標題

MSC93 の審議結果の紹介

ClassNK
テクニカル
インフォメーション

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各位

2014 年 5 月 14 日から 23 日にかけて開催された IMO の第 93 回海上安全委員会（MSC93）での情報及び審議結果について次の通りお知らせいたします。

1. 採択された強制要件
今回採択された強制要件のうち、主なものは次の通りです。
(1) 操舵装置の試験要件（SOLAS 条約 II-1 章第 29 規則）（添付 1 及び 11 参照）
海上試運転時に最大航海喫水の確保が困難な場合における操舵装置の試験要件を定めるものです。最大航海喫水で操舵試験を行うことに替え、以下いずれかの方法が認められます。
(i) 等喫水において舵全体が没水する喫水で操舵試験を行う。
(ii) 海上試運転時に没水する舵板面積を用い計算した、最大航海喫水時の場合と同等の舵力及びトルクがかかる速力で操舵試験を行う。
(iii) 海上試運転における操舵試験時の舵力とトルクを推定し、満載時の状態に外挿することにより、満載状態において十分な操舵能力を有することの確認を行う。

適用：本船の建造日に関わらず適用できる。本改正が発効する 2016 年 1 月 1 日前であっても本改正を適用できるよう、早期実施を認める MSC.1/Circ.1482 が併せて承認されている。

(2) イナートガス装置搭載の適用拡大（SOLAS 条約 II-2 章第 4 規則、IBC コード、FSS コード等）（添付 1、3 及び 5 参照）
イナートガス装置の搭載を 20,000DWT 以上のタンカーに義務付ける現行規則を、中小型のケミカルタンカーにおける爆発事故事例に鑑み、その適用対象を 8,000DWT 以上の油タンカー及びケミカルタンカーに拡大するものです。また、イナートガス装置の性能要件を定める FSS コード第 15 章の改正があわせて採択されました。

適用：2016 年 1 月 1 日以降の起工船

（次頁に続く）

(3) 通風ダクトの耐火性（SOLAS 条約 II-2 章第 9 規則）（添付 1 参照）
通風ダクトの要件について、その耐火性の向上やダンパーに起因する火災拡大の抑制を目的に、防熱材等のダクトを構成する材料の要件、防煙ダンパーの設置要件等を改めるものです。

適用：2016 年 1 月 1 日以降の起工船

(4) 甲板上にコンテナを積載する船舶の消火設備要件（SOLAS 条約 II-2 章第 10 規則）（添付 1 及び 12 参照）
甲板上にコンテナを積載する船舶に対し、次の追加の消火設備を要求する改正が採択されました。また、モバイル・ウォーター・モニターの性能要件等を定める MSC.1/Circ.1472 が承認されました。
(i) ウォーター・ミスト・ランス（少なくとも 1 つ）
コンテナに刺突し消火栓からの水をコンテナの中に送る器具。
(ii) モバイル・ウォーター・モニター（甲板上 5 段以上コンテナを積載する場合のみ）
消火栓からの水を最上層のコンテナにまで射水するための移動式の水供給装置。
船幅 B < 30m: 少なくとも 2 つ
船幅 B ≧30m: 少なくとも 4 つ

適用：2016 年 1 月 1 日以降の起工船

(5) 機関区域からの脱出設備の追加要件（SOLAS 条約 II-2 章第 13 規則）（添付 1 参照）
旅客船及び貨物船の新造船に対し、その機関区域内の機関制御室及び主作業室から 2 系統の脱出経路を確保することを要求する改正が採択されました。そのうち 1 系統には、機関区域の外側の安全な位置まで火災からの防護が要求されます。また、機関区域内の脱出経路のはしご及び階段の裏面に、脱出者を火災時の熱や炎から保護するための鋼製シールドが要求されます。

適用：2016 年 1 月 1 日以降の起工船

(6) 水素燃料自動車等を輸送する船舶の要件（SOLAS 条約 II-2 章第 20-1 規則）（添付 1 参照）
水素自動車及び圧縮天然ガス自動車を積載する船舶への追加要件（電気設備の防爆措置、持ち運び式ガス検知器等）を新たに定める SOLAS 条約 II-2 章第 20-1 規則が採択されました。なお、現存船は、持ち運び式ガス検知器（少なくとも 2 個）の搭載が要求されます。

適用：2016 年 1 月 1 日以降（新造船: 2016 年 1 月 1 日以降の起工船）

（次頁に続く）

(7) 液化ガスのばら積み運送のための船舶の構造及び設備に関する国際規則（IGC コード）の改正（添付 6 参照）
液化ガスに関連する新たな技術や運航形態及び船舶の大型化に対応するための全面改正が採択されました。

適用：2016 年 7 月 1 日以降の起工船

(8) 復原性計算機の搭載の義務付け（IBC コード、IGC コード等）（添付 5 及び 6 参照）
ケミカルタンカー及びガスキャリア（現存船含む）に、非損傷時及び損傷時計算機能を有する復原性計算機の搭載を義務付けるための IBC コード及び IGC コード等の改正が採択されました。なお、油タンカーについては、MEPC66（2014 年 4 月）にて MARPOL 条約附属書 I の改正が採択済みとなっております。

適用： (新造船) 2016 年 1 月 1 日以降の起工船
(現存船) 2016 年 1 月 1 日以降の最初の更新検査まで（ただし、2021 年 1 月 1 日まで）
ガスキャリアは、それぞれ 6 か月遅らせて適用。

(9) 救命胴衣標準試験体（RTD）の要件（LSA コード第 2 章）（添付 4 参照）
救命胴衣の RTD の数値基準の緩和及び幼児、子供用救命胴衣の試験要件を一部変更するものです。

適用：2016 年 1 月 1 日以降

(10) 2011ESP コードの改正（添付 7 参照）
ばら積貨物船及び油タンカーの検査強化規則を定める IACS UR Z10 シリーズの改正に伴い、共通構造規則(CSR)の要件等を反映する 2011ESP コードの改正が採択されました。

適用：2016 年 1 月 1 日以降

(11) 国際海上危険物コード（IMDG コード）の改正（添付 8 参照）
車両積載に関する特別規定の改訂、貨物輸送ユニットの収納前の取り扱い、冷凍・冷蔵コンテナの冷媒充填の要件の改正、及び危険物個品リストの運送要件の追加等 UN 勧告と整合を図るためのコード及び付録の改正が採択されました。

適用：2016 年 1 月 1 日以降
（ただし、2015 年 1 月 1 日からボランタリーベースでの適用が推奨されています。）

（次頁に続く）

(12) IMO 規則実施コード（III コード）の強制化（添付 2、9 及び 10 参照）
IMO 規則の実施において加盟国が遵守すべき内容を定める IMO 規則実施コード（III コード）を強制化するための SOLAS 条約 XIII 章の新設、国際満載喫水線条約 1988 年議定書の改正、STCW 条約及び同コードを改正するものです。

適用：2016 年 1 月 1 日以降

2. 今回承認された強制要件

次回 MSC94（2014 年 11 月開催予定）で採択が予定される強制要件が、次のとおり今回の MSC93 で承認されました。MSC94 での採択を経て、2016 年 7 月 1 日発効の見込みです。

(1) 閉囲区域の雰囲気（酸素濃度、一酸化炭素濃度、可燃性ガス濃度及び硫化水素濃度等）を測定する、持ち運び式計測器の搭載を要求する SOLAS 条約 XI-1 章第 7 規則の新設。
(2) コンテナ重量を検証し、貨物の概要及び総重量等を船長に提供することを荷送人に対して要求する SOLAS 条約 VI 章第 2 規則の改正。なお、コンテナ重量の検証に関するガイドライン（MSC.1/Circ.1475）も承認され、以下の 2 通りの方法が規定されています。
    (i) 貨物を収納したコンテナの重量を計測する方法
    (ii) 収納された貨物、パレット、ダンネージ等の重量及び空コンテナの重量を合算する方法
(3) 極海を航行する船舶に対する要件を定める極海コード（新コード）及び同コードを強制化するための SOLAS 条約 XIV 章の新設。
(4) 消火装置の要件を定める SOLAS 条約 II-2 章第 10.5.2 規則が、内燃機関のある A 類機関区域にのみ適用されることを明記する文言修正。
(5) ばら積貨物船及び油タンカーの検査強化規則を定める IACS UR Z10 シリーズの改正に伴う、貨物タンクの試験等に関する 2011ESP コードの改正。

3. 極海コード

IMO では、極海を航行する船舶の安全確保及び環境保護等を目的とする極海コード（Polar Code）の策定作業が 2009 年から行われています。
極海コードは安全要件と環境要件の二部構成となっており、Part 1 の安全要件（船体強度、復原性、機関設備、通信設備、航海設備等）、Part 2 の環境要件が、これまで各小委員会において審議され、同コードを強制化するための SOLAS 条約改正案及び MARPOL 条約改正案も併せて作成されてきました。
今回の会合では、次回 MSC94 での採択に向けた審議を行い、その結果、極海コードの安全要件及び同コードを強制化する SOLAS 条約 XIV 章の改正が、承認されました。なお、このうち、航海設備・通信関係の要件については、NCSR 小委員会（本年 6 月開催）において最終化され、次回 MSC94 において採択される運びとなりました。
極海コードの対象海域については、図 1 をご参照下さい。また、コード案の構成と概要については、表 1 をご参照下さい。
SOLAS 条約 XIV 章による極海コードの安全要件の適用対象船舶は、SOLAS 条約第 I 章により SOLAS の証書を有する船舶とされています。なお、SOLAS 条約非適用船舶への適用とそのための極海コードは、次の検討課題として検討を始めることが合意されています。
なお、海洋環境保護に関する MARPOL 条約の関連改正案並びに極海コードは、MEPC67（本年 10 月開催予定）において承認のために最終化される予定です。

（次頁に続く）

4. GBS（ゴールベースの新造船構造基準）関連
油タンカー及びバルクキャリアを対象とする「新造船の構造に関するGBS」は2004年のMSC78から検討され、2010年5月のMSC87に於いて当該GBS及びGBSを導入するための条約改正案等が採択されました。
なお、適用は2016年7月1日以降の建造契約の船舶ですが、具体的な技術要件はIMO GBSに適合しているとIMOが判断した船級協会等の規則に従う必要があります。
今回の会合では、IMO事務局より、ゴールベースの新造船構造基準に関し、12のIACSメンバー等からのGBS適合検証申請を受理し、監査作業を開始した旨の報告がありました。
具体的には、18の国及び2の国際機関から37名のGBS監査員の推薦があり17人を選出したこと、調和CSR以外のIACS統一規則等に基づくIACS共通の技術資料等を監査するチームを3月に設置したこと、ClassNK等が個別に提出した申請書類を監査するチームを間もなく設置予定である旨等が報告されました。

5. 各種ガイドラインの承認等
MSC93において、主要なガイドラインが以下のとおり作成されました（添付13参照）。
以下で参照されているIACS統一解釈（UI）については、弊会のホームページ（http://www.classnk.or.jp/）又はIACSホームページ（http://www.iacs.org.uk/）で公開されています。
(1) SOLAS条約II-2章第9.7規則に関し、空調機室内の空調機と通風用ダクトの連結部には、可燃性材料（長さ600mmまで）を使用することを認める統一解釈（IACS UI SC99を基に作成）が承認されました。[MSC.1/Circ.1480]
(2) 貨物油タンクの塗装性能基準に関する統一解釈（IACS UI SC259を基に作成）が承認されました。なお、IACS UI SC259は、バラストタンクの塗装性能基準に関する統一解釈（IACS UI SC223）を基に作成されています。[MSC.1/Circ.1479]
(3) 貨物油タンクの塗装の代替手段として認められている耐食鋼の性能基準に関する統一解釈（IACS UI SC259を基に作成）が承認されました。[MSC.1/Circ.1478]
(4) COLREG条約附属書1第9(b)規則に関し、全周灯2個を配置する場合に、一方の全周灯が180度を超えて遮蔽される場合であっても、もう一方の全周灯の遮光角を調整することで1個の灯火として視認できる場合の配置に関する統一解釈（IACS UI COLREG 1を基に作成）が承認されました。[MSC.1/Circ.1260/Rev.1]
(5) トン数条約の確実かつ統一的な実施のための統一解釈TM.5/Circ.5（1994年策定）の改正が承認されました。[TM.5/Circ.6]
(6) オートパイロットの信号を受けて船橋航海当直警報装置が自動起動することを要求する性能基準に対し、自動起動を使用するべきでないとするガイドラインが承認されました。[MSC.1/Circ.1474]
(7) 閉囲区域の雰囲気を測定する、持ち運び式計測器の搭載を要求するSOLAS条約XI-1章第7規則の新設を受け、計測器の選定に関するガイドラインが承認されました。[MSC.1/Circ.1477]
(8) コンテナ重量の検証、貨物の概要及び総重量等を船長に提供することを荷送人に対して要求するSOLAS条約VI章第2規則の改正が承認されたことを受け（次回MSC94で採択見込み）、具体的な検証方法を定めるガイドラインが承認されました。[MSC.1/Circ.1475]

（次頁に続く）

(9) 水素自動車及び圧縮天然ガス自動車を積載する船舶への追加要件（電気設備の防爆措置、持ち運び式ガス検知器等）を新たに定めるSOLAS条約II-2章第20-1規則に関連し、現存船（2016年1月1日前の起工船）への安全対策に関わる指針が承認されました。燃料の漏れがないことを確認した証明書/申告書の提供及びレベル等による標示を荷主に推奨する内容となっています。[MSC.1/Circ.1471]

6. 旅客船の安全

2012 年 1 月にイタリアにて発生したクルーズ船コスタ・コンコルディア号の事故を受け、同年 5 月に開催された海上安全委員会（MSC90）において、旅客船の安全対策強化について審議が行われました。その結果、速やかに実施すべき運航上の安全対策（短期的措置）と、事故調査結果を踏まえた技術的検討に基づき実施する安全対策（長期的措置）に分けて検討を進めることが合意されていました。

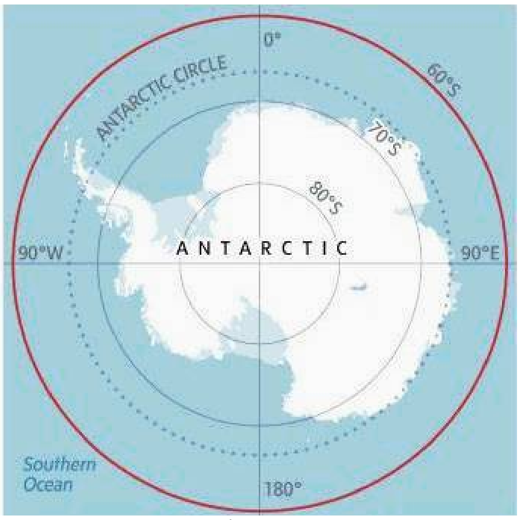
今回の会合では、長期的措置としてイタリアから提出されたコスタ・コンコルディア号事故調査報告に基づき、事故の再発防止策について審議が行われた結果、損傷時における対策として 5 つの検討項目が取り纏められ、関連の小委員会において今後検討することとなりました。

(1) 損傷制御訓練要件の策定
(2) 損傷制御図ガイドラインの見直し
(3) 水密戸の最小限の開放
(4) 機関室保護の強化
(5) 損傷時復原性訓練要件の強化

なお、本MSC93の審議概要につきましてはIMO ホームページにも掲載されていますのでご参照下さい。(http://www.imo.org/MediaCentre/MeetingSummaries/MSC/Pages/Default.aspx)

図 1 極海コードの対象海域

北極海



南極海

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表 1 極海コード案の構成と概要

章	項目	概要
Part I-A 安全規制（強制要件）		
1	通則	定義、検査及び証書等
2	極海域運航手順書	極海を航行する際の条件、手順等
3	船体構造	航行する氷海域に応じた船体強化等
4	復原性及び区画	氷の付着等を考慮した復原性等（損傷時・非損傷時）
5	水密及び風雨密	閉鎖装置等の凍結防止、低温時の操作性等
6	機関設備	機関設備・非常電源等の凍結防止等
7	防火設備	消火管系統の凍結防止等
8	救命設備	厳しい環境での救命設備等
9	航行安全	氷・気象情報の受信設備、探照灯等の追加等
10	通信	極海域の遠隔性を考慮した通信設備の追加、支援船との連絡等
11	航海計画	航海計画策定にあたり考慮すべき事項等
12	船員・配乗・訓練	船員の資格、配乗、訓練の上乗せ要件
Part I-B 安全規則（推奨要件及び Part I-A 実施のためのガイダンス）		
Part II-A 環境保護規制（強制要件）		
1	油汚染防止	極海域での油排出全面禁止、油を積載するタンクの保護等
2	有害液体物質汚染防止	有害液体物質を積載するタンクの保護等
3	容器に収納した有害物質による汚染防止	（現時点で要件なし）
4	汚水による汚染防止	極海域における汚水排出の陸地からの距離要件等
5	廃物による汚染防止	極海域における食物くず排出の陸地から距離要件等
Part II-B 環境保護規制（推奨要件及び Part II-A 実施のためのガイダンス）		

なお、本件に関してご不明な点は、以下の部署にお問い合わせください。

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添付:

1. SOLAS 条約 II-1 章及び II-2 章の改正 (Resolution MSC.365(93))
2. SOLAS 条約 XIII 章の改正 (Resolution MSC.366(93))
3. 火災安全設備のための国際コード(FSS コード)の改正 (Resolution MSC.367(93))
4. 国際救命設備コード(LSA コード)の改正 (Resolution MSC.368(93))
5. 危険化学品のばら積み運送のための船舶の構造及び設備に関する国際規則(IBC コード)の改正 (Resolution MSC.369(93))
6. 液化ガスのばら積み運送のための船舶の構造及び設備に関する国際規則(IGC コード)の改正 (Resolution MSC.370(93))
7. 2011ESP コードの改正 (Resolution MSC.371(93))
8. 国際海上危険物コード(IMDG コード)の改正 (Resolution MSC.372(93))
9. 1978 年の船員の訓練及び資格証明並びに当直の基準に関する国際条約(STCW 条約)及び同コードの改正 (Resolution MSC.373(93)及び MSC.374(93))
10. 1988 年議定書 Load Line 条約の改正 (Resolution MSC.375(93))
11. SOLAS 条約 II-1 章第 29 規則(操舵装置試験)改正の早期実施に関する Circular (MSC.1/Circ.1482)
12. モバイル・ウォーター・モニターの性能要件等を定めるガイドライン(MSC.1/Circ.1472)
13. 項目 5.において参照される IMO Circulars

ANNEX 1

RESOLUTION MSC.365(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974, AS AMENDED

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article VIII(b) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"), concerning the amendment procedure applicable to the annex to the Convention, other than to the provisions of chapter I thereof,

HAVING CONSIDERED, at its ninety-third session, amendments to the Convention, proposed and circulated in accordance with article VIII(b)(i) thereof,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the Convention, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2015, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES SOLAS Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 REQUESTS ALSO the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974, AS AMENDED

CHAPTER II-1
CONSTRUCTION – STRUCTURE, SUBDIVISION AND STABILITY, MACHINERY AND ELECTRICAL INSTALLATIONS

Part C
Machinery installations

Regulation 29 – Steering gear

1 At the end of paragraph 3.2, the following new text is added:

"where it is impractical to demonstrate compliance with this requirement during sea trials with the ship at its deepest seagoing draught and running ahead at the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch, ships regardless of date of construction may demonstrate compliance with this requirement by one of the following methods:

.1 during sea trials the ship is at even keel and the rudder fully submerged whilst running ahead at the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch; or

.2 where full rudder immersion during sea trials cannot be achieved, an appropriate ahead speed shall be calculated using the submerged rudder blade area in the proposed sea trial loading condition. The calculated ahead speed shall result in a force and torque applied to the main steering gear which is at least as great as if it was being tested with the ship at its deepest seagoing draught and running ahead at the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch; or

.3 the rudder force and torque at the sea trial loading condition have been reliably predicted and extrapolated to the full load condition. The speed of the ship shall correspond to the number of maximum continuous revolutions of the main engine and maximum design pitch of the propeller;"

2 The word "and" at the end of paragraph 4.2 is deleted and the following new text is added:

"where it is impractical to demonstrate compliance with this requirement during sea trials with the ship at its deepest seagoing draught and running ahead at one half of the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch or 7 knots, whichever is greater, ships regardless of date of construction, including those constructed before

1 January 2009, may demonstrate compliance with this requirement by one of the following methods:

.1 during sea trials the ship is at even keel and the rudder fully submerged whilst running ahead at one half of the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch or 7 knots, whichever is greater; or

.2 where full rudder immersion during sea trials cannot be achieved, an appropriate ahead speed shall be calculated using the submerged rudder blade area in the proposed sea trial loading condition. The calculated ahead speed shall result in a force and torque applied to the auxiliary steering gear which is at least as great as if it was being tested with the ship at its deepest seagoing draught and running ahead at one half of the speed corresponding to the number of maximum continuous revolutions of the main engine and maximum design pitch or 7 knots, whichever is greater; or

.3 the rudder force and torque at the sea trial loading condition have been reliably predicted and extrapolated to the full load condition; and"

CHAPTER II-2
CONSTRUCTION – PROTECTION, FIRE DETECTION AND FIRE EXTINCTION

Part A
General

Regulation 1 – Application

3 The following three new paragraphs are added after paragraph 2.5:

"2.6 Vehicle carriers constructed before 1 January 2016, including those constructed before 1 July 2012, shall comply with paragraph 2.2 of regulation 20-1, as adopted by resolution MSC.365(93).

