下任何可能的靜壓頭以及高速船運動所引起的動力載荷。

10.1.4 管系所用的材料應與所輸送的液體相容，並對發生火災的危險進行考慮後加以選擇。在保持船體、水密甲板和艙壁完整性的前提下，可以允許在某些系統中使用非金屬管系材料*。

10.1.5 本章規定中，術語“基準面”係指 2.2.1.3 所規定的基準面。

* 參見本組織大會以 A.753 (18) 號決議通過的《船舶使用塑料管材指南》。

10.2 燃油、潤滑油和其他易燃油類的佈置

10.2.1 7.1.2.2 的規定適用於燃油的使用。

10.2.2 燃油、潤滑油和易燃油類的管路應加以遮蔽或適當保護，儘可能避免油霧或漏油射向高溫表面、進入機器空氣進口或接觸其他着火源。上述管系的接頭數量應保持最少。輸送易燃液體的軟管應為認可的型式**。

10.2.3 燃油、潤滑油和其他易燃油類，不得裝在公共處所和船員艙室之前。

燃油佈置

10.2.4 使用燃油的高速船，其燃油的儲存、分佈和使用的佈置應確保高速船和船上人員的安全，並至少符合下列規定：

10.2.4.1 壓力超過 0.18 N/mm^2 熱油的燃油系統的所有部分，應儘可能不設在其損傷和泄漏不易觀察到的隱蔽地點。機器處所內燃油系統的上述部分，應有足夠的照明。

10.2.4.2 在所有正常情況下，機器處所均應有足夠的通風，以防止油類蒸氣的積聚。

10.2.4.3 燃油艙櫃的位置應符合 7.5.2 的規定。

10.2.4.4 燃油櫃不得位於因燃油溢漏到熱表面上而造成危險的地點。參見 7.5 的防火安全要求。

10.2.4.5 燃油管應按 7.5.3 的要求裝設旋塞或閥門。

** 參見 MSC/Circ.647 通函《關於把易燃液體系統的泄漏降至最低限度以改善可靠性和減少火災危險的指南》。

10.2.4.6 必要時，每個燃油櫃均應設置油盤或油槽，以便收集可能從該油櫃泄漏的燃油。

10.2.4.7 燃油艙櫃均應設有確定其儲油量的安全、有效裝置。

10.2.4.7.1 若採用測量管時，不得終止於有可能引燃測量管溢油危險的處所內，特別是不能終止在公共處所、船員艙室或機器處所內。測量管終端應設有適當的關閉裝置以及採取防止加油作業期間溢油的預防措施。

10.2.4.7.2 可以採用其他油位表來代替測量管，但應滿足下列條件：

- .1 對高速客船，不應從油櫃頂部以下部位穿過，並且在其失效後或燃油櫃加油過量時，不得有燃油溢出。
- .2 禁止使用玻璃管油位表，對高速貨船，主管機關可允許採用玻璃油位表，但在油位表和燃油櫃之間應設有自閉閥。這些油位表應取得主管機關的認可並應能維持適當的狀態，以確保使用中其持續準確的工作。

10.2.4.8 應採取適當措施，防止任何燃油櫃或包括注入在內的燃油系統的任何部分超壓。無論安全閥以及空氣管或溢流管，均應設在安全地點，對閃點低於 43°C 的燃油用的裝置，其排出端應設有符合本組織所制定的標準要求的阻焰器。^{*}

10.2.4.9 燃油管及其閥和附件應為鋼質或其他認可的材料製造，但在許可處所限制使用的軟管除外，這些需要使用軟管的處所應經主管

* 參見 MSC/Circ.373/Rev.1 號通函《關於防止火焰進入液貨艙內的裝置的設計、試驗和定位的修正標準》。

機關同意。上述軟管及其端部附件應以認可的具有足夠強度的耐火材料製成，其製造應使主管機關滿意。

潤滑油佈置

10.2.5 壓力潤滑系統中所用潤滑油的儲存、分佈和使用的佈置，應確保高速船和船上人員的安全。機器處所和輔助機器處所（如可行）的佈置，至少應符合 10.2.4.1 和 10.2.4.4 至 10.2.4.8 的規定，但下列要求除外：

- .1 經試驗表明，只要玻璃視流器具有適當的耐火能力，則不排除其在潤滑系統中的使用；
- .2 若裝有適當的關閉裝置，則可允許測量管位於機器處所內；
- .3 容積小於 500 L 的潤滑油儲存櫃，可允許不設 10.2.4.5 所要求的遙控閥。

其他易燃油類的佈置

10.2.6 動力傳動系統、控制和驅動系統以及加熱系統中，在壓力下使用的其他易燃油類的儲存、分佈和使用的佈置，應確保高速船和船上人員的安全。在有點火設備存在的場所，上述佈置至少應符合 10.2.4.4 和 10.2.4.7 的規定，以及 10.2.4.8 和 10.2.4.9 對強度和構造的有關規定。

機器處所內的佈置

10.2.7 除 10.2.1 至 10.2.6 的要求外，燃油和潤滑油系統還應符合下列要求：

- .1 若燃油日用櫃採用自動或遙控注入的方法，則應設有防止超

量的溢出裝置。

- .2 易燃液體的其他自動處理設備，如燃油淨化器，在切實可行的情況下，應安裝在專門用於淨化器及其加熱器的處所內，還應設有防止超量的溢出裝置。
- .3 若燃油日用櫃或燃油沉澱櫃裝有加熱裝置，如因恆溫控制裝置損壞可能使油溫達到其閃點，則應設有高溫報警裝置。

10.3 艙底水抽吸和排出系統

10.3.1 應設有排除任何水密艙室內艙底水的裝置，但其中用來永久儲存液體的水密艙室除外。若認為個別艙室沒有排水必要時，則可以免設排水裝置，但應以實例表明其不會削弱高速船的安全。

10.3.2 除用來永久儲存液體的艙室以外，其餘每個水密艙室均應能由所設的艙底抽吸裝置進行排水。這些艙室的容積或位置，應使其浸水後不致影響高速船的安全。

10.3.3 在受到 2.6.5 和 2.6.8 假設的破損以後，艙底水抽吸系統應能在任何可能的橫傾和縱傾狀態下工作。艙底水抽吸系統的設計，應能防止水從一個艙室流入另一艙室。控制艙底水吸入的必要的閥，應能從基準面以上進行操作。與艙底水抽吸裝置相連的所有分配閥箱以及手動操作閥的所在地點，在正常情況下均應易於接近。

10.3.4 動力驅動的自吸式艙底泵，可以用於諸如滅火或通用等其他用途，但不得用來抽吸燃油或其他易燃液體。

10.3.5 每台動力艙底泵，均應能以不小於 2 m/s 的流速來通過所要求的艙底水管進行抽水。

10.3.6 除了艙底總管的實際內徑可以圓整到認可標準最接近的尺寸以外，艙底總管的內徑（ d ）應按照下列公式進行計算：

$$d=25+1.68 (L (B+D))^{0.5}$$

式中： d ——艙底總管內徑，mm；

L ——第 1 章所定義的高速船船長，m；

B ——對單體高速船，是第 1 章所定義的高速船船寬；而對多體高速船，是在設計水線處或設計水線以下的船體寬度，m；

D ——至基準面處高速船的型深，m。

10.3.7 艙底水吸入支管的內徑，應滿足主管機關的要求，但不得小於 25 mm。吸入支管應裝有有效的濾器。

10.3.8 每個設有推進原動機的機器處所，均應設有 1 個應急艙底水吸口，該吸口應通往除艙底泵、推進泵或油泵以外的最大可用動力泵。

10.3.9 海水進口閥的閥杆，應延伸到機器處所花鐵板以上的適當高度。

10.3.10 所有的艙底水吸入管至與艙底泵的接頭前，應獨立於其他管路。

10.3.11 在預期最不利的破損情況下，位於水面以上的處所，可以通過裝有止回閥的排水管，把水直接排至舷外。

10.3.12 任何要求設置艙底水抽吸裝置的無人值班處所，均應設有艙底水報警裝置。

10.3.13 對於高速船所具有的艙底泵，每個船體艙底泵的總排量 Q ，應不低於 10.3.5 和 10.3.6 中所定義的艙底泵排量的 2.4 倍。

10.3.14 在艙底水抽吸管系佈置中，除公共處所和船員艙室前面的處所以外的其他處所，若未設艙底水總管時，則每一處所應至少設 1 台固定的潛水泵。此外，還應至少設 1 台能用於各個處所的移動式泵，如果是電動的，該泵應由應急電源供電。每台潛水泵的排量 Q_n 應不小於如下規定：

$$Q_n = Q / (N - 1) \text{ t/h (且最小為 8 t/h)}$$

式中： N ——潛水泵的數量；

Q ——10.3.13 所定義的總排量。

10.3.15 下列部件上應設置止回閥：

- .1 艙底水分配閥箱；
- .2 直接連接艙底泵或艙底水吸入總管的艙底吸入軟管接管；
- .3 直通艙底泵吸入管以及連接艙底水吸入總管的艙底泵接管。

10.4 壓載水系統

10.4.1 通常壓載水不得裝載在燃油艙內。若在高速船上，實際上不能避免把壓載水裝入燃油艙時，則應安裝油水分離設備或提供處理含油壓載水的其他替代措施，如排入岸上接收設備。本段規定不應妨礙現行的《國際防止船舶造成污染公約》的有關規定。

10.4.2 若燃油駁運系統兼作壓載用途時，該系統應與任何壓載水系統隔離開來，並應滿足燃油系統以及現行的《國際防止船舶造成污染公約》的要求。

10.5 冷卻系統

所設置的冷卻裝置，在該持證高速船的所有營運期間，應足以使所有潤滑油和液壓液體的溫度，保持在製造廠所推薦的限度之內。

10.6 發動機進氣系統

進氣系統應為發動機提供充足的空氣，並應予以適當的保護，以防異物進入，造成不同於磨損的損傷。

10.7 通風系統

機器處所應有足夠的通風，以保證處所內的機器在全天候包括惡劣氣候條件下全功率運轉時，維持向該處所充足供氣，以供人員安全舒適和機器運轉的需要。輔助機器處所也應有適合於其用途的足夠通風。通風裝置應足以確保高速船安全營運。

10.8 排氣系統

10.8.1 所有發動機的排氣系統均應足以確保機器的正確運轉以及高速船安全工作，而不致發生危險。

10.8.2 排氣系統的佈置，應使排出的廢氣進入有人處所、空調系統的進氣口以及發動機進氣口的可能性降至最低限度。排氣系統的廢氣不得排至氣墊進氣口。

10.8.3 在水線附近穿過殼板的排氣管，應在殼板上或管端裝設耐沖蝕/腐蝕的截止閘門或其他裝置並形成認可的佈置，以防水浸入該處所或進入發動機排氣總管。

10.8.4 燃氣輪機排氣管的佈置，應使直接排出的熾熱廢氣遠離高速船或靠泊時高速船附近有人員出入的區域。

B 部分 對高速客船的要求

10.9 艙底水抽吸和排出系統

10.9.1 B 類高速船至少應設 3 台、A 類高速船至少應設 2 台與艙底水總管相連的動力艙底水泵，其中之一可由推進主機驅動，或者其佈置可以按 10.3.14 的要求加以實施。

10.9.2 其佈置應至少有 1 台動力艙底泵在高速船被要求的所有浸水情況下可以使用。此項要求可採取下列方法之一予以滿足：

- .1 所要求的艙底水泵之一，應為 1 台有應急動力源的可靠的潛水式泵；或
- .2 各艙底水泵及其動力源應分佈在高速船的全長範圍內，浸水時至少在未破損的艙室內有 1 台泵能供使用。

10.9.3 在多體高速船上，每一片體至少應設有 2 台艙底水泵。

10.9.4 連接艙底水抽吸系統的分配閘箱、旋塞和閘的佈置，應確保在任一艙室浸水時，所設的艙底水泵之一可以工作。另外，一台泵或其與艙底水總管的連接管損壞時，不應使艙底水系統失去作用。在除了主艙底水抽吸系統外，還設有一個應急艙底水抽吸系統時，其應獨立於主系統，且其佈置應有 1 台泵在任一艙室按 10.3.3 所規定的浸水情況下可以工作，在這種情況下，僅應急系統運轉需要的那些閘應能在基準面以上進行操作。

10.9.5 在 10.9.4 中所述的所有能從基準面以上操作的旋塞和閘，應在其操作地點設帶有明顯標記的控制裝置，此外，還應設有明示其是打開還是關閉的設施。

C 部分 對高速貨船的要求

10.10 艙底水抽吸系統

10.10.1 至少應設置 2 台與艙底水總管系統連接的動力泵，其中 1 台可由推進主機驅動。若主管機關認為高速船的安全未受損害，則該艙室內的艙底水抽吸裝置可予免除，或者也可按 10.3.14 的要求來設置艙底水抽吸裝置。

10.10.2 在多體高速船上，除非在一個片體內的艙底水泵也能抽吸其他片體內的艙底水，否則，每個片體內應至少有 2 台動力泵。至少有 1 台艙底水泵應為獨立動力泵。

第 11 章 遙控、報警和安全系統

11.1 定義

11.1.1 遙控系統係指從一個控制地點操作若干裝置的所有必要設備組成的系統，在該控制地點操作者不能直接觀察其動作的結果。

11.1.2 後備控制系統係指在主控制系統損壞或失效後，維持高速船安全運轉所必需的控制設備組成的系統。

11.2 通則

11.2.1 任何遙控系統或自動控制系統的故障，均應能發出視聽警報，並且不得妨礙正常的手動控制。

11.2.2 操縱和應急控制裝置，應能使操作船員在沒有困難、不疲勞或不過分專注的情況下，以正確的方式完成他們所負責的工作。

11.2.3 如果在操縱室之外並與之相鄰的若干地點，設有推進或操縱控制裝置時，控制轉換應僅能從負責控制的地點來完成。在可以使用控制功能所有地點之間以及上述各地點和監視台之間，均應設有雙向通話設備。操作控制系統或控制轉換的故障，應使高速船在不對旅客或其本身造成危險的情況下降低轉速。

11.2.4 對 B 類高速船和高速貨船而言，推進主機的遙控系統和方向控制裝置，應設有能在操縱室控制的後備控制系統。對於高速貨船，可以允許用一個能在發動機控制處所（如位於操縱室之外的發動機控制室）進行控制的後備控制系統來代替上述後備控制系統。

11.3 應急控制裝置

11.3.1 在所有高速船上，均應在對高速船操縱和（或）其主機進行控制的操縱室內設置一個或數個控制站。控制站應易於到達，並設置具有下列應急用途的控制裝置：

- .1 啟動固定式滅火系統；
- .2 若未和.1 功能合為一體，關閉固定式滅火系統所覆蓋處所的通風開口，並停止通風機；
- .3 切斷向主、輔機器處所內機器的燃油供應；
- .4 從正常電力分配系統斷開所有電源（操縱控制裝置應予保護以減少誤操作的危險）；和
- .5 停止主機和輔助機械。

11.3.2 若操縱室外的控制站設有推進和操縱的控制裝置，這些控制站應設有與操縱室直接聯繫的通信設備，該操縱室應是一個連續有人值班的控制站。

11.4 報警系統

11.4.1 應設有以視聽方式向高速船控制站通報故障或不安全狀態的報警系統。報警信號應一直保持至得到應答，而各個可視信號則應保留到故障消除為止。故障消除後，報警裝置應自動恢復到正常工作狀態。如果一個報警已被應答，而第一個故障消除之前又發生了第二個故障，則應再次發出視聽報警。報警系統應含有試驗裝置。

11.4.1.1 應對下列情況設置報警裝置，這類報警裝置的報警信號對需要立即採取行動的不同狀態的顯示，應是各不相同的，而且應在操縱室內船員的整個視域之內：

- .1 探火系統的激發；
- .2 正常電力供應全部消失；
- .3 主機超速；
- .4 任何永久安裝的鎳-鎘電池的熱擊穿。

11.4.1.2 與 11.4.1.1 中所述報警裝置不同的具有可視顯示器的報警裝置，應指示出需要採取行動的情況，以防惡化到不安全程度。至少對下列情況應設置這類報警裝置：

- .1 除發動機超速外，超過了任何高速船、機器或系統參數的極限值；
- .2 電動定向裝置或縱傾控制裝置的正常供電故障；
- .3 任何自動艙底水泵運轉；
- .4 羅經系統故障；
- .5 燃油櫃內燃油低液位；
- .6 燃油櫃溢流；
- .7 舷燈、桅頂燈或尾航行燈熄滅；
- .8 對高速船正常營運實屬重要的液體容器內液體低液位；
- .9 任何連接的電源故障；
- .10 任何用於易燃蒸氣可積聚處所通風的通風機故障；
- .11 9.4.2 要求的柴油機燃油管路故障。

11.4.1.3 在所有可能實施控制功能的控制站，均應設有 11.4.1.1 和 11.4.1.2 要求的所有報警裝置。

11.4.2 報警系統應滿足對所需報警裝置*在結構上和使用上的適用要求。

11.4.3 對旅客處所、貨物處所以及機器處所的火災和浸水進行監控的設備，應儘可能把所有緊急情況的監控和觸發控制裝置進行合併形成一個集中的子中心，該子中心可要求設置反饋裝置，以指示初始動作已全部完成。

11.5 安全系統

若對符合 9.2.2 要求的推進主機的任何自動停車系統設置越控裝置時，應使越控裝置不可能被誤操作。當停車系統被觸發時，應在控制站發出視聽警報並應設有越控裝置，以便對除了有完全破損或爆炸危險情況以外的自動停車進行越控。

* 參見本組織大會以 A.686 (17) 號決議通過的《報警裝置和顯示器規則》。

第 12 章 電氣設備

A 部分 一般規定

12.1 通則

12.1.1 電氣設備*應是：

- .1 對所有為船舶正常操作和居住條件所必需的電氣輔助設備保證供電，而不求助於應急電源；
- .2 在各種應急情況下，能保證對安全所必需的電氣設備供電；
- .3 能確保旅客、船員和船舶的安全，免受電氣事故的危害。

考慮到電力故障對供電系統的影響，FMEA（故障模式與影響分析）應包括電力系統。若設備有可能會產生在常規檢查中未能發現的故障，該分析應考慮故障同時或連續發生的可能性。

12.1.2 電力系統的設計和配備應使船舶在航行中極少有因電力故障而導致危險的可能性。

12.1.3 若特定的重要設備的缺損會嚴重危害船舶，則該設備應至少由 2 個獨立線路供電，以使在供電或配電系統中的單一故障不會同時影響 2 路供電。

12.1.4 對蓄電池之類重的重物的繫固裝置，應儘可能防止由於擱淺或碰撞而產生的加速度引起過多的位移。

12.1.5 應採取預防措施，以減少由於疏忽或意外打開開關或斷路器，而使主電源和應急電源中斷供電的危險。

* 參見國際電工委員會出版的建議案，特別是 92 號出版物《船舶電氣設備》。

12.2 主電源

12.2.1 應配備能足以供 12.1.1 所述設備用電的主電源。主電源應至少由 2 套發電機組所組成。

12.2.2 這些發電機組的功率，應是當任一發電機組停止工作或發生故障時，仍能保證對正常推進操作和安全所必需的設備供電。最低舒適居住條件也要得到保證，至少包括烹調、取暖、食品冷凍、機械通風、衛生和淡水等。

12.2.3 不管推進機械或軸系的速度和轉動的方向如何，船舶主電源的裝置應使 12.1.1.1 所指的那些設備處於工作狀態。

12.2.4 此外，發電機組應保證任一發電機或其初級電源失效，其餘發電機組仍能向主推進裝置自癱船狀態起動所必需的設備供電。如應急電源單獨或與任何其他電源組合的功率足以同時向 12.7.3.1 至 12.7.3.3 或 12.7.4.1 至 12.7.4.4 或 12.8.2.1 至 12.8.2.4.1 所需的設備供電，則此應急電源可用作自癱船狀態起動的目的。

12.2.5 如變壓器組成本節所要求供電系統的必要部分，此系統的佈置應能保證 12.2 所述同樣的供電連續性。

12.2.6 向船員或旅客通常能到達和使用的各個部分提供照明的主照明系統應由主電源供電。

12.2.7 主照明系統的佈置應是：如果應急電源、相聯的變壓設備（如設有）、應急配電板和應急照明配電板所在處所發生火災或其他事故，不應使 12.2.6 所要求的主照明系統失效。

12.2.8 主配電板與一個主發電站的相對安裝位置，應儘實際可行，使正常供電的完整性只有在一個處所發生火災或其他事故才會受到影響。主配電板的環境圍蔽，例如利用位於該處所主界限以內的機器控制室，不能視作配電板已與發電機分開。

12.2.9 主匯流排通常應至少分成兩部分，應由一斷路器或其他經認可的裝置來連接；儘實際可行，發電機組和其他雙套設備應在這些部分中均分地連接。經主管機關同意，可准許採用等效的佈置。

12.3 應急電源

12.3.1 應備有 1 個獨立應急電源。

12.3.2 應急電源、相聯變壓設備（如設有）、臨時應急電源、應急配電板和應急照明配電板應置於第 2 章所指的損壞的最終狀態的水線以上部位，且在此狀況下可以工作，並易於到達。

12.3.3 應急電源、相聯變壓設備（如設有）、臨時應急電源、應急配電板和應急照明配電板，其與主電源、相聯變壓設備（如設有）和主配電板的相對位置應保證在主電源、相聯變壓設備（如設有）和主配電板所在處所或任何機器處所發生火災或其他事故時，不妨礙應急電源供電、控制和配電。應儘實際可行地使應急電源、相聯變壓設備（如設有）、臨時應急電源和應急配電板所在處所不毗鄰於機器處所或主電源、相聯變壓設備（如設有）或主配電板所在處所的限界面。

12.3.4 如採取適當措施保證能在各種情況下維持獨立的應急操作，應急發電機（如設有）可例外地用來短時間向非應急電路供電。

12.3.5 配電系統的佈置應使來自主電源和應急電源的饋電線在垂直和水平方向儘可能遠地分開。

12.3.6 應急電源可以是 1 台發電機或 1 組蓄電池並應符合下列要求：

.1 應急電源為發電機時，應是：

.1.1 由適當的原動機驅動，獨立供給燃油，燃油閃點滿足 7.1.2.2 的要求；

.1.2 主電源供電發生故障時應能自動起動，並應自動與應急配電板接通；12.7.5 或 12.8.3 所指設備也應轉由應急發電機組供電。自動起動系統和原動機的特性應能儘快地在最多 45 s 內使應急發電機安全和實際可行地承擔其全部額定負荷；和

.1.3 備有 12.7.5 或 12.8.3 規定的臨時應急電源。

.2 應急電源為蓄電池組時，應能：

.2.1 承擔應急負荷而無需再充電，在整個供電期間保持電池的電壓在其額定電壓的 $\pm 12\%$ 之內；

.2.2 主電源發生故障時自動與應急配電板接通；和

.2.3 立即向至少如 12.7.5 或 12.8.3 所指的用途供電。

12.3.7 應急配電板應儘實際可能設在靠近應急電源之處。

12.3.8 當應急電源為發電機時，應急配電板與應急電源應設置在同一處所，除非會妨礙應急配電板的操作。

12.3.9 按本節規定裝備的蓄電池組不得與應急配電板設置在同一處所。應在船舶操縱艙室的適當位置安裝一指示器，以指示蓄電池正在代替應急電源或 12.3.6.1.3 所指的臨時應急電源進行供電。

12.3.10 在正常工作情況下，應急配電板應用內連饋線由主配電板供電，此內連饋線在主配電板上應有適當保護，以防過載和短路，並能在主電源發生故障時自動在應急配電板處斷開。當此系統採用反饋操作，內連饋線也應在應急配電板處得到保護，至少要防短路。應急配電板在非應急狀態下使用時發生的故障，不應對船舶的航行構成危害。

12.3.11 為了保證應急電源隨時可用，應作出安排，當必要時，將非應急電路從應急配電板自動斷開，以保證向應急電路供電。

12.3.12 應急發電機及其原動機和任何應急蓄電池組的設計和佈置，應確保當船舶正浮和處於 9.1.12 所述的橫傾或縱傾狀態，包括第 2 章所考慮到的各種損壞狀態，或任何組合傾斜角度達到最大時，仍能以滿額定功率發揮作用。

12.3.13 若由蓄電池組向應急負載供電，應由可靠的船上電源就地向其充電。充電裝置的設計應使電池無論是否在充電，均能向負載供電。應採取措施儘可能減少電池組過度充電或過熱的危險。應採取有效的通風措施。

12.4 應急發電機組的起動裝置

12.4.1 應急發電機組應能在溫度為 0°C 的冷態下迅速起動。如實際上不可行或者可能遇到更低的溫度時，應提供加熱裝置，以保證發電機組的迅速起動。

12.4.2 每台應急發電機組應配備至少供 3 次連續起動的儲存能源的起動裝置。該儲存能源應受到保護，免被自動起動系統耗盡，除非備有第二套獨立的起動裝置。此外，還應配備 30 min 內另加 3 次起動的第三能源，除非能證明人工起動是有效的。

12.4.3 應隨時維持儲備的能源，具體如下：

- .1 電力和液壓起動系統應由應急配電板來維持；
- .2 壓縮空氣起動系統可用裝有合適止回閥的主或輔壓縮空氣瓶或應急空氣壓縮機來保持，如該應急空氣壓縮機是電力驅動的，則由應急配電板供電；
- .3 所有這些起動、充電和能源儲存裝置應設置在應急發電機處所內，這些裝置除操作應急發電機組外，不作其他目的之用。這並不排除由設置在應急發電機處所內的壓縮空氣系統或輔助壓縮空氣系統通過止回閥向應急發電機組的空氣瓶供氣。

12.5 操舵和穩定

12.5.1 若船舶的操舵和（或）穩定主要是依靠一種本身需要連續供電的裝置，如：單板舵或槳塔，則應至少由 2 條獨立電路供電，其中 1 條來自應急電源或本身來自獨立電源，該電源的佈置不應受到主電源的火災或浸水的影響。在轉換至由備用電源供電時，任一供電故障應不會對船舶或旅客造成任何危害，並且這種轉換佈置應符合 5.2.5 的要求，這些電路應配備短路保護裝置和過載報警器。

12.5.2 可配備過電流保護裝置，該裝置的整定值應不小於所保護的電機或電路的滿負荷電流的兩倍，並應調整妥當，以便在留有裕量

的情況下能承受相應的起動電流。若使用三相電源，則在船舶操縱艙室內易於觀察處應設置報警器，以便顯示任何一相的故障。

12.5.3 若操舵及穩定裝置並非依靠電力的連續可用性，而至少另有 1 套不需要電源的替換裝置，則其電力或控制系統可由 12.5.2 所述的加以保護的單路供電。

12.5.4 應滿足第 5 章和第 16 章對船舶方向控制系統和穩定系統的電源的要求。

12.6 觸電、電氣火災及其他電氣災害的預防措施

12.6.1.1 電機或電氣設備的裸露金屬部分，原來不帶電，但在各種故障情況下易變為帶電者，應予接地，除非這些電機或設備：

- .1 所用的電壓，直流不超過 55 V 或導體間均方根不超過 55 V；不可用自耦變壓器來實現這個電壓；或
- .2 由安全絕緣的變壓器供電，電壓不超過 250 V，同時這種變壓器只向一個耗電裝置供電；或
- .3 是根據雙層絕緣原理構造的。

12.6.1.2 對用於受限制的或特別潮濕的處所的便攜式電氣設備，而這些處所由於導電可能產生特殊危險者，主管機關可要求額外的預防措施。

12.6.1.3 一切電氣裝置的構造和安裝，應在正常使用或接觸時不致造成傷害。

12.6.2 主配電板和應急配電板的佈置，應在需要時易於到達電氣裝置和設備，而對人員無危險。配電板的側面、後面，必要時包括前

面，均應作適當的保護。裸露帶電部分的對地電壓超過主管機關規定電壓者，不應裝在這類配電板的板面上。必要時，配電板的前面和後面應安放絕緣墊或格柵。

12.6.3 當動力、加熱取暖或照明配電系統，不論是一次系統還是二次系統，不接地時，應備有能不斷監控對地絕緣程度和絕緣值異常低時能發出視聽信號的裝置。對個別二次配電系統，主管機關可允許採用手動絕緣檢測設備。

12.6.4 電纜和電線

12.6.4.1 除在例外情況下經主管機關許可外，電纜的所有金屬護套和鎧裝應為連續導電，並應接地。

12.6.4.2 設備外接的所有電纜和電線至少應為阻燃式，並應在敷設時不損傷其原來的阻燃性能。在特殊需要的情況下，主管機關可允許使用不符合前述要求的專用電纜，如射頻電纜。

12.6.4.3 重要部分和應急動力、照明、內部通信或信號使用的電纜和電線應儘可能地遠離機器處所和其圍壁以及其他有高度失火危險的區域。當實際可行時，所有這類電纜的敷設，要使它們不因相鄰處所失火所致的艙壁變熱而導致失效。

12.6.4.4 當敷設在危險區域的電纜因這類區域內的電器故障會引起火災或爆炸危險時，應採取主管機關同意的防止這類危險的專門預防措施。

12.6.4.5 電纜和電線的敷設和支承，應避免擦傷或其他損害。

12.6.4.6 所有導線的終端和接頭，應保持電纜原來的電氣、機械、阻燃性，必要時保持其耐火性。

12.6.5.1 除 12.5 許可或主管機關例外允許外，所有獨立饋電線路應予保護以免短路和過載。

12.6.5.2 每一饋電線路過載保護裝置的額定值或相應的整定值，應在該保護裝置所在位置作永久性標誌。

12.6.5.3 若保護裝置為保險絲時，則應安裝在保護電路分斷開關的負載一側。

12.6.6 照明裝置的佈置，應能防止其溫度升高而損傷電纜和電線，並能防止其周圍的材料發生過熱現象。

12.6.7 對儲藏庫或貨艙內的所有照明和動力電路，應在該處所以外備有切斷這些饋電線路的多極開關。

12.6.8.1 對蓄電池組應作適當的罩護，主要用作存放蓄電池組的艙室應有適當的構造和有效的通風。

12.6.8.2 除 12.6.9 的許可外，凡能形成易燃氣體着火源的電器或其他設備，不得安裝在這些艙室內。

12.6.8.3 蓄電池組不應放在船員起居處所內。

12.6.9 電氣設備不應安裝在任何可燃混合氣體易於積聚的處所，包括專門用來存放蓄電池的艙室、油漆間、乙炔儲藏室或類似處所，除非主管機關認為這些設備是：

- .1 操作所必需的；

- .2 不致點燃可燃混合氣體的型式；
- .3 適合於有關處所；和
- .4 經試驗證明在可能遇到的灰塵、蒸汽或氣體中能安全使用者。

12.6.10 應滿足以下.1 至.7 的補充要求，對非金屬船舶也應滿足.8 至.13 的要求：

- .1 船舶的配電電壓可以是直流的或交流的，但不應超過：
 - .1.1 500 V，供動力設備、電炊設備、電熱設備以及其他固定不移動的設備用；和
 - .1.2 250 V，供照明、內部通信和插座用。

主管機關可允許較高的電壓供推進用。

- .2 對於電力配電，應使用雙線、三線或四線絕緣系統，如適合，也應滿足 7.5.6.4 或 7.5.6.5 的要求。
- .3 應採取有效措施使得在每個電路、分電路及所有設備上能切斷電壓，以防危險。
- .4 電氣設備的設計應使意外觸及帶電部件、旋轉和運動部件以及會引起燃燒或產生火災的熱表面的可能性減少到最小程度。
- .5 電氣設備應充分固定。應將由電氣設備的損壞而引起火災危害的可能性減少至可接受的最小程度。

- .6 每一饋電線路過載保護裝置的額定值或相應的整定值，應在該保護裝置所在位置作永久性標誌。
- .7 若在蓄電池艙中和機器起動線路中的蓄電池組專用供電電纜上，不可能設有電氣保護裝置的話，則未加保護的電纜敷設應儘可能短，並應採取特別的預防措施以減少故障的發生，如使用附加絕緣護套且有帶罩端子的單芯電纜。
- .8 為了減少火災、結構損壞、觸電以及由於短暫的雷電或靜電釋放而產生的無線電干擾，船舶的所有金屬部件應屏蔽接地在一起，並儘可能考慮到不同金屬之間的電化鏽蝕，應設一適於電氣設備接地回路的連續導電系統，該系統使得船舶與水面相連。除非在燃油艙裏，通常結構內部的獨立元件的屏蔽接地是不必要的。
- .9 每一個壓力加油點應設一能使加油設備與船舶連接的設施。
- .10 應將由於液體和氣體的流動會釋放靜電的金屬管在其全長上連續電氣連接，並應充分接地。
- .11 通過雷電電流的基本導體如果為銅質，其最小截面積為 50 mm²；若為鋁質，則應具有相同的通過衝擊電流的能力。
- .12 用作均衡靜電、設備連接等而不通過雷電的輔助導體如果是銅質，最小截面積應為 5 mm²；若為鋁質，則應具有相同的通過衝擊電流的能力。
- .13 除非能證明較高的電阻不會引起危害，不然的話，接地物體與主結構之間的電阻值不應超過 0.05Ω。接地線路應具有足夠的截面積以傳送其所承受的最大電流而無過多的電壓降。

B 部分 對客船的要求

12.7 通則

12.7.1 船舶必需的雙套用電設備應由兩路相互分離的電源供電。在正常工作期間，兩路電源可以連在同一電力線路上，但應設有易於分離的裝置。每套電源應能向維持推進裝置、操舵裝置、穩定裝置、航行設備、照明以及通風設備的控制所必需的所有設備供電，並允許最大的重要電機在任何負載情況下起動。非重要設備可允許使用自動負荷分斷器。

12.7.2 應急電源

若主電源設在 2 個或 2 個以上不相連的艙室裏，每一主電源具有包括電力分配和控制裝置的獨立系統，兩者之間相互完全獨立，並且在任一處所的火災或其他事故不會影響其他處所的配電，或不影響 12.7.3 或 12.7.4 所要求的設備的使用，則可以考慮 12.3.1，12.3.2 和 12.3.4 的要求而無需附加的應急電源，只要：

- .1 至少 1 台滿足 12.3.12 的要求，並在至少 2 個互不相連的每一處所中提供滿足 12.7.3 或 12.7.4 要求的足夠容量的發電機組；
- .2 按 .1 所要求的在每一處所的佈置，等同於 12.3.6.1，12.3.7 至 12.3.11 和 12.4 的要求，以使一個電源在所有時間內向 12.7.3 或 12.7.4 所要求的設備供電；和
- .3 在 .1 所述發電機組及其獨立系統的安裝應使得在任一艙室內的破損或浸水後，其中 1 台仍能保持工作。

12.7.3 對於 A 類船舶，應急電源應能同時向如下設備供電：

- .1 下列處所 5h 的應急照明：
 - .1.1 救生設備存放處；
 - .1.2 所有的脫險通道處，如走廊、梯道、居住和服務處所的出口、登乘地點等；
 - .1.3 公共處所；
 - .1.4 機器處所和主應急發電處所包括其控制位置；
 - .1.5 控制站；
 - .1.6 消防員裝備存放處；和
 - .1.7 操舵裝置處。
- .2 下列設備 5h 的用電量：
 - .2.1 主航行燈，失控燈除外；
 - .2.2 在撤離時用於通知旅客和船員的船內電氣通信設備；
 - .2.3 探火和通用報警系統以及手動火災報警器；和
 - .2.4 滅火系統遙控裝置（若為電動時）。
- .3 下列設備間斷工作 4h 的用電量：
 - .3.1 白晝信號燈（若本身無蓄電池獨立供電）；和
 - .3.2 船舶號笛（若為電動時）。
- .4 下列設備 5h 的用電量：

- .4.1 按 14.12.2 所列的船舶無線電設備以及其他負載；和
- .4.2 推進機器所必需的電力儀錶和控制裝置（若這些設備無替換電源）。
- .5 為失控燈供電 12 h；和
- .6 以下設備供電 10 min：
 - .6.1 方向控制設備的電力驅動裝置，包括那些要求向前和向後推進的設備，除非配有由主管機關所接受的、符合 5.2.3 要求的手動替代裝置。

12.7.4 對於 B 類船舶，應有充足的電力向在緊急狀況下維持安全所必需的設備供電，並應考慮這些設備可以同時運行。考慮到起動電流和一些臨時性負載，應急電源應能在下述時間內滿足至少向下列設備供電（如果這些設備是依靠電力工作的）：

- .1 下列處所 12 h 的應急照明：
 - .1.1 救生設備存放處；
 - .1.2 所有的脫險通道處，如走道、梯道、居住和服務處所的出口、登乘地點等；
 - .1.3 旅客艙室；
 - .1.4 機器處所和主應急發電處所包括其控制位置；
 - .1.5 控制站；
 - .1.6 消防員裝備存放處；和
 - .1.7 操舵裝置處。

- .2 下列設備 12 h 的用電量：
 - .2.1 現行《國際海上避碰規則》所要求的航行燈和其他燈；
 - .2.2 撤離時用於通知旅客和船員的船內電氣通信設備；
 - .2.3 探火和通用報警系統以及手動火災報警器；和
 - .2.4 滅火系統遙控裝置（若為電動時）。
- .3 下列設備間斷工作 4 h 的用電量：
 - .3.1 白晝信號燈（若本身無蓄電池獨立供電）；和
 - .3.2 船舶號笛（若為電動時）。
- .4 下列設備 12 h 的用電量：
 - .4.1 第 13 章所要求的航行設備。若此規定被認為不合理或不合乎實際時，主管機關可對 5000 總噸以下的船舶免除此要求；
 - .4.2 推進機器所必需的電力儀錶和控制裝置（若這些設備無替換電源）；
 - .4.3 7.7.8.1 所要求的 1 台消防泵；
 - .4.4 噴水系統消防泵和灑水系統（如設有）；
 - .4.5 第 10 章所要求的應急艙底水泵以及所有操作電力遙控艙底閘必需的設備；和
 - .4.6 14.12.2 所列的船舶無線電設備以及其他負載。
- .5 對第 2 章所要求的電力操作的水密門及其指示器和警告信號供電 30 min；

- .6 對方向控制設備的電力驅動裝置，包括那些要求向前和向後推進的設備供電 10 min，除非配有由主管機關所接受的、符合 5.2.3 要求的手動替代裝置。

12.7.5 臨時應急電源

12.3.6.1.3 所要求的臨時應急電源，可由在緊急情況下便於使用的蓄電池組組成，該蓄電池組應在整個供電過程中能將其電壓保持在標定電壓的 $\pm 12\%$ 範圍內而無需再充電，並且具有充足的容量，其佈置應使得當主電源或應急電源發生故障時，至少能自動地向下列設備供電（如果這些設備是依靠電力工作的）：

- .1 供 12.7.3.1，12.7.3.2 和 12.7.3.3 或 12.7.4.1，12.7.4.2 和 12.7.4.3 所述的負荷 30 min 的用電量；和
- .2 對於水密門：
 - .2.1 除非備有 1 個獨立的臨時存儲能源，否則應提供操作水密門的電力，但不必同時操作。電源應備有足夠的容量，以便對每扇門至少進行 3 次操作，即在逆傾 15° 情況下，關閉—打開—關閉；和
 - .2.2 供水密門控制器、指示器和報警電路 0.5 h 的用電量。

12.7.6 對於 12.7.5 的要求，如該段所要求的每種用途能由安裝在適合於緊急情況使用位置的蓄電池組按所需時間獨立供電，則可不設臨時應急電源。對推進系統和方向系統的儀器和控制裝置的供電應是非中斷的。

12.7.7 在公共處所有限的 A 類船舶中，只要達到相應的安全標準，可以接受 12.7.9.1 所述的應急照明裝置也符合 12.7.3.1 和 12.7.5.1 的要求。

12.7.8 應規定對包括 12.7.3 或 12.7.4 和 12.7.5 要求的應急用電設備在內的整個應急系統進行定期試驗，並應對自動起動裝置進行試驗。

12.7.9 具有特種處所的每艘船舶除 12.7.3.1，12.7.4.1 和 12.7.5.1 所要求的應急照明外：

- .1 所有旅客公共處所和走道應設有附加電氣照明，當其他所有電源發生故障和在船舶任何橫傾狀態下，該附加電氣照明應仍能至少工作 3 h。所提供的照明應能看清脫險通道。附加照明的電源應是位於照明裝置之中並可連續充電的蓄電池，若實際可行，充電電源來自應急配電板，或主管機關可以接受至少是有效的任何其他照明設施。

附加照明所使用的燈的任一故障，應易於被立即發現。考慮到所使用環境下的特定服務壽命，所使用的蓄電池應定期更換；和

- .2 在每一船員處所、走道、娛樂處所以及每一工作處所，應配備 1 盞可充電式手提燈，除非配備有 .1 所要求的附加應急照明。

12.7.10 配電系統的佈置應使得在任何主豎區內的失火不會影響其他豎區內用於安全的設備，此要求可由通過任何豎區的主電源和應急電源饋電線路在垂向和水平方向都應儘可能遠離來滿足。

C 部分 對貨船的要求

12.8 通則

12.8.1 船舶必需的雙套用電設備應由兩路相互分離的電源供電。在正常工作期間，這些用電設備可以直接或通過配電板或組合起動器與同一電力線路相連，但可由可移式聯接器或其他認可裝置進行分離。每一電力線路應能向維持對推進裝置、操舵裝置、穩定裝置、航行設備、照明以及通風設備的控制所必需的所有設備供電，並允許最大的重要電機在任何負載情況下起動。無論如何，考慮到 12.1.2 的要求，可允許在正常工作下的容量有所減少，船舶必需的非雙套用電設備可允許直接或通過配電板連至應急配電板，非重要設備可允許使用自動負載分斷器。

12.8.2 應急電源

12.8.2.1 若主電源設在兩個或以上互不相連的艙室裏，每一主電源具有包括電力分配和控制裝置的獨立系統，兩者之間完全相互獨立，並且在任一處所的火災或其他事故不會影響其他處所的配電，或不影響 12.8.2.2 所要求的設備使用，則可考慮達到 12.3.1，12.3.2 和 12.3.4 的要求，而無需附加的應急電源，只要：

- .1 至少有 1 台滿足 12.3.12 要求，並在至少兩個互不相連的每一處所中，提供滿足 12.8.2.2 要求的足夠容量的發電機組；
- .2 按 .1 要求的每一處所的佈置等同於 12.3.6.1，12.3.7 至 12.3.11 以及 12.4 的要求，以使 1 個電源在所有時間內向 12.8.2 所要求的設備供電；和
- .3 .1 所述發電機組及其獨立系統的安裝應符合 12.3.2 的要求。

12.8.2.2 應具有充足的電力向在緊急狀況下維持安全所必需的設備供電，並應考慮這些設備可以同時運行。考慮到起動電流和一些臨時性負載，應急電源應能在下述時間內滿足同時至少向下列設備供電（如果這些設備是依靠電力工作的）：

- .1 下列處所 12 h 的應急照明：
 - .1.1 救生設備存放處；
 - .1.2 所有的脫險通道處，如走道、梯道、居住和服務處所的出口、登乘地點等；
 - .1.3 公共處所（如設有）；
 - .1.4 機器處所和主應急發電處所包括其控制位置；
 - .1.5 控制站；
 - .1.6 消防員裝備存放處；和
 - .1.7 操舵裝置處。
- .2 下列設備 12 h 的用電量：
 - .2.1 現行《國際海上避碰規則》所要求的航行燈和其他燈；
 - .2.2 撤離時用於通知的船內電氣通信設備；
 - .2.3 探火和通用報警系統以及手動火災報警器；和
 - .2.4 滅火系統遙控裝置（若為電動時）。
- .3 下列設備間斷工作 4 h 的用電量：
 - .3.1 白晝信號燈（若本身無蓄電池獨立供電）；和

- .3.2 船舶號笛（若為電動時）。
- .4 下列設備 12 h 用電量：
 - .4.1 第 13 章所要求的航行設備。若此規定被認為不合理或不合乎實際時，主管機關可以對 5000 總噸以下的船舶免除此要求；
 - .4.2 推進機器所必需的電力儀錶和控制裝置（若這些設備無替換電源）；
 - .4.3 7.7.8.1 所要求的 1 台消防泵；
 - .4.4 噴水系統消防泵和灑水系統（如設有）；
 - .4.5 第 10 章所要求的應急艙底水泵以及所有操作電力遙控艙底閥必需的設備；和
 - .4.6 14.12.2 所列的船舶無線電設備以及其他負載；
- .5 對方向控制設備的電力驅動裝置，包括那些要求向前和向後推進的設備供電 10 min，除非配有符合 5.2.3 要求、由主管機關所接受的手動替代裝置。

12.8.2.3 應規定對包括 12.8.2.2 要求的應急用電設備在內的整個應急系統進行定期試驗，並應對自動起動裝置進行試驗。

12.8.2.4 若應急電源為 1 台發電機時，應配備 1 個符合 12.8.3 要求的臨時應急電源，除非該發電機原動機的特性和自動起動裝置使得應急發電機在最多 45 s 內可安全迅速地達到其額定負荷。

12.8.3 臨時應急電源

12.8.2.4 所要求的臨時應急電源，可由在緊急情況下便於使用的蓄電池組組成，該蓄電池組應在整個供電過程中其電壓保持在標定電壓的 $\pm 12\%$ 範圍內而無需再充電，並且具有充足的容量，其佈置應使得當主電源或應急電源發生故障時，至少能自動地向下列設備供電（如果這些設備是依靠電力工作的）：

- .1 供 12.8.2.2.1，12.8.2.2.2 和 12.8.2.2.3 所述的負荷 30 min 的用電量；和
- .2 對於水密門；
 - .2.1 除非備有 1 個獨立的臨時存儲能源，不然的話，應提供操作水密門的電力，但不必同時操作。電源應備有足夠的容量，以便對每扇門至少進行 3 次操作，即在逆傾 15° 情況下，關閉—打開—關閉；和
 - .2.2 供水密門控制器、指示器和報警電路 0.5 h 的用電量。

第 13 章 航行設備

13.1 航行（通則）

13.1.1 本章只涉及與船舶安全運行不同的、與船舶航行有關的航行設備。除非向主管機關證明有其他方法可達到同等的安全標準，下列規定是正常安全航行所需的最低要求。

13.1.2 航行設備及安裝應經主管機關認可。

13.2 羅經

13.2.1 船舶應裝有磁羅經，無需電源，且可用於操舵。磁羅經應置於具有所要求的校正裝置的合適的羅經櫃裏，並與船舶的速度和運行特性相適應。

13.2.2 從船舶的正常操縱位置應能容易地讀取羅經標度盤或複示器的讀數。

13.2.3 每個磁羅經應正確校準，並應備有隨時可用的剩餘自差表或曲線。

13.2.4 應對磁羅經或磁性傳感元件採取保護措施，儘可能消除磁性干擾或使之降至最低點。

13.2.5 載客等於或少於 100 人的客船，除了應配備 13.2.1 所要求的羅經外，還應配備 1 個與船舶速度和運行特性及航行區域相適應的儀器，其航向精度的基準應優於磁羅經。

13.2.6 貨船和載客超過 100 人的客船，除了應配備 13.2.1 所要求的羅經外，還應配備 1 個與船舶速度和運行特性及航行區域相適應的陀螺羅經。

13.3 速度和航程測量

13.3.1 船舶應配備測量速度和航程的儀器，除非在船舶所有可能的速度範圍內無儀器能可靠地在工作。

13.3.2 在有自動雷達標繪儀的船舶上所裝設的速度和航程測量儀器應能測量船舶的對水速度和航程。

13.4 回聲測深儀

13.4.1 非兩棲船舶應裝有回聲測深儀。當船舶處於排水狀態時，應能指示具有足夠精確度的水深值。

13.5 雷達裝置

13.5.1 船舶至少應配備 1 台在 X 波段(3 cm)工作的方位穩定雷達。

13.5.2 500 總噸及其以上的船舶或經發證可以載客 450 人以上的船舶，應至少配備 2 台雷達。若環境條件有要求時，在 500 總噸以下的船舶或經發證可以載客 450 人或以下的船舶，應安裝第 2 台雷達。

13.5.3 至少有 1 台雷達應具有至少像光學反射標繪儀一樣有效的標繪設備。

13.5.4 雷達操作人員與直接管理船舶的人員之間應備有適當的通信設備。

13.5.5 所配備的雷達裝置應與船舶的預定速度、運行特性和環境條件相適應。

13.5.6 所配備的雷達裝置應安裝在儘可能避免振動的位置。

13.6 電子定位系統

如果高速船的航行區域由一可靠的電子定位系統所覆蓋，則該船應配備使用這種系統的電子定位設備。

13.7 回轉速度指示器和舵角指示器

13.7.1 應配備回轉速度指示器，除非主管機關有其他規定。若達到最大回轉速度時，應有裝置向操作者發出警告。

13.7.2 船舶應配備舵角指示器。如果船舶沒有舵，指示器則顯示操縱推進方向。

13.8 其他助航設備

13.8.1 航行系統的信息顯示應使讀錯的可能性減小到最低程度，且其讀數應能達到最佳精確度。

13.9 探照燈

13.9.1 船舶至少應配備 1 個適當的探照燈，並應便於在操縱台進行控制。

13.9.2 船舶應配備 1 個能不依靠主電源而工作的手提信號燈，並應置於駕駛室裏能供隨時使用。

13.10 夜視儀

13.10.1 若工作環境需要提供夜視增強設備，則應配備夜視儀。

13.11 操舵裝置和推進指示器

13.11.1 操舵裝置的設計應使船舶能與舵輪、舵柄、操縱杆或控制杆同方向旋轉。

13.11.2 船舶應配備顯示推進系統方式的指示器。

13.11.3 具有應急操舵位置的船舶應配備為應急操舵位置提供可見羅經讀數的裝置。

13.12 自動操舵儀（自動駕駛儀）

13.12.1 如可能，船舶應配備自動操舵儀。

13.12.2 本組織大會以 A.342（IX）號決議通過的《關於自動操舵儀性能標準的建議》中 3.1 和 3.2 所指的報警信號設備可予免除。

13.12.3 應採取措施，能通過人工越控將自動操舵方式轉為手動操舵方式。

13.13 性能標準

13.13.1 本章適用的所有設備應經主管機關認可，除 13.13.2 的規定外，這些設備應符合不低於本組織通過的相應的性能標準。

13.13.2 在本組織通過有關性能標準前所安裝的設備，主管機關在適當考慮了本組織可能通過的與這些性能標準有關的衡準後，可免除完全符合這些標準的要求。

第 14 章 無線電通信

14.1 適用範圍

14.1.1 本章適用於 1.3.1 和 1.3.2 所述的一切船舶。

14.1.2 本章不適用於在北美洲五大湖及其東至加拿大魁北克省蒙特利爾的聖拉姆特船閘下游出口處為止的相連水域和支流內航行的船舶，但此類船舶在其他情況下應適用本規則。*

14.1.3 本章的規定不得妨礙任何遇險船舶、救生艇筏或人員自行採用任何方法引起注意、顯示其位置和獲得救助。

14.2 術語和定義

14.2.1 在本章範圍內，下列名詞定義如下：

- .1 駕駛台對駕駛台通信係指從船舶通常的駕駛位置進行的船舶之間的安全通信。
- .2 連續值班係指有關的無線電值班不應中斷，除非當船舶接收能力由於自身通信被減弱或阻塞時，或當設備處於定期維修或檢查時，而引起簡短間隔。
- .3 數字選擇性呼叫（DSC）係指使用數碼使一無線電台與另一電台或一組電台建立聯繫和傳遞信息並符合國際無線電諮詢委員會（CCIR）有關建議的一種技術。

* 此類船舶為安全目的利用無線電的有關特殊要求辦理，此要求載於加拿大與美利堅合眾國的有關協議內。

- .4 直接印字電報係指符合國際無線電諮詢委員會有關建議的自動電報技術。
- .5 一般無線電通信係指通過無線電進行的除遇險、緊急和安全通信以外的業務和公共通信業務。
- .6 國際海事衛星組織 (INMARSAT) 係指按 1976 年 9 月 3 日通過的《國際海事衛星組織公約》成立的組織。
- .7 國際航行警告電文業務 (國際 NAVTEX) 係指在 518 kHz 上使用窄帶直接印字電報方式用英語協調廣播和自動接收海上安全信息。^{*}
- .8 定位係指發現遇險的船舶、航空器、海上設施或人員。
- .9 海上安全信息係指航行和氣象警告、氣象預報和其他對船舶廣播的與安全有關的緊急信息通信。
- .10 極軌道衛星業務係指用極軌道衛星接收和轉播發自衛星緊急無線電示位標的遇險報警並提供其位置的業務。
- .11 《無線電規則》係指附在任何時候有效的最新《國際電信公約》之後的或被認為是其附件的《無線電規則》。
- .12 A₁ 海區係指至少由一個具有連續 DSC 報警能力的甚高頻 (VHF) 岸台的無線電話所覆蓋的區域，該區域可由各締約國政府規定。^{**}

^{*} 參見由本組織批准的 NAVTEX 手冊。

^{**} 參見本組織大會以 A.704 (17) 號決議通過的《關於全球海上遇險和安全系統無線電通信業務的規定》。

.13 A₂ 海區係指 A₁ 海區以外，至少由一個具有連續 DSC 報警能力的中頻（MF）岸台的無線電話所覆蓋的區域，該區域可由各締約國政府規定。^{*}

.14 A₃ 海區係指除 A₁ 和 A₂ 海區以外，由具有連續報警能力的 INMARSAT 靜止衛星所覆蓋的區域。

.15 A₄ 海區係指除 A₁，A₂ 和 A₃ 海區以外的區域。

14.2.2 所有其他用於本章並在《無線電規則》內已定義的名詞和縮略語，其含義與該規則的定義相同。

14.3 免除

14.3.1 不背離本章的要求是極其必要的，但主管機關與基地港國政府一起，可准許個別船舶部分或有條件地免除 14.6 至 14.10 的要求，只要：

- .1 此類船舶符合 14.4 的功能要求；和
- .2 主管機關已考慮到這些免除對所有船舶安全業務總效率的影響。

14.3.2 按 14.3.1 所給與的免除，僅適用於下列情況：

- .1 如影響安全的條件致使完全適用 14.6 至 14.10 為不合理或不必要時；
- .2 在例外情況下，船舶在規定的營運海區外進行單次航行；或

^{*} 參見本組織大會以 A.704 (17) 號決議通過的《關於全球海上遇險和安全系統無線電通信業務的規定》。

- .3 在 1999 年 2 月 1 日前，船舶將在 14.1 所述實施本章要求規定日期後的兩年內永久退役。

14.3.3 各主管機關應於每年 1 月 1 日後，儘快向本組織提交 1 份關於上一年度按 14.3.1 和 14.3.2 核准的所有免除的報告，並闡明核准這些免除的理由。

14.4 功能要求

14.4.1 每艘船舶在海上應能：

- .1 除 14.7.1.1 和 14.9.1.4.3 的規定以外，至少由 2 台分開和獨立的裝置發送船對岸遇險警報，且每台裝置應使用不同的無線電通信業務；
- .2 接收岸對船遇險警報；
- .3 發送和接收船對船遇險警報；
- .4 發送和接收搜救協調通信；
- .5 發送和接收現場通信；
- .6 發送和按 13.5 的要求接收定位信號；*
- .7 發送和接收**海上安全信息；
- .8 按照 14.14.8 向海岸無線電系統或網絡發送和接收一般無線電通信；和
- .9 發送和接收駕駛台對駕駛台通信。

* 參見本組織大會以 A.614 (15) 號決議通過的《關於配備工作在 9300~9500 MHz 頻帶上的雷達》。

** 應注意到船舶在港口時，可能需要接收某些海上安全信息。

14.5 無線電裝置

14.5.1 每艘船舶應配備在其整個預定航程中均能符合 14.4 規定的功能要求的無線電裝置，除非按 14.3 已進行免除，否則還應符合 14.6 的要求以及 14.7，14.8，14.9 或 14.10 的要求（視預定航程所通過的海域而定）。

14.5.2 每台無線電裝置應：

- .1 安裝在機械、電氣或其他干擾源的有害干擾不會影響其正常使用的處所，從而確保電磁兼容性，避免與其他設備和系統產生有害的相互干擾；
- .2 設置在最安全和易操作的地方；
- .3 防止受水、極端溫度變化和其他不利環境條件的有害影響；
- .4 配備獨立於主電源和應急電源的可靠的、永久佈置的電氣照明，為操作無線電裝置的無線電控制台提供足夠照明；和
- .5 清楚地標明呼號、船台識別號及其他適於無線電裝置使用的代碼。

14.5.3 對航行安全所需的 VHF 無線電話頻道控制器應設在駕駛台指揮位置附近，可供隨時使用。必要時，在駕駛台兩翼應備有能進行無線電通信的設施，此要求可由便攜式 VHF 設備來滿足。

14.6 無線電設備：一般要求

14.6.1 每艘船舶應配備：

- .1 1 台 VHF 無線電裝置，能發送和接收：

- .1.1 在 156.525 MHz (70 頻道) 上的 DSC, 它應能從船舶通常駕駛的位置在 70 頻道啟動發送遇難警報*;
- .1.2 在 156.300 MHz (6 頻道)、156.650 MHz (13 頻道) 和 156.800 MHz (16 頻道) 上的無線電話;
- .2 1 台能在 VHF-70 頻道上保持連續 DSC 值班的無線電裝置。該裝置可以與 14.6.1.1.1 所要求的功能分開或相結合*;
- .3 1 台能在 9 GHz 頻帶上工作的雷達應答器，
 - .3.1 其存放應便於使用；和
 - .3.2 可以是 8.2.1.2 要求的救生艇筏所配備的其中 1 台；
- .4 如果船舶航行在任何具有國際 NAVTEX 業務的區域，1 台能接收國際 NAVTEX 業務廣播的接收機；
- .5 如果船舶航行在任何 INMARSAT 覆蓋的區域內，而該區域又未能提供國際 NAVTEX 業務，1 台接收來自 INMARSAT 增強群呼系統*的海上安全信息的無線電設備。但是，如果船舶僅航行在使用 HF 直接印字電報提供海上安全信息業務的區域，而該船已配備了能接收這種業務的設備，則可免除本要求；
**
- .6 1 台衛星緊急無線電示位標 (衛星 EPIRB)***，且應考慮到 14.7.3 的規定。該示位標應該：

* 某些船舶可以免除該要求 (參見 14.8.4, 14.9.4 和 14.10.2)。

* 參見本組織大會以 A.701 (17) 號決議通過的《關於按照全球海上遇險與安全系統 (GMDSS) 裝載國際海事衛星 (INMARSAT) 增強群呼安全網接收器》。

** 參見本組織大會以 A.705 (17) 號決議通過的《關於發佈海上安全信息的建議》。

*** 參見本組織大會以 A.616 (15) 號決議通過的《關於搜尋和救助的自導能力》。

- .6.1 能通過在 406 MHz 頻帶上工作的極軌道衛星業務發送遇險警報，或者，如果船舶僅航行在 INMARSAT 所覆蓋的區域，通過在 1.6 GHz 頻帶工作的 INMARSAT 靜止衛星業務發送遇險警報；****
- .6.2 存放在易於接近的位置；
- .6.3 易於人工釋放和能由 1 人攜入救生艇筏；
- .6.4 當船舶沉沒時，能自由漂浮並能在浮起時自動啟動；和
- .6.5 能人工啟動。

14.6.2 到 1999 年 2 月 1 日或到海上安全委員會可能決定的其他日期為止，每艘船舶還應配備 1 台具有能在 2182 kHz 頻率上工作的無線電話遇險頻率值班接收機的無線電裝置。

14.6.3 到 1999 年 2 月 1 日，除僅航行在 A₁ 海區的船舶外，每艘船舶應配備 1 台在 2182 kHz 頻率上發出無線電話報警信號的裝置。*

14.6.4 主管機關可以對在 1997 年 2 月 1 日或以後建造的船舶免除 14.6.2 和 14.6.3 所規定的要求。

14.7 無線電設備：A₁ 海區

14.7.1 除應滿足 14.6 的要求外，僅航行在 A₁ 海區的每艘船舶應配備 1 台能從船舶通常駕駛的位置啟動船對岸遇險警報的無線電裝置，該裝置應：

**** 取決於由 INMARSAT 衛星覆蓋的每個岸區內是否有合適的進行接收和處理的地面設施。

* 參見本組織大會以 A.421 (XI) 號決議通過的《關於無線電話報警信號發生器的操作標準》。

- .1 在 VHF 使用 DSC 工作。此要求可由 14.7.3 所規定的 EPIRB 來滿足，該 EPIRB 應位於靠近船舶通常駕駛的位置，或能從該位置遙控啟動；或
- .2 通過在 406 MHz 頻率上工作的極軌道衛星業務來工作。此要求可由 14.6.1.6 所要求的衛星 EPIRB 來滿足，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或能從該位置遙控啟動；或
- .3 如果船舶在備有 DSC 的 MF 岸台所覆蓋的範圍內航行，在 MF 使用 DSC 工作；或
- .4 在 HF 使用 DSC 工作；或
- .5 通過 INMARSAT 靜止衛星業務工作。此要求可由如下設備來滿足：
 - .5.1 1 台 INMARSAT 船舶地球站*；或
 - .5.2 按 14.6.1.6 要求的衛星 EPIRB，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或能從該位置遙控啟動。

14.7.2 14.6.1.1 所要求的 VHF 無線電裝置也應能用無線電話發送和接收一般無線電通信。

14.7.3 僅航行在 A₁ 海區的船舶可以配備 1 隻 EPIRB 以代替 14.6.1.6 所要求的衛星 EPIRB，該 EPIRB 應：

* 此要求可由能雙向通信的 INMARSAT 船舶地球站來滿足，如 A 標準和 B 標準(A.698 (17) 號決議)或 C 標準(A.663 (16) 號決議)船舶地球站。除非另有規定，本腳註適用於本章規定的對於 INMARSAT 船舶地球站的所有要求。

- .1 能在 VHF-70 頻道上使用 DSC 發送遇險警報，並通過在 9 GHz 頻帶上工作的雷達應答器提供定位；
- .2 存放在易於接近的位置；
- .3 易於人工釋放並能由 1 人攜入救生艇筏；
- .4 當船舶沉沒時，能自由漂浮並能在浮起時自動啟動；和
- .5 能人工啟動。

14.8 無線電設備：A₁ 和 A₂ 海區

14.8.1 除應滿足 14.6 的要求外，每艘在 A₁ 海區以外，但在 A₂ 海區範圍內航行的船舶應配備：

- .1 1 台能在下列頻率為遇險和安全目的進行發送和接收的中頻（MF）無線電裝置：
 - .1.1 在 2187.5 kHz 上使用 DSC；和
 - .1.2 在 2182 kHz 上使用無線電話；
- .2 1 台能在 2187.5 kHz 頻率上保持連續 DSC 值班的無線電裝置，該裝置可以與 14.8.1.1.1 所要求的功能分開或相結合；和
- .3 除 MF 以外的無線電業務啟動船對岸遇險警報發送的裝置，它應：

- .3.1 在 406 MHz 頻率上通過極軌道衛星業務進行工作。此要求可由 14.6.1.6 所要求的衛星 EPIRB 來滿足，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或能從該位置遙控啟動；或
 - .3.2 在 HF 使用 DSC 工作；或
 - .3.3 通過 INMARSAT 靜止衛星業務進行工作。此要求可由下列設備來滿足：
 - .3.3.1 14.8.3.2 所述設備；或
 - .3.3.2 14.6.1.6 所要求的衛星 EPIRB，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或能從該位置遙控啟動。
- 14.8.2 能從船舶通常駕駛的位置，通過 14.8.1.1 和 14.8.1.3 所要求的無線電裝置啟動遇險警報的發送。
- 14.8.3 此外，船舶應能使用下列設備用無線電話或直接印字電報發送和接收一般無線電通信：
- .1 1 台在 1605~4000 kHz 或 4000~27500 kHz 頻帶內工作的無線電裝置。此要求可由 14.8.1.1 所要求的設備增加該性能來滿足；或
 - .2 1 台 INMARSAT 船舶地球站。
- 14.8.4 對 1997 年 2 月 1 日以前建造的且僅航行在 A₂ 海區的船舶，在實際可行時，只要這些船舶在 VHF-16 頻道上，從船舶通常駕駛的位置保持連續守聽值班，主管機關可免除 14.6.1.1.1 和 14.6.1.2 的要求。此類免除應經基地港國政府在《營運許可證書》中簽署。

14.9 無線電設備：A₁，A₂ 和 A₃ 海區

14.9.1 除滿足 14.6 的要求外，每艘在 A₁ 和 A₂ 海區以外，但在 A₃ 海區範圍內航行的船舶，如其不符合 14.9.2 的要求，則應配備：

- .1 1 台 INMARSAT 船舶地球站，它能夠：
 - .1.1 使用直接印字電報發送和接收遇險和安全通信；
 - .1.2 啟動和接收遇險優先呼叫；
 - .1.3 保持岸對船遇險報警值班，包括特別確定的地理區域的遇險報警值班；
 - .1.4 使用無線電話或直接印字電報發送和接收一般無線電通信；和
- .2 1 台能在下列頻率為遇險和安全目的進行發送和接收的 MF 無線電裝置：
 - .2.1 在 2187.5 kHz 上使用 DSC；和
 - .2.2 在 2182 kHz 上使用無線電話；和
- .3 1 台能在 2187.5 kHz 頻率上保持連續 DSC 值班的無線電裝置，該裝置可以與 14.9.1.2.1 所要求的功能分開或相結合；和
- .4 通過無線電業務能啟動船對岸遇險警報發送的設備，可以：
 - .4.1 在 406 MHz 頻率上通過極軌道衛星業務進行工作。此要求可由 14.6.1.6 所要求的衛星 EPIRB 來滿足，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或可以從該位置遙控啟動；或

- .4.2 在 HF 使用 DSC 工作；或
- .4.3 由 1 台附加的船舶地球站或 14.6.1.6 所要求的衛星 EPIRB，通過 INMARSAT 靜止衛星業務進行工作，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或可以從該位置遙控啟動。

14.9.2 除應滿足 14.6 的要求外，每艘在 A₁ 和 A₂ 海區以外，但在 A₃ 海區範圍內航行的船舶，如其不符合 14.9.1 的要求，則應配備：

- .1 一台在 1605~4000 kHz 和 4000~27500 kHz 頻帶內的所有遇險和安全頻率上為遇險和安全目的進行發送和接收的 MF/HF 無線電裝置；
 - .1.1 使用 DSC；
 - .1.2 使用無線電話；和
 - .1.3 使用直接印字電報；和
- .2 能在 2187.5 kHz，8414.5 kHz 和至少在 4207.5 kHz，6312 kHz，12577 kHz 或 16804.5 kHz 遇險和安全 DSC 頻率的任一頻率上保持 DSC 值班的設備。在任何時候，應可能選擇這些 DSC 遇險和安全頻率中的任一頻率。該裝置可以與 14.9.2.1 所要求的設備分開或與其合為一體；和
- .3 通過除 HF 以外的無線電通信業務啟動船對岸遇險警報發送的設備，它可以：

- .3.1 在 406 MHz 頻率上通過極軌道衛星業務進行工作。此要求可以由 14.6.1.6 所要求的衛星 EPIRB 來滿足，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或可以從該位置遙控啟動；或
- .3.2 通過 INMARSAT 靜止衛星業務進行工作。此要求可由如下設備來滿足：
 - .3.2.1 1 台 INMARSAT 船舶地球站；或
 - .3.2.2 14.6.1.6 所要求的衛星 EPIRB，該衛星 EPIRB 應位於靠近船舶通常駕駛的位置，或可以從該位置遙控啟動；和
- .4 此外，船舶應能通過在 1605~4000 kHz 和 4000~275000 kHz 頻帶內的工作頻率上工作的 MF/HF 無線電裝置，使用無線電話或直接印字電報發送和接收一般無線電通信。此要求可由 14.9.2.1 所要求的設備增加該性能來滿足。

14.9.3 在 14.9.1.1，14.9.1.2，14.9.1.4，14.9.2.1 和 14.9.2.3 中所規定的無線電裝置，應能從船舶通常駕駛的位置啟動遇險警報的發送。

14.9.4 對 1997 年 2 月 1 日以前建造的且僅航行在 A₂ 和 A₃ 海區的船舶，在實際可行時，只要這些船舶在 VHF-16 頻道上，從船舶通常駕駛的位置保持連續守聽值班，主管機關與基地港國政府一起，可以免除 14.6.1.1.1 和 14.6.1.2 的要求。

14.10 無線電設備：A₁，A₂，A₃ 和 A₄ 海區

14.10.1 除應滿足 14.6 的要求外，航行於所有海區的船舶應配備 14.9.2 所要求的無線電裝置和設備。但是，14.9.2.3.2 所要求的設備不得作為 14.9.2.3.1 所要求設備的替代設備被接受，14.9.2.3.1 所要求的設備應是必備的。此外，航行於所有海區的船舶還應符合 14.9.3 的要求。