2.7 Tankers constructed before 1 January 2016, including those constructed before 1 July 2012, shall comply with regulation 16.3.3 except 16.3.3.3.

2.8 Regulations 4.5.5.1.1 and 4.5.5.1.3 apply to ships constructed on or after 1 January 2002 but before 1 January 2016, and regulation 4.5.5.2.1 applies to all ships constructed before 1 January 2016."

Regulation 3 – Definitions

4 The following three new paragraphs are added after paragraph 53:

"54 *Fire damper* is, for the purpose of implementing regulation 9.7 adopted by resolution MSC.365(93), as may be amended, a device installed in a ventilation duct, which under normal conditions remains open allowing flow in the duct, and is closed during a fire, preventing the flow in the duct to restrict the passage of fire. In using the above definition the following terms may be associated:

.1 *automatic fire damper* is a fire damper that closes independently in response to exposure to fire products;

.2 *manual fire damper* is a fire damper that is intended to be opened or closed by the crew by hand at the damper itself; and

.3 *remotely operated fire damper* is a fire damper that is closed by the crew through a control located at a distance away from the controlled damper.

55 *Smoke damper* is, for the purpose of implementing regulation 9.7 adopted by resolution MSC.365(93), as may be amended, a device installed in a ventilation duct, which under normal conditions remains open allowing flow in the duct, and is closed during a fire, preventing the flow in the duct to restrict the passage of smoke and hot gases. A smoke damper is not expected to contribute to the integrity of a fire rated division penetrated by a ventilation duct. In using the above definition the following terms may be associated:

.1 *automatic smoke damper* is a smoke damper that closes independently in response to exposure to smoke or hot gases;

.2 *manual smoke damper* is a smoke damper intended to be opened or closed by the crew by hand at the damper itself; and

.3 *remotely operated smoke damper* is a smoke damper that is closed by the crew through a control located at a distance away from the controlled damper.

56 *Vehicle carrier* means a cargo ship with multi deck ro-ro spaces designed for the carriage of empty cars and trucks as cargo."

Part B
Prevention of fire and explosion

Regulation 4 – Probability of ignition

5 Paragraph 5.5 is replaced with the following:

"**5.5 Inert gas systems**

5.5.1 Application

5.5.1.1 For tankers of 20,000 tonnes deadweight and upwards constructed on or after 1 July 2002 but before 1 January 2016, the protection of the cargo tanks shall be achieved by a fixed inert gas system in accordance with the requirements of the Fire Safety Systems Code, as adopted by resolution MSC.98(73), except that the Administration may accept other equivalent systems or arrangements, as described in paragraph 5.5.4.

5.5.1.2 For tankers of 8,000 tonnes deadweight and upwards constructed on or after 1 January 2016 when carrying cargoes described in regulation 1.6.1 or 1.6.2, the protection of the cargo tanks shall be achieved by a fixed inert gas system in accordance with the requirements of the Fire Safety Systems Code, except that the Administration may accept other equivalent systems or arrangements, as described in paragraph 5.5.4.

5.5.1.3 Tankers operating with a cargo tank cleaning procedure using crude oil washing shall be fitted with an inert gas system complying with the Fire Safety Systems Code and with fixed tank washing machines. However, inert gas systems fitted on tankers constructed on or after 1 July 2002 but before 1 January 2016 shall comply with the Fire Safety Systems Code, as adopted by resolution MSC.98(73).

5.5.1.4 Tankers required to be fitted with inert gas systems shall comply with the following provisions:

.1 double-hull spaces shall be fitted with suitable connections for the supply of inert gas;

.2 where hull spaces are connected to a permanently fitted inert gas distribution system, means shall be provided to prevent hydrocarbon gases from the cargo tanks entering the double hull spaces through the system; and

.3 where such spaces are not permanently connected to an inert gas distribution system, appropriate means shall be provided to allow connection to the inert gas main.

5.5.2 Inert gas systems of chemical tankers and gas carriers

5.5.2.1 The requirements for inert gas systems contained in the Fire Safety Systems Code need not be applied to chemical tankers constructed before 1 January 2016, including those constructed before 1 July 2012, and all gas carriers:

.1 when carrying cargoes described in regulation 1.6.1, provided that they comply with the requirements for inert gas systems on chemical tankers established by the Administration, based on the guidelines developed by the Organization*; or

.2 when carrying flammable cargoes other than crude oil or petroleum products such as cargoes listed in chapters 17 and 18 of the International Bulk Chemical Code, provided that the capacity of tanks used for their carriage does not exceed 3,000 m^3 and the individual nozzle capacities of tank washing machines do not exceed 17.5 m^3/h and the total combined throughput from the number of machines in use in a cargo tank at any one time does not exceed 110 m^3/h.

* Refer to the *Regulation for inert gas systems on chemical tankers*, adopted by the Organization by resolution A.567(14), and Corr.1.

5.5.3 General requirements for inert gas systems

5.5.3.1 The inert gas system shall be capable of inerting, purging and gas-freeing empty tanks and maintaining the atmosphere in cargo tanks with the required oxygen content.

5.5.3.2 Tankers fitted with a fixed inert gas system shall be provided with a closed ullage system.

5.5.4 Requirements for equivalent systems

5.5.4.1 The Administration may, after having given consideration to the ship's arrangement and equipment, accept other fixed installations, in accordance with regulation I/5 and paragraph 5.5.4.3.

5.5.4.2 For tankers of 8,000 tonnes deadweight and upwards but less than 20,000 tonnes deadweight constructed on or after 1 January 2016, in lieu of fixed installations as required by paragraph 5.5.4.1, the Administration may accept other equivalent arrangements or means of protection in accordance with regulation I/5 and paragraph 5.5.4.3.

5.5.4.3 Equivalent systems or arrangements shall:

.1 be capable of preventing dangerous accumulations of explosive mixtures in intact cargo tanks during normal service throughout the ballast voyage and necessary in-tank operations; and

.2 be so designed as to minimize the risk of ignition from the generation of static electricity by the system itself."

Part C
Suppression of fire

Regulation 9 – Containment of fire

6 Paragraph 7 is replaced with the following:

"**7 Ventilation systems**

(This paragraph applies to ships constructed on or after 1 January 2016)

7.1 General

7.1.1 Ventilation ducts, including single and double wall ducts, shall be of steel or equivalent material except flexible bellows of short length not exceeding 600 mm used for connecting fans to the ducting in air-conditioning rooms. Unless expressly provided otherwise in paragraph 7.1.6, any other material used in the construction of ducts, including insulation, shall also be non-combustible. However, short ducts, not generally exceeding 2 m in length and with a free cross-sectional area* not exceeding 0.02 m^2, need not be of steel or equivalent material, subject to the following conditions:

.1 the ducts shall be made of non-combustible material, which may be faced internally and externally with membranes having low flame-spread characteristics and, in each case, a calorific value** not exceeding 45 MJ/m^2 of their surface area for the thickness used;

.2 the ducts are only used at the end of the ventilation device; and

.3 the ducts are not situated less than 600 mm, measured along the duct, from an opening in an "A" or "B" class division, including continuous "B" class ceiling.

7.1.2 The following arrangements shall be tested in accordance with the Fire Test Procedures Code:

.1 fire dampers, including their relevant means of operation, however, the testing is not required for dampers located at the lower end of the duct in exhaust ducts for galley ranges, which must be of steel and capable of stopping the draught in the duct; and

.2 duct penetrations through "A" class divisions. However, the test is not required where steel sleeves are directly joined to ventilation ducts by means of riveted or screwed connections or by welding.

7.1.3 Fire dampers shall be easily accessible. Where they are placed behind ceilings or linings, these ceilings or linings shall be provided with an inspection hatch on which the identification number of the fire damper is marked. The fire damper identification number shall also be marked on any remote controls provided.

7.1.4 Ventilation ducts shall be provided with hatches for inspection and cleaning. The hatches shall be located near the fire dampers.

7.1.5 The main inlets and outlets of ventilation systems shall be capable of being closed from outside the spaces being ventilated. The means of closing shall be easily accessible as well as prominently and permanently marked and shall indicate the operating position of the closing device.

7.1.6 Combustible gaskets in flanged ventilation duct connections are not permitted within 600 mm of openings in "A" or "B" class divisions and in ducts required to be of "A" class construction.

7.1.7 Ventilation openings or air balance ducts between two enclosed spaces shall not be provided except as permitted by paragraphs 4.1.2.1 and 4.2.3.

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* The term *free cross-sectional area* means, even in the case of a pre-insulated duct, the area calculated on the basis of the inner dimensions of the duct itself and not the insulation.

** Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 1716:2002, Reaction to the fire tests for building products – Determination of the heat of combustion.

7.2 Arrangement of ducts

7.2.1 The ventilation systems for machinery spaces of category A, vehicle spaces, ro-ro spaces, galleys, special category spaces and cargo spaces shall, in general, be separated from each other and from the ventilation systems serving other spaces. However, the galley ventilation systems on cargo ships of less than 4,000 gross tonnage and in passenger ships carrying not more than 36 passengers need not be completely separated from other ventilation systems, but may be served by separate ducts from a ventilation unit serving other spaces. In such a case, an automatic fire damper shall be fitted in the galley ventilation duct near the ventilation unit.

7.2.2 Ducts provided for the ventilation of machinery spaces of category A, galleys, vehicle spaces, ro-ro spaces or special category spaces shall not pass through accommodation spaces, service spaces, or control stations unless they comply with paragraph 7.2.4.

7.2.3 Ducts provided for the ventilation of accommodation spaces, service spaces or control stations shall not pass through machinery spaces of category A, galleys, vehicle spaces, ro-ro spaces or special category spaces unless they comply with paragraph 7.2.4.

7.2.4 As permitted by paragraphs 7.2.2 and 7.2.3 ducts shall be either:

.1 constructed of steel having a thickness of at least 3 mm for ducts with a free cross-sectional area of less than 0.075 m^2, at least 4 mm for ducts with a free cross-sectional area of between 0.075 m^2 and 0.45 m^2, and at least 5 mm for ducts with a free cross-sectional area of over 0.45 m^2;

.2 suitably supported and stiffened;

.3 fitted with automatic fire dampers close to the boundaries penetrated; and

.4 insulated to "A-60" class standard from the boundaries of the spaces they serve to a point at least 5 m beyond each fire damper;

or

.1 constructed of steel in accordance with paragraphs 7.2.4.1.1 and 7.2.4.1.2; and

.2 insulated to "A-60" class standard throughout the spaces they pass through, except for ducts that pass through spaces of category (9) or (10) as defined in paragraph 2.2.3.2.2.

7.2.5 For the purposes of paragraphs 7.2.4.1.4 and 7.2.4.2.2, ducts shall be insulated over their entire cross-sectional external surface. Ducts that are outside but adjacent to the specified space, and share one or more surfaces with it, shall be considered to pass through the specified space, and shall be insulated over the surface they share with the space for a distance of 450 mm past the duct*.

7.2.6 Where it is necessary that a ventilation duct passes through a main vertical zone division, an automatic fire damper shall be fitted adjacent to the division. The damper shall also be capable of being manually closed from each side of the division. The control location shall be readily accessible and be clearly and prominently marked. The duct between the division and the damper shall be constructed of steel in accordance with paragraphs 7.2.4.1.1 and 7.2.4.1.2 and insulated to at least the same fire integrity as the division penetrated. The damper shall be fitted on at least one side of the division with a visible indicator showing the operating position of the damper.

* Sketches of such arrangements are contained in the Unified Interpretations of SOLAS chapter II-2 (MSC.1/Circ.1276).

7.3 Details of fire dampers and duct penetrations

7.3.1 Ducts passing through "A" class divisions shall meet the following requirements:

.1 where a thin plated duct with a free cross sectional area equal to, or less than, 0.02 m^2 passes through "A" class divisions, the opening shall be fitted with a steel sheet sleeve having a thickness of at least 3 mm and a length of at least 200 mm, divided preferably into 100 mm on each side of a bulkhead or, in the case of a deck, wholly laid on the lower side of the decks penetrated;

.2 where ventilation ducts with a free cross-sectional area exceeding 0.02 m^2, but not more than 0.075 m^2, pass through "A" class divisions, the openings shall be lined with steel sheet sleeves. The ducts and sleeves shall have a thickness of at least 3 mm and a length of at least 900 mm. When passing through bulkheads, this length shall be divided preferably into 450 mm on each side of the bulkhead. These ducts, or sleeves lining such ducts, shall be provided with fire insulation. The insulation shall have at least the same fire integrity as the division through which the duct passes; and

.3 automatic fire dampers shall be fitted in all ducts with a free cross-sectional area exceeding 0.075 m^2 that pass through "A" class divisions. Each damper shall be fitted close to the division penetrated and the duct between the damper and the division penetrated shall be constructed of steel in accordance with paragraphs 7.2.4.2.1 and 7.2.4.2.2. The fire damper shall operate automatically, but shall also be capable of being closed manually from both sides of the division. The damper shall be fitted with a visible indicator which shows the operating position of the damper. Fire dampers are not required, however, where ducts pass through spaces surrounded by "A" class divisions, without serving those spaces, provided those ducts have the same fire integrity as the divisions which they penetrate. A duct of cross-sectional area exceeding 0.075 m^2 shall not be divided into smaller ducts at the penetration of an "A" class division and then recombined into the original duct once through the division to avoid installing the damper required by this provision.

7.3.2 Ventilation ducts with a free cross-sectional area exceeding 0.02 m^2 passing through "B" class bulkheads shall be lined with steel sheet sleeves of 900 mm in length, divided preferably into 450 mm on each side of the bulkheads unless the duct is of steel for this length.

7.3.3 All fire dampers shall be capable of manual operation. The dampers shall have a direct mechanical means of release or, alternatively, be closed by electrical, hydraulic, or pneumatic operation. All dampers shall be manually operable from both sides of the division. Automatic fire dampers, including those capable of remote operation, shall have a failsafe mechanism that will close the damper in a fire even upon loss of electrical power or hydraulic or pneumatic pressure loss. Remotely operated fire dampers shall be capable of being reopened manually at the damper.

7.4 Ventilation systems for passenger ships carrying more than 36 passengers

7.4.1 In addition to the requirements in sections 7.1, 7.2 and 7.3, the ventilation system of a passenger ship carrying more than 36 passengers shall also meet the following requirements.

7.4.2 In general, the ventilation fans shall be so arranged that the ducts reaching the various spaces remain within a main vertical zone.

7.4.3 Stairway enclosures shall be served by an independent ventilation fan and duct system (exhaust and supply) which shall not serve any other spaces in the ventilation systems.

7.4.4 A duct, irrespective of its cross-section, serving more than one 'tween-deck accommodation space, service space or control station, shall be fitted, near the penetration of each deck of such spaces, with an automatic smoke damper that shall also be capable of being closed manually from the protected deck above the damper. Where a fan serves more than one 'tween-deck space through separate ducts within a main vertical zone, each dedicated to a single 'tween-deck space, each duct shall be provided with a manually operated smoke damper fitted close to the fan.

7.4.5 Vertical ducts shall, if necessary, be insulated as required by tables 9.1 and 9.2. Ducts shall be insulated as required for decks between the space they serve and the space being considered, as applicable.

7.5 Exhaust ducts from galley ranges

7.5.1 Requirements for passenger ships carrying more than 36 passengers

7.5.1.1 In addition to the requirements in sections 7.1, 7.2 and 7.3, exhaust ducts from galley ranges shall be constructed in accordance with paragraphs 7.2.4.2.1 and 7.2.4.2.2 and insulated to "A-60" class standard throughout accommodation spaces, service spaces, or control stations they pass through. They shall also be fitted with:

.1 a grease trap readily removable for cleaning unless an alternative approved grease removal system is fitted;

.2 a fire damper located in the lower end of the duct at the junction between the duct and the galley range hood which is automatically and remotely operated and, in addition, a remotely operated fire damper located in the upper end of the duct close to the outlet of the duct;

.3 a fixed means for extinguishing a fire within the duct[*];

.4 remote-control arrangements for shutting off the exhaust fans and supply fans, for operating the fire dampers mentioned in paragraph 7.5.1.1.2 and for operating the fire-extinguishing system, which shall be placed in a position outside the galley close to the entrance to the galley. Where a multi-branch system is installed, a remote means located with the above controls shall be provided to close all branches exhausting through the same main duct before an extinguishing medium is released into the system; and

.5 suitably located hatches for inspection and cleaning, including one provided close to the exhaust fan and one fitted in the lower end where grease accumulates.

7.5.1.2 Exhaust ducts from ranges for cooking equipment installed on open decks shall conform to paragraph 7.5.1.1, as applicable, when passing through accommodation spaces or spaces containing combustible materials.

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* Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 15371:2009, Ships and marine technology – Fire-extinguishing systems for protection of galley cooking equipment.

7.5.2 *Requirements for cargo ships and passenger ships carrying not more than 36 passengers*

When passing through accommodation spaces or spaces containing combustible materials, the exhaust ducts from galley ranges shall be constructed in accordance with paragraphs 7.2.4.1.1 and 7.2.4.1.2. Each exhaust duct shall be fitted with:

.1 a grease trap readily removable for cleaning;

.2 an automatically and remotely operated fire damper located in the lower end of the duct at the junction between the duct and the galley range hood and, in addition, a remotely operated fire damper in the upper end of the duct close to the outlet of the duct;

.3 arrangements, operable from within the galley, for shutting off the exhaust and supply fans; and

.4 fixed means for extinguishing a fire within the duct.*

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* Refer to the recommendations published by the International Organization for Standardization, in particular publication ISO 15371:2009, Ships and marine technology – Fire-extinguishing systems for protection of galley cooking equipment.

7.6 Ventilation rooms serving machinery spaces of category A containing internal combustion machinery

7.6.1 Where a ventilation room serves only such an adjacent machinery space and there is no fire division between the ventilation room and the machinery space, the means for closing the ventilation duct or ducts serving the machinery space shall be located outside of the ventilation room and machinery space.

7.6.2 Where a ventilation room serves such a machinery space as well as other spaces and is separated from the machinery space by a "A-0" class division, including penetrations, the means for closing the ventilation duct or ducts for the machinery space can be located in the ventilation room.

7.7 Ventilation systems for laundries in passenger ships carrying more than 36 passengers

Exhaust ducts from laundries and drying rooms of category (13) spaces as defined in paragraph 2.2.3.2.2 shall be fitted with:

.1 filters readily removable for cleaning purposes;

.2 a fire damper located in the lower end of the duct which is automatically and remotely operated;

.3 remote-control arrangements for shutting off the exhaust fans and supply fans from within the space and for operating the fire damper mentioned in paragraph 7.7.2; and

.4 suitably located hatches for inspection and cleaning."

Regulation 10 – Firefighting

7 Paragraph 1 is replaced with the following:

"**1 Purpose**

1.1 The purpose of this regulation is to suppress and swiftly extinguish a fire in the space of origin, except for paragraph 1.2. For this purpose, the following functional requirements shall be met:

.1 fixed fire-extinguishing systems shall be installed having due regard to the fire growth potential of the protected spaces; and

.2 fire-extinguishing appliances shall be readily available.

1.2 For open-top container holds* and on deck container stowage areas on ships designed to carry containers on or above the weather deck, constructed on or after 1 January 2016, fire protection arrangements shall be provided for the purpose of containing a fire in the space or area of origin and cooling adjacent areas to prevent fire spread and structural damage.

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* For a definition of this term, refer to the Interim guidelines for open-top containerships (MSC/Circ.608/Rev.1)."

8 In paragraph 2.1.3, the words ", other than those included in paragraph 7.3.2," are added between the words "cargo ships" and "the diameter".

9 In paragraph 2.2.4.1.2, the words ", other than those included in paragraph 7.3.2," are added between the words "cargo ship" and "need".

10 The following new paragraph is added after paragraph 7.2:

"7.3 *Firefighting for ships constructed on or after 1 January 2016 designed to carry containers on or above the weather deck*

7.3.1 Ships shall carry, in addition to the equipment and arrangements required by paragraphs 1 and 2, at least one water mist lance.

7.3.1.1 The water mist lance shall consist of a tube with a piercing nozzle which is capable of penetrating a container wall and producing water mist inside a confined space (container, etc.) when connected to the fire main.

7.3.2 Ships designed to carry five or more tiers of containers on or above the weather deck shall carry, in addition to the requirements of paragraph 7.3.1, mobile water monitors* as follows:

.1 ships with breadth less than 30 m: at least two mobile water monitors; or

.2 ships with breadth of 30 m or more: at least four mobile water monitors.

7.3.2.1 The mobile water monitors, all necessary hoses, fittings and required fixing hardware shall be kept ready for use in a location outside the cargo space area not likely to be cut-off in the event of a fire in the cargo spaces.

7.3.2.2 A sufficient number of fire hydrants shall be provided such that:

.1 all provided mobile water monitors can be operated simultaneously for creating effective water barriers forward and aft of each container bay;

.2 the two jets of water required by paragraph 2.1.5.1 can be supplied at the pressure required by paragraph 2.1.6; and

.3 each of the required mobile water monitors can be supplied by separate hydrants at the pressure necessary to reach the top tier of containers on deck.

7.3.2.3 The mobile water monitors may be supplied by the fire main, provided the capacity of fire pumps and fire main diameter are adequate to simultaneously operate the mobile water monitors and two jets of water from fire hoses at the required pressure values. If carrying dangerous goods, the capacity of fire pumps and fire main diameter shall also comply with regulation 19.3.1.5, as far as applicable to on-deck cargo areas.

7.3.2.4 The operational performance of each mobile water monitor shall be tested during initial survey on board the ship to the satisfaction of the Administration. The test shall verify that:

.1 the mobile water monitor can be securely fixed to the ship structure ensuring safe and effective operation; and

.2 the mobile water monitor jet reaches the top tier of containers with all required monitors and water jets from fire hoses operated simultaneously.

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* Refer to the *Guidelines for the design, performance, testing and approval of mobile water monitors used for the protection of on-deck cargo areas of ships designed and constructed to carry five or more tiers of containers on or above the weather deck* (MSC.1/Circ.1472)."

Part D
Escape

Regulation 13 – Means of escape

11 The following two new paragraphs are added after paragraph 4.1.4:

"*4.1.5 Inclined ladders and stairways*

For ships constructed on or after 1 January 2016, all inclined ladders/stairways fitted to comply with paragraph 4.1.1 with open treads in machinery spaces being part of or providing access to escape routes but not located within a protected enclosure shall be made of steel. Such ladders/stairways shall be fitted with steel shields attached to their undersides, such as to provide escaping personnel protection against heat and flame from beneath.

4.1.6 Escape from main workshops within machinery spaces

For ships constructed on or after 1 January 2016, two means of escape shall be provided from the main workshop within a machinery space. At least one of these escape routes shall provide a continuous fire shelter to a safe position outside the machinery space."

12 The following three new paragraphs are added after paragraph 4.2.3:

"*4.2.4 Inclined ladders and stairways*

For ships constructed on or after 1 January 2016, all inclined ladders/stairways fitted to comply with paragraph 4.2.1 with open treads in machinery spaces being part of or providing access to escape routes but not located within a protected enclosure shall be made of steel. Such ladders/stairways shall be fitted with steel shields attached to their undersides, such as to provide escaping personnel protection against heat and flame from beneath.

4.2.5 Escape from machinery control rooms in machinery spaces of category "A"

For ships constructed on or after 1 January 2016, two means of escape shall be provided from the machinery control room located within a machinery space. At least one of these escape routes shall provide a continuous fire shelter to a safe position outside the machinery space.

4.2.6 Escape from main workshops in machinery spaces of category "A"

For ships constructed on or after 1 January 2016, two means of escape shall be provided from the main workshop within a machinery space. At least one of these escape routes shall provide a continuous fire shelter to a safe position outside the machinery space."

Part E
Operational requirements

Regulation 16 – Operations

13 The following new paragraph is added after paragraph 3.2:

"**3.3 Operation of inert gas system**

3.3.1 The inert gas system for tankers required in accordance with regulation 4.5.5.1 shall be so operated as to render and maintain the atmosphere of the cargo tanks non-flammable, except when such tanks are required to be gas-free.

3.3.2 Notwithstanding the above, for chemical tankers, the application of inert gas, may take place after the cargo tank has been loaded, but before commencement of unloading and shall continue to be applied until that cargo tank has been purged of all flammable vapours before gas-freeing. Only nitrogen is acceptable as inert gas under this provision.

3.3.3 Notwithstanding regulation 1.2.2.2, the provisions of this paragraph shall only apply to tankers constructed on or after 1 January 2016. If the oxygen content of the inert gas exceeds 5% by volume, immediate action shall be taken to improve the gas quality. Unless the quality of the gas improves, all operations in those cargo tanks to which inert gas is being supplied shall be suspended so as to avoid air being drawn into the cargo tanks, the gas regulating valve, if fitted, shall be closed and the off-specification gas shall be vented to atmosphere.

3.3.4 In the event that the inert gas system is unable to meet the requirement in paragraph 16.3.3.1 and it has been assessed that it is impractical to effect a repair, then cargo discharge and cleaning of those cargo tanks requiring inerting shall only be resumed when suitable emergency procedures have been followed, taking into account guidelines developed by the Organization*.

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* Refer to the *Clarification of inert gas system requirements under the Convention* (MSC/Circ.485) and to the *Revised Guidelines for inert gas systems* (MSC/Circ.353), as amended by MSC/Circ.387."

Part G
Special requirements

Regulation 20 – Protection of vehicle, special category and ro-ro spaces

14 In paragraph 3.1.4.2, the words "9.7.2.1.1 and 9.7.2.1.2" are replaced with "9.7.2.4.1.1 and 9.7.2.4.1.2".

New regulation 20-1 – Requirements for vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo

15 The following new regulation 20-1 is added after regulation 20:

"**Regulation 20-1 – Requirements for vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo**

1 Purpose

The purpose of this regulation is to provide additional safety measures in order to address the fire safety objectives of this chapter for vehicle carriers with vehicle and ro-ro spaces intended for carriage of motor vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion as cargo.

2 Application

2.1 In addition to complying with the requirements of regulation 20, as appropriate, vehicle spaces of vehicle carriers constructed on or after 1 January 2016 intended for the carriage of motor vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion as cargo shall comply with the requirements in paragraphs 3 to 5 of this regulation.

2.2 In addition to complying with the requirements of regulation 20, as appropriate, vehicle carriers constructed before 1 January 2016, including those constructed before 1 July 2012*, shall comply with the requirements in paragraph 5 of this regulation.

* Refer to the Recommendation on safety measures for existing vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo (MSC.1/Circ.1471).

3 Requirements for spaces intended for carriage of motor vehicles with compressed natural gas in their tanks for their own propulsion as cargo

3.1 Electrical equipment and wiring

All electrical equipment and wiring shall be of a certified safe type for use in an explosive methane and air mixture*.

* Refer to the recommendations of the International Electrotechnical Commission, in particular, publication IEC 60079.

3.2 Ventilation arrangement

3.2.1 Electrical equipment and wiring, if installed in any ventilation duct, shall be of a certified safe type for use in explosive methane and air mixtures.

3.2.2 The fans shall be such as to avoid the possibility of ignition of methane and air mixtures. Suitable wire mesh guards shall be fitted over inlet and outlet ventilation openings.

3.3 Other ignition sources

Other equipment which may constitute a source of ignition of methane and air mixtures shall not be permitted.

4 Requirements for spaces intended for carriage of motor vehicles with compressed hydrogen in their tanks for their own propulsion as cargo

4.1 Electrical equipment and wiring

All electrical equipment and wiring shall be of a certified safe type for use in an explosive hydrogen and air mixture*.

* Refer to the recommendations of the International Electrotechnical Commission, in particular, publication IEC 60079.

4.2 Ventilation arrangement

4.2.1 Electrical equipment and wiring, if installed in any ventilation duct, shall be of a certified safe type for use in explosive hydrogen and air mixtures and the outlet from any exhaust duct shall be sited in a safe position, having regard to other possible sources of ignition.

4.2.2 The fans shall be designed such as to avoid the possibility of ignition of hydrogen and air mixtures. Suitable wire mesh guards shall be fitted over inlet and outlet ventilation openings.

4.3 Other ignition sources

Other equipment which may constitute a source of ignition of hydrogen and air mixtures shall not be permitted.

5 Detection

When a vehicle carrier carries as cargo one or more motor vehicles with either compressed hydrogen or compressed natural gas in their tanks for their own propulsion, at least two portable gas detectors shall be provided. Such detectors shall be suitable for the detection of the gas fuel and be of a certified safe type for use in the explosive gas and air mixture."

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ANNEX 2

RESOLUTION MSC.366(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974, AS AMENDED

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article VIII(b) of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"), concerning the amendment procedure applicable to the annex to the Convention, other than to the provisions of chapter I thereof,

RECALLING FURTHER that the Assembly, by resolution A.1070(28), adopted the IMO Instruments Implementation Code (III Code),

NOTING proposed amendments to the Convention to make the use of the III Code mandatory,

HAVING CONSIDERED, at its ninety-third session, amendments to the Convention, proposed and circulated in accordance with article VIII(b)(i) thereof,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the Convention, the text of which is set out in the annex to the present resolution;

2 DETERMINES that, pursuant to new regulation 2 of chapter XIII, whenever the word "should" is used in the III Code (Annex to resolution A.1070(28)), it is to be read as being "shall", except for paragraphs 29, 30, 31 and 32;

3 DETERMINES ALSO, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2015, unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

4 INVITES SOLAS Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

5 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

6 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CONVENTION FOR THE SAFETY OF LIFE AT SEA, 1974, AS AMENDED

CHAPTER XIII
VERIFICATION OF COMPLIANCE

A new chapter XIII is added after the existing chapter XII, as follows:

"**CHAPTER XIII**

VERIFICATION OF COMPLIANCE

Regulation 1 – Definitions

1 *Audit* means a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.

2 *Audit Scheme* means the IMO Member State Audit Scheme established by the Organization and taking into account the guidelines developed by the Organization*.

3 *Code for Implementation* means the IMO Instruments Implementation Code (III Code) adopted by the Organization by resolution A.1070(28).

4 *Audit Standard* means the Code for Implementation.

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* Refer to the *Framework and Procedures for the IMO Member State Audit Scheme*, adopted by the Organization by resolution A.1067(28).

Regulation 2 – Application

Contracting Governments shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in the present Convention.

Regulation 3 – Verification of compliance

1 Every Contracting Government shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of the present Convention.

2 The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization*.

3 Every Contracting Government shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines adopted by the Organization*.

4 Audit of all Contracting Governments shall be:

.1 based on an overall schedule developed by the Secretary-General of the Organization, taking into account the guidelines developed by the Organization*; and

.2 conducted at periodic intervals, taking into account the guidelines developed by the Organization*.

* Refer to the *Framework and Procedures for the IMO Member State Audit Scheme*, adopted by the Organization by resolution A.1067(28)."

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ANNEX 3

RESOLUTION MSC.367(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL CODE FOR FIRE SAFETY SYSTEMS (FSS CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.98(73), by which it adopted the International Code for Fire Safety Systems (hereinafter referred to as "the FSS Code"), which has become mandatory under chapter II-2 of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation II-2/3.22 of the Convention concerning the procedure for amending the FSS Code,

HAVING CONSIDERED, at its ninety-third session, amendments to the FSS Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the FSS Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE FOR FIRE SAFETY SYSTEMS (FSS CODE)

CHAPTER 15
INERT GAS SYSTEMS

The text of existing chapter 15 is replaced by the following:

"**1 Application**

This chapter details the specifications for inert gas systems as required by chapter II-2 of the Convention.

2 Engineering specifications

2.1 Definitions

For the purposes of this chapter:

2.1.1 *Cargo tanks* means those cargo tanks, including slop tanks, which carry cargoes, or cargo residues, having a flashpoint not exceeding 60ºC.

2.1.2 *Inert gas system* includes inert gas systems using flue gas, inert gas generators, and nitrogen generators and means the inert gas plant and inert gas distribution together with means for preventing backflow of cargo gases to machinery spaces, fixed and portable measuring instruments and control devices.

2.1.3 *Gas-safe space* is a space in which the entry of gases would produce hazards with regard to flammability or toxicity.

2.1.4 *Gas-free* is a condition in a tank where the content of hydrocarbon or other flammable vapour is less than 1% of the lower flammable limit (LFL), the oxygen content is at least 21%, and no toxic gases are present*.

* Refer to the *Revised recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27)).

2.2 Requirements for all systems

2.2.1 General

2.2.1.1 The inert gas system referred to in chapter II-2 of the Convention shall be designed, constructed and tested to the satisfaction of the Administration. It shall be designed to be capable of rendering and maintaining the atmosphere of the relevant cargo tanks non-flammable*.

* Refer to the *Revised standards for the design, testing and locating of devices to prevent the passage of flame into cargo tanks in tankers* (MSC/Circ.677, as amended by MSC/Circ.1009 and MSC.1/Circ.1324) and the *Revised factors to be taken into consideration when designing cargo tank venting and gas-freeing arrangements* (MSC/Circ.731).

2.2.1.2 The system shall be capable of:

.1 inerting empty cargo tanks and maintaining the atmosphere in any part of the tank with an oxygen content not exceeding 8% by volume and at a positive pressure in port and at sea except when it is necessary for such a tank to be gas-free;

.2 eliminating the need for air to enter a tank during normal operations except when it is necessary for such a tank to be gas-free;

.3 purging empty cargo tanks of hydrocarbon or other flammable vapours, so that subsequent gas-freeing operations will at no time create a flammable atmosphere within the tank;

.4 delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the ship expressed as a volume. For chemical tankers and chemical/product tankers, the Administration may accept inert gas systems having a lower delivery capacity provided that the maximum rate of discharge of cargoes from cargo tanks being protected by the system is restricted to not more than 80% of the inert gas capacity; and

.5 delivering inert gas with an oxygen content of not more than 5% by volume to the cargo tanks at any required rate of flow.

2.2.1.3 Materials used in inert gas systems shall be suitable for their intended purpose. In particular, those components which may be subjected to corrosive action of the gases and/or liquids are to be either constructed of corrosion-resistant material or lined with rubber, glass fibre epoxy resin or other equivalent coating material.

2.2.1.4 The inert gas supply may be:

.1 treated flue gas from main or auxiliary boilers, or

.2 gas from an oil or gas-fired gas generator, or

.3 gas from nitrogen generators.

The Administration may accept systems using inert gases from one or more separate gas generators or other sources or any combination thereof, provided that an equivalent level of safety is achieved. Such systems shall, as far as practicable, comply with the requirements of this chapter. Systems using stored carbon dioxide shall not be permitted unless the Administration is satisfied that the risk of ignition from generation of static electricity by the system itself is minimized.

2.2.2 Safety measures

2.2.2.1 The inert gas system shall be so designed that the maximum pressure which it can exert on any cargo tank will not exceed the test pressure of any cargo tank.

2.2.2.2 Automatic shutdown of the inert gas system and its components parts shall be arranged on predetermined limits being reached, taking into account the provisions of paragraphs 2.2.4, 2.3.2 and 2.4.2.

2.2.2.3 Suitable shutoff arrangements shall be provided on the discharge outlet of each generator plant.

2.2.2.4 The system shall be designed to ensure that if the oxygen content exceeds 5% by volume, the inert gas shall be automatically vented to atmosphere.

2.2.2.5 Arrangements shall be provided to enable the functioning of the inert gas plant to be stabilized before commencing cargo discharge. If blowers are to be used for gas-freeing, their air inlets shall be provided with blanking arrangements.

2.2.2.6 Where a double block and bleed valve is installed, the system shall ensure upon of loss of power, the block valves are automatically closed and the bleed valve is automatically open.

2.2.3 System components

2.2.3.1 Non-return devices

2.2.3.1.1 At least two non-return devices shall be fitted in order to prevent the return of vapour and liquid to the inert gas plant, or to any gas-safe spaces.

2.2.3.1.2 The first non-return device shall be a deck seal of the wet, semi-wet, or dry type or a double-block and bleed arrangement. Two shut-off valves in series with a venting valve in between, may be accepted provided:

.1 the operation of the valve is automatically executed. Signal(s) for opening/closing is (are) to be taken from the process directly, e.g. inert gas flow or differential pressure; and

.2 alarm for faulty operation of the valves is provided, e.g. the operation status of "blower stop" and "supply valve(s) open" is an alarm condition.

2.2.3.1.3 The second non-return device shall be a non-return valve or equivalent capable of preventing the return of vapours and liquids and fitted between the deck water seal (or equivalent device) and the first connection from the inert gas main to a cargo tank. It shall be provided with positive means of closure. As an alternative to positive means of closure, an additional valve having such means of closure may be provided between the non-return valve and the first connection to the cargo tanks to isolate the deck water seal, or equivalent device, from the inert gas main to the cargo tanks.

2.2.3.1.4 A water seal, if fitted, shall be capable of being supplied by two separate pumps, each of which shall be capable of maintaining an adequate supply at all times. The audible and visual alarm on the low level of water in the water seal shall operate at all times.

2.2.3.1.5 The arrangement of the water seal, or equivalent devices, and its associated fittings shall be such that it will prevent backflow of vapours and liquids and will ensure the proper functioning of the seal under operating conditions.

2.2.3.1.6 Provision shall be made to ensure that the water seal is protected against freezing, in such a way that the integrity of seal is not impaired by overheating.

2.2.3.1.7 A water loop or other approved arrangement shall also be fitted to each associated water supply and drain pipe and each venting or pressure-sensing pipe leading to gas-safe spaces. Means shall be provided to prevent such loops from being emptied by vacuum.

2.2.3.1.8 Any water seal, or equivalent device, and loop arrangements shall be capable of preventing return of vapours and liquids to an inert gas plant at a pressure equal to the test pressure of the cargo tanks.

2.2.3.1.9 The non-return devices shall be located in the cargo area on deck.

2.2.3.2 Inert gas lines

2.2.3.2.1 The inert gas main may be divided into two or more branches forward of the non-return devices required by paragraph 2.2.3.1.

2.2.3.2.2 The inert gas main shall be fitted with branch piping leading to the cargo tank. Branch piping for inert gas shall be fitted with either stop valves or equivalent means of control for isolating each tank. Where stop valves are fitted, they shall be provided with locking arrangements. The control system shall provide unambiguous information of the operational status of such valves to at least the control panel required in paragraph 2.2.4.

2.2.3.2.3 Each cargo tank not being inerted shall be capable of being separated from the inert gas main by:

.1 removing spool-pieces, valves or other pipe sections, and blanking the pipe ends; or

.2 arrangement of two spectacle flanges in series with provisions for detecting leakage into the pipe between the two spectacle flanges; or

.3 equivalent arrangements to the satisfaction of the Administration, providing at least the same level of protection.

2.2.3.2.4 Means shall be provided to protect cargo tanks against the effect of overpressure or vacuum caused by thermal variations and/or cargo operations when the cargo tanks are isolated from the inert gas mains.

2.2.3.2.5 Piping systems shall be so designed as to prevent the accumulation of cargo or water in the pipelines under all normal conditions.

2.2.3.2.6 Arrangements shall be provided to enable the inert gas main to be connected to an external supply of inert gas. The arrangements shall consist of a 250 mm nominal pipe size bolted flange, isolated from the inert gas main by a valve and located forward of the non-return valve. The design of the flange should conform to the appropriate class in the standards adopted for the design of other external connections in the ship's cargo piping system.

2.2.3.2.7 If a connection is fitted between the inert gas main and the cargo piping system, arrangements shall be made to ensure an effective isolation having regard to the large pressure difference which may exist between the systems. This shall consist of two shutoff valves with an arrangement to vent the space between the valves in a safe manner or an arrangement consisting of a spool-piece with associated blanks.

2.2.3.2.8 The valve separating the inert gas main from the cargo main and which is on the cargo main side shall be a non-return valve with a positive means of closure.

2.2.3.2.9 Inert gas piping systems shall not pass through accommodation, service and control station spaces.

2.2.3.2.10 In combination carriers, the arrangement to isolate the slop tanks containing oil or oil residues from other tanks shall consist of blank flanges which will remain in position at all times when cargoes other than oil are being carried except as provided for in the relevant section of the guidelines developed by the Organization*.

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* Refer to the *Revised Guidelines for inert gas systems* (MSC/Circ.353), as amended by MSC/Circ.387.

2.2.4 Indicators and alarms

2.2.4.1 The operation status of the inert gas system shall be indicated in a control panel.

2.2.4.2 Instrumentation shall be fitted for continuously indicating and permanently recording, when inert gas is being supplied:

.1 the pressure of the inert gas mains forward of the non-return devices; and

.2 the oxygen content of the inert gas.

2.2.4.3 The indicating and recording devices shall be placed in the cargo control room where provided. But where no cargo control room is provided, they shall be placed in a position easily accessible to the officer in charge of cargo operations.

2.2.4.4 In addition, meters shall be fitted:

.1 in the navigating bridge to indicate at all times the pressure referred to in paragraph 2.2.4.2.1 and the pressure in the slop tanks of combination carriers, whenever those tanks are isolated from the inert gas main; and

.2 in the machinery control room or in the machinery space to indicate the oxygen content referred to in paragraph 2.2.4.2.2.

2.2.4.5 Audible and visual alarms

2.2.4.5.1 Audible and visual alarms shall be provided, based on the system designed, to indicate:

.1 oxygen content in excess of 5% by volume;

.2 failure of the power supply to the indicating devices as referred to in paragraph 2.2.4.2;

.3 gas pressure less than 100 mm water gauge. The alarm arrangement shall be such as to ensure that the pressure in slop tanks in combination carriers can be monitored at all times;

.4 high-gas pressure; and

.5 failure of the power supply to the automatic control system.

2.2.4.5.2 The alarms required in paragraphs 2.2.4.5.1.1, 2.2.4.5.1.3 and 2.2.4.5.1.5 shall be fitted in the machinery space and cargo control room, where provided, but in each case in such a position that they are immediately received by responsible members of the crew.

2.2.4.5.3 An audible alarm system independent of that required in paragraph 2.2.4.5.1.3 or automatic shutdown of cargo pumps shall be provided to operate on predetermined limits of low pressure in the inert gas main being reached.

2.2.4.5.4 Two oxygen sensors shall be positioned at appropriate locations in the space or spaces containing the inert gas system. If the oxygen level falls below 19%, these sensors shall trigger alarms, which shall be both visible and audible inside and outside the space or spaces and shall be placed in such a position that they are immediately received by responsible members of the crew.

2.2.5 Instruction manuals

Detailed instruction manuals shall be provided on board, covering the operations, safety and maintenance requirements and occupational health hazards relevant to the inert gas system and its application to the cargo tank system.* The manuals shall include guidance on procedures to be followed in the event of a fault or failure of the inert gas system.

* Refer to the *Revised Guidelines for inert gas systems* (MSC/Circ.353), as amended by MSC/Circ.387.