14.10.2 對 1997 年 2 月 1 日以前建造的且僅航行在 A₂，A₃ 和 A₄ 海區的船舶，在實際可行時，只要這些船舶在 VHF-16 頻道上，從船舶通常駕駛的位置保持連續守聽值班，主管機關與基地港國政府一起，可以免除 14.6.1.1.1 和 14.6.1.2 的要求。

14.11 值班

14.11.1 每艘船舶在海上時，應保持連續值班：

- .1 按照 14.6.1.2 的要求，安裝有 VHF 無線電裝置的船舶，應在 VHF DSC-70 頻道上保持連續值班；
- .2 按照 14.8.1.2 或 14.9.1.3 的要求，安裝有 MF 無線電裝置的船舶，應在 2187.5 kHz DSC 遇險和安全頻率上保持連續值班；
- .3 按照 14.9.2.2 或 14.10.1 的要求，安裝有 MF/HF 無線電裝置的船舶，在遇險和安全 DSC 頻率 2187.5 kHz 和 8414.5 kHz 上，以及至少在遇險和安全 DSC 頻率 4207.5 kHz 和 6312 kHz，12577 kHz 或 16804.5 kHz 中的一個頻率上保持連續值班，視一天中的適當時間和船舶所在的地理位置而定。可用掃描接收機來保持該值班。

.4 按照 14.9.1.1 的要求，安裝有 INMARSAT 船舶地球站的船舶，應對衛星岸對船的遇險警報保持連續值班。

14.11.2 每艘船舶在海上時，應在該船舶航行區域發佈海上安全信息的適當頻率上，對海事安全信息的廣播保持無線電值班。

14.11.3 到 1999 年 2 月 1 日或到海上安全委員會可能確定的其他日期止，每艘在海上的船舶，如可行，應在船舶通常駕駛的位置，在 VHF-16 頻道上保持連續守聽值班。

14.11.4 到 1999 年 2 月 1 日或到海上安全委員會可能確定的其他日期止，要求配備無線電話值班接收機的每艘船舶在海上時，應在船舶通常駕駛的位置，在 2182 kHz 無線電話遇險頻率上保持連續守聽值班。

14.12 電源

14.12.1 當船舶在海上時，應始終備有足夠的電源供無線電裝置工作，並對作為無線電裝置的 1 個或多個備用電源組成部分的蓄電池進行充電。

14.12.2 每艘船舶應配備備用和應急電源，當船舶主電源和應急電源故障時，向無線電裝置供電，以便進行遇險和安全通信。該備用電源應能同時操作 14.6.1.1 所要求的 VHF 無線電裝置和，如適合，按船舶航行海區配備 14.8.1.1 所要求的 MF 無線電裝置、14.9.2.1 或 14.10.1 所要求的 MF/HF 無線電裝置，或 14.9.1.1 所要求的 INMARSAT 船舶地球站以及 14.12.5 和 14.12.8 所述的任何附加負載，其供電時間至少為 1 h。

14.12.3 備用電源應獨立於船舶推進動力及船舶電力系統。

14.12.4 除 VHF 無線電裝置外，當 14.12.2 提及的兩個或兩個以上的其他無線電裝置可以同備用電源連接時，如適合，應能在 14.12.2 規定的時間內，同時向 VHF 無線電裝置和下述裝置供電：

- .1 能同時與備用電源連接的所有其他無線電裝置；或
- .2 如果其他無線電裝置中只有 1 台能同時與 VHF 無線電裝置一起與備用電源相連接，則應取其他無線電裝置中最耗電的 1 台裝置。

14.12.5 備用電源可用來向 14.5.2.4 所要求的電力照明供電。

14.12.6 當備用電源由 1 個或多個可充電的蓄電池組成時：

- .1 應備有可對這些蓄電池自動充電的裝置，該裝置應能在 10 h 內通過充電使其達到最小容量要求；和
- .2 當船舶不出海時，應在不超過 12 個月的間隔期內，使用適當的辦法檢查蓄電池或蓄電池組的容量*。

14.12.7 作為備用電源的蓄電池組的位置和安裝應保證：

- .1 最有效的使用；
- .2 合理的壽命；
- .3 合理的安全；
- .4 不論充電與否，電池的溫度應保持在出廠說明書規定的溫度範圍內；和

* 檢驗蓄電池容量的一種辦法是用通常工作電流和時間（如 10 h）對蓄電池組徹底地充電和放電。對充電情況的評定可以在任何時候進行，但是，當船舶在海上時，不應進行大量放電。

- .5 在任何氣候條件下，完全充電後的電池應至少提供要求的最少工作小時數。

14.12.8 如果需要將船舶的導航或其他設備的信息連續輸入到本章要求的無線電裝置中以確保其適當的性能時，應備有能確保在船舶主電源或應急電源發生故障時能繼續提供此類信息的裝置。

14.13 性能標準

14.13.1 本章適用的所有設備應為主管機關認可的型式。這些設備應符合不低於本組織通過的適當的性能標準。 **

** 參見本組織大會通過的下列決議：

- .1 A.525 (13) 號決議《接收船舶航行和氣象警告以及緊急通知的窄帶直接打印電報設備的性能標準》。
- .2 A.694 (17) 號決議：《全球海上遇險和安全系統一部分的船載無線電設備和電子導航設備的一般要求》。
- .3 A.698 (17) 號決議：《能進行雙向通信的船舶地球站的性能標準》以及 A.570 (14) 號決議：《船舶地球站的型式認可》。
- .4 A.609 (15) 號決議：《能進行通話和數字選擇性呼叫的船載甚高頻無線電設備的性能標準》。
- .5 A.610 (15) 號決議：《能進行通話和數字選擇性呼叫的船載中頻無線電設備的性能標準》。
- .6 A.613 (15) 號決議：《能進行通話、窄帶直接打印和數字選擇性呼叫的船載中頻/高頻無線電設備的性能標準》。
- .7 A.695 (17) 號決議：《在 406 MHz 上工作的漂浮式衛星緊急無線電示位標 (EPIRB) 的性能標準》(同時參見 A.696 (17) 號決議：《在 COSPAS-SARSAT 系統工作的衛星緊急無線電示位標 (EPIRB) 的型式認可》)。
- .8 A.697 (17) 號決議：《搜救作業使用的救生艇筏雷達應答器的性能標準》。
- .9 A.612 (15) 號決議：《漂浮式甚高頻緊急無線電示位標的性能標準》。
- .10 A.663 (16) 號決議：《能發射和接收直接打印通信的 INMARSAT-C 標準船舶地球站的性能標準》以及 A.570 (14) 號決議：《船舶地球站的型式認可》。
- .11 A.664 (16) 號決議：《增強群呼設備的性能標準》。
- .12 A.661 (16) 號決議：《在 1.6 GHz 上通過 INMARSAT 衛星系統工作的漂浮式衛星緊急無線電示位標的性能標準》。
- .13 A.662 (16) 號決議：《緊急無線電設備漂浮釋放和啟動裝置的性能標準》。
- .14 A.699 (17) 號決議：《使用高頻窄帶直接打印的海上安全信息的發佈和協調的系統性能標準》。
- .15 A.700 (17) 號決議：《通過高頻無線電設備接收船舶航行和氣象警告以及緊急通知的窄帶直接打印電報設備的性能標準》。

14.14 維修要求

14.14.1 設備的設計應使主要部件易於更換而無需仔細地重新校準或調整。

14.14.2 如適用，設備的構造和安裝應便於進行檢查和船上維修。

14.14.3 應備有足夠的資料以便對設備進行正確的操作和維修，並考慮本組織的建議。^{*}

14.14.4 應備有足夠的工具和備件，以便對設備進行維修。

14.14.5 主管機關應確保本章要求的無線電設備予以維修，以保障 14.4 規定的功能要求的有效性，並符合對這些設備建議的性能標準。

14.14.6 航行於 A₁ 和 A₂ 海區的船舶，經主管機關認可，可通過使用雙套設備、岸上維修或海上電子維修能力或綜合使用上述方法來確保設備的可用性。

14.14.7 航行於 A₃ 和 A₄ 海區的船舶，經主管機關認可，應至少綜合使用下述兩種方法，例如：雙套設備、岸上維修或海上電子維修能力來確保設備的可用性，並考慮到本組織的建議案。^{*}

14.14.8 然而，對於僅航行於有適當設施可對無線電設備進行岸上維修的港口之間，且該兩港口之間的航程不超過 6 h 的船舶，主管機關可免除該類船舶至少使用兩種維修方法的要求。對於該類船舶應至少使用一種維修方法。

^{*} 參見本組織大會以 A.694 (17) 號決議通過的《作為全球海上遇險和安全系統一部分的船載無線電設備和電子導航設備的一般要求的建議》。

^{*} 主管機關應考慮本組織大會以 A.702 (17) 號決議通過的《關於 A₃ 和 A₄ 海區的全球海上遇險和安全系統的無線電維修指南》。

14.14.9 雖然應採取一切合理的步驟使設備處於有效工作狀態以確保符合 14.4 所規定的所有功能要求，但是只要船舶能執行所有遇險和安全功能，即使 14.4.8 所要求的用於提供一般無線電通信的設備發生故障，也不應認為該船舶已不適航，在不易獲得維修設施的港口，也不得作為滯留船舶的理由。

14.15 無線電人員

每艘船舶應配有主管機關滿意的、能勝任遇險和安全無線電通信的人員。這些人員應持有《無線電規則》規定的適當證書。在遇險時，應能指定其中任何一人承擔無線電通信的責任。

14.16 無線電記錄

無線電記錄應記載對海上人命安全具有重要意義的有關無線電通信的一切事件。記錄應令主管機關滿意，並符合《無線電規則》的要求。

第 15 章 操縱艙室佈置

15.1 定義

15.1.1 操縱區域係指操縱艙室以及船的操縱艙室兩側和接近操縱艙室延伸到船側的部分。

15.1.2 工作站係指某個位置，在此位置上執行構成特殊活動的一項或數項工作任務。

15.1.3 進塢工作站係指一個配備有用於船舶進塢所必需裝置的地方。

15.1.4 主控制器係指船舶在航行時用於安全操縱船舶所必需的所有控制設備，包括應急狀況下所要求的控制設備。

15.2 通則

船員進行船舶操縱的艙室的設計與佈置，應能允許從事操縱的船員以正確的方式執行其職責，而無不合理的麻煩、疲勞或緊張，並能使從事操縱的船員無論在正常情況下，還是緊急情況下受傷的可能性降至最小。

15.3 操縱艙室的視域

15.3.1 操縱站應設在所有其他上層建築之上，以使操作船員能夠從駕駛工作站獲得整個水平環繞視域。如果從單個駕駛工作站要滿足本條要求為不現實時，則操縱站的設計應能通過兩個駕駛工作站的組合或為主管機關滿意的任何其他方式來獲得整個水平環繞視域。

15.3.2 盲區應儘可能少和小，而且不應影響從操縱站處保持安全瞭望。如果窗子之間設有防撓材，則此防撓材不應對駕駛室內產生更多的阻擋。

15.3.3 從正前方到任一舷向後 22.5° 的扇形區中總的盲區不應超過 20° 。每一單獨盲區不能超過 5° 。在兩個盲區之間的可視扇形區不應小於 10° 。

15.3.4 若主管機關認為必要，從駕駛工作站的視域應允許駕駛人員從這個位置利用船舶後部的導標進行航跡監控。

15.3.5 操縱站的海面視域，當駕駛人員就座時，從船首前方到任一舷 90° ，不論船舶吃水、縱傾和甲板貨物情況如何，盲區不得超過一個船長。

15.3.6 如進塢工作站遠離操縱站，則該工作站的視域應能允許一個駕駛人員安全地操縱船到塢床。

15.4 操縱艙室

15.4.1 操縱艙室的設計與佈置，包括單獨工作站的位置與佈置，應確保每項工作所要求的視域。

15.4.2 船舶的操縱艙室不得用於除駕駛、通信和其他為安全操縱船舶、船舶主機，旅客及貨物所必要的工作之外的目的。

15.4.3 操縱艙室應設有一個能從事指揮、駕駛、操縱和通信的綜合操縱站，並應佈置成能容納安全駕駛船舶所要求的所有人員。

15.4.4 用於駕駛、操縱、控制、通信的設備和裝置以及其他必需的儀錶的佈置，應相對集中，以能使負責駕駛員及任何助理駕駛員在其就座的情況下能接收到所有必需的信息並按要求使用這些設備和進行控制。如有必要，用於這些功能的設備和裝置應為雙套。

15.4.5 如果在操縱艙室內設有用於監測主機性能的獨立工作站，則此工作站的位置和使用不得干擾在操縱站內要執行的主要功能。

15.4.6 無線電設備的位置不得干擾操縱站的主要駕駛功能。

15.4.7 船員從事船舶操縱的艙室以及主控制器的相對位置的設計與佈置應對照基本操縱人員配備標準進行評估。當建議最少配員標準時，則主控制器和通信控制器的設計和佈置，應形成一個綜合操縱和應急控制中心，在所有運行和緊急狀況下，由操作船員從該中心控制船舶，而無需任何一名船員離開該艙室。

15.4.8 主控制器以及座位的相對位置應為：每一操作船員在其座位適當調整後，並在不違反 15.2 的規定下能夠：

- .1 不受任何干擾，充分而無拘束地操作每個控制裝置，既可分別操作，也可對其他控制裝置按實際可行的組合進行操作；並且
- .2 在所有工作站，施加適當的控制力就可完成應執行的操作。

15.4.9 位於操縱船舶處所的座位，經調整到適宜操作者就座後，不得再為操縱任何控制裝置再變動座位位置。

15.4.10 若主管機關認為船上有必要配備安全帶供操作船員使用，則當操作船員繫妥其安全帶後，應能滿足 15.4.4 的要求，但對於某些能被證明僅在極少數情況下才需使用的控制裝置以及無須安全約束的控制器可以例外。

15.4.11 綜合操縱站應設有能提供相關資料的設備，使負責駕駛員及其任何助理駕駛員能安全和有效地履行航行和安全的職能。

15.4.12 應採取適當的措施以防止旅客使操作船員分散注意力。

15.5 儀錶和海圖桌

15.5.1 儀錶、儀錶板和控制裝置應在考慮操作維護和環境條件後，永久性地安裝在控制台上或其他合適的地方。但是，此要求並不阻止使用新的控制器或指示技術，只要所提供的設備不低於認可的標準。

15.5.2 所有儀錶應按其功能符合邏輯地分組。為了將混淆的危險降至最小，儀錶不得通過共用功能或互換開關使之合理化。

15.5.3 任何一名操作船員使用的儀錶應當清晰可見和容易閱讀：

- .1 從其正常就座位置和視線觀察的實際偏差應最小；並
- .2 在一切可能的運行情況下，混淆的危險應最小。

15.5.4 安全操縱船舶的主要儀錶，如果不另行將其任何限制條件向操作船員作清楚的說明，則應將這種限制條件清楚地標明。構成對救生筏投放和滅火系統監控的應急控制儀錶板，應設置在操縱區域內獨立且明顯劃定的位置。

15.5.5 為了將眩目和反射降至最小並防止在強光下模糊不清，儀錶和控制裝置應設有屏蔽和遮光裝置。

15.5.6 控制台頂部和儀錶表面應為無眩目的深色。

15.5.7 為一個以上人員提供可視信息的儀錶和指示器，應設在所有使用者同時能共同易於看到的位置。如不能達到此要求時，該儀錶和指示器應設雙套。

15.5.8 若主管機關認為必要，則操縱艙室內應設置供海圖作業的適宜桌子。應設有海圖的照明設備。海圖桌照明設備應加以屏蔽。

15.6 照明

15.6.1 應設有隨時可用且令人滿意的亮度的照明設備，使操作人員無論在海上還是在港內，白晝抑或是黑夜均能適宜地履行其所有的職責。在可能發生系統故障的情況下，應只能有限地降低主要儀錶和控制裝置的照明。

15.6.2 應避免在操作區域環境中發生眩目和雜散鏡象反射。應避免在工作區域及其周圍環境之間形成較大的亮度反差。應使用非反射或無光澤表面來降低非直接眩目至最小程度。

15.6.3 應在照明系統中使用令人滿意的柔性結構，使操作人員能夠根據操縱艙室內不同區域和各個儀錶與控制裝置的要求調整照明強度和照明方向。

15.6.4 為了保持暗的環境，當某個區域或某些設備的部件在操作狀態需要照明時，應採用紅色燈，但海圖桌除外。

15.6.5 在夜間，應能識別顯示的信息和控制設施。

15.6.6 參見 12.7 和 12.8 關於照明的附加要求。

15.7 玻璃窗

15.7.1 設在前方、兩側以及門上的玻璃窗之間的分擋應保持最小。直接裝在操縱站前方的玻璃窗不允許有分擋。

15.7.2 不論氣候條件如何，在任何時候通過操縱艙室玻璃窗觀察的清晰度應使主管機關滿意。保持玻璃窗清晰狀態的裝置應使合理而

可能的單個故障不會導致減少清晰的視域，以致嚴重影響操作船員繼續操縱船舶而停船。

15.7.3 應設有這樣的裝置以使操縱站的前方視域不受陽光閃爍的影響。不得使用起偏光的或染色的玻璃。

15.7.4 操縱艙室的玻璃窗為減少有害的反射，應呈傾斜狀。

15.7.5 玻璃窗應採用破裂時不會裂成危險碎片的材料製成。

15.8 通信設備

15.8.1 應提供認為必要的手段，以使船員在正常和應急情況下彼此之間並與船上其他人員之間能進行通信並能介入。

15.8.2 在操縱艙室和設有重要機器設備的處所之間，包括操縱艙室和任何應急操舵位置之間，應配備通信裝置，不論這些機器設備是遙控的還是就地控制的。

15.8.3 從控制站到所有旅客和船員可以進入的區域應配備用於廣播和安全通知的裝置。

15.8.4 應對操縱艙室內用於監控、接收和發送無線電安全信息的裝置作出規定。

15.9 溫度和通風

操縱艙室應裝設足夠的溫度和通風控制系統。

15.10 顏色

操縱艙室內部表面材料應具有適宜的顏色和覆層以避免反射。

15.11 安全措施

操縱區域應對操作人員無危險，在乾燥和潮濕的情況下的地板都能防滑，並有適當的扶手。應設有防止門移動的裝置，不論其處於開啟還是關閉的狀態。

第 16 章 穩定系統

16.1 定義

16.1.1 穩定控制系統係指用以穩定船舶狀態的主要參數：橫傾、縱傾、航向、高度及控制船舶運動：橫搖、縱搖、首搖、升沉的一種系統。該術語不包括與船舶安全營運無關的那些設備，諸如減少船舶運動或墊航控制的系統。

穩定控制系統的主要部件可包括如下：

- .1 執行裝置，諸如舵、水翼、襟翼、圍裙、風扇、噴水器、可回轉和可控制的螺旋槳、傳輸液體的泵等；
- .2 驅動執行裝置的動力機械；和
- .3 搜集和處理數據並作出判斷、發出指令的穩定設備，諸如傳感器、邏輯處理器和自動安全控制器等。

16.1.2 自穩係指船舶僅依靠其自身的特性保證穩定性。

16.1.3 強制穩定係指依靠下列手段使船舶達到穩定：

- .1 自控系統；或
- .2 手控輔助系統；或
- .3 自控及手控輔助相結合的聯合系統。

16.1.4 增穩係指自穩和強制穩定相結合的一種穩定。

16.1.5 穩定裝置係指依靠 16.1.1.1 所列舉的裝置產生的力來控制船舶位置的一種裝置。

16.1.6 自動安全控制器係指當船舶出現不安全情況時能處理數據，並發出指令將船舶置於排水狀態或其他安全狀態的一種邏輯單元。

16.2 通則

16.2.1 穩定系統的設計應滿足：當任一穩定裝置或設備失效或故障時，仍能憑藉正在工作的穩定裝置保證船舶的主要運動參數維持在安全極限內，或使船舶置於排水狀態或其他安全狀態。

16.2.2 當任一自動設備或穩定裝置或其動力驅動失效時，船舶的運動參數仍應保持在安全極限內。

16.2.3 設有自動穩定系統的船舶，除非該系統內的冗餘能提供等效的安全性，否則應配有自動安全控制器。若配有自動安全控制器，則應採取措施，使能從主控站越控該自動控制器和撤消該越控。

16.2.4 任何自動安全控制器發出降速和使船舶安全進入排水狀態或其他安全狀態的指令時，其參數和等級應考慮到與該特定船舶及其用途相適應的橫傾、縱傾、首搖及結合縱傾和吃水的安全值，以及推進、墊升或穩定裝置等動力源失效時可能引起的後果。

16.2.5 自動穩定系統提供的船舶穩定性參數和程度，就該船用途和營運條件而言，應是令人滿意的。

16.2.6 故障模式和影響分析應將穩定系統包括在內。

16.3 側向和高度控制系統

16.3.1 裝有自控系統的船舶應設置自動安全控制器。可能發生的故障或失靈對自控系統的操作應影響不大，且易被操作人員迅速消除。

16.3.2 任何自動控制系統發出降速和使船舶安全進入排水狀態或其他安全狀態的指令時，其參數和等級應考慮附錄 3 第 2.4 節中規定的安全值以及與該特定船舶及其用途相適應的安全運動值。

16.4 效用試驗

16.4.1 穩定控制系統的任何設備、裝置的安全使用極限應用通過附錄 8 所規定的效用試驗和鑑定程序確定。

16.4.2 按附錄 8 所作的效用試驗應該確定，當任一控制設備發生不能控制的完全偏差時，對該船安全操作的不利影響有多大。為了確保提供等效安全的穩定系統的冗餘或安全措施，任何可能作為必要的船舶操作方面的限制都應列入該船操作手冊之中。

第 17 章 操作、可控性和性能

17.1 通則

適用本規則的船舶，當其處於正常的工作狀態和處於設備故障狀態時的船舶操作安全，都應通過原型船的實船試驗證實。該試驗的目的是為了取得下列有關資料和數據，以便納入該船操作手冊：

- .1 操作和性能限制；
- .2 在前述故障事故中應採取的行動；和
- .3 在規定的故障事故後，對安全操作所作的限制。

17.2 符合證明

納入船舶操縱手冊的關於船舶可控性和操縱性的資料應包括：按 17.5 所述的特性，按照 17.6 規定可控性和操縱性受到損害的最不利情況下的參數清單，以及按附錄 8 驗證過的性能數據。

17.3 重量和重心

應核實在最大允許重量範圍內對船舶操作安全有重大影響的所有重量、重心組合是否符合船舶操作、可控性和性能等每項要求。

17.4 故障的影響

應對操縱和控制設備、服務設施或部件（如動力運行、輔助動力、平衡和增強穩性的設備）可能發生的任一故障的影響作出評估，以便使船舶運行的安全程度得以保持。根據附錄 4 確定的故障影響，作為臨界情況應按附錄 8 予以核實。

17.5 可控性和操縱性

17.5.1 前述的故障出現後，應採取的行動和對船舶的限制等有關須知，應列入船舶操縱手冊。

17.5.2 必須保證操作人員在最壞預期情況下操作控制裝置使船舶保持安全營運所需花費的努力不會導致自身疲勞或精力分散。

17.5.3 船舶應是可控的，並在該船達到臨界設計狀態時，能完成船舶安全操縱所需的基本機動動作。

17.5.4.1 主管機關在確定船舶操作、可控性和性能等方面的安全性時，應特別注意到在正常操作中、出現故障時和故障後的下列情況：

- .1 偏航；
- .2 轉向；
- .3 在正常和應急情況下停車；
- .4 在非排水狀態時船舶在三個軸向上的穩定性和升沉；
- .5 縱傾；
- .6 埋首；和
- .7 墊升動力限制。

17.5.4.2 對 17.5.4.1 中的第 2 項、第 6 項和第 7 項定義如下：

- .1 轉向係指船舶在特定的風、浪條件下，以最大營運航速航行時船舶的方向變化率。

- .2 埋首係指航行中的全墊升氣墊船在氣墊系統局部漏氣情況下，因阻力增加而造成船體的一種被動的運動。
- .3 墊升動力限制係指對提供升力的機械和設備所作的種種限制。

17.6 運行表面和狀態的改變

當船舶從一種型式的運行表面或狀態轉到另一種運行表面或狀態時，船舶的穩性、可控性或姿態不應發生不安全的變化。運行表面和狀態轉變時，船舶有關運動特性的變化資料應提供給船長。

17.7 表面不平度

對限制船舶越過傾斜的、台階狀的或不連續的地面的營運能力的有關因數，應按適用情況加以確定，並提供給船長。

17.8 加速和減速

主管機關應該確認，凡因任何可能的失速、應急停車或其他可能的原因造成的最壞的加速或減速，均不會危及船上人員安全。

17.9 航速

應確定船舶的最大安全航速，計及對該船適合的營運狀態、風力、風向以及在靜水、波浪和其他表面上運行時，任一升舉系統或推進系統可能發生故障後的影響。

17.10 最小水深

船舶在各種狀態下營運時，所需的最小水深和其他適當數據都應予以確定。

17.11 硬結構的間距

對於兩棲船，應確定該船墊態時其船體硬結構的最低點與硬質平坦表面之間的間距。

17.12 夜航

試驗計劃應包括通過充分的運行對船舶內部照明和外部照明及其亮度作出評估。運行試驗應在營運狀態、航行狀態、靠碼頭操縱狀態下分別採用正常供電和應急供電進行。

第 18 章 營運要求

A 部分 一般規定

18.1 船舶營運控制

18.1.1 船舶應持有《高速船安全證書》、《高速船營運許可證書》或其副本，以及航線操作手冊和船舶操縱手冊副本。若主管機關有要求，還應持有保養手冊中操作部分的副本。

18.1.2 船舶不應故意在《高速船營運許可證書》、《高速船安全證書》或有關文件規定的預定最不利條件和各種限制範圍外的情況下營運。

18.1.3 當主管機關對船舶營運人從總體安全角度出發，在下述方面所採取的措施感到滿意時，應頒發《高速船營運許可證書》。若主管機關認為這些措施未能保持到其滿意的程度時，則應撤銷其營運許可證書：

- .1 考慮了航線操作手冊中所載的安全限制和有關資料後的船舶擬從事業務的適宜性；
- .2 航線操作手冊中所載的操縱條件的適宜性；
- .3 獲得准予開航所依據的氣象資料的措施；
- .4 設有符合 18.1.4 要求的設施的基地港作業區域內的管理規定；
- .5 指派負責根據獲取的氣象資料決定取消或延遲某一特定的航次的人員；

- .6 操縱船舶、部署與駕駛救生艇筏，以及營運許可證書中規定的正常和應急情況下對乘客、車輛、貨物實施監督所需的足夠船員配員。船員組成應使船舶在航行途中，操縱艙室內有兩名駕駛員值班，其中之一可為船長；
- .7 船員的資格與培訓，包括對有關特殊類型船舶和擬從事業務的能力以及他們安全操作程序方面的須知；
- .8 有關對船員工作時間、作息的限制和防止疲勞的任何其他措施，包括足夠的休息周期；
- .9 船員在船舶操縱和應變程序方面的培訓；
- .10 保持船員操縱和應變程序方面的能力；
- .11 在港時的安全措施，若適當，應符合任何現有的安全措施；
- .12 交通管制措施，若適當，應符合任何現有的交通管制；
- .13 關於定位、夜間或視線受限情況下航行的限制和(或)規定，若適當，包括使用雷達和(或)其他電子助航設備；
- .14 由於擬從事業務的特殊性，例如夜航，可能要求的額外設備；
- .15 在船舶與岸台、基地港電台、應急服務站和其他船舶之間的通信聯繫，包括所使用的電台頻率和值班安排；
- .16 持有供主管機關查核的下列記錄：
 - .16.1 船舶按規定參數營運；
 - .16.2 遵守應急和安全操作程序；

- .16.3 操作船員的工作時間；
 - .16.4 船上的乘客人數；
 - .16.5 執行該船應遵守的任何法規；
 - .16.6 船舶操縱；以及
 - .16.7 船舶及其機器按批准的計劃表進行維護保養；
 - .17 確保設備按主管機關的要求進行維護保養的措施以及確保船舶和設備的可維修性的資料在船舶營運機構內營運部門與維修部門之間協調一致的措施；
 - .18 具備並使用下列說明：
 - .18.1 船舶裝載情況，以便有效地監視重量、重心的限制，必要時，對貨物進行適當繫固；
 - .18.2 裝有足夠的燃油儲備量；
 - .18.3 合理且可預見的應急情況下的對策；以及
 - .19 營運人為應付可預見的偶然事件而制訂的應變方案，包括岸基為應付每一事件所採取的行動。該方案應提供給操作船員有關搜救（SAR）當局及當地主管機關和機構的情況資料。這些主管機關和機構可以用設備協助完成由船員承擔的任務。^{*}
- 18.1.4 對 18.1.3 規定作出評估後，主管機關應確定距基地港或庇護地的最大許可距離。

* 參見本組織大會以 A.439 (XI) 號決議通過的《IMO 搜救手冊 (IMOSAR)》和 A.530 (13) 號決議通過的《用於搜尋和救助的雷達應答器》。

18.2 船舶文件

主管機關應確保船上備有技術手冊形式的適當資料和指導性文件，以便能夠安全地操縱和保養船舶。這些技術手冊應由航線操作手冊、船舶操縱手冊、培訓手冊、保養手冊和檢修計劃表組成。應採取措施使這些資料在必要時更新。

18.2.1 船舶操縱手冊

船舶操縱手冊至少應包括下列資料：

- .1 船舶的主要要素；
- .2 船舶及其設備的說明；
- .3 核查浮力艙完整性的程序；
- .4 根據第 2 章的要求，船員在緊急情況下可能直接實際應用的細節；
- .5 破損控制程序；
- .6 機器系統的說明和操作；
- .7 輔助系統的說明和操作；
- .8 遙控和報警系統的說明和操作；
- .9 電氣設備的說明和操作；
- .10 裝載程序和限制，包括最大營運重量、重心位置和載荷分配；
- .11 探火和滅火設備的說明和操作；

- .12 結構防火佈置圖；
- .13 無線電設備和導航設備的說明和操作；
- .14 按第 17 章規定確定有關船舶操縱資料；
- .15 適用時，最大的許可拖曳速度和拖曳載荷；
- .16 進乾塢或起吊程序，包括各種限制；
- .17 本手冊特別應提供主管機關專門批准的有關章節中明確規定的有關資料：
 - .17.1 指示應急情況或危及安全的故障，要求採取的行動以及由此對船舶或其機器在操縱方面的任何限制；
 - .17.2 撤離程序；
 - .17.3 操縱限制，包括預定的最不利條件；
 - .17.4 安全操作要求的所有機器參數的限制值。

關於機器或系統故障的資料中的數據，應考慮在船舶設計期間制訂的任何“故障模式與影響分析”（FMEA）報告中的結果。

18.2.2 航線操作手冊

航線操作手冊至少應包括下列資料：

- .1 撤離程序；
- .2 操縱限制，包括預定的最不利條件，諸如海浪高度、海水與空氣溫度以及風況；
- .3 在.2的限制條件內，船舶的操縱程序；

- .4 在可預見的偶然事件中，用於主要及輔助救援的適用應變計劃的諸要素，包括用於每一事件的岸基設施和活動；
- .5 獲得氣象資料的措施；
- .6 指定“基地港”；
- .7 指定作出取消或延遲航班決定的責任人員；
- .8 規定船員組成、職責和資格；
- .9 對船員工作時間的限制；
- .10 在港口的安全措施；
- .11 適用時，交通管制措施和限制；
- .12 特定航線情況或有關定位、夜間和視線受限制情況下航行的要求，包括使用雷達或其他電子助航設備的要求；以及
- .13 在船舶與岸台、基地港電台、應急服務站和其他船舶之間的通信聯繫，包括使用的電台頻率和守聽值班。

18.2.3 培訓手冊

培訓手冊可由各分冊組成，它應以通俗易懂的術語，可能時還應附以圖例，說明有關撤離、火災和破損控制的設備和系統以及最佳逃生方法的須知和資料。這類資料的任何部分都可用音像製品的方式代替手冊。若適用，培訓手冊的內容可以包含在船舶操縱手冊之中。下列事項應予詳細說明：

- .1 救生衣和浸水服的穿着，如適用時；
- .2 在指定的地點集合；

- .3 登乘、降落和解脫救生艇筏與救助艇；
- .4 從救生艇筏內降落自身艇筏的方法；
- .5 與降落裝置脫開；
- .6 在降落區域內保護裝置的使用與方法，如適用時；
- .7 降落區域的照明；
- .8 所有救生設備的使用；
- .9 所有探測設備的使用；
- .10 藉助圖例，使用無線電救生設備；
- .11 海錨的使用；
- .12 發動機和輔助設備的使用；
- .13 救生艇筏和救助艇的回收，包括存放和繫固；
- .14 暴露的危險和對保溫服的需要；
- .15 充分利用救生艇筏設施以求生存；
- .16 拯救的方法，包括使用直升飛機的救助設備（吊環、吊籃、擔架）、連褲救生圈和岸上救生設施以及船上拋繩器；
- .17 在應變部署表和應變須知中所包含的所有其他職責；
- .18 緊急修復救生設備須知；
- .19 防火和滅火設備與系統的使用須知；
- .20 火災時，消防員裝備（若設有）的使用指南；

- .21 與火災安全有關的報警與通信設備的使用；
- .22 檢查破損的方法；
- .23 破損控制設施和系統的使用，包括水密門和艙底泵的操作；
以及
- .24 客船在應急情況下對乘客的控制與通知。

18.2.4 保養手冊

船舶保養手冊應至少包括：

- .1 船舶安全營運所要求的所有船舶結構、機器裝置和所有安裝的設備與系統的詳細說明和示意圖。
- .2 修理可能需要的所有充注液體和結構材料的規格和數量；
- .3 以參數、振動和充注液體消耗的數值表示的主機的操作限制；
- .4 結構或主機部件損耗限制，包括要求按日期或運行時間換新的部件的壽命；
- .5 有關裝卸主、輔機械、傳動裝置、推進裝置、墊升裝置和柔性結構部件程序的詳細說明，包括應採取的任何安全預防措施或要求的專用設備；
- .6 機器或系統部件更換後或故障診斷時應遵循的試驗程序；
- .7 船舶起吊或進塢程序，包括重量或狀態的限制；
- .8 關於船舶的重量和確定重心縱向位置（LCG）的程序；

- .9 當船舶可能需拆卸運輸時，應提供有關拆卸、運輸和再裝配的說明；
- .10 檢修計劃表，無論是包括在保養手冊內還是另冊印出，均應詳細說明為保持船舶及其機器和系統的安全操作所要求的定期保養和維護操作。

18.3 培訓和合格證明

18.3.1 應對船長和每名船員所必要的的能力等級和培訓作出規定，並證明符合指南要求，該指南應使主管機關對有關船舶的特殊類型、型式以及擬從事的業務的要求感到滿意。應有一名以上的船員經培訓後，能在正常和緊急情況下執行所有的基本操作任務。

18.3.2 主管機關應對船長和每名船員規定適當的操作培訓期限。如必要，應制定出適當的再培訓期限。

18.3.3 經過適當期限的操作/模擬培訓，通過考試合格，包括在有關的特定類型和型式的船上和所從事的航線上經過相應的操作任務的實際測試之後，主管機關應給船長和所有擔任操作任務的船員簽發型式等級證書。型式等級培訓應至少包括下列項目：

- .1 船上所有推進和控制系統，包括通信和航行設備、操縱、電氣、液壓與氣動系統以及艙底泵和消防泵方面的知識；
- .2 控制、操縱和推進系統的故障模式和此類故障的正確對策；
- .3 船舶的操縱特性和限制的操縱條件；
- .4 駕駛室通信和航程序序；
- .5 完整與破艙穩性，以及在破損情況下船舶的殘存能力；

- .6 船舶救生設備包括救生艇筏裝置的位置與使用；
 - .7 船上逃生與乘客撤離的位置與使用；
 - .8 在船上發生火災的情況下，防火與滅火設施和系統的位置和使用；
 - .9 破損控制設施和系統的位置和使用，包括水密門和艙底泵的操作；
 - .10 貨物和車輛的存放繫固系統；
 - .11 應急情況下對乘客的控制和通知的方法；以及
 - .12 培訓手冊中列出的所有其他項目的位置和使用。
- 18.3.4 對於一艘特定類型和型式的船舶，其型式等級證書只有在完成擬從事的航線上的實際試航並經主管機關簽署後，且從事該特定航線的營運時才有效。
- 18.3.5 型式等級證書每兩年應重新簽證，並且主管機關應制訂重新簽證的程序。
- 18.3.6 所有船員均應接受 18.3.3.6 至 .12 所規定的須知和培訓。
- 18.3.7 主管機關應根據有關的航線和船舶，規定船員的健康標準和體格檢查的周期。
- 18.3.8 船舶營運所在國如非船旗國，其主管機關應對船長和每名船員的培訓經歷和資格滿意。船舶營運所在國的主管機關應接受船長和船員持有的業經簽署的有效型式等級證書，連同船旗國簽發的《培訓、發證和值班標準國際公約》（STCW）規定應持有的有效執照或

證書（該船旗國應是國際公約締約國），並視其為培訓、履歷和資格的良好證明。

18.4 救生艇筏人員配置和監督

18.4.1 船上應有足夠數量的業經培訓的人員，以召集和幫助未受培訓的人員。

18.4.2 船上應有足夠數量的船員，可以是駕駛員或持證人員，能操作救生艇筏、救助艇及其降落裝置，以滿足全體船上人員棄船時之需。

18.4.3 每艘救生艇筏均應有 1 名駕駛人員或持證人員負責。主管機關在進一步考慮航行的特點、船上人員的數量和救生艇筏的特徵後，可以允許每個或 1 組救生筏上有 1 名駕駛人員或持證人員或在操作和操縱救生筏方面有經驗的數名人員負責。

18.4.4 負責救生艇筏的人員應備有 1 份救生艇筏上船員的清單，並應使其指揮下的船員清楚自己的職責。

18.4.5 每艘救助艇和機動救生艇筏上應有 1 名指定人員，此人應有能力操作發動機並能作一些小調整。

18.4.6 船長應負責保證 18.4.1 至 18.4.3 涉及的救生艇筏上需配人員的合理分佈。

18.5 應變須知和應變演習

18.5.1 在開航時或開航前，乘客應被告知在應急情況下救生衣的使用和應採取的行動，並應使旅客注意到 8.4.1 和 8.4.3 所要求的應變須知。

18.5.2 船員應在船上進行應急火災和撤離演習，演習間隔期對客船不應超過 1 周，對貨船不應超過 1 月。

18.5.3 每名船員每月應至少參加 1 次撤離、滅火和破損控制演習。

18.5.4 船上的演習應儘實際可能來模擬實際應急情況。此類模擬應包括船上的撤離、火災與破損控制設施和系統的指導和操作。

18.5.5 船上撤離、火災與破損控制設施和系統的指導和操作，應在船員中間進行適當的交叉培訓。

18.5.6 應向每位乘客和船員提供一份包括全船應變設施佈置圖在內的應變須知，該圖應標明所有出口、撤離線路、應急裝置、救生裝置和設備的位置以及救生衣穿着圖例。應變須知應置於每位乘客和船員座位附近。

18.5.7 記錄

舉行應變集合的日期以及棄船演習、火災演習、其他救生設備的演習和船上培訓的細節均應記錄在可能為主管機關規定的航海日誌上。如不能在指定日期舉行完整的應變集合、演習和培訓，則應在航海日誌上作出記錄，寫明所舉行的應變集合、演習或培訓的情況和範圍。該資料的副本應提交營運管理部門。

18.5.8 撤離演習

18.5.8.1 撤離演習的險情應每周不同，以便模擬各種應急情況。

18.5.8.2 每次船舶撤離演習應當包括：

- .1 船員根據 8.2.2.2 所要求的警報被召集到集合站，並且確保他們了解應變部署表中規定的棄船順序；

- .2 到集合站報到並準備執行應變部署表中規定的職責；
- .3 檢查船員的穿着是否合適；
- .4 檢查救生衣的穿着是否正確；
- .5 操作吊艇架用於降落救生筏；
- .6 由適當的船員穿着浸水服或保溫服；
- .7 試驗用於應急集合和棄船的應急照明；以及
- .8 講授船上救生設備的使用和海上生存的須知。

18.5.8.3 救助艇演習

- .1 作為撤離演習的一部分，只要合理並且實際可行，每月應降落救助艇 1 次，艇上載有指定船員且在水中操縱。在所有情況下，此要求至少每 3 個月應執行 1 次。
- .2 如果救助艇降落演習係在船舶以航行速度前進時進行，由於所涉及的危險性，此類演習應僅在遮蔽水域中進行，並應由對此類演習有經驗的船員加以監督。*

18.5.8.4 單次培訓指導可以涉及船上救生系統的不同部分，但對客船應用 1 個月，對貨船用 2 個月的時間，覆蓋船上全部救生裝置和設備。每名船員都應接受培訓指導，此類培訓指導應當包括，但不必限於：

- .1 操作和使用船上的氣脹式救生筏；

* 參見關於為培訓目的從以航行速度前進的船上降落救生艇和救助艇下水的指南的大會 A.624 (15) 號決議。

- .2 體溫過低問題、體溫過低的急救處理以及其他適宜的急救程序；以及
- .3 在惡劣氣候和惡劣海況下使用船上的救生設備所必需的特別輔導。

18.5.8.5 在船上培訓使用吊艇架降落救生筏，對每艘裝有該類設備的船應在不超過 4 個月的間隔期舉行。當實際可行時，此類培訓應包括救生筏的充氣和下降。這種筏可以是一種特殊的、僅擬用於培訓目的的筏，它不屬於船上救生設備的一部分。這種特殊的救生筏應予以明顯標記。

18.5.9 消防演習

18.5.9.1 消防演習的險情應每周變化，以便模擬船上不同艙室着火的應急狀況。

18.5.9.2 每次消防演習應包括：

- .1 將船員召集到防火站；
- .2 到防火站報到並準備執行應變部署表中的職責；
- .3 穿着消防員裝備；
- .4 操作防火門和擋火閘；
- .5 操作消防泵和滅火設備；
- .6 操作通信設備、應急信號和通用報警；
- .7 操作探火系統；以及
- .8 講授船上滅火設備和水噴淋和灑水系統，如設有時。

18.5.10 破損控制演習

18.5.10.1 破損控制演習險情應每周變化，以便模擬不同破損情況的應急狀態。

18.5.10.2 每次破損控制演習應包括：

- .1 將船員召集到破損控制站；
- .2 到控制站報到並準備執行應變部署表中的職責；
- .3 操作水密門和其他水密關閉裝置；
- .4 操作艙底泵並試驗艙底報警和自動艙底泵啟動系統；以及
- .5 講授破損檢查、船上破損控制系統的使用和在應急情況下對乘客的控制。

B 部分 對客船的要求

18.6 型式等級培訓

18.6.1 對全體船員而言，型式等級培訓除 18.3.6 的規定外，還應包括對乘客的控制和撤離。

18.6.2 當船上裝載貨物時，除本部分規定外，還應符合本章 C 部分的要求。

18.7 應變須知和應變演習

18.7.1 應為每位乘客提供一份包括應變設施佈置圖在內的應變須知，該圖應標明所有出口、撤離線路、應急裝置、救生裝置和設備的位置以及救生衣穿着圖例。應變須知應置於每位乘客座位附近。

18.7.2 應使乘客在上船時就注意到應變須知的規定。

C 部分 對貨船的要求

18.8 型式等級培訓

對全體船員而言，型式等級培訓應包括貨物與車輛存放區域中繫固系統的知識。

18.9 應變須知和應變演習

應為每位船員提供一份包括應變設施佈置圖在內的應變須知，該圖應標明所有出口、撤離線路、應急裝置、救生裝置和設備的位置以及救生衣穿着圖例。

第 19 章 檢驗和維修保養要求

19.1 船舶營運人組織或船舶營運人可能招聘對其船舶作維修保養的任何組織，應能使主管機關滿意。考慮了該組織的人員數量及能力、可用的設施情況、必要時邀請專家幫助的措施、紀錄保持、通信和職責分配後，主管機關應對該組織內各部門可以承擔的職責範圍作出規定。

19.2 船舶和設備的維修保養應使主管機關滿意，特別是：

- .1 日常防護檢查和維修保養應按主管機關認可的計劃表進行。該計劃表至少應首先考慮了工廠的計劃表；
- .2 在進行維修工作時，應注意到主管機關認可的保養手冊、修理報告和對這方面的任何補充指示；
- .3 所有改建工作均應予以記錄，並對其安全狀態予以調查研究。若對安全可能產生任何影響時，改建部分及其安裝應能使主管機關滿意；
- .4 應採取適當的措施，將船舶及其設備的可維修性的情況通報船長；
- .5 應明確規定操作船員在保養維護方面的職責，以及當船舶離開基地港時要求廠方協助修理的手續；
- .6 船長應向維修廠報告在運行期間發生的任何已知的故障和修理；
- .7 應保存故障及修復的記錄。對於經常性的故障或者對船舶或人身安全產生不利影響的故障，應向主管機關報告。

19.3 為保證船上配備的所有救生設備和遇險信號均能得到適當的檢查、維護和記錄而採取的措施，應能使主管機關滿意。

附錄 1

高速船安全證書的格式

高速船安全證書

本證書應附有一份《設備記錄簿》

(公章)

(國名)

根據《國際高速船安全規則》(MSC.36 (63) 號決議)

本證書由_____政府授權_____頒發。

(國家全名)

(主管機關授權的個人或組織的全名)

船舶特徵*

船名_____

建造廠號和船體編號_____

船舶編號或呼號_____

IMO 編號**_____

船籍港_____

總噸位_____

設計水線相應的吃水：首吃水_____，尾吃水_____

船舶類別：A 類客船/B 類客船/貨船***

船舶類型：氣墊船/表面效應船/水翼船/單體/多體/其他 (詳細說明具體類型_____) ***

安放龍骨或處於相應建造階段的日期或重大改裝開始的日期_____

* 船舶特徵也可以一一在水平排列的格子中列出。

** 按照本組織大會以 A.600 (15) 號決議通過的《IMO 船舶識別編號方案》的要求。

*** 不適用者刪去。

茲證明

1 上述船舶業經依照《國際高速船安全規則》的規定進行了相應的檢驗。

2 檢驗表明，該船的結構、設備、屬具、無線電設備、材料及其狀況等各方面均良好，且該船符合上述規則的有關規定。

3 救生設備僅供總人數_____人用，計有：_____

4 按《規則》1.11 規定，該船的下列等效已被批准：

章節_____等效佈置_____

本證書有效期至_____止。

_____年_____月_____日發於_____

(證書頒發地點)

(授權發證的官員簽名)

(發證機關蓋章或鋼印)

定期檢驗的簽署

茲證明按《規則》1.5 的要求進行的檢驗證明該船已符合《規則》的有關規定。

定期檢驗： 簽名： _____
(授權官員簽名)
地點： _____
日期： _____
(發證機關蓋章或鋼印)

定期檢驗： 簽名： _____
(授權官員簽名)
地點： _____
日期： _____
(發證機關蓋章或鋼印)

定期檢驗： 簽名： _____
(授權官員簽名)
地點： _____
日期： _____
(發證機關蓋章或鋼印)

定期檢驗： 簽名： _____
(授權官員簽名)
地點： _____
日期： _____
(發證機關蓋章或鋼印)

按《規則》1.8.8 如果證書有效期不到 5 年時證書展期的簽署

本船符合《規則》的有關規定，按《規則》1.8.8，承認本證書有效至
_____止。

簽名：_____

(授權官員簽名)

地點：_____

日期：_____

(發證機關蓋章或鋼印)

完成換證檢驗和《規則》1.8.9 適用時的簽署

本船符合《規則》的有關規定，按《規定》1.8.9，承認本證書有效至
_____止。

簽名：_____

(授權官員簽名)

地點：_____

日期：_____

(發證機關蓋章或鋼印)

按《規則》1.8.10 證書有效期展期到抵檢驗港時止的簽署

按《規則》1.8.10 的規定，承認本證書有效至_____止。

簽名：_____

(授權官員簽名)

地點：_____

日期：_____

(發證機關蓋章或鋼印)

《規則》1.8.13 適用時，證書周年日提前的簽署

按《規則》1.8.13 的規定，新的周年日為：_____。

簽名：_____

(授權官員簽名)

地點：_____

日期：_____

(發證機關蓋章或鋼印)

按《規則》1.8.13 的規定，新的周年日為：_____。

簽名：_____

(授權官員簽名)

地點：_____

日期：_____

(發證機關蓋章或鋼印)

高速船安全證書的設備記錄簿

本記錄應永久附在《高速船安全證書》之後

符合《國際高速船安全規則》的設備記錄簿

1 船舶特徵

船名 _____

建造廠號和船體編號 _____

船舶編號或呼號 _____

IMO 編號* _____

船舶類別：A 類客船/B 類客船/貨船**

船舶類型：氣墊船/表面效應船/水翼船/單體/多體/其他（詳細說明具體類型 _____）**

經認可的乘客數 _____

有資格操作無線電設備的最低人數 _____

2 救生設備細目

1 提供救生設備的總人數	_____
2 救生艇總數	_____
2.1 所有救生艇能容納的總人數	_____
2.2 符合 SOLAS 公約第 III/42 條的部分封閉救生艇的數量	_____
2.3 符合 SOLAS 公約第 III/44 條的全封閉救生艇的數量	_____
2.4 其他救生艇	
2.4.1 數量	_____
2.4.2 類型	_____

* 按照本組織大會以 A.600 (15) 號決議通過的《IMO 船舶識別編號方案》的要求。

** 不適用者刪去。

3 救助艇數量	_____
3.1 計入救生艇總數的救助艇數量	_____
4 符合 SOLAS 公約第 III/38 至 40 條，且配備合適的降落裝置的救生筏數量	_____
4.1 救生筏數量	_____
4.2 救生筏能裝載的總人數	_____
5. 開敞式兩面可用救生筏（見本《規則》附錄 10）	
5.1 救生筏數量	_____
5.2 救生筏能裝載的總人數	_____
6 海上撤離系統（MES）的數量	_____
6.1 可經 MES 撤離的人數	_____
7 救生圈數量	_____
8 救生衣數量	_____
8.1 成人救生衣數量	_____
8.2 兒童救生衣數量	_____
9 浸水服	
9.1 總數	_____
9.2 符合救生衣要求的浸水服數量	_____
10 防暴露服數量	_____
10.1 總數	_____
10.2 符合救生衣要求的防暴露服數量	_____
11 用於救生設備的無線電設備	
11.1 雷達應答器數量	_____
11.2 雙向甚高頻無線電話數量	_____

3 無線電設備細目

項目	實際配置數
1 主系統	_____
1.1 VHF 無線電裝置：	
1.1.1 DSC 編碼器	_____
1.1.2 DSC 值班接收機	_____
1.1.3 無線電話	_____
1.2 MF 無線電設備：	
1.2.1 DSC 編碼器	_____
1.2.2 DSC 值班接收機	_____
1.2.3 無線電話	_____
1.3 MF/HF 無線電裝置：	
1.3.1 DSC 編碼器	_____
1.3.2 DSC 值班接收機	_____
1.3.3 無線電話	_____
1.3.4 直接打印無線電報機	_____
1.4 INMARSAT 船舶地球站	_____
2 輔報警設備	_____
3 海上安全信號接收裝置：	
3.1 NAVTEX 接收機	_____
3.2 EGC 接收機	_____
3.3 HF 直接打印無線電報接收機	_____
4 衛星應急無線電示位標：	
4.1 COSPAS-SARSAT	_____
4.2 INMARSAT	_____
5 VHF 應急無線電示位標	_____
6 船用雷達應答器	_____

7	2182 kHz 無線電話遇險頻率值班接收機*	_____
8	2182 kHz 無線電話報警信號發生器**	_____

4 保證無線電設備有效工作所採取的方法（見本《規則》14.14.6，14.14.7 和 14.14.8）

4.1 雙套設備_____

4.2 岸基維護保養_____

4.3 海上維護保養能力_____

茲證明本記錄簿全部正確無誤

本記錄於_____在_____簽發。

（簽發時間） （簽發地點）

頒發記錄簿的正式授權官員簽名：_____

（發證機關蓋章或鋼印）

* 除非海上安全委員會另外確定日期，在 1999 年 2 月 1 日以後所發證書所附的記錄簿上，這一項目不需要再列上。

** 在 1999 年 2 月 1 日以後所發證書所附的記錄簿上，這一項目不需要再列上。

附錄 2

高速船營運許可證書格式

高速船營運許可證書

根據《國際高速船安全規則》（MSC.36（63）號決議）頒發

- 1 船名_____
- 2 建造廠號和船體編號_____
- 3 船舶編號或呼號_____
- 4 IMO 編號*_____
- 5 船籍港_____
- 6 船舶類別：A 類客船/B 類客船/貨船**
- 7 經營人名稱_____
- 8 營運航區或航線_____
- 9 基地港_____
- 10 至避難處的最大距離_____
- 11 人數
 - (1) 最大核准載客數_____
 - (2) 要求配各的船員數_____
- 12 預計的最不利條件_____
- 13 其他營運限制_____

* 按照本組織大會以 A.600（15）號決議通過的《IMO 船舶識別編號方案》的要求。

** 不適用者刪去。

本許可證書證明上述服務符合本《規則》1.2.2 至 1.2.7 的一般要求。

本許可證書由_____政府授權簽發。

本許可證書有效期至_____，只要《高速船安全證書》保持有效。

本證書於_____在_____簽發。

(簽發時間) (簽發地點)

頒發許可證書的正式授權官員簽名：_____

(發證機關蓋章或鋼印)

附錄 3

概率概念的使用

1 通則

1.1 人類在任何活動中不可能達到絕對的安全。很自然地，在制定安全要求時必須考慮這樣一個事實，就是說，這些要求並不意味着絕對安全。對於傳統的船舶，常常能夠在設計或建造的某些方面作出相當詳細的規定，在某種程度上適應了多少年來一向被直覺地認作無需下定義的危險程度。

1.2 對於高速船，把技術要求包括在本《規則》中，常常會顯得限制過分。因此，一些要求須寫成（當此問題提出時）這種含義：“……主管機關應根據各項試驗、調查和以往的經驗確信……的概率是（小到可以接受）”。由於不同的不良事故可認為具有不同的可接受概率的大概等級（例如推進裝置的暫時損壞與不可控制的火災相比），因此，合適的辦法是，商定一系列能用於表達各種事故的相對可接受概率的標準措辭，即實行一種質量分級方法。下面給出的詞彙目的是確保在需要描述那種不得被超出的危險限度時，保持所提各種要求之間的一致性。

2 與概率有關的術語

不同的不良事故可有不同的可接受概率的等級，因此，合適的辦法是商定標準措辭，用以表達各種事故的相對可接受概率，即實行一種質量分級方法。

2.1 事故

2.1.1 事故係指可能會降低安全程度的一種情況。

2.1.2 故障係指船舶的一個或幾個部件失效或工作不正常的事例，例如失控。故障包括：

- .1 個別故障；
- .2 與一個系統有關的獨立故障；
- .3 涉及一個以上系統的獨立故障，包括：
 - .3.1 任何已出現但未被探測到的故障；
 - .3.2 有理由預計將跟隨正在處理中的故障之後，還會發生的進一步的故障*；和
- .4 共同原因故障（由相同的原因引起一個以上部件或系統的失效）。

2.1.3 事件係指起源於船外因素（例如波浪）的事例。

2.1.4 差錯係指由於操作人員或維修人員不正確的行動而造成的事例。

2.2 事故的概率

2.2.1 經常的係指在一特定船的使用期限內，可能經常發生的。

2.2.2 相當可能的係指在一特定船的總使用期限內，不可能經常發生，但可能發生幾次的。

* 在估計隨後發生的進一步的故障時，應考慮到對當時尚未出現故障的設備將會造成更嚴重工況的任何故障。

2.2.3 複發的係指包括經常的和相當可能的這兩者總範圍的術語。

2.2.4 很少可能的係指不可能每艘船發生，但在同一類型的許多船的總使用期限內，其中的少數船可能發生。

2.2.5 極少可能的係指從同一類型許多船的總使用期限內考慮時不可能發生，但還是須當作可能發生來考慮。

2.2.6 極不可能的係指是極少可能，以至須當作不可能發生來考慮。

2.3 後果

2.3.1 後果係指事故的結果造成的情況。

2.3.2 輕微後果係指可能由於如 2.1.2，2.1.3，2.1.4 所定義的故障、事件或差錯所造成的，可由操作船員迅速補救的後果，包括：

- .1 稍微增加船員的工作任務或稍微增加其執行任務的困難；或
- .2 操作性能中等程度的降低；或
- .3 細微地改變許可的工作條件。

2.3.3 重大後果係指產生下列情況的後果：

- .1 明顯加重船員的工作任務，或增加其執行任務的困難，如果沒有其他重大後果同時發生，該任務不應超出合格船員的能力；或
- .2 操作性能明顯地降低；或
- .3 明顯地改變許可的工作條件，但不要求操作船員具有超出正常的技能仍具有可安全完成一個航程的能力。

2.3.4 危險後果係指產生下列情況的後果：

- .1 危險地加重船員的工作任務，或增加其執行任務的困難，以致難以指望船員去克服這些困難，而很可能需要外來援助；
或
- .2 操作性能危險地降低；或
- .3 船舶強度危險地降低；或
- .4 產生危及乘員的臨界狀態或傷害乘員；或
- .5 非得外來救援不可。

2.3.5 災難性後果係指導致沉船和（或）死人後果。

2.4 安全等級

安全等級係指表徵船舶性能（以水平單幅加速度 g 和加速度率 g/s 表示）和加速度載荷對站着和坐着的人的影響程度之間關係的數值。

安全等級和相應的對旅客影響的嚴重性及對船舶性能的安全衡準應遵照表 1 中的規定。

3 數值

在採用概率數值評定以類似上述術語制定的要求是否得到滿足時，可使用下表近似數值作為指南，以提供有普遍意義的參考。所引用的概率應以每小時或每一航程為基礎，取決於何者更適合於所評定的情況。

經常的	超過 10^{-3}
相當可能的	$10^{-3} \sim 10^{-5}$
很少可能的	$10^{-5} \sim 10^{-7}$
極少可能的	$10^{-7} \sim 10^{-9}$
極不可能的	雖對此沒有定出大致的概率數值， 但如用數字應比 10^{-9} 小得多

註：不同的事故，根據其後果的嚴重程度，可能具有不同的可接受概率（見表 2）。

表 1

後果	不得超出的衡準		註釋
	載荷類型	數值	
等級 1 輕微後果 中等降低安全性	水平方向測得的 最大加速度*	0.20g**	0.08g 和 0.20g/s***：老年人抓住把手時，能保持平衡 0.15g 和 0.20g/s：普通人抓住把手時，能保持平衡 0.15g 和 0.80g/s：坐着的人需開始抓住把手
等級 2 重大後果 明顯降低安全性	水平方向測得的 最大加速度*	0.35g	0.25g 和 0.20g/s：普通人抓住把手時，保持平衡的最大負荷 0.45g 和 10g/s：普通人未繫座椅帶時，會從座椅上跌下
等級 3 危險性後果 嚴重降低安全性	計算的碰撞設計 情況 根據重心處垂向 加速度確定的最大 結構設計載荷	參考 4.3.3 參考 4.3.1	傷害旅客的危險，碰撞後的安全緊急操作 1.0g：旅客安全性降低
等級 4 災難性後果			沉船和（或）死人

註：* 所用記錄儀的精度為：加速度與真值相差應不超過 5%，頻率響應使用最小值應為 20 Hz，應使用最大通頻帶衰減為 100+5%的抗失真濾波器。

** g 為重力加速度 (9.81 m/s²)

*** g -率或衝擊可從加速度/時間曲線中估算出。

表 2

安全等級	1	1	1	2	3	4
對船舶和乘員的影響	正常	干擾	操作限制	緊急步驟；安全限界明顯減小；船員應付不利情況有困難；旅客受到傷害	安全限界大幅減小；因工作負荷或環境條件，船員不堪忍受；少量乘員受嚴重傷害	死人，通常船沉沒
F.A.R.* 概率 (僅供參考)	← 可能 →		← 不大可能 →		← 極不可能 →	
JAR-25** 概 率	← 可能 →		← 不大可能 →		← 極不可能 →	
	← 經常 →		← 相當可能 →		← 很少可能 →	
	← 極少可能 →					
	10 ⁻⁰	10 ⁻¹	10 ⁻²	10 ⁻³	10 ⁻⁴	10 ⁻⁵
				10 ⁻⁶	10 ⁻⁷	10 ⁻⁸
						10 ⁻⁹
後果類型	← 輕微 →		← 重大 →		← 危險性 →	
					← 災難性 →	

註：* 美國聯邦航空規則 (F.A.R)。

** 歐洲聯合飛行性能規則 (JAR)。

附錄 4

故障模式和影響分析程序

1 前言

1.1 對於傳統的船舶，已能夠在設計或建造的某些方面作出相當詳細的規定，在某種程度上適應多少年來一向被直覺地認作無需下定義的危險程度。

1.2 隨着大型高速船的發展，所需要的經驗還相當不全面。然而，隨着從整體上作工業安全性評價的概率方法正在被廣泛地接受，因而可以提出用故障特性分析來幫助評價高速船操作的安全性。

1.3 應對船舶及其部件系統的故障特性進行一種實際、真實和書面的評價，以對可能存在的重要故障情況作出定義和進行研究。

1.4 本附錄描述一種故障模式和影響分析（FMEA），並就如何通過下述程序來應用提供了指南：

- .1 解釋基本原則；
- .2 規定為進行分析而必需的程序步驟；
- .3 確定合適的術語、假設、措施和故障模式；以及
- .4 提供所需工作表格的例子。

1.5 對高速船，FMEA 是建立在單個故障概念基礎上的，據此在系統功能體系的各個狀態的每一個系統，在任一時刻，假定其可能由於一個原因發生故障。該假定故障的影響按其嚴重性進行分析和分類。這些影響可以包括在其他程度上的次級故障（或多重故障）。任何可能引起船舶災難性後果的故障模式應通過系統或設備冗餘加以

防範，除非這種故障的概率為極不可能（參閱第 13 節）。對於引起危險後果的故障模式，可以接受糾正措施來代替。應制定試驗程序以確證 FMEA 的結論。

1.6 雖然 FMEA 被認為是最靈活的分析技術之一，但同時也承認存在其他可用的方法，在某些環境條件下，也可以對特定的故障特性提供同等的綜合分析。

2 目的

2.1 FMEA 的基本目的是提供一個全面的、系統的和書面的調研，以建立船舶的重大故障情況，從而評價其對船舶及其乘員和環境安全的重要性。

2.2 進行分析的主要目的是：

- .1 為主管機關提供船舶故障特性的研究結果，以便對所建議的船舶操作安全性水平進行評定；
- .2 為船舶經營人提供產生全面培訓、操作和維護程序及說明的數據；和
- .3 為船舶和系統設計者提供審核其建議的設計資料。

3 適用範圍

3.1 每一艘高速船在投入營運之前，對於按本規則 5.2，9.1.10，12.1.1 和 16.2.6 要求的系統應完成 FMEA。

3.2 對設計相同並具有相同設備的船舶，只需對首制船進行一次 FMEA，但每艘船應進行相同 FMEA 結論的試驗。

4 系統故障模式和影響分析

4.1 在對系統部件故障關於系統功能輸出所產生的影響進行詳細的 FMEA 之前，必須先對船舶重要系統進行功能故障分析。這樣，僅那些功能故障分析失敗的系統需通過更詳細的 FMEA 進行研究。

4.2 當實施系統 FMEA 時，應考慮以下船舶正常設計環境條件中的典型操作模式：

- .1 正常情況下全速航行；
- .2 擁擠水域中最大允許操作航速；以及
- .3 靠碼頭操縱。

4.3 為使故障影響易於被理解，這些系統的功能相互關係還應以框圖或故障樹圖加以說明或以敘述方式說明。所要分析的每個系統應儘可能假定在以下故障模式下失效：

- .1 完全失去功能；
- .2 迅速改為最大或最小輸出；
- .3 輸出不受控制或改變輸出；
- .4 過早操作；
- .5 在規定的時間不能操作；和
- .6 在規定的時間不能停止運轉。

根據所考慮的系統，其他故障模式也可計及。

4.4 如果系統失效不會造成危險性後果或災難性後果，就無須將詳細的 FMEA 引進系統結構。對那些個別的故障能造成危險性後果或災難性後果的系統，且無備用系統，則應遵循以下所述的詳細的 FMEA。系統功能故障分析的結果應通過按分析所擬定的實際試驗程序來說明和證實。

4.5 如果一個可能因其故障而造成危險性後果或災難性後果的系統配有一個備用系統，則可不要求詳細的 FMEA，但其前提是：

- .1 備用系統能在 4.2 中所述最麻煩的操作模式的時間限制內，投入運轉或接替失效的系統而不危及船舶；
- .2 備用系統完全獨立於該系統，並且不共用會導致該系統和備用系統都會發生故障的公共系統部件，但如果故障概率符合第 13 節的要求，則公共系統部件可予以接受；以及
- .3 備用系統可以與該系統共用同一動力源。在這種情況下，備用動力源應能按上述.1 的要求迅速投入運行。

還應考慮操作者失誤引進備用系統的可能性和後果。

5 設備故障模式和影響分析

要在這方面作更詳細 FMEA 研究的系統應包括所有那些系統 FMEA 已經失敗的系統，並且可以包括對船舶及其乘員的安全性有非常重要影響的系統，以及包括要求作較系統功能故障分析更深一層研究的系統。這些系統常常專門為船舶設計或採用的，例如船舶的電力和液壓系統。

6 程序

實施 FMEA 應遵循以下步驟：

- .1 確定要分析的系統；
- .2 利用方框圖說明系統功能部件的相互關係；
- .3 確定所有功能的故障模式及其原因；
- .4 評估每種故障模式對系統的影響；
- .5 確定故障探測方法；
- .6 確定故障模式的糾正措施；
- .7 如可能，評定引起危險後果或災難性後果的概率；
- .8 編寫分析資料；
- .9 制定試驗程序；
- .10 準備 FMEA 報告。

7 系統定義

FMEA 研究的第一步是利用圖紙和設備手冊詳細研究要分析的系統。應編製包括以下資料的系統及其功能要求的敘述說明：

- .1 系統操作和結構的一般說明；
- .2 系統部件之間的功能關係；
- .3 在每一種典型的運行模式中系統及其組成部件的可接受的功能限制；以及

.4 系統約束。

8 系統框圖的編製

8.1 第二步是編製說明系統功能流程的框圖，以便從技術上了解系統的功能和運行，及其隨後進行的分析，框圖至少應包括：

- .1 將系統劃分成主要子系統或設備；
- .2 所有固定用以適當標記每一個子系統的輸入、輸出和標識號碼；
- .3 所有冗餘、選擇性符號路線和提供“故障－安全”措施的其他工程細節。

關於系統框圖的例子，請見附註 1。

8.2 對每一種運行模式必要時可提供不同形式的框圖。

9 故障模式、原因及影響的識別

9.1 故障模式是藉以觀測故障的方式，它一般地描述了故障發生的情形以及對設備或系統的影響。表 1 中列出了故障模式的例子。表 1 中所列的故障模式使得可以用相當明確的術語描述任意系統部件的故障，如果在系統框圖中一起使用帶有控制輸入和輸出的性能說明，就能標識和描述所有可能的故障模式。例如，供電有可能描述為“失去輸出”（29）的故障模式，以及說明為“斷開（電）”（31）的故障原因。

9.2 系統部件的故障模式也可能是系統故障的原因，例如，舵機系統的液壓管路可能有“外部泄漏”（10）的故障模式，此液壓管路的故障模式可能成為該舵機系統故障模式“失去輸出”（29）的故障原因。

9.3 每個系統應視作一個從系統的功能輸出的從上到下的過程，故障應假定在某一時刻由一個可能的原因引起。由於一個故障模式可能具有不止一個原因，對每一個故障模式的所有可能的相互獨立的原因都應加以辨識。

9.4 如果主要系統失效不引起任何有害的後果，則沒有進一步對其進行考慮的必要，除非該故障不能被操作者發現。判斷不存在有害影響並不意味着正好具有系統冗餘。冗餘應表現為立即起作用或以可忽略的時間滯後到位。另外，如果次序是：“故障－報警－操作者動作－備用開始－備用運行”，則應考慮滯後的影響。

10 故障後果

10.1 設備或系統的運行、功能、或狀態方面故障模式的結果稱為“故障後果”。所考慮的一特定子系統或設備方面的故障後果被稱為“局部故障後果”。評估局部故障後果將有助於在該系統水平上確定任何備件或糾正行動的有效性。在某些情況下，除故障模式本身以外可能不存在局部後果。

10.2 設備或子系統故障對系統輸出（系統功能）的影響被稱為“末端後果”。末端後果應按照以下類型進行評估和劃分嚴重程度：

- .1 災難性的；
- .2 危險性的；
- .3 重大的；和
- .4 輕微的。

本規則附錄 3 的 2.3 中列出了這四類故障後果的定義。

10.3 如果故障的末端後果劃定為危險性的或災難性的，則為了預防這類後果或將其減至最小，常常要求設有備用設備。對危險性的故障後果可以同意採用糾正操作程序。

11 故障探測

11.1 通常 FMEA 研究僅根據系統中單個故障分析故障後果，因此應確定故障探測方式，例如聲或光報警裝置、自動檢測裝置、傳感儀或其他專用指示器等。

11.2 如果系統部件故障是不可探測的（即隱匿的損壞或任何不向操作者發出聲、光指示的故障），且系統能以規定的操作繼續運行，則分析應擴大至測定第二個故障的後果，該故障連同第一個未探測到的故障可能導致更嚴重故障後果，例如危險性後果或災難性後果。

12 糾正措施

12.1 為預防或減小系統部件或設備故障模式的影響，還應確定和評估在給定的系統水平上起動任何備用設備或任何糾正行動的響應。

12.2 為了消除失靈或故障造成的後果，在任何系統水平上作為設計細節的措施，諸如為防止產生或擴散故障後果的控制，或關閉系統部件，或啟動備用件或輔助部件或系統等，均應予以說明。糾正設計措施包括：

- .1 允許連續安全運轉的備用設備；
- .2 限制操作或限制損壞的安全設備、監視或報警設備；和

.3 操作的替代模式。

12.3 為防止或減輕假定故障的後果而要求操作者採取的措施應予以說明。當評估消除局部故障後果的措施時，如果糾正措施或備用設備的啟動要求操作者介入，則應考慮操作者錯誤的可能性和後果。

12.4 應注意的是一種操作模式中可接受糾正響應不為另一種操作模式所接受，例如一個具有較大時間滯後的備用系統部件引入到管路中，其符合操作模式“全速正常航行情況”但可能在另一種操作模式，例如“擁擠水域中最大允許操作航速”中導致災難性後果。

13 概率概念的應用

13.1 如果未向任何故障提供前述章節說明的糾正措施或冗餘，作為替代此類故障的發生概率應滿足下列可接受的衡準：

- .1 導致災難性後果的故障模式應評為極不可能；
- .2 評為極少可能的故障模式應不導致較危險性後果更壞的結果；和
- .3 評為經常的或相當可能的故障模式應不導致較輕微後果更壞的結果。

13.2 本規則附錄 3 第 3 節中列出了各種概率水平的數值。在沒有來自船舶的資料以測定故障概率水平時，可以利用其他的來源，諸如：

- .1 車間試驗，或
- .2 用在其他領域中類似的操作情況下的可靠性歷史，或

.3 數學模型，如適用時。

14 文件

14.1 附註 2 列出的工作表格對實施 FMEA 是有益的。

14.2 工作表格的填寫，應首先顯示最高一級系統水平，然後順序往下減小系統水平。

15 試驗程序

15.1 應擬定 FMEA 試驗程序以證明 FMEA 的結論，為此建議試驗程序應包括其故障會導致下列後果的所有系統或系統部件：

- .1 重大或更嚴重的後果；
- .2 限制操作；和
- .3 任何其他糾正措施。

對其故障不易在船上模擬的設備，可用其他試驗的結果來確定對系統和船舶的後果和影響。

15.2 試驗還應包括下列調研：

- .1 控制站的佈置為確保減少船員可能的無意和不正確操作（尤其是在應急情況下），應考慮開關和其他控制設備的相對定位，以及為防止對重要系統運行誤操作的連鎖裝置的預防措施；
- .2 有關船舶操作文件的存在和質量，特別是開航前檢查單。這些檢查必須包括在故障分析中確認的任何未展示的故障模式；和

.3 理論分析中所說明的主要故障的後果。

15.3 由本規則 5.3，16.4 和 17.4 所規定的船上 FMEA 試驗應在船舶投入營運之前進行。

16 FMEA 報告

FMEA 報告應是一份完備的文件，應對船舶、船舶的系統及其功能、建議的操作和故障模式、原因及後果和環境條件進行充分的闡述，且均不必藉助於不在該報告之內的其他圖紙和文件而能夠被理解。如需要，該文件應包括分析的假設和系統框圖。報告應包含結論的摘要以及系統故障分析和設備故障分析中的每一個所分析系統的說明。如需要，還應列出所有可能的故障及其故障概率，在每一種所分析操作模式中對每一個系統的糾正措施或操作限制。該報告應包含有試驗程序、所參考的所有其他試驗報告和 FMEA 試驗。

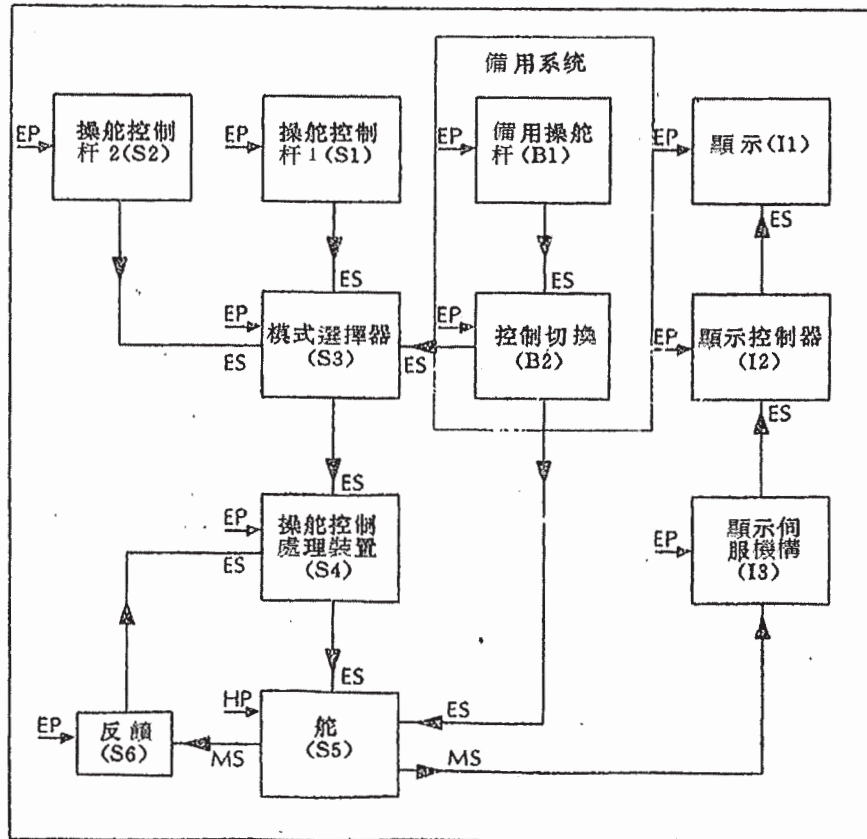
附註 1

系統框圖例子

操舵控制系統

日期： _____

分析者： _____



- 其中：
- EP—電力
 - HP—液壓力
 - ES—電信號
 - MS—機械信號

表 1 一組故障模式例子

1	結構故障（破裂）	18	假動作
2	機械性咬合或卡塞	19	未能制動
3	振動	20	未能啟動
4	未能處於（適當位置）	21	未能轉換
5	未能打開	22	超前運行
6	未能關閉	23	延遲運行
7	出故障時自動打開	24	錯誤輸入（增加）
8	出故障時自動關閉	25	錯誤輸入（減少）
9	內部泄漏	26	錯誤輸出（增加）
10	外部泄漏	27	錯誤輸出（減少）
11	偏離公差（高）	28	失去輸入
12	偏離公差（低）	29	失去輸出
13	無意的運行	30	短路（電）
14	斷續運行	31	斷開（電）
15	不穩定運行	32	漏（電）
16	錯誤指示	33	系統特性、要求和操作限制方面的其他異常故障情況
17	限制流動		

參考 IEC 出版物：IEC 812（1985）《系統可靠性分析技術—故障模式和影響分析（FMEA）程序》。

附錄 5

適用於各種船舶結冰的有關規定

1 結冰允許量

1.1 在結冰可能性較大區域營運的船舶，其穩性計算可採用如下的結冰允許量：

- .1 在露天甲板和舷梯， 30 kg/m^2 ；
- .2 船舶水線以上每舷的側投影面積， 7.5 kg/m^2 ；
- .3 欄杆、各種吊杆、杆或柱（桅除外）和索具等的不連續表面的側投影面積，以及其他小件物品的側投影面積，可將連續表面的側投影總面積增加 5%，以及將此總面積的靜力矩增加 10%來計算；
- .4 由於在橋體結構處結冰的不對稱，穩性要降低。

1.2 對於在預料會結冰區域營運的船舶：

- .1 在 2.1，2.3，2.4 和 2.5 規定的區域內，與 1.1 有大不相同冰凍情況，可採用規定的結冰允許量的 0.5~2 倍作為結冰允許量；
- .2 在 2.2 規定的區域內，預料結冰超過 1.1 規定允許量的 2 倍，可採用比 1.1 規定更高的要求。

1.3 在計算本附錄規定的各種情況下船舶的狀態時，須作一些假設。為此，應提供有關下列情況的資料：

- .1 以到達目的地和返回港口所需時間來表示的續航力；

.2 在航行中燃料、水、供應品和其他船用物資的消耗量。

2 冰區

在運用第 1 段時，適用的冰區如下：

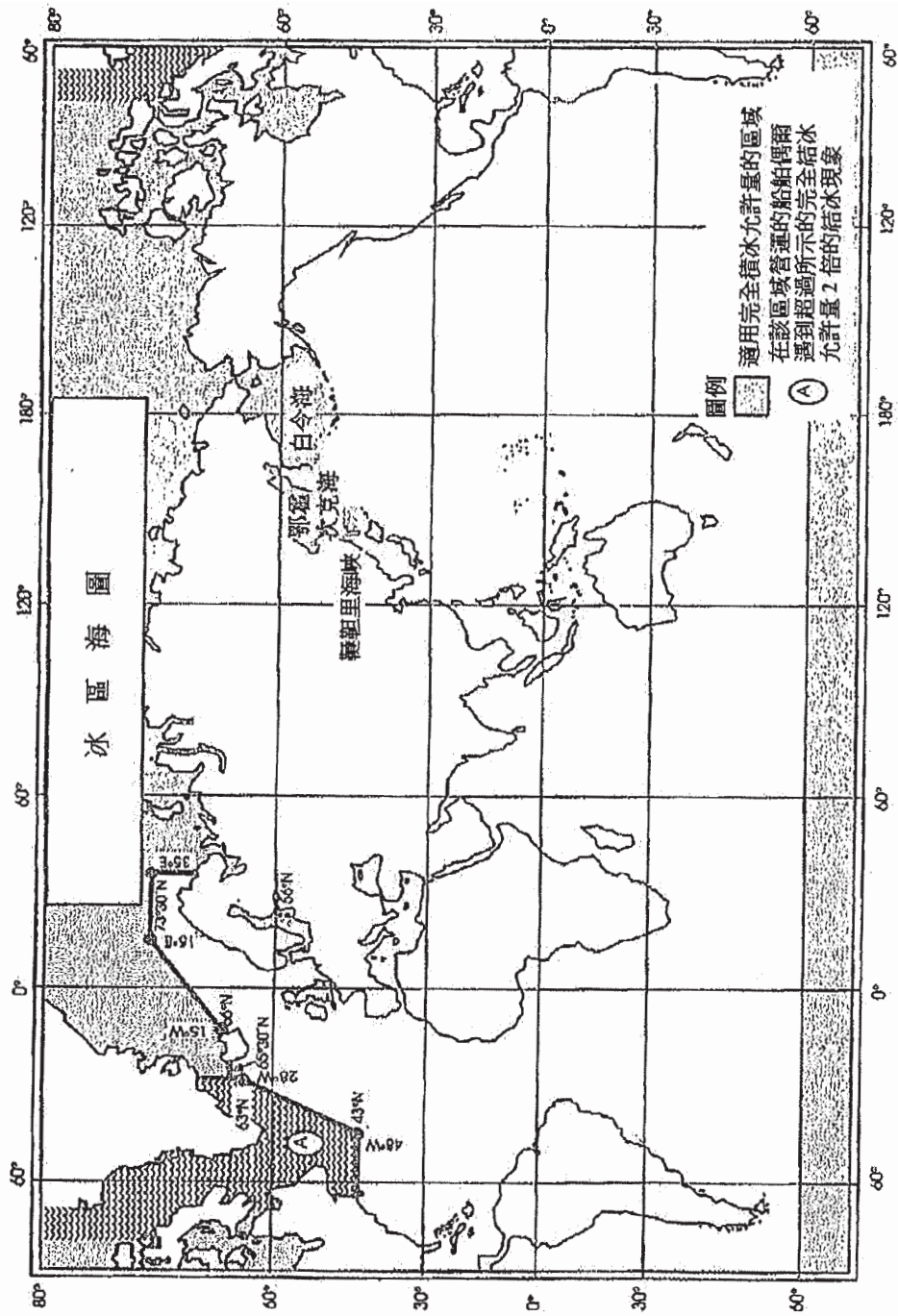
- .1 北緯 65°30' 以北，界於西徑 28° 和冰島西海岸之間；冰島北海岸以北；從北緯 66°、西經 15° 至北緯 73°30'、東經 15° 的恆向線以北；北緯 73°30' 以北、界於東經 15° 和 35° 之間；和東經 35° 以東，以及波羅的海內北緯 56° 以北等區域。
- .2 北緯 43° 以北，西部以北美海岸為界，東部以從北緯 43°、西經 48° 至北緯 63°、西經 28°，然後沿着西徑 28° 的恆向線為界的區域。
- .3 北美大陸以北，本段 .1 和 .2 規定區域以西的所有海區。
- .4 白令海、鄂霍次克海和在結冰季節的韃靼里海峽。
- .5 南緯 60° 以南。

附有一份標明冰區的海圖。

3 特殊要求

預定在已知會發生結冰的區域營運的船舶應：

- .1 設計成能使結冰減少到最小限度；和
- .2 如主管機關有要求應配備可消除結冰的裝置。



附錄 6

水翼船完整穩性研究的方法

應考慮這些船舶在排水狀態、過渡狀態和翼航狀態中的穩性。研究穩性時還應考慮外力的影響。下述程序是研究穩性的簡要指南。

1 割劃式水翼船

1.1 排水狀態

1.1.1 穩性應充分滿足本規則 2.3 和 2.4 的要求。

1.1.2 回轉橫傾力矩

在排水狀態操縱船舶的過程中產生的橫傾力矩可按下式計算：

$$M_R = 0.196 \frac{V_o^2}{L} \cdot \Delta \cdot KG \quad (\text{kN}\cdot\text{m})$$

式中： M_R —橫傾力矩；

V_o —船舶回轉速度，m/s；

Δ —排水量，t；

L —船舶水線長，m；

KG —重心距龍骨高度，m；

本公式適用於回轉半徑與船長之比為 2 至 4 的情況。

1.1.3 符合氣象衡準數的傾覆力矩和傾側力矩之間的關係

排水狀態水翼船的穩性可用下列氣象衡準數 K 進行核查：

$$K = \frac{M_G}{M_V} \geq 1$$

式中： M_C —根據橫搖確定的最小傾覆力矩；

M_V —風壓傾側力矩。

1.1.4 風壓傾側力矩

傾側力矩 M_V 是風壓 P_V ，受風面積 A_V 和受風面積力臂 Z 的乘積。

$$M_V = 0.001 P_V A_V Z \quad (\text{kN}\cdot\text{m})$$

在傾側的整個過程中，傾側力矩作為常數保持不變。

受風面積 A_V 包括船體、上層建築和水線以上各種結構的側投影面積。受風面積力臂 Z 是風力作用中心至水線的垂直距離。風力作用中心的位置可取為受風面積的中心。

表 1 列出了根據受風面積中心位置而定的蒲氏（Beaufort）風力 7 級時，以帕斯卡（pascal）為單位的風壓數值。

表 1 蒲氏風力 7 級、距陸地 100 海哩的標準風壓

Z 在水線以上， m	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
P_V (Pa)	46	46	50	53	56	58	60	62	64

註：這些數值並不是所有區域都適用。

1.1.5 排水狀態中最小傾覆力矩 M_C 的計算

最小傾覆力矩是通過計及橫搖的靜穩性曲線和動穩性曲線來確定的。

- 1 當用靜穩性曲線時，如圖 1 所示，應考慮橫搖，使傾覆和回復力矩（或力臂）曲線下的面積相等而確定 M_C ，圖中 θ_z 是

橫搖角， M_K 是平行於橫坐標的直線，此線使陰影面積 S_1 和 S_2 相等。

$M_c = OM$ ，如縱坐標標尺為力矩；

$M_c = OM \times \text{排水量}$ ，如縱坐標標尺為力臂。

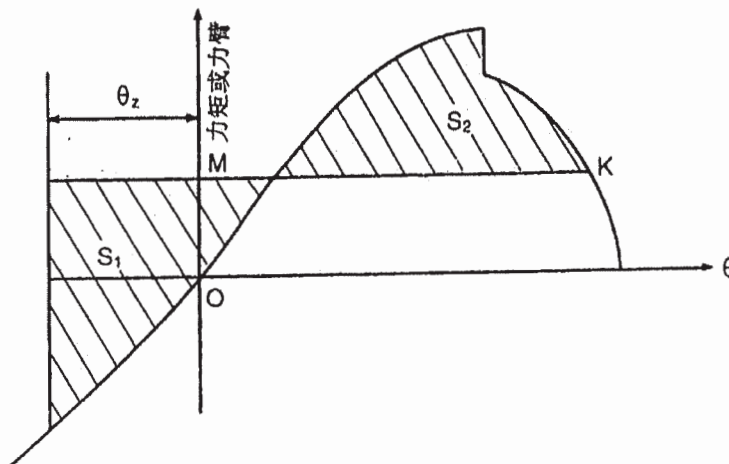


圖 1 靜穩性曲線

- 2 當使用動穩性曲線時，首先應確定輔助點 A 。為此，沿橫坐標向右定出橫搖角，找到 A' 點（見圖 2）。過 A' 點作一平行於橫坐標軸的線 AA' ，使其長度等於橫搖角的兩倍（ $AA' = 2\theta_z$ ），從而找到要求的輔助點 A ，作出動穩性曲線的切線 AC 。從 A 點起，作一平行於橫坐標軸的線 AB ，使其等於 1 弧度（ 57.3° ）。從 B 點作一垂線，與切線相交於 E 點。如沿動穩性曲線的縱坐標軸量取，則 \overline{BE} 的長度即等於傾覆力矩。如縱坐標軸表示動穩性力臂，則 \overline{BE} 為傾覆力臂，在此情況下，傾覆力矩 M_C 應以 \overline{BE} 的長度（以 m 為單位）乘以相應的排水量（以 t 為單位）而確定：

$$M_C = 9.81 \Delta \cdot \overline{BE} \quad (\text{kN} \cdot \text{m})$$

- .3 橫搖角 θ_z 是通過船模和在不規則波浪中實船試驗確定的，以作為船舶在最惡劣設計海況中與波浪方向成 90° 行駛時橫搖 50 次的最大橫搖角。如果缺乏這樣的數據，則橫搖角可假設為 15° 。
- .4 穩性曲線的有效性應以進水角為極限。

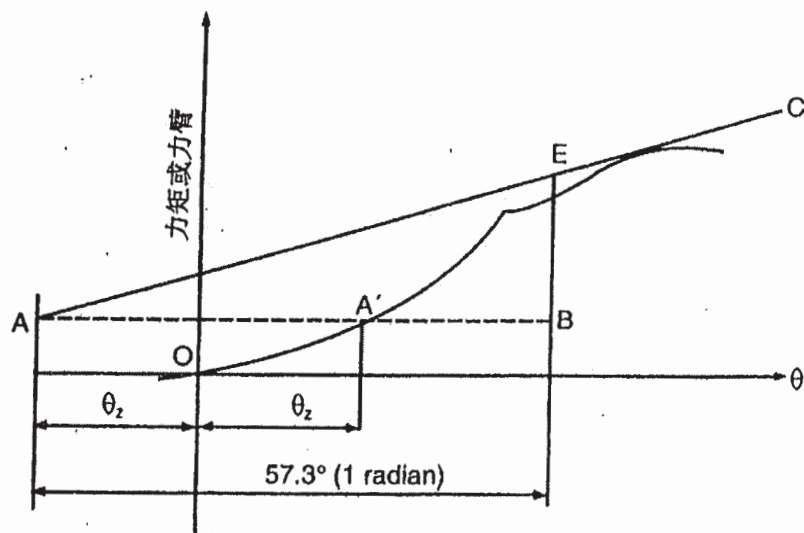


圖 2 動穩性曲線

1.2 過渡狀態和翼航狀態

1.2.1 穩性應符合本規則 2.4 和 2.5 的要求。

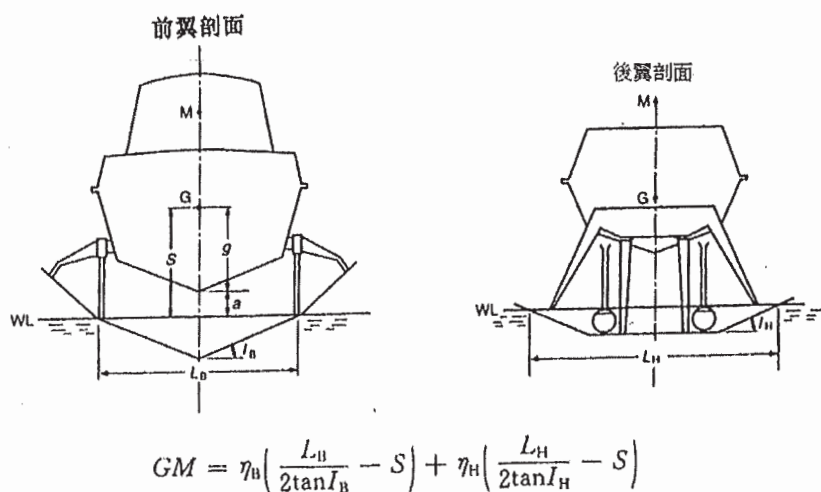
1.2.2.1 應審核船舶在預定用途的各種裝載情況下，在過渡狀態和翼航狀態下的穩性。

1.2.2.2 過渡狀態和翼航狀態下的穩性可通過計算或根據船模試驗獲得的數據來確定，並應通過實船試驗核實。實船試驗是用偏離中心線的壓載重量，造成一系列已知的橫傾力矩進行的，並記錄這些力矩產生的橫傾角。當進入排水狀態，起飛、穩定翼航狀態和穩定於

排水狀態時，其結果將會表明船在過渡狀態中各種情況的穩性數值。

1.2.2.3 在翼航狀態中，由於旅客集中於一舷所引起的橫傾角不應超過 8° 。在過渡狀態中，由於旅客集中一舷所引起的橫傾角不應超過 12° 。該旅客集中程度應由主管機關在考慮本規則附錄 7 提供的指南後作出決定。

1.2.3 圖 3 中提供了一典型水翼型式在設計階段估算翼航狀態穩心高度 (GM) 的一種可能的方法。



- 式中：
- η_B —前翼負荷的百分比；
 - η_H —後翼負荷的百分比；
 - L_B —前翼間距；
 - L_H —後翼間距；
 - a —龍骨底部至水面距離；
 - g —重心距龍骨底部高度；
 - I_B —前翼傾斜於水平線的角度；
 - I_H —後翼傾斜於水平線的角度；
 - S —重心距水面高度。

圖 3

2 全浸式水翼船

2.1 排水狀態

2.1.1 排水狀態的穩性應符合本規則 2.3 和 2.6 的要求。

2.1.2 本附錄 1.1.2 至 1.1.5 的要求適用於處於排水狀態此類型的船舶。

2.2 過渡狀態

2.2.1 應使用校驗過的計算機仿真檢驗穩性，以評估在正常的情況下和在限定的營運範圍內，以及在任何故障影響情況下，船舶的運動、性能及響應。

2.2.2 應對過渡階段在系統或操作程序中存在的將會危及船舶的水密完整性和穩性的任何潛在故障造成的穩性狀況進行檢查。

2.3 翼航狀態

船舶翼航狀態的穩性應符合本規則 2.4 的要求，還應符合本附錄 2.2 的規定。

2.4 本附錄 1.2.2.1，1.2.2.2 和 1.2.2.3 的要求應按適當情況應用於這類船舶。任何計算機仿真或設計計算都應通過實船試驗予以驗證。

附錄 7

多體船的穩性

1 完整狀態下的穩性衡準

在完整狀態下，多體船舶在海上橫搖時，應有足夠的穩性，以能承受本附錄 1.4 規定的旅客集中一舷或高速回轉的影響。如果符合本節的要求則應認為船舶的穩性是足夠的。

1.1 GZ 曲線下的面積

GZ 曲線下至 θ 角的面積 (A_1) 應不小於：

$$A_1 = 0.055 \times 30^\circ / \theta \quad \text{m} \cdot \text{rad}$$

式中： θ 取下列角度中之最小者：

- (1) 進水角；
- (2) 最大 GZ 值對應角；和
- (3) 30° 。

1.2 最大 GZ 值

最大 GZ 值應對應於不小於 10° 的角度處。

1.3 由風引起的橫傾

應假定在各個傾側角度下的風傾力臂為常數，並應按下式計算：

$$HL_1 = \frac{P_i \cdot A \cdot Z}{9800 \Delta} \quad \text{m} \quad (\text{見圖 1})$$

$$HL_2 = 1.5 HL_1 \quad \text{m} \quad (\text{見圖 1})$$

式中： $P_i^*=500$ (Pa)

A —船舶最輕營運水線以上部分的側投影面積， m^2 ；

Z —從面積 A 之中心至船舶最輕營運吃水一半時的一點的垂直距離， m ；

Δ —排水量， t 。

1.4 由旅客聚集或高速回轉引起的橫傾

由於旅客集中一舷或高速回轉引起的橫傾，其中之大者應與風傾力臂 (HL_2) 結合起來應用。

1.4.1 旅客集中一舷引起的橫傾

當計算旅客集中一舷引起的橫傾角時，旅客集中一舷力臂應使用本規則 2.9 中規定的假設來計算。

1.4.2 高速回轉引起的橫傾

當計算高速回轉的作用引起的橫傾角時，高速回轉力臂應利用以下公式計算：

$$TL = \frac{1}{g} \frac{V_0^2}{R} \left(KG - \frac{d}{2} \right) \quad m$$

式中： TL —回轉力臂， m ；

V_0 —船舶回轉時速度， m/s ；

R —回轉半徑， m ；

KG —重心距龍骨的垂直高度， m ；

d —平均吃水， m ；

* 對限制航區船舶，經主管機關同意， P_i 值可予以減少。

g —重力加速度。

1.5 波浪中橫搖（圖 1）

船舶在海上橫搖對穩性的影響應用數學方法加以闡明。為此， GZ 曲線下的剩餘面積（ A_2 ），即橫傾角 θ_h 至橫搖角 θ_r 的面積應不小於 $0.028 \text{ m} \cdot \text{rad}$ 。在缺乏模型試驗或其他資料時， θ_r 應取 15° 和 $(\theta_d - \theta_h)$ 中之小者。

2 破損後剩餘穩性衡準

2.1 剩餘穩性曲線衡準的應用方法相似於完整穩性，但船破損後最終狀態下剩餘穩性應符合如下標準：

- .1 要求的面積 A_2 應不小於 $0.028 \text{ m} \cdot \text{rad}$ （見圖 2）；以及
- .2 對最大 GZ 所對應的角度無要求。

2.2 用於剩餘穩性曲線的風傾力臂在各個傾角下均假定為常數並應按下式計算：

$$HL_3 = \frac{P_d \cdot A \cdot Z}{9800 \Delta}$$

式中： $P_d=120$ （Pa）；

A —船舶最輕營運水線以上部分的側投影面積， m^2 ；

Z —從面積 A 之中心至船舶最輕營運吃水一半時的一點的垂直距離， m ；

Δ —排水量， t 。

2.3 橫搖角應採用與完整穩性所用的相同值。

2.4 進水點十分重要，被視作剩餘穩性曲線的終止，因此，面積 A_2 應在進水角處被截斷。

2.5 應檢查當船舶如本規則 2.4 所規定的那樣破損時，破損後最終狀態下船舶的穩性並表明其符合衡準。

2.6 在進水的中間階段，最大復原力臂不小於 0.05 m，復原力臂正值範圍應不小於 7° 。在所有情況下，均假定船體只有一個破口和只有一個自由面。

3 傾側力臂的應用

3.1 在將傾側力臂應用至完整的和破損後的曲線時，應考慮：

3.1.1 對完整狀態：

- .1 風傾力臂一定常風 (HL_1)；和
- .2 風傾力臂（包括陣風影響）加旅客集中一舷力臂或高速回轉力臂兩者中之大者 (HTL)。

3.1.2 對破損狀態：

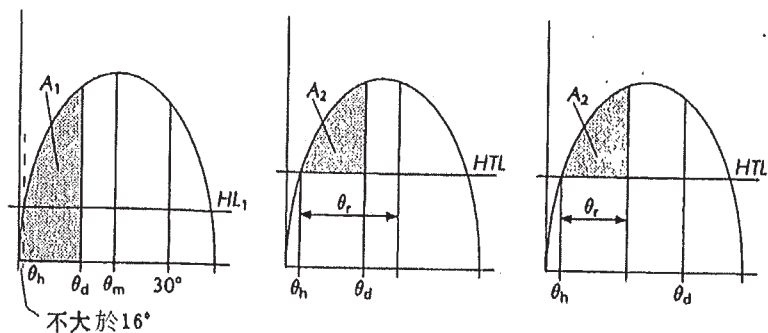
- .1 風傾力臂一定常風 (HL_3)；和
- .2 風傾力臂加旅客集中一舷力臂 (HL_4)。

3.2 定常風引起的橫傾角

3.2.1 按 1.3 所得的由定常風傾力臂 HL_1 引起的橫傾角用於完整穩性曲線時，應不超過 16° ；和

3.2.2 按 2.2 所得的由定常風傾力臂 HL_3 引起的橫傾角用於破損後的剩餘穩性曲線時，應不超過 20° 。

多體船衡準



HL_1 —風傾力臂；

HTL —（定常風+突風+旅客集中一舷或回轉）傾側力臂。

圖 1 完整穩性

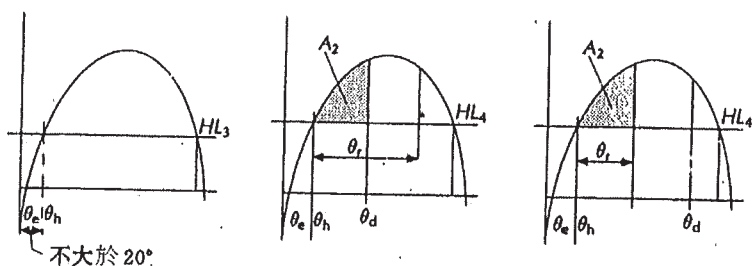


圖 2 破損穩性

HL_1 —風傾力臂；

HTL —（定常風+突風+旅客集中一舷或回轉）傾側力臂；

HL_3 —風傾力臂；

HL_4 —（定常風+旅客集中一舷）傾側力臂；

θ_m —最大 GZ 對應角；

θ_d —進水角；

θ_r —橫搖角；

θ_e —假定無風、無旅客集中一舷或回轉影響下的平衡角；

θ_h —傾側力臂 HL_1 ， HTL ， HL_3 或 HL_4 引起的橫傾角；

$A_1 \geq 1.1$ 所要求的面積；

$A_2 \geq 0.028m \cdot rad$ 。

附錄 8

有關運行和安全性能的定義、要求和符合標準

本附錄適用於所有類型的高速船。為評估運行的安全性，應對新設計的或設計中具有可能改變原先試驗結果的新穎特徵的船舶進行原型試驗。這種試驗應按主管機關和建造廠商間協商一致的計劃表進行。若營運條件（例如低溫）導致附加試驗是必要的話，則主管機關或基地港所在國當局在適宜時，可要求作進一步驗證。有關了解和評估船舶性能的功能說明、技術和系統說明書應可供使用。

這些試驗的目的是要提供必需的資料和指南，使船舶在設計航速和環境條件範圍內，在正常和緊急情況下，均能安全地運行。

下列程序中提出了有關船舶性能驗證要求的要點。

1 性能

1.1 通則

1.1.1 船舶應在發證要求的所有最大限度的乘客和裝載配置情況下滿足本規則第 17 章和本附錄中適用的操縱要求。有關不同操縱模式下的限制海況應通過發證所要求的試驗和對船舶類型的分析來驗證。

1.1.2 船舶的操縱控制應按照營運申請人制定的程序進行。所制定的程序應包括啟航程序、航行程序、正常和應急停船與操縱程序。

1.1.3 按 1.1.2 制定的程序應：

- .1 表明船舶的正常運行和對故障的響應性能保持不變；

- .2 使用安全可靠的方法或裝置；以及
- .3 包括在執行營運中可以被預期的程序時的時間滯後允許量。

1.1.4 本附錄所要求的程序應能在足夠的水深範圍內實施，使船舶的性能不受影響。

1.1.5 試驗應在實際可行的最小重量情況下進行，而附加性試驗則應在最大重量情況下進行，該最大重量足以確定附加限制的需要，以及通過試驗來檢查重量的影響。

2 停船

2.1 本試驗是為了確定停船時所經受的加速度，此時船處於風平浪靜水域，船上無乘客載荷或貨物載荷，且應在下列情況下進行：

- .1 在最大營運航速下正常停船；
- .2 在最大營運航速下應急停船；以及
- .3 從最大營運航速和從任何過渡狀態航速急速停船。

2.2 按 2.1.1 和 2.1.2 所述的試驗應提供資料證明：當按照船舶操縱手冊中所制定的程序使用控制杆或在自動模式中時，加速度應不超過附錄 3 中的安全等級 1。若在正常停船過程中加速度超過安全等級 1，則應修正控制系統，以避免這種超過，或應要求乘客在停船過程中就坐。若在緊急停船過程中加速度超過安全等級 1，則在船舶操縱手冊的文字程序中應包括如何避免這種超過的詳細資料，或應修正控制系統而避免超過。

2.3 按 2.1.3 所述的試驗應提供資料證明：當使用自動模式的控制杆而產生最大加速時，該加速度不應超過附錄 3 中的安全等級 2。若超

出安全等級 2，則在船舶操縱手冊中應包括一個警告：如果實施急速停船，將會造成乘客受傷。

2.4 為了確定在運行中需要或不需實施任何有關的速度限制，應在船舶回轉期間重複進行其他試驗。

3 航行性能

3.1 本試驗是為了確定船舶的性能和在航行模式期間所經受的加速度，此時船上無乘客載荷或貨物載荷，且在下列情況下進行：

- .1 正常運行情況，係指船舶在任何首航向情況下均安全航行，不論手動操作、自動駕駛儀輔助操作或藉助任何置於正常模式的自動控制系統操作；以及
- .2 本規則 1.4.48 所述的預定最不利情況，係指不需要特殊的引航技巧，船舶應能維持安全航行。但是，在所有相對於風和海況的首航向情況下的操縱可認為不可能。對於在非排水模式下具有較高性能標準的船型，其性能和加速度也應在船舶處於預定最不利情況下操縱時的排水模式下確定。

3.2 按 3.1 中所定義的操縱水平應通過實尺度試驗來確定和提供證明資料，這種試驗至少應在兩個有關海況和在迎浪、橫浪和隨浪情況下進行。試驗時間應至少為 15 min，可以使用模型試驗和數學模擬，以驗證船舶在預定最不利情況下的性能。

應通過測量船速、首航向相對波浪方向以及對按附錄 3 中 2.4 要求所得到的最大水平加速度測量值的插值，提供對正常操作情況限制的證明資料。波高和波浪周期的測量值應取最大實用範圍。

應通過測量船速、波高和波浪周期、首航向相對波浪方向以及通過對按附錄 3 中 2.4 要求得到的水平加速度和接近船舶重心縱向位置的垂向加速度取均方根值 (RMS) 提供對最不利預定情況作限制的證明資料。均方根值可用於外推峰值。為了獲得有關結構設計載荷和安全等級 (每 5 min 超出一) 所要求的峰值，可將均方根值乘以 3.0 或

$$C = \sqrt{2 \ln N}$$

式中，N 為有關周期內的相繼振幅的數目。

如果不另外以模型試驗或數學計算進行驗證，則可以假定基於在兩種海況下的測量值所得到的波高和加速度之間存在線性關係。對預定最不利情況的限制應寫入與附錄 3 中 2.4 要求的乘客安全和聯繫船舶的實際結構設計載荷有關的文件。

3.3 試驗和驗證過程應提供對船舶的安全運行所限制的海況的證明資料：

- .1 在處於最大營運航速的正常運行情況下，加速度不應超過附錄 3 中的安全等級 1，量計時取每 5 min 一個平均值。船舶操縱手冊中應包括：為防止超出而採取的減速或改變船相對波浪方向的首航向所產生影響的詳細說明；
- .2 在預定最不利情況下，必要時採取減速，其加速度不應超過附錄 3 中的安全等級 2，量計時取每 5 min 一個平均值。任何其他船舶的特徵運動，如縱搖、橫搖和首搖也不應超過可能有礙乘客安全的等級。在最不利的預定情況下，必要時採取減速，使船能安全操縱，並具有足夠的穩性，使船舶能夠持

續安全運行到最近的避風地。如超過附錄 3 中的安全等級 1，則應要求乘客就坐；以及

- .3 在船舶的實際結構設計載荷範圍內，必要時採取減速和改變航向。

3.4 回轉和可操縱性

船舶在下列狀態下均應能安全控制和操縱：

- .1 排水狀態下營運；
- .2 非排水模式營運；
- .3 起飛、降落；
- .4 任何中間或過渡模式，如適用；以及
- .5 靠泊操作，如適用。

4 故障或誤動作的影響

4.1 通則

應通過模擬可能的設備故障的實尺度試驗的結果檢驗和提出對安全營運的限制、特殊的操作程序和任何限制。

所檢驗的故障應為能導致主要的或較嚴重後果的故障，這種影響可由 FMEA 評估中或類似分析中確定。

所檢驗的故障應在船舶建造廠商和主管機關之間取得一致，並對每一故障均應以漸進的方式檢查。

4.2 試驗目的

對每一故障的檢查應導致：

- .1 確定對船舶在故障發生時運行的安全限制，如超出該安全限制將導致安全等級 1 降至安全等級 2 以下；
- .2 確定船員的行動，如有任何需要的話，以抵消故障的影響或將其降至最小；及
- .3 確定船舶或機器需遵循的限制，以使船舶處於存在故障的情況下能夠到達避難地。

4.3 需檢驗的故障

設備故障應包括下列項目，但不限於此：

- .1 推進動力全部喪失；
- .2 墊升動力全部喪失（對於氣墊船和表面效應船）；
- .3 一套推進系統的控制全部失效；
- .4 一套系統中全推進推力（正的或負的）的誤動作；
- .5 一套方向控制系統的控制失效；
- .6 一套方向控制系統的偶然完全偏差；
- .7 縱傾控制系統的控制失效；
- .8 一套縱傾控制系統元件的偶然完全偏差；以及
- .9 供電全部喪失。

故障應能充分代表營運狀況，並且應儘可能準確模擬最惡劣的船舶運行情況，在此情況下故障將具有最大的影響。

4.4 “癱船”試驗

為了確定船舶運動和相對風和浪的方向以決定撤離船舶的條件，應停船並關閉所有主機一段足夠久的時間，以使相對於風浪的船舶首航向穩定下來。這種試驗應在隨機的基础上建立各種風和海況下所設計的“癱船”狀態。

附錄 9

乘客與船員座椅的試驗衡準和評估

1 目的和適用範圍

本衡準係對乘客和船員座椅、座椅固定、座椅附件及其安裝作出規定，旨在使船舶遭到碰撞時所引起的乘員受傷和（或）出入通道受堵的可能性降至最低。

2 座椅靜力試驗

2.1 本段的要求適用於船上的設計碰撞載荷小於 3g 的船員和乘客座椅。

2.2 本段適用於所有座椅、連同座椅支座及其與甲板的連接應設計成至少能承受船上下列各方向的靜力作用：

- .1 向前：2.25 kN；
- .2 向後：1.5 kN；
- .3 橫向：1.5 kN；
- .4 垂直向下：2.25 kN；
- .5 垂直向上：1.5 kN。

若作用於座椅上的力是向前的或向後的，應水平地作用於座墊以上 350 mm 處的椅背上。若作用於座椅上的力是橫向的，應水平地作用於座椅墊處。垂直向上的力應是均勻分佈在座墊框架的角上。垂直向下的力則應均勻分佈在座椅墊上。

若一套座椅有幾個座位組成，則這些力在試驗時應均勻地作用於每個座位上。

2.3 當力作用到一隻座椅上時，應考慮到船上座椅的朝向。例如，座椅朝向側邊，則船上橫向力應作用於座椅的前後；船上向前的力應作用於座椅的橫向。

2.4 用於試驗的每一套座椅，應使用類似於在船上將其固定在甲板結構上的方式固定在支承結構上。雖然某一剛性支承結構可用於這些試驗，但最好是用具有與船上支承結構一樣強度和扶強形式的支承結構。

2.5 按 2.2.1 至 2.2.3 中所述的力應通過一半徑為 82 mm，寬度至少等於座椅寬的圓柱表面作用於座椅，該表面應至少配有一個力傳感器，以測出規定的力。

2.6 下列座椅應認為是可以接受的，如果，

- .1 在受到 2.2.1 至 2.2.3 中的力作用下，在力作用點測得的永久性位移不超過 400 mm；
- .2 試驗期間，座椅的任何部件、座椅底座或其他附件均未完全脫落；
- .3 當一個或多個固定件部分鬆動時，座椅仍能繫固。在整個試驗期間，所有的鎖緊系統應保持鎖緊（試驗後，調整和操作鎖緊系統不必保持其原有的功能）；且
- .4 座椅上乘員可能觸及的硬質部件，應做成半徑至少為 5 mm 的曲面。

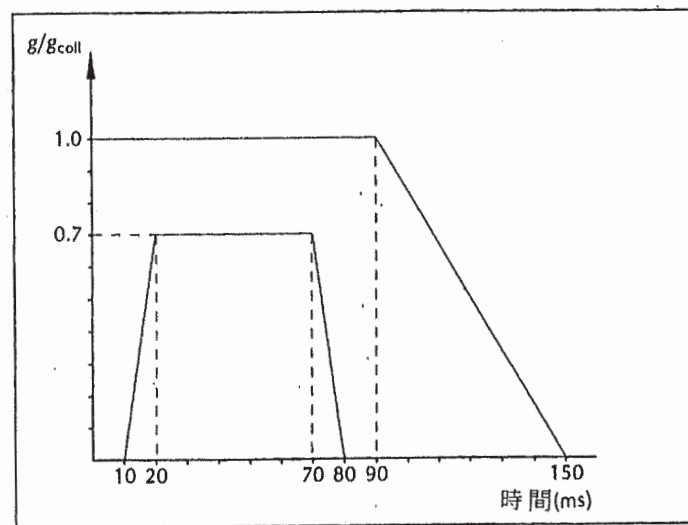
2.7 若試驗時的加速度至少等於 $3g$ 時，可用第 3 節的要求來代替本節的要求。

3 座椅動力試驗

3.1 本節的要求適用於船舶設計碰撞載荷大於等於 $3g$ 的船員和乘客座椅。

3.2 本節適用的所有座椅、座椅支承結構、座椅與甲板結構的連接、安全帶或肩帶（如有時）等均應設計成能承受在設計碰撞時作用於其上的最大加速度力。應考慮到該座椅相對於該加速度力的方向（即，座椅朝向船艏、船艙還是朝向舷側）。

3.3 作用於座椅上的加速度衝量，應能代表船舶碰撞與時間的關係，如果不知道該碰撞與時間的關係或不能模擬，則可使用下圖中加速度與時間的包絡線。



加速度與時間關係的包絡線圖

3.4 在試驗框架中，每一座椅及其部件（如安全帶和肩帶）都應固定在支承結構上，其固定方式應與其固定在船舶甲板結構上相似。該支承結構可以是某一剛性表面，但最好是具有與船上支承結構相同強度和扶強形式的支承結構。在船舶碰撞時，凡該座椅就坐者有可能碰及的其他座椅和（或）桌子亦應包括在試驗框架內，並按其在船上的實際位置，以及典型的固定方式安裝。

3.5 座椅動力試驗時，一個百分之五十仿真試驗假人（相當於 Hybrid II 或 Hybrid III（更宜）型假人，如有更先進的試驗假人亦可）應以正常坐姿，置於該座椅上。如果一個典型的座椅由幾個座位組成，則每個座位均應放置假人。應按照公認的國家標準*的程序將假人繫牢在座椅上，如設有安全帶和肩帶，則應僅用安全帶和肩帶將假人繫牢。餐桌及類似裝置應設置在最容易對人員造成潛在傷害的位置。

3.6 試驗的假人按照公認的國家標準的要求安裝儀器和標定，以便計算頭部損傷指數和胸部損傷指數，並測量腿骨受力、骨盆的最大相對加速以及骨盆在脊柱方向的最大載荷，如可能還應測量頸部的伸長及彎曲。

3.7 如果試驗中需用不至一個假人，則設置在乘客最有可能受到傷害的座椅處的假人應安裝一套儀器，其他假人不必安裝儀器。

3.8 應按國家標準的規定進行試驗，並對測試儀器進行校準，表明該儀器能足夠可靠地反映出假人的反應。

* 公認的國家標準包括：ECE 80 及其附錄 79；澳大利亞的 ADR 66/00 和美國的 NCHRP 報告 350。其他與此等效的國家標準亦可接受。

3.9 在下列情況下，按本節要求進行試驗的座椅可認為是滿意的：

- .1 座椅和安裝在座椅上或附近的桌面並未與支承它們的甲板結構脫開，也未產生那種可能夾住乘客或使乘客受傷的變形；
- .2 如設有安全帶，在碰撞過程中，安全帶應牢固且繫緊在假人骨盆處，如設有肩帶則在碰撞過程中，肩帶應牢固且繫緊在假人肩膀附近。碰撞後鬆開的機械裝置仍應能操作。
- .3 應滿足下列可接受標準：

- .3.1 按下式算得的頭部受傷指數（HIC）應不超過 500。

$$\text{HIC} = (t_2 - t_1) \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a(t) dt \right]^{2.5}$$

式中： t_1 和 t_2 分別為當 HIC 達到最大值的那段時間的開始和結束時間（s）， $a(t)$ 是假人頭部加速度測定的結果，用 g 表示。

- .3.2 按下式算得的胸部損傷指數（TTI）應不超過 30g（碰撞時間小於 3 ms 除外）

$$\text{TTI} = \frac{g_R + g_{LS}}{2} \text{或重心處的加速度}$$

式中： g_R 是上肋骨或下肋骨處的加速度，用 g 表示。 g_{LS} 是人體下脊柱的加速度，用 g 表示。

- .3.3 骨盆處最大加速度不超過 130 g；
- .3.4 在脊柱軸線處測得的最大骨盆載荷不超過 6.7 kN；

- .3.5 頸部曲率不超過 $88 \text{ N} \cdot \text{m}$ ，如測量；
- .3.6 頸部伸長不超過 $48 \text{ N} \cdot \text{m}$ ，如測量；且
- .3.7 大腿處的力不超過 10 kN ，如碰撞時間大於 20 ms ，則大腿處的力不能超過 8 kN 。
- .4 軀幹安全帶上的載荷不超過 7.8 kN ，如果是雙帶，則總載荷不超過 8.9 kN 。

附錄 10

開敞式兩面可用救生筏

1 通則

1.1 所有開敞式兩面可用救生筏：

- .1 應用良好的工藝和適當的材料製造；
- .2 應在 -18°C 至 $+65^{\circ}\text{C}$ 的室溫範圍內存放而不致損壞；
- .3 應能在 -18°C 至 $+65^{\circ}\text{C}$ 的氣溫範圍以及在 -1°C 至 30°C 的海水溫度範圍內使用。
- .4 應能防腐爛、耐腐蝕，並不受海水、原油或霉菌侵襲的過度影響；
- .5 充氣及全部受載後應保持其形狀不變；以及
- .6 應裝貼符合本組織通過建議的反光材料，以便被發覺。^{*}

2 構造

2.1 開敞式兩面可用救生筏的構造應是：從 10 m 高度將其容器投落水後，救生筏及其屬具應符合使用要求。如開敞式兩面可用救生筏準備存放在超過最輕載重海水線 10 m 以上的高度處，則應從這個高度處做過滿意的投落試驗。

2.2 漂浮的開敞式兩面可用救生筏應能經受從至少 4.5 m 高度處反覆蹬跳。

^{*} 參見本組織大會以 A.658 (16) 號決議通過的《關於救生設備上使用和裝貼反光材料的建議》。

2.3 開敞式兩面可用救生筏及其艙裝件的構造，應使救生筏在載足全部乘員及屬具並使用海錨的情況下，在靜水中能以 3 節航速被拖帶。

2.4 全部充氣後的開敞式兩面可用救生筏，不論哪一面朝上，人都能從水中登上救生筏。

2.5 主浮力室應分成：

- .1 不少於兩個獨立室，每個室通過止回充氣閥充氣；以及
- .2 浮力室的佈置應是在任一室萬一損壞或充氣失效時，未破損的那個室應能支持該筏額定乘員，且開敞式兩面可用救生筏的整個周圍均應具有正的乾舷。每個乘員的質量以 75 kg 計，且都坐在規定的座位上。

2.6 開敞式兩面可用救生筏筏底應為水密。

2.7 開敞式兩面可用救生筏應用無毒氣體充氣，充氣系統應符合公約第 III/39 條的要求。環境溫度為 18°C 至 20°C 時，應在 1 min 內充足氣；環境溫度為 -18°C 時，應在 3 min 內完全充足氣。充氣後，救生筏在載滿全部乘員和屬具的情況下，應保持其形狀不變。

2.8 每個充氣室應能經受至少等於 3 倍工作壓力的超壓，並應不論使用安全閥或限制供氣方法，均能防止其壓力超過 2 倍工作壓力。應提供用來安裝充氣泵或手動吹風器（皮老虎）的設施。

2.9 浮胎的表面應為防滑材料，至少有 25% 的浮胎應是很容易識別的顏色。

2.10 開敞式兩面可用救生筏的乘員定額，應等於下列較小者：

- .1 充氣後其主浮胎的容量(就此而言，不包括橫座板，如設有)以 m^3 計時，除以 0.096 後所得的最大整數；或
- .2 開敞式兩面可用救生筏測量浮胎的最內邊的内水平橫剖面面積(可包括一個或多個橫座板在內，如設有)以 m^3 計時，除以 0.372 所得的最大整數；或
- .3 可坐在浮胎內，全部穿着救生衣且不妨礙任何救生筏屬具操作的人員數(每人的平均質量為 75 kg)。

3 開敞式兩面可用救生筏屬具

3.1 救生繩應繫固在開敞式兩面可用救生筏的内外四周。

3.2 開敞式兩面可用救生筏應配備有適合於在水面上自動充氣的、足夠長度的有效首纜。對容納超過 30 名乘員的開敞式兩面可用救生筏，應配附加的拉索。

3.3 首纜系統，包括其繫連於開敞式兩面可用救生筏上設施的破斷負荷，按公約第 III/39 條要求的薄弱環除外，應該是：

- .1 對 8 名及 8 名乘員以下的開敞式兩面可用救生筏，7.5 kN；
- .2 對 9 至 30 名乘員的開敞式兩面可用救生筏，10.0 kN；及
- .3 對超過 30 名乘員的開敞式兩面可用救生筏，15.0 kN。

3.4 開敞式兩面可用救生筏應至少配有下列數量的充氣登筏踏板，以助於不論救生筏充氣後哪一面朝上都能從水中登筏：

- .1 對 30 名及 30 名乘員以下的開敞式兩面可用救生筏，一塊登筏踏板；或

- .2 對超過 30 名乘員的開敞式兩面可用救生筏，兩塊登筏踏板。這樣的登筏踏板應分開 180°。

3.5 開敞式兩面可用救生筏應配備符合下列要求的水袋：

- .1 水袋的橫剖面積呈等腰三角形，其三角形底邊附連於救生筏的下面；
- .2 水袋應設計成在佈放的 15 s 至 25 s 內能充到大約 60% 的容量；
- .3 通常對乘員在 10 名及 10 名以下的開敞式兩面可用救生筏，其水袋的總容量在 125 L 和 150 L 之間；
- .4 對額定乘員超過 10 名的開敞式兩面可用救生筏，其水袋的總容量應儘可能有 12 NL，其中 N 為筏的乘員數。
- .5 每一水袋在浮胎上應這樣附連，即當水袋在佈放位置時，應沿下浮胎最底下部分的上邊緣或接近最底下部分全長分佈；以及
- .6 水袋應在救生筏的四周對稱分佈，且每一水袋之間應有足夠間隔，以能讓空氣容易泄出。

3.6 在浮胎的上下表面應至少裝有 1 盞符合要求的人工控制燈。

3.7 開敞式兩面可用救生筏筏底的每一面，應按下列方式設有適當的自動排水裝置：

- .1 對容納 30 名及 30 名以下乘員的救生筏配 1 個排水裝置；
- .2 對容納 30 名以上乘員的救生筏，配 2 個排水裝置。

3.8 每具開敞式兩面可用救生筏的屬具應包括：

- .1 繫有不短於 30 m 長浮索的可浮救生環 1 個，浮索的破斷負荷至少為 1.0 kN；
- .2 2 把具有浮柄的非折疊型安全刀，用 1 根細繩繫固在救生筏上，且應存放在護套內，並且不管開敞式兩面可用救生筏用什麼方式充氣，至少能在上浮胎頂部一個適當位置處，容易得到 1 把安全刀，以便割斷首纜；
- .3 1 隻浮瓢；
- .4 2 塊海綿；
- .5 1 隻海錨，在救生筏上的固定方式應能在救生筏充氣時容易佈放。海錨的位置應在兩隻浮胎上明顯地加以標誌；
- .6 2 把可浮手划槳；
- .7 1 套急救藥包，置於使用後可以緊蓋的防水箱內；
- .8 1 隻哨笛或等效的音響號具；
- .9 2 支手持火焰信號；
- .10 1 支適於摩爾氏通信的防水手電筒，連同備用電池 1 副，備用燈泡 1 隻，裝在同一防水容器內；
- .11 1 套修理工具，用來修理浮胎內的破裂；以及
- .12 1 隻充氣泵或數隻手動充氣器（皮老虎）。

3.9 按 3.8 配備的救生筏屬具應標為 HSC PACK。

3.10 如適合，屬具應存放在容器內，如容器不是救生筏的整體部分或固定在救生筏上的話，則容器應存放並繫固在救生筏內，並能在水面漂浮至少 30 min 而不致損壞其內存的屬具。不論屬具容器是救生筏整體部分，還是固定在救生筏上，其屬具應在不論救生筏哪一面朝上的情況下，都能很容易地被接近。繫固屬具容器的繩子的破斷負荷應為 2 kN 或所繫固的整套屬具質量的 3 倍，取其大者。

4 開敞式兩面可用氣脹式救生筏的容器

4.1 開敞式兩面可用救生筏應裝在容器內，該容器：

- .1 其結構應能承受海上所遇到的各種狀況；
- .2 具有充裕的自然浮力。當其裝有的救生筏及屬具時，如高速船沉沒後，應能從內部拉首纜，並拉動充氣裝置；以及
- .3 應儘可能地水密，但容器底部的泄水孔除外。

4.2 容器上應標明：

- .1 製造廠名或商標；
- .2 出廠編號；
- .3 額定乘員數；
- .4 非 SOLAS 兩面可用型；
- .5 內裝應急袋型號；
- .6 最近一次檢修日期；
- .7 首纜長度；

- .8 水線以上最大許可存放高度（取決於拋落試驗高度）；以及
- .9 降落須知。

5 開敞式兩面可用氣脹式救生筏上的標誌

5.1 開敞式兩面可用救生筏應標明：

- .1 製造廠名或商標；
- .2 出廠編號；
- .3 製造日期（年月）；
- .4 最近一次檢修站名稱和地點；以及
- .5 每一浮胎頂上允許容納的乘員數，字高不小於 100 mm，其顏色同浮胎的顏色形成明顯的對比。

6 說明書和資料

所要求的說明書和資料的書寫形式應採用適合於包括在高速船上所採用救生設備培訓手冊和維修說明書的格式。說明書和資料應該用簡明扼要的形式書寫，且應包括下列合適的項目：

- .1 開敞式兩面可用救生筏及屬具的一般說明；
- .2 安裝佈置；
- .3 操作須知，包括有關求生設備的使用；以及
- .4 檢修要求。

RESOLUTION MSC.36(63)
(adopted on 20 May 1994)

ADOPTION OF THE INTERNATIONAL CODE OF SAFETY FOR
HIGH SPEED CRAFT

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING FURTHER resolution A.373(X) by which the Assembly, when adopting on 14 November 1977 the Code of Safety for Dynamically Supported Craft (DSC Code) for craft such as hydrofoil boats and air-cushion vehicles which were increasingly being introduced in international transport, authorized the Maritime Safety Committee to amend the DSC Code as may be necessary,

RECOGNIZING the continual development of novel types and sizes of high speed craft, which are not necessarily dynamically supported, cargo craft, passenger craft carrying larger numbers of passengers or operating at greater distances from places of refuge than permitted by the DSC Code,

RECOGNIZING FURTHER that improvements of maritime safety standards since the adoption of the DSC Code are required to be reflected in the provisions for the design, construction, equipment and operation of high speed craft in order to maintain certification and safety equivalence with conventional ships,

NOTING that the SOLAS Conference to be held from 17 to 24 May 1994 will be invited to adopt amendments to the 1974 SOLAS Convention which, *inter alia*, include a new chapter X on Safety measures for high speed craft, to make the provisions of the International Code of Safety for High Speed Craft (HSC Code) mandatory under that Convention for all such craft constructed on or after 1 January 1996,

HAVING CONSIDERED at its sixty-third session the text of the proposed HSC Code which has been developed following a thorough revision of the DSC Code,

1. ADOPTS the HSC Code, the text of which is set out in the Annex to the present resolution;
2. NOTES that under the proposed chapter X of the 1974 SOLAS Convention, amendments to the HSC Code shall be adopted, brought into force and shall take effect in accordance with the provisions of article VIII of that Convention concerning the amendment procedures applicable to the Annex to the Convention other than chapter I;
3. REQUESTS the Secretary-General to transmit a copy of the present resolution together with the text of the HSC Code to all Members of the Organization and to all Contracting Governments to the 1974 SOLAS Convention which are not Members of the Organization;
4. RECOMMENDS Governments to apply the Code on a voluntary basis in respect of craft constructed between the adoption of this resolution and the entry into force of the amendments to the 1974 SOLAS Convention referred to above as may be adopted by the 1994 SOLAS Conference.

ANNEX

INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT

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INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT

PREAMBLE

1 The international conventions ratified in respect of conventional ships and the regulations applied as a consequence of such conventions have largely been developed having in mind the manner in which conventional ships are constructed and operated. Traditionally, ships have been built of steel and with the minimum of operational controls. The requirements for ships engaged on long international voyages are therefore framed in such a way that, providing the ship is presented for survey and a ship safety certificate is issued, the ship may go anywhere in the world without any operational restrictions being imposed. Providing the ship is not involved in a casualty, all that is needed is that it is made available to the Administration for the purpose of a satisfactory resurvey before the ship safety certificate expires and the certificate will be reissued.

2 The traditional method of regulating ships should not be accepted as being the only possible way of providing an appropriate level of safety. Nor should it be assumed that another approach, using different criteria, could not be applied. Over a long period of years, numerous new designs of marine vehicles have been developed and have been in service. While these do not fully comply with the provisions of the international conventions relating to conventional ships built of steel, they have demonstrated an ability to operate at an equivalent level of safety when engaged on restricted voyages under restricted operational weather conditions and with approved maintenance and supervision schedules.

3 This Code has been derived from the previous Code of Safety for Dynamically Supported Craft (DSC) adopted by IMO in 1977. The Code recognized that safety levels can be significantly enhanced by the infrastructure associated with regular service on a particular route, whereas the conventional ship safety philosophy relies on the ship being self-sustaining with all necessary emergency equipment being carried on board. This revised Code has been prepared in recognition of the growth in size and types of high speed craft now existing and is intended to facilitate future research and development of fast sea transportation in order that they may be accepted internationally.

4 The safety philosophy of this Code is based on the management and reduction of risk as well as the traditional philosophy of passive protection in the event of an accident. Management of risk through accommodation arrangement, active safety systems, restricted operation, quality management and human factors engineering should be considered in evaluating safety equivalent to current conventions. Application of mathematical analysis should be encouraged to assess risk and determine the validity of safety measures.

5 The Code takes into account that a high speed craft is of a light displacement compared with a conventional ship. This displacement aspect is the essential parameter to obtain fast and competitive sea transportation and consequently this Code allows for use of non-conventional shipbuilding materials, provided that a safety standard at least equivalent to conventional ships is achieved.

6 To clearly distinguish such craft, criteria based on speed and volumetric Froude number have been used to delineate those craft to which this Code applies from other, more conventional, craft.

7 The Code requirements also reflect the additional hazards which may be caused by the high speed compared with conventional ship transportation. Thus, in addition to the normal requirements including life-saving appliances, evacuation facilities, etc., provided in case of an accident occurring, further emphasis is placed on reducing the risk of hazardous situations arising. Some advantages result from the high speed craft concept, i.e. the light displacement provides a large reserve buoyancy in relation to displacement, reducing the hazards addressed by the International Load Line Convention. The consequences of other hazards such as of collision at high speed are balanced by more stringent navigational and operational requirements and specially developed accommodation provisions.

8 The above-mentioned safety concepts were originally reflected in the Code of Safety for Dynamically Supported Craft. The development of novel types and sizes of craft has led to the development of pressures within the maritime industry for craft which are not dynamically supported cargo craft, passenger craft carrying larger numbers of passengers or operating further afield than permitted by that Code to be certified according to those concepts. Additionally, improvements of maritime safety standards since 1977 were required to be reflected in the revisions of the Code to maintain safety equivalence with conventional ships.

9 Accordingly, two differing principles of protection and rescue were developed.

10 The first of these recognizes the craft which were originally foreseen at the time of development of the DSC Code. Where rescue assistance is readily available and the total number of passengers is limited, a reduction in passive and active protection may be permitted. Such craft are called "assisted craft" and form the basis for "category A passenger craft" of this Code.

11 The second concept recognizes the further development of high speed craft into larger craft. Where rescue assistance is not readily available or the number of passengers is unlimited, additional passive and active safety precautions are required. These additional requirements provide for an area of safe refuge on board, redundancy of vital systems, increased watertight and structural integrity and full fire-extinguishing capability. Such craft are called "unassisted craft" and form the basis for "cargo craft" and "category B passenger craft" of this Code.

12 These two concepts of the Code have been developed as a unified document on the basis that an equivalent level of safety to that normally expected on ships complying with the International Convention for the Safety of Life at Sea is achieved. Where the application of new technology or design indicates an equivalent safety level to the strict application of the Code, the Administration is permitted to formally recognize such equivalence.

13 It is important that an Administration, in considering the suitability of a high speed craft under this Code, should apply all sections of the Code because non-compliance with any part of the Code could result in an imbalance which would adversely affect the safety of the craft, passengers and crew. For a similar reason, modifications to existing craft, which may have an effect on safety, should be approved by the Administration.

14 In developing the Code, it has been considered desirable to ensure that high speed craft do not impose unreasonable demands on existing users of the environment or conversely suffer unnecessarily through lack of reasonable accommodation by existing users. Whatever burden of compatibility there is, it should not necessarily be laid wholly on the high speed craft.

CHAPTER 1 - GENERAL COMMENT AND REQUIREMENTS

1.1 General comments

This Code should be applied as a complete set of comprehensive requirements. It contains requirements for the design and construction of high speed craft engaged on international voyages, the equipment which should be provided and the conditions for their operation and maintenance. The basic aim of the Code is to set levels of safety which are equivalent to those of conventional ships required by the International Convention for the Safety of Life at Sea, 1974, as amended, (SOLAS Convention) and International Convention on Load Lines, 1966 (Load Line Convention) by the application of constructional and equipment standards in conjunction with strict operational controls.

1.2 General requirements

The application of the provisions of this Code is subject to the following general requirements that:

- .1 the Code will be applied in its entirety;
- .2 the management of the company operating the craft exercises strict control over its operation and maintenance by a quality management system*;
- .3 the management ensures that only persons qualified to operate the specific type of craft used on the intended route are employed;
- .4 the distances covered and the worst intended conditions in which operations are permitted will be restricted by the imposition of operational limits;
- .5 the craft will at all times be in reasonable proximity to a place of refuge;
- .6 adequate communications facilities, weather forecasts and maintenance facilities are available within the area of operation;
- .7 in the intended area of operation there will be suitable rescue facilities readily available;
- .8 areas of high fire risk such as machinery spaces and special category spaces are protected with fire-resistant materials and fire-extinguishing systems to ensure, as far as is practicable, containment and rapid extinguishing of fire;
- .9 efficient facilities are provided for the rapid and safe evacuation of all persons into survival craft;
- .10 that all passengers and crew are provided with seats;

* Refer to the International Safety Management (ISM) Code adopted by the Organization by resolution A.741(18).

- .11 that no enclosed sleeping berths for passengers are provided;
- .12 where the Administration has made a comprehensive review of the adequacy of the fire safety measures and evacuation procedures for the crew accommodation, sleeping berths for crew may be permitted.

1.3 Application

- 1.3.1 This Code applies to high speed craft which are engaged in international voyages.
- 1.3.2 This Code applies to:
 - .1 passenger craft which do not proceed in the course of their voyage more than 4 h at operational speed from a place of refuge when fully laden; and
 - .2 cargo craft of 500 gross tonnage and upwards which do not proceed in the course of their voyage more than 8 h at operational speed from a place of refuge when fully laden.
- 1.3.3 This Code, unless expressly provided otherwise, does not apply to:
 - .1 craft of war and troopcraft;
 - .2 craft not propelled by mechanical means;
 - .3 wooden craft of primitive built;
 - .4 pleasure craft not engaged in trade; and
 - .5 fishing craft.
- 1.3.4 This Code does not apply to craft solely navigating the Great Lakes of North America and the River St. Lawrence as far east as a straight line drawn from Cap des Rosiers to West Point, Anticosti Island and, on the north side of Anticosti Island, the 63rd meridian.
- 1.3.5 The application of this Code should be verified by the Administration and be acceptable to the Governments of the States to which the craft will be operating.

1.4 Definitions

For the purpose of this Code, unless expressly provided otherwise, the terms used therein have the meanings defined in the following paragraphs. Additional definitions are given in the general parts of the various chapters.

- 1.4.1 "Administration" means the Government of the State whose flag the craft is entitled to fly.
- 1.4.2 "Air-cushion vehicle" (ACV) is a craft such that the whole or a significant part of its weight can be supported, whether at rest or in motion, by a continuously generated cushion of air dependent for its effectiveness on the proximity of the surface over which the craft operates.

- 1.4.3 "Auxiliary machinery spaces" are spaces containing internal combustion engines of power output up to and including 110 kW driving generators, sprinkler, drencher or fire pumps, bilge pumps, etc., oil filling stations, switchboards of aggregate capacity exceeding 800 kW, similar spaces and trunks to such spaces.
- 1.4.4 "Auxiliary machinery spaces having little or no fire risk" are spaces such as refrigerating, stabilizing, ventilation and air conditioning machinery, switchboards of aggregate capacity 800 kW or less, similar spaces and trunks to such spaces.
- 1.4.5 "Base port" is a specific port identified in the route operational manual and provided with:
- .1 appropriate facilities providing continuous radio communications with the craft at all times while in ports and at sea;
 - .2 means for obtaining a reliable weather forecast for the corresponding region and its due transmission to all craft in operation;
 - .3 for a category A craft, access to facilities provided with appropriate rescue and survival equipment; and
 - .4 access to craft maintenance services with appropriate equipment.
- 1.4.6 "Base port State" means the State in which the base port is located.
- 1.4.7 "Breadth (B)" means breadth of the broadest part of the moulded watertight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.
- 1.4.8 "Cargo craft" is any high speed craft other than passenger craft, and which is capable of maintaining the main functions and safety systems of unaffected spaces, after damage in any one compartment on board.
- 1.4.9 "Cargo spaces" are all spaces other than special category spaces used for cargo and trunks to such spaces.
- 1.4.10 "Category A craft" is any high speed passenger craft:
- .1 operating on a route where it has been demonstrated to the satisfaction of the flag and port States that there is a high probability that in the event of an evacuation at any point of the route, all passengers and crew can be rescued safely within the least of:
 - the time to prevent persons in survival craft from exposure causing hypothermia in the worst intended conditions,
 - the time appropriate with respect to environmental conditions and geographical features of the route, or
 - 4 h; and
 - .2 carrying not more than 450 passengers.