2.3 Requirements for flue gas and inert gas generator systems

In addition to the provisions in paragraph 2.2, for inert gas systems using flue gas or inert gas generators, the provisions of this section shall apply.

2.3.1 System requirements

2.3.1.1 Inert gas generators

2.3.1.1.1 Two fuel oil pumps shall be fitted to the inert gas generator. Suitable fuel in sufficient quantity shall be provided for the inert gas generators.

2.3.1.1.2 The inert gas generators shall be located outside the cargo tank area. Spaces containing inert gas generators shall have no direct access to accommodation service or control station spaces, but may be located in machinery spaces. If they are not located in machinery spaces, such a compartment shall be separated by a gastight steel bulkhead and/or deck from accommodation, service and control station spaces. Adequate positive-pressure-type mechanical ventilation shall be provided for such a compartment.

2.3.1.2 Gas regulating valves

2.3.1.2.1 A gas regulating valve shall be fitted in the inert gas main. This valve shall be automatically controlled to close, as required in paragraph 2.2.2.2. It shall also be capable of automatically regulating the flow of inert gas to the cargo tanks unless means are provided to automatically control the inert gas flow rate.

2.3.1.2.2 The gas regulating valve shall be located at the forward bulkhead of the forward most gas-safe space through which the inert gas main passes.

2.3.1.3 Cooling and scrubbing arrangement

2.3.1.3.1 Means shall be fitted which will effectively cool the volume of gas specified in paragraph 2.2.1.2 and remove solids and sulphur combustion products. The cooling water arrangements shall be such that an adequate supply of water will always be available without interfering with any essential services on the ship. Provision shall also be made for an alternative supply of cooling water.

2.3.1.3.2 Filters or equivalent devices shall be fitted to minimize the amount of water carried over to the inert gas blowers.

2.3.1.4 Blowers

2.3.1.4.1 At least two inert gas blowers shall be fitted and be capable of delivering to the cargo tanks at least the volume of gas required by paragraph 2.2.1.2. For systems fitted with inert gas generators the Administration may permit only one blower if that system is capable of delivering the total volume of gas required by paragraph 2.2.1.2 to the cargo tanks, provided that sufficient spares for the blower and its prime mover are carried on board to enable any failure of the blower and its prime mover to be rectified by the ship's crew.

2.3.1.4.2 Where inert gas generators are served by positive displacement blowers, a pressure relief device shall be provided to prevent excess pressure being developed on the discharge side of the blower.

2.3.1.4.3 When two blowers are provided, the total required capacity of the inert gas system shall be divided evenly between the two and in no case is one blower to have a capacity less than 1/3 of the total required.

2.3.1.5 Inert gas isolating valves

For systems using flue gas, flue gas isolating valves shall be fitted in the inert gas mains between the boiler uptakes and the flue gas scrubber. These valves shall be provided with indicators to show whether they are open or shut, and precautions shall be taken to maintain them gastight and keep the seatings clear of soot. Arrangements shall be made to ensure that boiler soot blowers cannot be operated when the corresponding flue gas valve is open.

2.3.1.6 Prevention of flue gas leakage

2.3.1.6.1 Special consideration shall be given to the design and location of scrubber and blowers with relevant piping and fittings in order to prevent flue gas leakages into enclosed spaces.

2.3.1.6.2 To permit safe maintenance, an additional water seal or other effective means of preventing flue gas leakage shall be fitted between the flue gas isolating valves and scrubber or incorporated in the gas entry to the scrubber.

2.3.2 Indicators and alarms

2.3.2.1 In addition to the requirements in paragraph 2.2.4.2, means shall be provided for continuously indicating the temperature of the inert gas at the discharge side of the system, whenever it is operating.

2.3.2.2 In addition to the requirements of paragraph 2.2.4.5, audible and visual alarms shall be provided to indicate:

.1 insufficient fuel oil supply to the oil-fired inert gas generator;

.2 failure of the power supply to the generator;

.3 low water pressure or low water flow rate to the cooling and scrubbing arrangement;

.4 high water level in the cooling and scrubbing arrangement;

.5 high gas temperature;

.6 failure of the inert gas blowers; and

.7 low water level in the water seal.

2.4 Requirements for nitrogen generator systems

In addition to the provisions in paragraph 2.2, for inert gas systems using nitrogen generators, the provisions of this section shall apply.

2.4.1 System requirements

2.4.1.1 The system shall be provided with one or more compressors to generate enough positive pressure to be capable of delivering the total volume of gas required by paragraph 2.2.1.2.

2.4.1.2 A feed air treatment system shall be fitted to remove free water, particles and traces of oil from the compressed air.

2.4.1.3 The air compressor and nitrogen generator may be installed in the engine-room or in a separate compartment. A separate compartment and any installed equipment shall be treated as an "Other machinery space" with respect to fire protection. Where a separate compartment is provided for the nitrogen generator, the compartment shall be fitted with an independent mechanical extraction ventilation system providing six air changes per hour. The compartment is to have no direct access to accommodation spaces, service spaces and control stations.

2.4.1.4 Where a nitrogen receiver or a buffer tank is installed, it may be installed in a dedicated compartment, in a separate compartment containing the air compressor and the generator, in the engine room, or in the cargo area. Where the nitrogen receiver or a buffer tank is installed in an enclosed space, the access shall be arranged only from the open deck and the access door shall open outwards. Adequate, independent mechanical ventilation, of the extraction type, shall be provided for such a compartment.

2.4.2 Indicators and alarms

2.4.2.1 In addition to the requirements in paragraph 2.2.4.2, instrumentation is to be provided for continuously indicating the temperature and pressure of air at the suction side of the nitrogen generator.

2.4.2.2 In addition to the requirements in paragraph 2.2.4.5, audible and visual alarms shall be provided to include:

.1 failure of the electric heater, if fitted;

.2 low feed-air pressure or flow from the compressor;

.3 high-air temperature; and

.4 high condensate level at automatic drain of water separator."

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ANNEX 4

RESOLUTION MSC.368(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL LIFE-SAVING APPLIANCE (LSA) CODE

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.88(66), by which it adopted the International Life-Saving Appliance (LSA) Code (hereinafter referred to as "the LSA Code"), which has become mandatory under chapter III of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation III/3.10 of the Convention concerning the procedure for amending the LSA Code,

HAVING CONSIDERED, at its ninety-third session, amendments to the LSA Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the LSA Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL LIFE-SAVING APPLIANCE (LSA) CODE

CHAPTER II PERSONAL LIFE-SAVING APPLIANCES

Section 2.2 – Lifejackets

1 Paragraph 2.2.1.6 is amended to read as follows:

"2.2.1.6 When tested according to the recommendations of the Organization on at least 12 persons, adult lifejackets shall have sufficient buoyancy and stability in calm fresh water to:

.1 lift the mouth of exhausted or unconscious persons by an average height of not less than the average provided by the adult RTD minus 10 mm;

.2 turn the body of unconscious, face down persons in the water to a position where the mouth is clear of the water in an average time not exceeding that of the RTD plus 1 s, with the number of persons not turned by the lifejacket no greater than that of the RTD;

.3 incline the body backwards from the vertical position for an average torso angle of not less than that of the RTD minus 10°;

.4 lift the head above horizontal for an average faceplane angle of not less than that of the RTD minus 10°; and

.5 return at least as many wearers to a stable face-up position after being destabilized when floating in the flexed foetal position as with the RTD when tested on the wearers in the same manner."

2 The following new paragraphs 2.2.1.8.4, 2.2.1.8.5 and 2.2.1.8.6 are added after existing paragraph 2.2.1.8.3 and the word "and" at the end of paragraph 2.2.1.8.2 is deleted:

".4 for infants the jump and drop tests shall be exempted;

.5 for children, five of the nine subjects shall perform the jump and drop tests; and

.6 *in lieu* of paragraph 2.2.1.8.5, manikins may be substituted for human test subjects."

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ANNEX 5

RESOLUTION MSC.369(93)
(adopted on 22 May 2014)

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

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.4(48), by which it adopted the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (hereinafter referred to as "the IBC Code"), which has become mandatory under chapter VII of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation VII/8.1 of the Convention concerning the procedure for amending the IBC Code,

HAVING CONSIDERED, at its ninety-third session, amendments to the IBC Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the IBC Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Contracting Governments to the Convention.

ANNEX

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

Chapter 1 – General

1 New paragraphs 1.3.37 and 1.3.38 are added as follows:

"1.3.37 *Purging* means the introduction of inert gas into a tank which is already in an inert condition with the object of further reducing the oxygen content; and/or reducing the existing hydrocarbon or other flammable vapours content to a level below which combustion cannot be supported if air is subsequently introduced into the tank.

1.3.38 *Gas-freeing* means the process where a portable or fixed ventilation system is used to introduce fresh air into a tank in order to reduce the concentration of hazardous gases or vapours to a level safe for tank entry."

Chapter 2 – Ship survival capability and location of cargo tanks

2.2 – Freeboard and intact stability

2 The title of section 2.2 is amended to read:

"Freeboard and stability"

3 A new subparagraph 2.2.6 is added as follows:

"2.2.6 All ships, subject to the Code, shall be fitted with a stability instrument, capable of verifying compliance with intact and damage stability requirements, approved by the Administration having regard to the performance standards recommended by the Organization*:

.1 ships constructed before 1 January 2016 shall comply with this requirement at the first scheduled renewal survey of the ship on or after 1 January 2016 but not later than 1 January 2021;

.2 notwithstanding the requirements of 2.2.6.1, a stability instrument fitted on a ship constructed before 1 January 2016 need not be replaced provided it is capable of verifying compliance with intact and damage stability, to the satisfaction of the Administration; and

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

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* Refer to part B, chapter 4, of the International Code on Intact Stability, 2008 (2008 IS Code), as amended; the *Guidelines for the Approval of Stability Instruments* (MSC.1/Circ.1229), annex, section 4, as amended; and the technical standards defined in part 1 of the *Guidelines for verification of damage stability requirements for tankers* (MSC.1/Circ.1461)."

4 A new subparagraph 2.2.7 is added as follows:

"2.2.7 The Administration may waive the requirements of paragraph 2.2.6 for the following ships provided the procedures employed for intact and damage stability verification maintain the same degree of safety, as being loaded in accordance with the approved conditions*. Any such waiver shall be duly noted on the International Certificate of Fitness referred to in paragraph 1.5.4:

.1 ships which are on a dedicated service, with a limited number of permutations of loading such that all anticipated conditions have been approved in the stability information provided to the master in accordance with the requirements of paragraph 2.2.5;

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

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

.4 ships constructed before 1 January 2016 provided with approved limiting KG/GM curves covering all applicable intact and damage stability requirements.

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* Refer to operational guidance provided in part 2 of the *Guidelines for verification of damage stability requirements for tankers* (MSC.1/Circ.1461)."

Chapter 8 – Cargo tank venting and gas-freeing arrangements

5 In paragraph 8.1.5, the references to "SOLAS regulations II-2/4.5.3 and 4.5.6" are replaced by references to "SOLAS regulations II-2/4.5.3, 4.5.6 and 16.3.2".

6 A new paragraph 8.5 is inserted as follows:

"8.5 Cargo tank purging

When the application of inert gas is required by 11.1.1, before gas-freeing, the cargo tanks shall be purged with inert gas through outlet pipes with cross-sectional area such that an exit velocity of at least 20 m/s can be maintained when any three tanks are being simultaneously supplied with inert gas. The outlets shall extend not less than 2 m above the deck level. Purging shall continue until the concentration of hydrocarbon or other flammable vapours in the cargo tanks has been reduced to less than 2% by volume."

7 The existing paragraph 8.5 and subparagraphs 8.5.1, 8.5.2 and 8.5.3 are renumbered as paragraph 8.6 and subparagraphs 8.6.1, 8.6.2 and 8.6.3, respectively, and, in the renumbered paragraphs 8.6.2 and 8.6.3 the referenced paragraph numbers "8.5.1", "8.5.1.2" and "8.5.1.3" are replaced with "8.6.1", "8.6.1.2" and "8.6.1.3", respectively.

Chapter 9 – Environmental control

8 The chapeau of paragraph 9.1.3 is replaced by the following:

"9.1.3 Where inerting or padding of cargo tanks is required by this Code in column "h" of chapter 17:"

Chapter 11 – Fire protection and fire extinction*

9 Subparagraph 11.1.1.1 is replaced by the following:

"11.1.1.1 Regulations 10.8 and 10.9 shall not apply;"

Chapter 15 – Special requirements

10 The following footnote is added at the end of paragraph 15.13.3.2:

"
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* Refer to MSC-MEPC.2/Circ.14 on Products requiring oxygen-dependent inhibitors."

11 Paragraph 15.13.5 is replaced by the following:

"15.13.5 When a product containing an oxygen-dependent inhibitor is to be carried:

.1 in a ship for which inerting is required under SOLAS regulation II-2/4.5.5, as amended, the application of inert gas shall not take place before loading or during the voyage, but shall be applied before commencement of unloading*;

.2 in a ship to which SOLAS regulation II-2/4.5.5, as amended, does not apply, the product may be carried without inertion (in tanks of a size not greater than 3,000 m^3). If inertion is to be applied on such a ship, then the application of inert gas shall not take place before loading or during the voyage, but shall be applied before commencement of unloading*.

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* Refer to MSC-MEPC.2/Circ.14 on Products requiring oxygen-dependent inhibitors."

Chapter 17 – Summary of minimum requirements

12 The explanatory notes for "Tank environment control (column h)" are replaced by the following:

"Tank environmental control (*column h*)	Inert:	inerting (9.1.2.1)
	Pad:	liquid or gas padding (9.1.2.2)
	Dry:	drying (9.1.2.3)
	Vent:	natural or forced ventilation (9.1.2.4)
	No:	no special requirements under this Code (inerting may be required under SOLAS)"

Certificate of Fitness

13 Paragraph 6 is replaced with the following:

"6 That the ship must be loaded:

.1* only in accordance with loading conditions verified compliant with intact and damage stability requirements using the approved stability instrument fitted in accordance with paragraph 2.2.6 of the Code;

.2* where a waiver permitted by paragraph 2.2.7 of the Code is granted and the approved stability instrument required by paragraph 2.2.6 of the Code is not fitted, loading shall be made in accordance with one or more of the following approved methods:

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

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

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

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

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

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

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* Delete as appropriate."

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ANNEX 6

RESOLUTION MSC.370(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (IGC CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.5(48), by which it adopted the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (hereinafter referred to as "the IGC Code"), which has become mandatory under chapter VII of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation VII/11.1 of the Convention concerning the procedure for amending the IGC Code,

HAVING CONSIDERED, at its ninety-third session, amendments to the IGC Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the IGC Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK (IGC CODE)

The complete text of the IGC Code is replaced by the following:

"**Contents**

Preamble

1 The purpose of this Code is to provide an international standard for the safe carriage, by sea in bulk, of liquefied gases and certain other substances that are listed in chapter 19. Through consideration of the products carried, it prescribes the design and construction standards of the ships involved and the equipment they should carry to minimize the risk to the ship, its crew and the environment.

2 The basic philosophy is one of ship types related to the hazards of the products covered by the Code. Each of the products may have one or more hazard properties, which include flammability, toxicity, corrosivity and reactivity. A further possible hazard may arise where products are transported under cryogenic or pressure conditions.

3 Severe collisions or strandings could lead to cargo tank damage and result in uncontrolled release of the product. Such a release could result in evaporation and dispersion of the product and, in some cases, could cause brittle fracture of the ship's hull. The requirements in the Code are intended to minimize this risk as far as is practicable, based upon present knowledge and technology.

4 Throughout the development of the Code, it was recognized that it must be based on sound naval architectural and engineering principles and the best understanding available as to the hazards of the various products covered. Gas carrier design technology is not only a complex technology but is rapidly evolving and the Code shall not remain static. The Organization will periodically review the Code, continually taking into account both experience and future development.

5 Requirements for new products and their conditions of carriage will be circulated as recommendations, on an interim basis, when adopted by the Maritime Safety Committee of the Organization, prior to the entry into force of the appropriate amendments, under the terms of article VIII of the International Convention for the Safety of Life at Sea, 1974.

6 The Code primarily deals with ship design and equipment. To ensure the safe transport of the products the total system must, however, be appraised. Other important facets of the safe transport of the products, such as training, operation, traffic control and handling in port, are being or will be examined further by the Organization.

7 The development of the Code has been greatly assisted by a number of organizations in consultative status, such as the Society of International Gas Tanker and Terminal Operators Limited (SIGTTO) and other organizations, such as members of the International Association of Classification Societies (IACS).

8 Chapter 18 of the Code dealing with operation of liquefied gas carriers highlights the regulations in other chapters that are operational in nature and mentions those other important safety features that are peculiar to gas carrier operations.

9 The layout of the Code is in line with the International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), adopted by the Maritime Safety Committee at its forty-eighth session. Gas carriers may also carry in bulk liquid chemicals covered by the IBC Code, as prescribed in the IGC Code.

10 Floating production, storage and offloading (FPSO) facilities, which are designed to handle liquefied gases in bulk, do not fall under the IGC Code. However, designers of such units may consider using the IGC Code to the extent that the Code provides the most appropriate risk mitigation measures for the operations the unit is to perform. Where other more appropriate risk mitigation measures are determined that are contrary to this Code, they shall take precedence over the Code.

CHAPTER 1

GENERAL

Goal

To provide an international standard for the safe carriage, by sea in bulk, of liquefied gases by laying down the design and construction standards of ships involved in such carriage and the equipment, they shall carry to minimize the risk to the ship, its crew and to the environment, having regard to the nature of the products including flammability, toxicity, asphyxiation, corrosivity, reactivity and low temperature and vapour pressure.

1.1 Application and implementation

1.1.1 The Code applies to ships regardless of their size, including those of less than 500 gross tonnage, engaged in the carriage of liquefied gases having a vapour pressure exceeding 0.28 MPa absolute at a temperature of 37.8°C and other products, as shown in chapter 19, when carried in bulk.

1.1.2.1 Unless expressly provided otherwise, the Code applies to ships whose keels are laid, or which are at a similar stage of construction where:

.1 construction identifiable with the ship begins; and

.2 assembly of that ship has commenced, comprising at least 50 tonnes or 1% of the estimated mass of all structural material, whichever is less,

on or after 1 July 2016.

1.1.2.2 For the purpose of the Code, the expression "ships constructed" means ships the keels of which are laid or which are at a similar stage of construction.

1.1.2.3 Unless expressly provided otherwise, for ships constructed on or after 1 July 1986 and before 1 July 2016, the Administration shall ensure that the requirements which are applicable under this Code, as adopted by resolution MSC.5(48) as amended by resolutions MSC.17(58), MSC.30(61), MSC.32(63), MSC.59(67), MSC.103(73), MSC.177(79) and MSC.220(82), are complied with.

1.1.3 A ship, irrespective of the date of construction, which is converted to a gas carrier on or after 1 July 2016, shall be treated as a gas carrier constructed on the date on which such conversion commences.

1.1.4.1 When cargo tanks contain products for which the Code requires a type 1G ship, neither flammable liquids having a flashpoint of 60°C (closed cup test) or less, nor flammable products listed in chapter 19, shall be carried in tanks located within the protective zones described in 2.4.1.1.

1.1.4.2 Similarly, when cargo tanks contain products for which the Code requires a type 2G/2PG ship, the flammable liquids as described in 1.1.4.1, shall not be carried in tanks located within the protective zones described in 2.4.1.2.

1.1.4.3 In each case, for cargo tanks loaded with products for which the Code requires a type 1G or 2G/2PG ship, the restriction applies to the protective zones within the longitudinal extent of the hold spaces for those tanks.

1.1.4.4 The flammable liquids and products described in 1.1.4.1 may be carried within these protective zones when the quantity of products retained in the cargo tanks, for which the Code requires a type 1G or 2G/2PG ship is solely used for cooling, circulation or fuelling purposes.

1.1.5 Except as provided in 1.1.7.1, when it is intended to carry products covered by this Code and products covered by the *International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk* (IBC Code), adopted by resolution MSC.4(48), as may be amended by the Organization, the ship shall comply with the requirements of both Codes appropriate to the products carried.

1.1.6.1 Where it is proposed to carry products that may be considered to come within the scope of this Code that are not at present designated in chapter 19, the Administration and the port Administrations involved in such carriage shall establish a Tripartite Agreement based on a provisional assessment and lay down preliminary suitable conditions of carriage based on the principles of the Code.

1.1.6.2 For the evaluation of such products, the manufacturer of the product shall submit to the Administration a completed assessment form (see appendix 1), which includes the proposed ship type and carriage requirements.

1.1.6.3 When a provisional assessment for a pure or technically pure product has been completed and agreed with the other parties, the Administration shall submit the assessment form and a proposal for a new and complete entry in the IGC Code, to the relevant sub-committee of the Organization (see appendix 1).

1.1.6.4 After provisional assessment by Tripartite Agreement and express or tacit agreement has been established, an addendum to the relevant ship's certificate may be issued (see appendix 3).

1.1.7.1 The requirements of this Code shall take precedence when a ship is designed and constructed for the carriage of the following products:

.1 those listed exclusively in chapter 19 of the Code; and

.2 one or more of the products that are listed both in the Code and in the International Bulk Chemical Code. These products are marked with an asterisk in column "a" in the table contained within chapter 19.

1.1.7.2 When a ship is intended to exclusively carry one or more of the products referred to in 1.1.7.1.2, the requirements of the International Bulk Chemical Code, as amended, shall apply.

1.1.8 The ship's compliance with the requirements of the International Gas Carrier Code shall be shown by its International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk, as described in 1.4. Compliance with the amendments to the Code, as appropriate, shall also be indicated in the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk.