- 1.4.11 "Category B craft" is any high speed passenger craft, other than a category A craft, with machinery and safety systems arranged such that, in the event of damage disabling any essential machinery and safety systems in one compartment, the craft retains the capability to navigate safely.
- 1.4.12 "Continuously manned control station" is a control station which is continuously manned by a responsible member of the crew while the craft is in normal service.
- 1.4.13 "Control stations" are those spaces in which the craft's radio or navigating equipment or the emergency source of power and emergency switchboard are located, or where the fire recording or fire control equipment is centralized, or where other functions essential to the safe operation of the craft such as propulsion control, public address, stabilization systems, etc., are located.
- 1.4.14 "Convention" means the International Convention for the Safety of Life at Sea, 1974, as amended.
- 1.4.15 "Crew accommodation" are those spaces allocated for the use of the crew, and include cabins, sick bays, offices, lavatories, lounges and similar spaces.
- 1.4.16 "Critical design conditions" means the limiting specified conditions chosen for design purposes, which the craft should keep in displacement mode. Such conditions should be more severe than the worst intended conditions by a suitable margin to provide for adequate safety in survival condition.
- 1.4.17 "Design waterline" means the waterline corresponding to the maximum operational weight of the craft with no lift or propulsion machinery active and is limited by the requirements of chapters 2 and 3.
- 1.4.18 "Displacement mode" means the regime, whether at rest or in motion, where the weight of the craft is fully or predominantly supported by hydrostatic forces.
- 1.4.19 "Failure mode and effect analysis (FMEA)" is an examination, in accordance with annex 4, of the craft's systems and equipment to determine whether any reasonably probable failure or improper operation can result in a hazardous or catastrophic effect.
- 1.4.20 "Flap" means an element formed as integrated part of, or an extension of, a foil, used to adjust the hydro- or aerodynamic lift of the foil.
- 1.4.21 "Flashpoint" means a flashpoint determined by a test using the closed cup apparatus referenced in the International Maritime Dangerous Goods (IMDG) Code.

- 1.4.22 "Foil" means a profiled plate or three dimensional construction at which hydrodynamic lift is generated when the craft is under way.
- 1.4.23 "Fully submerged foil" means a foil having no lift components piercing the surface of the water in the foil-borne mode.
- 1.4.24 "High speed craft" is a craft capable of a maximum speed in metres per second (m/s) equal to or exceeding:

$$3.7 \sqrt{0.1667}$$

where:

V = displacement corresponding to the design waterline (m³).

- 1.4.25 "Hydrofoil boat" is a craft which is supported above the water surface in non-displacement mode by hydrodynamic forces generated on foils.
- 1.4.26 "Length (L)" means the overall length of the underwater watertight envelope of the rigid hull, excluding appendages, at or below the design waterline in the displacement mode with no lift or propulsion machinery active.
- 1.4.27 "Lightweight" is the displacement of the craft in tonnes without cargo, fuel, lubricating oil, ballast water, fresh water and feedwater in tanks, consumable stores, passengers and crew and their effects.
- 1.4.28 "Machinery spaces" are spaces containing internal combustion engines with aggregate total power output of more than 110 kW, generators, oil fuel units, propulsion machinery, major electrical machinery and similar spaces and trunks to such spaces.
- 1.4.29 "Maximum operational weight" means the overall weight up to which operation in the intended mode is permitted by the Administration.
- 1.4.30 "Maximum speed" is the speed achieved at the maximum continuous propulsion power for which the craft is certified at maximum operational weight and in smooth water.
- 1.4.31 "Muster station" is an area where passengers can be gathered in the event of an emergency, given instructions and prepared to abandon the craft, if necessary. The passenger spaces may serve as muster stations if all passengers can be instructed there and prepared to abandon the craft.
- 1.4.32 "Non-displacement mode" means the normal operational regime of a craft when non-hydrostatic forces substantially or predominantly support the weight of the craft.
- 1.4.33 "Oil fuel unit" is the equipment used for the preparation of oil fuel for delivery to an oil-fired boiler, or equipment used for the preparation for delivery of heated oil to an internal combustion engine, and includes any oil pressure pumps, filters and heaters dealing with oil at a pressure of more than 0.18 N/mm².

- 1.4.34 "Open vehicle spaces" are spaces:
- .1 to which any passengers carried have access;
 - .2 intended for carriage of motor vehicles with fuel in their tanks for their own propulsion; and
 - .3 either open at both ends, or open at one end and provided with adequate natural ventilation effective over their entire length through permanent openings in the side plating or deckhead or from above.
- 1.4.35 "Operating compartment" means the enclosed area from which the navigation and control of the craft is exercised.
- 1.4.36 "Operating station" means a confined area of the operating compartment equipped with necessary means for navigation, manoeuvring and communication, and from where the functions of navigating, manoeuvring, communication, commanding, conning and lookout are carried out.
- 1.4.37 "Operational speed" is 90% of the maximum speed.
- 1.4.38 "Organization" means the International Maritime Organization.
- 1.4.39 "Passenger" is every person other than:
- .1 the master and members of the crew or other persons employed or engaged in any capacity on board a craft on the business of that craft; and
 - .2 a child under one year of age.
- 1.4.40 "Passenger craft" is a craft which carries more than twelve passengers.
- 1.4.41 "Place of refuge" is any naturally or artificially sheltered area which may be used as a shelter by a craft under conditions likely to endanger its safety.
- 1.4.42 "Public spaces" are those spaces allocated for the passengers and include bars, kiosks, smoke rooms, main seating areas, lounges, dining rooms, recreation rooms, lobbies, lavatories and similar permanently enclosed spaces allocated for passengers.
- 1.4.43 "Service spaces" are those enclosed spaces used for pantries containing food warming equipment but no cooking facilities with exposed heating surfaces, lockers, sales shops, store-rooms and enclosed baggage rooms.
- 1.4.44 "Significant wave height" is the average height of the one third highest observed wave heights over a given period.

- 1.4.45 "Special category spaces" are those enclosed spaces intended for the carriage of motor vehicles with fuel in their tanks for their own propulsion, into and from which such vehicles can be driven and to which passengers have access, including spaces intended for the carriage of cargo vehicles.
- 1.4.46 "Surface effect ship" (SES) is an air-cushion vehicle whose cushion is totally or partially retained by permanently immersed hard structures.
- 1.4.47 "Transitional mode" means the regime between displacement and non-displacement modes.
- 1.4.48 "Worst intended conditions" means the specified environmental conditions within which the intentional operation of the craft is provided for in the certification of the craft. This should take into account parameters such as the worst conditions of wind force allowable, significant wave height (including unfavourable combinations of length and direction of waves), minimum air temperature, visibility and depth of water for safe operation and such other parameters as the Administration may require in considering the type of craft in the area of operation.

1.5 Surveys

- 1.5.1 Each craft should be subject to the surveys specified below:
- .1 an initial survey before the craft is put in service or before the certificate is issued for the first time;
 - .2 a renewal survey at intervals specified by the Administration but not exceeding 5 years except where 1.8.5 or 1.8.10 is applicable;
 - .3 a periodical survey within three months before or after each anniversary date of the certificate; and
 - .4 an additional survey as the occasion arises.
- 1.5.2 The surveys referred to in 1.5.1 should be carried out as follows:
- .1 the initial survey should include:
 - .1.1 an appraisal of the assumptions made and limitations proposed in relation to loadings, environment, speed and manoeuvrability;
 - .1.2 an appraisal of the data supporting the safety of the design obtained as appropriate from calculations, tests and trials;
 - .1.3 a failure mode and effect analysis as required by this Code;
 - .1.4 an investigation into the adequacy of the various manuals to be supplied to the craft; and

- .1.5 a complete inspection of the structure, safety equipment, radio installations and other equipment, fittings, arrangements and materials to ensure that they comply with the requirements of the Code, are in satisfactory condition and are fit for the service for which the craft is intended;
 - .2 the renewal and periodical surveys should include a complete inspection of the structure, including the outside of the craft's bottom and related items, safety equipment, radio installations and other equipment as referred to in 1.5.2.1 to ensure that they comply with the requirements of the Code, are in satisfactory condition and are fit for the service for which the craft is intended. The inspection of the craft's bottom should be conducted with the craft out of the water under suitable conditions for close-up examination of any damaged or problem areas; and
 - .3 an additional survey, either general or partial according to the circumstances, should be made after a repair resulting from investigations prescribed in 1.7.3, or wherever any important repairs or renewals are made. The survey should be such as to ensure that the necessary repairs or renewals have been effectively made, that the material and workmanship of such repairs or renewals are in all respects satisfactory, and that the craft complies in all respects with the requirements of the Code.
- 1.5.3 The periodical surveys referred to in 1.5.1.3 should be endorsed on the High Speed Craft Safety Certificate.
- 1.5.4 The inspection and survey of the craft, so far as regards the enforcement of the provisions of the Code, should be carried out by officers of the Administration. The Administration may, however, entrust the inspections and surveys either to surveyors nominated for the purpose or to organizations recognized by it.
- 1.5.5 An Administration nominating surveyors or recognizing organizations to conduct inspections and surveys as set forth in 1.5.4 should, as a minimum, empower any nominated surveyor or recognized organization to:
- .1 require repairs to a craft; and
 - .2 carry out inspections and surveys if requested by the appropriate authorities of a port State.
- The Administration should notify the Organization of the specific responsibilities and conditions of the authority delegated to nominated surveyors or recognized organizations.
- 1.5.6 When a nominated surveyor or recognized organization determines that the condition of the craft or its equipment does not correspond substantially with the particulars of the certificate or is such that the craft is not fit to operate without danger to the craft or persons on board, 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 craft is in an area under the jurisdiction of another Government, the appropriate authorities of the port State should be notified immediately. When an officer of the Administration, a nominated surveyor or 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 section. When applicable, the Government of the port State concerned should ensure that the craft should not continue to operate until it can do so without danger to the craft or the persons on board.

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

1.6 Approvals

The owner of a craft should accept the obligation to supply sufficient information to enable the Administration to fully assess the features of the design. It is strongly recommended that the owner and Administration and, where appropriate, the port State or States, commence discussions at the earliest possible stage so that the Administration may fully evaluate the design in determining what additional or alternative requirements should be applied to the craft to achieve the required level of safety.

1.7 Maintenance of conditions after survey

- 1.7.1 The condition of the craft and its equipment should be maintained to conform with the provisions of this Code to ensure that the craft in all respects will remain fit to operate without danger to the craft or the persons on board.
- 1.7.2 After any survey of the craft under 1.5 has been completed, no change should be made to structure, equipment, fittings, arrangements and materials covered by the survey, without the sanction of the Administration.
- 1.7.3 Whenever an accident occurs to a craft or a defect is discovered, either of which affects the safety of the craft or the efficiency or completeness of structure, equipment, fittings, arrangements and materials, the person in charge or owner of the craft should report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible, who should cause investigations to be initiated to determine whether a survey, as required by 1.5, is necessary. If the craft is in an area under the jurisdiction of another Government, the person in charge or the 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.

1.8 High Speed Craft Safety Certificate

- 1.8.1 A certificate called a High Speed Craft Safety Certificate is issued after completion of an initial or renewal survey to a craft which complies with the requirements of the Code. The certificate should be issued or endorsed either by the Administration or by any person or organization recognized by it. In every case, that Administration assumes full responsibility for the certificate.
- 1.8.2 A Contracting Government to the Convention may, at the request of the Administration, cause a craft to be surveyed and, if satisfied that the requirements of the Code are complied with, should issue or authorize the issue of a certificate to the craft and, where appropriate, endorse or authorize the endorsement of a certificate on the craft 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 the flag of which the craft is entitled to fly, and it should have the same force and receive the same recognition as a certificate issued under 1.8.1.
- 1.8.3 The certificate should be that of the model given in annex 1 to the Code. If the language used is neither English nor French, the text should include a translation into one of these languages.
- 1.8.4 The High Speed Craft Safety Certificate should be issued for a period specified by the Administration which should not exceed five years.
- 1.8.5 Notwithstanding the requirements of 1.8.4, when the renewal survey is completed within three 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 five years from the date of expiry of the existing certificate.
- 1.8.6 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 five years from the date of expiry of the existing certificate.
- 1.8.7 When the renewal survey is completed more than three 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 five years from the date of completion of the renewal survey.
- 1.8.8 If a certificate is issued for a period of less than five years, the Administration may extend the validity of the certificate beyond the expiry date to the maximum period specified in 1.8.4, provided that the surveys when a certificate is issued for a period of five years are carried out.
- 1.8.9 If a renewal survey has been completed and a new certificate cannot be issued or placed on board the craft 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.

- 1.8.10 If a craft at the time when a certificate expires is not in the place 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 craft to proceed to the place 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 one month, and a craft to which an extension is granted should not, on its arrival in the place in which it is to be surveyed, be entitled by virtue of such extension to leave that place without having a new certificate. When the renewal survey is completed, the new certificate should be valid to a date not exceeding five years from the date of expiry of the existing certificate before the extension was granted.
- 1.8.11 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 1.8.6 or 1.8.10. In these circumstances, the new certificate should be valid to a date not exceeding five years from the date of completion of the renewal survey.
- 1.8.12 If a periodical survey is completed before the period specified in 1.5, then:
- .1 the anniversary date shown on the relevant certificate should be amended by endorsement to a date which should not be more than three months later than the date on which the survey was completed;
 - .2 the subsequent periodical survey required by 1.5 should be completed at the intervals prescribed by 1.5 using the new anniversary date; and
 - .3 the expiry date may remain unchanged provided one or more periodical surveys are carried out so that the maximum intervals between the surveys prescribed by 1.5.1.3 are not exceeded.
- 1.8.13 A certificate issued under 1.8.1 or 1.8.2 should cease to be valid in any of the following cases:
- .1 if the relevant surveys are not completed within the periods specified in 1.5.1;
 - .2 if the certificate is not endorsed in accordance with 1.5.3; or
 - .3 upon transfer of the craft 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 craft is in compliance with the requirements of 1.7.1 and 1.7.2. In the case of a transfer between Governments that are Contracting Governments to the Convention, if requested within three months after the transfer has taken place, the Government of the State whose flag the craft was formerly entitled to fly should, as soon as possible, transmit to the Administration a copy of the certificate carried by the craft before the transfer and, if available, copies of the relevant survey reports.

- 1.8.14 The privileges of the Code may not be claimed in favour of any craft unless it holds a valid certificate.

1.9 Permit to Operate High Speed Craft

- 1.9.1 The craft should not operate commercially unless a Permit to Operate High Speed Craft is issued and valid in addition to the High Speed Craft Safety Certificate. Transit voyage without passengers or cargo may be undertaken without the Permit to Operate High Speed Craft.
- 1.9.2 The Permit to Operate High Speed Craft should be issued by the Administration to certify compliance with 1.2.2 to 1.2.7 and stipulate conditions of the operation of the craft and drawn up on the basis of the information contained in the route operational manual specified in chapter 18 of this Code.
- 1.9.3 Before issuing the Permit to Operate, the Administration should consult with each port State to obtain details of any operational conditions associated with operation of the craft in that State. Any such conditions imposed should be shown by the Administration on the Permit to Operate and included in the route operational manual.
- 1.9.4 A port State may inspect the craft and audit its documentation for the sole purpose of verifying its compliance with the matters certified by and conditions associated with the Permit to Operate. Where deficiencies are shown by such an audit, the Permit to Operate ceases to be valid until such deficiencies are corrected or otherwise resolved.
- 1.9.5 The provisions of 1.8 should apply to the issue and the period of validity of the Permit to Operate High Speed Craft.
- 1.9.6 The Permit to Operate High Speed Craft should be that of the model given in annex 2 to this Code. If the language used is neither English nor French, the text should include a translation into one of these languages.

1.10 Control

The provisions of regulation I/19 of the Convention should be applied to include the Permit to Operate High Speed Craft in addition to the certificate issued under 1.8.

1.11 Equivalents

- 1.11.1 Where this Code requires that a particular fitting, material, appliance or apparatus, or type thereof, should be fitted or carried in a craft, or that any particular provision should be made, the Administration may allow any other fitting, material, appliance or apparatus, or type thereof, to be fitted or carried, or any other provision to be made in that craft, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance or apparatus, or type thereof, or provision, is at least as effective as that required by this Code.

1.11.2 Where compliance with any of the requirements of this Code would be impractical for the particular designs of the craft, the Administration may substitute those with alternative requirements provided that equivalent safety is achieved. The Administration which allows any such substitution should communicate to the Organization particulars of these substitutions and the reasons therefor, which the Organization should circulate to its Member Governments for their information.

1.12 Information to be made available

1.12.1 The Administration should ensure that the management of the company operating the craft has provided the craft with adequate information and guidance in the form of manuals to enable the craft to be operated and maintained safely. These manuals should include a route operational manual, craft operating manual, maintenance manual and servicing schedule. Such information should be updated as necessary.

1.12.2 The manuals should contain at least the information specified in chapter 18 and should be in a language understood by the crew. Where this language is not English, a translation into English should be provided of at least the route operational manual and the craft operating manual.

1.13 Further developments

1.13.1 It is recognized that there is much ongoing research and development in the design of high speed craft and that new types may emerge which have different geometry to that envisaged during the formulation of this Code. It is important that this Code does not restrict this progress and the development of new designs.

1.13.2 A design may be produced which cannot comply with the provisions of this Code. In such a case the Administration should determine the extent to which the provisions of the Code are applicable to the design and, if necessary, develop additional or alternative requirements to provide an equivalent level of safety for the craft.

1.13.3 The foregoing should be considered by the Administration when assessing the granting of equivalents under the Code.

1.14 Circulation of safety information

1.14.1 In the event that an Administration has cause to investigate an accident involving a craft to which this Code applies, that Administration should provide a copy of the official report to the Organization, which will invite Member States to note the existence of the report and to obtain a copy.

1.14.2 In the event that operational experience reveals structural or equipment failures affecting the safety of a design, craft owners should inform the Administration.

1.15 Review of the Code

- 1.15.1 The Code should be reviewed by the Organization at intervals preferably not exceeding four years to consider revision of existing requirements to take account of new developments in design and technology.
- 1.15.2 Where a new development in design and technology has been found acceptable to an Administration, that Administration may submit particulars of such development to the Organization for consideration for incorporation into the Code during periodical review.

CHAPTER 2 - BUOYANCY, STABILITY AND SUBDIVISION

PART A - GENERAL

2.1 General

2.1.1 A craft should be provided with:

- .1 stability characteristics and stabilization systems adequate for safety when the craft is operated in the non-displacement mode and during the transient mode;
- .2 buoyancy and stability characteristics adequate for safety where the craft is operated in the displacement mode, both in the intact condition and the damaged condition; and
- .3 stability characteristics in the non-displacement and transient modes adequate to transfer the craft safely to displacement mode in case of any system malfunction.

2.1.2 Account should be taken of the effect of icing in the stability calculations. An example for established practice for ice accretion allowances is given in annex 5 for the guidance of Administrations.

2.1.3 For the purpose of this and other chapters, unless expressly defined otherwise, the following definitions apply:

- .1 "Down flooding point" means any opening through which flooding of the spaces which comprise the reserve buoyancy could take place while the craft is in the intact or damaged condition, and heels to an angle past the angle of equilibrium.
- .2 "Fully submerged foil" means a foil having no lift components piercing the surface of the water in the foil borne mode.
- .3 "Multihull craft" means a craft which in any normally achievable operating trim or heel angle, has a rigid hull structure which penetrates the surface of the sea over more than one discrete area.
- .4 "Permeability" of a space means the percentage of the volume of that space which can be occupied by water.
- .5 "Skirt" means a downwardly-extending, flexible structure used to contain or divide an air cushion.
- .6 "Watertight" in relation to a structure means capable of preventing the passage of water through the structure in any direction under the head of water likely to occur in the intact or damaged condition.
- .7 "Weathertight" means that water will not penetrate into the craft in any wind and wave conditions up to those specified as critical design conditions.

2.2 Intact buoyancy

- 2.2.1 All craft should have a sufficient reserve of buoyancy at the design waterline to meet the intact and damage stability requirements of this chapter. The Administration may require a larger reserve of buoyancy to permit the craft to operate in any of its intended modes. This reserve of buoyancy should be calculated by including only those compartments which are:
- .1 watertight;
 - .2 accepted as having scantlings and arrangements adequate to maintain their watertight integrity; and
 - .3 situated in locations below a datum, which may be a watertight deck or equivalent structure of a non-watertight deck covered by a weathertight structure as defined in 2.2.3.1.
- 2.2.2 Arrangements should be provided for checking the watertight integrity of those compartments taken into account in 2.2.1.
- 2.2.3 Where entry of water into structures above the datum as defined in 2.2.1.3 would significantly influence the stability and buoyancy of the craft, such structures should be:
- .1 of adequate strength to maintain the weathertight integrity and fitted with weathertight closing appliances; or
 - .2 provided with adequate drainage arrangements; or
 - .3 an equivalent combination of both measures.
- 2.2.4 The means of closing openings in the boundaries of weathertight structures should be such as to maintain weathertight integrity in all operational conditions.

2.3 Intact stability in the displacement mode

- 2.3.1 Hydrofoil craft fitted with surface-piercing foils and/or fully submerged foils should have sufficient stability under all permitted cases of loading to comply with the relevant provisions of annex 6 and specifically maintain a heel angle of less than 10° when subjected to the greater of the heeling moments in 1.1.2 and 1.1.4 of that annex.
- 2.3.2 Multihull craft should meet the relevant requirements of annex 7 for all permitted cases of loading.
- 2.3.3 Subject to 2.3.4, all other craft should meet the following criteria in all permitted conditions of loading:
- .1 resolution A.562(14) (weather criterion);

- .2 the area under the righting lever curve (GZ curve) should not be less than 0.07 m.rad up to $\Theta = 15^\circ$ when the maximum righting lever (GZ) occurs at $\Theta = 15^\circ$ and 0.055 m.rad up to $\Theta = 30^\circ$ when the maximum righting lever occurs at $\Theta = 30^\circ$ or above. Where the maximum righting lever occurs at angles of between $\Theta = 15^\circ$ and $\Theta = 30^\circ$, the corresponding area under the righting lever curve should be:

$$A = 0.055 + 0.001 (30^\circ - \Theta_{\max}) \quad (\text{m.rad})$$

where:

Θ_{\max} is the angle of heel in degrees at which the righting lever curve reaches its maximum;

- .3 the area under the righting lever curve between $\Theta = 30^\circ$ and $\Theta = 40^\circ$ or between $\Theta = 30^\circ$ and the angle of flooding Θ_f^* , if this angle is less than 40° , should not be less than 0.03 m.rad;
- .4 the righting lever GZ should be at least 0.20 m at an angle of heel equal to or greater than 30° ;
- .5 the maximum righting lever should occur at an angle of heel not less than 15° ; and
- .6 the initial metacentric height GM_0 should not be less than 0.15 m.

2.3.4 Where the characteristics of the craft are unsuitable for application of 2.3.3, the Administration may accept alternative criteria equivalent to those stipulated in 2.3.3, appropriate to the type of craft and area of operation.

2.4 Intact stability in the non-displacement mode

- 2.4.1 The requirements of this section and section 2.12 should be applied on the assumption that any stabilization systems fitted are fully operational.
- 2.4.2 Suitable calculations should be carried out and/or tests conducted to demonstrate that, when operating in the non-displacement and transient modes within approved operational limitations, the craft will, after a disturbance causing roll, pitch, heave or heel due to turning or any combination thereof, return to the original attitude.
- 2.4.3 The roll and pitch stability on the first and/or any other craft of a series should be qualitatively assessed during operational safety trials as required by chapter 18 and annex 8. The results of such trials may indicate the need to impose operational limitations.

* In applying this criterion, small openings through which progressive flooding cannot take place need not be considered as open.

- 2.4.4 Where craft are fitted with surface piercing structure or appendages, precautions should be taken against dangerous attitudes or inclinations and loss of stability subsequent to a collision with a submerged or floating object.
- 2.4.5 In designs where periodic use of cushion deformation is employed as a means of assisting craft control, or periodic use of cushion air exhausting to atmosphere for purposes of craft manoeuvring, the effects upon cushion-borne stability should be determined, and the limitations on the use by virtue of craft speed or attitude should be established.
- 2.4.6 In the case of an air-cushion vehicle fitted with flexible skirts, it should be demonstrated that the skirts remain stable under operational conditions.

2.5 Intact stability in the transient mode

- 2.5.1 Under weather conditions up to the worst intended conditions, the time to pass from the displacement mode to the non-displacement mode and vice versa should be minimized unless it is demonstrated that no substantial reduction of stability occurs during this transition.
- 2.5.2 Hydrofoil craft should comply with the relevant provisions of annex 6.

2.6 Buoyancy and stability in the displacement mode following damage

- 2.6.1 The requirements of this section apply to all permitted conditions of loading.
- 2.6.2 For the purpose of making damage stability calculations the volume and surface permeabilities should be in general as follows:

Spaces	Permeability
Appropriated to cargo or stores	60
Occupied by accommodation	95
Occupied by machinery	85
Intended for liquids	0 or 95*
Appropriated for cargo vehicles	90
Void spaces	95

* whichever results in the more severe requirements.

- 2.6.3 Notwithstanding 2.6.2, permeability determined by direct calculation should be used where a more onerous condition results, and may be used where a less onerous condition results from that provided according to 2.6.2.

- 2.6.4 Administrations may permit the use of low density foam or other media to provide buoyancy in void spaces, provided that satisfactory evidence is provided that any such proposed medium is the most suitable alternative and is:
- .1 of closed cell form if foam, or otherwise impervious to water absorption;
 - .2 structurally stable under service conditions;
 - .3 chemically inert in relation to structural materials with which it is in contact or other substances with which the medium is likely to be in contact (reference is made to 7.4.3.7); and
 - .4 properly secured in place and easily removable for inspection of the void spaces.
- 2.6.5 Any damage of a lesser extent than that postulated in 2.6.6 to 2.6.8, as applicable, which would result in a more severe condition, should also be investigated. The shape of the damage should be assumed to be a parallelepiped.
- 2.6.6 The following side damages should be assumed anywhere on the periphery of the craft:
- .1 the longitudinal extent of damage should be $0.1L$, or $3\text{ m} + 0.03L$ or 11 m , whichever is the least;
 - .2 the transverse extent of penetration into the craft should be $0.2B$ or $0.05L$ or 5 m , whichever is the least. However, where the craft is fitted with inflated skirts or with non-buoyant side structures, the transverse extent of penetration should be at least 0.12 of the width of the main buoyancy hull or tank structure; and
 - .3 the vertical extent of damage should be taken for the full depth of the craft.
- 2.6.7 Subject to 2.6.8, bottom damages should be assumed anywhere on the bottom of the craft as follows:
- .1 the longitudinal extent of damage should be $0.1L$ or $3\text{ m} + 0.03L$ or 11 m , whichever is the least;
 - .2 the transverse extent of damage should be the full breadth of the bottom of the craft or 7 m , whichever is the less, as shown in figure 2.6.7.2; and
 - .3 the vertical extent of penetration into the craft should be $0.02B$ or 0.5 m , whichever is the less.
- 2.6.8 In the case of a category B craft, the length of the assumed damage specified in 2.6.7 should be increased by 50% in the case of damage in the forward $0.5L$ of the craft.

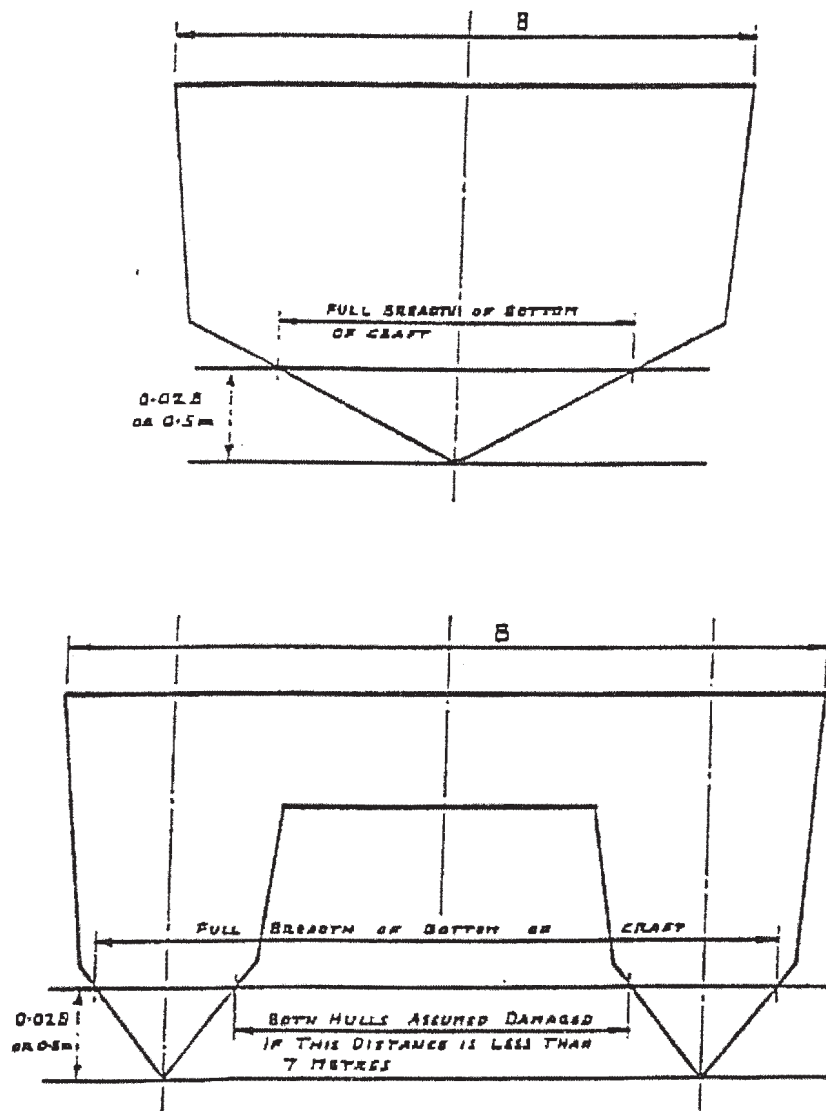


Figure 2.6.7.2

2.7 Inclining and stability information

- 2.7.1 Every craft on completion of build should be inclined and the elements of its stability determined. When an accurate inclining is not practical the lightship displacement and centre of gravity should be determined by a lightweight survey and accurate calculation.
- 2.7.2 The master should be supplied by the owner with reliable information relating to the stability of the craft in accordance with the following provisions of this paragraph. The information relating to stability should, before issue to the master, be submitted to the Administration for approval, together with a copy thereof for their retention and should incorporate such additions and amendments as the Administration may in any particular case require.
- 2.7.3 Where any alterations are made to a craft so as materially to affect the stability information supplied to the master, amended stability information should be provided. If necessary, the craft should be re-inclined.
- 2.7.4 A report of each inclining or lightweight survey carried out in accordance with this chapter and of the calculation therefrom of the lightship condition particulars should be submitted to the Administration for approval, together with a copy for their retention. The approved report should be placed on board the craft by the owner in the custody of the master and should incorporate such additions and amendments as the Administration may in any particular case require. The amended lightship condition particulars so obtained from time to time should be used by the master in substitution for such previously approved particulars when calculating the craft's stability.
- 2.7.5 Following any inclining or lightweight survey the master should be supplied with amended stability information if the Administration so requires. The information so supplied should be submitted to the Administration for approval, together with a copy thereof for their retention and should incorporate such additions and amendments as the Administration may in any particular case require.
- 2.7.6 Stability information demonstrating compliance with this chapter should be furnished in the form of a stability information book which should be kept on board the craft at all times in the custody of the master. The information should include particulars appropriate to the craft and should reflect the craft's loading conditions and mode of operation. Any enclosed superstructures or deckhouses included in the cross curves of stability and the critical downflooding points and angles should be identified.
- 2.7.7 Every craft should have scales of draughts marked clearly at the bow and stern. In the case where the draught marks are not located where they are easily readable, or operational constraints for a particular trade make it difficult to read the draught marks, then the craft should also be fitted with a reliable draught indicating system by which the bow and stern draughts can be determined.

- 2.7.8 The owner or builder as appropriate should ensure that the positions of the draught marks are accurately determined and that the marks are located on the hull in a permanent manner. Accuracy of the draught marks should be demonstrated to the Administration prior to the inclining experiment.

2.8 Loading and stability assessment

On completion of loading of the craft and prior to its departure on a voyage, the master should determine the craft's trim and stability and also ascertain and record that the craft is in compliance with stability criteria of the relevant requirements. The Administration may accept the use of an electronic loading and stability computer or equivalent means for this purpose.

2.9 Marking and recording of the design waterline

The design waterline should clearly be marked amidships on the craft's outer sides and should be recorded in the High Speed Craft Safety Certificate. This waterline should be distinguished by the notation H.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

2.10 General

Where compliance with this chapter requires consideration of the effects of passenger weight, the following information should be used:

- .1 The distribution of passengers is 4 persons per square metre.
- .2 Each passenger has a mass of 75 kg.
- .3 Vertical centre of gravity of seated passengers is 0.3 m above seat.
- .4 Vertical centre of gravity of standing passengers is 1.0 m above deck.
- .5 Passengers and luggage should be considered to be in the space normally at their disposal.
- .6 Passengers should be distributed on available deck areas towards one side of the craft on the decks where muster stations are located and in such a way that they produce the most adverse heeling moment.

2.11 Intact stability in the displacement mode

The craft should have sufficient intact stability that, when in still water conditions, the inclination of the craft from the horizontal would not exceed 10° under all permitted cases of loading and uncontrolled passenger movements as may occur.

2.12 Intact stability in the non-displacement mode

- 2.12.1 The total heel angle in still water due to the effect of passenger movements and due to beam wind pressure as per 1.1.4 of annex 6 should not exceed 10°.

- 2.12.2 In all loading conditions, the outward heel due to turning should not exceed 8°, and the total heel due to beam wind pressure as per 1.1.4 of annex 6 and due to turning should not exceed 12° outward.

2.13 Buoyancy and stability in the displacement mode following damage

Following any of the postulated damages detailed in 2.6.5 to 2.6.8, the craft in still water should have sufficient buoyancy and positive stability to simultaneously ensure that:

- .1 after flooding has ceased and a state of equilibrium has been reached, the final waterline be 300 mm below the level of any opening through which further flooding could take place;
- .2 the angle of inclination of the craft from the horizontal does not normally exceed 10° in any direction. However, where this is clearly impractical, angles of inclination up to 15° immediately after damage but reducing to 10° within 15 min may be permitted provided that efficient non-slip deck surfaces and suitable holding points, e.g., holes, bars, etc., are provided;
- .3 there is a positive freeboard from the damage waterline to survival craft embarkation positions;
- .4 any flooding of passenger compartments or escape routes which might occur will not significantly impede the evacuation of passengers;
- .5 essential emergency equipment, emergency radios, power supplies and public address systems needed for organizing the evacuation remain accessible and operational;
- .6 the residual stability of multihull craft complies with the appropriate criteria as laid out in annex 7; and
- .7 residual stability of any other craft meets the requirements of regulation II-1/8 of the Convention.

2.14 Inclining and stability information

- 2.14.1 At periodical intervals not exceeding five years, a lightweight survey should be carried out on all passenger craft to verify any changes in lightweight displacement and longitudinal centre of gravity. The passenger craft should be re-inclined whenever, in comparison with the approved stability information, a deviation from the lightweight displacement exceeding 2% or a deviation of the longitudinal centre of gravity exceeding 1% of L is found or anticipated.
- 2.14.2 A report of each inclining or lightweight survey carried out in accordance with 2.7.1 and of the calculation therefrom of the lightweight condition particulars should be submitted to the Administration for approval, together with a copy for their retention. The approved report should be placed on board the craft by the owner in the custody of the master and should incorporate such additions and amendments as the Administration may in any particular case require. The amended lightweight condition

particulars so obtained from time to time should be used by the master in substitution for such previously approved particulars when calculating the craft's stability.

- 2.14.3 Following any inclining or lightweight survey the master should be supplied with amended stability information if the Administration so requires. The information so supplied should be submitted to the Administration for approval, together with a copy thereof for their retention and should incorporate such additions and amendments as the Administration may in any particular case require.

PART C - REQUIREMENTS FOR CARGO CRAFT

2.15 Buoyancy and stability in the displacement mode following damage

Following any of the postulated damages detailed in 2.6.5 to 2.6.7, the craft in still water should have sufficient buoyancy and positive stability to simultaneously ensure that:

- .1 after flooding has ceased and a state of equilibrium has been reached the final waterline is 150 mm below the level of any opening through which further flooding could take place;
- .2 the angle of inclination of the craft from the horizontal does not normally exceed 15° in any direction. However, where this is clearly impractical, angles of inclination up to 20° immediately after damage but reducing to 15° within 15 min may be permitted provided that efficient non-slip deck surfaces and suitable holding points, e.g., holes, bars, etc., are provided;
- .3 there is a positive freeboard from the damage waterline to survival craft embarkation positions;
- .4 essential emergency equipment, emergency radios, power supplies and public address systems needed for organizing the evacuation remain accessible and operational;
- .5 the residual stability of multihull craft complies with the appropriate criteria as laid out in annex 7; and
- .6 the residual stability of any other craft meets the requirements of regulation II-1/8 of the Convention.

2.16 Inclining

Where it is satisfied by lightweight survey, weighing or other demonstration, that the lightweight of a craft is closely similar to that of another craft of the series to which 2.7.1 has been applied, the Administration may waive the requirement of 2.7.1 for craft to be inclined. In this regard, a craft which lies within the parameters of 2.14.1, when compared with a craft of the series which has been inclined, should be regarded as being closely similar to that craft.

CHAPTER 3 – STRUCTURES

3.1 General

This chapter covers those elements of hull and superstructure which provide longitudinal and other primary and local strength of the craft as a whole and also other important components such as foils and skirts which are directly associated with the hull and superstructure.

3.2 Materials

Materials used for the hull and superstructure and the other features referred to in 3.1 should be adequate for the intended use of the craft.

3.3 Structural strength

The structure should be capable of withstanding the static and dynamic loads which can act on the craft under all operating conditions in which the craft is permitted to operate, without such loading resulting in inadmissible deformation and loss of watertightness or interfering with the safe operation of the craft.

3.4 Cyclic loads

Cyclic loads, including those from vibrations which can occur on the craft should not:

- .1 impair the integrity of structure during the anticipated service life of the craft or the service life agreed with the Administration;
- .2 hinder normal functioning of machinery and equipment; and
- .3 impair the ability of the crew to carry out its duties.

3.5 Design criteria

The Administration should be satisfied that the choice of design conditions, design loads and accepted safety factors corresponds to the intended operating conditions for which certification is sought.

3.6 Trials

If the Administration consider it necessary, it should require full-scale trials to be undertaken in which loadings are determined. Cognizance should be taken of the results where these indicate that loading assumptions of structural calculations have been inadequate.

CHAPTER 4 - ACCOMMODATION AND ESCAPE MEASURES

4.1 General

- 4.1.1 Passenger and crew accommodation should be designed and arranged so as to protect the occupants from unfavourable environmental conditions and to minimize the risk of injury to occupants during normal and emergency conditions.
- 4.1.2 Spaces accessible to passengers should not contain controls, electrical equipment, high temperature parts and pipelines, rotating assemblies or other items, from which injury to passengers could result, unless such items are adequately shielded, isolated, or otherwise protected.
- 4.1.3 Passenger accommodation should not contain operating controls unless the operating controls are so protected and located that their operation by a crew member should not be impeded by passengers during normal and emergency conditions.
- 4.1.4 Windows in passenger and crew accommodation should be of adequate strength and suitable for the worst intended conditions specified in the Permit to Operate and be made of material which will not break into dangerous fragments if fractured.
- 4.1.5 The public spaces, crew accommodation and the equipment therein should be designed so that each person making proper use of these facilities will not suffer injury during craft's normal and emergency start, stop and manoeuvring in normal cruise and in failure or maloperation conditions.

4.2 Public address and information system

- 4.2.1 A general emergency alarm system should be provided. The alarm should be audible throughout all the accommodation and normal crew working spaces and open decks, and the sound pressure level should be at least 10 dB(A) above ambient noise levels underway in normal cruise operation. The alarm should continue to function after it has been triggered until it is normally turned off or is temporarily interrupted by a message on the public address system.
- 4.2.2 There should be a public address system covering all areas where passengers and crew have access, escape routes, and places of embarkation into survival craft. The system should be such that flooding or fire in any compartment does not render other parts of the system inoperable.
- 4.2.3 All passenger craft should be equipped with illuminated or luminous notices or video information system(s) visible to all sitting passengers, in order to notify them of safety measures.
- 4.2.4 The master should, by means of 4.2.3, be able to request passengers "please be seated" when he finds this appropriate to safeguard passengers and always when the safety level 2 according to table 1 of annex 3, is exceeded.

- 4.2.5 Emergency instructions including a general diagram of the craft showing the location of all exits, routes of evacuation, emergency equipment, life-saving equipment and illustration of lifejacket donning should be available to each passenger and placed near each passenger's seat.

4.3 Design acceleration levels

- 4.3.1 For passenger craft, superimposed vertical accelerations above 1.0 g at longitudinal centre of gravity should be avoided unless special precautions are taken with respect to passenger safety.

- 4.3.2 Passenger craft should be designed for the collision load with respect to the safety in, and escape from, the public spaces, crew accommodation and escape routes, including in way of life-saving appliances and emergency source of power. The size and type of craft together with speed, displacement and building material should be taken into consideration when the collision load is determined. The collision design condition should be based on head-on collision at operational speed with a vertical rock with maximum 2 m height above the waterline.

- 4.3.3 Taking into consideration the provisions of 4.3.2, the collision load should be determined by:

$$g_{\text{coll}} = 1.2 \left(\frac{P}{g \cdot \Delta} \right)$$

where the load P should be taken as the lesser of:

$$P = 460 (M \cdot c_L)^{2/3} (E \cdot c_H)^{1/3} \quad \text{and}$$

$$P = 9000 \cdot M \cdot c_L (c_H (T + 2))^{1/2}$$

where the hull material factor M should be taken as:

M = 1.3 for high tensile steel

M = 1.00 for aluminium alloy

M = 0.95 for mild steel

M = 0.8 for fibre reinforced plastics

where the length factor c_L of the craft is:

$$c_L = \frac{(165 + L)}{245} \left(\frac{L}{80} \right)^{0.4}$$

where the height factor c_H of the craft is:

Factor c_H	Catamaran/surface effect ship	Monohull/hydrofoil	Air-cushion vehicle
c_H	$\frac{T + 2 + f(D/2)}{2D}$	$\frac{T + 2 + f(D/2)}{2D}$	$\frac{f}{4}$
where: $f=0$ for where: $f=1$ for where: $f=2$ for	$T + 2 < D - H_T$ $D > T + 2 \geq D - H_T$ $T + 2 \geq D$	$T + 2 < D$ $T + 2 \geq D$ --	-- $H_T > 2$ $H_T \leq 2$

where the kinetic energy of the craft at speed V is:

$$E = \frac{1}{2} \Delta \cdot V^2 \text{ (kJ)}$$

where the main particulars of the craft are:

- L = craft length as defined in chapter 1 (m)
 D = craft depth from the underside of keel amidships to the top of the effective hull girder (m)
 T = buoyancy tank clearance to skirt tip (m, (negative)) for air-cushion vehicles; lifted clearance from keel to water surface (m, (negative)) for hydrofoils; and craft draught to the underside of keel amidships for all other craft (m)
 H_T = minimum height from tunnel or wet-deck bottom to the top of the effective hull girder on catamarans and surface effect ships and D for air-cushion vehicle (m)
 Δ = craft displacement, being the mean of the lightweight and maximum operational weight (t)
 V = operational speed of craft (m/s)
 g = gravitational acceleration = 9.806 (m/s²)

For hydrofoils, if the result is greater than the deceleration, g_{coll} should be taken as:

$$g_{coll} = \frac{F}{g \cdot \Delta}$$

where:

- F = failure load of bow foil assembly applied at the operational waterline (kN)

- 4.3.4 As an alternative to the requirements of 4.3.3, collision deceleration may be determined by carrying out collision load analysis of the craft in accordance with the assumptions of 4.3.2. If the collision accelerations are determined by both use of the formula referred to in 4.3.3 and the collision load analysis, the lower resulting value may be used as the collision deceleration.

- 4.3.5 Compliance with the provisions of 4.1.5 and 4.3.1 should be shown for the actual type of craft, as described in annex 8.
- 4.3.6 Limiting sea states for operation of the craft should be given in normal operation condition and in the worst intended conditions, at operational speed and at reduced speed as necessary. Operational information should be available on board for guidance, or the craft should have an instrument system for on-line check of operational performance. As a minimum, the system should measure accelerations in three axes close to the longitudinal craft centre of gravity.

4.4 Accommodation design

- 4.4.1 The public spaces and crew accommodation of high speed craft should be located and designed to protect passengers and crew under the collision design condition. In this respect, these spaces should not be located within a distance of:

$$\frac{v^2}{20 \cdot g_{coll}}$$

of the extreme forward end of the top of the effective hull girder of the craft, where the terms V and g_{coll} are as defined in 4.3.3. For this purpose g_{coll} need not be taken as less than 3, and should not be taken as greater than 12.

- 4.4.2 The accommodation should be designed according to the guidelines given in table 4.4.2 and to performance requirements given in annex 9, or by other methods which have been proven to give equal protective qualities.
- 4.4.3 Equipment and baggage in public spaces and in the operator's compartment should be positioned and secured so that they remain in the stowed position when exposed to the collision design acceleration according to 4.3.3 and 4.3.4.
- 4.4.4 Mountings of large masses such as main engines, auxiliary engines, lift fans, transmissions and electrical equipment should be proved by calculations to withstand the collision design acceleration according to 4.3.3 and 4.3.4 without fracturing.
- 4.4.5 Seats, life-saving appliances and items of substantial mass and their supporting structure should not deform or dislodge under any loads up to those specified in 4.3.3 and 4.3.4 in any manner that would impede subsequent rapid evacuation of passengers.
- 4.4.6 There should be adequate handholds on both sides of any passage to enable passengers to steady themselves while moving about.

Table 4.4.2 - Overview general design guidelines*

 Design level 1: g_{coll} less than 3

- 1 Seat/Seat belts
 - 1.1 Low or high seatback
 - 1.2 No restrictions on seating direction
 - 1.3 Sofas allowed
 - 1.4 No seat belts requirement
 - 2 Tables in general allowed
 - 3 Padding of projecting objects
 - 4 Kiosks, bars, etc., no special restrictions
 - 5 Baggage, no special requirements
 - 6 Large masses, restraintment and positioning
-

 Design level 2: g_{coll} 3 to 12

- 1 Seat/Seat belts
 - 1.1 High seatback with protective deformation and padding
 - 1.2 Forward or backward seating direction
 - 1.3 No sofas allowed as seat
 - 1.4 Lap belt in seats when no protective structure forward
 - 2 Tables with protective features allowed. Dynamic testing
 - 3 Padding of projecting objects
 - 4 Kiosk, bars, etc., on aft side of bulkheads, or other specially approved arrangements
 - 5 Baggage placed with protection forward
 - 6 Large masses, restraintment and positioning
-

 Design level 3: g_{coll} above 12

- 1 Seat/Seat belts
 - 1.1 High seatback with protective deformation and padding
 - 1.2 Forward or backward seating direction
 - 1.3 No sofas allowed
 - 1.4 Seat belt when necessary to obtain required protection
 - No belts in backward facing seats
 - 3 point belt or belt with shoulder harness in forward facing seats
 - 2 No tables allowed
 - 3 Padding of projecting objects, specially approved
 - 4 Kiosk, bars, etc., specially approved
 - 5 Baggage placed with protection forward, specially approved
 - 6 Large masses, restraintment and positioning, specially approved
-

* Other arrangements may be employed if an equivalent level of safety is achieved.

4.5 Seating construction

- 4.5.1 A seat should be provided for each passenger and crew member for which the craft is certified to carry.
- 4.5.2 Seats fitted in addition to those required under 4.5.1 and which are not permitted to be used in hazardous navigational situations or potentially dangerous weather or sea conditions, need not comply with 4.5 or 4.6. Such seats should be secured according to 4.4.5 and clearly identified as not being able to be used in hazardous situations.
- 4.5.3 The installation of seats should be such as to allow adequate access to any part of the accommodation space. In particular, they should not obstruct access to, or use of, any essential emergency equipment or means of escape.
- 4.5.4 Seats and their attachments, and the structure in the proximity of the seats, should be of a form and design, and so arranged, such as to minimize the possibility of injury and to avoid trapping of the passengers after the assumed damage in the collision design condition according to 4.4.1. Dangerous projections and hard edges should be eliminated or padded.
- 4.5.5 Seat, seat belts, seat arrangement and adjacent parts such as tables should be designed for the actual collision design acceleration as specified in 4.3.3.
- 4.5.6 All seats, their supports and their deck attachments should have good energy absorbing characteristics and should meet the requirements of annex 9.

4.6 Safety belts

- 4.6.1 One-hand-release safety belts of 3 point type or with shoulder harness should be provided for all seats from which the craft may be operated for all craft with the g_{coll} acceleration from the collision design acceleration exceeding 3g, as prescribed in 4.3.3.
- 4.6.2 Safety belts should be provided on passenger seats and crew seats, if necessary, to obtain the protective performance measures described in annex 9.

4.7 Exits and means of escape

- 4.7.1 For the same reason, easy, safe and quick access from the operating compartment to the passenger accommodation should be provided. In order to ensure immediate assistance from the crew in an emergency situation, the crew accommodation, including any cabins, should be located with due regard to easy, safe and quick access to the public spaces from inside the craft.
- 4.7.2 The design of the craft should be such that all occupants may safely evacuate the craft into survival craft under all emergency conditions, by day or by night. The positions of all exits which may be used in an emergency, and of all life-saving appliances, the practicability of the evacuation procedure, and the evacuation time to evacuate all passengers and crew should be demonstrated.
- 4.7.3 Public spaces, evacuation routes, exits, lifejacket stowage, survival craft stowage, and the embarkation stations should be clearly and permanently marked and illuminated as required in chapter 12.
- 4.7.4 Each enclosed public space and similar permanently enclosed space allocated to passengers or crew should be provided with at least two exits arranged in the opposite ends of the space. Exits should be safely accessible and should provide a route to a normal point of boarding or disembarking from the craft.
- 4.7.5 Subdivision of public spaces to provide refuge in case of fire may be required in compliance with 7.4.4.1 and 7.11.1.
- 4.7.6 Exit doors should be capable of being readily operated from inside and outside the craft in daylight and in darkness. The means of operation should be obvious, rapid and of adequate strength.
- 4.7.7 The closing, latching and locking arrangements for exits should be such that it is readily apparent to the appropriate crew member when the doors are closed and in a safe operational condition, either in direct view or by an indicator. The design of external doors should be such as to eliminate the possibility of jamming by ice or debris.
- 4.7.8 The craft should have a sufficient number of exits which are suitable to facilitate the quick and unimpeded escape of persons wearing approved lifejackets in emergency conditions, such as collision damage or fire.

- 4.7.9 Sufficient space for a crew member should be provided adjacent to exits for ensuring the rapid evacuation of passengers.
- 4.7.10 All exits, together with their means of opening, should be adequately marked for the guidance of passengers. Adequate marking should also be provided for the guidance of rescue personnel outside the craft.
- 4.7.11 Footholds, ladders, etc., provided to give access from the inside to exits, should be of rigid construction and permanently fixed in position. Permanent handholds should be provided whenever necessary to assist persons using exits, and should be suitable for conditions when the craft has developed any possible angles of list or trim.
- 4.7.12 At least two unobstructed evacuation paths should be available for the use of each person. Evacuation paths should be disposed such that adequate evacuation facilities will be available in the event of any likely damage or emergency conditions, and evacuation paths should have adequate lighting supplied from the main and emergency sources of power.
- 4.7.13 The dimensions of passages, doorways and stairways which form part of evacuation paths should be such as to allow easy movement of persons when wearing lifejackets. There should be no protrusions in evacuation paths which could cause injury, ensnare clothing, damage lifejackets or restrict evacuation of disabled persons.
- 4.7.14 Adequate notices should be provided to direct passengers to exits.
- 4.7.15 Provision should be made on board for embarkation stations to be properly equipped for evacuation of passengers into life-saving appliances. Such provision should include handholds, anti-skid treatment of the embarkation deck, and adequate space which is clear of cleats, bollards and similar fittings.

4.8 Evacuation time

- 4.8.1 The provisions for evacuation should be designed such that the craft can be evacuated under controlled conditions in a time of one third of the structural fire protection time (SFP) provided in 7.4.2 for major fire hazard areas after subtracting a period of 7 min for initial detection and extinguishing action.

$$\text{Evacuation time} = \frac{(\text{SFP} - 7)}{3} \quad (\text{min})$$

where:

SFP = structural fire protection time (min)

- 4.8.2 An evacuation procedure, including a critical path analysis, should be developed for the information of the Administration in connection with the approval of fire insulation plans and for assisting the owners and builders in planning the evacuation demonstration required in 4.8.3.

The evacuation procedures should include:

- .1 the emergency announcement made by the master;
- .2 contact with base port;
- .3 the donning of lifejackets;
- .4 manning of survival craft and emergency stations;
- .5 the shutting down of machinery and oil fuel supply lines;
- .6 the order to evacuate;
- .7 the deployment of survival craft and marine escape systems and rescue boats;
- .8 the bowing in of survival craft;
- .9 the supervision of passengers;
- .10 the orderly evacuation of passengers under supervision;
- .11 crew checking that all passengers have left the craft;
- .12 the evacuation of crew;
- .13 releasing the survival craft from the craft; and
- .14 the marshalling of survival craft by the rescue boat where provided.

4.8.3 Achievement of the required evacuation time (as ascertained in accordance with 4.8.1) should be verified by a practical demonstration conducted under controlled conditions in the presence of the Administration, and should be fully documented and verified for passenger craft by the Administration.

4.8.4 Evacuation demonstrations should be carried out with due concern for the problems of mass movement or panic acceleration likely to arise in an emergency situation when rapid evacuation is necessary. The evacuation demonstrations should be dry shod with the survival craft initially in their stowed positions and be conducted as follows:

- .1 The evacuation time on a category A craft should be the time elapsed from the moment the first abandon craft announcement is given, with any passengers distributed in a normal voyage configuration, until the last person has embarked in a survival craft, and should include the time for passengers and crew to don lifejackets.
- .2 The evacuation time on a category B craft and cargo craft should be the time elapsed from the moment the order to abandon the craft is given, until the last person has embarked in a survival craft. Passengers and crew may be wearing lifejackets and prepared for evacuation, and they may be distributed among muster stations.

- .3 For all craft the evacuation time should include the time necessary to launch, inflate and secure the survival craft alongside ready for embarkation.
- 4.8.5 The evacuation time should be verified by an evacuation demonstration which should be performed using the survival craft and exits on one side, for which the critical path analysis indicates the greatest evacuation time, with the passengers and crew allocated to them.
- 4.8.6 On craft where a half trial is impracticable, the Administration may consider a partial evacuation trial using a route which the critical path analysis shows to be the most critical.
- 4.8.7 The demonstration should be carried out in controlled conditions in the following manner in compliance with the evacuation plan.
- .1 The demonstration should commence with the craft afloat in harbour, in reasonably calm conditions, with all machinery and equipment operating in the normal seagoing condition.
- .2 All exits and doors inside the craft should be in the same position as they are under normal seagoing condition.
- .3 Safety belts, if required, should be fastened.
- .4 The evacuation routes for all passengers and crew should be such that no person need enter the water during the evacuation.
- 4.8.8 For passenger craft, a representative composition of persons with normal health, height and weight should be used in the demonstration, and should consist of different sexes and ages so far as it is practicable and reasonable.
- 4.8.9 The persons, other than the crew selected for the demonstration, should not have been specially drilled for such a demonstration.
- 4.8.10 An emergency evacuation demonstration should be carried out for all new designs of high speed craft and for other craft where evacuation arrangements differ substantially from those previously tested.
- 4.8.11 The specific evacuation procedure followed during the craft's initial demonstration on which certification is based should be included in the craft operating manual together with the other evacuation procedures contained in 4.8.2. During the demonstration video recordings should be made both inside and outside the craft which should form an integral part of the training manual required by 18.2.
- 4.9 Baggage, stores, shops and cargo compartments
- 4.9.1 Provision should be made to prevent shifting of baggage, stores and cargo compartment contents, having due regard to occupied compartments and accelerations likely to arise. If safeguarding by positioning is not practicable, adequate means of restraint for baggage, stores and cargo should be provided. Shelves and overhead

shelves for storage of carry-on baggage in passenger accommodation should be provided with adequate means to prevent the luggage from falling out in any conditions that may occur.

- 4.9.2 Controls, electric equipment, high temperature parts, pipelines or other items, the damage or failure of which could affect the safe operation of the craft or which may require access by crew members during a voyage, should not be located in baggage, store and cargo compartments unless such items are adequately protected so that they cannot be damaged or, where applicable, operated inadvertently by loading, unloading or by movement of the contents of the compartment.
- 4.9.3 Loading limits, if necessary, should be durably marked in those compartments.
- 4.9.4 Having regard to the purpose of the craft, the closures of the exterior openings of the luggage and cargo compartments as well as special category spaces should be appropriately weathertight.

4.10 Noise levels

- 4.10.1 The noise level in crew and passengers' accommodations should be kept as low as possible to enable the public address system to be heard, and should not in general exceed 75 dB(A).
- 4.10.2 The maximum noise level in the operating compartment should not in general exceed 65 dB(A) to facilitate communication within the compartment and external radiocommunications.

CHAPTER 5 - DIRECTIONAL CONTROL SYSTEMS

5.1 General

- 5.1.1 Craft should be provided with means for directional control of adequate strength and suitable design to enable the craft's heading and direction of travel to be effectively controlled to the maximum extent possible in the prevailing conditions and craft speed without undue physical effort at all speeds and in all conditions for which the craft is to be certificated. The performance should be verified in accordance with annex 8.
- 5.1.2 Directional control may be achieved by means of air or water rudders, foils, flaps, steerable propellers or jets, yaw control ports or side thrusters, differential propulsive thrust, variable geometry of the craft or its lift system components or by a combination of these devices.
- 5.1.3 For the purpose of this chapter, a directional control system includes any steering device or devices, any mechanical linkages and all power or manual devices, controls and actuating systems.
- 5.1.4 Attention is drawn to the possibility of interaction between directional control systems and stabilization systems. Where such interaction occurs or where dual purpose components are fitted, the requirements of 12.5 and chapters 16 and 17 should also be complied with as applicable.

5.2 Reliability

- 5.2.1 The probability of total failure of all directional control systems should be extremely remote when the craft is operating normally, i.e., excluding emergency situations such as grounding, collision or a major fire.
- 5.2.2 A design incorporating a power drive or an actuation system employing powered components for normal directional control should provide a secondary means of actuating the device unless an alternative system is provided.
- 5.2.3 The secondary means of actuating the directional control device may be manually driven when the Administration is satisfied that this is adequate, bearing in mind the craft's size and design and any limitations of speed or other parameters that may be necessary.
- 5.2.4 The directional control systems should be constructed so that a single failure in one drive or system, as appropriate, will not render any other one inoperable or unable to bring the craft to a safe situation. The Administration may allow a short period of time to permit the connection of a secondary control device when the design of the craft is such that such delay will not, in their opinion, hazard the craft.

- 5.2.5 A failure mode and effect analysis should include the directional control system.
- 5.2.6 If necessary to bring the craft to a safe condition, power drives for directional control devices, including those required to direct thrust forward or astern, should become operative automatically, and respond correctly, within 5 s of power or other failure. Back-up electrical systems may be required for the starting-up time of an auxiliary diesel according to 12.2 or an emergency diesel generator according to 12.3.6.
- 5.2.7 Directional control devices involving variable geometry of the craft or its lift system components should, so far as is practicable, be so constructed that any failure of the drive linkage or actuating system will not significantly hazard the craft.

5.3 Demonstrations

- 5.3.1 The limits of safe use of any of the control system devices should be based on demonstrations and verification process in accordance with annex 8.
- 5.3.2 Demonstration in accordance with annex 8 should determine any adverse effects upon safe operation of the craft in the event of an uncontrollable total deflection of any one control device. Any limitation on the operation of the craft as may be necessary to ensure that the redundancy or safeguards in the systems provide equivalent safety should be included in the craft operating manual.

5.4 Control position

- 5.4.1 All directional control systems should normally be operated from the craft's operating station.
- 5.4.2 If directional control systems can also be operated from other positions, then two-way communication should be arranged between the operating station and these other positions.
- 5.4.3 Adequate indications should be provided at the operating station and these other positions to provide the person controlling the craft with verification of the correct response of the directional control device to this demand, and also to indicate any abnormal responses or malfunction. The indications of steering response or rudder angle indicator should be independent of the system for directional control. The logic of such feedback and indications should be consistent with the other alarms and indications so that in an emergency operators are unlikely to be confused.

CHAPTER 6 - ANCHORING, TOWING AND BERTHING

6.1 General

- 6.1.1 A primary assumption made in this chapter is that high speed craft will only need an anchor for emergency purposes.
- 6.1.2 The arrangements for anchoring, towing and berthing and the local craft structure, the design of the anchor, towing and berthing arrangements and the local craft structure should be such that risks to persons carrying out anchoring, towing or berthing procedures are kept to a minimum.
- 6.1.3 All anchoring equipment, towing bits, mooring bollards, fairleads, cleats and eyebolts should be so constructed and attached to the hull that in use up to design loads, the watertight integrity of the craft will not be impaired. Design loads and any directional limitations assumed should be listed in the craft operating manual.

6.2 Anchoring

- 6.2.1 High speed craft should be provided with at least one anchor with its associated cable or cable and warp and means of recovery. Every craft should be provided with adequate and safe means for releasing the anchor, its cable and warp.
- 6.2.2 Good engineering practice should be followed in the design of any enclosed space containing the anchor recovery equipment to ensure that persons using the equipment are not put at risk. Particular care should be taken with the means of access to such spaces, the walkways, the illumination and protection from the cable and the recovery machinery.
- 6.2.3 Adequate arrangements should be provided for two-way voice communication between the operating compartment and persons engaged in dropping, weighing or releasing the anchor.
- 6.2.4 The anchoring arrangements should be such that any surfaces against which the cable may chafe (for example, hawse pipes and hull obstructions) are designed to prevent the cable from being damaged and fouled. Adequate arrangements should be provided to secure the anchor under all operational conditions.
- 6.2.5 The craft should be protected so as to minimize the possibility of the anchor and cable damaging the structure during normal operation.

6.3 Towing

- 6.3.1 Adequate arrangements should be provided to enable the craft to be towed in the worst intended conditions. Where towage is to be from more than one point a suitable bridle should be provided.
- 6.3.2 The towing arrangements should be such that any surfaces against which the towing cable may chafe (for example, fairleads), is of sufficient radius to prevent the cable being damaged when under load.

6.3.3 The maximum permissible speed at which the craft may be towed should be included in the operating manual.

6.4 Berthing

6.4.1 Where necessary, suitable fairleads, bitts and mooring ropes should be provided.

6.4.2 Adequate storage space for mooring lines should be provided such that they are readily available and secured against the high relative wind speeds and accelerations which may be experienced.

CHAPTER 7 - FIRE SAFETY

PART A - GENERAL

7.1 General requirements

7.1.1 The following basic principles underlay the provisions in this chapter and are embodied therein as appropriate, having regard to the category of craft and the potential fire hazard involved:

- .1 maintenance of the main functions and safety systems of the craft, including propulsion and control, fire detection, alarms and extinguishing capability of unaffected spaces, after fire in any one compartment on board;
- .2 division of the passenger accommodation area for category B craft, in such a way that the occupants of any compartment can escape to an alternative safe area or compartment in case of fire;
- .3 subdivision of the craft by fire-resisting boundaries;
- .4 restricted use of combustible materials and materials generating smoke and toxic gases in a fire;
- .5 detection, containment and extinction of any fire in the space of origin;
- .6 protection of means of escape and access for fire fighting; and
- .7 immediate availability of fire-extinguishing appliances.

7.1.2 The requirements in this chapter are based on the following conditions:

- .1 Where a fire is detected, the crew immediately puts into action the fire-fighting procedures, informs the base port of the accident and prepares for the escape of passengers to alternative safe area or compartment, or, if necessary, for the evacuation of passengers.
- .2 The use of fuel with a flashpoint below 43°C is not recommended. However, fuel with a lower flashpoint, but not lower than 35°C, may be used in gas turbines only subject to compliance with the provisions specified in 7.5.1 to 7.5.6.
- .3 The repair and maintenance of the craft is carried out in accordance with the requirements given in chapters 18 and 19 of this Code.
- .4 Enclosed spaces such as cinemas, discotheques, and similar spaces are not permitted. Refreshment kiosks which do not contain cooking facilities with exposed heating surfaces may be permitted. Galleys, if fitted, should be in full compliance with chapter II-2 of the Convention.

- .5 Dangerous goods may be carried provided the relevant provisions of regulations II-2/53 and 54 of the Convention are complied with.
- .6 Passenger access to vehicle spaces is prohibited during the voyage except when accompanied by a crew member responsible for fire safety. Only authorized crew members should be permitted to enter cargo spaces at sea.

7.2 Definitions

7.2.1 "Fire-resisting divisions" are those divisions formed by bulkheads and decks which comply with the following:

- .1 They should be constructed of non-combustible or fire-restricting materials which by insulation or inherent fire-resisting properties satisfy the requirements of 7.2.1.2 to 7.2.1.6.
- .2 They should be suitably stiffened.
- .3 They should be so constructed as to be capable of preventing the passage of smoke and flame up to the end of the appropriate fire protection time.
- .4 Where required, they should maintain load-carrying capabilities up to the end of the appropriate fire protection time.
- .5 They should have thermal properties such that the average temperature on the unexposed side will not rise more than 139°C above the original temperature, nor will the temperature, at any one point, including any joint, rise more than 180°C above the original temperature during the appropriate fire protection time.
- .6 A test in accordance with the test procedures for a prototype bulkhead and deck should be required to ensure that it meets the above requirements.

7.2.2 "Fire-restricting materials" are those materials which have properties complying with the standards developed by the Organization* with respect to the following:

- .1 they should have low flame-spread characteristics;
- .2 limit heat flux, due regard being paid to the risk of ignition of furniture in the compartment;
- .3 limited rate of heat release, due regard being paid to the risk of spread of fire to an adjacent compartment; and
- .4 gas and smoke should not be emitted in quantities that could be dangerous to the occupants of the craft.

* Standards should be further developed by the Organization.

- 7.2.3 "Local fire", the standards for compliance with 7.2.2.2 are to be developed by the Organization* as applicable to surface materials on bulkheads, wall, and ceiling linings including their supporting structure as considered necessary.
- 7.2.4 "Non-combustible material" is a material which neither burns nor gives off flammable vapours in sufficient quantity for self-ignition when heated to approximately 750°C, this being determined to the satisfaction of the Administration by an established test procedure.** Any other material is a combustible material.
- 7.2.5 "A standard fire test" is one in which specimens of the relevant bulkheads, decks or other constructions are exposed in a test furnace by specified test method according to the standards*** developed by the Organization.
- 7.2.6 Where the words "steel or other equivalent material" occur, "equivalent material" means any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g., aluminium alloy with appropriate insulation).
- 7.2.7 "Low flame-spread" means that the surface thus described will adequately restrict the spread of flame, this being determined by an established test procedure**** developed by the Organization.
- 7.2.8 "Smoke-tight" or "capable of preventing the passage of smoke" means that a division made of non-combustible or fire-restricting materials is capable of preventing the passage of smoke.

7.3 Classification of space use

- 7.3.1 For the purposes of classification of space use in accordance with fire hazard risks, the following grouping should apply:
- .1 "Areas of major fire hazard" referred to in tables 7.4-1 and 7.4-2 by A, include the following spaces:

* Refer to Full scale room fire test adopted by International Organization for Standardization (ISO) by ISO 9705 and Fire test - reaction to fire - rate of heat release from building products adopted by ISO by ISO 5660.

** Refer to the Improved recommendation on test method for qualifying marine construction materials as non-combustible adopted by the Organization by resolution A.472(XII).

*** Refer to the Recommendation on improved fire test procedures for "A", "B" and "F" class divisions, adopted by the Organization by resolution A.754(18).

**** Refer to the Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials adopted by the Organization by resolution A.653(16).

- Machinery spaces
 - Open vehicle spaces
 - Spaces containing dangerous goods
 - Special category spaces
 - Store-rooms containing flammable liquids
- .2 "Areas of moderate fire hazard" referred to in tables 7.4-1 and 7.4-2 by B, include the following spaces:
- Auxiliary machinery spaces, as defined in 1.4.3
 - Bond stores containing packaged beverages with alcohol content not exceeding 24% by volume
 - Crew accommodations
 - Service spaces
- .3 "Areas of minor fire hazard" referred to in tables 7.4-1 and 7.4-2 by C, include the following spaces:
- Auxiliary machinery spaces, as defined in 1.4.4
 - Cargo spaces
 - Fuel tank compartments
 - Public spaces
 - Tanks, voids and areas of little or no fire risk
- .4 "Control stations" referred to in tables 7.4-1 and 7.4-2 by D, as defined in 1.4.13.
- .5 "Evacuation stations and external escape routes" referred to in tables 7.4-1 and 7.4-2 by E, include the following areas:
- External stairs and open decks used for escape routes
 - Muster stations, internal and external
 - Open deck spaces and enclosed promenades forming lifeboat and liferaft embarkation and lowering stations
 - The craft's side to the waterline in the lightest seagoing condition, superstructure and deckhouse sides situated below and adjacent to the liferaft's and evacuation slide's embarkation areas
- .6 "Open spaces" referred to in tables 7.4-1 and 7.4-2 by F, include the following areas:
- Open spaces locations other than evacuation stations and external escape routes and control stations.

Table 7.4-1

STRUCTURAL FIRE PROTECTION TIMES FOR
SEPARATING BULKHEADS AND DECKS
OF PASSENGER CRAFT

	A	B	C	D	E	F	
Areas of major fire hazard	A 60 1,2 60 1,2	B 30 1 30 1,8	C 60 3 60 1,8	D 3 60 4 3 1	E 3 60 3 1	F 3 60 1,7	-
Areas of moderate fire hazard		B 30 2 30 8	C 30 3 30 8	D 3 60 4 3 8	E 3 30 3 3	F 3 3	-
Areas of minor fire hazard			C 3 30 8	D 3 4 3 3 8	E 3 3 3	F 3	-
Control stations				D 3 4 3 3 8	E 3 3 3	F 3	-
Evacuation stations and escape routes					E 3 3 3	F 3	-
Open Spaces						F -	-

Table 7.4-2

STRUCTURAL FIRE PROTECTION TIMES FOR
SEPARATING BULKHEADS AND DECKS
OF CARGO CRAFT

	A	B	C	D	E	F
A Areas of major fire hazard	60 1.2	30	3	3	3	-
B Areas of moderate fire hazard	60 1.2	60 1	60 1.8	60 1	60 1	60 1.7
C Areas of minor fire hazard		6 2	3	3 4	3	-
D Control stations		6 2	6	60	6	3
E Evacuation stations and escape routes			3	3 4	3 4	3
F Open Spaces			3	30 8	3	3
				3 4	3 4	3
					3	3
						-

Notes:

The figures on either side of the diagonal line represent the required structural fire protection time for the protection system on the relevant side of the division.

- 1 The upper side of the decks of special category spaces need not be insulated.
- 2 Where adjacent spaces are in the same alphabetical category and a note 2 appears, a bulkhead or deck between such spaces need not be fitted if deemed unnecessary by the Administration. For example, a bulkhead need not be required between two store-rooms. A bulkhead is, however, required between a machinery space and a special category space even though both spaces are in the same category.
- 3 No structural fire protection requirements, however, smoke-tight non-combustible or fire-restricting material is required.
- 4 Control stations which are also auxiliary machinery spaces should be provided with 30 min structural fire protection.
- 5 There are no special requirements for material or integrity of boundaries where only a dash appears in the tables.
- 6 The fire protection time is 0 min and the time for prevention of passage of smoke and flame is 30 min as determined by the first 30 min of the standard fire test.
- 7 When steel construction is used, fire-resisting divisions need not comply with 7.2.1.5.
- 8 When steel construction is used, fire-resisting divisions adjacent to void spaces need not comply with 7.2.1.5.

7.4 Structural fire protection

7.4.1 Main structure

7.4.1.1 The requirements below apply to all craft irrespective of construction material. The structural fire protection times for separating bulkheads and decks should be in accordance with tables 7.4-1 and 7.4-2, and the structural fire protection times are all based on providing protection for a period of 60 min as referred to in 4.8.1. If any other lesser structural fire protection time is determined for category A craft and cargo craft by 4.8.1, then the times given below in 7.4.2.2 and 7.4.2.3 may be amended pro-rata. In no case should the structural fire protection time be less than 30 min.

7.4.1.2 In using tables 7.4-1 and 7.4-2, it should be noted that the title of each category is intended to be typical rather than restricted. For determining the appropriate fire integrity standards to be applied to boundaries between adjacent spaces, where there is doubt as to their classification for the purpose of this section, they should be treated as spaces within the relevant category having the most stringent boundary requirement.

7.4.1.3 The hull, superstructure, structural bulkheads, decks, deckhouses and pillars should be constructed of approved non-combustible materials having adequate structural properties. The use of other fire-restricting materials may be permitted provided the requirements of this chapter are complied with (including a test procedure, developed by the Organization*, for structural strength of composites at elevated temperatures).

7.4.2 Fire-resisting divisions

7.4.2.1 Areas of major and moderate fire hazard should be enclosed by fire-resisting divisions complying with the requirements of 7.2.1 except where the omission of any such division would not affect the safety of the craft. These requirements need not apply to those parts of the structure in contact with water at the lightweight condition, but due regard should be given to the effect of temperature of hull in contact with water and heat transfer from any uninsulated structure in contact with water to insulated structure above the water.

7.4.2.2 Fire-resisting bulkheads and decks should be constructed to resist exposure to the standard fire test for a period of 30 min for areas of moderate fire hazard and 60 min for areas of major fire hazards except as provided in 7.4.1.1.

7.4.2.3 Main load-carrying structures within major and moderate fire hazard areas should be arranged to distribute load such that there will be no collapse of the construction of the hull and superstructure when it is exposed to fire for the appropriate fire protection time. The load-carrying structure should also comply with the requirements of 7.4.2.4 and 7.4.2.5.

* Standards should be developed by the Organization.

- 7.4.2.4 If the structures specified in 7.4.2.3 are made of aluminium alloy their installation should be such that the temperature of the core does not rise more than 200°C above the ambient temperature in accordance with the times in 7.4.1.1 and 7.4.2.2.
- 7.4.2.5 If the structures specified in 7.4.2.3 are made of combustible material, their insulation should be such that their temperatures will not rise to a level where deterioration of the construction will occur during the exposure to the composite standard fire test developed by the Organization to such an extent that the load-carrying capability, in accordance with the times in 7.4.1.1 and 7.4.2.3, will be impaired.
- 7.4.2.6 The construction of all doors, and door frames in fire-resisting divisions, with the means of securing them when closed, should provide resistance to fire as well as to the passage of smoke and flame equivalent to that of the bulkheads in which they are situated. Watertight doors of steel need not be insulated. Also, where a fire-resisting division is penetrated by pipes, ducts, controls, electrical cables or for other purposes, arrangements and necessary testing should be made to ensure that the fire-resisting integrity of the division is not impaired.
- 7.4.3 Restricted use of combustible materials
- 7.4.3.1 All separating divisions, ceilings or linings if not a fire-resisting division, should be of non-combustible or fire-restricting materials.
- 7.4.3.2 Where insulation is installed in areas in which it could come into contact with any flammable fluids or their vapours, its surface should be impermeable to such flammable fluids or vapours. The exposed surfaces of vapour barriers and adhesives used in conjunction with insulation materials should have low flame-spread characteristics.
- 7.4.3.3 Furniture and furnishings in public spaces and crew accommodation should comply with the following standards:
- .1 all case furniture is constructed entirely of approved non-combustible or fire-restricting materials, except that a combustible veneer with a calorific value not exceeding 45 MJ/m² may be used on the exposed surface of such articles;
 - .2 all other furniture such as chairs, sofas and tables is constructed with frames of non-combustible or fire-restricting materials;
 - .3 all draperies, curtains and other suspended textile materials have qualities of resistance to the propagation of flame in accordance with standards* developed by the Organization;

* Refer to the Recommendation on test method for determining the resistance to flame of vertically supported textiles and films, adopted by the Organization by resolution A.471(XII), and amendments to the recommendation adopted by resolution A.563(14).

- .4 all upholstered furniture has qualities of resistance to the ignition and propagation of flame in accordance with standards* developed by the Organization;
 - .5 all bedding components comply with the standards** developed by the Organization; and
 - .6 all deck finish materials comply with the standards*** developed by the Organization.
- 7.4.3.4 The following surfaces should, as a minimum standard be constructed of materials having low flame-spread characteristics:
- .1 exposed surfaces in corridors and stairway enclosures, and of bulkheads, wall and ceiling linings in all accommodation and service spaces and control stations;
 - .2 concealed or inaccessible spaces in accommodation, service spaces and control stations.
- 7.4.3.5 Any thermal and acoustic insulation material, if not in compliance with 7.2.1 or 7.2.2, should be of non-combustible material.
- 7.4.3.6 Materials used in the craft, when exposed to fire, should not emit smoke or toxic gases in quantities that could be dangerous to humans as determined in tests of a standard developed by the Organization.
- 7.4.3.7 Void compartments, where low density combustible materials are used to provide buoyancy, should be protected from adjacent fire hazard areas by fire-resisting divisions, in accordance with tables 7.4-1 and 7.4-2. Also, the space and closures to it should be gastight but it should be ventilated to atmosphere.
- 7.4.3.8 In compartments where smoking is allowed, suitable non-combustible ash containers should be provided. In compartments where smoking is not allowed, adequate notices should be displayed.

* Refer to the Recommendation on fire test procedures for upholstered furniture, adopted by the Organization by resolution A.652(16).

** Refer to the Recommendation on fire test procedures for ignitability of bedding components, adopted by the Organization by resolution A.688(17).

*** Refer to the Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials, adopted by the Organization by resolution A.653(16) and the Recommendation on fire test procedures for ignitability of primary deck coverings, adopted by the Organization by resolution A.687(16).

- 7.4.3.9 The exhaust gas pipes should be arranged so that the risk of fire is kept to a minimum. To this effect, the exhaust system should be insulated and all the compartments and structures which are contiguous with the exhaust system, or those which may be affected by increased temperatures caused by waste gases in normal operation or in an emergency, should be constructed of non-combustible material or be shielded and insulated with non-combustible material to protect from high temperatures.
- 7.4.3.10 The design and arrangement of the exhaust manifolds or pipes should be such as to ensure the safe discharge of exhaust gases.
- 7.4.4 Arrangement
- 7.4.4.1 Internal stairways which serve more than two decks of accommodation should be enclosed at all levels with smoke-tight divisions of non-combustible or fire-restricting materials, and where only two decks are served, such enclosures should be provided on at least one level. Stairways may be fitted in the open in a public space, provided they lie wholly within such public space.
- 7.4.4.2 Lift trunks should be so fitted as to prevent the passage of smoke and flame from one deck to another and should be provided with means of closing so as to permit the control of draught and smoke.
- 7.4.4.3 In accommodation and service spaces, control stations, corridors and stairways air spaces enclosed behind ceilings, panelling or linings should be suitably divided by close fitting draught stops not more than 14 m apart.
- 7.5 Fuel and other flammable fluid tanks and systems
- 7.5.1 Tanks containing fuel and other flammable fluids should be separated from passenger, crew, and baggage compartments by vapour-proof enclosures or cofferdams which are suitably ventilated and drained.
- 7.5.2 Fuel oil tanks should not be located in or contiguous to major fire hazard areas. However, flammable fluids of a flashpoint not less than 60°C may be located within such areas provided the tanks are made of steel or other equivalent material.
- 7.5.3 Every oil fuel pipe which, if damaged, would allow oil to escape from a storage, settling or daily service tank should be fitted with a cock or valve directly on the tank capable of being closed from a position outside the space concerned in the event of a fire occurring in the space in which such tanks are situated.
- 7.5.4 Pipes, valves and couplings conveying flammable fluids should be of steel or such alternative material satisfactory to a standard*, in respect of strength and fire integrity having regard to the

* Refer to Guidelines for materials other than steel for pipes adopted by the Organization by resolution A.753(18).

service pressure and the spaces in which they are installed. Wherever practicable, the use of flexible pipes should be avoided.

7.5.5 Pipes, valves and couplings conveying flammable fluids should be arranged as far from hot surfaces or air intakes of engine installations, electrical appliances and other potential sources of ignition as is practicable and be located or shielded so that the likelihood of fluid leakage coming into contact with such sources of ignition is kept to a minimum.

7.5.6 Fuel with a flashpoint below 35°C should not be used. In every craft in which fuel with a flashpoint below 43°C is used, the arrangements for the storage, distribution and utilization of the fuel should be such that, having regard to the hazard of fire and explosion which the use of such fuel may entail, the safety of the craft and of persons on board is preserved. The arrangements should comply, in addition to the requirements of 7.5.1 to 7.5.5, with the following provisions:

- .1 tanks for the storage of such fuel should be located outside any machinery space and at a distance of not less than 760 mm inboard from the shell side and bottom plating, and from decks and bulkheads;
- .2 arrangements should be made to prevent overpressure in any fuel tank or in any part of the oil fuel system, including the filling pipes. Any relief valves and air or overflow pipes should discharge to a position which, in the opinion of the Administration, is safe;
- .3 the spaces in which fuel tanks are located should be mechanically ventilated using exhaust fans providing not less than six air changes per hour. The fans should be such as to avoid the possibility of ignition of flammable gas air mixtures. Suitable wire mesh guards should be fitted over inlet and outlet ventilation openings. The outlets for such exhausts should be discharged to a position which, in the opinion of the Administration, is safe. 'No Smoking' signs should be posted at the entrances to such spaces;
- .4 earthed electrical distribution systems should not be used, with the exception of earthed intrinsically safe circuits;
- .5 suitable certified safe type* electrical equipment should be used in all spaces where fuel leakage could occur including ventilation system. Only electrical equipment and fittings essential for operational purposes should be fitted in such spaces;

* Refer to the Recommendations published by the International Electrotechnical Commission and, in particular, publication 92 - Electrical installations in ships.

- .6 a fixed vapour detection system should be installed in each space through which fuel lines pass, with alarms provided at the continuously manned control station;
- .7 every fuel tank should, where necessary, be provided with "savealls" or gutters which would catch any fuel which may leak from such tank;
- .8 safe and efficient means of ascertaining the amount of fuel contained in any tank should be provided. Sounding pipes should not terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they should not terminate in passenger or crew spaces. The use of gauge glasses is prohibited. Other means of ascertaining the amount of fuel contained in any tank may be permitted if such means do not require penetration below the top of the tank, and providing their failure or overfilling of the tank will not permit the release of fuel;
- .9 during bunkering operations no passenger should be on board the craft or in the vicinity of the bunkering station, and adequate 'No Smoking' and 'No Naked Lights' signs should be posted. Vessel-to-shore fuel connections should be of closed type and suitably grounded during bunkering operations;
- .10 the provision of fire detection and extinguishing systems in spaces where non-integral fuel tanks are located should be in accordance with paragraphs 7.7.1 to 7.7.4; and
- .11 refuelling of the craft should be done at the approved refuelling facilities, detailed in the route operational manual, at which the following fire appliances are provided:
 - .11.1 a suitable foam applicator system consisting of monitors and foam making branch pipes capable of delivering foam solution at a rate of not less than 500 l/min for not less than 10 min;
 - .11.2 dry powder extinguishers of total capacity not less than 50 kg; and
 - .11.3 carbon dioxide extinguishers of total capacity not less than 16 kg.

7.6 Ventilation

- 7.6.1 The main inlets and outlets of all ventilation systems should be capable of being closed from outside the spaces being ventilated. In addition, such openings to areas of major fire hazard should be capable of being closed from a continuously manned control station.
- 7.6.2 All ventilation fans should be capable of being stopped from outside the spaces which they serve, and from outside the spaces in which they are installed. Ventilation fans serving major fire hazard areas should be capable of being operated from a continuously manned control station. The means provided for stopping the power

ventilation to the machinery space should be separated from the means provided for stopping ventilation of other spaces.

- 7.6.3 Major fire hazard areas and main passenger spaces serving as muster stations should have separate ventilation systems and ventilation ducts. Ventilation ducts for major fire hazard areas should not pass through other spaces, and ducts for ventilation of other spaces should not pass through major fire hazard areas.
- 7.6.4 Where, of necessity, a ventilation duct passes through a fire-resisting or smoke-tight division, a fail safe automatic closing fire damper should be fitted adjacent to the division. The duct between the division and the damper should be of steel or other equivalent material and insulated to the same standard as required for the fire-resisting division.
- 7.6.5 Where ventilation systems penetrate decks, the arrangements should be such that the effectiveness of the deck in resisting fire is not thereby impaired and precautions should be taken to reduce the likelihood of smoke and hot gases passing from one between deck space to another through the system.
- 7.6.6 All dampers fitted on fire-resisting or smoke-tight divisions should also be capable of being manually closed from each accessible side of the division in which they are fitted, and remotely closed from the continuously manned control station.

7.7 Fire detection and extinguishing systems

- 7.7.1 Areas of major and moderate fire hazard and other enclosed spaces in the accommodation not regularly occupied, such as toilets, stairway enclosures and corridors should be provided with an approved automatic smoke detection system and manually operated call points to indicate at the control station the location of outbreak of a fire in all normal operating conditions of the installations. Main propulsion machinery room(s) should in addition have detectors sensing other than smoke and be supervised by TV cameras monitored from the operating compartment. Manually operated call points should be installed throughout the accommodation spaces, service spaces and, where necessary, control stations. One manually operated call point should be located at each exit from these spaces and from areas of major fire hazard.
- 7.7.2 The fixed fire detection and fire alarm systems should comply with the following requirements.
- 7.7.2.1 General requirements
- .1 Any required fixed fire detection and fire alarm system with manually operated call points should be capable of immediate operation at all times.
 - .2 Power supplies and electric circuits necessary for the operation of the system should be monitored for loss of power or fault conditions as appropriate. Occurrence of a fault condition should initiate a visual and audible fault signal

at the control panel which should be distinct from a fire signal.

- .3 There should be not less than two sources of power supply for the electrical equipment used in the operation of the fixed fire detection and fire alarm systems, one of which should be an emergency source. The supply should be provided by separate feeders reserved solely for that purpose. Such feeders should run to an automatic change-over switch situated in or adjacent to the control panel for the fire detection system.
- .4 Detectors and manually operated call points should be grouped into sections. The activation of any detector or manually operated call point should initiate a visual and audible fire signal at the control panel and indicating units. If the signals have not received attention within two minutes an audible alarm should be automatically sounded throughout the crew accommodation and service spaces, control stations and machinery spaces. This alarm sounder system need not be an integral part of the fire detection system.
- .5 The control panel should be located in the operating compartment or in the main fire control station.
- .6 Indicating units should, as a minimum, denote the section in which a detector or manually operated call point has operated. At least one unit should be so located that it is easily accessible to responsible members of the crew at all times, when at sea or in port, except when the craft is out of service. One indicating unit should be located in the operating compartment if the control panel is located in the space other than the operating compartment.
- .7 Clear information should be displayed on or adjacent to each indicating unit about the spaces covered and the location of the sections.
- .8 Where the fire detection system does not include means of remotely identifying each detector individually, no section covering more than one deck within accommodation spaces, service spaces and control stations should normally be permitted except a section which covers an enclosed stairway. In order to avoid delay in identifying the source of fire, the number of enclosed spaces included in each section should be limited as determined by the Administration. In no case should more than 50 enclosed spaces be permitted in any section. If the detection system is fitted with remotely and individually identifiable fire detectors, the sections may cover several decks and serve any number of enclosed spaces.
- .9 In passenger craft, if there is no fire detection system capable of remotely and individually identifying each detector, a section of detectors should not serve spaces on both sides of the craft nor on more than one deck and neither should it be situated in more than one zone according to

7.11.1 except that the Administration, if it is satisfied that the protection of the craft against fire will not thereby be reduced, may permit such a section of detectors to serve both sides of the craft and more than one deck. In passenger craft fitted with individually identifiable fire detectors, a section may serve spaces on both sides of the craft and on several decks.

- .10 A section of fire detectors which covers a control station, a service space or an accommodation space, should not include a machinery space of major fire hazard.
- .11 Detectors should be operated by heat, smoke or other products of combustion, flame, or any combination of these factors. Detectors operated by other factors indicative of incipient fires may be considered by the Administration provided that they are no less sensitive than such detectors. Flame detectors should only be used in addition to smoke or heat detectors.
- .12 Suitable instructions and component spares for testing and maintenance should be provided.
- .13 The function of the detection system should be periodically tested by means of equipment producing hot air at the appropriate temperature, or smoke or aerosol particles having the appropriate range of density or particle size, or other phenomena associated with incipient fires to which the detector is designed to respond. All detectors should be of a type such that they can be tested for correct operation and restored to normal surveillance without the renewal of any component.
- .14 The fire detection system should not be used for any other purpose, except that closing of fire doors and similar functions may be permitted at the control panel.
- .15 Fire detection systems with a zone address identification capability should be so arranged that:
 - .1 a loop cannot be damaged at more than one point by a fire;
 - .2 means are provided to ensure that any fault (e.g., power break; short circuit; earth) occurring in the loop should not render the whole loop ineffective;
 - .3 all arrangements are made to enable the initial configuration of the system to be restored in the event of failure (electrical, electronic, informatic); and
 - .4 the first initiated fire alarm should not prevent any other detector to initiate further fire alarms.

7.7.2.2 Installation requirements:

- .1 Manually operated call points should be installed throughout the accommodation spaces, service spaces and control stations. One manually operated call point should be located at each exit. Manually operated call points should be readily accessible in the corridors of each deck such that no part of the corridor is more than 20 m from a manually operated call point.
- .2 Smoke detectors should be installed in all stairways, corridors and escape routes within accommodation spaces. Consideration should be given to the installation of special purpose smoke detectors within ventilation ducting.
- .3 Where a fixed fire detection and fire alarm system is required for the protection of spaces other than those specified in .2, at least one detector complying with 7.7.2.1.11 should be installed in each such space.
- .4 Detectors should be located for optimum performance. Positions near beams and ventilation ducts or other positions where patterns of air flow could adversely affect performance and positions where impact or physical damage is likely should be avoided. In general, detectors which are located on the overhead should be a minimum distance of 0.5 m away from bulkheads.
- .5 The maximum spacing of detectors should be in accordance with the table below:

Type of detector	Maximum floor area per detector	Maximum distance apart between centres	Maximum distance away from bulkheads
Heat	37 m ²	9 m	4.5 m
Smoke	74 m ²	11 m	5.5 m

The Administration may require or permit other spacings based upon test data which demonstrate the characteristics of the detectors.

- .6 Electrical wiring which forms part of the system should be so arranged as to avoid machinery spaces of major fire hazard, and other enclosed spaces of major fire hazard except, where it is necessary, to provide for fire detection or fire alarm in such spaces or to connect to the appropriate power supply.

7.7.2.3 Design requirements:

- .1 The system and equipment should be suitably designed to withstand supply voltage variation and transients, ambient temperature changes, vibration, humidity, shock, impact and corrosion normally encountered in ships.
- .2 Smoke detectors required by paragraph 7.7.2.2.2 should be certified to operate before the smoke density exceeds 12.5% obscuration per metre, but not until the smoke density exceeds 2% obscuration per metre. Smoke detectors to be installed in other spaces should operate within sensitivity limits to the satisfaction of the Administration having regard to the avoidance of detector insensitivity or over-sensitivity.
- .3 Heat detectors should be certified to operate before the temperature exceeds 78°C but not until the temperature exceeds 54°C, when the temperature is raised to those limits at a rate less than 1°C per minute. At higher rates of temperature rise, the heat detector should operate within temperature limits having regard to the avoidance of detector insensitivity or over-sensitivity.
- .4 At the discretion of the Administration, the permissible temperature of operation of heat detectors may be increased to 30°C above the maximum deckhead temperature in drying rooms and similar spaces of a normal high ambient temperature.
- .5 Flame detectors referred to in 7.7.2.1.11 should have a sensitivity sufficient to determine flame against an illuminated space background and a false signal identification system.

7.7.3 A fixed fire detection and fire alarm system for periodically unattended machinery spaces should comply with the following requirements:

- .1 The fire detection system should be so designed and the detectors so positioned as to detect rapidly the onset of fire in any part of those spaces and under any normal conditions of operation of the machinery and variations of ventilation as required by the possible range of ambient temperatures. Except in spaces of restricted height and where their use is specially appropriate, detection system using only thermal detectors should not be permitted. The detection system should initiate audible and visual alarms distinct in both respects from the alarms of any other system not indicating fire, in sufficient places to ensure that the alarms are heard and observed on the navigating bridge and by a responsible engineer officer. When the operating compartment is unmanned the alarm should sound in a place where a responsible member of the crew is on duty.
- .2 After installation, the system should be tested under varying conditions of engine operation and ventilation.

- 7.7.4 Areas of major fire hazard should be protected by an approved fixed extinguishing system operable from the control position which is adequate for the fire hazard that may exist. The system should be capable of local manual control and remote control from the continuously manned control stations.
- 7.7.5 In all craft where gas is used as the extinguishing medium, the quantity of gas should be sufficient to provide two independent discharges. The second discharge into the space should only be activated (released) manually from a position outside the space being protected. Where the space has a second fixed means of extinguishing installed, then the second discharge should not be required.
- 7.7.6.1 The fixed fire-extinguishing systems should comply with the following requirements:
- .1 The use of a fire-extinguishing medium which, in the opinion of the Administration, either by itself or under expected conditions of use will adversely affect the earth's ozone layer and/or gives off toxic gases in such quantities as to endanger persons should not be permitted.
 - .2 The necessary pipes for conveying fire-extinguishing medium into protected spaces should be provided with control valves so marked as to indicate clearly the spaces to which the pipes are led. Non-return valves should be installed in discharge lines between cylinders and manifolds. Suitable provision should be made to prevent inadvertent admission of the medium to any space.
 - .3 The piping for the distribution of fire-extinguishing medium should be arranged and discharge nozzles so positioned that a uniform distribution of medium is obtained.
 - .4 Means should be provided to close all openings which may admit air to, or allow gas to escape from, a protected space.
 - .5 Where the volume of free air contained in air receivers in any space is such that, if released in such space in the event of fire, such release of air within that space would seriously affect the efficiency of the fixed fire-extinguishing system, the Administration should require the provision of an additional quantity of fire-extinguishing medium.
 - .6 Means should be provided for automatically giving audible warning of the release of fire-extinguishing medium into any space in which personnel normally work or to which they have access. The alarm should operate for a suitable period before the medium is released.
 - .7 The means of control of any fixed gas fire-extinguishing system should be readily accessible and simple to operate and should be grouped together in as few locations as possible at positions not likely to be cut off by a fire in a protected

space. At each location there should be clear instructions relating to the operation of the system having regard to the safety of personnel.

- .8 Automatic release of fire-extinguishing medium should not be permitted.
- .9 Where the quantity of extinguishing medium is required to protect more than one space, the quantity of medium available need not be more than the largest quantity required for any one space so protected.
- .10 Pressure containers required for the storage of fire-extinguishing medium should be located outside protected spaces in accordance with 7.7.6.1.13.
- .11 Means should be provided for the crew to safely check the quantity of medium in the containers.
- .12 Containers for the storage of fire-extinguishing medium and associated pressure components should be designed to pressure codes of practice to the satisfaction of the Administration having regard to their locations and maximum ambient temperatures expected in service.
- .13 When the fire-extinguishing medium is stored outside a protected space, it should be stored in a room which should be situated in a safe and readily accessible position and should be effectively ventilated. Any entrance to such a storage room should preferably be from the open deck and in any case should be independent of the protected space. Access doors should open outwards, and bulkheads and decks including doors and other means of closing any opening therein, which form the boundaries between such rooms and adjoining enclosed spaces, should be gas tight. Such storage rooms should be treated as control stations.
- .14 Spare parts for the system should be stored on board or at a base port.

7.7.6.2 Carbon dioxide systems

- .1 For cargo spaces, the quantity of carbon dioxide available should, unless otherwise provided, be sufficient to give a minimum volume of free gas equal to 30% of the gross volume of the largest cargo space so protected in the craft.
- .2 For machinery spaces, the quantity of carbon dioxide carried should be sufficient to give a minimum volume of free gas equal to the larger of the following volumes, either:
 - .2.1 40% of the gross volume of the largest machinery space so protected, the volume to exclude that part of the casing above the level at which the horizontal area of the casing is 40% or less of the horizontal area of the space concerned taken midway between the tank top and the lowest part of the casing; or

- .2.2 35% of the gross volume of the largest machinery space protected, including the casing;
- provided that the above-mentioned percentages may be reduced to 35% and 30% respectively for cargo craft of less than 2,000 tons gross tonnage; provided also that if two or more machinery spaces are not entirely separate they should be considered as forming one space.
- .3 For the purpose of this paragraph the volume of free carbon dioxide should be calculated at 0.56 m³/kg.
- .4 For machinery spaces, the fixed piping system should be such that 85% of the gas can be discharged into the space within 2 min.
- .5 Two separate controls should be provided for releasing carbon dioxide into a protected space and to ensure the activation of the alarm. One control should be used to discharge the gas from its storage containers. A second control should be used for opening the valve of the piping which conveys the gas into the protected spaces.
- .6 The two controls should be located inside a release box clearly identified for the particular space. If the box containing the controls is to be locked, a key to the box should be in a break-glass type enclosure conspicuously located adjacent to the box.
- 7.7.7 Control stations, accommodation spaces and service spaces should be provided with portable fire extinguishers of appropriate types. At least five portable extinguishers should be provided, and so positioned as to be readily available for immediate use. In addition, at least one extinguisher suitable for machinery space fires should be positioned outside each machinery space entrance.
- 7.7.8 Fire pumps, and appropriate associated equipment, or alternative effective fire-extinguishing systems should be fitted as follows:
- .1 At least two independently driven pumps should be arranged. Each pump should have at least two thirds the capacity of a bilge pump as determined by 10.3.5 and 10.3.6 but not less than 25 m³/h. Each fire pump should be able to deliver sufficient quantity and pressure of water to simultaneously operate the hydrants as required by .4.
- .2 The arrangement of the pumps should be such that in the event of a fire in any one compartment all the fire pumps will not be put out of action.
- .3 Isolating valves to separate the section of the fire main within the machinery space containing the main fire pump or pumps from the rest of the fire main should be fitted in an easily accessible and tenable position outside the machinery spaces. The fire main should be so arranged that when the isolating valves are shut all the hydrants on the craft,

except those in the machinery space referred to above, can be supplied with water by a fire pump not located in this machinery space through pipes which do not enter this space.

- .4 Hydrants should be arranged so that any location on the craft can be reached by the water jets from two fire hoses from two different hydrants, one of the jets being from a single length of hose. Special category spaces hydrants should be located so that any location within the space can be reached by two water jets from two different hydrants, each jet being supplied from a single length of hose.
- .5 Each fire hose should be of non-perishable material and have a maximum length approved by the Administration. Fire hoses, together with any necessary fittings and tools, should be kept ready for use in conspicuous positions near the hydrants. All fire hoses in interior locations should be connected to the hydrants at all times. One fire hose should be provided for each hydrant as required by .4.
- .6 Each fire hose should be provided with a nozzle of an approved dual purpose type (i.e. spray/jet type) incorporating a shutoff.

7.8 Protection of special category spaces

7.8.1 Structural protection

- .1 Boundaries of special category spaces should be insulated in accordance with tables 7.4-1 and 7.4-2. The standing deck of a special category space need only be insulated on the underside if required.
- .2 Indicators should be provided on the navigating bridge which should indicate when any door leading to or from the special category space is closed.

7.8.2 Fixed fire-extinguishing system*

Each special category space should be fitted with an approved fixed pressure water-spraying system for manual operation which should protect all parts of any deck and vehicle platform in such space, provided that the Administration may permit the use of any other fixed fire-extinguishing system that has been shown by full-scale test in conditions simulating a flowing petrol fire in a special category space to be not less effective in controlling fires likely to occur in such a space.

* Refer to the Recommendation on fixed fire-extinguishing systems for special category spaces, adopted by the Organization by resolution A.123(V).

7.8.3 Patrols and detection

7.8.3.1 A continuous fire patrol should be maintained in special category spaces unless a fixed fire detection and fire alarm system, complying with the requirements of 7.7.2, and a television surveillance system are provided. The fixed fire detection system should be capable of rapidly detecting the onset of fire. The spacing and location of detectors should be tested taking into account the effects of ventilation and other relevant factors.

7.8.3.2 Manually operated call points should be provided as necessary throughout the special category spaces and one should be placed close to each exit from such spaces.

7.8.4 Fire-extinguishing equipment

7.8.4.1 There should be provided in each special category space:

.1 at least three water fog applicators;

.2 one portable foam applicator unit consisting of an air-foam nozzle of an inductor type capable of being connected to the fire main by a fire hose, together with a portable tank containing 20 l of foam-making liquid and one spare tank. The nozzle should be capable of producing effective foam suitable for extinguishing an oil fire of at least 1.5 m³/min. At least two portable foam applicator units should be available in the craft for use in such space; and

.3 portable fire extinguishers should be located so that no point in the space is more than approximately 15 m walking distance from an extinguisher, provided that at least one portable extinguisher is located at each access to such space.

7.8.5 Ventilation system

7.8.5.1 There should be provided an effective power ventilation system for the special category spaces sufficient to give at least 10 air changes per hour while navigating and 20 air changes per hour at the quayside during vehicle loading and unloading operations. The system for such spaces should be entirely separated from other ventilation systems and should be operating at all times when vehicles are in such spaces. Ventilation ducts serving special category spaces capable of being effectively sealed should be separated for each such space. The system should be capable of being controlled from a position outside such spaces.

7.8.5.2 The ventilation should be such as to prevent air stratification and the formation of air pockets.

7.8.5.3 Means should be provided to indicate in the operating compartment any loss or reduction of the required ventilating capacity.

7.8.5.4 Arrangements should be provided to permit a rapid shutdown and effective closure of the ventilation system in case of fire, taking into account the weather and sea conditions.

- 7.8.5.5 Ventilation ducts, including dampers should be made of steel or other equivalent material.
- 7.8.6 Scuppers, bilge pumping and drainage
- 7.8.6.1 In view of the serious loss of stability which could arise due to large quantities of water accumulating on the deck or decks consequent to the operation of the fixed pressure water-spraying system, scuppers should be fitted so as to ensure that such water is rapidly discharged directly overboard. Alternatively, pumping and drainage facilities should be provided additional to the requirements of chapter 10.
- 7.8.7 Precautions against ignition of flammable vapours
- 7.8.7.1 On any deck or platform, if fitted, on which vehicles are carried and on which explosive vapours might be expected to accumulate, except platforms with openings of sufficient size permitting penetration of petrol gases downwards, equipment which may constitute a source of ignition of flammable vapours and, in particular, electrical equipment and wiring, should be installed at least 450 mm above the deck or platform. Electrical equipment installed at more than 450 mm above the deck or platform should be of a type so enclosed and protected as to prevent the escape of sparks. However, if the installation of electrical equipment and wiring at less than 450 mm above the deck or platform is necessary for the safe operation of the craft, such electrical equipment and wiring may be installed provided that it is of a type approved for use in an explosive petrol and air mixture.
- 7.8.7.2 Electrical equipment and wiring, if installed in an exhaust ventilation duct, should be of a type approved for use in explosive petrol and air mixtures and the outlet from any exhaust duct should be sited in a safe position, having regard to other possible sources of ignition.
- 7.9 Miscellaneous
- 7.9.1 There should be permanently exhibited, for the guidance of the master and officers of the craft, fire control plans showing clearly for each deck the following positions: the control stations, the sections of the craft which are enclosed by fire-resisting divisions together with particulars of the fire alarms, fire detection systems, the sprinkler installations, the fixed and portable fire-extinguishing appliances, the means of access to the various compartments and decks in the craft, the ventilating system including particulars of the master fan controls, the positions of dampers and identification numbers of the ventilating fans serving each section of the craft, the location of the international shore connection, if fitted, and the position of all means of control referred to in 7.5.3, 7.6.2, 7.7.1 and 7.7.4. The text of such plans* should be in the official language of the flag State.

* Refer to Graphical symbols for fire control plans adopted by the Organization by resolution A.654(16).

However, if the language is neither English nor French, a translation into one of those languages should be included.

- 7.9.2 A duplicate set of fire control plans or a booklet containing such plans should be permanently stored in a prominently marked weathertight enclosure outside the deckhouse for the assistance of shore side fire-fighting personnel.
- 7.9.3 Openings in fire-resisting divisions
- 7.9.3.1 Except for the hatches between cargo, special category, store, and baggage spaces and between such spaces and the weather decks, all openings should be provided with permanently attached means of closing which should be at least as effective for resisting fires as the divisions in which they are fitted.
- 7.9.3.2 It should be possible for each door to be opened and closed from each side of the bulkhead by one person only.
- 7.9.3.3 Fire doors bounding major fire hazard areas and stairway enclosures should satisfy the following requirements:
- .1 The doors should be self-closing and be capable of closing with an angle of inclination of up to 3.5° opposing closure, and should have an approximately uniform rate of closure of no more than 40 s and no less than 10 s with the craft in the upright position.
 - .2 Remote-controlled sliding or power-operated doors should be equipped with an alarm that sounds at least 5 s but no more than 10 s before the door begins to move and continue sounding until the door is completely closed. Doors designed to reopen upon contacting an object in their paths should reopen sufficiently to allow a clear passage of at least 0.75 m, but no more than 1 m.
 - .3 All doors should be capable of remote and automatic release from a continuously manned central control station, either simultaneously or in groups, and also individually from a position at both sides of the door. Indication should be provided at the fire control panel in the continuously manned control station whether each of the remote-controlled doors is closed. The release mechanism should be so designed that the door will automatically close in the event of disruption of the control system or central power supply. Release switches should have an on-off function to prevent automatic resetting of the system. Hold-back hooks not subject to control station release should be prohibited.
 - .4 Local power accumulators for power-operated doors should be provided in the immediate vicinity of the doors to enable the doors to be operated at least ten times (fully opened and closed) using the local controls.

- .5 Double-leaf doors equipped with a latch necessary to their fire integrity should have a latch that is automatically activated by the operation of the doors when released by the system.
 - .6 Doors giving direct access to special category spaces which are power-operated and automatically closed need not be equipped with alarms and remote-release mechanisms required in .2 and .3.
- 7.9.3.4 The requirements for integrity of fire-resisting divisions of the outer boundaries facing open spaces of a craft should not apply to glass partitions, windows and sidescuttles. Similarly, the requirements for integrity of fire-resisting divisions facing open spaces should not apply to exterior doors in superstructures and deckhouses.
- 7.10 Fireman's outfits
- 7.10.1 All craft other than category A passenger craft should carry at least two fireman's outfits complying with the requirements of 7.10.3.
- 7.10.1.1 In addition, there should be provided in category B passenger craft for every 80 m, or part thereof, of the aggregate of the length of all passenger spaces and service spaces on the deck which carries such spaces or, if there is more than one such deck, on the deck which has the largest aggregate of such length, two fireman's outfits and two sets of personal equipment, each set comprising the items stipulated in 7.10.3.1.1 to 7.10.3.1.3;
- 7.10.1.2 In category B passenger craft, for each pair of breathing apparatus there should be provided one water fog applicator which should be stored adjacent to such apparatus.
- 7.10.1.3 The Administration may require additional sets of personal equipment and breathing apparatus, having due regard to the size and type of the craft.
- 7.10.2 The fireman's outfits or sets of personal equipment should be so stored as to be easily accessible and ready for use and, where more than one fireman's outfit or more than one set of personal equipment is carried, they should be stored in widely separated positions. In passenger craft, at least two fireman's outfits and one set of personal equipment should be available at any one control station.
- 7.10.3 A fireman's outfit should consist of:
- .1 Personal equipment comprising:
 - .1.1 protective clothing of material to protect the skin from the heat radiating from the fire and from burns and scalding by steam or gases. The outer surface should be water-resistant;

- .1.2 boots and gloves of rubber or other electrically non-conductive material;
 - .1.3 a rigid helmet providing effective protection against impact;
 - .1.4 an electric safety lamp (hand lantern) of an approved type with a minimum burning period of 3 h; and
 - .1.5 an axe.
- .2 A breathing apparatus of an approved type which may be either:
- .2.1 a smoke helmet or smoke mask which should be provided with a suitable air pump and a length of air hose sufficient to reach from the open deck, well clear of hatch or doorway, to any part of the holds or machinery spaces. If, in order to comply with this subparagraph, an air hose exceeding 36 m in length would be necessary, a self-contained breathing apparatus should be substituted or provided in addition as determined by the Administration; or
 - .2.2 a self-contained compressed-air-operated breathing apparatus, the volume of air contained in the cylinders of which should be at least 1,200 l, or other self-contained breathing apparatus which should be capable of functioning for at least 30 min. A number of spare charges, suitable for use with the apparatus provided, should be available on board.
- .3 For each breathing apparatus, a fireproof lifeline of sufficient length and strength should be provided capable of being attached by means of a snaphook to the harness of the apparatus or to a separate belt in order to prevent the breathing apparatus becoming detached when the lifeline is operated.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

7.11 Arrangement

- 7.11.1 For category B craft, the public spaces should be divided into zones according to the following:
- .1 The craft should be divided into at least two zones. The mean length of each zone should not exceed 40 m.
 - .2 For the occupants of each zone there should be an alternative safe area to which it is possible to escape in case of fire. The alternative safe area should be separated from other passenger zones by smoke-tight divisions of non-combustible materials or fire-restricting materials extending from deck to

deck. The alternative safe area can be another passenger zone provided the additional number of passengers may be accommodated in an emergency.

- .3 The alternative safe area should, as far as practicable, be located adjacent to the passenger zone it is intended to serve. There should be at least two exits from each passenger zone, located as far away from each other as possible, leading to the alternative safe area. Escape routes should be provided to enable all passengers and crew to be safely evacuated from the alternative safe area.

7.11.2 Category A craft need not be divided into zones.

7.11.3 Control stations, life-saving appliance stowage positions, escape routes and places of embarkation into survival craft should not, as far as practicable, be located adjacent to any major or moderate fire hazard areas.

7.12 Ventilation

The ventilation fans of each zone in the accommodation spaces should also be capable of being independently controlled from a continuously manned control station.

7.13 Fixed sprinkler system

7.13.1 Public spaces and service spaces, storage rooms other than those containing flammable liquids, and similar spaces should be protected by a fixed sprinkler system meeting a standard developed by the Organization. Manually operated sprinkler systems should be divided into sections of appropriate size, and the valves for each section, start of sprinkler pump(s) and alarms should be operable from two spaces separated as widely as possible, one of which should be a continuously manned control station. In category B craft, no section of the system should serve more than one of the zones required in 7.11.

7.13.2 Plans of the system should be displayed at each operating station. Suitable arrangements should be made for the drainage of water discharged when the system is activated.

PART C – REQUIREMENTS FOR CARGO CRAFT

7.14 Control station

Control stations, life-saving appliances stowage positions, escape routes and places of embarkation into survival craft should be located adjacent to crew accommodation areas.

7.15 Cargo spaces

Cargo spaces, except open deck areas or refrigerated holds, should be provided with an approved automatic smoke detection system complying with 7.7.2 to indicate at the control station the location of outbreak of a fire in all normal operating conditions of the installations and should be protected by an approved fixed quick acting fire-extinguishing system complying with 7.7.6.1 operable from the control station.

CHAPTER 8 - LIFE-SAVING APPLIANCES AND ARRANGEMENTS

8.1 General and definitions

- 8.1.1 Life-saving appliances and arrangements should enable abandonment of the craft in accordance with the requirements of 4.7 and 4.8.
- 8.1.2 Except where otherwise provided in this Code, the life-saving appliances and arrangements required by this chapter should meet the detailed specifications set out in part C of chapter III of the Convention and be approved by the Administration.
- 8.1.3 Before giving approval to life-saving appliances and arrangements, the Administration should ensure that such life-saving appliances and arrangements:
- .1 are tested to confirm that they comply with the requirements of this chapter, in accordance with the recommendations of the Organization;* or
 - .2 have successfully undergone, to the satisfaction of the Administration, tests which are substantially equivalent to those specified in those recommendations.
- 8.1.4 Before giving approval to novel life-saving appliances or arrangements, the Administration should ensure that such appliances or arrangements:
- .1 provide safety standards at least equivalent to the requirements of this chapter and have been evaluated and tested in accordance with the recommendations of the Organization;** or
 - .2 have successfully undergone, to the satisfaction of the Administration, evaluation and tests which are substantially equivalent to those recommendations.
- 8.1.5 Before accepting life-saving appliances and arrangements that have not been previously approved by the Administration, the Administration should be satisfied that life-saving appliances and arrangements comply with the requirements of this chapter.
- 8.1.6 Except where otherwise provided in this Code, life-saving appliances required by this chapter for which detailed specifications are not included in part C of chapter III of the Convention should be to the satisfaction of the Administration.

* Refer to the Recommendation on testing of life-saving appliances, adopted by the Organization by resolution A.689(17).

** Refer to the Code of practice for the evaluation, testing and acceptance of prototype novel life-saving appliances and arrangements, adopted by the Organization by resolution A.520(13).

- 8.1.7 The Administration should require life-saving appliances to be subjected to such production tests as are necessary to ensure that the life-saving appliances are manufactured to the same standard as the approved prototype.
- 8.1.8 Procedures adopted by the Administration for approval should also include the conditions whereby approval would continue or would be withdrawn.
- 8.1.9 The Administration should determine the period of acceptability of life-saving appliances which are subject to deterioration with age. Such life-saving appliances should be marked with a means for determining their age or the date by which they should be replaced.
- 8.1.10 For the purposes of this chapter, unless expressly provided otherwise:
- .1 "Detection" is the determination of the location of survivors or survival craft.
 - .2 "Embarkation ladder" is the ladder provided at survival craft embarkation stations to permit safe access to survival craft after launching.
 - .3 "Embarkation station" is the place from which a survival craft is boarded. An embarkation station may also serve as a muster station, provided there is sufficient room, and the muster station activities can safely take place there.
 - .4 "Float-free launching" is that method of launching a survival craft whereby the craft is automatically released from a sinking craft and is ready for use.
 - .5 "Free-fall launching" is that method of launching a survival craft whereby the craft with its complement of persons and equipment on board is released and allowed to fall into the sea without any restraining apparatus.
 - .6 "Immersion suit" is a protective suit which reduces the body heat-loss of a person wearing it in cold water.
 - .7 "Inflatable appliance" is an appliance which depends upon non-rigid, gas-filled chambers for buoyancy and which is normally kept uninflated until ready for use.
 - .8 "Inflated appliance" is an appliance which depends upon non-rigid, gas-filled chambers for buoyancy and which is normally kept inflated and ready for use at all times.
 - .9 "Launching appliance or arrangement" is a means of transferring a survival craft or rescue boat from its stowed position safely to the water.
 - .10 "Marine evacuation system"(MES) is an appliance designed to rapidly transfer large number of persons from an embarkation station by means of a passage to a floating platform for subsequent embarkation into associated survival craft or directly into associated survival craft.

- .11 "Novel life-saving appliance or arrangement" is a life-saving appliance or arrangement which embodies new features not fully covered by the provisions of this chapter but which provides an equal or higher standard of safety.
- .12 "Rescue boat" is a boat designed to assist and rescue persons in distress and to marshal survival craft.
- .13 "Retrieval" is the safe recovery of survivors.
- .14 "Retro-reflective material" is a material which reflects in the opposite direction a beam of light directed on it.
- .15 "Survival craft" is a craft capable of sustaining the lives of persons in distress from the time of abandoning the craft.
- .16 "Thermal protective aid" is a bag or suit of waterproof material with low thermal conductance.

8.2 Communications

8.2.1 Craft should be provided with the following radio life-saving appliances:

- .1 at least three two-way VHF radiotelephone apparatus should be provided on every passenger high speed craft and on every cargo high speed craft of 500 tons gross tonnage and upwards. Such apparatus should conform to performance standards not inferior to those adopted by the Organization*;
- .2 at least one radar transponder should be carried on each side of every passenger high speed craft and of every cargo high speed craft of 500 tons gross tonnage and upwards. Such radar transponders should conform to performance standards not inferior to those adopted by the Organization.** The radar transponders should be stowed in such locations that they can be rapidly placed in any one of the liferafts. Alternatively, one radar transponder should be stowed in each survival craft.

* Refer to the Recommendation on performance standards for survival craft portable two-way VHF radiotelephone apparatus, adopted by the Organization by resolution A.605(15).

** Refer to the Recommendation on performance standards for survival craft radar transponders for use in search and rescue operations, adopted by the Organization by resolution A.697(17).

- 8.2.2 Craft should be provided with the following on-board communications and alarm systems:
- .1 an emergency means comprising either fixed or portable equipment or both for two-way communications between emergency control stations, muster and embarkation stations and strategic positions on board; and
 - .2 a general emergency alarm system complying with the requirements of regulation III/50 of the Convention to be used for summoning passengers and crew to muster stations and to initiate the actions included in the muster list. The system should be supplemented by either a public address system or other suitable means of communication. The systems should be operable from the operating compartment.

8.2.3 Signalling equipment

- 8.2.3.1 All craft should be provided with a portable daylight signalling lamp which is available for use in the operating compartment at all times and which is not dependent on the craft's main source of electrical power.
- 8.2.3.2 Craft should be provided with not less than 12 rocket parachute flares, complying with the requirements of regulation III/35 of the Convention, stowed in or near the operating compartment.

8.3 Personal life-saving appliances

- 8.3.1 Where passengers or crew have access to exposed decks under normal operating conditions, at least one lifebuoy on each side of the craft capable of quick release from the control compartment and from a position at or near where it is stowed, should be provided with a self-igniting light and a self-activating smoke signal. The positioning and securing arrangements of the self-activating smoke signal should be such that it cannot be released or activated solely by the accelerations produced by collisions or groundings.
- 8.3.2 At least one lifebuoy should be provided adjacent to each normal exit from the craft and on each open deck to which passengers and crew have access, subject to a minimum of two being installed.
- 8.3.3 Lifebuoys fitted adjacent to each normal exit from the craft should be fitted with buoyant lines of at least 30 m in length.
- 8.3.4 Not less than half the total number of lifebuoys should be fitted with self-igniting lights. However, the lifebuoys provided with self-igniting lights should not include those provided with lines in accordance with 8.3.3.
- 8.3.5 A lifejacket complying with the requirements of regulation III/32.1 or III/32.2 of the Convention should be provided for every person on board the craft and, in addition:
- .1 a number of lifejackets suitable for children equal to at least 10% of the number of passengers on board should be provided or such greater number as may be required to provide a lifejacket for each child;

- .2 every passenger craft should carry lifejackets for not less than 5% of the total number of persons on board. These lifejackets should be stowed in conspicuous places on deck or at muster stations;
 - .3 a sufficient number of lifejackets should be carried for persons on watch and for use at remotely located survival craft and rescue boat stations; and
 - .4 all lifejackets should be fitted with a light, which complies with the requirements of regulation III/32.3 of the Convention.
- 8.3.6 Lifejackets should be so placed as to be readily accessible and their positions should be clearly indicated.
- 8.3.7 An immersion suit, of an appropriate size, complying with the requirements of regulation III/33 of the Convention should be provided for every person assigned to crew the rescue boat.
- 8.3.8 An immersion suit or anti-exposure suit should be provided for each member of the crew assigned, in the muster list, to duties in an MES party for embarking passengers into survival craft. These immersion suits or anti-exposure suits need not be required if the craft is constantly engaged on voyages in warm climates where, in the opinion of the Administration, such suits are unnecessary.
- 8.4 Muster list, emergency instructions and manuals
- 8.4.1 Clear instructions to be followed in the event of an emergency should be provided for each person on board.
- 8.4.2 Muster lists complying with the requirements of regulation III/53 of the Convention should be exhibited in conspicuous places throughout the craft including the control compartment, engine-room and crew accommodation spaces.
- 8.4.3 Illustrations and instructions in appropriate languages should be posted in public spaces and be conspicuously displayed at muster stations, at other passenger spaces and near each seat to inform passengers of:
- .1 their muster station;
 - .2 the essential actions they must take in an emergency;
 - .3 the method of donning lifejackets.
- 8.4.4 Every passenger craft should have passenger muster stations:
- .1 in the vicinity of, and which provide ready access for all the passengers to, the embarkation stations unless in the same location; and
 - .2 which have ample room for the marshalling and instruction of passengers.
- 8.4.5 A training manual complying with the requirements of 18.2.3 should be provided in each crew messroom and recreation room.

8.5 Operating instructions

8.5.1 Poster or signs should be provided on or in the vicinity of survival craft and their launching controls and should:

- .1 illustrate the purpose of controls and the procedures for operating the appliance and give relevant instructions and warnings;
- .2 be easily seen under emergency lighting conditions;
- .3 use symbols in accordance with the recommendations of the Organization*.

8.6 Survival craft stowage

- 8.6.1 Survival craft should be securely stowed outside and as close as possible to the passenger accommodation and embarkation stations. The stowage should be such that each survival craft can be safely launched in a simple manner and remain secured to the craft during and subsequent to the launching procedure. The length of the securing lines and the arrangements of the bowsing lines should be such as to maintain the survival craft suitably positioned for embarkation. The Administrations may permit the use of adjustable securing and/or bowsing lines at exits where more than one survival craft is used. The securing arrangements for all securing and bowsing lines should be of sufficient strength to hold the survival craft in position during the evacuation process.
- 8.6.2 Survival craft should be so stowed as to permit release from their securing arrangements at or near to their stowage position on the craft and from a position at or near to the operating compartment.
- 8.6.3 So far as is practicable, survival craft should be distributed in such a manner that there is an equal capacity on both sides of the craft.
- 8.6.4 The launching procedure for inflatable liferafts should, where practicable, initiate inflation. Where it is not practicable to provide automatic inflation of liferafts (for example, when the liferafts are associated with an MES), the arrangement should be such that the craft can be evacuated within the time specified in 4.8.1.
- 8.6.5 Survival craft should be capable of being launched and then boarded from the designated embarkation stations in all operational conditions and also in all conditions of flooding after receiving damage to the extent prescribed in chapter 2.
- 8.6.6 Survival craft launching stations should be in such positions as to ensure safe launching having particular regard to clearance from the propeller or waterjet and steeply overhanging portions of the hull.

* Refer to Symbols related to life-saving appliances and arrangements, adopted by the Organization by resolution A.760(18).

- 8.6.7 During preparation and launching, the survival craft and the area of water into which it is to be launched should be adequately illuminated by the lighting supplied from the main and emergency sources of electrical power required by chapter 12.
- 8.6.8 Means should be available to prevent any discharge of water on to survival craft when launched.
- 8.6.9 Each survival craft should be stowed:
- .1 so that neither the survival craft nor its stowage arrangements will interfere with the operation of any other survival craft or rescue boat at any other launching station;
 - .2 in a state of continuous readiness;
 - .3 fully equipped; and
 - .4 as far as practicable, in a secure and sheltered position and protected from damage by fire and explosion.
- 8.6.10 Every liferaft should be stowed with its painter permanently attached to the craft and with a float free arrangement complying with the requirements of regulation III/38.6 of the Convention so that, as far as practicable, the liferaft floats free and, if inflatable, inflates automatically should the high speed craft sink.
- 8.6.11 Rescue boats should be stowed:
- .1 in a state of continuous readiness for launching in not more than 5 min;
 - .2 in a position suitable for launching and recovery; and
 - .3 so that neither the rescue boat nor its stowage arrangements will interfere with the operation of survival craft at any other launching station.
- 8.6.12 Rescue boats and survival craft should be secured and fastened to the deck so that they at least withstand the loads likely to arise due to a defined horizontal collision load for the actual craft, and the vertical design load at the stowage position.
- 8.7 Survival craft and rescue boat embarkation and recovery arrangements
- 8.7.1 Embarkation stations should be readily accessible from accommodation and work areas. If the designated muster stations are other than the passenger spaces, the muster stations should be readily accessible from the passenger spaces, and the embarkation stations should be readily accessible from the muster stations.
- 8.7.2 Evacuation routes, exits and embarkation points should comply with the requirements of 4.7.

- 8.7.3 Alleyways, stairways and exits giving access to the muster and embarkation stations should be adequately illuminated by lighting supplied from the main and emergency source of electrical power required by chapter 12.
- 8.7.4 Where davit-launched survival craft are not fitted, MES or equivalent means of evacuation should be provided in order to avoid persons entering the water to board survival craft. Such MES or equivalent means of evacuation should be so designed as to enable persons to board survival craft in all operational conditions and also in all conditions of flooding after receiving damage to the extent prescribed in chapter 2.
- 8.7.5 Subject to survival craft and rescue boat embarkation arrangements being effective within the environmental conditions in which the craft is permitted to operate and in all undamaged and prescribed damage conditions of trim and heel, where the freeboard between the intended embarkation position and the waterline is not more than 1.5 m, the Administration may accept a system where persons board liferafts directly.
- 8.7.6 Rescue boat embarkation arrangements should be such that the rescue boat can be boarded and launched directly from the stowed position and recovered rapidly when loaded with its full complement of persons and equipment.
- 8.7.7 A safety knife should be provided at each MES embarkation station.
- 8.8 Line-throwing appliance
- A line-throwing appliance complying with the requirements of regulation III/49 of the Convention should be provided.
- 8.9 Operational readiness, maintenance and inspections
- 8.9.1 Operational readiness
- Before the craft leaves port and at all times during the voyage, all life-saving appliances should be in working order and ready for immediate use.
- 8.9.2 Maintenance
- .1 Instructions for on-board maintenance of life-saving appliances complying with the requirements of regulation III/52 of the Convention should be provided and maintenance should be carried out accordingly.
- .2 The Administration may accept, in lieu of the instructions required by .1, a shipboard planned maintenance programme which includes the requirements of regulation III/52 of the Convention.

8.9.3 Maintenance of falls

Falls used in launching should be turned end for end at intervals of not more than 30 months and be renewed when necessary due to deterioration of the falls or at intervals of not more than five years, whichever is the earlier.

8.9.4 Spares and repair equipment

Spares and repair equipment should be provided for life-saving appliances and their components which are subject to excessive wear or consumption and need to be replaced regularly.

8.9.5 Weekly inspection

The following tests and inspections should be carried out weekly:

- .1 all survival craft, rescue boats and launching appliances should be visually inspected to ensure that they are ready for use;
- .2 all engines in rescue boats should be run ahead and astern for a total period of not less than 3 min provided the ambient temperature is above the minimum temperature required for starting the engine;
- .3 the general emergency alarm system should be tested.

8.9.6 Monthly inspections

Inspection of the life-saving appliances, including survival craft equipment should be carried out monthly using the checklist required by regulation III/52.1 of the Convention to ensure that they are complete and in good order. A report of the inspection should be entered in the log-book.

8.9.7 Servicing of inflatable liferafts, inflatable lifejackets and inflated rescue boats

- .1 Every inflatable liferaft, inflatable lifejacket and MES should be serviced:
 - .1.1 at intervals not exceeding 12 months, provided where in any case this is impracticable, the Administration may extend this period by one month;
 - .1.2 at an approved servicing station which is competent to service them, maintains proper servicing facilities and uses only properly trained personnel.*

* Refer to the Recommendation on conditions for the approval of servicing stations for inflatable liferafts, adopted by the Organization by resolution A.761(18).

- 8.9.8 All repairs and maintenance of inflated rescue boats should be carried out in accordance with the manufacturer's instructions. Emergency repairs may be carried out on board the craft; however, permanent repairs should be effected at an approved servicing station.
- 8.9.9 Periodic servicing of hydrostatic release units
- Hydrostatic release units should be serviced:
- .1 at intervals not exceeding 12 months, provided where in any case this is impracticable, the Administration may extend this period by one month;
 - .2 at a servicing station which is competent to service them, maintains proper servicing facilities and uses only properly trained personnel.
- 8.10 Survival craft and rescue boats
- 8.10.1 All craft should carry:
- .1 survival craft with sufficient capacity as will accommodate not less than 100% of the total number of persons the craft is certified to carry, subject to a minimum of two such survival craft being carried;
 - .2 in addition, survival craft with sufficient aggregate capacity to accommodate not less than 10% of the total number of persons the craft is certified to carry;
 - .3 in the event of any one survival craft being lost or rendered unserviceable, sufficient survival craft to accommodate the total number of persons the craft is certified to carry;
 - .4 at least one rescue boat for retrieving persons from the water, but not less than one such boat on each side when the craft is certified to carry more than 450 passengers;
 - .5 craft of less than 20 m in length may be exempted from carrying a rescue boat, provided the craft meets all of the following requirements:
 - .5.1 the craft is arranged to allow a helpless person to be recovered from the water;
 - .5.2 recovery of the helpless person can be observed from the navigating bridge; and
 - .5.3 the craft is sufficiently manoeuvrable to close and recover persons in the worst intended conditions.

- .6 notwithstanding provisions of .4 and .5 above, craft should carry sufficient rescue boats to ensure that, in providing for abandonment by the total number of persons the craft is certified to carry:
 - .6.1 not more than nine of the liferafts provided in accordance with 8.10.1.1 are marshalled by each rescue boat; or
 - .6.2 if the Administration is satisfied that the rescue boats are capable of towing a pair of such liferafts simultaneously, not more than 12 of the liferafts provided in accordance with 8.10.1.1 are marshalled by each rescue boat; and
 - .6.3 the craft can be evacuated within the time specified in 4.8.

- 8.10.2 Where the Administration considers it appropriate, in view of the sheltered nature of the voyages and the suitable climatic conditions of the intended area of operations, the Administration may permit the use of open reversible inflatable liferafts complying with annex 10 on category A craft as an alternative to liferafts complying with regulation III/39 or III/40 of the Convention.

CHAPTER 9 - MACHINERY

PART A - GENERAL

9.1 General

9.1.1 The machinery, associated piping systems and fittings relating to main machinery and auxiliary power units should be of a design and construction adequate for the service for which they are intended and should be so installed and protected as to reduce to a minimum any danger to persons on board, due regard being paid to moving parts, hot surfaces and other hazards. The design should have regard to materials used in construction, the purpose for which the equipment is intended, the working conditions to which it will be subjected and the environmental conditions on board.

9.1.2 All surfaces with temperatures exceeding 220°C where impingement of flammable liquids may occur as a result of a system failure should be insulated. The insulation should be impervious to flammable liquids and vapours.

9.1.3 Special consideration should be given to the reliability of single essential propulsion components and may require a separate source of propulsion power sufficient to give the craft a navigable speed, especially in the case of unconventional arrangements.

9.1.4 Means should be provided whereby normal operation of propulsion machinery can be sustained or restored even though one of the essential auxiliaries becomes inoperative. Special consideration should be given to the malfunctioning of:

- .1 a generating set which serves as a main source of electrical power;
- .2 the fuel oil supply systems for engines;
- .3 the sources of lubricating oil pressure;
- .4 the sources of water pressure;
- .5 an air compressor and receiver for starting or control purposes;
- .6 the hydraulic, pneumatic or electrical means for control in main propulsion machinery including controllable pitch propellers.

However, having regard to overall safety considerations, a partial reduction in propulsion capability from normal operation may be accepted.

9.1.5 Means should be provided to ensure that the machinery can be brought into operation from the dead craft condition without external aid.

- 9.1.6 All parts of machinery, hydraulic, pneumatic and other systems and their associated fittings which are under internal pressure should be subjected to appropriate tests including a pressure test before being put into service for the first time.
- 9.1.7 Provision should be made to facilitate cleaning, inspection and maintenance of main propulsion and auxiliary machinery including boilers and pressure vessels.
- 9.1.8 The reliability of machinery installed in the craft should be adequate for its intended purpose.
- 9.1.9 The Administration may accept machinery which does not show detailed compliance with the Code where it has been used satisfactorily in a similar application, provided that it is satisfied:
- .1 that the design, construction, testing, installation and prescribed maintenance are together adequate for its use in a marine environment; and
 - .2 that an equivalent level of safety will be achieved.
- 9.1.10 A failure mode and effect analysis should include machinery systems and their associated controls.
- 9.1.11 Such information as is necessary to ensure that machinery can be installed correctly regarding such factors as operating conditions and limitations should be made available by the manufacturers.
- 9.1.12 Main propulsion machinery and all auxiliary machinery essential to the propulsion and the safety of the craft should, as fitted in the craft, be designed to operate when the craft is upright and when inclined at any angle of list up to and including 15° either way under static conditions and 22.5° under dynamic conditions (rolling) either way and simultaneously inclined by dynamically (pitching) 7.5° by bow or stern. The Administration may permit deviation from these angles, taking into consideration the type, size and service conditions of the craft.
- 9.1.13 All boilers, and pressure vessels and associated piping systems should be of a design and construction adequate for the purpose intended and should be so installed and protected as to minimize danger to persons on board. In particular, attention should be paid to the materials used in the construction and the working pressures and temperatures at which the item will operate and the need to provide an adequate margin of safety over the stresses normally produced in service. Every boiler, pressure vessel and associated piping systems should be fitted with adequate means to prevent over-pressures in service and be subjected to a hydraulic test before being put into service, and where appropriate at subsequent specified intervals, to a pressure suitably in excess of the working pressure.
- 9.1.14 Arrangements should be provided to ensure that, in the event of failure in any liquid cooling system, it is rapidly detected and alarmed (visual and audible) and means instituted to minimize the effects of such failures on machinery serviced by the system.

9.2 Engine (general)

- 9.2.1 The engines should be fitted with adequate safety monitoring and control devices in respect of speed, temperature, pressure and other operational functions. Control of the machinery should be from the craft's operating compartment. Category B craft and cargo craft should be provided with additional machinery controls in or close to the machinery space. The machinery installation should be suitable for operation as in an unmanned machinery space* including automatic fire detection system, bilge alarm system, remote machinery instrumentation and alarm system. Where the space is continuously manned, this requirement may be varied in accordance with the requirements of the Administration.
- 9.2.2 The engines should be protected against overspeed, loss of lubricating oil pressure, loss of cooling medium, high temperature, malfunction of moving parts and overload. Safety devices should not cause complete engine shutdown without prior warning, except in cases where there is a risk of complete breakdown or explosion. Such safety devices should be capable of being tested.
- 9.2.3 At least two independent means of stopping the engines quickly from the operating compartment under any operating conditions should be available. Duplication of the actuator fitted to the engine should not be required.
- 9.2.4 The major components of the engine should have adequate strength to withstand the thermal and dynamic conditions of normal operation. The engine should not be damaged by a limited operation at a speed or at temperatures exceeding the normal values but within the range of the protective devices.
- 9.2.5 The design of the engine should be such as to minimize the risk of fire or explosion and to enable compliance with the fire precaution requirements of chapter 7.
- 9.2.6 Provision should be made to drain all excess fuel and oil to a safe position so as to avoid a fire hazard.
- 9.2.7 Provision should be made to ensure that, whenever practical, the failure of systems driven by the engine should not unduly affect the integrity of the major components.
- 9.2.8 The ventilation arrangements in the machinery spaces should be adequate under all envisaged operating conditions. Where appropriate, arrangements should ensure that enclosed engine compartments are forcibly ventilated to the atmosphere before the engine can be started.
- 9.2.9 Any engines should be so installed as to avoid excessive vibration within the craft.

* Refer to part E of chapter II-1 of the Convention.

9.3 Gas turbines

- 9.3.1 Gas turbines should be designed to operate in the marine environment and should be free from surge or dangerous instability throughout its operating range up to the maximum steady speed approved for use. The turbine installation should be arranged to ensure that the turbine cannot be continuously operated within any speed range where excessive vibration, stalling, or surging may be encountered.
- 9.3.2 The gas turbines should be designed and installed such that any reasonably probable shedding of compressor or turbine blades will not endanger the craft, other machinery, occupants of the craft or any other persons.
- 9.3.3 Requirements of 9.2.6 should apply to gas turbines in respect of fuel which might reach the interior of the jet pipe or exhaust system after a false start or after stopping.
- 9.3.4 Turbines should be safeguarded as far as practicable against the possibility of damage by ingestion of contaminants from the operating environment. Information regarding the recommended maximum concentration of contamination should be made available. Provision should be made for preventing the accumulation of salt deposits on the compressors and turbines and, if necessary, for preventing the air intake from icing.
- 9.3.5 In the event of a failure of a shaft or weak link, the broken end should not hazard the occupants of the craft, either directly or by damaging the craft or its systems. Where necessary, guards may be fitted to achieve compliance with these requirements.
- 9.3.6 Each engine should be provided with an emergency overspeed shutdown device connected, where possible, directly to each rotor shaft.
- 9.3.7 Where an acoustic enclosure is fitted which completely surrounds the gas generator and the high pressure oil pipes, a fire detection and extinguishing system should be provided for the acoustic enclosure.
- 9.3.8 Details of the manufacturers' proposed automatic safety devices to guard against hazardous conditions arising in the event of malfunction in the turbine installation should be provided together with the failure mode and effect analysis.
- 9.3.9 The manufacturers should demonstrate the soundness of the casings. Intercoolers and heat exchangers should be hydraulically tested on each side separately.

9.4 Diesel engines for main propulsion and essential auxiliaries

- 9.4.1 Any main diesel propulsion system should have satisfactory torsional vibration and other vibrational characteristics verified by individual and combined torsional and other vibration analyses for the system and its components from power unit through to propulsor.