1.1.9 Where reference is made in the Code to a paragraph, all the provisions of the subparagraph of that designation shall apply.

1.1.10 When a ship is intended to operate for periods at a fixed location in a re-gasification and gas discharge mode or a gas receiving, processing, liquefaction and storage mode, the Administration and port Administrations involved in the operation shall take appropriate steps to ensure implementation of the provisions of the Code as are applicable to the proposed arrangements. Furthermore, additional requirements shall be established based on the principles of the Code as well as recognized standards that address specific risks not envisaged by it. Such risks may include, but not be limited to:

.1 fire and explosion;

.2 evacuation;

.3 extension of hazardous areas;

.4 pressurized gas discharge to shore;

.5 high-pressure gas venting;

.6 process upset conditions;

.7 storage and handling of flammable refrigerants;

.8 continuous presence of liquid and vapour cargo outside the cargo containment system;

.9 tank over-pressure and under-pressure;

.10 ship-to-ship transfer of liquid cargo; and

.11 collision risk during berthing manoeuvres.

1.1.11 Where a risk assessment or study of similar intent is utilized within the Code, the results shall also include, but not be limited to, the following as evidence of effectiveness:

.1 description of methodology and standards applied;

.2 potential variation in scenario interpretation or sources of error in the study;

.3 validation of the risk assessment process by an independent and suitable third party;

.4 quality system under which the risk assessment was developed;

.5 the source, suitability and validity of data used within the assessment;

.6 the knowledge base of persons involved within the assessment;

.7 system of distribution of results to relevant parties; and

.8 validation of results by an independent and suitable third party.

1.1.12 Although the Code is legally treated as a mandatory instrument under the SOLAS Convention, the provisions of section 4.28 and appendices 1, 3 and 4 of the Code are recommendatory or informative.

1.2 Definitions

Except where expressly provided otherwise, the following definitions apply to the Code. Additional definitions are provided in chapters throughout the Code.

1.2.1 *Accommodation spaces* are those spaces used for public spaces, corridors, lavatories, cabins, offices, hospitals, cinemas, games and hobby rooms, barber shops, pantries without cooking appliances and similar spaces.

1.2.2 "*A*" *class divisions* are divisions as defined in regulation II-2/3.2 of the SOLAS Convention.

1.2.3 *Administration* means the Government of the State whose flag the ship is entitled to fly. For *Administration (port)*, see *port Administration.*

1.2.4 *Anniversary date* means the day and the month of each year that will correspond to the date of expiry of the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk.

1.2.5 *Boiling point* is the temperature at which a product exhibits a vapour pressure equal to the atmospheric pressure.

1.2.6 *Breadth (B)* means the maximum breadth of the ship, measured amidships to the moulded line of the frame in a ship with a metal shell, and to the outer surface of the hull in a ship with a shell of any other material. The breadth *(B)* shall be measured in metres.

1.2.7 *Cargo area* is that part of the ship which contains the cargo containment system and cargo pump and compressor rooms and includes the deck areas over the full length and breadth of the part of the ship over these spaces. Where fitted, the cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the foremost hold space are excluded from the cargo area.

1.2.8 *Cargo containment system* is the arrangement for containment of cargo including, where fitted, a primary and secondary barrier, associated insulation and any intervening spaces, and adjacent structure, if necessary, for the support of these elements. If the secondary barrier is part of the hull structure, it may be a boundary of the hold space.

1.2.9 *Cargo control room* is a space used in the control of cargo handling operations.

1.2.10 *Cargo machinery spaces* are the spaces where cargo compressors or pumps, cargo processing units, are located, including those supplying gas fuel to the engine-room.

1.2.11 *Cargo pumps* are pumps used for the transfer of liquid cargo including main pumps, booster pumps, spray pumps, etc.

1.2.12 *Cargoes* are products listed in chapter 19, that are carried in bulk by ships subject to the Code.

1.2.13 *Cargo service spaces* are spaces within the cargo area, used for workshops, lockers and store-rooms that are of more than 2 m^2 in area.

1.2.14 *Cargo tank* is the liquid-tight shell designed to be the primary container of the cargo and includes all such containment systems whether or not they are associated with the insulation or/and the secondary barriers.

1.2.15 *Closed loop sampling* is a cargo sampling system that minimizes the escape of cargo vapour to the atmosphere by returning product to the cargo tank during sampling.

1.2.16 *Cofferdam* is the isolating space between two adjacent steel bulkheads or decks. This space may be a void space or a ballast space.

1.2.17 *Control stations* are those spaces in which ship's radio, main navigating equipment or the emergency source of power is located or where the fire-recording or fire control equipment is centralized. This does not include special fire control equipment, which can be most practically located in the cargo area.

1.2.18 *Flammable products* are those identified by an "F" in column "*f*" in the table of chapter 19.

1.2.19 *Flammability limits* are the conditions defining the state of fuel-oxidant mixture at which application of an adequately strong external ignition source is only just capable of producing flammability in a given test apparatus.

1.2.20 *FSS Code* is the Fire Safety Systems Code meaning the *International Code for Fire Safety System*s, adopted by the Maritime Safety Committee of the Organization by resolution MSC.98(73), as amended.

1.2.21 *Gas carrier* is a cargo ship constructed or adapted and used for the carriage in bulk of any liquefied gas or other products listed in the table of chapter 19.

1.2.22 *Gas combustion unit (GCU)* is a means of disposing excess cargo vapour by thermal oxidation.

1.2.23 *Gas consumer* is any unit within the ship using cargo vapour as a fuel.

1.2.24 *Hazardous area* is an area in which an explosive gas atmosphere is, or may be expected to be present, in quantities that require special precautions for the construction, installation and use of electrical equipment. When a gas atmosphere is present, the following hazards may also be present: toxicity, asphyxiation, corrosivity, reactivity and low temperature. These hazards shall also be taken into account and additional precautions for the ventilation of spaces and protection of the crew will need to be considered. Examples of hazardous areas include, but are not limited to, the following[1]:

.1 the interiors of cargo containment systems and any pipework of pressure-relief or other venting systems for cargo tanks, pipes and equipment containing the cargo;

.2 interbarrier spaces;

.3 hold spaces where the cargo containment system requires a secondary barrier;

.4 hold spaces where the cargo containment system does not require a secondary barrier;

.5 a space separated from a hold space by a single gastight steel boundary where the cargo containment system requires a secondary barrier;

[1] Refer to chapter 10 for a separate list of examples and classification of hazardous areas for the purpose of selection and design of electrical installations.

.6 cargo machinery spaces;

.7 areas on open deck, or semi-enclosed spaces on open deck, within 3 m of possible sources of gas release, such as cargo valve, cargo pipe flange, cargo machinery space ventilation outlet, etc.;

.8 areas on open deck, or semi-enclosed spaces on open deck within 1.5 m of cargo machinery space entrances, cargo machinery space ventilation inlets;

.9 areas on open deck over the cargo area and 3 m forward and aft of the cargo area on the open deck up to a height of 2.4 m above the weather deck;

.10 an area within 2.4 m of the outer surface of a cargo containment system where such surface is exposed to the weather;

.11 enclosed or semi-enclosed spaces in which pipes containing cargoes are located, except those where pipes containing cargo products for boil-off gas fuel burning systems are located;

.12 an enclosed or semi-enclosed space having a direct opening into any hazardous area;

.13 void spaces, cofferdams, trunks, passageways and enclosed or semi-enclosed spaces, adjacent to, or immediately above or below, the cargo containment system;

.14 areas on open deck or semi-enclosed spaces on open deck above and in the vicinity of any vent riser outlet, within a vertical cylinder of unlimited height and 6 m radius centred upon the centre of the outlet and within a hemisphere of 6 m radius below the outlet; and

.15 areas on open deck within spillage containment surrounding cargo manifold valves and 3 m beyond these up to a height of 2.4 m above deck.

1.2.25 *Non-hazardous area* is an area other than a hazardous area.

1.2.26 *Hold space* is the space enclosed by the ship's structure in which a cargo containment system is situated.

1.2.27 *IBC Code* means the *International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk*, adopted by the Maritime Safety Committee of the Organization by resolution MSC.4(48), as amended.

1.2.28 *Independent* means that a piping or venting system, for example, is in no way connected to another system and that there are no provisions available for the potential connection to other systems.

1.2.29 *Insulation space* is the space, which may or may not be an interbarrier space, occupied wholly or in part by insulation.

1.2.30 *Interbarrier space* is the space between a primary and a secondary barrier, whether or not completely or partially occupied by insulation or other material.

1.2.31 *Length (L)* is the length as defined in the International Convention on Load Lines in force.

1.2.32 *Machinery spaces of category A* are those spaces, and trunks to those spaces, which contain either:

.1 internal combustion machinery used for main propulsion; or

.2 internal combustion machinery used for purposes other than main propulsion where such machinery has, in the aggregate, a total power output of not less than 375 kW; or

.3 any oil-fired boiler or oil fuel unit or any oil-fired equipment other than boilers, such as inert gas generators, incinerators, etc.

1.2.33 *Machinery spaces* are machinery spaces of category A and other spaces containing propelling machinery, boilers, oil fuel units, steam and internal-combustion engines, generators and major electrical machinery, oil filling stations, refrigerating, stabilizing, ventilation and air-conditioning machinery, and similar spaces and the trunks to such spaces.

1.2.34 *MARVS* is the maximum allowable relief valve setting of a cargo tank (gauge pressure).

1.2.35 *Nominated surveyor* is a surveyor nominated/appointed by an Administration to enforce the provisions of the SOLAS Convention regulations with regard to inspections and surveys and the granting of exemptions therefrom.

1.2.36 *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 MPa gauge.

1.2.37 *Organization* is the International Maritime Organization (IMO).

1.2.38 *Permeability* of a space means the ratio of the volume within that space which is assumed to be occupied by water to the total volume of that space.

1.2.39 *Port Administration* means the appropriate authority of the country for the port where the ship is loading or unloading.

1.2.40 *Primary barrier* is the inner element designed to contain the cargo when the cargo containment system includes two boundaries.

1.2.41 *Products* is the collective term used to cover the list of gases indicated in chapter 19 of this Code.

1.2.42 *Public spaces* are those portions of the accommodation that are used for halls, dining rooms, lounges and similar permanently enclosed spaces.

1.2.43 *Recognized organization* is an organization authorized by an Administration in accordance with SOLAS regulation XI-1/1.

1.2.44 *Recognized standards* are applicable international or national standards acceptable to the Administration, or standards laid down and maintained by the recognized organization.

1.2.45 *Relative density* is the ratio of the mass of a volume of a product to the mass of an equal volume of fresh water.

1.2.46 *Secondary barrier* is the liquid-resisting outer element of a cargo containment system, designed to afford temporary containment of any envisaged leakage of liquid cargo through the primary barrier and to prevent the lowering of the temperature of the ship's structure to an unsafe level. Types of secondary barrier are more fully defined in chapter 4.

1.2.47 *Separate systems* are those cargo piping and vent systems that are not permanently connected to each other.

1.2.48 *Service spaces* are those used for galleys, pantries containing cooking appliances, lockers, mail and specie rooms, store-rooms, workshops other than those forming part of the machinery spaces, and similar spaces and trunks to such spaces.

1.2.49 *SOLAS Convention* means the International Convention for the Safety of Life at Sea, 1974, as amended.

1.2.50 *Tank cover* is the protective structure intended to either protect the cargo containment system against damage where it protrudes through the weather deck or to ensure the continuity and integrity of the deck structure.

1.2.51 *Tank dome* is the upward extension of a portion of a cargo tank. In the case of below-deck cargo containment systems, the tank dome protrudes through the weather deck or through a tank cover.

1.2.52 *Thermal oxidation method* means a system where the boil-off vapours are utilized as fuel for shipboard use or as a waste heat system subject to the provisions of chapter 16 or a system not using the gas as fuel complying with this Code.

1.2.53 *Toxic products* are those defined by a "T" in column "*f*" in the table of chapter 19.

1.2.54 *Turret compartments* are those spaces and trunks that contain equipment and machinery for retrieval and release of the disconnectable turret mooring system, high-pressure hydraulic operating systems, fire protection arrangements and cargo transfer valves.

1.2.55 *Vapour pressure* is the equilibrium pressure of the saturated vapour above the liquid, expressed in Pascals (Pa) absolute at a specified temperature.

1.2.56 *Void space* is an enclosed space in the cargo area external to a cargo containment system, other than a hold space, ballast space, oil fuel tank, cargo pumps or compressor room, or any space in normal use by personnel.

1.3 Equivalents

1.3.1 Where the Code requires that a particular fitting, material, appliance, apparatus, item of equipment or type thereof shall be fitted or carried in a ship, or that any particular provision shall be made, or any procedure or arrangement shall be complied with, the Administration may allow any other fitting, material, appliance, apparatus, item of equipment or type thereof to be fitted or carried, or any other provision, procedure or arrangement to be made in that ship, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance, apparatus, item of equipment or type thereof, or that any particular provision, procedure or arrangement, is at least as effective as that required by the Code. However, the Administration may not allow operational methods or procedures to be made as an alternative to a particular fitting, material, appliance, apparatus, item of equipment, or type thereof that is prescribed by the Code, unless such a substitution is specifically allowed by the Code.

1.3.2 When the Administration so allows, any fitting, material, appliance, apparatus, item of equipment, or type thereof, or provision, procedure or arrangement or novel design or application to be substituted, it shall communicate to the Organization the particulars thereof, together with a report on the evidence submitted, so that the Organization may circulate the same to other Contracting Governments to the SOLAS Convention for the information of their officers.

1.4 Surveys and certification

1.4.1 *Survey procedure*

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

1.4.1.2 The recognized organization, referred to in 1.2.43, shall comply with the provisions of the SOLAS Convention and with the Code for recognized organizations (RO Code).

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

.1 require repairs to a ship; and

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

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

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

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

1.4.2 *Survey requirements*

The structure, equipment, fittings, arrangements and material (other than items in respect of which a Cargo Ship Safety Construction Certificate, Cargo Ship Safety Equipment Certificate and Cargo Ship Safety Radio Certificate; or Cargo Ship Safety Certificate, required by the SOLAS Convention, are issued) of a gas carrier shall be subjected to the following surveys:

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

.2 A renewal survey at intervals specified by the Administration, but not exceeding five years, except where regulation 1.4.6.2.1, 1.4.6.5, 1.4.6.6 or 1.4.6.7 is applicable. The renewal survey shall be such as to ensure that the structure, equipment, fittings, arrangements and material fully comply with the applicable provisions of the Code.

.3 An intermediate survey within three months before or after the second anniversary date, or within three months before or after the third anniversary date of the certificate, which shall take the place of one of the annual surveys specified in 1.4.2.4. The intermediate survey shall be such as to ensure that the safety equipment, and other equipment, and associated pump and piping systems fully comply with the applicable provisions of the Code and are in good working order. Such intermediate surveys shall be endorsed on the certificate issued under 1.4.4 or 1.4.5.

.4 An annual survey within three months before or after each anniversary date of the certificate, including a general inspection of the structure, equipment, fittings, arrangements and material referred to in 1.4.2.1 to ensure that they have been maintained in accordance with 1.4.3 and that they remain satisfactory for the service for which the ship is intended. Such annual surveys shall be endorsed on the certificate issued under 1.4.4 or 1.4.5.

.5 An additional survey, either general or partial according to the circumstances, shall be made when required after an investigation prescribed in 1.4.3.3, or whenever any important repairs or renewals are made. Such a survey shall ensure that the necessary repairs or renewals have been effectively made, that the materials and workmanship of such repairs or renewals are satisfactory, and that the ship is fit to proceed to sea without danger to the ship or persons on board or without presenting unreasonable threat of harm to the marine environment.

1.4.3 *Maintenance of conditions after survey*

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

1.4.3.2 After any survey of the ship, as described in 1.4.2, has been completed, no change shall be made in the structure, equipment, fittings, arrangements and material covered by the survey without the sanction of the Administration, except by direct replacement.

1.4.3.3 Whenever an accident occurs to a ship or a defect is discovered, either of which affects the safety of the ship or the efficiency or completeness of its life-saving appliances or other equipment covered by the Code, the master or owner of the ship shall report at the earliest opportunity to the Administration, the nominated surveyor or recognized organization responsible for issuing the certificate, who shall cause investigations to be initiated to determine whether a survey, as required by 1.4.2.5, is necessary. If the ship is in a port of another Contracting Government, the master or owner shall also report immediately to the appropriate authorities of the port State and the nominated surveyor or recognized organization shall ascertain that such a report has been made.

1.4.4 ***Issue and endorsement of an International Certificate of Fitness of Liquefied Gases in Bulk***

1.4.4.1 An International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk shall be issued, after an initial or renewal survey, to a gas carrier engaged on international voyages that comply with the relevant provisions of the Code.

1.4.4.2 Such a certificate shall be drawn up in the form corresponding to the model given in appendix 2. If the language used is not English, French or Spanish, the text shall include a translation into one of these languages.

1.4.4.3 The certificate issued under the provisions of this section shall be available on board for examination at all times.

1.4.4.4 Notwithstanding any other provisions of the amendments to the Code, adopted by the Maritime Safety Committee by resolution MSC.17(58), any International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk that is current when these amendments enter into force shall remain valid until it expires under the terms of this Code prior to the amendments entering into force.

1.4.5 ***Issue or endorsement of an International Certificate of Fitness of Liquefied Gases in Bulk by another Government***

1.4.5.1 A Contracting Government to the SOLAS Convention may, at the request of another Contracting Government, cause a ship entitled to fly the flag of the other State to be surveyed and, if satisfied that the requirements of the Code are complied with, issue or authorize the issue of the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk to the ship and, where appropriate, endorse or authorize the endorsement of the certificate on board the ship in accordance with the Code. Any certificate so issued shall contain a statement to the effect that it has been issued at the request of the Government of the State whose flag the ship is entitled to fly.

1.4.6 ***Duration and validity of an International Certificate of Fitness of Liquefied Gases in Bulk***

1.4.6.1 An International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk shall be issued for a period specified by the Administration, which shall not exceed five years.

1.4.6.2.1 Notwithstanding the provisions of 1.4.6.1, when the renewal survey is completed within three months before the expiry date of the existing certificate, the new certificate shall 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.

1.4.6.2.2 When the renewal survey is completed after the expiry date of the existing certificate, the new certificate shall 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.

1.4.6.2.3 When the renewal survey is completed more than three months before the expiry date of the existing certificate, the new certificate shall 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.

1.4.6.3 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 1.4.6.1, provided that the surveys referred to in regulations 1.4.2.3 and 1.4.2.4, applicable when a certificate is issued for a period of five years, are carried out as appropriate.

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

1.4.6.5 If a ship is not in a port in which it is to be surveyed at the time when a certificate expires, the Administration may extend the period of validity of the certificate. However, the extension shall be granted only for the purpose of allowing the ship to complete its voyage to the port in which it is to be surveyed, and then only in cases where it appears proper and reasonable to do so.

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

1.4.6.7 In special circumstances, as determined by the Administration, a new certificate need not be dated from the date of expiry of the existing certificate as required by 1.4.6.2.2, 1.4.6.5 or 1.4.6.6. In these special circumstances, the new certificate shall be valid to a date not exceeding five years from the date of completion of the renewal survey.

1.4.6.8 If an annual or intermediate survey is completed before the period specified in 1.4.2, then:

.1 the anniversary date shown on the certificate shall be amended by endorsement to a date that shall not be more than three months later than the date on which the survey was completed;

.2 the subsequent annual or intermediate survey required by 1.4.2 shall be completed, at the intervals prescribed by that section, using the new anniversary date; and

.3 the expiry date may remain unchanged, provided one or more annual or intermediate surveys, as appropriate, are carried out so that the maximum intervals between the surveys prescribed by 1.4.2 are not exceeded.

1.4.6.9 A certificate issued under 1.4.4 or 1.4.5 shall cease to be valid in any of the following cases:

.1 if the relevant surveys are not completed within the periods specified in 1.4.2;

.2 if the certificate is not endorsed in accordance with 1.4.2.3 or 1.4.2.4; and

.3 upon transfer of the ship to the flag of another State. A new certificate shall only be issued when the Government issuing the new certificate is fully satisfied that the ship is in compliance with the provisions of 1.4.3.1 and 1.4.3.2. In the case of a transfer between Contracting Governments to the SOLAS Convention, if requested within three months after the transfer has taken place, the Government of the State whose flag the ship was formerly entitled to fly shall, as soon as possible, transmit to the Administration copies of the certificate carried by the ship before the transfer and, if available, copies of the relevant survey reports.

CHAPTER 2

SHIP SURVIVAL CAPABILITY AND LOCATION OF CARGO TANKS

Goal

To ensure that the cargo tanks are in a protective location in the event of minor hull damage, and that the ship can survive the assumed flooding conditions.

2.1 General

2.1.1 Ships subject to the Code shall survive the hydrostatic effects of flooding following assumed hull damage caused by some external force. In addition, to safeguard the ship and the environment, the cargo tanks shall be protected from penetration in the case of minor damage to the ship resulting, for example, from contact with a jetty or tug, and also given a measure of protection from damage in the case of collision or grounding, by locating them at specified minimum distances inboard from the ship's shell plating. Both the damage to be assumed and the proximity of the tanks to the ship's shell shall be dependent upon the degree of hazard presented by the product to be carried. In addition, the proximity of the cargo tanks to the ship's shell shall be dependent upon the volume of the cargo tank.