- 9.4.2 All external high pressure fuel delivery lines between the high pressure fuel pumps and fuel nozzles should be protected with a jacketed tubing system capable of containing fuel from a high pressure line failure. The jacketed tubing system should include a means for collection of leakages and arrangements should be provided for an alarm to be given of a fuel line failure.
- 9.4.3 Engines of a cylinder diameter of 200 mm or a crankcase volume of 0.6 m³ and above should be provided with crankcase explosion relief valves of an approved type with sufficient relief area. The relief valves should be arranged with means to ensure that discharge from them is directed so as to minimize the possibility of injury to personnel.
- 9.4.4 The lubrication system and arrangements should be efficient at all running speeds, due consideration being given to the need to maintain suction and avoid the spillage of oil in all conditions of list and trim and degree of motion of the craft.
- 9.4.5 Arrangements should be provided to ensure that visual and audible alarms are activated in the event of either lubricating oil pressure or lubricating oil level falling below a safe level, considering the rate of circulation of oil in the engine. Such events should also cause automatic reduction of engine speed to a safe level, but automatic shutdown should only be activated by conditions leading to a complete breakdown, fire or explosion.
- 9.4.6 Where diesel engines are arranged to be started, reversed or controlled by compressed air, the arrangement of the air compressor, air receiver and air starting system should be such as to minimize the risk of fire or explosion.
- 9.5 Transmissions
- 9.5.1 The transmission should be of adequate strength and stiffness to enable it to withstand the most adverse combination of the loads expected in service without exceeding acceptable stress levels for the material concerned.
- 9.5.2 The design of shafting, bearings and mounts should be such that hazardous whirling and excessive vibration could not occur at any speed up to 105% of the shaft speed attained at the designed overspeed trip setting of the prime mover.
- 9.5.3 The strength and fabrication of the transmission should be such that the probability of hazardous fatigue failure under the action of the repeated loads of variable magnitude expected in service is extremely remote throughout its operational life. Compliance should be demonstrated by suitably conducted tests, and by designing for sufficiently low stress levels, combined with the use of fatigue resistant materials and suitable detail design. Torsional vibration or oscillation likely to cause failure may be acceptable if it occurs at transmission speeds which would not be used in normal craft operation, and it is recorded in the craft operating manual as a limitation.

- 9.5.4 Where a clutch is fitted in the transmission, normal engagement of the clutch should not cause excessive stresses in the transmission or driven items. Inadvertent operation of any clutch should not produce dangerously high stresses in the transmission or driven item.
- 9.5.5 Provision should be made such that a failure in any part of the transmission, or of a driven component, will not cause damage which might hazard the craft or its occupants.
- 9.5.6 Where failure of lubricating fluid supply or loss of lubricating fluid pressure could lead to hazardous conditions, provision should be made to enable such failure to be indicated to the operating crew in adequate time to enable them as far as practicable to take the appropriate action before the hazardous condition arises.
- 9.6 Propulsion and lift devices
- 9.6.1 The requirements of this section are based on the premise that:
- .1 Propulsion arrangements and lift arrangements may be provided by separate devices, or be integrated into a single propulsion and lift devices. Propulsion devices may be air, or water propellers or water jets and the requirements apply to all types of craft.
 - .2 Propulsion devices are those which directly provide the propulsive thrust and include machinery items and any associated ducts, vanes, scoops and nozzles, the primary function of which is to contribute to the propulsive thrust.
 - .3 The lift devices, for the purposes of this section, are those items of machinery which directly raise the pressure of the air and move it for the primary purpose of providing lifting force for an air-cushion vehicle.
- 9.6.2 The propulsion and lift devices should be of adequate strength and stiffness. The design data, calculations and trials, where necessary, should establish the ability of the device to withstand the loads which can arise during the operations for which the craft is to be certificated, so that the possibility of catastrophic failure is extremely remote.
- 9.6.3 The design of propulsion and lift devices should pay due regard to the effects of allowable corrosion, electrolytic action between different metals, erosion or cavitation which may result from operation in environments in which they are subjected to spray, debris, salt, sand, icing, etc.
- 9.6.4 The design data and testing of propulsion and lift devices should pay due regard, as appropriate, to any pressure which could be developed as a result of a duct blockage, to steady and cyclic loadings, to loadings due to external forces and to the use of the devices in manoeuvring and reversing and to the axial location of rotating parts.

- 9.6.5 Appropriate arrangements should be made to ensure that:
- .1 ingestion of debris or foreign matter is minimized;
 - .2 the possibility of injury to personnel from shafting or rotating parts is minimized; and
 - .3 where necessary, inspection and removal of debris can be carried out safely in service.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

9.7 Independent means of propulsion for category B craft

Category B craft should be provided with at least two independent means of propulsion so that the failure of one engine or its support systems would not cause the failure of the other engine or engine systems and with additional machinery controls in or close to the machinery space.

9.8 Means for return to a port of refuge for category B craft

Category B craft should be capable of maintaining the essential machinery and control so that, in the event of a fire or other casualties in any one compartment on board, the craft can return to a port of refuge under its own power.

PART C - REQUIREMENTS FOR CARGO CRAFT

9.9 Essential machinery and control

Cargo craft should be capable of maintaining the essential machinery and control in the event of a fire or other casualties in one of any compartment on board. The craft need not be able to return to a place of refuge under its own power.

CHAPTER 10 - AUXILIARY SYSTEMS

PART A - GENERAL

10.1 General

- 10.1.1 Fluid systems should be constructed and arranged so as to assure a safe and adequate flow of fluid at a prescribed flow rate and pressure under all conditions of craft operation. The probability of a failure or a leakage in any one fluid system causing damage to the electrical system, a fire or an explosion hazard should be extremely remote. Attention should be directed to the avoidance of flammable liquid impingement on hot surfaces in the event of leakage or fracture of the pipe.
- 10.1.2 The maximum allowable working pressure in any part of the fluid system should not be greater than the design pressure, having regard to the allowable stresses in the materials. Where the maximum allowable working pressure of a system component, such as a valve or a fitting, is less than that computed for the pipe or tubing, the system pressure should be limited to the lowest of the component minimum allowable working pressures. Every system which may be exposed to pressures higher than the system's maximum allowable working pressure should be safeguarded by appropriate relief devices.
- 10.1.3 Tanks and piping should be pressure tested to a pressure that will assure a safety margin in excess of the working pressure of the item. The test on any storage tank or reservoir should take into account any possible static head in the overflow condition and the dynamic forces arising from craft motions.
- 10.1.4 Materials used in piping systems should be compatible with the fluid conveyed and selected giving due regard to the risk of fire. Non-metallic piping material may be permitted in certain systems provided the integrity of the hull and watertight decks and bulkheads is maintained.*
- 10.1.5 For the purposes of this chapter, the term "datum" means the datum described in 2.2.1.3.

10.2 Arrangement of oil fuel, lubricating oil and other flammable oil

- 10.2.1 The provisions of 7.1.2.2 should apply to the use of oil as fuel.
- 10.2.2 Oil fuel, lubricating oil and other flammable oil lines should be screened or otherwise suitably protected to avoid, as far as practicable, oil spray or oil leakages onto hot surfaces, into machinery air intakes or other sources of ignition. The number of joints in such piping systems should be kept to a minimum. Flexible pipes carrying flammable liquids should be of an approved type.**

* Refer to the Guidelines for materials other than steel for pipes, adopted by the Organization by resolution A.753(18).

** Refer to MSC/Circ.647 on the Guidelines to minimize leakages from flammable liquid systems for improving reliability and reducing risk of fire.

- 10.2.3 Fuel oil, lubricating oils and other flammable oils should not be carried forward of public spaces and crew accommodation.

Oil fuel arrangements

- 10.2.4 In a craft in which oil fuel is used, the arrangements for the storage, distribution and utilization of the oil fuel should be such as to ensure the safety of the craft and persons on board and should at least comply with the following provisions.
- 10.2.4.1 As far as practicable, all parts of the oil fuel system containing heated oil under pressure exceeding 0.18 N/mm^2 should not be placed in a concealed position such that defects and leakage cannot readily be observed. The machinery spaces in way of such parts of the oil fuel system should be adequately illuminated.
- 10.2.4.2 The ventilation of machinery spaces should be sufficient under all normal conditions to prevent accumulation of oil vapour.
- 10.2.4.3 Location of fuel tanks should be in accordance with 7.5.2.
- 10.2.4.4 No oil fuel tank should be situated where spillage or leakage therefrom can constitute a hazard by falling on heated surfaces. Reference is made to the fire safety requirements in 7.5
- 10.2.4.5 Oil fuel pipes should be fitted with cocks or valves in accordance with 7.5.3.
- 10.2.4.6 Every fuel tank should, where necessary, be provided with savealls or gutters to catch any fuel which may leak from such tanks.
- 10.2.4.7 Safe and efficient means of ascertaining the amount of oil fuel contained in any oil fuel tank should be provided.
- 10.2.4.7.1 Where sounding pipes are used they should not terminate in any space where the risk of ignition of spillage from the sounding pipe might arise. In particular, they should not terminate in public spaces, crew accommodation or machinery spaces. Terminations should be provided with a suitable means of closure and provision to prevent spillage during refuelling operations.
- 10.2.4.7.2 Other oil-level gauges may be used in place of sounding pipes. Such means should be subject to the following conditions:
- .1 In passenger craft, such means should not require penetration below the top of the tank and their failure or overfilling of the tanks will not permit release of fuel.
 - .2 The use of cylindrical gauge glasses should be prohibited. In cargo craft, the Administration may permit the use of oil-level gauges with flat glasses and self-closing valves between the gauges and fuel tanks. Such other means should be acceptable to the Administration and should be maintained in the proper condition to ensure their continued accurate functioning in service.

- 10.2.4.8 Provision should be made to prevent overpressure in any oil tank or in any part of the oil fuel system, including the filling pipes. Any relief valves and air or overflow pipes should discharge to a safe position and, for fuel of flashpoint less than 43°C, should terminate with flame arresters in accordance with the standards developed by the Organization.*
- 10.2.4.9 Oil fuel pipes and their valves and fittings should be of steel or other approved material, except that restricted use of flexible pipes should be permissible in positions where the Administration is satisfied that they are necessary. Such flexible pipes and end attachments should be of approved fire-resisting materials of adequate strength and should be constructed to the satisfaction of the Administration.

Lubricating oil arrangements

- 10.2.5 The arrangements for the storage, distribution and utilization of oil used in pressure lubrication systems should be such as to ensure the safety of the craft and persons on board. The arrangements made in machinery spaces and, whenever practicable, in auxiliary machinery spaces should at least comply with the provisions of 10.2.4.1 and 10.2.4.4 to 10.2.4.8 except that:
- .1 this does not preclude the use of sight-flow glasses in lubricating systems provided they are shown by test to have a suitable degree of fire resistance;
 - .2 sounding pipes may be permitted in machinery spaces if fitted with appropriate means of closure; and
 - .3 lubricating oil storage tanks with a capacity of less than 500 l may be permitted without remote operated valves as required in 10.2.4.5.

Arrangements for other flammable oils

- 10.2.6 The arrangements for storage, distribution and utilization of other flammable oils employed under pressure in power transmission systems, control and activating systems and heating systems should be such as to ensure the safety of the craft and persons on board. In locations where means of ignition are present, such arrangements should at least comply with the provisions of 10.2.4.4 and 10.2.4.7 and with the provisions of 10.2.4.8 and 10.2.4.9 in respect of strength and construction.

* Refer to the Revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks (MSC/Circ.373/Rev.1).

Arrangements within machinery spaces

10.2.7 In addition to the requirements of 10.2.1 to 10.2.6, the oil fuel and lubricating oil systems should comply with the following:

10.2.7.1 Where daily service fuel tanks are filled automatically or by remote control, means should be provided to prevent overflow spillages.

10.2.7.2 Other equipment which treats flammable liquids automatically, such as oil fuel purifiers, which, whenever practicable, should be installed in a special space reserved for purifiers and their heaters, should have arrangements to prevent overflow spillages.

10.2.7.3 Where daily service oil fuel tanks or settling tanks are fitted with heating arrangements, a high temperature alarm should be provided if the flashpoint of the oil can be reached due to failure of the thermostatic control.

10.3 Bilge pumping and drainage systems

10.3.1 Arrangements should be made for draining any watertight compartment other than the compartments intended for permanent storage of liquid. Where in relation to particular compartments drainage is not considered necessary, drainage arrangements may be omitted but it should be demonstrated that the safety of the craft will not be impaired.

10.3.2 Bilge pumping arrangements should be provided to allow every watertight compartment other than those intended for permanent storage of liquid to be drained. The capacity or position of any such compartment should be such that flooding thereof could not affect the safety of the craft.

10.3.3 The bilge pumping system should be capable of operation under all possible values of list and trim after the craft has sustained the postulated damage in 2.6.5 and 2.6.8. The bilge pumping system should be so designed as to prevent water flowing from one compartment to another. The necessary valves for controlling the bilge suction should be capable of being operated from above the datum. All distribution boxes and manually operated valves in connection with the bilge pumping arrangements should be in positions which are accessible under ordinary circumstances.

10.3.4 The power operated self-priming bilge pumps may be used for other duties such as fire fighting or general service but not for pumping fuel or other flammable liquids.

10.3.5 Each power bilge pump should be capable of pumping water through the required bilge pipe at a speed of not less than 2 m/s.

- 10.3.6 The diameter (d) of the bilge main should be calculated according to the following formula, except that the actual internal diameter of the bilge main may be rounded off to the nearest size of a recognized standard:

$$d = 25 + 1.68(L(B + D))^{0.5}$$

where:

d is the internal diameter of the bilge main (mm);

L is the length of the craft (m) as defined in chapter 1;

B is for monohull craft, the breadth of the craft in m as defined in chapter 1 and for multihull craft, the breadth of a hull at or below the design waterline (m); and

D is the moulded depth of the craft to the datum (m).

- 10.3.7 Internal diameters of suction branches should meet the requirements of the Administration but should not be less than 25 mm. Suction branches should be fitted with effective strainers.
- 10.3.8 An emergency bilge suction should be provided for each machinery space containing a propulsion prime mover. This suction should be led to the largest available power pump other than a bilge pump, propulsion pump or oil pump.
- 10.3.9 The spindles of the sea inlet valves should extend well above the machinery space floor plates.
- 10.3.10 All bilge suction piping up to the connection to the pumps should be independent of other piping.
- 10.3.11 Spaces situated above the water level in the worst anticipated damage conditions may be drained directly overboard through scuppers fitted with nonreturn valves.
- 10.3.12 Any unattended space for which bilge pumping arrangements are required should be provided with a bilge alarm.
- 10.3.13 For craft with individual bilge pumps, the total capacity Q of the bilge pumps for each hull should not be less than 2.4 times the capacity of the pump defined in 10.3.5 and 10.3.6.
- 10.3.14 In bilge pumping arrangements where a bilge main is not provided then, with the exception of the spaces forward of public spaces and crew accommodation, at least one fixed submersible pump should be provided for each space. In addition, at least one portable pump should be provided supplied from the emergency supply, if electric, for use on individual spaces. The capacity of each submersible pump Q_n should not be less than:

$$Q_n = Q/(N-1) \text{ tonne/h with a minimum of 8 tonnes/h}$$

where: N = number of submersible pumps

Q = total capacity as defined in 10.3.13.

10.3.15 Nonreturn valves should be fitted in the following components:

- .1 bilge valve distribution manifolds;
- .2 bilge suction hose connections where fitted directly to the pump or to the main bilge suction pipe; and
- .3 direct bilge suction pipes and bilge pump connections to main bilge suction pipe.

10.4 Ballast systems

10.4.1 Water ballast should not in general be carried in tanks intended for oil fuel. In craft in which it is not practicable to avoid putting water in oil fuel tanks, oily-water separating equipment should be fitted, or other alternative means such as discharge to shore facilities should be provided for disposing of the oily-water ballast. The provisions of this paragraph are without prejudice to the provisions of the International Convention for the Prevention of Pollution from Ships in force.

10.4.2 Where a fuel transfer system is used for ballast purposes, the system should be isolated from any water ballast system and meet the requirements for fuel systems and the International Convention for the Prevention of Pollution from Ships in force.

10.5 Cooling systems

The cooling arrangements provided should be adequate to maintain all lubricating and hydraulic fluid temperatures within manufacturers' recommended limits during all operations for which the craft is to be certificated.

10.6 Engine air intake systems

Arrangements should provide sufficient air to the engine and should give adequate protection against damage as distinct from deterioration, due to ingress of foreign matter.

10.7 Ventilation systems

Machinery spaces should be adequately ventilated so as to ensure that when machinery therein is operating at full power in all weather conditions including heavy weather, an adequate supply of air is maintained to the spaces for the safety and comfort of personnel and the operation of the machinery. Auxiliary machinery spaces should be adequately ventilated appropriate for the purpose of those spaces. The ventilation arrangements should be adequate to ensure that the safe operation of the craft is not put at risk.

10.8 Exhaust systems

10.8.1 All engines exhaust systems should be adequate to assure the correct functioning of the machinery and that safe operation of the craft is not put at risk.

- 10.8.2 Exhaust systems should be so arranged as to minimize the intake of exhaust gases into manned spaces, air-conditioning systems, and engine intakes. Exhaust systems should not discharge into air cushion intakes.
- 10.8.3 Pipes through which exhaust gases are discharged through the hull in the vicinity of the waterline should be fitted with erosion/corrosion resistant shut-off flaps or other devices on the shell or pipe end and acceptable arrangements made to prevent water flooding the space or entering the engine exhaust manifold.
- 10.8.4 Gas turbine engine exhausts should be arranged so that hot exhaust gases are directed away from areas to which personnel have access, either on board the craft or in the vicinity of the craft when berthed.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

10.9 Bilge pumping and drainage systems

- 10.9.1 For category B craft at least three and for category A craft at least two power bilge pumps should be fitted connected to the bilge main, one of which may be driven by the propulsion machinery. Alternatively, the arrangement may be in accordance with the requirements of 10.3.14.
- 10.9.2 The arrangements should be such that at least one power bilge pump should be available for use in all flooding conditions which the craft is required to withstand as follows:
- .1 one of the required bilge pumps should be an emergency pump of a reliable submersible type having an emergency source of power; or
 - .2 the bilge pumps and their sources of power should be so distributed throughout the length of the craft that at least one pump in an undamaged compartment will be available.
- 10.9.3 On multihull craft, each hull should be provided with at least two bilge pumps.
- 10.9.4 Distribution boxes, cocks and valves in connection with the bilge pumping system should be so arranged that, in the event of flooding, one of the bilge pumps may be operative in any compartment. In addition, damage to a pump or its pipe connecting to the bilge main should not put the bilge system out of action. When, in addition to the main bilge pumping system, an emergency bilge pumping system is provided, it should be independent of the main system and so arranged that a pump is capable of operating in any compartment under flooding conditions as specified in 10.3.3. In that case only the valves necessary for the operation of the emergency system need be capable of being operated from above the datum.
- 10.9.5 All cocks and valves referred to in 10.9.4 which can be operated from above the datum should have their controls at their place of operation clearly marked and should be provided with means to indicate whether they are open or closed.

PART C - REQUIREMENTS FOR CARGO CRAFT

10.10 Bilge pumping systems

- 10.10.1 At least two power pumps connected to the main bilge system should be provided, one of which may be driven by the propulsion machinery. If the Administration is satisfied that the safety of the craft is not impaired, bilge pumping arrangements may be dispensed with in particular compartments. Alternatively, the arrangement may be in accordance with the requirements of 10.3.14.
- 10.10.2 On multihull craft each hull should be provided with at least two power pumps, unless a bilge pump in one hull is capable of pumping bilge in the other hull. At least one pump in each hull should be an independent power pump.

CHAPTER 11 - REMOTE CONTROL, ALARM AND SAFETY SYSTEMS

11.1 Definitions

11.1.1 "Remote control systems" comprise all equipment necessary to operate units from a control position where the operator cannot directly observe the effect of his actions.

11.1.2 "Back-up control systems" comprise all equipment necessary to maintain control of essential functions required for the craft's safe operation when the main control systems have failed or malfunctioned.

11.2 General

11.2.1 Failure of any remote or automatic control systems should initiate an audible and visual alarm and should not prevent normal manual control.

11.2.2 Manoeuvring and emergency controls should permit the operating crew to perform the duties for which they are responsible in a correct manner without difficulty, fatigue or excessive concentration.

11.2.3 Where control of propulsion or manoeuvring is provided at stations adjacent to but outside the operating compartment, the transfer of control should only be effected from the station which takes charge of control. Two-way voice communication should be provided between all stations from which control functions may be exercised and between each such station and the look-out position. Failure of the operating control system or of transfer of control should bring the craft to low speed without hazarding passengers or the craft.

11.2.4 For category B craft and cargo craft, remote control systems for propulsion machinery and directional control should be equipped with back-up systems controllable from the operating compartment. For cargo craft, instead of a back-up system described above, a back-up system controllable from an engine control space such as an engine control room outside the operating compartment is acceptable.

11.3 Emergency controls

11.3.1 In all craft, the station or stations in the operating compartment from which control of craft manoeuvring and/or of its main machinery is exercised should be provided, within easy reach of the crew member at that station, with controls for use in an emergency to:

- .1 activate fixed fire-extinguishing systems;
- .2 close ventilation openings and stop ventilating machinery supplying spaces covered by fixed fire-extinguishing systems, if not incorporated in .1;
- .3 shut off fuel supplies to machinery in main and auxiliary machinery spaces;

- .4 disconnect all electrical power sources from the normal power distribution system (the operating control should be guarded to reduce the risk of inadvertent or careless operation); and
 - .5 stop main engine(s) and auxiliary machinery.
- 11.3.2 Where control of propulsion and manoeuvring is provided at stations outside the operating compartment, such stations should have direct communication with the operating compartment which should be a continuously manned control station.
- 11.4 Alarm system
- 11.4.1 Alarm systems should be provided which announce at the craft's control position, by visual and audible means, malfunctions or unsafe conditions. Alarms should be maintained until they are accepted and the visual indications of individual alarms should remain until the fault has been corrected, when the alarm should automatically reset to the normal operating condition. If an alarm has been accepted and a second fault occurs before the first is rectified, the audible and visual alarms should operate again. Alarm systems should incorporate a test facility.
- 11.4.1.1 Alarms giving indication of conditions requiring immediate action should be distinctive and in full view of crew members in the operating compartment, and should be provided for the following:
- .1 activation of a fire detection system;
 - .2 total loss of normal electrical supply;
 - .3 overspeed of main engines;
 - .4 thermal runaway of any permanently installed nickel-cadmium battery.
- 11.4.1.2 Alarms with a visual display distinct from that of alarms referred to in 11.4.1.1 should indicate conditions requiring action to prevent degradation to an unsafe condition. These should be provided for at least the following:
- .1 exceeding the limiting value of any craft, machinery or system parameter other than engine overspeed;
 - .2 failure of normal power supply to powered directional or trim control devices;
 - .3 operation of any automatic bilge pump;
 - .4 failure of compass system;
 - .5 low level of a fuel tank contents;
 - .6 fuel oil tank overflow;
 - .7 extinction of side, masthead or stern navigation lights;

- .8 low level of contents of any fluid reservoir the contents of which are essential for normal craft operation;
 - .9 failure of any connected electrical power source;
 - .10 failure of any ventilation fan installed for ventilating spaces in which inflammable vapours may accumulate.
 - .11 diesel engine fuel line failure as required by 9.4.2.
- 11.4.1.3 All warnings required by 11.4.1.1 and 11.4.1.2 should be provided at all stations at which control functions may be exercised.
- 11.4.2 The alarm system should meet appropriate constructional and operational requirements for required alarms.*
- 11.4.3 Equipment monitoring the passenger, cargo and machinery spaces for fire and flooding should, so far as is practicable, form an integrated sub-centre incorporating monitoring and activation controls for all emergency situations. This sub-centre may require feed-back instrumentation to indicate that actions initiated have been fully implemented.

11.5 Safety system

Where arrangements are fitted for overriding any automatic shutdown system for the main propulsion machinery in accordance with 9.2.2, they should be such as to preclude inadvertent operation. When a shutdown system is activated, an audible and visual alarm should be given at the control station and means should be provided to override the automatic shutdown except in cases where there is a risk of complete breakdown or explosion.

* Refer to the Code on alarms and indicators adopted by the Organization by resolution A.686(17).

CHAPTER 12 - ELECTRICAL INSTALLATIONS

PART A - GENERAL

12.1 General

12.1.1 Electrical installations* should be such that:

- .1 all electrical auxiliary services necessary for maintaining the craft in normal operation and habitable conditions will be ensured without recourse to the emergency source of electrical power;
- .2 electrical services essential for safety will be ensured under various emergency conditions; and
- .3 the safety of passengers, crew and craft from electrical hazards will be ensured.

The FMEA should include the electrical system, taking into account the effects of electrical failure on the systems being supplied. In cases where faults can occur without being detected during routine checks on the installations, the analysis should take into account the possibility of faults occurring simultaneously or consecutively.

12.1.2 The electrical system should be designed and installed so that the probability of the craft being at risk of failure of a service is extremely remote.

12.1.3 Where loss of particular essential service would cause serious risk to the craft, the service should be fed by at least two independent circuits fed in such a way that no single failure in the electrical supply or distribution systems would effect both supplies.

12.1.4 The securing arrangements for heavy items, i.e. accumulator batteries, should, as far as practicable, prevent excessive movement during the accelerations due to grounding or collision.

12.1.5 Precautions should be taken to minimize risk of supplies to essential and emergency services being interrupted by the inadvertent or accidental opening of switches or circuit breakers.

12.2. Main source of electrical power

12.2.1 A main source of electrical power of sufficient capacity to supply all those services mentioned in 12.1.1 should be provided. The main source of electrical power should consist of at least two generating sets.

* Refer to the recommendations published by the International Electrotechnical Commission and, in particular, Publication 92 - Electrical installations in ships.

- 12.2.2 The capacity of these generating sets should be such that in the event of any one generating set being stopped or failing it will still be possible to supply those services necessary to provide the normal operational conditions of propulsion and safety. Minimum comfortable conditions of habitability should also be ensured which include at least adequate services for cooking, heating, domestic refrigeration, mechanical ventilation, sanitary and fresh water.
- 12.2.3 The arrangements of the craft's main source of electrical power should be such that the services referred to in 12.1.1.1 can be maintained regardless of the speed and direction of the propulsion machinery or shafting.
- 12.2.4 In addition, the generating sets should be such as to ensure that with any one generator or its primary source of power out of operation, the remaining generating set should be capable of providing the electrical services necessary to start the main propulsion plant from dead craft condition. The emergency source of electrical power may be used for the purpose of starting from a dead craft condition if its capability either alone or combined with that of any other source of electrical power is sufficient to provide at the same time those services required to be provided by 12.7.3.1 to 12.7.3.3 or 12.7.4.1 to 12.7.4.4 or 12.8.2.1 to 12.8.2.4.1, as appropriate.
- 12.2.5 Where transformers constitute an essential part of the electrical supply system required by this section, the system should be so arranged as to ensure the same continuity of supply as is stated in 12.2.
- 12.2.6 A main electric lighting system which should provide illumination throughout those parts of the craft normally accessible to and used by passengers and crew should be supplied from the main source of electrical power.
- 12.2.7 The arrangement of the main electric lighting system should be such that a fire or other casualty in spaces containing the emergency source of electrical power, associated transforming equipment, if any, the emergency switchboard and the emergency lighting switchboard will not render inoperative the main electric lighting system required by 12.2.6.
- 12.2.8 The main switchboard should be so placed relative to one main generating station that, as far as practicable, the integrity of the normal electrical supply may be affected only by a fire or other casualty in one space. An environmental enclosure for the main switchboard, such as may be provided by a machinery control room situated within the main boundaries of the space, should not be considered as separating the switchboards from the generators.
- 12.2.9 The main busbars should normally be subdivided into at least two parts which should be connected by a circuit-breaker or other approved means. So far as is practicable, the connection of generating sets and any other duplicated equipment should be equally divided between the parts. Equivalent arrangements may be permitted to the satisfaction of the Administration.

- 12.3 Emergency source of electrical power
- 12.3.1 A self-contained emergency source of electrical power should be provided.
- 12.3.2 The emergency source of electrical power, associated transforming equipment, if any, transitional source of electrical power, emergency switchboard and emergency lighting switchboard should be located above the waterline in the final condition of damage as referred to in chapter 2, operable in that condition and readily accessible.
- 12.3.3 The location of the emergency source of electrical power and associated transforming equipment, if any, the transitional source of emergency power, the emergency switchboard and the emergency electrical lighting switchboards in relation to the main source of electrical power, associated transforming equipment, if any, and the main switchboard should be such as to ensure that a fire or other casualty in spaces containing the main source of electrical power, associated transforming equipment, if any, and the main switchboard or in any machinery space will not interfere with the supply, control and distribution of emergency electrical power. As far as practicable, the space containing the emergency source of electrical power, associated transforming equipment, if any, the transitional source of emergency electrical power and the emergency switchboard should not be contiguous to the boundaries of main machinery spaces or those spaces containing the main source of electrical power, associated transforming equipment, if any, or the main switchboard.
- 12.3.4 Provided that suitable measures are taken for safeguarding independent emergency operation under all circumstances, the emergency generator, if provided, may be used exceptionally, and for short periods, to supply non-emergency circuits.
- 12.3.5 Distribution systems should be so arranged that the feeders from the main and emergency sources are separated both vertically and horizontally as widely as practicable.
- 12.3.6 The emergency source of electrical power may be either a generator or an accumulator battery, which should comply with the following:
- .1 Where the emergency source of electrical power is a generator, it should be:
- .1.1 driven by a suitable prime mover with an independent supply of fuel having a flashpoint which meets the requirements of 7.1.2.2;
- .1.2 started automatically upon failure of the electrical supply from the main source of electrical power and should be automatically connected to the emergency switchboard. Those services referred to in 12.7.5 or 12.8.3 should then be transferred to the emergency generating set. The automatic starting system and the characteristic of the prime mover should be such as to permit the emergency generator to carry its full rated load as quickly as is safe and practicable, subject to a maximum of 45 s; and

- .1.3 provided with a transitional source of emergency electrical power according to 12.7.5 or 12.8.3.
- .2 Where the emergency source of electrical power is an accumulator battery, it should be capable of:
 - .2.1 carrying the emergency electrical load without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage;
 - .2.2 automatically connecting to the emergency switchboard in the event of failure of the main source of electrical power; and
 - .2.3 immediately supplying at least those services specified in 12.7.5 or 12.8.3.
- 12.3.7 The emergency switchboard should be installed as near as is practicable to the emergency source of electrical power.
- 12.3.8 Where the emergency source of electrical power is a generator, the emergency switchboard should be located in the same space unless the operation of the emergency switchboard would thereby be impaired.
- 12.3.9 No accumulator battery fitted in accordance with this section should be installed in the same space as the emergency switchboard. An indicator should be mounted in a suitable space at the craft's operating compartment to indicate when the batteries constituting either the emergency source of electrical power or the transitional source of emergency electrical power referred to in 12.3.6.1.3 are being discharged.
- 12.3.10 The emergency switchboard should be supplied during normal operation from the main switchboard by an interconnector feeder which should be adequately protected at the main switchboard against overload and short circuit and which should be disconnected automatically at the emergency switchboard upon failure of the main source of electrical power. Where the system is arranged for feedback operation, the interconnector feeder should also be protected at the emergency switchboard at least against short circuit. Failure of the emergency switchboard, when being used in other than an emergency, should not put at risk the operation of the craft.
- 12.3.11 In order to ensure ready availability of the emergency source of electrical power, arrangements should be made, where necessary, to disconnect automatically non-emergency circuits from the emergency switchboard to ensure that power should be available to the emergency circuits.
- 12.3.12 The emergency generator and its prime mover and any emergency accumulator battery should be so designed and arranged as to ensure that they will function at full rated power when the craft is upright and when the craft has a list or trimming accordance with 9.1.12 including any damage cases considered in chapter 2, or is in any combination of angles within those limits.

12.3.13 Where accumulator batteries are installed to supply emergency services, provisions should be made to charge them in situ from a reliable on-board supply. Charging facilities should be designed to permit the supply of services, regardless of whether battery is on charge or not. Means should be provided to minimize the risk of overcharging or overheating the batteries. Means for efficient air ventilation should be provided.

12.4 Starting arrangements for emergency generating sets

12.4.1 Emergency generating sets should be capable of being readily started in their cold condition at a temperature of 0°C. If this is impracticable, or if lower temperatures are likely to be encountered, provisions should be made for heating arrangements to ensure ready starting of the generating sets.

12.4.2 Each emergency generating set should be equipped with starting devices with a stored energy capability of at least three consecutive starts. The source of stored energy should be protected to preclude critical depletion by the automatic starting system, unless a second independent means of starting is provided. A second source of energy should be provided for an additional three starts within 30 min, unless manual starting can be demonstrated to be effective.

12.4.3 The stored energy should be maintained at all times, as follows:

- .1 electrical and hydraulic starting systems should be maintained from the emergency switchboard;
- .2 compressed air starting systems may be maintained by the main or auxiliary compressed air receivers through a suitable nonreturn valve or by an emergency air compressor which, if electrically driven, is supplied from the emergency switchboard;
- .3 all of these starting, charging and energy storing devices should be located in the emergency generator space. These devices should not be used for any purpose other than the operation of the emergency generating set. This does not preclude the supply to the air receiver of the emergency generating set from the main or auxiliary compressed air system through the nonreturn valve fitted in the emergency generator space.

12.5 Steering and stabilization

12.5.1 Where steering and/or stabilization of a craft is essentially dependent on one device as with a single rudder or pylon, which is itself dependent on the continuous availability of electric power, it should be served by at least two independent circuits one of which should be fed either from the emergency source of electric power or from an independent power source located in such a position as to be unaffected by fire or flooding affecting the main source of power. Failure of either supply should not cause any risk to the craft or passengers during switching to the alternative supply and such switching arrangements should meet the requirements in 5.2.5. These circuits should be provided with short circuit protection and an overload alarm.

- 12.5.2 Protection against excess current may be provided, in which case it should be for not less than twice the full load current of the motor or circuit so protected, and should be arranged to accept the appropriate starting current with a reasonable margin. Where three-phase supply is used, an alarm should be provided in a readily observed position in the craft's operating compartment that will indicate failure of any one of the phases.
- 12.5.3 Where such systems are not essentially dependent on the continuous availability of electric power but at least one alternative system, not dependent on the electric supply is installed, then the electrically powered or controlled system may be fed by a single circuit protected in accordance with 12.5.2.
- 12.5.4 The requirements of chapters 5 and 16 for power supply of the directional control system and stabilization system of the craft should be met.
- 12.6 Precautions against shock, fire and other hazards of electrical origin
- 12.6.1.1 Exposed metal parts of electrical machines or equipment which are not intended to be live but which are liable under fault conditions to become live should be earthed unless the machines or equipment are:
- .1 supplied at a voltage not exceeding 55 V direct current or 55 V root mean square between conductors; auto-transformers should not be used for the purpose of achieving this voltage; or
 - .2 supplied at a voltage not exceeding 250 V by safety isolating transformers supplying only one consuming device; or
 - .3 constructed in accordance with the principle of double insulation.
- 12.6.1.2 The Administration may require additional precautions for portable electrical equipment for use in confined or exceptionally damp spaces where particular risks due to conductivity may exist.
- 12.6.1.3 All electrical apparatus should be so constructed and so installed as not to cause injury when handled or touched in the normal manner.
- 12.6.2 Main and emergency switchboards should be so arranged as to give easy access, as may be needed, to apparatus and equipment, without danger to personnel. The sides and the rear and, where necessary, the front of switchboards should be suitably guarded. Exposed live parts having voltages to earth exceeding a voltage to be specified by the Administration should not be installed on the front of such switchboards. Where necessary, nonconducting mats or gratings should be provided at the front and rear of the switchboard.
- 12.6.3 When a distribution system, whether primary or secondary, for power, heating or lighting, with no connection to earth is used, a device capable of continuously monitoring the insulation level to earth and

of giving an audible or visual indication of abnormally low insulation values should be provided. For limited secondary distribution systems the Administration may accept a device for manual checking of the insulation level.

12.6.4 Cables and wiring

- 12.6.4.1 Except as permitted by the Administration in exceptional circumstances, all metal sheaths and armour of cables should be electrically continuous and should be earthed.
- 12.6.4.2 All electric cables and wiring external to equipment should be at least of a flame-retardant type and should be so installed as not to impair their original flame-retarding properties. Where necessary for particular applications, the Administration may permit the use of special types of cables such as radio frequency cables, which do not comply with the foregoing.
- 12.6.4.3 Cables and wiring serving essential or emergency power, lighting, internal communications or signals should so far as practicable be routed clear of machinery spaces and their casings and other high fire risk areas. Where practicable all such cables should be run in such a manner as to preclude their being rendered unserviceable by heating of the bulkheads that may be caused by a fire in an adjacent space.
- 12.6.4.4 Where cables which are installed in hazardous areas introduce the risk of fire or explosion in the event of an electrical fault in such areas, special precautions against such risks should be taken to the satisfaction of the Administration.
- 12.6.4.5 Cables and wiring should be installed and supported in such manner as to avoid chafing or other damage.
- 12.6.4.6 Terminations and joints in all conductors should be so made as to retain the original electrical, mechanical, flame-retarding and, where necessary, fire-resisting properties of the cable.
- 12.6.5.1 Each separate circuit should be protected against short circuit and against overload, except as permitted in 12.5, or where the Administration may exceptionally otherwise permit.
- 12.6.5.2 The rating or appropriate setting of the overload protective device for each circuit should be permanently indicated at the location of the protective device.
- 12.6.5.3 When the protective device is a fuse it should be placed on the load side of the disconnect switch serving the protected circuit.
- 12.6.6 Lighting fittings should be so arranged as to prevent temperature rises which could damage the cables and wiring, and to prevent surrounding material from becoming excessively hot.
- 12.6.7 All lighting and power circuits terminating in a bunker or cargo space should be provided with a multiple-pole switch outside the space for disconnecting such circuits.

- 12.6.8.1 Accumulator batteries should be suitably housed, and compartments used primarily for their accommodation should be properly constructed and efficiently ventilated.
- 12.6.8.2 Electrical or other equipment which may constitute a source of ignition of flammable vapours should not be permitted in these compartments except as permitted in 12.6.9.
- 12.6.8.3 Accumulator batteries should not be located in crew accommodation.
- 12.6.9 No electrical equipment should be installed in any space where flammable mixtures are liable to collect including those in compartments assigned principally to accumulator batteries, in paint lockers, acetylene stores or similar spaces, unless the Administration is satisfied that such equipment is:
- .1 essential for operational purposes;
 - .2 of a type which will not ignite the mixture concerned;
 - .3 appropriate to the space concerned; and
 - .4 appropriately certified for safe usage in the dusts, vapours or gases likely to be encountered.
- 12.6.10 The following additional requirements from .1 to .7 should be met, and requirements from .8 to .13 should be met also for non-metallic craft:
- .1 The electrical distribution voltages throughout the craft may be either direct current or alternating current and should not exceed:
 - .1.1 500 V for power, cooking, heating and other permanently connected equipment; and
 - .1.2 250 V for lighting, internal communications and receptacle outlets.

The Administration may accept higher voltage for propulsion purposes.
 - .2 For electrical power distribution, two-wire, three-wire or four-wire insulated systems should be used. Where applicable, the requirements of 7.5.6.4 or 7.5.6.5 should also be met.
 - .3 Effective means should be provided so that voltage may be cut off from each and every circuit and sub-circuit and from all apparatus as may be necessary to prevent danger.
 - .4 Electrical equipment should be so designed that the possibility of accidentally touching live parts, rotating or moving parts as well as heated surfaces which might cause burns or initiate fire is minimized.

- .5 Electrical equipment should be adequately secured. The probability of fire or dangerous consequences arising from damage to electrical equipment should be reduced to an acceptable minimum.
- .6 The rating or appropriate setting of the overload protective device for each circuit should be permanently indicated at the location of the protection device.
- .7 Where it is impracticable to provide electrical protective devices for certain cables supplied from batteries, e.g. within battery compartments and in engine starting circuits, unprotected cable runs should be kept as short as possible and special precautions should be taken to minimize risk of faults, e.g. use of single core cables with additional sleeve over the insulation of each core, with shrouded terminals.
- .8 In order to minimize the risk of fire, structural damage, electrical shock and radio interference due to lightning strike or electrostatic discharge, all metal parts of the craft should be bonded together, in so far as possible in consideration of galvanic corrosion between dissimilar metals, to form a continuous electrical system, suitable for the earth return of electrical equipment and to connect the craft to the water when water-borne. The bonding of isolated components inside the structure is not generally necessary, except in fuel tanks.
- .9 Each pressure refuelling point should be provided with a means of bonding the fuelling equipment to the craft.
- .10 Metallic pipes capable of generating electrostatic discharges, due to the flow of liquids and gases should be bonded so as to be electrically continuous throughout their length and should be adequately earthed.
- .11 Primary conductors provided for lightning discharge currents should have a minimum cross section of 50 mm² in copper or equivalent surge carrying capacity in aluminium.
- .12 Secondary conductors provided for the equalization of static discharges, bonding of equipment, etc., but not for carrying lightning discharges should have a minimum cross section of 5 mm² copper or equivalent surge current carrying capacity in aluminium.
- .13 The electrical resistance between bonded objects and the basic structure should not exceed 0.05 Ohms except where it can be demonstrated that a higher resistance will not cause a hazard. The bonding path should have sufficient cross-sectional area to carry the maximum current likely to be imposed on it without excessive voltage drop.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

12.7 General

12.7.1 Separation and duplication of electrical supply should be provided for duplicated consumers of essential services. During normal operation the systems may be connected to the same power-bus, but facilities for easy separation should be provided. Each system should be able to supply all equipment necessary to maintain the control of propulsion, steering, stabilization, navigation, lighting and ventilation, and allow starting of the largest essential electric motor at any load. Automatic load-dependent disconnection of non-essential consumers may be allowed.

12.7.2 Emergency source of electrical power

Where the main source of electrical power is located in two or more compartments which are not contiguous, each of which has its own self-contained systems, including power distribution and control systems, completely independent of each other and such that a fire or other casualty in any one of the spaces will not affect the power distribution from the others, or to the services required by 12.7.3 or 12.7.4, the requirements of 12.3.1, 12.3.2 and 12.3.4 may be considered satisfied without an additional emergency source of electrical power, provided that:

- .1 there is at least one generating set, meeting the requirements of 12.3.12 and of sufficient capacity to meet the requirements of 12.7.3 or 12.7.4 in each of at least two non-contiguous spaces;
- .2 the arrangements required by .1 in each such space are equivalent to those required by 12.3.6.1, 12.3.7 to 12.3.11 and 12.4 so that a source of electrical power is available at all times to the services required by 12.7.3 or 12.7.4; and
- .3 the generator sets referred to in .1 and their self-contained systems are installed such that one of them remains operable after damage or flooding in any one compartment.

12.7.3 For category A craft, the emergency source of power should be capable of supplying simultaneously the following services:

- .1 for a period of 5 h emergency lighting:
 - .1.1 at the stowage positions of life-saving appliances;
 - .1.2 at all escape routes such as alleyways, stairways, exits from accommodation and service spaces, embarkation points, etc;
 - .1.3 in the public spaces;
 - .1.4 in the machinery spaces and main emergency generating spaces including their control positions;
 - .1.5 in control stations;

- .1.6 at the stowage positions for firemen's outfits; and
 - .1.7 at the steering gear;
 - .2 for a period of 5 h:
 - .2.1 main navigation lights, except for "not under command" lights;
 - .2.2 electrical internal communication equipment for announcements for passengers and crew required during evacuation;
 - .2.3 fire detection and general alarm system and manual fire alarms; and
 - .2.4 remote control devices of fire-extinguishing systems, if electrical;
 - .3 for a period of 4 h of intermittent operation:
 - .3.1 the daylight signalling lamps, if they have no independent supply from their own accumulator battery; and
 - .3.2 the craft's whistle, if electrically driven;
 - .4 for a period of 5 h:
 - .4.1 craft radio facilities and other loads as set out in 14.12.2; and
 - .4.2 essential electrically powered instruments and controls for propulsion machinery, if alternate sources of power are not available for such devices;
 - .5 for a period of 12 h, the "not under command" lights; and
 - .6 for a period of 10 min:
 - .6.1 power drives for directional control devices including those required to direct thrust forward and astern, unless there is a manual alternative acceptable to the Administration as complying with 5.2.3.
- 12.7.4 For category B craft, the electrical power available should be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of electrical power should be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation.
- .1 for a period of 12 h, emergency lighting:
 - .1.1 at the stowage positions of life-saving appliances;

- .1.2 at all escape routes, such as alley ways, stairways, exits from accommodation and service spaces, embarkation points, etc;
- .1.3 in the passenger compartments;
- .1.4 in the machinery spaces and main emergency generating spaces including their control positions;
- .1.5 in control stations;
- .1.6 at the stowage positions for firemen's outfits; and
- .1.7 at the steering gear.
- .2 for a period of 12 h:
 - .2.1 the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force;
 - .2.2 electrical internal communication equipment for announcements for passengers and crew required during evacuation;
 - .2.3 fire detection and general alarm system and manual fire alarms; and
 - .2.4 remote control devices of fire-extinguishing systems, if electrical;
- .3 for a period of 4 h on intermittent operation:
 - .3.1 the daylight signalling lamps, if they have no independent supply from their own accumulator battery; and
 - .3.2 the craft's whistle, if electrically driven;
- .4 for a period of 12 h:
 - .4.1 the navigational equipment as required by chapter 13. Where such provision is unreasonable or impracticable, the Administration may waive this requirement for craft of less than 5,000 tons gross tonnage;
 - .4.2 essential electrically powered instruments and controls for propulsion machinery, if alternate sources of power not available for such devices;
 - .4.3 one of the fire pumps required by 7.7.8.1;
 - .4.4 the sprinkler pump and drencher pump, if fitted;
 - .4.5 the emergency bilge pump and all the equipment essential for the operation of electrically powered remote controlled bilge valves as required by chapter 10; and

- .4.6 craft radio facilities and other loads as set out in 14.12.2;
- .5 for a period of 30 min, any watertight doors, required by chapter 2 to be power operated, together with their indicators and warning signals;
- .6 for a period of 10 min, power drives for directional control devices including those required to direct thrust forward and astern, unless there is a manual alternative acceptable to the Administration as complying with 5.2.3.

12.7.5 Transitional source of emergency electrical power

The transitional source of emergency electrical power required by paragraph 12.3.6.1.3 may consist of an accumulator battery suitably located for use in an emergency which should operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be of sufficient capacity and so arranged as to supply automatically in the event of failure of either the main or emergency source of electrical power at least the following services, if they depend upon an electrical source for their operation:

- .1 for a period of 30 min, the load specified in 12.7.3.1, .2 and .3, or in 12.7.4.1, .2 and .3; and
- .2 with respect to the watertight doors:
 - .2.1 power to operate the watertight doors, but not necessarily simultaneously, unless an independent temporary source of stored energy is provided. The power source should have sufficient capacity to operate each door at least three times, i.e. closed - open - closed, against an adverse list of 15°; and
 - .2.2 power to the control, indication and alarm circuits for the watertight doors for half an hour.

12.7.6 The requirements of 12.7.5 may be considered satisfied without the installation of a transitional source of emergency electrical power if each of the services required by that paragraph has independent supplies, for the period specified, from accumulator batteries suitably located for use in an emergency. The supply of emergency power to the instruments and controls of the propulsion and direction systems should be uninterruptible.

12.7.7 In category A craft having limited public spaces, emergency lighting fittings of the type described in 12.7.9.1 as meeting the requirements of 12.7.3.1 and 12.7.5.1 may be accepted, provided that an adequate standard of safety is attained.

- 12.7.8 Provision should be made for the periodic testing of the complete emergency system including the emergency consumers required by 12.7.3 or 12.7.4 and 12.7.5, and should include the testing of automatic starting arrangements.
- 12.7.9 In addition to the emergency lighting required by 12.7.3.1, 12.7.4.1 and 12.7.5.1 on every craft with special category spaces:
- .1 all passenger public spaces and alleyways should be provided with supplementary electric lighting that can operate for at least 3 h when all other sources of electric power have failed and under any condition of heel. The illumination provided should be such that the approach to the means of escape can be readily seen. The source of power for the supplementary lighting should consist of accumulator batteries located within the lighting units that are continuously charged, where practicable, from the emergency switchboard. Alternatively, any other means of lighting, which is at least as effective, may be accepted by the Administration.
- The supplementary lighting should be such that any failure of the lamp will be immediately apparent. Any accumulator battery provided should be replaced at intervals having regard to the specified service life in the ambient condition that it is subject to in service; and
- .2 a portable rechargeable battery operated lamp should be provided in every crew space alleyway, recreational space and every working space which is normally occupied unless supplementary emergency lighting, as required by .1, is provided.
- 12.7.10 Distribution systems should be so arranged that fire in any main vertical zone will not interfere with services essential for safety in any other such zone. This requirement will be met if main and emergency feeders passing through any such zone are separated both vertically and horizontally as widely as is practicable.

PART C - REQUIREMENTS FOR CARGO CRAFT

12.8 General

- 12.8.1 Separation and duplication of electrical supply should be provided for duplicated consumers of essential services. During normal operation these consumers may be connected to the same power-bus directly or via distribution boards or group starters, but should be separated by removeable links or other approved means. Each power-bus should be able to supply all equipment necessary to maintain the control of propulsion, steering, stabilization, navigation, lighting and ventilation, and allow starting of the largest essential electric motor at any load. However, having regard to 12.1.2, partial reduction in the capability from normal operation may be accepted. Non-duplicated consumers of essential services connected to the emergency switchboard directly or via distribution boards may be accepted. Automatic load-dependent disconnection of non-essential consumers may be allowed.

12.8.2 Emergency source of electrical power

12.8.2.1 Where the main source of electrical power is located in two or more compartments which are not contiguous, each of which has its own self-contained systems, including power distribution and control systems, completely independent of each other and such that a fire or other casualty in any one of the spaces will not affect the power distribution from the others, or to the services required by 12.8.2.2, the requirements of 12.3.1, 12.3.2 and 12.3.4 may be considered satisfied without an additional emergency source of electrical power, provided that:

- .1 there is at least one generating set, meeting the requirements of 12.3.12 and each of sufficient capacity to meet the requirements of 12.8.2.2, in each of at least two non-contiguous spaces;
- .2 the arrangements required by .1 in each such space are equivalent to those required by 12.3.6.1, 12.3.7 to 12.3.11 and 12.4 so that a source of electrical power is available at all times to the services required by 12.8.2; and
- .3 the generator sets referred to in .1 and their self-contained systems are installed in accordance with 12.3.2.

12.8.2.2 The electrical power available should be sufficient to supply all those services that are essential for safety in an emergency, due regard being paid to such services as may have to be operated simultaneously. The emergency source of electrical power should be capable, having regard to starting currents and the transitory nature of certain loads, of supplying simultaneously at least the following services for the periods specified hereinafter, if they depend upon an electrical source for their operation:

- .1 for a period of 12 h, emergency lighting:
 - .1.1 at the stowage positions of life-saving appliances;
 - .1.2 at all escape routes such as alleyways, stairways, exits from accommodation and service spaces, embarkation points, etc.;
 - .1.3 in the public spaces, if any;
 - .1.4 in the machinery spaces and main emergency generating spaces including their control positions;
 - .1.5 in control stations;
 - .1.6 at the stowage positions for fireman's outfits; and
 - .1.7 at the steering gear;
- .2 for a period of 12 h:
 - .2.1 the navigation lights and other lights required by the International Regulations for Preventing Collisions at Sea in force;

- .2.2 electrical internal communication equipment for announcements during evacuation;
 - .2.3 fire detection and general alarm system and manual fire alarms; and
 - .2.4 remote control devices of fire-extinguishing systems, if electrical;
 - .3 for a period of 4 h of intermittent operation:
 - .3.1 the daylight signalling lamps, if they have no independent supply from their own accumulator battery; and
 - .3.2 the craft's whistle, if electrically driven;
 - .4 for a period of 12 h:
 - .4.1 the navigational equipment as required by chapter 13. Where such provision is unreasonable or impracticable, the Administration may waive this requirement for craft of less than 5,000 tons gross tonnage;
 - .4.2 essential electrically powered instruments and controls for propulsion machinery, if alternate sources of power are not available for such devices;
 - .4.3 one of the fire pumps required by 7.7.8.1;
 - .4.4 the sprinkler pump and drencher pump, if fitted;
 - .4.5 the emergency bilge pump and all the equipment essential for the operation of electrically powered remote controlled bilge valves as required by chapter 10; and
 - .4.6 craft radio facilities and other loads as set out in 14.12.2;
 - .5 for a period of 10 min, power drives for directional control devices including those required to direct thrust forward and astern, unless there is a manual alternative acceptable to the Administration as complying with 5.2.3.
- 12.8.2.3 Provision should be made for the periodic testing of the complete emergency system including the emergency consumers required by 12.8.2.2 and should include the testing of automatic starting arrangements.
- 12.8.2.4 Where the emergency source of electrical power is a generator, a transitional source of emergency electrical power should be provided according to 12.8.3, unless the automatic starting system and the characteristics of the prime mover are such as to permit the emergency generator to carry its full rated load as quickly as is safe and practicable, subject to a maximum of 45 s.

12.8.3 Transitional source of emergency electrical power

The transitional source of emergency electrical power required by paragraph 12.8.2.4 may consist of an accumulator battery suitably located for use in an emergency which should operate without recharging while maintaining the voltage of the battery throughout the discharge period within 12% above or below its nominal voltage and be of sufficient capacity and so arranged as to supply automatically, in the event of failure of either the main or emergency source of electrical power, at least the following services, if they depend upon an electrical source for their operation:

- .1 for a period of 30 min, the load specified in 12.8.2.2.1, .2 and .3; and
- .2 with respect to the watertight doors:
 - .2.1 power to operate the watertight doors, but not necessarily simultaneously, unless an independent temporary source of stored energy is provided. The power source should have sufficient capacity to operate each door at least three times, i.e closed - open - closed against an adverse list of 15°; and
 - .2.2 power to the control, indication and alarm circuits for the watertight doors for half an hour.

CHAPTER 13 - NAVIGATIONAL EQUIPMENT

13.1 Navigation (general)

13.1.1 This chapter only covers items of navigational equipment which relate to the navigation of the craft as distinct from the safe functioning of the craft. The following paragraphs represent the minimum requirements for normal safe navigation unless it is demonstrated to the Administration that an equivalent level of safety is achieved by other means.

13.1.2 The navigational equipment and its installation should be to the satisfaction of the Administration.

13.2 Compasses

13.2.1 Craft should be provided with a magnetic compass which is capable of operating without electrical supply, and which may be used for steering purposes. This compass should be mounted in a suitable binnacle containing the required correcting devices and should be suitable for the speed and motion characteristics of the craft.

13.2.2 The compass card or repeater should be capable of being easily read from the position at which the craft is normally controlled.

13.2.3 Each magnetic compass should be properly adjusted and its table or curve of residual deviations should be available at all times.

13.2.4 Care should be taken in siting a magnetic compass or magnetic sensing element so that magnetic interference is eliminated or minimized so far as is practicable.

13.2.5 Passenger craft certified to carry 100 passengers or less should, in addition to the compass required by 13.2.1, be provided with an instrument, suitable for the speed and motion characteristics and area of operation of the craft, providing a heading reference of accuracy superior to that provided by a magnetic compass.

13.2.6 Cargo craft and passenger craft certified to carry more than 100 passengers should, in addition to the compass required in 13.2.1, be provided with a gyro-compass which should be suitable for the speed and motion characteristics and area of operation of the craft.

13.3 Speed and distance measurement

13.3.1 Craft should be provided with a device to measure speed and distance, except when no device is available which will function reliably at all speeds at which the craft may operate.

13.3.2 Speed and distance measuring devices on craft fitted with automatic radar plotting aid should be capable of measuring speed and distance through the water.

13.4 Echo-sounding device

13.4.1 Non-amphibious craft should be fitted with an echo-sounding device which will give an indication of depth of water to a sufficient degree of accuracy for use when the craft is in the displacement mode.

13.5 Radar installations

13.5.1 Craft should be provided with at least one azimuth-stabilized radar operating in the X-band (3 cm).

13.5.2 Craft of 500 tons gross tonnage and upwards or craft certified to carry more than 450 passengers should be provided with at least two radar installations. A second radar may also be provided in craft of less than 500 tons gross tonnage or certified to carry 450 passengers or less where environmental conditions so require.

13.5.3 At least one radar should be equipped with facilities for plotting which are at least as effective as a reflector plotter.

13.5.4 Adequate communication facilities should be provided between the radar observer and the person in immediate charge of the craft.

13.5.5 Each radar installation provided should be suitable for the intended craft speed, motion characteristics and commonly encountered environmental conditions.

13.5.6 Each radar installation should be mounted so as to be as free as practicable from vibration.

13.6 Electronic positioning systems

Where the area of operation of a high speed craft is covered by a reliable electronic position-fixing system, the craft should be provided with the means to fix its position using such system.

13.7 Rate-of-turn indicator and rudder angle indicator

13.7.1 A rate-of-turn indicator should be provided unless the Administration determines otherwise. Means should be provided to warn the operator if an operationally dictated maximum rate of turn is being reached.

13.7.2 Craft should be provided with an indicator showing the rudder angle. In craft without a rudder, the indicator should show the direction of steering thrust.

13.8 Other navigational aids

13.8.1 The information provided by navigational systems should be so displayed that the probability of misreading is reduced to a minimum and should be capable of giving readings to an optimum accuracy.

13.9 Searchlight

- 13.9.1 Craft should be equipped with at least one adequate searchlight which should be controllable from the operating station.
- 13.9.2 One portable signalling lamp capable of operating independently of the craft's main electrical supply should be provided and maintained ready for use in the operating compartment at all times.

13.10 Night vision equipment

- 13.10.1 When operational conditions justify the provision of night vision enhancement equipment, such equipment should be fitted.

13.11 Steering arrangement and propulsion indicators

- 13.11.1 The steering arrangement should be so designed that the craft turns in the same direction as that of the wheel, tiller, joy stick or control lever.
- 13.11.2 Craft should be provided with indicators showing the mode of the propulsion system(s).
- 13.11.3 Craft with emergency steering positions should be provided with arrangements for supplying visual compass readings to the emergency steering position.

13.12 Automatic steering aid (automatic pilot equipment)

- 13.12.1 Craft should, where possible, be equipped with automatic pilot equipment.
- 13.12.2 The alarm signalling facilities prescribed in paragraphs 3.1 and 3.2 of the Recommendation on performance standards for automatic pilots, adopted by the Organization by resolution A.342(IX), may be omitted.
- 13.12.3 Provision should be made to change from the automatic to manual mode by a manual override.

13.13 Performance standards

- 13.13.1 All equipment to which this chapter applies should be of a type approved by the Administration. Subject to 13.13.2, such equipment should conform to performance standards not inferior to those adopted by the Organization.
- 13.13.2 Equipment installed before the adoption of performance standards by the Organization may be exempted from full compliance with the performance standards having due regard to the criteria which the Organization may adopt in connection with such standards.

CHAPTER 14 - RADIOCOMMUNICATIONS

14.1 Application

14.1.1 This chapter applies to all craft specified in 1.3.1 and 1.3.2.

14.1.2 This chapter does not apply to craft to which this Code would otherwise apply while such craft are being navigated within the Great Lakes of North America and their connecting and tributary waters as far east as the lower exit of the St. Lambert Lock at Montreal in the Province of Quebec, Canada.*

14.1.3 No provision in this chapter should prevent the use by any craft, survival craft or person in distress, of any means at their disposal to attract attention, make known their position and obtain help.

14.2 Terms and definitions

14.2.1 For the purpose of this chapter, the following terms should have the meanings defined below:

- .1 "Bridge-to-bridge communications" means safety communications between craft and ships from the position from which the craft is normally navigated.
- .2 "Continuous watch" means that the radio watch concerned should not be interrupted other than for brief intervals when the craft's receiving capability is impaired or blocked by its own communications or when the facilities are under periodical maintenance or checks.
- .3 "Digital selective calling (DSC)" means a technique using digital codes which enables a radio station to establish contact with, and transfer information to, another station or group of stations, and complying with the relevant recommendations of the International Radio Consultative Committee (CCIR).
- .4 "Direct-printing telegraphy" means automated telegraphy techniques which comply with the relevant recommendations of the International Radio Consultative Committee (CCIR).
- .5 "General radiocommunications" means operational and public correspondence traffic other than distress, urgency and safety messages, conducted by radio.
- .6 "INMARSAT" means the Organization established by the Convention on the International Maritime Satellite Organization (INMARSAT) adopted on 3 September 1976.

* Such craft are subject to special requirements relative to radio for safety purposes, as contained in the relevant agreement between Canada and the United States.

- .7 "International NAVTEX service" means the co-ordinated broadcast and automatic reception on 518 kHz of maritime safety information by means of narrow-band direct-printing telegraphy using the English language*.
- .8 "Locating" means the finding of the ships, craft, aircraft, units or persons in distress.
- .9 "Maritime safety information" means navigational and meteorological warnings, meteorological forecasts and other urgent safety related messages broadcast to ships and craft.
- .10 "Polar orbiting satellite service" means a service which is based on polar orbiting satellites which receive and relay distress alerts from satellite EPIRBs and which provides their position.
- .11 "Radio Regulations" mean the Radio Regulations annexed to, or regarded as being annexed to, the most recent International Telecommunication Convention which is in force at any time.
- .12 "Sea area A1" means an area within the radiotelephone coverage of at least one VHF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government to the Convention.**
- .13 "Sea area A2" means an area, excluding sea area A1, within the radiotelephone coverage of at least one MF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government to the Convention.**
- .14 "Sea area A3" means an area, excluding sea areas A1 and A2, within the coverage of an INMARSAT geostationary satellite in which continuous alerting is available.
- .15 "Sea area A4" means an area outside sea areas A1, A2 and A3.
- 14.2.2 All other terms and abbreviations which are used in this chapter and which are defined in the Radio Regulations should have the meanings as defined in those Regulations.
- 14.3 Exemptions
- 14.3.1 It is considered highly desirable not to deviate from the requirements of this chapter; nevertheless the Administration, in conjunction with the base port State, may grant partial or conditional exemptions to individual craft from the requirements of 14.6 to 14.10 provided:
- .1 such craft comply with the functional requirements of 14.4; and
- .2 the Administration has taken into account the effect such exemptions may have upon the general efficiency of the service for the safety of all ships and craft.

* Refer to the NAVTEX manual approved by the Organization.

** Refer to resolution A.704(17) concerning provision of radio services for the Global Maritime Distress and Safety System (GMDSS), adopted by the Organization.

- 14.3.2 An exemption may be granted under 14.3.1 only:
- .1 if the conditions affecting safety are such as to render the full application of 14.6 to 14.10 unreasonable or unnecessary;
 - .2 in exceptional circumstances, for a single voyage outside the sea area or sea areas for which the craft is equipped; or
 - .3 prior to 1 February 1999, when the craft will be taken permanently out of service within two years of a date prescribed by 14.1 for the application of requirements of this chapter.

14.3.3 Each Administration should submit to the Organization, as soon as possible after the first of January in each year, a report showing all exemptions granted under 14.3.1 and 14.3.2 during the previous calendar year and giving the reasons for granting such exemptions.

14.4 Functional requirements

- 14.4.1 Every craft, while at sea, should be capable:
- .1 except as provided in 14.7.1.1 and 14.9.1.4.3, of transmitting ship-to-shore distress alerts by at least two separate and independent means, each using a different radiocommunication service;
 - .2 of receiving shore-to-ship distress alerts;
 - .3 of transmitting and receiving ship-to-ship distress alerts;
 - .4 of transmitting and receiving search and rescue co-ordinating communications;
 - .5 of transmitting and receiving on-scene communications;
 - .6 of transmitting and, as required by 13.5, receiving signals for locating*;
 - .7 of transmitting and receiving** marine safety information;
 - .8 of transmitting and receiving general radiocommunications to and from shore-based radio systems or networks subject to 14.14.8; and
 - .9 of transmitting and receiving bridge-to-bridge communications.

* Refer to resolution A.614(15) on carriage of radar operating in the frequency band 9,300–9,500 MHz adopted by the Organization.

** It should be noted that craft may have a need for reception of certain maritime safety information while in port.

14.5 Radio installations

14.5.1 Every craft should be provided with radio installations capable of complying with the functional requirements prescribed by 14.4 throughout its intended voyage and, unless exempted under 14.3, complying with the requirements of 14.6 and, as appropriate for the sea area or areas through which it will pass during its intended voyage, the requirements of either 14.7, 14.8, 14.9 or 14.10.

14.5.2 Every radio installation should:

- .1 be so located that no harmful interference of mechanical, electrical or other origin affects its proper use, and so as to ensure electromagnetic compatibility and avoidance of harmful interaction with other equipment and systems;
- .2 be so located as to ensure the greatest possible degree of safety and operational availability;
- .3 be protected against harmful effects of water, extremes of temperature and other adverse environmental conditions;
- .4 be provided with reliable, permanently arranged electrical lighting, independent of the main sources of electrical power, for the adequate illumination of the radio controls for operating the radio installation; and
- .5 be clearly marked with the call sign, the ship station identity and other codes as applicable for the use of the radio installation.

14.5.3 Control of the VHF radiotelephone channels, required for navigational safety, should be immediately available on the navigating bridge convenient to the conning position, and where necessary, facilities should be available to permit radiocommunications from the wings of the navigating bridge. Portable VHF equipment may be used to meet the latter provision.

14.6 Radio equipment: General

14.6.1 Every craft should be provided with:

- .1 a VHF radio installation capable of transmitting and receiving:
 - .1.1 DSC on the frequency 156.525 MHz (channel 70). It should be possible to initiate the transmission of distress alerts on channel 70 from the position from which the craft is normally navigated*; and
 - .1.2 radiotelephony on the frequencies 156.300 MHz (channel 6), 156.650 MHz (channel 13) and 156.800 MHz (channel 16);
- .2 a radio installation capable of maintaining a continuous DSC watch on VHF channel 70 which may be separate from, or combined with, that required by 14.6.1.1.1;*

* Certain craft may be exempted from this requirement (see 14.8.4, 14.9.4, and 14.10.2.).

- .3 a radar transponder capable of operating in the 9 GHz band, which:
 - .3.1 should be so stowed that it can be easily utilized; and
 - .3.2 may be one of those required by 8.2.1.2 for a survival craft;
- .4 a receiver capable of receiving International NAVTEX service broadcasts if the craft is engaged on voyages in any area in which an International NAVTEX service is provided;
- .5 a radio facility for reception of maritime safety information by the INMARSAT enhanced group calling system* if the craft is engaged on voyages in any area of INMARSAT coverage but in which an international NAVTEX service is not provided. However, craft engaged exclusively on voyages in areas where a HF direct-printing telegraphy maritime safety information service is provided and fitted with equipment capable of receiving such service, may be exempt from this requirement.**
- .6 subject to the provisions of 14.7.3, a satellite emergency position-indicating radio beacon (satellite EPIRB)*** which should be:
 - .6.1 capable of transmitting a distress alert either through the polar orbiting satellite service operating in the 406 MHz band or, if the craft is engaged only on voyages within INMARSAT coverage, through the INMARSAT geostationary satellite service operating in the 1.6 GHz band****;
 - .6.2 installed in an easily accessible position;
 - .6.3 ready to be manually released and capable of being carried by one person into a survival craft;
 - .6.4 capable of floating free if the craft sinks and of being automatically activated when afloat; and
 - .6.5 capable of being activated manually.

* Refer to resolution A.701(17) concerning carriage of INMARSAT enhanced group call SafetyNET receivers under the GMDSS, adopted by the Organization.

** Refer to the Recommendation on promulgation of maritime safety information, adopted by the Organization by resolution A.705(17).

*** Refer to resolution A.616(15) concerning search and rescue homing capability, adopted by the Organization.

**** Subject to the availability of appropriate receiving and processing ground facilities for each ocean region covered by INMARSAT satellites.

- 14.6.2 Until 1 February 1999, or until such other date as may be determined by the Maritime Safety Committee, every craft should, in addition, be fitted with a radio installation consisting of a radiotelephone distress frequency watch receiver capable of operating on 2,182 kHz.
- 14.6.3 Until 1 February 1999, every craft should, unless the craft is engaged on voyages in sea area A1 only, be fitted with a device for generating the radiotelephone alarm signal on the frequency 2,182 kHz*.
- 14.6.4 The Administration may exempt craft constructed on or after 1 February 1997 from the requirements prescribed by 14.6.2 and 14.6.3.
- 14.7 Radio equipment: Sea area A1
- 14.7.1 In addition to meeting the requirements of 14.6, every craft engaged on voyages exclusively in sea area A1 should be provided with a radio installation capable of initiating the transmission of ship-to-shore distress alerts from the position from which the craft is normally navigated, operating either:
- .1 on VHF using DSC; this requirement may be fulfilled by the EPIRB prescribed by 14.7.3, either by installing the EPIRB close to, or by remote activation from, the position from which the craft is normally navigated; or
 - .2 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from the position from which the craft is normally navigated; or
 - .3 if the craft on voyages within coverage of MF coast stations equipped with DSC, on MF using DSC; or
 - .4 on HF using DSC; or
 - .5 through the INMARSAT geostationary satellite service; this requirement may be fulfilled by:
 - .5.1 an INMARSAT ship earth station**; or

* Refer to resolution A.421(XI) concerning operational standards for radiotelephone alarm signal generators, adopted by the Organization.

** This requirement can be met by INMARSAT ship earth stations capable of two-way communications, such as Standard-A and B (resolution A.698(17)) or Standard-C (resolution A.663(16)) ship earth stations. Unless otherwise specified, this footnote applies to all requirements for an INMARSAT ship earth station prescribed by this chapter.