2.1.2 Ships subject to the Code shall be designed to one of the following standards:

.1 A *type 1G ship* is a gas carrier intended to transport the products indicated in chapter 19 that require maximum preventive measures to preclude their escape.

.2 A *type 2G ship* is a gas carrier intended to transport the products indicated in chapter 19, that require significant preventive measures to preclude their escape.

.3 A *type 2PG ship* is a gas carrier of 150 m in length or less intended to transport the products indicated in chapter 19 that require significant preventive measures to preclude their escape, and where the products are carried in type C independent tanks designed (see 4.23) for a MARVS of at least 0.7 MPa gauge and a cargo containment system design temperature of -55°C or above. A ship of this description that is over 150 m in length is to be considered a type 2G ship.

.4 A *type 3G ship* is a gas carrier intended to carry the products indicated in chapter 19 that require moderate preventive measures to preclude their escape.

Therefore, a type 1G ship is a gas carrier intended for the transportation of products considered to present the greatest overall hazard and types 2G/2PG and type 3G for products of progressively lesser hazards. Accordingly, a type 1G ship shall survive the most severe standard of damage and its cargo tanks shall be located at the maximum prescribed distance inboard from the shell plating.

2.1.3 The ship type required for individual products is indicated in column "*c*" in the table of chapter 19.

2.1.4 If a ship is intended to carry more than one of the products listed in chapter 19, the standard of damage shall correspond to the product having the most stringent ship type requirements. The requirements for the location of individual cargo tanks, however, are those for ship types related to the respective products intended to be carried.

2.1.5 For the purpose of this Code, the position of the moulded line for different containment systems is shown in figures 2.5 (a) to (e).

2.2 Freeboard and stability

2.2.1 Ships subject to the Code may be assigned the minimum freeboard permitted by the International Convention on Load Lines in force. However, the draught associated with the assignment shall not be greater than the maximum draught otherwise permitted by this Code.

2.2.2 The stability of the ship, in all seagoing conditions and during loading and unloading cargo, shall comply with the requirements of the International Code on Intact Stability[2] This includes partial filling and loading and unloading at sea, when applicable. Stability during ballast water operations shall fulfil stability criteria.

2.2.3 When calculating the effect of free surfaces of consumable liquids for loading conditions, it shall be assumed that, for each type of liquid, at least one transverse pair or a single centre tank has a free surface. The tank or combination of tanks to be taken into account shall be those where the effect of free surfaces is the greatest. The free surface effect in undamaged compartments shall be calculated by a method according to the International Code on Intact Stability.

2.2.4 Solid ballast shall not normally be used in double bottom spaces in the cargo area. Where, however, because of stability considerations, the fitting of solid ballast in such spaces becomes unavoidable, its disposition shall be governed by the need to enable access for inspection and to ensure that the impact loads resulting from bottom damage are not directly transmitted to the cargo tank structure.

[2] Refer to the *International Code on Intact Stability, 2008 (2008 IS Code),* adopted by the Maritime Safety Committee of the Organization by resolution MSC.267(85).

2.2.5 The master of the ship shall be supplied with a loading and stability information booklet. This booklet shall contain details of typical service conditions, loading, unloading and ballasting operations, provisions for evaluating other conditions of loading and a summary of the ship's survival capabilities. The booklet shall also contain sufficient information to enable the master to load and operate the ship in a safe and seaworthy manner.

2.2.6 All ships, subject to the Code shall be fitted with a stability instrument, capable of verifying compliance with intact and damage stability requirements, approved by the Administration having regard to the performance standards recommended by the Organization[3].

.1 ships constructed before 1 July 2016 shall comply with this paragraph at the first scheduled renewal survey of the ship after 1 July 2016 but not later than 1 July 2021;

.2 notwithstanding the requirements of paragraph 2.2.6.1 a stability instrument installed on a ship constructed before 1 July 2016 need not be replaced provided it is capable of verifying compliance with intact and damage stability, to the satisfaction of the Administration; and

.3 for the purposes of control under SOLAS regulation XI-1/4, the Administration shall issue a document of approval for the stability instrument.

2.2.7 The Administration may waive the requirements of paragraph 2.2.6 for the following ships, provided the procedures employed for intact and damage stability verification maintain the same degree of safety, as being loaded in accordance with the approved conditions[4]. Any such waiver shall be duly noted on the International Certificate of Fitness referred to in paragraph 1.4.4:

.1 ships which are on a dedicated service, with a limited number of permutations of loading such that all anticipated conditions have been approved in the stability information provided to the master in accordance with the requirements of paragraph 2.2.5;

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

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

.4 ships constructed before 1 July 2016 provided with approved limiting KG/GM curves covering all applicable intact and damage stability requirements.

2.2.8 ***Conditions of loading***

Damage survival capability shall be investigated on the basis of loading information submitted to the Administration for all anticipated conditions of loading and variations in draught and trim. This shall include ballast and, where applicable, cargo heel.

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3 Refer to part B, chapter 4, of the International Code on Intact Stability, 2008 (2008 IS Code), as amended; the *Guidelines for the Approval of Stability Instruments* (MSC.1/Circ.1229), annex, section 4, as amended; and the technical standards defined in part 1 of the *Guidelines for verification of damage stability requirements for tankers* (MSC.1/Circ.1461).

4 Refer to operational guidance provided in part 2 of the *Guidelines for verification of damage stability requirements for tankers* (MSC.1/Circ.1461).

2.3 Damage assumptions

2.3.1 The assumed maximum extent of damage shall be:

.1	Side damage		
.1.1	Longitudinal extent:	1/3 $L^{2/3}$ or 14.5 m, whichever is less	
.1.2	Transverse extent: measured inboard from the moulded line of the outer shell at right angles to the centreline at the level of the summer waterline	B/5 or 11.5 m, whichever is less	
.1.3	Vertical extent: from the moulded line of the outer shell	Upwards, without limit	
.2	Bottom damage:	For 0.3 L from the forward perpendicular of the ship	Any other part of the ship
.2.1	Longitudinal extent:	1/3$L^{2/3}$ or 14.5 m, whichever is less	1/3$L^{2/3}$ or 14.5 m, whichever is less
.2.2	Transverse extent:	B/6 or 10 m, whichever is less	B/6 or 5 m, whichever is less
.2.3	Vertical extent:	B/15 or 2 m, whichever is less, measured from the moulded line of the bottom shell plating at centreline (see 2.4.3)	B/15 or 2 m, whichever is less measured from the moulded line of the bottom shell plating at centreline (see 2.4.3)

2.3.2 ***Other damage***

2.3.2.1 If any damage of a lesser extent than the maximum damage specified in 2.3.1 would result in a more severe condition, such damage shall be assumed.

2.3.2.2 Local damage anywhere in the cargo area extending inboard distance "*d*" as defined in 2.4.1, measured normal to the moulded line of the outer shell shall be considered. Bulkheads shall be assumed damaged when the relevant subparagraphs of 2.6.1 apply. If a damage of a lesser extent than "*d*" would result in a more severe condition, such damage shall be assumed.

2.4 Location of cargo tanks

2.4.1 Cargo tanks shall be located at the following distances inboard:

.1 Type 1G ships: from the moulded line of the outer shell, not less than the transverse extent of damage specified in 2.3.1.1.2 and, from the moulded line of the bottom shell at centreline, not less than the vertical extent of damage specified in 2.3.1.2.3, and nowhere less than "*d*" where "*d*" is as follows:

.1 for Vc below or equal 1,000 m^3, d = 0.8 m;

.2 for 1,000 m^3 < Vc < 5,000 m^3, $d = 0.75 + Vc \times 0.2/4,000$ m;

.3 for $5{,}000\ m^3 \leq Vc < 30{,}000\ m^3$, $d = 0.8 + Vc/25{,}000$ m; and

.4 for $Vc \geq 30{,}000\ m^3$, $d = 2$ m,

where:

- Vc corresponds to 100% of the gross design volume of the individual cargo tank at 20°C, including domes and appendages (see figures 2.1 and 2.2). For the purpose of cargo tank protective distances, the cargo tank volume is the aggregate volume of all the parts of tank that have a common bulkhead(s); and

- "*d*" is measured at any cross section at a right angle from the moulded line of outer shell.

Tank size limitations may apply to type 1G ship cargoes in accordance with chapter 17.

.2 Types 2G/2PG: from the moulded line of the bottom shell at centreline not less than the vertical extent of damage specified in 2.3.1.2.3 and nowhere less than "*d*" as indicated in 2.4.1.1 (see figures 2.1 and 2.3).

.3 Type 3G ships: from the moulded line of the bottom shell at centreline not less than the vertical extent of damage specified in 2.3.1.2.3 and nowhere less than "*d*", where "*d*" = 0.8 m from the moulded line of outer shell (see figures 2.1 and 2.4).

2.4.2 For the purpose of tank location, the vertical extent of bottom damage shall be measured to the inner bottom when membrane or semi-membrane tanks are used, otherwise to the bottom of the cargo tanks. The transverse extent of side damage shall be measured to the longitudinal bulkhead when membrane or semi-membrane tanks are used, otherwise to the side of the cargo tanks. The distances indicated in 2.3 and 2.4 shall be applied as in figures 2.5(a) to (e). These distances shall be measured plate to plate, from the moulded line to the moulded line, excluding insulation.

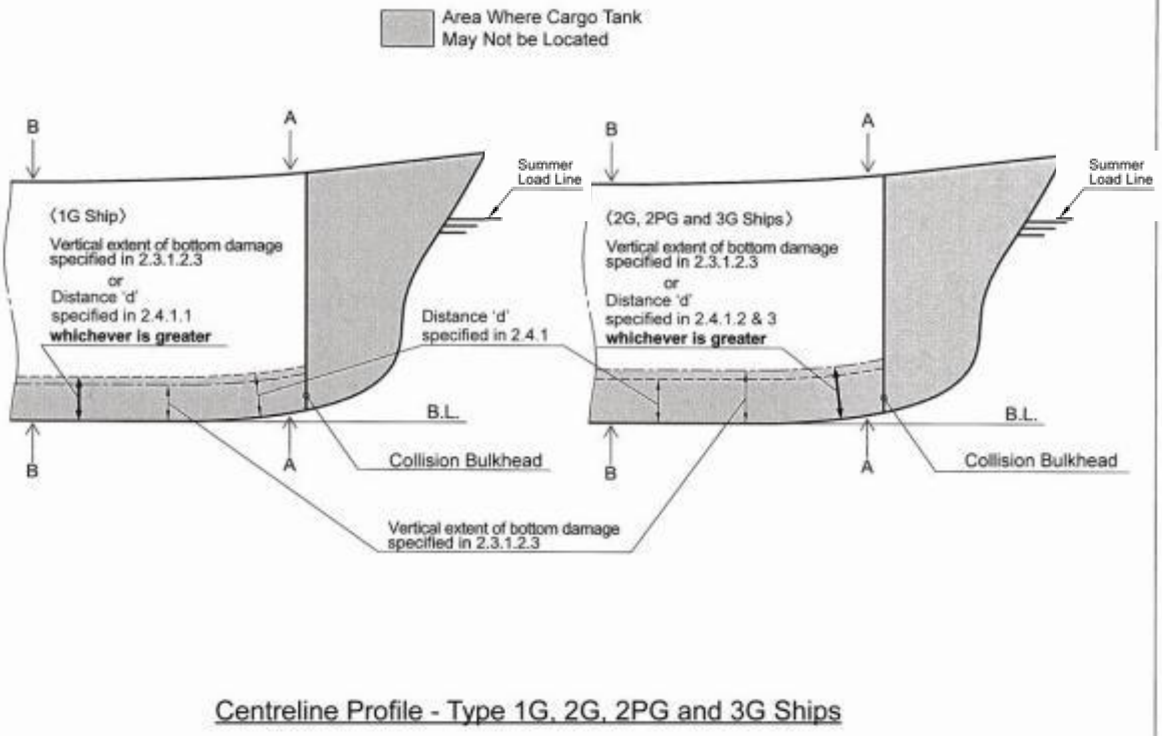


Figure 2.1 - *Cargo tank location requirements*

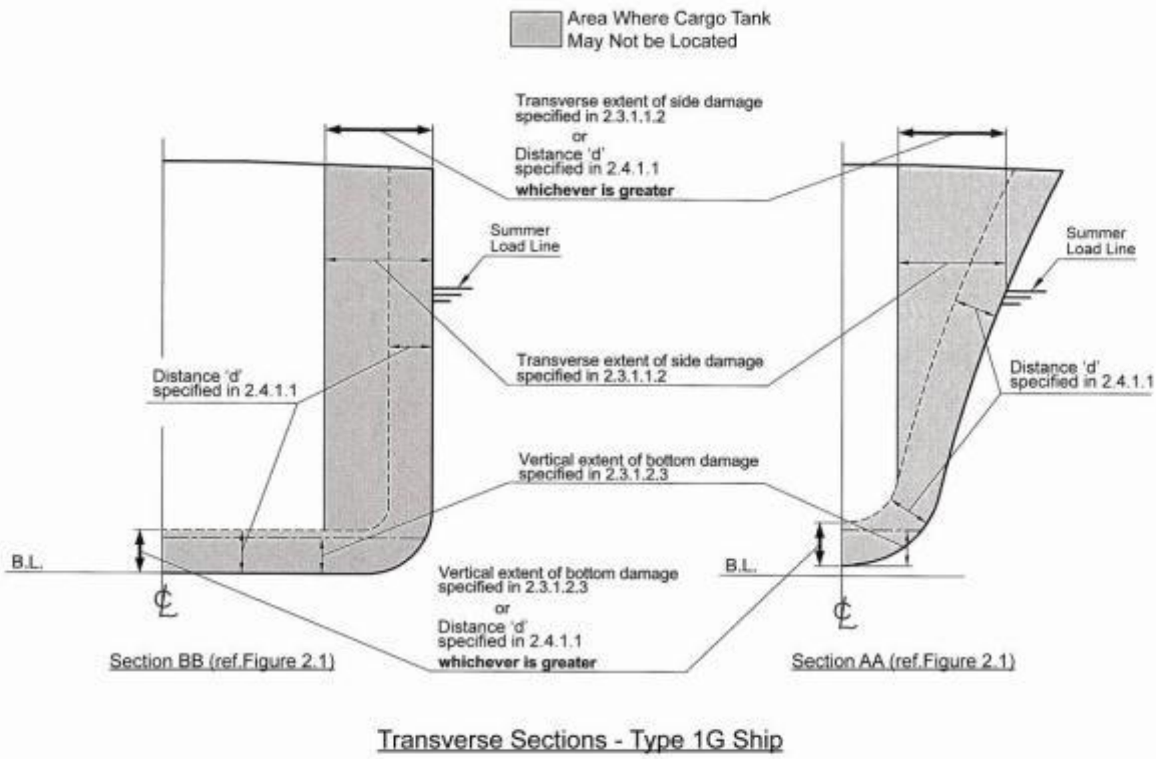


Figure 2.2 - *Cargo tank location requirements*

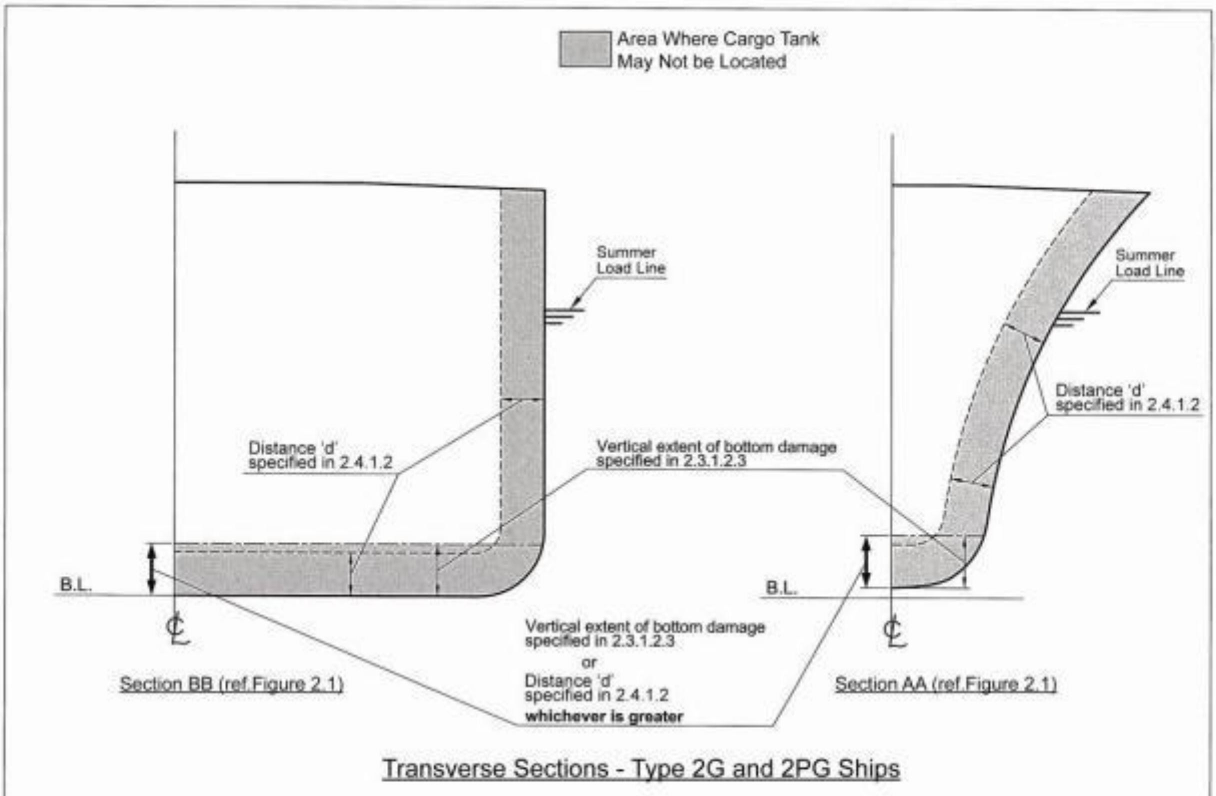


Figure 2.3 - *Cargo tank location requirements*

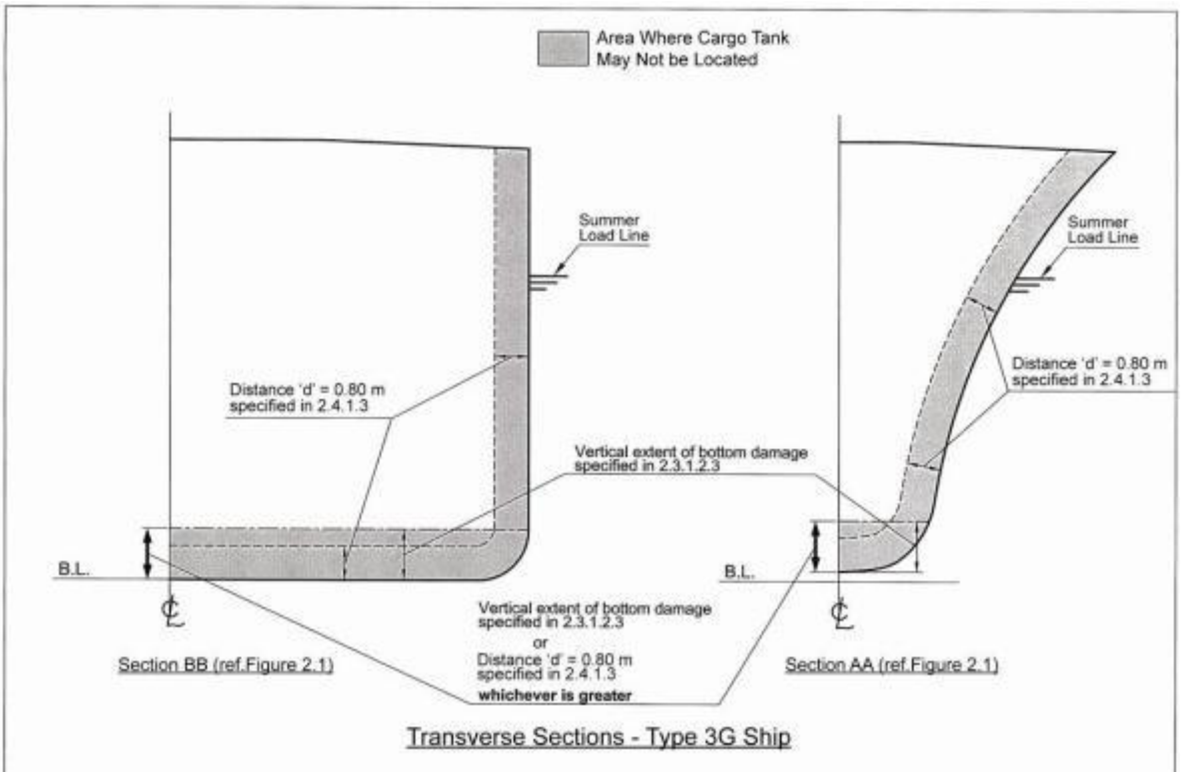
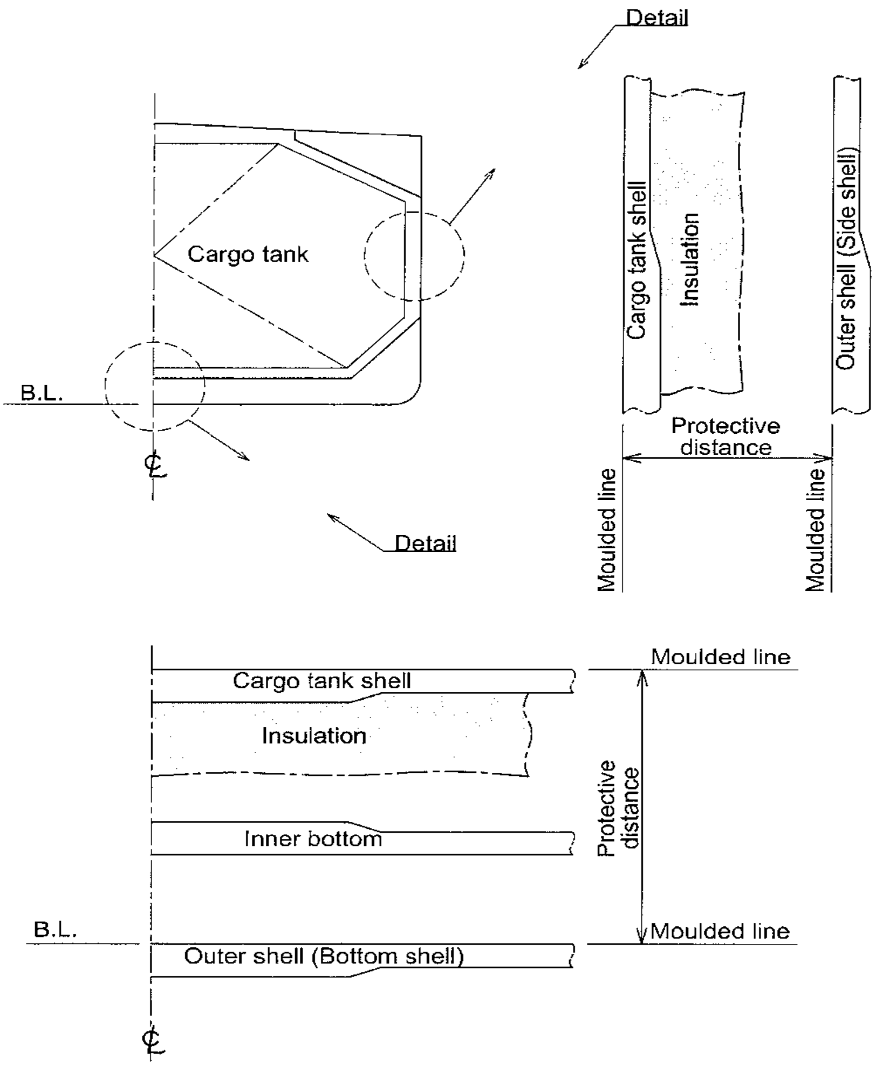
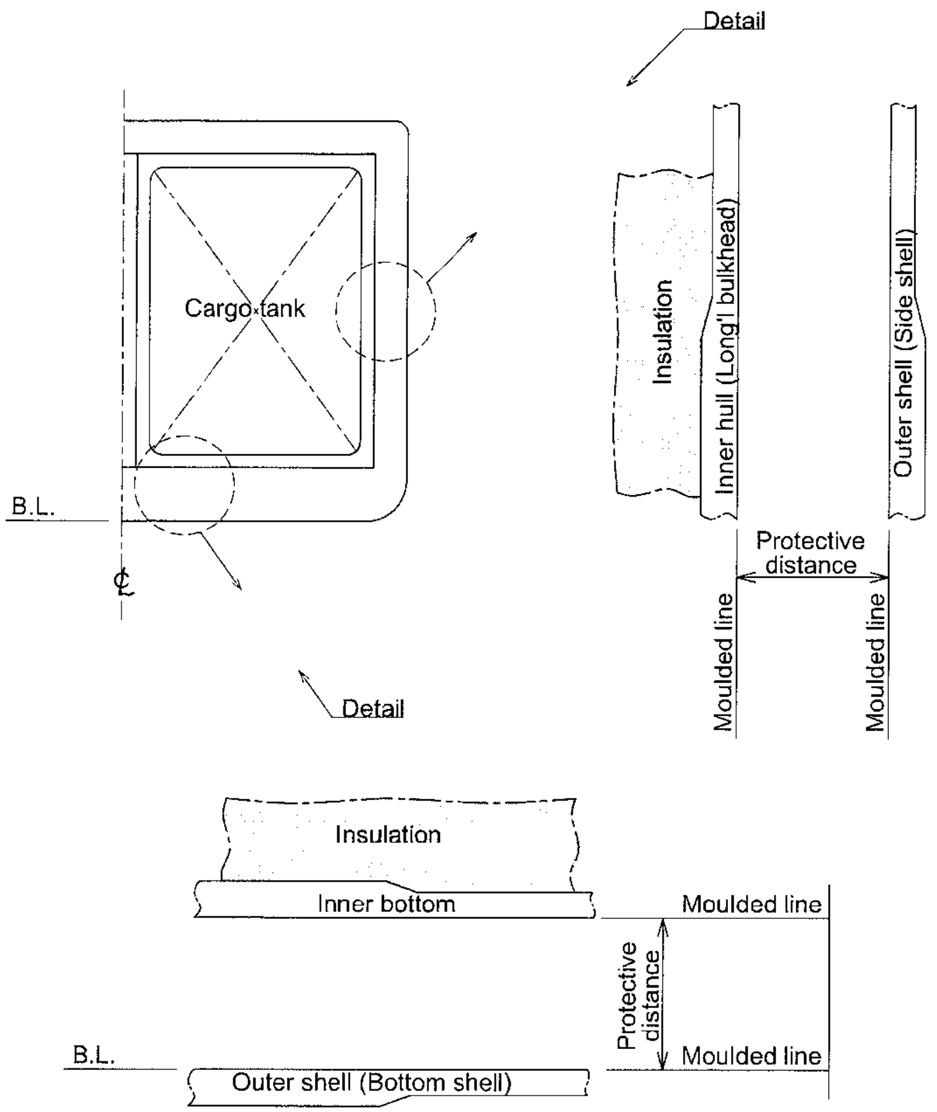


Figure 2.4 - *Cargo tank location requirements*



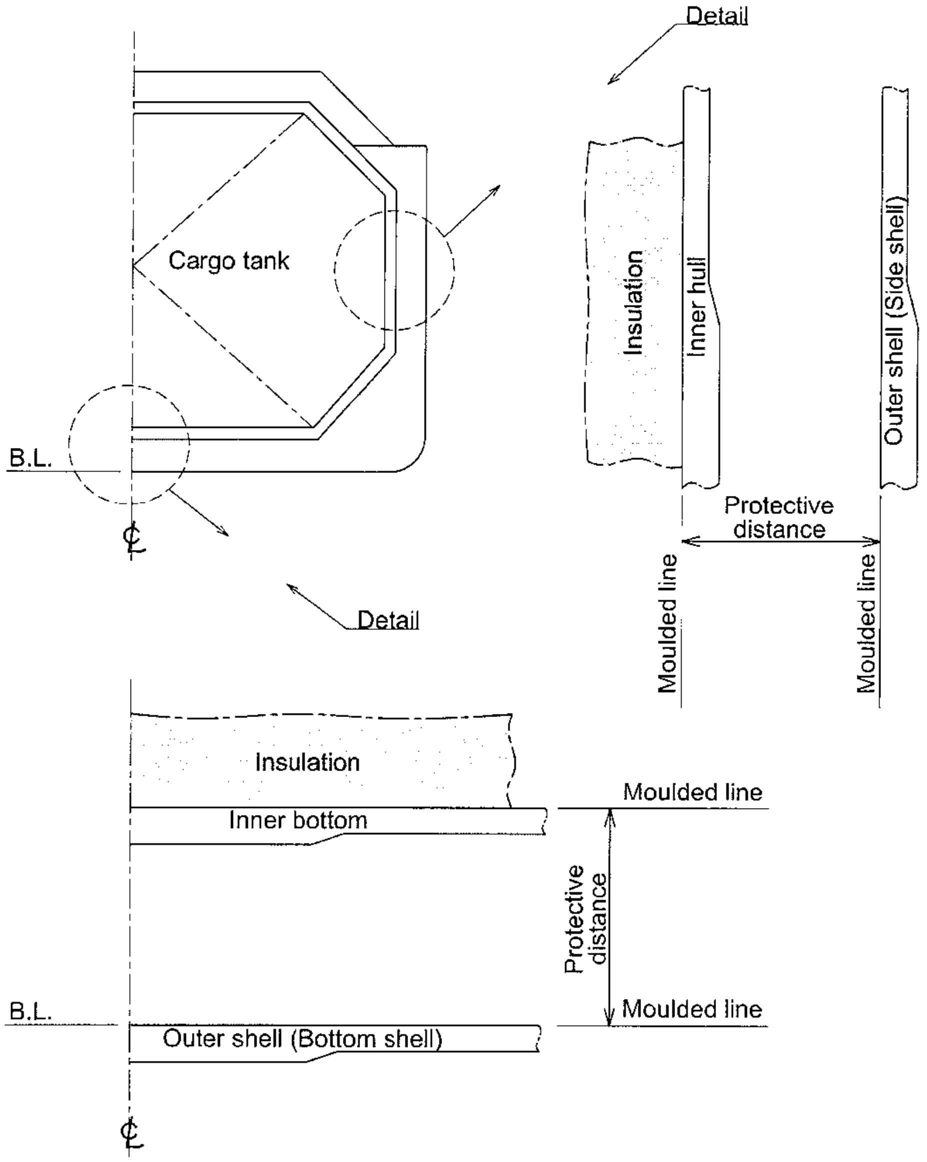
Independent prismatic tank

Figure 2.5(a) - *Protective distance*



Semi-membrane tank

Figure 2.5(b) - *Protective distance*



Membrane tank

Figure 2.5(c) - *Protective distance*

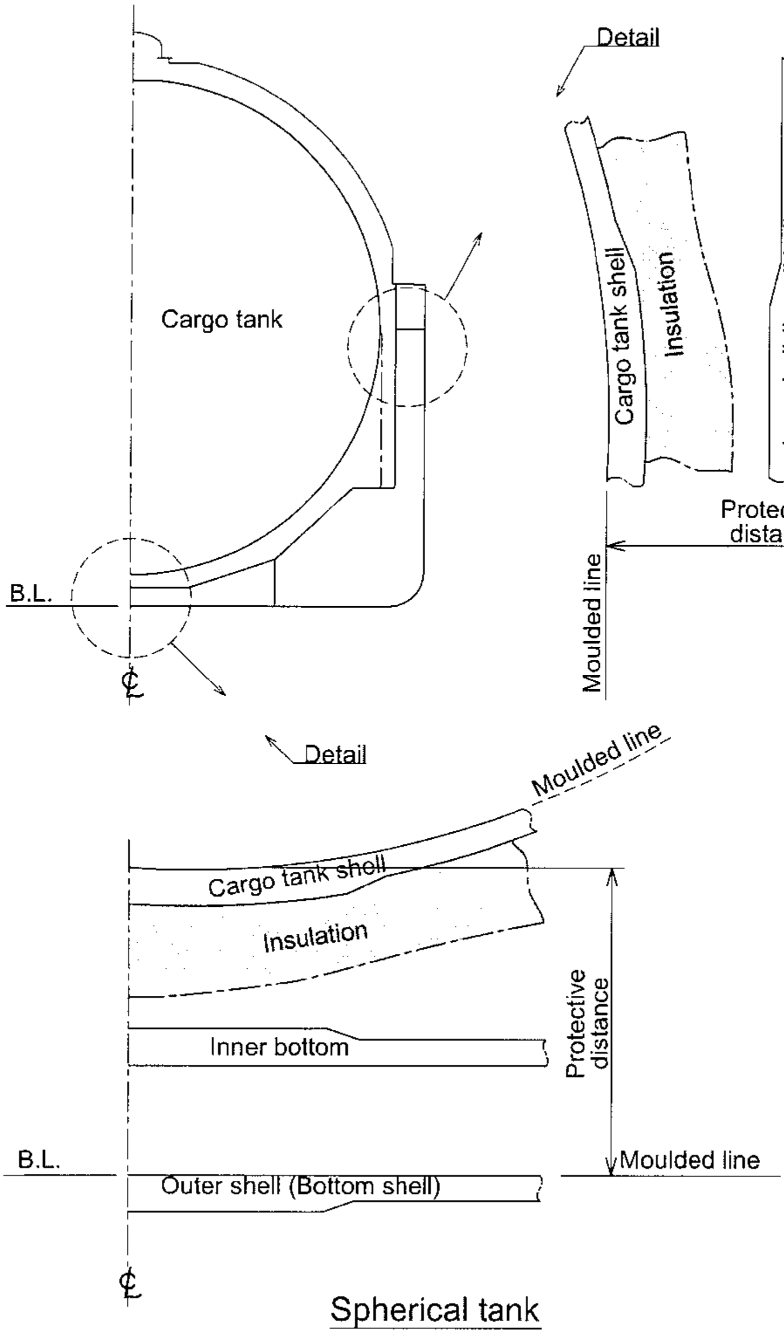
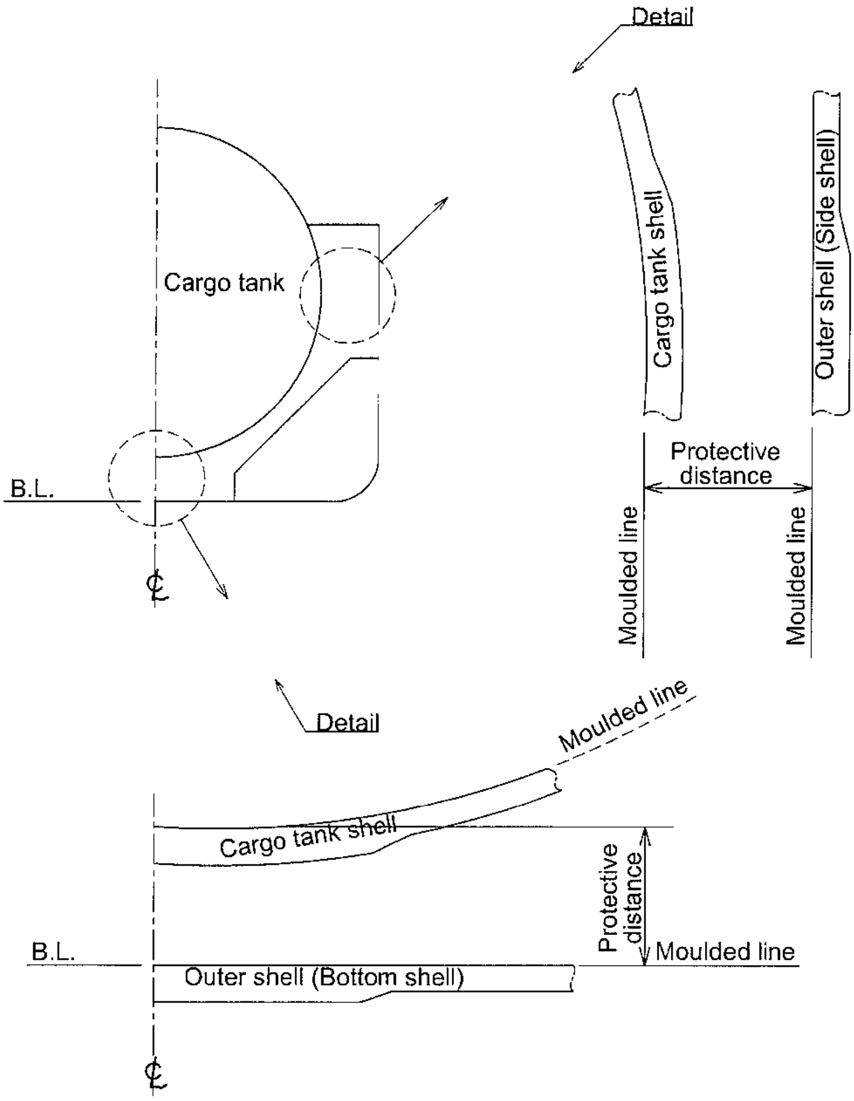


Figure 2.5(d) - *Protective distance*



Pressure type tank

Figure 2.5(e) - *Protective distance*

2.4.3 Except for type 1G ships, suction wells installed in cargo tanks may protrude into the vertical extent of bottom damage specified in 2.3.1.2.3 provided that such wells are as small as practicable and the protrusion below the inner bottom plating does not exceed 25% of the depth of the double bottom or 350 mm, whichever is less. Where there is no double bottom, the protrusion below the upper limit of bottom damage shall not exceed 350 mm. Suction wells installed in accordance with this paragraph may be ignored when determining the compartments affected by damage.

2.4.4 Cargo tanks shall not be located forward of the collision bulkhead.

2.5 Flood assumptions

2.5.1 The requirements of 2.7 shall be confirmed by calculations that take into consideration the design characteristics of the ship, the arrangements, configuration and contents of the damaged compartments, the distribution, relative densities and the free surface effects of liquids and the draught and trim for all conditions of loading.

2.5.2 The permeabilities of spaces assumed to be damaged shall be as follows:

Spaces	Permeabilities
Stores	0.6
Accommodation	0.95
Machinery	0.85
Voids	0.95
Hold spaces	0.95[1]
Consumable liquids	0 to 0.95[2]
Other liquids	0 to 0.95[2]

Note 1 Other values of permeability can be considered based on the detailed calculations. Interpretations of regulation of part B-1 of SOLAS chapter II-1 (MSC/Circ.651) are referred.

Note 2 The permeability of partially filled compartments shall be consistent with the amount of liquid carried in the compartment.

2.5.3 Wherever damage penetrates a tank containing liquids, it shall be assumed that the contents are completely lost from that compartment and replaced by salt water up to the level of the final plane of equilibrium.

2.5.4 Where the damage between transverse watertight bulkheads is envisaged, as specified in 2.6.1.4, 2.6.1.5, and 2.6.1.6, transverse bulkheads shall be spaced at least at a distance equal to the longitudinal extent of damage specified in 2.3.1.1.1 in order to be considered effective. Where transverse bulkheads are spaced at a lesser distance, one or more of these bulkheads within such extent of damage shall be assumed as non-existent for the purpose of determining flooded compartments. Further, any portion of a transverse bulkhead bounding side compartments or double bottom compartments shall be assumed damaged if the watertight bulkhead boundaries are within the extent of vertical or horizontal penetration required by 2.3. Also, any transverse bulkhead shall be assumed damaged if it contains a step or recess of more than 3 m in length located within the extent of penetration of assumed damage. The step formed by the after peak bulkhead and the after peak tank top shall not be regarded as a step for the purpose of this paragraph.

2.5.5 The ship shall be designed to keep unsymmetrical flooding to the minimum consistent with efficient arrangements.

2.5.6 Equalization arrangements requiring mechanical aids such as valves or cross-levelling pipes, if fitted, shall not be considered for the purpose of reducing an angle of heel or attaining the minimum range of residual stability to meet the requirements of 2.7.1, and sufficient residual stability shall be maintained during all stages where equalization is used. Spaces linked by ducts of large cross-sectional area may be considered to be common.

2.5.7 If pipes, ducts, trunks or tunnels are situated within the assumed extent of damage penetration, as defined in 2.3, arrangements shall be such that progressive flooding cannot thereby extend to compartments other than those assumed to be flooded for each case of damage.

2.5.8 The buoyancy of any superstructure directly above the side damage shall be disregarded. However, the unflooded parts of superstructures beyond the extent of damage may be taken into consideration, provided that:

.1 they are separated from the damaged space by watertight divisions and the requirements of 2.7.1.1 in respect of these intact spaces are complied with; and

.2 openings in such divisions are capable of being closed by remotely operated sliding watertight doors and unprotected openings are not immersed within the minimum range of residual stability required in 2.7.2.1. However, the immersion of any other openings capable of being closed weathertight may be permitted.

2.6 Standard of damage

2.6.1 Ships shall be capable of surviving the damage indicated in 2.3 with the flood assumptions in 2.5, to the extent determined by the ship's type, according to the following standards:

.1 a type 1G ship shall be assumed to sustain damage anywhere in its length;

.2 a type 2G ship of more than 150 m in length shall be assumed to sustain damage anywhere in its length;

.3 a type 2G ship of 150 m in length or less shall be assumed to sustain damage anywhere in its length, except involving either of the bulkheads bounding a machinery space located aft;

.4 a type 2PG ship shall be assumed to sustain damage anywhere in its length except involving transverse bulkheads spaced further apart than the longitudinal extent of damage as specified in 2.3.1.1.1;

.5 a type 3G ship of 80 m in length or more shall be assumed to sustain damage anywhere in its length, except involving transverse bulkheads spaced further apart than the longitudinal extent of damage specified in 2.3.1.1.1; and

.6 a type 3G ship less than 80 m in length shall be assumed to sustain damage anywhere in its length, except involving transverse bulkheads spaced further apart than the longitudinal extent of damage specified in 2.3.1.1.1 and except damage involving the machinery space when located after.

2.6.2 In the case of small type 2G/2PG and 3G ships that do not comply in all respects with the appropriate requirements of 2.6.1.3, 2.6.1.4 and 2.6.1.6, special dispensations may only be considered by the Administration provided that alternative measures can be taken which maintain the same degree of safety. The nature of the alternative measures shall be approved and clearly stated and be available to the port Administration. Any such dispensation shall be duly noted on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk referred to in 1.4.4.

2.7 Survival requirements

Ships subject to the Code shall be capable of surviving the assumed damage specified in 2.3, to the standard provided in 2.6, in a condition of stable equilibrium and shall satisfy the following criteria.