- .5.2 the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated.
- 14.7.2 The VHF radio installation, required by 14.6.1.1, should also be capable of transmitting and receiving general radiocommunications using radiotelephony.
- 14.7.3 Craft engaged on voyages exclusively in sea area A1 may carry, in lieu of the satellite EPIRB required by 14.6.1.6, an EPIRB which should be:
 - .1 capable of transmitting a distress alert using DSC on VHF channel 70 and providing for locating by means of a radar transponder operating in the 9 GHz band;
 - .2 installed in an easily accessible position;
 - .3 ready to be manually released and capable of being carried by one person into a survival craft;
 - .4 capable of floating free if the craft sinks and of being automatically activated when afloat; and
 - .5 capable of being activated manually.
- 14.8 Radio equipment – Sea areas A1 and A2
- 14.8.1 In addition to meeting the requirements of 14.6, every craft engaged on voyages beyond sea area A1, but remaining within sea area A2, should be provided with:
 - .1 an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies:
 - .1.1 2,187.5 kHz using DSC; and
 - .1.2 2,182 kHz using radiotelephony;
 - .2 a radio installation capable of maintaining a continuous DSC watch on the frequency 2,187.5 kHz which may be separate from, or combined with, that required by 14.8.1.1.1; and
 - .3 means of initiating the transmission of ship-to-shore distress alerts by a radio service other than MF operating either:
 - .3.1 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated; or

- .3.2 on HF using DSC; or
- .3.3 through the INMARSAT geostationary satellite service; this requirement may be fulfilled by:
 - .3.3.1 the equipment specified in 14.8.3.2; or
 - .3.3.2 the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated.
- 14.8.2 It should be possible to initiate transmission of distress alerts by the radio installations specified in 14.8.1.1 and 14.8.1.3 from the position from which the craft is normally navigated.
- 14.8.3 The craft should, in addition, be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by either:
 - .1 a radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000 kHz or between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by 14.8.1.1; or
 - .2 an INMARSAT ship earth station.
- 14.8.4 The Administration may exempt crafts constructed before 1 February 1997, which are engaged exclusively on voyages within sea area A2, from the requirements of 14.6.1.1.1 and 14.6.1.2 provided such crafts maintain, when practicable, a continuous listening watch on VHF channel 16. This watch should be kept at the position from which the craft is normally navigated. Such exemption should be endorsed by the base port State in the Permit to Operate.
- 14.9 Radio equipment: Sea areas A1, A2 and A3
- 14.9.1 In addition to meeting the requirements of 14.6, every craft engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, should, if it does not comply with the requirements of 14.9.2, be provided with:
 - .1 an INMARSAT ship earth station capable of:
 - .1.1 transmitting and receiving distress and safety communications using direct-printing telegraphy;
 - .1.2 initiating and receiving distress priority calls;
 - .1.3 maintaining watch for shore-to-ship distress alerts, including those directed to specifically defined geographical areas;
 - .1.4 transmitting and receiving general radiocommunications, using either radiotelephony or direct-printing telegraphy; and

- .2 an MF radio installation capable of transmitting and receiving, for distress and safety purposes, on the frequencies:
 - .2.1 2,187.5 kHz using DSC; and
 - .2.2 2,182 kHz using radiotelephony; and
 - .3 a radio installation capable of maintaining a continuous DSC watch on the frequency 2,187.5 kHz which may be separate from or combined with that required by 14.9.1.2.1; and
 - .4 means of initiating the transmission of ship-to-shore distress alerts by a radio service operating either:
 - .4.1 through the polar orbiting service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated; or
 - .4.2 on HF using DSC; or
 - .4.3 through the INMARSAT geostationary satellite service, by an additional ship earth station or by the satellite EPIRB required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated;
- 14.9.2 In addition to meeting the requirements of 14.6, every craft engaged on voyages beyond sea areas A1 and A2, but remaining within sea area A3, should, if it does not comply with the requirements of 14.9.1, be provided with:
- .1 an MF/HF radio installation capable of transmitting and receiving, for distress and safety purposes, on all distress and safety frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz:
 - .1.1 using DSC;
 - .1.2 using radiotelephony; and
 - .1.3 using direct-printing telegraphy; and
 - .2 equipment capable of maintaining DSC watch on 2,187.5 kHz, 8,414.5 kHz and on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz; at any time, it should be possible to select any of these DSC distress and safety frequencies. This equipment may be separate from, or combined with, the equipment required by 14.9.2.1; and
 - .3 means of initiating the transmission of ship-to-shore distress alerts by a radiocommunication service other than HF operating either:

- .3.1 through the polar orbiting satellite service on 406 MHz; this requirement may be fulfilled by the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated; or
 - .3.2 through the INMARSAT geostationary satellite service; this requirement may be fulfilled by:
 - .3.2.1 an INMARSAT ship earth station; or
 - .3.2.2 the satellite EPIRB, required by 14.6.1.6, either by installing the satellite EPIRB close to, or by remote activation from, the position from which the craft is normally navigated; and
 - .4 in addition, the craft should be capable of transmitting and receiving general radiocommunications using radiotelephony or direct-printing telegraphy by an MF/HF radio installation operating on working frequencies in the bands between 1,605 kHz and 4,000 kHz and between 4,000 kHz and 27,500 kHz. This requirement may be fulfilled by the addition of this capability in the equipment required by 14.9.2.1.
- 14.9.3 It should be possible to initiate transmission of distress alerts by the radio installations specified in 14.9.1.1, 14.9.1.2, 14.9.1.4, 14.9.2.1 and 14.9.2.3 from the position from which the craft is normally navigated.
- 14.9.4 The Administration, in conjunction with the base port State, may exempt crafts constructed before 1 February 1997 and engaged exclusively on voyages within sea areas A2 and A3, from the requirements of 14.6.1.1.1 and 14.6.1.2 provided such crafts maintain, when practicable, a continuous listening watch on VHF channel 16. This watch should be kept at the position from which the craft is normally navigated.
- 14.10 Radio equipment: Sea areas A1, A2, A3 and A4
- 14.10.1 In addition to meeting the requirements of 14.6, craft engaged on voyages in all sea areas should be provided with the radio installations and equipment required by 14.9.2, except that the equipment required by 14.9.2.3.2 should not be accepted as an alternative to that required by 14.9.2.3.1, which should always be provided. In addition, craft engaged on voyages in all sea areas should comply with the requirements of 14.9.3.
- 14.10.2 The Administration, in conjunction with the base port State, may exempt crafts constructed before 1 February 1997, and engaged exclusively on voyages within sea areas A2, A3 and A4, from the requirements of 14.6.1.1.1 and 14.6.1.2 provided such crafts maintain, when practicable, a continuous listening watch on VHF channel 16. This watch should be kept at the position from which the craft is normally navigated.

14.11 Watches

14.11.1 Every craft, while at sea, should maintain a continuous watch:

- .1 on VHF DSC channel 70, if the craft, in accordance with the requirements of 14.6.1.2, is fitted with a VHF radio installation;
- .2 on the distress and safety DSC frequency 2,187.5 kHz, if the craft, in accordance with the requirements of 14.8.1.2 or 14.9.1.3, is fitted with an MF radio installation;
- .3 on the distress and safety DSC frequencies 2,187.5 kHz and 8,414.5 kHz and also on at least one of the distress and safety DSC frequencies 4,207.5 kHz, 6,312 kHz, 12,577 kHz or 16,804.5 kHz, appropriate to the time of day and the geographical position of the craft, if the craft, in accordance with the requirements of 14.9.2.2 or 14.10.1, is fitted with an MF/HF radio installation. This watch may be kept by means of a scanning receiver;
- .4 for satellite shore-to-ship distress alerts, if the craft, in accordance with the requirements of 14.9.1.1, is fitted with an INMARSAT ship earth station.

14.11.2 Every craft, while at sea, should maintain a radio watch for broadcasts of maritime safety information on the appropriate frequency or frequencies on which such information is broadcast for the area in which the craft is navigating.

14.11.3 Until 1 February 1999 or until such other date as may be determined by the Maritime Safety Committee, every craft while at sea should maintain, when practicable, a continuous listening watch on VHF channel 16. This watch should be kept at the position from which the craft is normally navigated.

14.11.4 Until 1 February 1999 or until such other date as may be determined by the Maritime Safety Committee, every craft required to carry a radiotelephone watch receiver should maintain, while at sea, a continuous watch on the radiotelephone distress frequency 2,182 kHz. This watch should be kept at the position from which the craft is normally navigated.

14.12 Sources of energy

14.12.1 There should be available at all times, while the craft is at sea, a supply of electrical energy sufficient to operate the radio installations and to charge any batteries used as part of a reserve source of energy for the radio installations.

14.12.2 Reserve and emergency sources of energy should be provided on every craft to supply radio installations, for the purpose of conducting distress and safety radiocommunications, in the event of failure of the craft's main and emergency sources of electrical power. The reserve source of energy should be capable of simultaneously operating the VHF radio installation required by 14.6.1.1 and, as

appropriate for the sea area or sea areas for which the craft is equipped, either the MF radio installation required by 14.8.1.1, the MF/HF radio installation required by 14.9.2.1 or 14.10.1 or the INMARSAT ship earth station required by 14.9.1.1 and any of the additional loads mentioned in 14.12.5 and 14.12.8 for a period of at least 1 h.

- 14.12.3 The reserve source of energy should be independent of the propelling power of the craft and the craft's electrical system.
- 14.12.4 Where, in addition to the VHF radio installation, two or more of the other radio installations, referred to in 14.12.2, can be connected to the reserve source of energy, they should be capable of simultaneously supplying, for the period specified in 14.12.2, the VHF radio installation and:
- .1 all other radio installations which can be connected to the reserve source of energy at the same time; or
 - .2 whichever of the radio installations will consume the most power, if only one of the other radio installations can be connected to the reserve source of energy at the same time as the VHF radio installation.
- 14.12.5 The reserve source of energy may be used to supply the electrical lighting required by 14.5.2.4.
- 14.12.6 Where a reserve source of energy consists of a rechargeable accumulator battery or batteries:
- .1 a means of automatically charging such batteries should be provided which should be capable of recharging them to minimum capacity requirements within 10 h; and
 - .2 the capacity of the battery or batteries should be checked, using an appropriate method*, at intervals not exceeding 12 months, when the craft is not at sea.
- 14.12.7 The siting and installation of accumulator batteries which provide a reserve source of energy should be such as to ensure:
- .1 the highest degree of service;
 - .2 a reasonable lifetime;
 - .3 reasonable safety;

* One method of checking the capacity of an accumulator battery is to fully discharge and recharge the battery, using normal operating current and period (e.g. 10 h). Assessment of the charge condition can be made at any time, but it should be done without significant discharge of the battery when the craft is at sea.

- .4 that the battery temperatures remain within the manufacturer's specifications whether under charge or idle; and
 - .5 that when fully charged, the batteries will provide at least the minimum required hours of operation under all weather conditions.
- 14.12.8 If an uninterrupted input of information from the craft's navigational or other equipment to a radio installation required by this chapter is needed to ensure its proper performance, means should be provided to ensure the continuous supply of such information in the event of failure of the craft's main or emergency source of electrical power.

14.13 Performance standards

- 14.13.1 All equipment to which this chapter applies should be of a type approved by the Administration. Such equipment should conform to appropriate performance standards not inferior to those adopted by the Organization*.

* Refer to the following resolutions adopted by the Assembly of the Organization:

- .1 Resolution A.525(13): Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships.
- .2 Resolution A.694(17): General requirements for shipborne radio equipment forming part of the global maritime distress and safety system (GMDSS) and for electronic navigational aids.
- .3 Resolution A.698(17): Performance standards for ship earth stations capable of two-way communications and resolution A.570(14): Type approval of ship earth stations.
- .4 Resolution A.609(15): Performance standards for shipborne VHF radio installations capable of voice communication and digital selective calling.
- .5 Resolution A.610(15): Performance standards for shipborne MF radio installations capable of voice communication and digital selective calling.
- .6 Resolution A.613(15): Performance standards for shipborne MF/HF radio installations capable of voice communication, narrow-band direct-printing and digital selective calling.
- .7 Resolution A.695(17): Performance standards for float-free satellite emergency position-indicating radio beacons (EPIRBs) operating on 406 MHz (see also Assembly resolution A.696(17): Type approval of satellite emergency position-indicating radio beacons (EPIRBs) operating in the COSPAS-SARSAT system).

(Footnote continued)

- .8 Resolution A.697(17): Performance standards for survival craft radar transponders for use in search and rescue operations.
- .9 Resolution A.612(15): Performance standards for float-free VHF emergency position-indicating radio beacons.
- .10 Resolution A.663(16): Performance standards for INMARSAT Standard-C ship earth stations capable of transmitting and receiving direct-printing communications and resolution A.570(14): Type approval of ship earth stations.
- .11 Resolution A.664(16): Performance standards for enhanced group call equipment.
- .12 Resolution A.661(16): Performance standards for float-free satellite emergency position-indicating radio beacons operating through the geostationary INMARSAT satellite system on 1.6 GHz.
- .13 Resolution A.662(16): Performance standards for float-free release and activation arrangements for emergency radio equipment.
- .14 Resolution A.699(17): System performance standard for the promulgation and co-ordination of maritime safety information using high-frequency narrow-band direct-printing.
- .15 Resolution A.700(17): Performance standards for narrow-band direct-printing telegraph equipment for the reception of navigational and meteorological warnings and urgent information to ships (MSI) by HF.

14.14 Maintenance requirements

- 14.14.1 Equipment should be so designed that the main units can be replaced readily without elaborate recalibration or readjustment.
- 14.14.2 Where applicable, equipment should be so constructed and installed that it is readily accessible for inspection and on-board maintenance purposes.
- 14.14.3 Adequate information should be provided to enable the equipment to be properly operated and maintained, taking into account the recommendations of the Organization*.
- 14.14.4 Adequate tools and spares should be provided to enable equipment to be maintained.
- 14.14.5 The Administration should ensure that radio equipment required by this chapter is maintained to provide the availability of the functional requirements specified in 14.4 and to meet the recommended performance standards of such equipment.
- 14.14.6 On crafts engaged on voyages in sea areas A1 and A2, the availability should be ensured by using such methods as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, or a combination of these, as may be approved by the Administration.
- 14.14.7 On crafts engaged on voyages in sea areas A3 and A4, the availability should be ensured by using a combination of at least two methods such as duplication of equipment, shore-based maintenance or at-sea electronic maintenance capability, as may be approved by the Administration, taking into account the recommendations of the Organization**.
- 14.14.8 However, crafts operating solely between ports where adequate facilities for shore-based maintenance of the radio installations are available and provided no journey between two such ports exceeds six hours, then the Administration may exempt such crafts from the requirement to use at least two maintenance methods. For such crafts at least one maintenance method should be used.

* Refer to the Recommendation on general requirements for shipborne radio equipment forming part of the global maritime distress and safety system and for electronic navigational aids, adopted by the Organization by resolution A.694(17).

** Administrations should take account of the Recommendations on radio maintenance guidelines for the Global Maritime Distress and Safety System (GMDSS) related to sea areas A3 and A4, adopted by the Organization by resolution A.702(17)

14.14.9 While all reasonable steps should be taken to maintain the equipment in efficient working order to ensure compliance with all the functional requirements specified in 14.4, malfunction of the equipment for providing the general radiocommunications, required by 14.4.8, should not be considered as making a craft unseaworthy or as a reason for delaying the craft in ports where repair facilities are not readily available, provided the craft is capable of performing all distress and safety functions.

14.15 Radio personnel

Every craft should carry personnel qualified for distress and safety radiocommunication purposes to the satisfaction of the Administration. The personnel should be holders of certificates specified in the Radio Regulations as appropriate, any one of whom should be designated to have primary responsibility for radiocommunications during distress incidents.

14.16 Radio records

A record should be kept, to the satisfaction of the Administration and as required by the Radio Regulations, of all incidents connected with the radiocommunication service which appear to be of importance to safety of life at sea.

CHAPTER 15 - OPERATING COMPARTMENT LAYOUT

15.1 Definitions

- 15.1.1 "Operating area" is the operating compartment and those parts of the craft on both sides of, and close to, the operating compartment which extend to the craft's side.
- 15.1.2 "Workstation" is a position at which one or several tasks constituting a particular activity are carried out.
- 15.1.3 "Docking workstation" is a place equipped with necessary means for docking the craft.
- 15.1.4 "Primary controls" are all control equipment necessary for the safe operation of the craft when it is underway, including those required in an emergency situation.

15.2 General

The design and layout of the compartment from which the crew operate the craft should be such as to permit operating crew members to perform their duties in a correct manner without unreasonable difficulty, fatigue or concentration, and to minimize the likelihood of injury to operating crew members in both normal and emergency conditions.

15.3 Field of vision from the operating compartment

- 15.3.1 The operating station should be placed above all other superstructures so that the operating crew are able to gain a view all round the horizon from the navigating workstation. Where it is impractical to meet the requirements of this paragraph from a single navigating workstation, the operating station should be designed so that an all-round view of the horizon is obtained using two navigating workstations combined or any other means to the satisfaction of the Administration.
- 15.3.2 Blind sectors should be as few and as small as possible, and not adversely affect the keeping of a safe lookout from the operating station. If stiffeners between windows are to be covered, this should not cause further obstruction inside the wheelhouse.
- 15.3.3 The total arc of blind sectors from right ahead to 22.5° abaft the beam on either side should not exceed 20°. Each individual blind sector should not exceed 5°. The clear sector between two blind sectors should not be less than 10°.
- 15.3.4 Where it is considered necessary by the Administration, the field of vision from the navigating workstation should permit the navigators from this position to utilize leading marks astern of the craft for track monitoring.

- 15.3.5 The view of the sea surface from the operating station, when the navigators are seated, should not be obscured by more than one craft length forward of the bow to 90° on either side irrespective of the craft's draught, trim and deck cargo.
- 15.3.6 The field of vision from the docking workstation, if remote from the operating station, should permit one navigator to safely manoeuvre the craft to a berth.
- 15.4 Operating compartment
- 15.4.1 The design and arrangement of the operating compartment, including location and layout of the individual workstations, should ensure the required field of vision for each function.
- 15.4.2 The craft's operating compartment should not be used for purposes other than navigation, communications and other functions essential to the safe operation of the craft, its engines, passengers and cargo.
- 15.4.3 The operating compartment should be provided with an integrated operating station for command, navigation, manoeuvring and communication and so arranged that it can accommodate those persons required to navigate the craft safely.
- 15.4.4 The arrangement of equipment and means for navigation, manoeuvring, control, communication and other essential instruments should be located sufficiently close together to enable both the officer in charge and any assisting officer to receive all necessary information and to use the equipment and controls, as required, while they are seated. If necessary, the equipment and means serving these functions should be duplicated.
- 15.4.5 If a separate workstation for supervision of engine performance is placed in the operating compartment, the location and use of this workstation should not interfere with the primary functions to be performed in the operating station.
- 15.4.6 The location of the radio equipment should not interfere with the primary navigational functions in the operating station.
- 15.4.7 The design and layout of the compartment from which the crew operate the craft and the relative positions of the primary controls should be assessed against the essential operational manning level. Where minimum manning levels are proposed, the design and layout of the primary and communication controls should form an integrated operational and emergency control centre from which the craft can be controlled under all operational and emergency events by the operating crew without the necessity for any crew member to vacate the compartment.
- 15.4.8 The relative positions of the primary controls and the seats should be such that each operating crew member, with the seat suitably adjusted, and without prejudicing compliance with 15.2 can:
- .1 without interference, produce full and unrestricted movement of each control both separately and with all practical combinations of movement of other controls; and

- .2 at all work stations, exert adequate control forces for the operation to be performed.
- 15.4.9 When a seat at a station from which the craft may be operated has been adjusted so as to suit the occupant, subsequent change of seat position to operate any control should not be acceptable.
- 15.4.10 In craft where the Administration considers the provision of a safety belt necessary for use by the operating crew, it should be possible for those operating crew members, with their safety belts correctly worn, to comply with 15.4.4 except in respect of controls which it can be shown will only be required on very rare occasions and which are not associated with the need for safety restraint.
- 15.4.11 The integrated operating station should contain equipment which provides relevant information to enable the officer in charge and any assisting officer to carry out navigational and safety functions safely and efficiently.
- 15.4.12 Adequate arrangements should be made to prevent passengers from distracting the attention of the operating crew.
- 15.5 Instruments and chart table
- 15.5.1 Instruments, instrument panels and controls should be permanently mounted in consoles or other appropriate places taking into account operation, maintenance and environmental conditions. However, this should not prevent the use of new control or display techniques, provided the facilities offered are not inferior to recognized standards.
- 15.5.2 All instruments should be logically grouped according to their functions. In order to reduce to a minimum the risk of confusion, instruments should not be rationalized by sharing functions or by interswitching.
- 15.5.3 Instruments required for use by any member of the operating crew should be plainly visible and easily read:
- .1 with minimum practicable deviation from his normal seating position and line of vision; and
- .2 with the minimum risk of confusion under all likely operating conditions.
- 15.5.4 Instruments essential for the safe operation of the craft should be clearly marked with any limitation if this information is not otherwise clearly presented to the operating crew. The instrument panels forming the emergency control for the launching of liferafts and the monitoring of the fire-fighting systems should be in separate and clearly defined positions within the operating area.
- 15.5.5 The instruments and controls should be provided with means for screening and dimming in order to minimize glare and reflections and prevent them being obscured by strong light.

- 15.5.6 The surfaces of console tops and instruments should have dark glare-free colours.
- 15.5.7 Instruments and displays, providing visual information to more than one person, should be located for easy viewing by all users concurrently. If this is not possible, the instrument or display should be duplicated.
- 15.5.8 If considered necessary by the Administration, the operating compartment should be provided with a suitable table for chart work. There should be facilities for lighting the chart. Chart table lighting should be screened.

15.6 Lighting

- 15.6.1 A satisfactory level of lighting should be available to enable the operating personnel to adequately perform all their tasks both at sea and in port, by day and night. There should be only a limited reduction in the illumination of essential instruments and controls under likely system fault conditions.
- 15.6.2 Care should be taken to avoid glare and stray image reflection in the operating area environment. High contrast in brightness between work area and surroundings should be avoided. Non-reflective or matt surfaces should be used to reduce indirect glare to a minimum.
- 15.6.3 A satisfactory degree of flexibility within the lighting system should be available to enable the operating personnel to adjust the lighting intensity and direction as required in the different areas of the operating compartment and at individual instruments and controls.
- 15.6.4 Red light should be used to maintain dark adaptation whenever possible in areas or on items of equipment requiring illumination in the operational mode, other than chart table.
- 15.6.5 During hours of darkness, it should be possible to discern displayed information and control devices.
- 15.6.6 Reference is made to additional requirements on lighting in 12.7 and 12.8.

15.7 Windows

- 15.7.1 Divisions between windows, located in the front, on the sides and in the doors, should be kept to a minimum. No division should be installed immediately forward of the operating stations.
- 15.7.2 Administrations should be satisfied that a clear view through the operating compartment windows is provided at all times regardless of weather conditions. The means provided for maintaining the windows in a clear condition should be so arranged that no reasonably probable single failure can result in a reduction of the cleared field of vision such as to interfere seriously with the ability of the operating crew to continue the operation and bring the craft to rest.

- 15.7.3 Arrangements should be provided so that the forward view from operating stations is not adversely affected by solar glare. Neither polarized nor tinted window glass should be fitted.
- 15.7.4 Operating compartment windows should be angled to reduce unwanted reflection.
- 15.7.5 The windows should be made of material which will not break into dangerous fragments if fractured.
- 15.8 Communication facilities
- 15.8.1 Such means as are necessary should be provided to enable the crew to communicate between, and have access to, each other and with other occupants of the craft in both normal and emergency conditions.
- 15.8.2 Means to communicate between the operating compartment and spaces containing essential machinery, including any emergency steering position, irrespective of whether the machinery is remotely or locally controlled, should be provided.
- 15.8.3 Means for making public address and safety announcements from control stations to all areas to which passengers and crew have access should be provided.
- 15.8.4 Provisions should be made for means to monitor, receive and transmit radio safety messages at the operating compartment.
- 15.9 Temperature and ventilation
- The operating compartment should be equipped with adequate temperature and ventilation control systems.
- 15.10 Colours
- The surface materials inside the operating compartment should have a suitable colour and finish to avoid reflections.
- 15.11 Safety measures
- The operating area should be free of physical hazard to the operating personnel and have non-skid flooring in dry and wet conditions and adequate handrails. Doors should be fitted with devices to prevent them moving, whether they are open or closed.

CHAPTER 16 - STABILIZATION SYSTEMS

16.1 Definitions

16.1.1 "Stabilization control system" is a system intended to stabilize the main parameters of the craft's attitude: heel, trim, course and height and control the craft's motions: roll, pitch, yaw and heave. This term excludes devices not associated with the safe operation of the craft, e.g. motion reduction or ride control systems.

The main elements of a stabilization control system may include the following:

- .1 devices such as rudders, foils, flaps, skirts, fans, water jets, tilting and steerable propellers, pumps for moving fluids;
- .2 power drives actuating stabilization devices; and
- .3 stabilization equipment for accumulating and processing data for making decisions and giving commands such as sensors, logic processors and automatic safety control.

16.1.2 "Self-stabilization" of the craft is stabilization ensured solely by the craft's inherent characteristics.

16.1.3 "Forced stabilization" of the craft is stabilization achieved by:

- .1 an automatic control system; or
- .2 a manually control assisted system; or
- .3 a combined system incorporating elements of both automatic and manually assisted control systems.

16.1.4 "Augmented stabilization" is a combination of self-stabilization and forced stabilization.

16.1.5 "Stabilization device" means a device as enumerated in 16.1.1.1 with the aid of which forces for controlling the craft's position are generated.

16.1.6 "Automatic safety control" is a logic unit for processing data and making decisions to put the craft into the displacement or other safe mode if a condition impairing safety arises.

16.2 General requirements

16.2.1 Stabilization systems should be so designed that in case of failure or malfunctioning of any one of the stabilization devices, or equipment, it would be possible either to ensure maintaining the main parameters of craft's motion within safe limits with the aid of working stabilization devices or to put the craft into the displacement or other safe mode.

- 16.2.2 In case of failure of any automatic equipment or stabilization device, or its power drive, the parameters of craft motion should remain within safe limits.
- 16.2.3 Craft fitted with an automatic stabilization system should be provided with an automatic safety control unless the redundancy in the system provides equivalent safety. Where an automatic safety control is fitted, provision should be made to override it and to cancel the override from the main operating station.
- 16.2.4 The parameters and the levels at which any automatic safety control gives the command to decrease speed and put the craft safely in the displacement or other safe mode should take account of the safe values of heel, trim, yaw and combination of trim and draught appropriate to the particular craft and service; also to the possible consequences of power failure for propulsion, lift or stabilization devices.
- 16.2.5 The parameters and the degree of stabilization of the craft provided by the automatic stabilization system should be satisfactory having regard to the purpose and service conditions of the craft.
- 16.2.6 Failure mode and effect analysis should include the stabilization system.
- 16.3 Lateral and height control systems
- 16.3.1 Craft fitted with an automatic control system should be provided with an automatic safety control. Probable malfunctions should have only minor effects on automatic control system operation and should be capable of being readily counteracted by the operating crew.
- 16.3.2 The parameters and levels at which any automatic control system gives the command to decrease speed and put the craft safely into the displacement or other safe mode should take account of the safety levels as given in section 2.4 of annex 3 and of the safe values of motions appropriate to the particular craft and service.
- 16.4 Demonstrations
- 16.4.1 The limits of safe use of any of the stabilization control system devices should be based on demonstrations and verification process in accordance with annex 8.
- 16.4.2 Demonstration in accordance with annex 8 should determine any adverse effects upon safe operation of the craft in the event of an uncontrollable total deflection of any one control device. Any limitation on the operation of the craft as may be necessary to ensure that the redundancy or safeguards in the systems provide equivalent safety should be included in the craft operating manual.

CHAPTER 17 - HANDLING, CONTROLLABILITY AND PERFORMANCE

17.1 General

The operational safety of the craft in normal service conditions and in equipment failure situations of a craft to which this Code applies should be demonstrated by full-scale tests of the prototype craft. The objective of tests is to determine information to be included in the craft operating manual in relation to:

- .1 handling and performance limitations;
- .2 actions to be taken in the event of prescribed failure; and
- .3 limitations to be observed for safe operation subsequent to prescribed failures.

17.2 Proof of compliance

The information on controllability and manoeuvrability which should be contained in the operating manual should include the characteristics under 17.5, and the list of parameters of the worst intended conditions affecting the controllability and manoeuvrability according to 17.6 and the performance data verified in accordance with annex 8.

17.3 Weight and centre of gravity

Compliance with each of the handling, controllability and performance requirements should be established for all combinations of weight and centre of gravity position significant for the operational safety in the range of weights up to the maximum permissible weight.

17.4 Effect of failures

The effect of any likely failure in handling and control devices, services or components (e.g. power operation, power assistance, trimming and stability augmentation) should be assessed in order that a safe level of craft operation can be maintained. Effects of failure identified as being critical according to annex 4 should be verified in accordance with annex 8.

17.5 Controllability and manoeuvrability

17.5.1 Instructions to crew members should be provided in the craft operating manual regarding required actions and craft limitations subsequent to prescribed failures.

17.5.2 It is necessary to ensure that the effort required to operate the controls in the worst intended conditions is not such that the person at the control will be unduly fatigued or distracted by the effort necessary to maintain the safe operation of the craft.

- 17.5.3 The craft should be controllable and be capable of performing those manoeuvres essential to its safe operation up to the critical design conditions.
- 17.5.4.1 When determining the safety of a craft in respect of handling, controllability and performance, the Administration should pay particular attention to the following aspects during normal operation and during and subsequent to failures:
- .1 yawing;
 - .2 turning;
 - .3 stopping in normal and emergency conditions;
 - .4 stability in the non-displacement mode about three axes and in heave;
 - .5 trim;
 - .6 plough in; and
 - .7 lift power limitations.
- 17.5.4.2 The terms in 17.5.4.1.2, .6 and .7 are defined as follows:
- .1 "Turning" is the rate of change of direction of a craft at its normal maximum operating speed in specified wind and sea conditions.
 - .2 "Plough in" is an involuntary motion involving sustained increase in drag of an air-cushion vehicle at speed, usually associated with partial collapse of the cushion system.
 - .3 "Lift power limitations" are those limitations imposed upon the machinery and components which provide the lift.
- 17.6 Change of operating surface and mode
- There should be no unsafe change in the stability, controllability or attitude of the craft during transition from one type of operating surface or mode to another. Information on change in the behaviour characteristics of the craft during transition should be available to the master.
- 17.7 Surface irregularities
- Factors which limit the ability of the craft to operate over sloping ground and steps or discontinuities should be determined, as applicable, and made available to the master.
- 17.8 Acceleration and deceleration
- The Administration should be satisfied that the worst likely acceleration or deceleration of the craft, due to any likely failure, emergency stopping procedures or other likely causes, would not hazard the persons on the craft.

17.9 Speeds

Safe maximum speeds should be determined, taking account of modes of operation, wind force and direction and the effects of possible failures of any one lift or propulsion system over calm water, rough water and over other surfaces as appropriate to the craft.

17.10 Minimum depth of water

The minimum depth of water and other appropriate information required for operations in all modes should be determined.

17.11 Hard structure clearance

For amphibious craft, when cushion borne, clearance of the lowest point of the hard structure above a hard flat surface should be determined.

17.12 Night operation

The schedule of tests should include sufficient operation to evaluate the adequacy of internal and external lighting and visibility, under conditions of normal and emergency electrical power supply during service, cruising and docking manoeuvres.

CHAPTER 18 – OPERATIONAL REQUIREMENTS

PART A – GENERAL

- 18.1 Craft operational control
- 18.1.1 The High Speed Craft Safety Certificate, the Permit to Operate High Speed Craft or certified copies thereof, and copies of the route operational manual, craft operating manual, and a copy of such elements of the maintenance manual as the Administration may require, should be carried on board.
- 18.1.2 The craft should not be intentionally operated outside the worst intended conditions and limitations specified in the Permit to Operate High Speed Craft, in the High Speed Craft Safety Certificate, or in documents referred to therein.
- 18.1.3 The Administration should issue a Permit to Operate High Speed Craft when it is satisfied that the operator has made adequate provisions from the point of view of safety generally, including the following matters specifically, and should revoke the Permit to Operate if such provisions are not maintained to its satisfaction:
- .1 the suitability of the craft for the service intended having regard to the safety limitations and information contained in the route operational manual;
 - .2 the suitability of the operating conditions in the route operational manual;
 - .3 the arrangements for obtaining weather information on the basis of which the commencement of a voyage may be authorized;
 - .4 provision in the area of operation of a base port fitted with facilities in accordance with 18.1.4;
 - .5 the designation of the person responsible for decisions to cancel or delay a particular voyage, e.g. in the light of the weather information available;
 - .6 sufficient crew complement required for operating the craft, deploying and manning survival craft, the supervision of passengers, vehicles and cargo in both normal and emergency conditions as defined in the Permit to Operate. The crew complement should be such that two officers are on duty in the operating compartment when the craft is underway, one of whom may be the master;
 - .7 crew qualifications and training, including competence in relation to the particular type of craft and service intended, and their instructions in regard to safe operational procedures;
 - .8 restrictions with regard to working hours, rostering of crews and any other arrangements to prevent fatigue including adequate rest periods;

- .9 the training of crew in craft operation and emergency procedures;
- .10 the maintenance of crew competence in regard to operation and emergency procedures;
- .11 safety arrangements at terminals and compliance with any existing safety arrangements, as appropriate;
- .12 traffic control arrangements and compliance with any existing traffic control, as appropriate;
- .13 restrictions and/or provisions relating to position fixing, to operation by night or in restricted visibility, including the use of radar and/or other electronic aids to navigation, as appropriate;
- .14 additional equipment which may be required, due to the specific characteristics of the service intended, for example, night operation;
- .15 communication arrangements between craft, coast radio stations, base ports radio stations, emergency services and other ships, including radio frequencies to be used and watch to be kept;
- .16 the keeping of records to enable the Administration to verify:
 - .16.1 that the craft is operated within the specified parameters;
 - .16.2 the observance of emergency and safety drills/procedures;
 - .16.3 the hours worked by the operating crew;
 - .16.4 the number of passengers on board;
 - .16.5 compliance with any law to which the craft is subject;
 - .16.6 craft operations; and
 - .16.7 maintenance of the craft and its machinery in accordance with approved schedules;
- .17 arrangements to ensure that equipment is maintained in compliance with the Administration's requirements, and to ensure co-ordination of information as to the serviceability of the craft and equipment between the operating and maintenance elements of the operator's organization;
- .18 the existence and use of adequate instructions regarding:
 - .18.1 loading of the craft so that weight and centre of gravity limitations can be effectively observed and cargo is, when necessary, adequately secured;
 - .18.2 the provision of adequate fuel reserves;

- .18.3 action in the event of reasonable foreseeable emergencies; and
 - .19 provision of contingency plans by operators for foreseeable incidents including all land-based activities for each scenario. The plans should provide operating crews with information regarding search and rescue (SAR) authorities and local administrations and organizations which may complement the tasks undertaken by crews with the equipment available to them*.
- 18.1.4 The Administration should determine the maximum allowable distance from a base port or place of refuge after assessing the provisions made under 18.1.3.
- 18.2 Craft documentation
- The Administration should ensure that the craft is provided with adequate information and guidance in the form of technical manual(s) to enable the craft to be operated and maintained safely. The technical manual(s) should consist of a Route Operational Manual, Craft Operating Manual, Training Manual, Maintenance Manual and Servicing Schedule. Arrangements should be made for such information to be updated as necessary.
- 18.2.1 Craft operating manual
- The craft operating manual should contain at least the following information:
- .1 leading particulars of the craft;
 - .2 description of the craft and its equipment;
 - .3 procedures for checking the integrity of buoyancy compartments;
 - .4 details arising from compliance with the requirements of chapter 2 likely to be of direct practical use to the crew in an emergency;
 - .5 damage control procedures;
 - .6 description and operation of machinery systems;
 - .7 description and operation of auxiliary systems;
 - .8 description and operation of remote control and warning systems;
 - .9 description and operation of electrical equipment;
 - .10 loading procedures and limitations including maximum operational weight, centre of gravity position and distribution of load;

* Refer to IMO Search and Rescue Manual (IMOSAR) adopted by the Organization by resolution A.439(XI) and Use of radar transponders for search and rescue purposes adopted by resolution A.530(13).

- .11 description and operation of fire detection and fire-extinguishing equipment;
- .12 drawings indicating the structural fire protection arrangements;
- .13 description and operation of radio equipment and navigational aids;
- .14 information regarding the handling of the craft as determined in accordance with chapter 17;
- .15 maximum permissible towing speeds and towing loads, where applicable;
- .16 procedure for dry-docking or lifting, including limitations;
- .17 in particular, the manual should provide information, in clearly defined chapters approved specifically by the Administration, relating to:
 - .17.1 indication of emergency situations or malfunctions jeopardizing safety, required actions to be taken and any consequential restrictions on operation of the craft or its machinery;
 - .17.2 evacuation procedures;
 - .17.3 operating limitations including the worst intended conditions;
 - .17.4 limiting values of all machinery parameters requiring compliance for safe operation.

In regard to information on machinery or system failures, data should take into account the results of any FMEA reports developed during the craft design.

18.2.2 Route operational manual

The route operational manual should include at least the following information:

- .1 evacuation procedures;
- .2 operating limitations including the worst intended conditions such as sea height, sea and air temperatures, and wind conditions;
- .3 procedures for operation of the craft within the limitations of .2;
- .4 the elements of applicable contingency plans for primary and secondary rescue assistance in the case of foreseeable incidents, including land-based arrangements and activities for each incident;

- .5 arrangements for obtaining weather information;
- .6 identification of the "base port(s)";
- .7 identification of the person responsible for decisions to cancel or delay voyages;
- .8 identification of crew complement, functions and qualifications;
- .9 restrictions on working hours of crew;
- .10 safety arrangements at terminals;
- .11 traffic control arrangements and limitations, as appropriate;
- .12 specific route conditions or requirements relating to position fixing, operations by night and in restricted visibility, including the use of radar or other electronic aids to navigation; and
- .13 communication arrangements between craft, coast radio stations, base ports radio stations, emergency services and other ships, including radio frequencies to be used and watch to be kept.

18.2.3 Training manual

The training manual, which may comprise several volumes, should contain instructions and information, in easily understood terms illustrated wherever possible, on evacuation, fire and damage control appliances and systems and on the best methods of survival. Any part of such information may be provided in the form of audio-visual aids in lieu of the manual. Where appropriate the contents of the training manual may be included in the craft operating manual. The following should be explained in detail:

- .1 donning lifejackets and immersion suits, as appropriate;
- .2 muster at the assigned stations;
- .3 boarding, launching and clearing the survival craft and rescue boats;
- .4 method of launching from within the survival craft;
- .5 release from launching appliances;
- .6 methods and use of devices for protection in launching areas, where appropriate;
- .7 illumination in launching areas;
- .8 use of all survival equipment;
- .9 use of all detection equipment;

- .10 with the assistance of illustrations, the use of radio life-saving appliances;
- .11 use of drogues;
- .12 use of engine and accessories;
- .13 recovery of survival craft and rescue boats including stowage and securing;
- .14 hazards of exposure and the need for warm clothing;
- .15 best use of the survival craft facilities in order to survive;
- .16 methods of retrieval, including the use of helicopter rescue gear (slings, baskets, stretchers), breeches-buoy and shore life-saving apparatus and craft's line-throwing apparatus;
- .17 all other functions contained in the muster list and emergency instructions; and
- .18 instructions for emergency repair of the life-saving appliances.
- .19 instructions in the use of fire protection and fire-extinguishing appliances and systems;
- .20 guidelines for use of fireman's outfit in a fire, if fitted;
- .21 use of alarms and communications associated with fire safety;
- .22 methods for surveying damage;
- .23 use of damage control appliances and systems including operation of watertight doors and bilge pumps; and
- .24 for passenger craft, control of and communication with passengers in an emergency.

18.2.4 Maintenance and servicing manual

The craft maintenance and servicing manual should contain as a minimum:

- .1 detailed, illustrated description of all craft structure, machinery installations and all installed equipment and systems required for safe operation of the craft;
- .2 specifications and quantities of all replenishable fluids, and of structural materials which may be required for repairs;
- .3 operational limitations of machinery in terms of values of parameters, vibration and consumption of replenished fluids;
- .4 limitations of wear of structure or machinery components, including lives of components requiring calendar or operating time replacement;

- .5 detailed description of procedures, including any safety precautions to be taken or special equipment required, to remove and install main and auxiliary machinery, transmissions, propulsion and lift devices and flexible structure components;
- .6 test procedures to be followed subsequent to replacement of machinery or system components or for malfunction diagnosis;
- .7 procedure for lifting or dry-docking the craft, including any weight or attitude limitations;
- .8 procedure for weighing the craft and establishing the position of longitudinal centre of gravity (LCG);
- .9 where craft may be dismantled for transportation, instructions should be provided for dismantling, transport and re-assembly;
- .10 a servicing schedule, included in the maintenance manual or published separately, detailing the routine servicing and maintenance operations required to maintain the operational safety of the craft and its machinery and systems.

18.3 Training and qualifications

- 18.3.1 The level of competence and the training considered necessary in respect of the master and each crew member should be laid down and demonstrated in the light of the following guidelines to the satisfaction of the Administration in respect of the particular type and model of craft concerned and the service intended. More than one crew member should be trained to perform all essential operational tasks in both normal and emergency situations.
- 18.3.2 The Administration should specify an appropriate period of operational training for the master and each member of the crew and, if necessary, the periods at which appropriate re-training should be carried out.
- 18.3.3 The Administration should issue a type rating certificate to the master and all officers having an operational role following an appropriate period of operational/simulator training and on the conclusion of an examination including practical test commensurate with the operational tasks on board the particular type and model of craft concerned and the route followed. The type rating training should cover at least the following items:
 - .1 knowledge of all on-board propulsion and control systems, including communication and navigational equipment, steering, electrical, hydraulic and pneumatic systems and bilge and fire pumping;
 - .2 the failure mode of the control, steering and propulsion systems and proper response to such failures;
 - .3 handling characteristics of the craft and the limiting operational conditions;

- .4 bridge communication and navigation procedures;
 - .5 intact and damage stability and survivability of the craft in damage condition;
 - .6 location and use of the craft's life-saving appliances, including survival craft equipment;
 - .7 location and use of escapes in the craft and the evacuation of passengers;
 - .8 location and use of fire protection and fire-extinguishing appliances and systems in the event of fire on board;
 - .9 location and use of damage control appliances and systems including operation of watertight doors and bilge pumps;
 - .10 cargo and vehicle stowage securement systems;
 - .11 methods for control of and communication with passengers in an emergency; and
 - .12 location and use of all other items listed in the training manual.
- 18.3.4 The type rating certificate for a particular type and model of craft should only be valid for service on the route to be followed when it is so endorsed by the Administration following the completion of a practical test over that route.
- 18.3.5 The type rating certificate should be re-validated every two years and the Administration should lay down the procedures for re-validation.
- 18.3.6 All crew members should receive instructions and training, as specified in 18.3.3.6 to .12.
- 18.3.7 The Administration should specify standards of physical fitness and frequency of medical examinations having regard to the route and craft concerned.
- 18.3.8 The Administration of the country in which the craft is to operate, if other than the flag State, should be satisfied with the training, experience and qualifications of the master and each crew member. A valid type rating certificate appropriately endorsed and held by a master or crew member, in conjunction with the current and valid licence or certificate issued by a flag State which is signatory to the International Convention on Standards of Training, Certification and Watchkeeping (STCW) in force for those who are required to hold such a licence or certificate, should be acceptable as evidence of satisfactory training, experience and qualification to the Administration of the country in which the craft is to operate.

- 18.4 Manning of survival craft and supervision
- 18.4.1 There should be a sufficient number of trained persons on board for mustering and assisting untrained persons.
- 18.4.2 There should be a sufficient number of crew members, who may be deck officers or certificated persons, on board for operating the survival craft, rescue boats and launching arrangements required for abandonment by the total number of persons on board.
- 18.4.3 A deck officer or certificated person should be placed in charge of each survival craft to be used. However, the Administration, having due regard to the nature of the voyage, the number of persons on board and the characteristics of the craft, may permit a deck officer, certificated person or persons practised in the handling and operation of liferafts to be placed in charge of each liferaft or group of liferafts.
- 18.4.4 The person in charge of survival craft should have a list of the survival craft crew and should see that the crew under command are acquainted with their duties.
- 18.4.5 Every rescue boat and motorized survival craft should have a person assigned who is capable of operating the engine and carrying out minor adjustments.
- 18.4.6 The master should ensure the equitable distribution of persons referred to in 18.4.1 to 18.4.3 among the craft's survival craft.
- 18.5 Emergency instructions and drills
- 18.5.1 On or before departure, passengers should be instructed in the use of lifejackets and the action to be taken in an emergency. The attention of the passengers should be drawn to the emergency instructions required by 8.4.1 and 8.4.3.
- 18.5.2 Emergency fire and evacuation drills for the crew should be held on board the craft at intervals not exceeding one week for passenger craft and one month for cargo craft.
- 18.5.3 Each member of each crew should participate in at least one evacuation, fire and damage control drill per month.
- 18.5.4 On-board drills should, as far as practicable, be conducted to simulate an actual emergency. Such simulations should include instruction and operation of the craft's evacuation, fire and damage control appliances and systems.
- 18.5.5 On-board instruction and operation of the craft's evacuation, fire and damage control appliances and systems should include appropriate cross-training of crew members.
- 18.5.6 Emergency instructions including a general diagram of the craft showing the location of all exits, routes of evacuation, emergency equipment, life-saving equipment and appliances and illustration of lifejacket donning should be available to each passenger and crew member. It should be placed near each passenger and crew seat.

18.5.7 Records

The date when musters are held, details of abandon craft drills and fire drills, drills of other life-saving appliances and on-board training should be recorded in such log-book as may be prescribed by the Administration. If a full muster, drill or training session is not held at the appointed time, an entry should be made in the log-book stating the circumstances and the extent of the muster, drill or training session held. A copy of such information should be forwarded to the operator's management.

18.5.8 Evacuation drills

18.5.8.1 Evacuation drill scenarios should vary each week so that different emergency conditions are simulated.

18.5.8.2 Each evacuation craft drill should include:

- .1 summoning of crew to muster stations with the alarm required by 8.2.2.2 and ensuring that they are made aware of the order to abandon craft specified in the muster list;
- .2 reporting to stations and preparing for the duties described in the muster list;
- .3 checking that crew are suitably dressed;
- .4 checking that lifejackets are correctly donned;
- .5 operation of davits if any used for launching liferafts;
- .6 donning of immersion suits or thermal protective clothing by appropriate crew members;
- .7 testing of emergency lighting for mustering and abandonment; and
- .8 giving instructions in the use of the craft's life-saving appliances and in survival at sea.

18.5.8.3 Rescue boat drill

- .1 As far as is reasonable and practicable, rescue boats should be launched each month as part of the evacuation drill, with their assigned crew aboard, and manoeuvred in the water. In all cases this requirement should be complied with at least once every three months.
- .2 If rescue boat launching drills are carried out with the craft making headway, such drills should, because of the dangers involved, be practised in sheltered waters only and under the supervision of an officer experienced in such drills.*

* Refer to resolution A.624(15) concerning Guidelines on training for the purpose of launching lifeboats and rescue boats from ships making headway through the water.

- 18.5.8.4 Individual instructions may cover different parts of the craft's life-saving system, but all the craft's life-saving equipment and appliances should be covered within any period of one month on passenger craft and two months on cargo craft. Each member of the crew should be given instructions which should include but not necessarily be limited to:
- .1 operation and use of the craft's inflatable liferafts;
 - .2 problems of hypothermia, first-aid treatment of hypothermia and other appropriate first-aid procedures; and
 - .3 special instructions necessary for use of the craft's life-saving appliances in severe weather and severe sea conditions.
- 18.5.8.5 On-board training in the use of davit-launched liferafts should take place at intervals of not more than four months on every craft fitted with such appliances. Whenever practicable, this should include the inflation and lowering of a liferaft. This liferaft may be a special liferaft intended for training purposes only, which is not part of the craft's life-saving equipment. Such a special liferaft should be conspicuously marked.
- 18.5.9 Fire drills
- 18.5.9.1 Fire drill scenarios should vary each week so that emergency conditions are simulated for different vessel compartments;
- 18.5.9.2 Each fire drill should include:
- .1 summoning of crew to fire stations;
 - .2 reporting to stations and preparing for the duties described in the muster list;
 - .3 donning of fireman's outfits;
 - .4 operation of fire doors and fire dampers;
 - .5 operation of fire pumps and fire-fighting equipment;
 - .6 operation of communication equipment, emergency signals and general alarm;
 - .7 operation of fire detection system; and
 - .8 instruction in the use of the craft's fire-fighting equipment and sprinkler and drencher systems, if fitted.

- 18.5.10 Damage control drills
- 18.5.10.1 Damage control drill scenarios should vary each week so that emergency conditions are simulated for different damage conditions.
- 18.5.10.2 Each damage control drill should include:
- .1 summoning of crew to damage control stations;
 - .2 reporting to stations and preparing for the duties described in the muster list;
 - .3 operation of watertight doors and other watertight closures;
 - .4 operation of bilge pumps and testing of bilge alarms and automatic bilge pump starting systems; and
 - .5 instruction in damage survey, use of the craft damage control systems and passenger control in the event of an emergency.

PART B - REQUIREMENTS FOR PASSENGER CRAFT

- 18.6 Type rating training
- 18.6.1 For all crew members, the type rating training should cover the control and evacuation of passengers additionally to 18.3.6.
- 18.6.2 When the craft carry cargoes, the craft should comply with the requirements of part C of this chapter in addition to this part.
- 18.7 Emergency instructions and drills
- 18.7.1 Emergency instructions including a general diagram of the craft showing the location of all exits, routes of evacuation, emergency equipment, life-saving equipment and appliances and illustration of lifejacket donning should be available to each passenger and placed near each passenger's seat.
- 18.7.2 Attention of passengers should be drawn to the provisions of the emergency instructions on boarding.

PART C - REQUIREMENTS FOR CARGO CRAFT

- 18.8 Type rating training
- For all crew members, the type rating training should cover knowledge of cargo and vehicles storage area securement systems.
- 18.9 Emergency instructions and drills
- Emergency instructions including a general diagram of the craft showing the location of all exits, routes of evacuation, emergency equipment, life-saving equipment and appliances and illustration of lifejacket donning should be available to each crew member.

CHAPTER 19 - INSPECTION AND MAINTENANCE REQUIREMENTS

- 19.1 The Administration should be satisfied with the operator's organization or any organization on which he may call in the maintenance of his craft and should specify the scope of the duties which any part of the organization may carry out having regard to the number and competence of its staff, facilities available, arrangements for calling on specialist assistance should it be necessary, record-keeping, communication and allocation of responsibilities.
- 19.2 The craft and equipment should be maintained to the satisfaction of the Administration, in particular:
- .1 routine preventive inspection and maintenance should be performed to a schedule approved by the Administration, which should have regard at least in the first instance to the manufacturer's schedule;
 - .2 in the performance of maintenance tasks, due regard should be paid to maintenance manuals, service bulletins acceptable to the Administration and to any additional instructions of the Administration in this respect;
 - .3 all modifications should be recorded and their safety aspects investigated. Where it could have any effect on safety, the modification, together with its installation, should be to the satisfaction of the Administration;
 - .4 appropriate arrangements should be provided for informing the master of the serviceability state of his craft and its equipment;
 - .5 the duties of the operating crew in respect of maintenance and repairs and the procedure for obtaining assistance with repairs when the craft is away from the base port should be clearly defined;
 - .6 the master should report to the maintenance organization any defects and repairs which are known to have occurred during operations;
 - .7 records of defects and their correction should be maintained and those defects of recurrent nature, or those which adversely affect craft or personal safety, should be reported to the Administration.
- 19.3 The Administration should be satisfied that arrangements are provided for ensuring adequate inspection, maintenance and recording of all life-saving appliances and distress signals carried.

ANNEX 1

Form of Safety Certificate for High Speed Craft

HIGH SPEED CRAFT SAFETY CERTIFICATE

This Certificate should be supplemented by a Record of Equipment

(Official seal)

(State)

Issued under the provisions of the

INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT
(Resolution MSC .36 (63))

under the authority of the Government of

.....
(full designation of the State)

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

Particulars of craft*

Name of craft

Manufacturer's model and hull number

Distinctive number or letters

IMO number**

Port of registry

Gross tonnage.....

Design waterline corresponding to draughts at draught marks of ... forward,
... aft

Category category A passenger craft/category B passenger craft/
cargo craft***

Craft type air-cushion vehicle/surface effect ship/hydrofoil/
monohull/multihull/other (give detail)***

Date on which keel was laid or craft was at
a similar stage of construction or on which
a major conversion was commenced

* Alternatively, the particulars of the craft may be placed horizontally in boxes.
** In accordance with the IMO ship identification number scheme adopted by the Organization by resolution A.600(15).
*** Delete as appropriate.

THIS IS TO CERTIFY:

1 That the above-mentioned craft has been duly surveyed in accordance with the applicable provisions of the International Code of Safety for High Speed Craft.

2 That the survey showed that the structure, equipment, fittings, radio station arrangements and materials of the craft and the condition thereof are in all respects satisfactory and that the craft complies with the relevant provisions of the Code.

3 That the life-saving appliances are provided for a total number of ... persons and no more as follows:

.....
.....

4 That, in accordance with 1.11 of the Code, the following equivalents have been granted in respect of the craft:

paragraph equivalent arrangement.....
.....

This certificate is valid until

Issued at
(Place of issue of certificate)

..... (Date of issue) (Signature of authorized official issuing the certificate)

.....
(Seal or stamp of the issuing authority, as appropriate)

Endorsement for periodical surveys

This is to certify that, at a survey required by 1.5 of the Code, this craft was found to comply with the relevant provisions of the Code.

Periodical survey: Signed:
(Signature of authorized official)
Place:
Date:
(Seal or stamp of authority, as appropriate)

Periodical survey: Signed:
(Signature of authorized official)
Place:
Date:
(Seal or stamp of authority, as appropriate)

Periodical survey: Signed:
(Signature of authorized official)
Place:
Date:
(Seal or stamp of authority, as appropriate)

Periodical survey: Signed:
(Signature of authorized official)
Place:
Date:
(Seal or stamp of Authority, as appropriate)

Endorsement to extend the Certificate if valid for less than 5 years where 1.8.8 of the Code applies

This craft complies with the relevant requirements of the Code, and this Certificate should, in accordance with 1.8.8 of the Code, be accepted as valid until

Signed:
(Signature of authorized official)
Place:
Date:

(Seal or stamp of authority, as appropriate)

Endorsement where the renewal survey has been completed and 1.8.9 of the Code applies

This craft complies with the relevant requirements of the Code and this Certificate should, in accordance with 1.8.9 of the Code, be accepted as valid until

Signed:
(Signature of authorized official)

Place:

Date:

(Seal or stamp of Authority, as appropriate)

Endorsement to extend the validity of the Certificate until reaching the port of survey where 1.8.10 of the Code applies

This Certificate should, in accordance with 1.8.10 of the Code, be accepted until

Signed:
(Signature of authorized official)

Place:

Date:

(Seal or stamp of authority, as appropriate)

Endorsement for the advancement of the anniversary date where 1.8.13 of the Code applies

In accordance with 1.8.13 of the Code, the new anniversary date is

Signed:
(Signature of authorized official)

Place:

Date:

(Seal or stamp of authority, as appropriate)

In accordance with 1.8.13 of the Code, the new anniversary date is

Signed:
(Signature of authorized official)

Place:

Date:

(Seal or stamp of authority, as appropriate)

Record of equipment for high speed craft
safety certificate

This Record shall be permanently attached to the
High Speed Craft Safety Certificate

RECORD OF EQUIPMENT FOR COMPLIANCE WITH THE
INTERNATIONAL CODE OF SAFETY
FOR HIGH SPEED CRAFT

1 Particulars of craft

Name of craft

Manufacturer's model and hull number

Distinctive number or letters

IMO Number*

Category: Category A passenger craft/category B passenger craft/cargo craft**

Craft type: air cushion, surface effect ship, hydrofoil, monohull, multihull,
other (give details)**

Number of passengers for which certified

Minimum number of persons with required qualifications to operate the radio
installations

2 Details of life-saving appliances

1	Total number of persons for which life-saving appliances are provided	.....
2	Total number of lifeboats	.....
2.1	Total number of persons accommodated by them	.....
2.2	Number of partially enclosed lifeboats complying with SOLAS regulation III/42	.....
2.3	Number of totally enclosed lifeboats complying with SOLAS regulation III/44	.....

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

** Delete as appropriate.

2.4	Other lifeboats	
2.4.1	Number	.....
2.4.2	Type	.....
3.	Number of rescue boats	.....
3.1	Number of boats which are included in the total lifeboats shown above	.....
4	Liferafts complying with SOLAS regulations III/38 to 40 for which suitable means of launching are provided	
4.1	Number of liferafts	.....
4.2	Number of persons accommodated by them	.....
5	Open reversible liferafts (Annex 10 of the Code)	
5.1	Number of liferafts	.....
5.2	Number of persons accommodated by them	.....
6	Number of Marine Evacuation System (MES)	.....
6.1	Number of persons served by them	.....
7	Number of lifebuoys	.....
8	Number of lifejackets	
8.1	Number suitable for adults	.....
8.2	Number suitable for children	.....
9	Immersion suits	
9.1	Total number	.....
9.2	Number of suits complying with the requirements for lifejackets	.....
10	Number of anti-exposure suits	
10.1	Total number	.....
10.2	Number of suits complying with the requirements for lifejackets	.....
11	Radio installations used in life-saving appliances	
11.1	Number of radar transponders	.....
11.2	Number of two-way VHF radiotelephone apparatus	.....

3 Details of radio facilities

Item	Actual provision
1 Primary systems	
1.1 VHF radio installation:	
1.1.1 DSC encoder
1.1.2 DSC watch receiver
1.1.3 Radiotelephony
1.2 MF radio installation:	
1.2.1 DSC encoder
1.2.2 DSC watch receiver
1.2.3 Radiotelephony
1.3 MF/HF radio installation:	
1.3.1 DSC encoder
1.3.2 DSC watch receiver
1.3.3 Radiotelephony
1.3.4 Direct-printing radiotelegraphy
1.4 INMARSAT ship earth station
2 Secondary means of alerting
3 Facilities for reception of maritime safety information	
3.1 NAVTEX receiver
3.2 EGC receiver
3.3 HF direct-printing radiotelegraph receiver
4 Satellite EPIRB	
4.1 COSPAS-SARSAT
4.2 INMARSAT
5 VHF EPIRB
6 Ship's radar transponder
7 Radiotelephone distress frequency watch receiver on 2,182 kHz ¹
8 Device for generating the radiotelephone alarm signal on 2,182 kHz ²

1 Unless another date is determined by the Maritime Safety Committee, this item need not be reproduced on the record attached to certificates issued after 1 February 1999.

2 This item need not be reproduced on the record attached to certificates issued after 1 February 1999.

- 4 Methods used to ensure availability of radio facilities
(paragraphs 14.14.6, 14.14.7 and 14.14.8 of the Code)
- 4.1 Duplication of equipment
- 4.2 Shore-based maintenance
- 4.3 At-sea maintenance capability

THIS IS TO CERTIFY that this Record is correct in all respects

Issued at
(Place of issue of the Record)

.....
(Date of issue)

.....
(Signature of duly authorized official
issuing the Record)

(Seal or stamp of the issuing authority, as appropriate)

ANNEX 2

Form of Permit to Operate High Speed Craft

PERMIT TO OPERATE HIGH SPEED CRAFT

Issued under the provision of the

INTERNATIONAL CODE OF SAFETY FOR HIGH SPEED CRAFT
(Resolution MSC.36 (63))

- 1 Name of craft
- 2 Manufacturer's model and hull number
- 3 Distinctive number or letters
- 4 IMO number*
- 5 Port of registry
- 6 Category of craft category A passenger craft/category B passenger craft/cargo craft**
- 7 Name of operator
- 8 Areas or routes of operation
- 9 Base port(s)
- 10 Maximum distance from place of refuge
- 11 Number of:
 - .1 passengers maximum permitted
 - .2 manning scale required
- 12 Worst intended conditions
- 13 Other operational restrictions

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

** Delete as appropriate.

This permit confirms that the service mentioned above has been found to be in accordance with the general requirements of 1.2.2 to 1.2.7 of the Code.

THIS PERMIT is issued under the authority of the Government of

THIS PERMIT is valid until
subject to the High Speed Craft Safety Certificate remaining valid

Issued at
(Place of issue of permit)

..... (Signed)
(Date of issue) (Signature of authorized official issuing the permit)

.....
(Seal or stamp of the issuing authority, as appropriate)

ANNEX 3

USE OF PROBABILITY CONCEPT

1 General

- 1.1 Absolute safety cannot be achieved in any human activity. Naturally, this fact should be taken into account in developing safety requirements, which means that requirements should not imply that safety is absolute. In the case of traditional craft, it has frequently been possible to specify certain aspects of design or construction in some detail, in a way which was consistent with some level of risk which had over the years been intuitively accepted without having to be defined.
- 1.2 For high speed craft, however, it would often be too restrictive to include engineering specifications into the Code. Requirements therefore need to be written (where this question arises) in the sense of "... the Administration should be satisfied on the basis of tests, investigations and past experience that the probability of ... is (acceptably low)". Since different undesirable events may be regarded as having different general orders of acceptable probability (e.g. temporary impairment of propulsion as compared with an uncontrollable fire), it is convenient to agree on a series of standardized expressions which can be used to convey the relative acceptable probabilities of various incidents, i.e. to perform a qualitative ranking process. A vocabulary is given below which is intended to ensure consistency between various requirements, where it is necessary to describe the level of risk which should not be exceeded.

2 Terms associated with probabilities

Different undesirable events may have different orders of acceptable probability. In connection with this, it is convenient to agree on standardized expressions to be used to convey the relatively acceptable probabilities of various occurrences, i.e. to perform a qualitative ranking process.

2.1 Occurrences

- 2.1.1 "Occurrence" is a condition involving a potential lowering of the level of safety.
- 2.1.2 "Failure" is an occurrence in which a part, or parts, of the craft fail or malfunction, e.g. runaway. A failure includes:
- .1 a single failure;
 - .2 independent failures in combination within a system;
 - .3 independent failures in combinations involving more than one system, taking into account:
 - .1 any undetected failure that is already present;

- .2 such further failures* as would be reasonably expected to follow the failure under consideration; and
 - .4 common cause failure (failure of more than one component or system due to the same cause).
- 2.1.3 "Event" is an occurrence which has its origin outside the craft (e.g. waves).
- 2.1.4 "Error" is an occurrence arising as a result of incorrect action by the operating crew or maintenance personnel.
- 2.2 Probability of occurrences
- 2.2.1 "Frequent" is one which is likely to occur often during the operational life of a particular craft.
- 2.2.2 "Reasonably probable" is one which is unlikely to occur often but which may occur several times during the total operational life of a particular craft.
- 2.2.3 "Recurrent" is a term embracing the total range of frequent and reasonably probable.
- 2.2.4 "Remote" is one which is unlikely to occur to every craft but may occur to a few craft of a type over the total operational life of a number of craft of the same type.
- 2.2.5 "Extremely remote" is one which is unlikely to occur when considering the total operational life of a number of craft of the type, but nevertheless should be considered as being possible.
- 2.2.6 "Extremely improbable" is one which is so extremely remote that it should not be considered as possible to occur.
- 2.3 Effects
- 2.3.1 "Effect" is a situation arising as a result of an occurrence.
- 2.3.2 "Minor effect" is an effect which may arise from a failure, an event, or an error, as defined in 2.1.2, 2.1.3, 2.1.4, which can be readily compensated for by the operating crew. It may involve:
- .1 a small increase in the operational duties of the crew or in their difficulty in performing their duties; or
 - .2 a moderate degradation in handling characteristics; or
 - .3 slight modification of the permissible operating conditions.

* In assessing the further failures which follow, account should be taken of any resulting more severe operating conditions for items that have not up to that time failed.

2.3.3 "Major effect" is an effect which produces:

- .1 a significant increase in the operational duties of the crew or in their difficulty in performing their duties which by itself should not be outside the capability of a competent crew provided that another major effect does not occur at the same time; or
- .2 significant degradation in handling characteristics; or
- .3 significant modification of the permissible operating conditions, but will not remove the capability to complete a safe journey without demanding more than normal skill on the part of the operating crew.

2.3.4 "Hazardous effect" is an effect which produces:

- .1 a dangerous increase in the operational duties of the crew or in their difficulty in performing their duties of such magnitude that they cannot reasonably be expected to cope with them and will probably require outside assistance; or
- .2 dangerous degradation of handling characteristics; or
- .3 dangerous degradation of the strength of the craft; or
- .4 marginal conditions for, or injury to, occupants; or
- .5 an essential need for outside rescue operations.

2.3.5 "Catastrophic effect" is an effect which results in the loss of the craft and/or in fatalities.

2.4 Safety level

"Safety level" is a numerical value characterizing the relationship between craft performance represented as horizontal single amplitude acceleration (g) and rate of acceleration (g/s) and the severity of acceleration-load effects on standing and sitting humans.

The safety levels and the corresponding severity of effects on passengers and safety criteria for craft performance should be as defined in table 1.

3 Numerical values

Where numerical probabilities are used in assessing compliance with requirements using the terms similar to those given above, the following approximate values may be used as guidelines to assist in providing a common point of reference. The probabilities quoted should be on an hourly or per journey basis, depending on which is more appropriate to the assessment in question.

Frequent	More than 10^{-3}
Reasonably probable	10^{-3} to 10^{-5}
Remote	10^{-5} to 10^{-7}
Extremely remote	10^{-7} to 10^{-9}
Extremely improbable	Whilst no approximate numerical probability is given for this, the figures used should be substantially less than 10^{-9} .

Note:

Different occurrences may have different acceptable probabilities, according to the severity of their consequences (see table 2).

TABLE 1

EFFECT	CRITERIA NOT TO BE EXCEEDED		COMMENTS
	Type of load	Value	
LEVEL 1 MINOR EFFECT Moderate degradation of safety	Maximum acceleration measured horizontally ^{1/}	0.20 g ^{2/}	0.08 g and 0.20 g/s ^{3/} : Elderly person will keep balance when holding 0.15 g and 0.20 g/s: Mean person will keep balance when holding 0.15 g and 0.80 g/s: Sitting person will start holding
LEVEL 2 MAJOR EFFECT Significant degradation of safety	Maximum acceleration measured horizontally ^{1/}	0.35 g	0.25 g and 2.0 g/s: Maximum load for mean person keeping balance when holding 0.45 g and 10 g/s: Mean person falls out of seat when not wearing seat belts.
LEVEL 3 HAZARDOUS EFFECT Major degradation of safety	Collision design condition calculated Maximum structural design load, based on vertical acceleration at centre of gravity	Ref. 4.3.3 Ref. 4.3.1	Risk of injury to passengers, safe emergency operation after collision. 1.0 g: Degradation of passenger safety.
LEVEL 4 CATASTROPHIC EFFECT			Loss of craft or/and fatalities.

1/ The recording instruments used should be such that acceleration accuracy is better than 5% of the real value and frequency response should be minimum 20 Hz. Antialiasing filters with maximum passband attenuation 100 + 5% should be used.

2/ g = gravity acceleration (9.81 m/s²)

3/ g-rate or jerk may be evaluated from acceleration/time curves.

TABLE 2

SAFETY LEVEL	1	1	1	1	2	3	4
EFFECT ON CRAFT AND OCCUPANTS	Normal	Nuisance	Operating limitations	Emergency procedures; significant reduction in safety margins; difficult for crew to cope with adverse conditions; passenger injuries.	Large reduction in safety margins; crew over-burden because of workload or environmental conditions; serious injury to a small number of occupants.	Deaths, usually with loss of craft	
F.A.R. 1/ PROBABILITY (reference only)	←	→ Probable ←	←	→ IMPROBABLE ←	←	←	EXTREMELY IMPROBABLE
JAR-252/ PROBABILITY	← FREQUENT 10 ⁻⁰ 10 ⁻¹ 10 ⁻²	→ Probable ← 10 ⁻²	← REASONABLY PROBABLE 10 ⁻³ 10 ⁻⁴	← REMOTE 10 ⁻⁵ 10 ⁻⁶	← EXTREMELY REMOTE 10 ⁻⁷ 10 ⁻⁸ 10 ⁻⁹	←	EXTREMELY IMPROBABLE
CATEGORY OF EFFECT	←	← MINOR →	←	← MAJOR →	← HAZARDOUS →	←	CATASTROPHIC

1/ The United States Federal Aviation Regulations

2/ European Joint Airworthiness Regulations

ANNEX 4

PROCEDURES FOR FAILURE MODE AND EFFECTS ANALYSIS

1 Introduction

1.1 In the case of traditional craft, it has been possible to specify certain aspects of design or construction in some level of detail, in a way which was consistent with some level of risk which had over the years been intuitively accepted without having to be defined.

1.2 With the development of large high speed craft, this required experience has not been widely available. However, with the now broad acceptance of the probabilistic approach to safety assessments within industry as a whole, it is proposed that an analysis of failure performance may be used to assist in the assessment of the safety of operation of high speed craft.

1.3 A practical, realistic and documented assessment of the failure characteristics of the craft and its component systems should be undertaken with the aim of defining and studying the important failure conditions that may exist.

1.4 This annex describes a failure mode and effects analysis (FMEA) and gives guidance as to how it may be applied by:

- .1 explaining basic principles;
- .2 providing the procedural steps necessary to perform an analysis;
- .3 identifying appropriate terms, assumptions, measures and failure modes; and
- .4 providing examples of the necessary worksheets.

1.5 FMEA for high speed craft is based on a single failure concept under which each system at various levels of a system's functional hierarchy is assumed to fail by one probable cause at a time. The effects of the postulated failure are analysed and classified according to their severity. Such effects may include secondary failures (or multiple failures) at other level(s). Any failure mode which may cause a catastrophic effect to the craft should be guarded against by system or equipment redundancy unless the probability of such failure is extremely improbable (refer to section 13). For failure modes causing hazardous effects corrective measures may be accepted in lieu. A test programme should be drawn to confirm the conclusions of FMEA.

1.6 Whilst FMEA is suggested as one of the most flexible analysis techniques, it is accepted that there are other methods which may be used and which in certain circumstances may offer an equally comprehensive insight into particular failure characteristics.

2 Objectives

2.1 The primary objective of FMEA is to provide a comprehensive, systematic and documented investigation which establishes the important failure

conditions of the craft and assesses their significance with regard to the safety of the craft, its occupants and the environment.

2.2 The main aims of undertaking the analysis are to:

- .1 provide the Administration with the results of a study into the craft's failure characteristics so as to assist in an assessment of the levels of safety proposed for the craft's operation;
- .2 provide craft operators with data to generate comprehensive training, operational and maintenance programmes and documentation; and
- .3 provide craft and system designers with data to audit their proposed designs.

3 Scope of application

3.1 FMEA should be conducted for each high speed craft, before its entry into service, in respect of the systems as required under the provisions of 5.2, 9.1.10, 12.1.1 and 16.2.6 of this Code.

3.2 For craft of the same design and having the same equipment, one FMEA on the lead craft will be sufficient, but each of the craft should be subject to the same FMEA conclusion trials.

4 System failure mode and effects analysis

4.1 Before proceeding with a detailed FMEA into the effects of the failure of the system elements on the system functional output it is necessary to perform a functional failure analysis of the craft's important systems. In this way only systems which fail the functional failure analysis need to be investigated by a more detailed FMEA.

4.2 When conducting a system FMEA the following typical operational modes within the normal design environmental conditions of the craft should be considered:

- .1 normal seagoing conditions at full speed;
- .2 maximum permitted operating speed in congested waters; and
- .3 manoeuvring alongside.

4.3 The functional interdependence of these systems should also be described in either block diagrams or fault tree diagrams or in a narrative format to enable the failure effects to be understood. As far as applicable, each of the systems to be analysed is assumed to fail in the following failure modes:

- .1 complete loss of function;
- .2 rapid change to maximum or minimum output;
- .3 uncontrolled or varying output;

- .4 premature operation;
- .5 failure to operate at a prescribed time; and
- .6 failure to cease operation at a prescribed time.

Depending on the system under consideration other failure modes may have to be taken into account.

4.4 If a system can fail without any hazardous or catastrophic effect, there is no need to conduct a detailed FMEA into the system architecture. For systems whose individual failure can cause hazardous or catastrophic effects and where a redundant system is not provided, a detailed FMEA as described in the following paragraphs should be followed. Results of the system functional failure analysis should be documented and confirmed by a practical test programme drawn up from the analysis.

4.5 Where a system, the failure of which may cause a hazardous or catastrophic effect, is provided with a redundant system, a detailed FMEA may not be required provided that:

- .1 the redundant system can be put into operation or can take over the failed system within the time-limit dictated by the most onerous operational mode in 4.2 without hazarding the craft;
- .2 the redundant system is completely independent from the system and does not share any common system element the failure of which would cause failure of both the system and the redundant system. Common system element may be acceptable if the probability of failure complies with section 13; and
- .3 the redundant system may share the same power source as the system. In such case an alternative power source should be readily available with regard to the requirement of .1.

The probability and effects of operator error to bring in the redundant system should also be considered.

5 Equipment failure mode and effects analysis

The systems to be subject to a more detailed FMEA investigation at this stage should include all those that have failed the system FMEA and may include those that have a very important influence on the safety of the craft and its occupants and which require an investigation at a deeper level than that undertaken in the system functional failure analysis. These systems are often those which have been specifically designed or adapted for the craft, such as the craft's electrical and hydraulic systems.

6 Procedures

The following steps are necessary to perform FMEA:

- .1 to define the system to be analysed;
- .2 to illustrate the interrelationships of functional elements of the system by means of block diagrams;

- .3 to identify all potential failure modes and their causes;
- .4 to evaluate the effects on the system of each failure mode;
- .5 to identify failure detection methods;
- .6 to identify corrective measures for failure modes;
- .7 to assess the probability of failures causing hazardous or catastrophic effects, where applicable;
- .8 to document the analysis;
- .9 to develop a test programme;
- .10 to prepare FMEA report.

7 System definition

The first step in an FMEA study is a detailed study of the system to be analysed through the use of drawings and equipment manuals. A narrative description of the system and its functional requirements should be drawn up including the following information:

- .1 general description of system operation and structure;
- .2 functional relationship among the system elements;
- .3 acceptable functional performance limits of the system and its constituent elements in each of the typical operational modes; and
- .4 system constraints.

8 Development of system block diagrams

8.1 The next step is to develop block diagram(s) showing the functional flow sequence of the system, both for technical understanding of the functions and operation of the system, and for the subsequent analysis. As a minimum the block diagram should contain:

- .1 breakdown of the system into major sub-systems or equipment;
- .2 all appropriate labelled inputs and outputs and identification numbers by which each sub-system is consistently referenced; and
- .3 all redundancies, alternative signal paths and other engineering features which provide "fail-safe" measures.

An example of a system block diagram is given at appendix 1.

8.2 It may be necessary to have a different set of block diagrams prepared for each operational mode.

9 Identification of failure modes, causes and effects

9.1 Failure mode is the manner by which a failure is observed. It generally describes the way the failure occurs and its impact on the equipment or system. As an example, a list of failure modes is given in table 1. The failure modes listed in table 1 can describe the failure of any system element in sufficiently specific terms. When used in conjunction with performance specifications governing the inputs and outputs on the system block diagram, all potential failure modes can be thus identified and described. Thus, for example, a power supply may have a failure mode described as "loss of output"(29), and a failure cause "open (electrical)"(31).

9.2 A failure mode in a system element could also be the failure cause of a system failure. For example, the hydraulic line of a steering gear system might have a failure mode of "external leakage"(10). This failure mode of the hydraulic line could become a failure cause of the steering gear system's failure mode "loss of output"(29).

9.3 Each system should be considered in a top-down approach, starting from the system's functional output, and failure should be assumed by one possible cause at a time. Since a failure mode may have more than one cause, all potential independent causes for each failure mode should be identified.

9.4 If major systems can fail without any adverse effect there is no need to consider them further unless the failure can go undetected by an operator. To decide that there is no adverse effect does not mean just the identification of system redundancy. The redundancy should be shown to be immediately effective or brought on line with negligible time lag. In addition, if the sequence is:

"failure-alarm-operator action - start of back up - back up in service", the effects of delay should be considered.

10 Failure effects

10.1 The consequence of a failure mode on the operation, function, or status of an equipment or a system is called a "failure effect". Failure effects on a specific sub-system or equipment under consideration are called "local failure effects". The evaluation of local failure effects will help to determine the effectiveness of any redundant equipment or corrective action at that system level. In certain instances, there may not be a local effect beyond the failure mode itself.

10.2 The impact of an equipment or sub-system failure on the system output (system function) is called an "end effect". End effects should be evaluated and their severity classified in accordance with the following categories:

- .1 catastrophic;
- .2 hazardous;
- .3 major; and
- .4 minor.

The definitions of these four categories of failure effects are given in 2.3 of annex 3 of this Code.

10.3 If the end effect of a failure is classified as hazardous or catastrophic, back-up equipment is usually required to prevent or minimize such effect. For hazardous failure effects corrective operational procedures may be accepted.

11 Failure detection

11.1 The FMEA study in general only analyses failure effects based on a single failure in the system and therefore a failure detection means, such as visual or audible warning devices, automatic sensing devices, sensing instrumentation or other unique indications should be identified.

11.2 Where the system element failure is non-detectable (i.e. a hidden fault or any failure which does not give any visual or audible indication to the operator) and the system can continue with its specific operation, the analysis should be extended to determine the effects of a second failure, which in combination with the first undetectable failure may result in a more severe failure effect, e.g., hazardous or catastrophic effect.

12 Corrective measures

12.1 The response of any back-up equipment, or any corrective action initiated at a given system level to prevent or reduce the effect of the failure mode of a system element or equipment, should also be identified and evaluated.

12.2 Provisions which are features of the design at any system level to nullify the effects of a malfunction or failure, such as controlling or deactivating system elements to halt generation or propagation of failure effects, or activating back-up or standby items or systems, should be described. Corrective design provisions include:

- .1 redundancies that allow continued and safe operation;
- .2 safety devices, monitoring or alarm provisions, which permit restricted operation or limit damage; and
- .3 alternative modes of operation.

12.3 Provisions which require operator action to circumvent or mitigate the effects of the postulated failure should be described. The possibility and effect of operator error should be considered, if the corrective action or the initiation of the redundancy requires operator input, when evaluating the means to eliminate the local failure effects.

12.4 It should be noted that corrective responses acceptable in one operational mode may not be acceptable at another, e.g., a redundant system element with considerable time lag to be brought into line, while meeting the operational mode "normal seagoing conditions at full speed" may result in a catastrophic effect in another operational mode, e.g., "maximum permitted operating speed in congested water".

13 Use of probability concept

13.1 If corrective measures or redundancy as described in preceding paragraphs are not provided for any failure, as an alternative the probability of occurrence of such failure should meet the following criteria of acceptance:

- .1 a failure mode which results in a catastrophic effect should be assessed to be extremely improbable;
- .2 a failure mode assessed as extremely remote should not result in worse than hazardous effects; and
- .3 a failure mode assessed as either frequent or reasonably probable should not result in worse than minor effects.

13.2 Numerical values for various levels of probabilities are laid down in section 3 of annex 3 of this Code. In areas where there is no data from craft to determine the level of probabilities of failure other sources can be used such as:

- .1 workshop test, or
- .2 history of reliability used in other areas under similar operating conditions, or
- .3 mathematical model if applicable.

14 Documentation

14.1 It is helpful to perform FMEA on worksheet(s) as shown in appendix 2.

14.2 The worksheets(s) should be organized to first display the highest system level and then proceed down through decreasing system levels.

15 Test programme

15.1 An FMEA test programme should be drawn up to prove the conclusions of FMEA. It is recommended that the test programme should include all systems or system elements whose failure would lead to:

- .1 major or more severe effects;
- .2 restricted operations; and
- .3 any other corrective action.

For equipment where failure cannot be easily simulated on the craft, the results of other tests can be used to determine the effects and influences on the systems and craft.

15.2 The trials should also include investigations into:

- .1 the layout of control stations with particular regard to the relative positioning of switches and other control devices to ensure a low potential for inadvertent and incorrect crew action, particularly during emergencies, and the provision of interlocks to prevent inadvertent operation for important system operation;

- .2 the existence and quality of the craft's operational documentation with particular regard to the pre-voyage checklists. It is essential that these checks account for any unrevealed failure modes identified in the failure analysis; and
- .3 the effects of the main failure modes as prescribed in the theoretical analysis.

15.3 The FMEA tests on board should be conducted in conjunction with provisions specified in 5.3, 16.4 and 17.4 of this Code, before the craft enters into service.

16 FMEA Report

The FMEA report should be a self-contained document with a full description of the craft, its systems and their functions and the proposed operation and environmental conditions for the failure modes, causes and effects to be understood without any need to refer to other plans and documents not in the report. The analysis assumptions and system block diagrams should be included, where appropriate. The report should contain a summary of conclusions and recommendations for each of the systems analysed in the system failure analysis and the equipment failure analysis. It should also list all probable failures and their probability of failure, where applicable, the corrective actions or operational restrictions for each system in each of the operational modes under analysis. The report should contain the test programme, reference any other test reports and the FMEA trials.

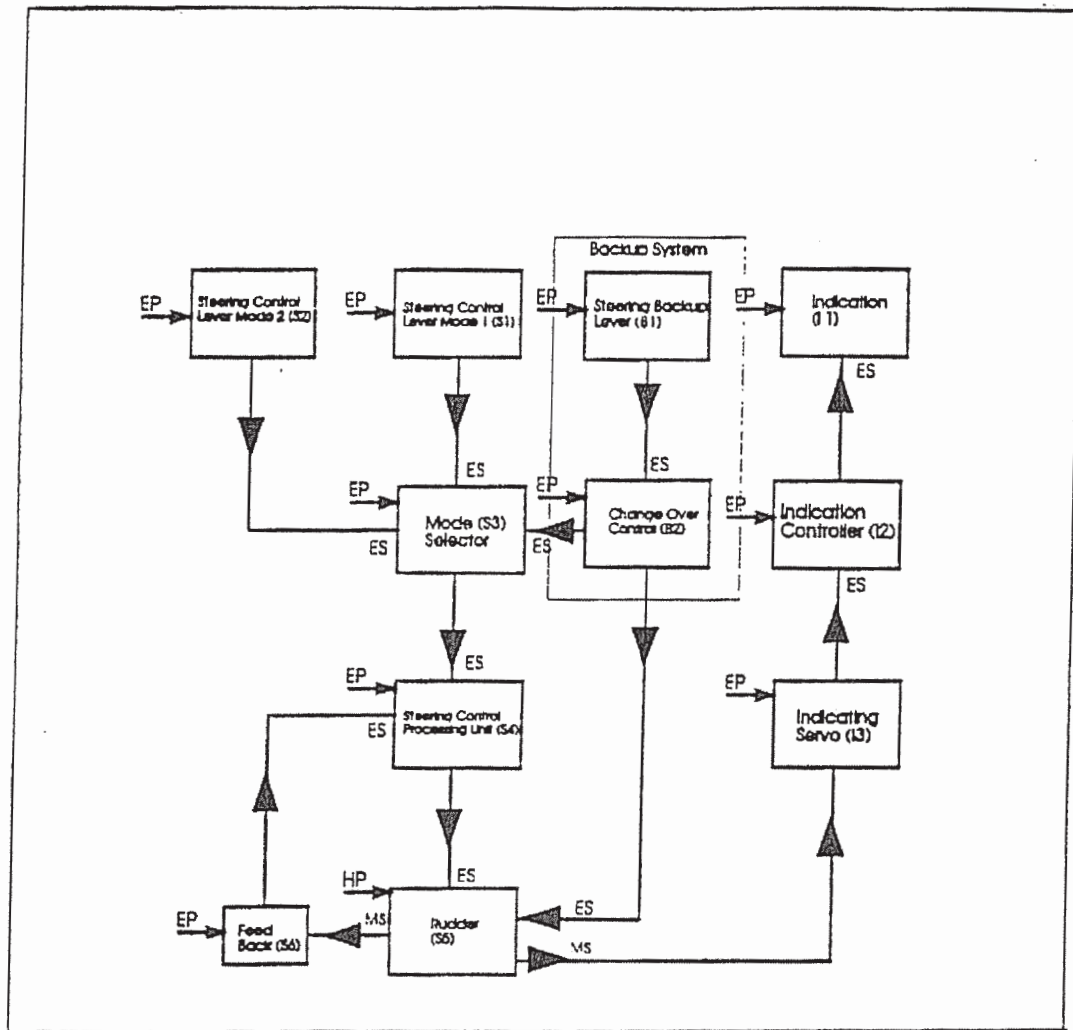
APPENDIX 1

EXAMPLE OF A SYSTEM BLOCK DIAGRAM

Steering Control System

Date _____

Analyst _____



where:

- EP - electric power
- HP - hydraulic power
- ES - electric signal
- MS - mechanical signal

TABLE 1

EXAMPLE OF A SET OF FAILURE MODES

1	Structural failure (rupture)	18	False actuation
2	Physical binding or jamming	19	Fails to stop
3	Vibration	20	Fails to start
4	Fails to remain (in position)	21	Fails to switch
5	Fails to open	22	Premature operation
6	Fails to close	23	Delayed operation
7	Fails open	24	Erroneous input (increased)
8	Fails closed	25	Erroneous input (decreased)
9	Internal leakage	26	Erroneous output (increased)
10	External leakage	27	Erroneous output (decreased)
11	Fails out of tolerance (high)	28	Loss of input
12	Fails out of tolerance (low)	29	Loss of output
13	Inadvertent operation	30	Shorted (electrical)
14	Intermittent operation	31	Open (electrical)
15	Erratic operation	32	Leakage (electrical)
16	Erroneous indication	33	Other unique failure conditions as applicable to the system characteristics, requirements and operational constraints
17	Restricted flow		

Refer to the following IEC Publication⁸ IEC 1985

ANNEX 5

ICE ACCRETION APPLICABLE TO ALL TYPES OF CRAFT

1 Icing allowances

1.1 For craft operating in areas where ice accretion is likely to occur the following icing allowance should be made in the stability calculations:

- .1 30 kg/m² on exposed weather decks and gangways;
- .2 7.5 kg/m² for projected lateral area of each side of the craft above the waterplane;
- .3 the projected lateral area of discontinuous surfaces of rail, sundry booms, spars (except masts) and rigging and the projected lateral area of other small objects should be computed by increasing the total projected area of continuous surfaces by 5% and the static moments of this area by 10%;
- .4 reduction of stability due to asymmetric ice accumulations in cross-structure.

1.2 For craft operating in areas where ice accretion may be expected:

- .1 Within the areas defined in 2.1, 2.3, 2.4 and 2.5 known to have icing conditions significantly different from those in 1.1, ice accretion requirements of one half to twice the required allowance may be applied.
- .2 Within the area defined in 2.2, where ice accretion in excess of twice the allowance required by 1.1 may be expected, more severe requirements than those given in 1.1 may be applied.

1.3 Information should be provided in respect of the assumptions made in calculating the condition of the craft in each of the circumstances set out in this annex for the following:

- .1 duration of the voyage in terms of the period spent in reaching the destination and returning to port; and
- .2 consumption rates during the voyage for fuel, water, stores and other consumables.

2 Areas of icing conditions

In the application of 1, the following icing areas should apply:

- .1 The area north of latitude 65°30'N, between longitude 28°W and the West coast of Iceland; north of the north coast of Iceland; north of the rhumb line running from latitude 66°N, longitude 15°W to latitude 73°30'N, longitude 15°E, north of latitude 73°30'N between longitude 15°E and 35°E, and east of longitude 35°E, as well as north of latitude 56°N in the Baltic Sea.
- .2 The area north of latitude 43°N bounded in the west by the North American coast and the east by the rhumb line running from

latitude 43°N, longitude 48°W to latitude 63°N, longitude 28°W and thence along longitude 28°W.

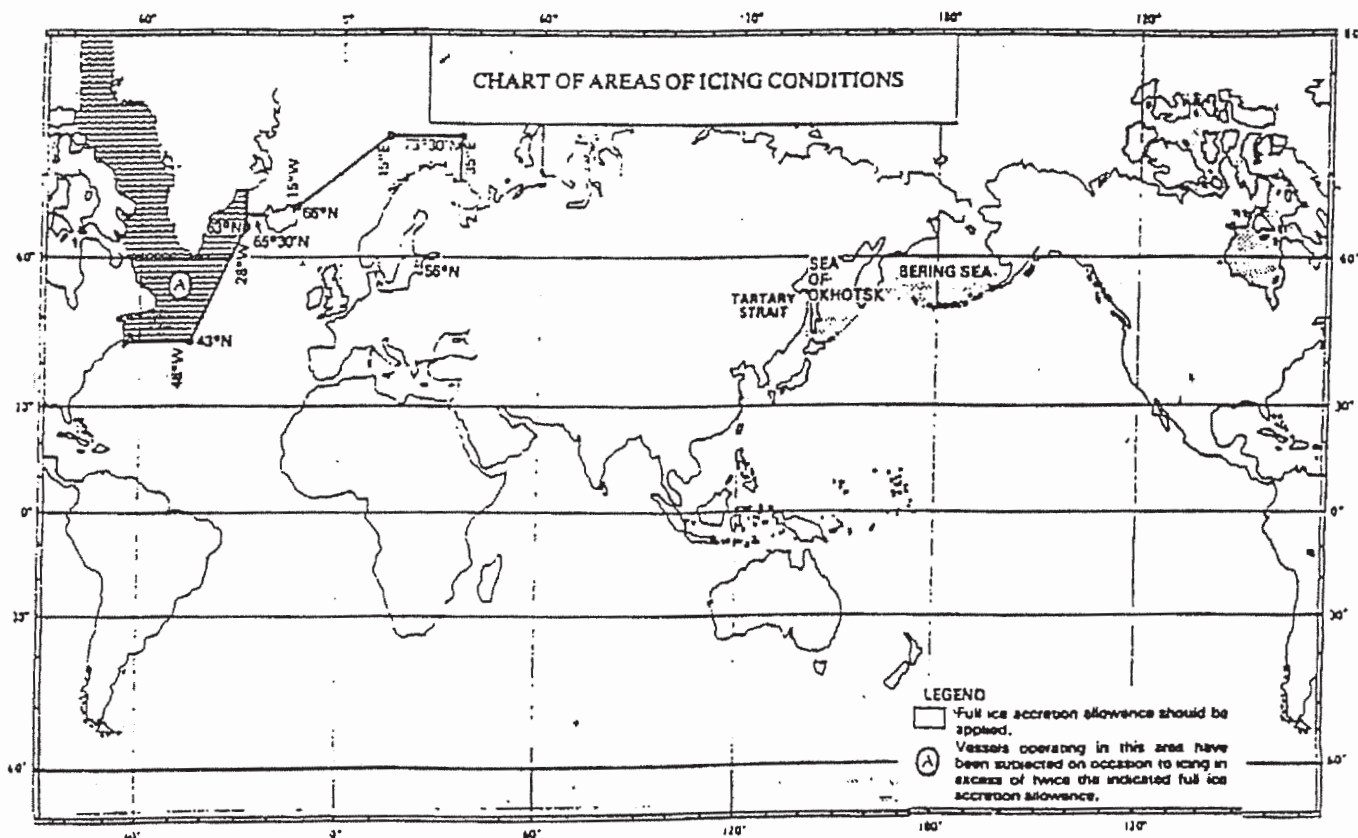
- .3 All sea areas north of the North American continent, west of the areas defined in subparagraphs .1 and .2 of this paragraph.
- .4 The Bering and Okhotsk Seas and the Tartary Strait during the icing season.
- .5 South of latitude 60°S.

A chart to illustrate the areas is attached.

3 Special requirements

Craft intended for operation in areas where ice accretion is known to occur should be:

- .1 designed to minimize the accretion of ice; and
- .2 equipped with such means for removing ice as the Administration may require.



ANNEX 6

METHODS RELATING TO THE INTACT STABILITY INVESTIGATION OF HYDROFOIL CRAFT

The stability of these crafts should be considered in the hull-borne, transient and foil-borne modes. The stability investigation should also take into account the effects of external forces. The following procedures are outlined for guidance in dealing with stability.

1 Surface-piercing hydrofoils1.1 Hull-borne mode

1.1.1 The stability should be sufficient to satisfy the provisions of 2.3 and 2.4 of this Code.

1.1.2 Heeling moment due to turning

The heeling moment developed during manoeuvring of the craft in the displacement mode may be derived from the following formula:

$$M_R = 0.196 \frac{V_o^2}{L} \cdot \Delta \cdot KG \text{ (kNm)}$$

where:

- M_R = moment of heeling;
- V_o = speed of the craft in the turn (m/s)
- Δ = displacement (t);
- L = length of the craft on the waterline (m)
- KG = height of the centre of gravity above keel (m).

This formula is applicable when the ratio of the radius of the turning circle to the length of the craft is 2 to 4.

1.1.3 Relationship between the capsizing moment and heeling moment to satisfy the weather criterion

The stability of a hydrofoil boat in the displacement mode can be checked for compliance with the weather criterion K as follows:

$$K = \frac{M_C}{M_V} \geq 1$$

where:

- M_C = minimum capsizing moment as determined when account is taken of rolling;
- M_V = dynamically applied heeling moment due to the wind pressure.

1.1.4 Heeling moment due to wind pressure

The heeling moment M_V is a product of wind pressure P_V , the windage area A_V and the lever of windage area Z .

$$M_V = 0.001 P_V A_V Z \text{ (kNm)}$$

The value of the heeling moment is taken as constant during the whole period of heeling.

The windage area A_v is considered to include the projections of the lateral surfaces of the hull, superstructure and various structures above the waterline. The windage area lever Z is the vertical distance to the centre of windage from the waterline and the position of the centre of windage may be taken as the centre of the area.

The values of the wind pressure in Pascal associated with Force 7 Beaufort Scale depending on the position of the centre of windage area are given in table 1.

TABLE 1

Typical wind pressures for Beaufort scale 7, 100 nautical miles from land

Z above waterline (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
P_v (Pa)	46	46	50	53	56	58	60	62	64

Note: These values may not be applicable in all areas.

1.1.5 Evaluation of the minimum capsizing moment M_c in the displacement mode

The minimum capsizing moment is determined from the static and dynamic stability curves taking rolling into account.

.1 When the static stability curve is used, M_c is determined by equating the areas under the curves of the capsizing and righting moments (or levers) taking rolling into account, as indicated by figure 1, where θ_z is the amplitude of roll and MK is a line drawn parallel to the abscissa axis such that the shaded areas S_1 and S_2 are equal.

$$M_c = OM, \quad \text{if the scale of ordinates represents moments,}$$

$$M_c = OM \times \text{Displacement,} \quad \text{if the scale of ordinates represents levers,}$$

STATIC STABILITY CURVE

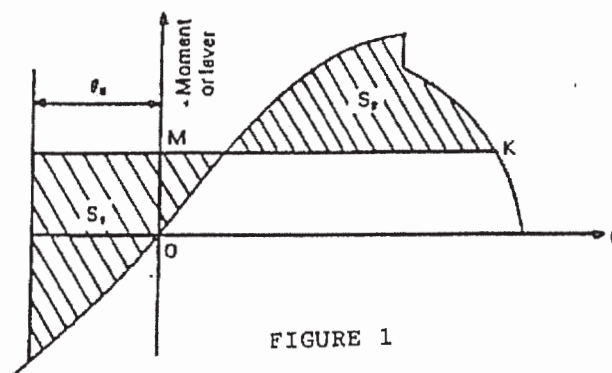


FIGURE 1

- .2 When the dynamic stability curve is used, first an auxiliary point A should be determined. For this purpose the amplitude of heeling is plotted to the right along the abscissa axis and a point A' is found (see figure 2). A line AA' is drawn parallel to the abscissa axis equal to the double amplitude of heeling ($AA' = 2\theta_z$) and the required auxiliary point A is found. A tangent AC to the dynamic stability curve is drawn. From the point A the line AB is drawn parallel to the abscissa axis and equal to 1 radian (57.3°). From the point B a perpendicular is drawn to intersect with the tangent in point E. The distance \overline{BE} is equal to the capsizing moment if measured along the ordinate axis of the dynamic stability curve. If, however, the dynamic stability levers are plotted along this axis, \overline{BE} is then the capsizing lever, and in this case the capsizing moment M_C is determined by multiplication of ordinate \overline{BE} (in metres) by the corresponding displacement in tonnes

$$M_C = 9.81 \Delta \overline{BE} \text{ (kNm)}$$

- .3 The amplitude of rolling θ_z is determined by means of model and full-scale tests in irregular seas as a maximum amplitude of rolling of 50 oscillations of a craft travelling at 90° to the wave direction in sea state for the worst design condition. If such data are lacking the amplitude is assumed to be equal to 15° .
- .4 The effectiveness of the stability curves should be limited to the angle of flooding.

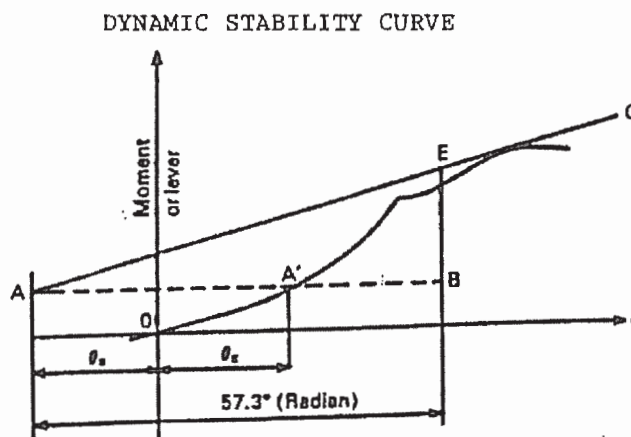


FIGURE 2

1.2 Transient and foil-borne modes

- 1.2.1 The stability should satisfy the provisions of 2.4 and 2.5 of this Code.
- 1.2.2.1 The stability in the transient and foil-borne modes should be checked for all cases of loading for the intended service of the craft.

- 1.2.2.2 The stability in the transient and foil-borne modes may be determined either by calculation or on the basis of data obtained from model experiments and should be verified by full-scale tests by the imposition of a series of known heeling moments by off-centre ballast weights, and recording the heeling angles produced by these moments. When taken in the hull-borne, take-off, steady foil-borne and settling to hull-borne modes, these results will provide an indication of the values of the stability in the various situations of the craft during the transient condition.
- 1.2.2.3 The angle of heel in the foil-borne mode caused by the concentration of passengers at one side should not exceed 8°. During the transient mode the angle of heel due to the concentration of passengers on one side should not exceed 12°. The concentration of passengers should be determined by the Administration, having regard to the guidance given at annex 7 to this Code.
- 1.2.3 One of the possible methods of assessing foil-borne metacentric height (GM) in the design stage for a particular foil configuration is given in figure 3.

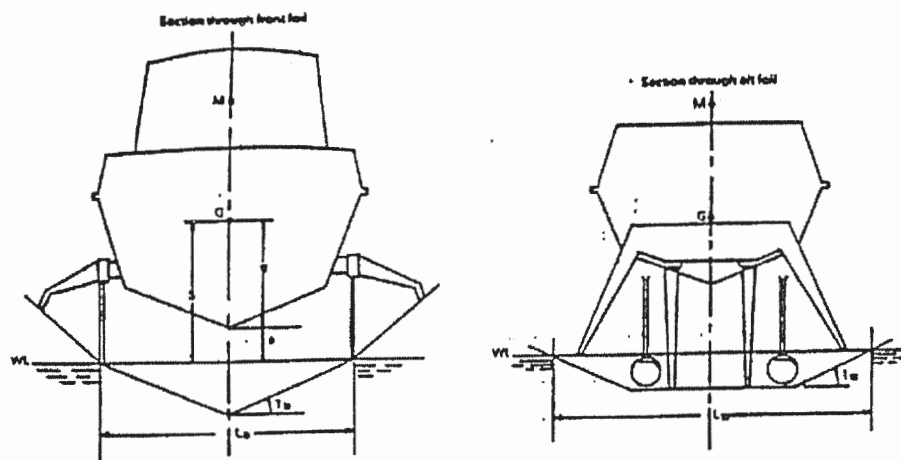


FIGURE 3

$$GM = n_{II} \left(\frac{L_{II}}{2 \tan \tau_{II}} - S \right) + n_n \left(\frac{L_n}{2 \tan \tau_n} - S \right)$$

- where n_n = percentage of hydrofoil load borne by front foil
 n_{II} = percentage of hydrofoil load borne by aft foil
 L_n = clearance width of front foil
 L_{II} = clearance width of aft foil
 g = clearance between bottom of keel and water
 g = height of centre of gravity above bottom of keel
 τ_n = angle at which front foil is inclined to horizontal
 τ_{II} = angle at which aft foil is inclined to horizontal
 s = height of centre of gravity above water

2 Fully submerged hydrofoils

2.1 Hull-borne mode

2.1.1 The stability in the hull-borne mode should be sufficient to satisfy the provisions of 2.3 and 2.6 of this Code.

2.1.2 Paragraphs 1.1.2 to 1.1.5 of this annex are appropriate to this type of craft in the hull-borne mode.

2.2 Transient mode

2.2.1 The stability should be examined by the use of verified computer simulations to evaluate the craft's motions, behaviour and responses under the normal conditions and limits of operation and under the influence of any malfunction.

2.2.2 The stability conditions resulting from any potential failures in the systems or operational procedures during the transient stage which could prove hazardous to the craft's watertight integrity and stability should be examined.

2.3 Foil-borne mode

The stability of the craft in the foil-borne mode should be in compliance with the provisions of 2.4 of this Code. The provisions of paragraph 2.2 of this annex should also apply.

2.4 Paragraph 1.2.2 of this annex should be applied to this type of craft as appropriate and any computer simulations or design calculations should be verified by full-scale tests.

ANNEX 7

STABILITY OF MULTIHULL CRAFT

1 Stability criteria in the intact condition

A multihull craft, in the intact condition, should have sufficient stability when rolling in a seaway to successfully withstand the effect of either passenger crowding or high speed turning as described in 1.4. The craft's stability should be considered to be sufficient provided compliance with this paragraph is achieved.

1.1 Area under the GZ curve

The area (A1) under the GZ curve up to an angle Θ should be at least:

$$A1 = 0.055 \times 30^\circ / \Theta \text{ (m.rad)}$$

where:

Θ is the least of the following angles:

- .1 the downflooding angle;
- .2 the angle at which the maximum GZ occurs; and
- .3 30°

1.2 Maximum GZ

The maximum GZ value should occur at an angle of at least 10° .

1.3 Heeling due to wind

The wind heeling lever should be assumed constant at all angles of inclination and should be calculated as follows:

$$HL1 = \frac{P_i \cdot A \cdot Z}{9800\Delta} \quad (\text{m}) \quad (\text{see figure 1})$$

$$HL2 = 1.5 HL1 \quad (\text{m}) \quad (\text{see figure 1})$$

where:

$$P_i^* = 500 \quad (\text{Pa})$$

A = projected lateral area of the portion of the ship above the lightest service waterline (m^2)

Z = vertical distance from the centre of A to a point one half the lightest service draught (m)

Δ = displacement (t)

* The value of P_i for ships in restricted service may be reduced subject to the approval of the Administration.

1.4 Heeling due to passenger crowding or high speed turning

Heeling due to the crowding of passengers on one side of the craft or to high speed turning, whichever is the greater should be applied in combination with the heeling lever due to wind (HL2).

.1 Heeling due to passenger crowding

When calculating the magnitude of the heel due to passenger crowding, a passenger crowding lever should be developed using the assumptions stipulated in 2.9 of this Code.

.2 Heeling due to high speed turning

When calculating the magnitude of the heel due to the effects of high speed turning, a high speed turning lever should be developed using the following formula:

$$TL = \frac{1}{g} \frac{V_0^2}{R} \left(KG - \frac{d}{2} \right) \quad (m)$$

where:

TL	= turning lever	(m)
Vo	= speed of craft in the turn	(m/s)
R	= turning radius	(m)
KG	= height of vertical centre of gravity above keel	(m)
d	= mean draught	(m)

1.5 Rolling in waves (figure 1)

The effect of rolling in a seaway upon the craft's stability should be demonstrated mathematically. In doing so, the residual area under the GZ curve (A2), i.e. beyond the angle of heel (Θ_h), should be at least equal to 0.028 m.rad up to the angle of roll Θ_r . In the absence of model test or other data Θ_r should be taken as 15° or an angle of ($\Theta_d - \Theta_h$), whichever is less.

2 Criteria for residual stability after damage

2.1 The method of application of criteria to the residual stability curve is similar to that for intact stability except that the craft in the final condition after damage should be considered to have an adequate standard of residual stability provided:

- .1 the required area A2 should be not less than 0.028 m.rad (figure 2 refers); and
- .2 there is no requirement regarding the angle at which the maximum GZ value should occur.

2.2 The wind heeling lever for application on the residual stability curve should be assumed constant at all angles of inclination and should be calculated as follows:

$$HL3 = \frac{P_d \cdot A \cdot Z}{9800\Delta}$$

where:

$$P_d = 120 \quad (\text{Pa})$$

A = projected lateral area of the portion of the ship above the lightest service waterline (m²)

Z = vertical distance from the centre of A to a point one half of the lightest service draught (m)

Δ = displacement (t)

- 2.3 The same values of roll angle should be used as for the intact stability.
- 2.4 The downflooding point is important and is regarded as terminating the residual stability curve. The area A2 should therefore be truncated at the downflooding angle.
- 2.5 The stability of the craft in the final condition after damage should be examined and shown to satisfy the criteria, when damaged as stipulated in 2.4 of this Code.
- 2.6 In the intermediate stages of flooding, the maximum righting lever should be at least 0.05 m and the range of positive righting lever should be at least 7°. In all cases, only one breach in the hull and only one free surface need to be assumed.

3 Application of heeling levers

3.1 In applying the heeling levers to the intact and damaged curves the following should be considered:

3.1.1 for intact condition:

- .1 wind heeling lever - steady wind (HL1); and
- .2 wind heeling lever (including gusting effect) plus either the passenger crowding or speed turning levers whichever is the greater (HTL).

3.1.2 for damage condition:

- .1 wind heeling lever - steady wind (HL3); and
- .2 wind heeling lever plus heeling lever due to passenger crowding (HL4).

3.2 Angles of heel due to steady wind

- 3.2.1 The angles of heel due to steady wind when the heeling lever HL1, obtained as in 1.3, is applied to the intact stability curve, should not exceed 16°; and
- 3.2.2 The angle of heel due to steady wind when the heeling lever HL3, obtained as in 2.2, is applied to the residual stability curve, after damage, should not exceed 20°.

Multihull craft criteria

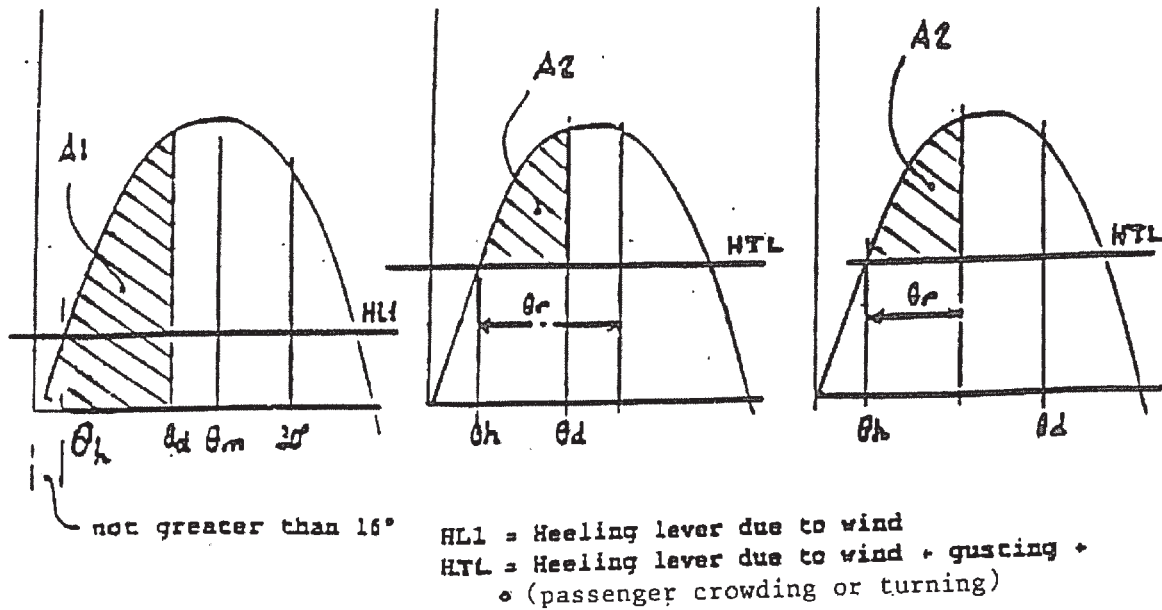


Figure 1 - Intact stability

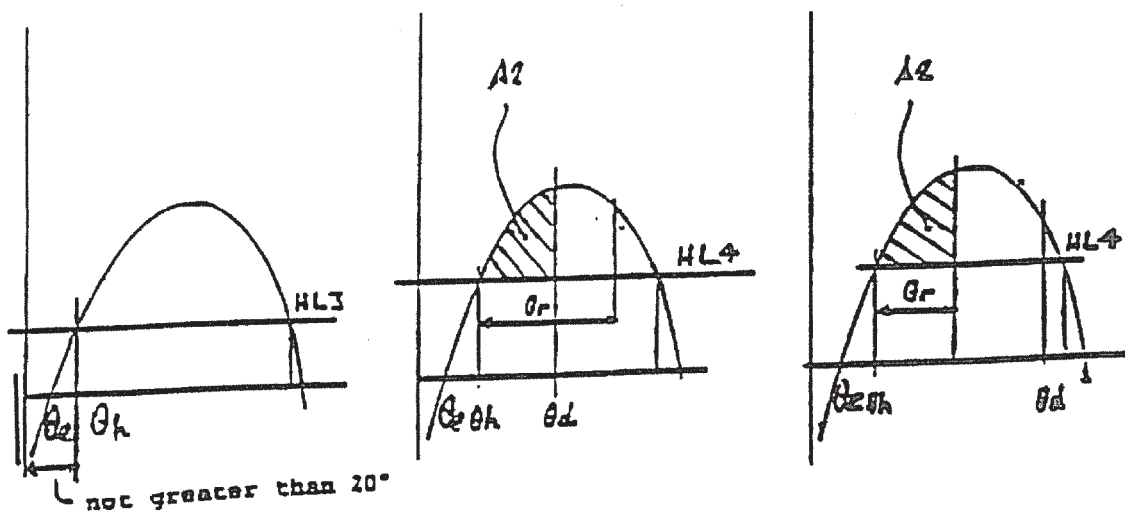


Figure 2 - Damage stability

- HL1 = Heeling lever due to wind
- HTL = Heeling lever due to wind + gusting + (passenger crowding or turning)
- HL3 = Heeling lever due to wind
- HL4 = Heeling lever due to wind + passenger crowding
- θ_m = Angle of maximum GZ
- θ_d = Angle of downflooding
- θ_r = Angle of roll
- θ_e = Angle of equilibrium, assuming no wind, passenger crowding or turning effects
- θ_h = Angle of heel due to heeling lever HL1, HTL, HL3 or HL4
- $A1 \geq$ Area required by 1.1
- $A2 \geq$ 0.028 m.rad

ANNEX 8

DEFINITIONS, REQUIREMENTS AND COMPLIANCE CRITERIA
RELATED TO OPERATIONAL AND SAFETY PERFORMANCE

This annex applies to all types of craft. Tests to evaluate operational safety should be conducted on the prototype craft of a new design or of a design incorporating new features which may modify the results of a previous testing. The tests should be carried out to a schedule agreed between the Administration and the manufacturer. Where conditions of service warrant additional testing (e.g., low temperature), the Administration or base port State authorities as appropriate may require further demonstrations. Functional descriptions, technical and system specifications relevant to the understanding and evaluation of craft performance should be available.

The objective of these tests is to provide essential information and guidance to enable the craft to be operated safely under normal and emergency conditions within the design speed and environmental envelope.

The following procedures are outlined as requirements in dealing with verification of craft performance.

1 Performance

1.1 General

- 1.1.1 The craft should meet the applicable operational requirements in chapter 17 of this Code and this annex for all extremes of passenger and load configurations for which certification is required. The limiting sea state related to the different modes of operation should be verified by tests and analyses of a craft of the type for which certification is requested.
- 1.1.2 Operational control of the craft should be in accordance with procedures established by the applicant for operation in service. Procedures to be established should be start procedure, cruise procedures, normal and emergency stop and manoeuvre procedures.
- 1.1.3 The procedures established under 1.1.2 should:
- .1 demonstrate that normal manoeuvres and craft responses to failures are consistent in performance;
 - .2 use methods or devices that are safe and reliable; and
 - .3 include allowance for any time lag in the execution of procedures that may reasonably be expected in service.
- 1.1.4 Procedures required by this annex should be conducted over water of sufficient depth such that craft performance will not be affected.
- 1.1.5 Tests should be conducted at minimum practicable weight and additional testing should be conducted at maximum weight sufficient to establish the need for additional restrictions and for testing to examine the effect of weight.

2 Stopping

- 2.1 This test is to establish the acceleration experienced when stopping the craft in calm water with no passenger load or cargo load during the following conditions:
- .1 normal stop for maximum operational speed;
 - .2 emergency stop for maximum operational speed; and
 - .3 crash stop from maximum operational speed and from any transient mode speed.
- 2.2 The tests referred to in 2.1.1 and 2.1.2 should document that the accelerations do not exceed safety level 1 in annex 3 when control levers are used in accordance to written procedures as given in the craft operating manual or in an automatic mode. Should safety level 1 be exceeded during normal stop, control systems should be modified in order to avoid exceedance or passengers should be required to be seated during normal stop. Should safety level 1 be exceeded during emergency stop, then written procedures in the craft operating manual should include detailed information of how to avoid exceedance or control system should be modified to avoid exceedance.
- 2.3 The test referred to in 2.1.3 should document that the accelerations do not exceed safety level 2 of annex 3 when control levers of automatic modes are used in a manner which will give the highest accelerations. If safety level 2 is exceeded then the craft operating manual should include a warning that it is a risk to passengers being injured, if crash stop is performed.
- 2.4 Other tests should be repeated during craft turning to establish the need or otherwise to impose any speed related restrictions during manoeuvres.

3 Cruise performance

- 3.1 This test is to establish the craft performance and accelerations experienced during cruise modes with no passenger load or cargo load during the following conditions:
- .1 normal operation conditions are those in which the craft will safely cruise at any heading while manually operated, auto-pilot assisted operated or operated with any automatic control system in normal mode; and
 - .2 worst intended conditions, referred to in 1.4.48 of this Code, are those in which it should be possible to maintain safe cruise without exceptional piloting skill. However, operations at all headings relative to the wind and sea may not be possible. For type of craft having a higher performance standard in non-displacement mode, the performance and accelerations should also be established at displacement mode during operation in the worst intended condition.
- 3.2 Operation levels, as defined in 3.1, should be established and documented by full-scale tests in at least two relevant sea conditions and in head, beam and following seas. Test period should be at least 15 min. Model tests and mathematical simulations could be used to verify the performance in the worst intended conditions.

Limits for normal operation condition should be documented by measurements of craft speed, heading to the wave and interpolation of measurements of maximum horizontal accelerations in accordance with 2.4 of annex 3. Measurement of wave height and period should be made to the maximum extent practicable.

Limits for worst intended condition should be documented by measurements of craft speed, wave height and period, heading to the wave and by root mean square (RMS) values of horizontal accelerations in accordance with 2.4 of annex 3 and of vertical accelerations close to the craft longitudinal centre of gravity. RMS values could be used for extrapolation of peak values. To obtain the expected peak values related to structural design load and safety levels (1 per 5-min exceedance), multiply the RMS values by 3.0 or

$$C = \sqrt{2LnN},$$

where:

N is the number of successive amplitudes within the relevant period.

If not otherwise verified by model tests or by mathematical calculations, it might be assumed a linear relation between wave height and accelerations based on measurements in the two sea conditions. Limits for worst intended condition should be documented both related to passenger safety in accordance with 2.4 of annex 3 and related to the actual structural design load of the craft.

3.3 The tests and verification process should document the limiting seas for safe operation of the craft:

- .1 in normal operation at maximum operational speed the accelerations should not exceed safety level 1 in annex 3 with an average of 1 per 5-min period. The craft operating manual should include detailed description of the effects of speed reduction or change of heading to the waves in order to prevent exceedance;
- .2 in the worst intended conditions, with reduced speed as necessary, the accelerations should not exceed safety level 2 in annex 3 with an average of 1 per 5-min period, nor should any other craft characteristic motion as pitch, roll and yaw exceed levels that could impede the safety of passengers. In worst intended conditions, with reduced speed as necessary, craft should be safely manoeuvrable and provide adequate stability in order that the craft can continue safe operation to the nearest place of refuge, provided caution is exercised in handling. Passengers should be required to be seated when safety level 1 in annex 3 is exceeded; and
- .3 within the actual structural design load for the craft, with reduced speed and change of heading, as necessary.

3.4 Turning and manoeuvrability

The craft should be safely controllable and manoeuvrable during:

- .1 hull-borne operation;
- .2 operation in non-displacement mode;

- .3 take-off, landing;
- .4 any intermediate or transition modes, as applicable; and
- .5 berthing operations, as applicable.

4 Effects of failures or malfunction

4.1 General

The limits of safe operation, special handling procedures and any operational restrictions should be examined and developed as a result of full-scale trials conducted by simulating possible equipment failures.

The failures to be examined should be those leading to major or more severe effects as determined from evaluation of FMEA or similar analysis.

Failures to be examined should be agreed between the craft manufacturer and the Administration and each single failure should be examined in a progressive manner.

4.2 Objects of tests

Examination of each failure should result in:

- .1 determining safe limits of craft operation at the time of failure, beyond which the failure will result in degradation beyond safety level 2;
- .2 determining crew member's actions, if any, to minimize or counter the effect of the failure; and
- .3 determining craft or machinery restrictions to be observed to enable the craft to proceed to a place of refuge with the failure present.

4.3 Failures to be examined

Equipment failures should include, but not be limited to, the following:

- .1 total loss of propulsion power;
- .2 total loss of lift power (for ACV and SES);
- .3 total failure of control of one propulsion system;
- .4 involuntary application of full propulsion thrust (positive or negative) on one system;
- .5 failure of control of one directional control system;
- .6 involuntary full deflection of one directional control system;
- .7 failure of control of trim control system;
- .8 involuntary full deflection of one trim control system element; and
- .9 total loss of electrical power.

Failures should be fully representative of service conditions and should be simulated as accurately as possible in the most critical craft manoeuvre where the failure will have maximum impact.

4.4 "Dead ship" test

In order to establish craft motions and direction of laying to wind and waves, for the purposes of determining the conditions of a craft evacuation, the craft should be stopped and all main machinery shut down for sufficient time that the craft's heading relative to wind and waves has stabilized. This test should be carried out on an opportunity basis to establish patterns of the design's "dead ship" behaviour under a variety of wind and sea states.

ANNEX 9

CRITERIA FOR TESTING AND EVALUATION OF
REVENUE AND CREW SEATS1 Purpose and scope

The purpose of these criteria is to provide requirements for revenue and crew seats, seat anchorages and seat accessories and their installation to minimize the possibility of occupant injury and/or disruption of egress/ingress if the craft suffers a collision.

2 Static seat tests

2.1 The requirements of this paragraph are applicable for crew and revenue seats in craft having a design collision load of less than 3 g.

2.2 All seats to which this paragraph applies, along with their supports and deck attachments, should be designed to withstand at least the following static forces applied in the direction of the craft:

- .1 Forward direction: a force of 2.25 kN,
- .2 After direction: a force of 1.5 kN,
- .3 Transverse direction: a force of 1.5 kN,
- .4 Vertically downward: a force of 2.25 kN, and
- .5 Vertically upward: a force of 1.5 kN.

If these forces are applied in the fore or aft direction of the seat, they should be applied horizontally to the seat back 350 mm above the seat bottom. If the forces are applied in the transverse seat direction, they should be applied horizontally to the seat bottom. Vertical upward forces should be evenly distributed to the corners of seat bottom frame. Vertical downward forces should be uniformly distributed over the seat bottom.

If a seating unit consists of more than one seating position, these forces should be applied at each seating position concurrently during the tests.

2.3 When the forces are applied to a seat, consideration should be given to the direction in which the seat is to face in the craft. For example, if the seat faces sideways, the transverse craft force would be applied fore and aft on the seat and the forward craft force would be applied transversely on the seat.

2.4 Each seating unit to be tested should be attached to the support structure similar to the manner in which it will be attached to the deck structure in the craft. Although a rigid support structure can be used for these tests, a support structure, having the same strength and stiffness as the support structure in the craft, is preferred.

2.5 The forces described in 2.2.1 to 2.2.3 should be applied to the seat through a cylindrical surface having a radius of 82 mm and a width at least equal to the width of the seat. The surface should be equipped with at least one force transducer able to measure the forces specified.

2.6 The seat should be considered acceptable if:

- .1 under the influence of the forces referred to in 2.2.1 to 2.2.3, the permanent displacement measured at the point of application of the force is not more than 400 mm;
- .2 no part of the seat, the seat mountings or the accessories become completely detached during the tests;
- .3 the seat remains firmly held, even if one or more of the anchorages is partly detached, and all of the locking systems remain locked during the whole duration of the test (adjustment and locking systems need not be operational after the tests); and
- .4 rigid parts of the seat with which the occupant may come into contact should present a curved surface with a radius of at least 5 mm.

2.7 The requirements of section 3 may be used in lieu of the requirements of this section provided that the accelerations used for the tests are at least 3 g.

3 Dynamic seat tests

3.1 The requirements of this section are applicable for crew and revenue seats in craft having a design collision load of 3 g or greater.

3.2 All seats for which this section applies, the seat supporting structure, the attachment to the deck structure, the lap belt, if installed, and shoulder harness, if installed, should be designed to withstand the maximum acceleration force that can be imposed upon them during a design collision. Consideration should be given to the orientation of the seat relative to the acceleration force (i.e. whether the seat is forward, aft, or side facing).

3.3 The acceleration pulse to which the seat is subjected should be representative of the collision time-history of the craft. If the collision time-history is not known, or cannot be simulated, the acceleration time-history envelope shown in the figure can be used.

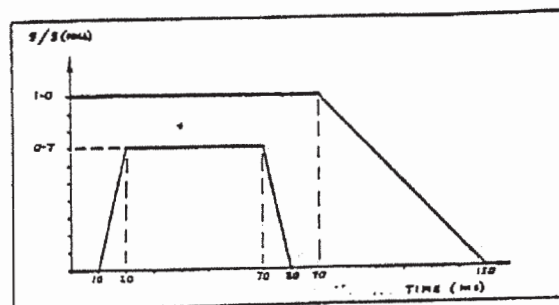


Figure - Acceleration time-history envelope

3.4 In the test frame, each seat unit and its accessories (e.g., lap belts and shoulder harnesses) should be attached to the support structure similar to the manner in which it will be attached to the deck structure in the craft. The support structure can be a rigid surface, however, a support structure having the same strength and stiffness as the support structure in the craft is preferred. Other seats and/or tables with which an occupant may come in contact during a collision should be included in the test frame in an orientation and with a method of attachment typical of that in the craft.

3.5 During the dynamic seat test, a fiftieth percentile anthropomorphic test dummy, corresponding to the Hybrid II or Hybrid III (preferred) human surrogate (unless a more advanced test dummy is available), should be placed in the seat in an upright seating position. If a typical seating unit is composed of more than one occupant seat, a test dummy should be placed in each occupant seat in the unit. The dummy, or dummies, should be secured in the seat unit in accordance with procedures of recognized national standards^{1/} and be secured using only the lap belt and shoulder harness if they are installed. Tray tables and other such devices should be placed in the position that would cause the greatest potential for an occupant to become injured.

3.6 The test dummy should be instrumented and calibrated, in accordance with the requirements of a recognized national standard, so as to permit calculation of the head injury criterion, calculation of the thoracic trauma index, measurement of force in the femur, and measurement, if possible, of extension and flexion of the neck, measurement of the maximum relative pelvis acceleration, and measurement of the maximum pelvis load in the direction of the spine.

3.7 If more than one dummy is used in the tests, the dummy located in the seat having the highest potential for an occupant to be injured should be the one instrumented. The other dummy or dummies need not be instrumented.

3.8 The tests should be conducted and the instrumentation should be sampled at a rate sufficient to reliably show response of the dummy in accordance with the requirements of a recognized national standard.

3.9 The seat unit tested in accordance with the requirements of this section should be considered acceptable if:

- .1 The seat unit and tables installed in the seat unit or area do not become dislodged from the supporting deck structure and do not deform in a manner that would cause the occupant to become trapped or injured.

^{1/} Recognized national standards include ECE 80 with addendum 79, ADR 66/00 from Australia and NCHRP Report 350 from the United States. Other national standards equivalent to these standards may be considered acceptable.

- .2 The lap belt, if installed, remains attached and on the test dummy's pelvis during the impact. The shoulder harness, if installed, remains attached and in the immediate vicinity of the test dummy's shoulder during the impact. After the impact, the release mechanisms should be operative.

- .3 The following acceptability criteria are met:

- .1 the head injury criterion (HIC), calculated in accordance with the formula, does not exceed 500

$$HIC = (t_2 - t_1) \left[\frac{1}{t_2 - t_1} \int_{t_1}^{t_2} a(t) dt \right]^{2.5}$$

where:

t_1 and t_2 are the beginning and ending times (in seconds) of the interval in which the HIC is a maximum. The term $a(t)$ is the resultant measured acceleration in the head of the dummy in g;

- .2 the thoracic trauma index (TTI), calculated in accordance with the formula, does not exceed 30 g except for periods totalling less than 3 ms

$$TTI = \frac{g_R + g_{LS}}{2} \quad \text{or acceleration at the centre of gravity}$$

where:

g_R is the acceleration in g of either the upper or lower rib; and

g_{LS} is the acceleration in g of the lower spine;

- .3 the maximum pelvis acceleration does not exceed 130 g's;
- .4 the maximum pelvic load does not exceed 6.7 kN measured in the axis of the spine;
- .5 neck flexion does not exceed 88 Nm, if measured;
- .6 neck extension does not exceed 48 Nm, if measured; and
- .7 the force in the femur does not exceed 10 kN except that it cannot exceed 8 kN for periods totalling more than 20 ms.
- .4 Loads on the upper torso harness straps do not exceed 7.8 kN or a total of 8.9 kN if dual straps are used.

ANNEX 10

OPEN REVERSIBLE LIFERAFTS

1 General

1.1 All open reversible liferafts should:

- .1 be constructed with proper workmanship and materials;
- .2 not be damaged in stowage throughout the air temperature range of -18°C to $+65^{\circ}\text{C}$;
- .3 be capable of operating throughout an air temperature range of -18°C to $+65^{\circ}\text{C}$ and a seawater temperature range of -1°C to $+30^{\circ}\text{C}$;
- .4 be rot-proof, corrosion-resistant and not be unduly affected by seawater, oil or fungal attack;
- .5 be stable and maintain their shape when inflated and fully laden; and
- .6 be fitted with retro-reflective material, where it will assist in detection, and in accordance with the recommendations adopted by the Organization*.

2 Construction

2.1 The open reversible liferaft should be so constructed that when it is dropped into the water in its container from a height of 10 m, the liferaft and its equipment will operate satisfactorily. If the open reversible liferaft is to be stowed at a height of more than 10 m above the waterline in the lightest seagoing condition, it should be of a type which has been satisfactorily drop-tested from at least that height.

2.2 The open reversible floating liferaft should be capable of withstanding repeated jumps on to it from a height of at least 4.5 m.

2.3 The open reversible liferaft and its fittings should be so constructed as to enable it to be towed at a speed of 3 knots in calm water when loaded with its full complement of persons and equipment, with the sea-anchor deployed.

2.4 The open reversible liferaft when fully inflated should be capable of being boarded from the water whichever way up it inflates.

2.5 The main buoyancy chamber should be divided into:

- .1 not less than two separate compartments, each inflated through a nonreturn inflation valve on each compartment; and

* Refer to the Recommendation on the use and fitting of retro-reflective materials on life-saving appliances adopted by the Organization by resolution A.658(16).

- .2 the buoyancy chambers should be so arranged that in the event of one of the compartments being damaged or failing to inflate, the intact compartment should be able to support, with positive freeboard over the open reversible liferaft's entire periphery, the number of persons which the liferaft is permitted to accommodate, each having a mass of 75 kg and seated in their normal positions.

2.6 The floor of the open reversible liferaft should be waterproof.

2.7 The open reversible liferaft should be inflated with a non-toxic gas by an inflation system complying with the requirements of regulation III/39 of the Convention. Inflation should be completed within the period of one minute at an ambient temperature of between 18°C and 20°C and within a period of three minutes at an ambient temperature of -18°C. After inflation the open reversible liferaft should maintain its form when loaded with its full complement of persons and equipment.

2.8 Each inflatable compartment should be capable of withstanding a pressure equal to at least three times the working pressure and should be prevented from reaching a pressure exceeding twice the working pressure either by means of relief valves or by a limited gas supply. Means should be provided for fitting the topping-up pump or bellows.

2.9 The surface of the buoyancy tubes should be of non-slip material. At least 25% of these tubes should be of a highly visible colour.

2.10 The number of persons which an open reversible liferaft should be permitted to accommodate should be equal to the lesser of:

- .1 the greatest whole number obtained by dividing by 0.096 the volume, measured in cubic metres of the main buoyancy tubes (which for this purpose should not include the thwarts if fitted) when inflated; or
- .2 the greatest whole number obtained by dividing by 0.372 the inner horizontal cross-sectional area of the open reversible liferaft measured in square metres (which for this purpose may include the thwart or thwarts, if fitted) measured to the innermost edge of the buoyancy tubes; or
- .3 the number of persons having an average mass of 75 kg, all wearing lifejackets, that can be seated inboard of the buoyancy tubes without interfering with the operation of any of the liferaft's equipment.

3 Open reversible liferaft fittings

3.1 Lifelines should be securely becketed around the inside and outside of the open reversible liferaft.

3.2 The open reversible liferaft should be fitted with an efficient painter of a length suitable for automatic inflation on reaching the water. For open reversible liferafts accommodating more than 30 persons an additional bowsing-in line should be fitted.

3.3 The breaking strength of the painter system including its means of attachment to the open reversible liferaft, except the weak link required by regulation III/39 of the Convention, should be:

- .1 7.5 kN for open reversible liferafts accommodating up to 8 persons;
- .2 10.0 kN for open reversible liferafts accommodating 9 to 30 persons; and
- .3 15.0 kN for open reversible liferafts accommodating more than 30 persons.

3.4 The open reversible liferaft should be fitted with at least the following number of inflated ramps to assist boarding from the sea whichever way up the raft inflates:

- .1 one boarding ramp for open reversible liferafts accommodating up to 30 persons; or
- .2 two boarding ramps for open reversible liferafts accommodating more than 30 persons, such boarding ramps should be 180° apart.

3.5 The open reversible liferaft should be fitted with water pockets complying with the following requirements:

- .1 the cross-sectional area of the pockets should be in the shape of an isosceles triangle with the base of the triangle attached to the buoyancy tubes of the open reversible liferaft;
- .2 the design should be such that the pockets fill to approximately 60% of capacity within 15 s to 25 s of deployment;
- .3 the pockets attached to each buoyancy tube should normally have aggregate capacity of between 125 l and 150 l for inflatable open reversible liferafts up to and including the 10 person size;
- .4 the pockets to be fitted to each buoyancy tube on liferafts certified to carry more than 10 persons should have as far as practicable an aggregate capacity of $(12 \times N)$ litres, where N is the number of persons carried;
- .5 each pocket on a buoyancy tube should be attached so that when the pocket is in the deployed position it is attached along the full length of its upper edges to, or close to, the lowest part of the lower buoyancy tube; and
- .6 the pockets should be distributed symmetrically round the circumference of the liferaft with sufficient separation between each pocket to enable air to escape readily.

3.6 At least one manually controlled lamp complying with the requirements should be fitted on the upper and lower surfaces of the buoyancy tubes.

3.7 Suitable automatic drain arrangements should be provided on each side of the floor of the liferaft in the following manner:

- .1 one for open reversible liferafts accommodating up to 30 persons; or
- .2 two for open reversible liferafts accommodating more than 30 persons.

3.8 The equipment of every open reversible liferaft should consist of:

- .1 one buoyant rescue quoit, attached to not less than 30 m of buoyant line with a breaking strength of at least 1 kN;
- .2 two safety knives of the non-folding type having a buoyant handle should be fitted attached to open reversible liferaft by light lines. They should be stowed in pockets so that, irrespective of the way in which the open reversible liferaft inflates, one will be readily available on the top surface of the upper buoyancy tube in a suitable position to enable the painter to be readily cut;
- .3 one buoyant bailer;
- .4 two sponges;
- .5 one sea anchor permanently attached to the open reversible liferaft in such a way as to be readily deployable when the open reversible liferaft inflates. The position of the sea anchor should be clearly marked on both buoyancy tubes;
- .6 two buoyant paddles;
- .7 one first-aid outfit in a waterproof case capable of being closed tightly after use;
- .8 one whistle or equivalent sound signal;
- .9 two hand flares;
- .10 one waterproof electric torch suitable for Morse signalling together with one spare set of batteries and one spare bulb in a waterproof container;
- .11 one repair outfit for repairing punctures in buoyancy compartments; and
- .12 one topping-up pump or bellows.

3.9 The equipment specified in 3.8 is designated an HSC Pack.

3.10 Where appropriate, the equipment should be stowed in a container which, if it is not an integral part of, or permanently attached to the open reversible liferaft, should be stowed and secured to the open reversible liferaft and be capable of floating in water for at least 30 min without damage to its contents. Irrespective of whether the equipment container is an integral part of, or is permanently attached to, the open reversible liferaft, the equipment should be readily accessible irrespective of which way up the open reversible liferaft inflates. The line which secures the equipment container to the open reversible liferaft should have a breaking strength of 2 kN or a breaking strength of 3:1 based on the mass of the complete equipment pack, whichever is the greater.

4 Containers for open reversible inflatable liferafts

4.1 The open reversible liferafts should be packed in a container that is:

- .1 so constructed as to withstand conditions encountered at sea;
- .2 of sufficient inherent buoyancy, when packed with the liferaft and its equipment, to pull the painter from within and to operate the inflation mechanism should the craft sink; and
- .3 as far as practicable watertight, except for drain holes in the container bottom.

4.2 The container should be marked with:

- .1 maker's name or trademark;
- .2 serial number;
- .3 the number of persons it is permitted to carry;
- .4 non-SOLAS reversible;
- .5 type of emergency pack enclosed;
- .6 date when last serviced;
- .7 length of painter;
- .8 maximum permitted height of stowage above waterline (depending on drop-test height); and
- .9 launching instructions.

5 Markings on open reversible inflatable liferafts

The open reversible liferafts should be marked with:

- .1 maker's name or trademark;
- .2 serial number;
- .3 date of manufacture (month and year);
- .4 name and place of service station where it was last serviced; and
- .5 number of persons, it is permitted to accommodate on the top of each buoyancy tube, in characters not less than 100 mm in height and of a colour contrasting with that of the tube.

6 Instructions and information

Instructions and information required for inclusion in the craft's training manual and in the instructions for on-board maintenance should be in a form suitable for inclusion in such training manual and instructions for

on-board maintenance. Instructions and information should be in a clear and concise form and should include, as appropriate, the following:

- .1 general description of the open reversible liferaft and its equipment;
- .2 installation arrangements;
- .3 operational instructions including use of associated survival equipment; and
- .4 servicing requirements.

第 92/2014 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一九七四年十一月一日訂於倫敦的《國際海上人命安全公約》的締約國；

國際海事組織海上安全委員會於一九九零年五月二十四日透過第MSC.16(58)號決議通過了《國際散裝運輸危險化學品船舶構造和設備規則》的修正案，且有關修正案自二零零零年二月三日起對澳門特別行政區生效；

基於此，行政長官根據澳門特別行政區第3/1999號法律第六條第一款的規定，命令公佈包含上指修正案的MSC.16(58)號決議的中文及英文文本。

二零一四年十一月十一日發佈。

行政長官 崔世安

Aviso do Chefe do Executivo n.º 92/2014

Considerando que a República Popular da China é um Estado Membro da Organização Marítima Internacional e um Estado Contratante da Convenção Internacional para a Salvaguarda da Vida Humana no Mar, concluída em Londres em 1 de Novembro de 1974;

Considerando igualmente que, em 24 de Maio de 1990, o Comité de Segurança Marítima da Organização Marítima Internacional, através da resolução MSC.16(58), adoptou emendas ao Código Internacional para a Construção e Equipamento de Navios que Transportam Substâncias Químicas Perigosas a Granel, e que tais emendas entraram em vigor, em relação à Região Administrativa Especial de Macau, em 3 de Fevereiro de 2000;

O Chefe do Executivo manda publicar, nos termos do n.º 1 do artigo 6.º da Lei n.º 3/1999 da Região Administrativa Especial de Macau, a resolução MSC.16(58), que contém as referidas emendas, nos seus textos em línguas chinesa e inglesa.

Promulgado em 11 de Novembro de 2014.

O Chefe do Executivo, *Chui Sai On*.