2.7.1 In any stage of flooding:

.1 the waterline, taking into account sinkage, heel and trim, shall be below the lower edge of any opening through which progressive flooding or downflooding may take place. Such openings shall include air pipes and openings that are closed by means of weathertight doors or hatch covers and may exclude those openings closed by means of watertight manhole covers and watertight flush scuttles, small watertight cargo tank hatch covers that maintain the high integrity of the deck, remotely operated watertight sliding doors and sidescuttles of the non-opening type;

.2 the maximum angle of heel due to unsymmetrical flooding shall not exceed 30°; and

.3 the residual stability during intermediate stages of flooding shall not be less than that required by 2.7.2.1.

2.7.2 At final equilibrium after flooding:

.1 the righting lever curve shall have a minimum range of 20° beyond the position of equilibrium in association with a maximum residual righting lever of at least 0.1 m within the 20° range; the area under the curve within this range shall not be less than 0.0175 m-radians. The 20° range may be measured from any angle commencing between the position of equilibrium and the angle of 25° (or 30° if no deck immersion occurs). Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. Within this range, the immersion of any of the openings listed in 2.7.1.1 and other openings capable of being closed weathertight may be permitted; and

.2 the emergency source of power shall be capable of operating.

CHAPTER 3

SHIP ARRANGEMENTS

Goal

To ensure that the cargo containment and handling system are located such that the consequences of any release of cargo will be minimized, and to provide safe access for operation and inspection.

3.1 Segregation of the cargo area

3.1.1 Hold spaces shall be segregated from machinery and boiler spaces, accommodation spaces, service spaces, control stations, chain lockers, domestic water tanks and from stores. Hold spaces shall be located forward of machinery spaces of category A. Alternative arrangements, including locating machinery spaces of category A forward, may be accepted, based on SOLAS regulation II-2/17, after further consideration of involved risks, including that of cargo release and the means of mitigation.

3.1.2 Where cargo is carried in a cargo containment system not requiring a complete or partial secondary barrier, segregation of hold spaces from spaces referred to in 3.1.1 or spaces either below or outboard of the hold spaces may be effected by cofferdams, oil fuel tanks or a single gastight bulkhead of all-welded construction forming an "A-60" class division. A gastight "A-0" class division is acceptable if there is no source of ignition or fire hazard in the adjoining spaces.

3.1.3 Where cargo is carried in a cargo containment system requiring a complete or partial secondary barrier, segregation of hold spaces from spaces referred to in 3.1.1, or spaces either below or outboard of the hold spaces that contain a source of ignition or fire hazard, shall be effected by cofferdams or oil fuel tanks. A gastight "A-0" class division is acceptable if there is no source of ignition or fire hazard in the adjoining spaces.

3.1.4 Turret compartments segregation from spaces referred to in 3.1.1, or spaces either below or outboard of the turret compartment that contain a source of ignition or fire hazard, shall be effected by cofferdams or an A-60 class division. A gastight "A-0" class division is acceptable if there is no source of ignition or fire hazard in the adjoining spaces.

3.1.5 In addition, the risk of fire propagation from turret compartments to adjacent spaces shall be evaluated by a risk analysis (see 1.1.11) and further preventive measures, such as the arrangement of a cofferdam around the turret compartment, shall be provided if needed.

3.1.6 When cargo is carried in a cargo containment system requiring a complete or partial secondary barrier:

.1 at temperatures below -10°C, hold spaces shall be segregated from the sea by a double bottom; and

.2 at temperatures below -55°C, the ship shall also have a longitudinal bulkhead forming side tanks.

3.1.7 Arrangements shall be made for sealing the weather decks in way of openings for cargo containment systems.

3.2 Accommodation, service and machinery spaces and control stations

3.2.1 No accommodation space, service space or control station shall be located within the cargo area. The bulkhead of accommodation spaces, service spaces or control stations that face the cargo area shall be so located as to avoid the entry of gas from the hold space to such spaces through a single failure of a deck or bulkhead on a ship having a containment system requiring a secondary barrier.

3.2.2 To guard against the danger of hazardous vapours, due consideration shall be given to the location of air intakes/outlets and openings into accommodation, service and machinery spaces and control stations in relation to cargo piping, cargo vent systems and machinery space exhausts from gas burning arrangements.

3.2.3 Access through doors, gastight or otherwise, shall not be permitted from a non-hazardous area to a hazardous area except for access to service spaces forward of the cargo area through airlocks, as permitted by 3.6.1, when accommodation spaces are aft.

3.2.4.1 Entrances, air inlets and openings to accommodation spaces, service spaces, machinery spaces and control stations shall not face the cargo area. They shall be located on the end bulkhead not facing the cargo area or on the outboard side of the superstructure or deckhouse or on both at a distance of at least 4% of the length (*L*) of the ship but not less than 3 m from the end of the superstructure or deckhouse facing the cargo area. This distance, however, need not exceed 5 m.

3.2.4.2 Windows and sidescuttles facing the cargo area and on the sides of the superstructures or deckhouses within the distance mentioned above shall be of the fixed (non-opening) type. Wheelhouse windows may be non-fixed and wheelhouse doors may be located within the above limits so long as they are designed in a manner that a rapid and efficient gas and vapour tightening of the wheelhouse can be ensured.

3.2.4.3 For ships dedicated to the carriage of cargoes that have neither flammable nor toxic hazards, the Administration may approve relaxations from the above requirements.

3.2.4.4 Accesses to forecastle spaces containing sources of ignition may be permitted through a single door facing the cargo area, provided the doors are located outside hazardous areas as defined in chapter 10.

3.2.5 Windows and sidescuttles facing the cargo area and on the sides of the superstructures and deckhouses within the limits specified in 3.2.4, except wheelhouse windows, shall be constructed to "A-60" class. Wheelhouse windows shall be constructed to not less than "A-0" class (for external fire load). Sidescuttles in the shell below the uppermost continuous deck and in the first tier of the superstructure or deckhouse shall be of fixed (non-opening) type.

3.2.6 All air intakes, outlets and other openings into the accommodation spaces, service spaces and control stations shall be fitted with closing devices. When carrying toxic products, they shall be capable of being operated from inside the space. The requirement for fitting air intakes and openings with closing devices operated from inside the space for toxic products need not apply to spaces not normally manned, such as deck stores, forecastle stores, workshops. In addition, the requirement does not apply to cargo control rooms located within the cargo area.

3.2.7 Control rooms and machinery spaces of turret systems may be located in the cargo area forward or aft of cargo tanks in ships with such installations. Access to such spaces containing sources of ignition may be permitted through doors facing the cargo area, provided the doors are located outside hazardous areas or access is through airlocks.

3.3 Cargo machinery spaces and turret compartments

3.3.1 Cargo machinery spaces shall be situated above the weather deck and located within the cargo area. Cargo machinery spaces and turret compartments shall be treated as cargo pump-rooms for the purpose of fire protection according to SOLAS regulation II-2/9.2.4, and for the purpose of prevention of potential explosion according to SOLAS regulation II-2/4.5.10.

3.3.2 When cargo machinery spaces are located at the after end of the aftermost hold space or at the forward end of the foremost hold space, the limits of the cargo area, as defined in 1.2.7, shall be extended to include the cargo machinery spaces for the full breadth and depth of the ship and the deck areas above those spaces.

3.3.3 Where the limits of the cargo area are extended by 3.3.2, the bulkhead that separates the cargo machinery spaces from accommodation and service spaces, control stations and machinery spaces of category A shall be located so as to avoid the entry of gas to these spaces through a single failure of a deck or bulkhead.

3.3.4 Cargo compressors and cargo pumps may be driven by electric motors in an adjacent non-hazardous space separated by a bulkhead or deck, if the seal around the bulkhead penetration ensures effective gastight segregation of the two spaces. Alternatively, such equipment may be driven by certified safe electric motors adjacent to them if the electrical installation complies with the requirements of chapter 10.

3.3.5 Arrangements of cargo machinery spaces and turret compartments shall ensure safe unrestricted access for personnel wearing protective clothing and breathing apparatus, and in the event of injury to allow unconscious personnel to be removed. At least two widely separated escape routes and doors shall be provided in cargo machinery spaces, except that a single escape route may be accepted where the maximum travel distance to the door is 5 m or less.

3.3.6 All valves necessary for cargo handling shall be readily accessible to personnel wearing protective clothing. Suitable arrangements shall be made to deal with drainage of pump and compressor rooms.

3.3.7 Turret compartments shall be designed to retain their structural integrity in case of explosion or uncontrolled high-pressure gas release (overpressure and/or brittle fracture), the characteristics of which shall be substantiated on the basis of a risk analysis with due consideration of the capabilities of the pressure relieving devices.

3.4 Cargo control rooms

3.4.1 Any cargo control room shall be above the weather deck and may be located in the cargo area. The cargo control room may be located within the accommodation spaces, service spaces or control stations, provided the following conditions are complied with:

.1 the cargo control room is a non-hazardous area;

.2 if the entrance complies with 3.2.4.1, the control room may have access to the spaces described above; and

.3 if the entrance does not comply with 3.2.4.1, the cargo control room shall have no access to the spaces described above and the boundaries for such spaces shall be insulated to "A-60" class.

3.4.2 If the cargo control room is designed to be a non-hazardous area, instrumentation shall, as far as possible, be by indirect reading systems and shall, in any case, be designed to prevent any escape of gas into the atmosphere of that space. Location of the gas detection system within the cargo control room will not cause the room to be classified as a hazardous area, if installed in accordance with 13.6.11.

3.4.3 If the cargo control room for ships carrying flammable cargoes is classified as a hazardous area, sources of ignition shall be excluded and any electrical equipment shall be installed in accordance with chapter 10.

3.5 Access to spaces in the cargo area

3.5.1 Visual inspection of at least one side of the inner hull structure shall be possible without the removal of any fixed structure or fitting. If such a visual inspection, whether combined with those inspections required in 3.5.2, 4.6.2.4 or 4.20.3.7 or not, is only possible at the outer face of the inner hull, the inner hull shall not be a fuel-oil tank boundary wall.

3.5.2 Inspection of one side of any insulation in hold spaces shall be possible. If the integrity of the insulation system can be verified by inspection of the outside of the hold space boundary when tanks are at service temperature, inspection of one side of the insulation in the hold space need not be required.

3.5.3 Arrangements for hold spaces, void spaces, cargo tanks and other spaces classified as hazardous areas, shall be such as to allow entry and inspection of any such space by personnel wearing protective clothing and breathing apparatus and shall also allow for the evacuation of injured and/or unconscious personnel. Such arrangements shall comply with the following:

.1 Access shall be provided as follows:

.1 access to all cargo tanks. Access shall be direct from the weather deck;

.2 access through horizontal openings¸ hatches or manholes. The dimensions shall be sufficient to allow a person wearing a breathing apparatus to ascend or descend any ladder without obstruction, and also to provide a clear opening to facilitate the hoisting of an injured person from the bottom of the space. The minimum clear opening shall be not less than 600 mm x 600 mm;

.3 access through vertical openings or manholes providing passage through the length and breadth of the space. The minimum clear opening shall be not less than 600 mm x 800 mm at a height of not more than 600 mm from the bottom plating unless gratings or other footholds are provided; and

.4 circular access openings to type C tanks shall have a diameter of not less than 600 mm.

.2 The dimensions referred to in 3.5.3.1.2 and 3.5.3.1.3 may be decreased, if the requirements of 3.5.3 can be met to the satisfaction of the Administration.

.3 Where cargo is carried in a containment system requiring a secondary barrier, the requirements of 3.5.3.1.2 and 3.5.3.1.3 do not apply to spaces separated from a hold space by a single gastight steel boundary. Such spaces shall be provided only with direct or indirect access from the weather deck, not including any enclosed non-hazardous area.

.4 Access required for inspection shall be a designated access through structures below and above cargo tanks, which shall have at least the cross-sections as required by 3.5.3.1.3.

.5 For the purpose of 3.5.1 or 3.5.2, the following shall apply:

.1 where it is required to pass between the surface to be inspected, flat or curved, and structures such as deck beams, stiffeners, frames, girders, etc., the distance between that surface and the free edge of the structural elements shall be at least 380 mm. The distance between the surface to be inspected and the surface to which the above structural elements are fitted, e.g. deck, bulkhead or shell, shall be at least 450 mm for a curved tank surface (e.g. for a type C tank), or 600 mm for a flat tank surface (e.g. for a type A tank) (see figure 3.1);

.2 where it is not required to pass between the surface to be inspected and any part of the structure, for visibility reasons the distance between the free edge of that structural element and the surface to be inspected shall be at least 50 mm or half the breadth of the structure's face plate, whichever is the larger (see figure 3.2);

.3 if for inspection of a curved surface where it is required to pass between that surface and another surface, flat or curved, to which no structural elements are fitted, the distance between both surfaces shall be at least 380 mm (see figure 3.3). Where it is not required to pass between that curved surface and another surface, a smaller distance than 380 mm may be accepted taking into account the shape of the curved surface;

.4 if for inspection of an approximately flat surface where it is required to pass between two approximately flat and approximately parallel surfaces, to which no structural elements are fitted, the distance between those surfaces shall be at least 600 mm. Where fixed access ladders are fitted, a clearance of at least 450 mm shall be provided for access (see figure 3.4);

.5 the minimum distances between a cargo tank sump and adjacent double bottom structure in way of a suction well shall not be less than those shown in figure 3.5 (figure 3.5 shows that the distance between the plane surfaces of the sump and the well is a minimum of 150 mm and that the clearance between the edge between the inner bottom plate, and the vertical side of the well and the knuckle point between the spherical or circular surface and sump of the tank is at least 380 mm). If there is no suction well, the distance between the cargo tank sump and the inner bottom shall not be less than 50 mm;

.6 the distance between a cargo tank dome and deck structures shall not be less than 150 mm (see figure 3.6);

.7 fixed or portable staging shall be installed as necessary for inspection of cargo tanks, cargo tank supports and restraints (e.g. anti-pitching, anti-rolling and anti-flotation chocks), cargo tank insulation etc. This staging shall not impair the clearances specified in 3.5.3.5.1 to 3.5.3.5.4; and

.8 if fixed or portable ventilation ducting shall be fitted in compliance with 12.1.2, such ducting shall not impair the distances required under 3.5.3.5.1 to 3.5.3.5.4.

3.5.4 Access from the open weather deck to non-hazardous areas shall be located outside the hazardous areas as defined in chapter 10, unless the access is by means of an airlock in accordance with 3.6.

3.5.5 Turret compartments shall be arranged with two independent means of access/egress.

3.5.6 Access from a hazardous area below the weather deck to a non-hazardous area is not permitted.

3.6 Airlocks

3.6.1 Access between hazardous area on the open weather deck and non-hazardous spaces shall be by means of an airlock. This shall consist of two self-closing, substantially gastight, steel doors without any holding back arrangements, capable of maintaining the overpressure, at least 1.5 m but no more than 2.5 m apart. The airlock space shall be artificially ventilated from a non-hazardous area and maintained at an overpressure to the hazardous area on the weather deck.

3.6.2 Where spaces are protected by pressurization, the ventilation shall be designed and installed in accordance with recognized standards[5].

3.6.3 An audible and visible alarm system to give a warning on both sides of the airlock shall be provided. The visible alarm shall indicate if one door is open. The audible alarm shall sound if doors on both sides of the air lock are moved from the closed positions.

3.6.4 In ships carrying flammable products, electrical equipment that is located in spaces protected by airlocks and not of the certified safe type, shall be de-energized in case of loss of overpressure in the space.

3.6.5 Electrical equipment for manoeuvring, anchoring and mooring, as well as emergency fire pumps that are located in spaces protected by airlocks, shall be of a certified safe type.

3.6.6 The airlock space shall be monitored for cargo vapours (see 13.6.2).

3.6.7 Subject to the requirements of the International Convention on Load Lines in force, the door sill shall not be less than 300 mm in height.

3.7 Bilge, ballast and oil fuel arrangements

3.7.1 Where cargo is carried in a cargo containment system not requiring a secondary barrier, suitable drainage arrangements for the hold spaces that are not connected with the machinery space shall be provided. Means of detecting any leakage shall be provided.

3.7.2 Where there is a secondary barrier, suitable drainage arrangements for dealing with any leakage into the hold or insulation spaces through the adjacent ship structure shall be provided. The suction shall not lead to pumps inside the machinery space. Means of detecting such leakage shall be provided.

[5] Such as the recommended publication by the International Electrotechnical Commission, in particular IEC 60092-502:1999.

3.7.3 The hold or interbarrier spaces of type A independent tank ships shall be provided with a drainage system suitable for handling liquid cargo in the event of cargo tank leakage or rupture. Such arrangements shall provide for the return of any cargo leakage to the liquid cargo piping.

3.7.4 Arrangements referred to in 3.7.3 shall be provided with a removable spool piece.

3.7.5 Ballast spaces, including wet duct keels used as ballast piping, oil fuel tanks and non-hazardous spaces, may be connected to pumps in the machinery spaces. Dry duct keels with ballast piping passing through may be connected to pumps in the machinery spaces, provided the connections are led directly to the pumps, and the discharge from the pumps is led directly overboard with no valves or manifolds in either line that could connect the line from the duct keel to lines serving non-hazardous spaces. Pump vents shall not be open to machinery spaces.

3.8 Bow and stern loading and unloading arrangements

3.8.1 Subject to the requirements of this section and chapter 5, cargo piping may be arranged to permit bow or stern loading and unloading.

3.8.2 Bow or stern loading and unloading lines that are led past accommodation spaces, service spaces or control stations shall not be used for the transfer of products requiring a type 1G ship. Bow or stern loading and unloading lines shall not be used for the transfer of toxic products as specified in 1.2.53, where the design pressure is above 2.5 MPa.

3.8.3 Portable arrangements shall not be permitted.

3.8.4.1 Entrances, air inlets and openings to accommodation spaces, service spaces, machinery spaces and controls stations, shall not face the cargo shore connection location of bow or stern loading and unloading arrangements. They shall be located on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship, but not less than 3 m from the end of the superstructure or deckhouse facing the cargo shore connection location of the bow or stern loading and unloading arrangements. This distance need not exceed 5 m.

3.8.4.2 Windows and sidescuttles facing the shore connection location and on the sides of the superstructure or deckhouse within the distance mentioned above shall be of the fixed (non-opening) type.

3.8.4.3 In addition, during the use of the bow or stern loading and unloading arrangements, all doors, ports and other openings on the corresponding superstructure or deckhouse side shall be kept closed.

3.8.4.4 Where, in the case of small ships, compliance with 3.2.4.1 to 3.2.4.4 and 3.8.4.1 to 3.8.4.3 is not possible, the Administration may approve relaxations from the above requirements.

3.8.5 Deck openings and air inlets and outlets to spaces within distances of 10 m from the cargo shore connection location shall be kept closed during the use of bow or stern loading or unloading arrangements.

3.8.6 Firefighting arrangements for the bow or stern loading and unloading areas shall be in accordance with 11.3.1.4 and 11.4.6.

3.8.7 Means of communication between the cargo control station and the shore connection location shall be provided and, where applicable, certified for use in hazardous areas.

Figure 3.1

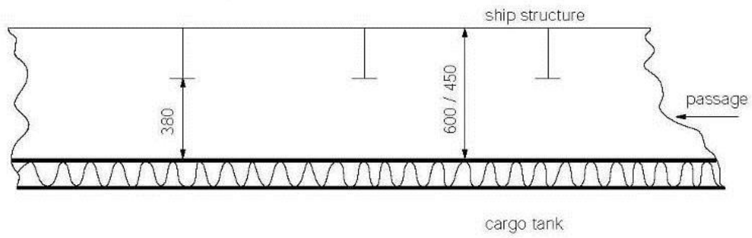


Figure 3.2

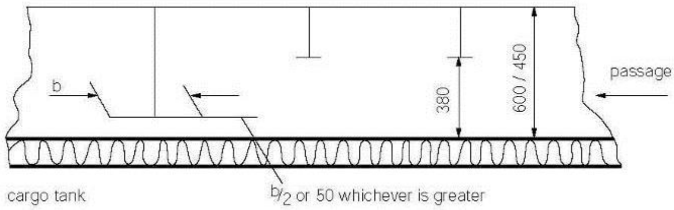


Figure 3.3

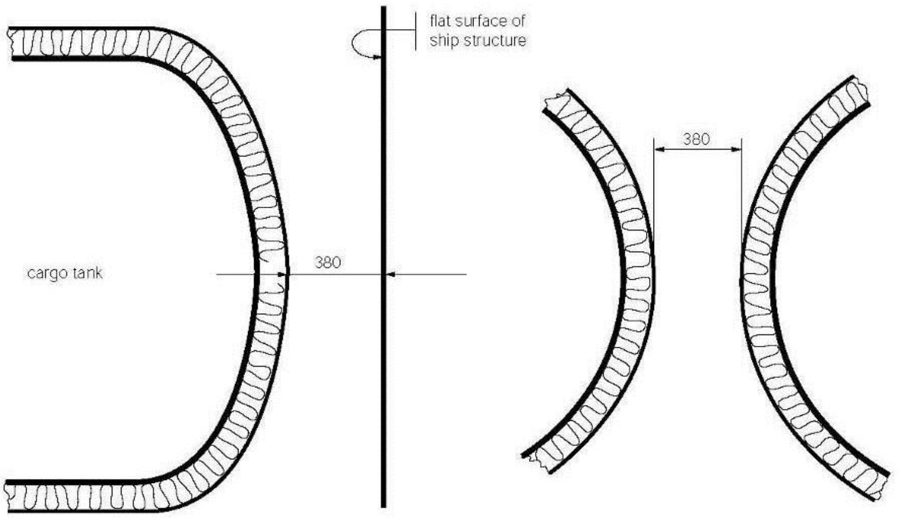


Figure 3.4

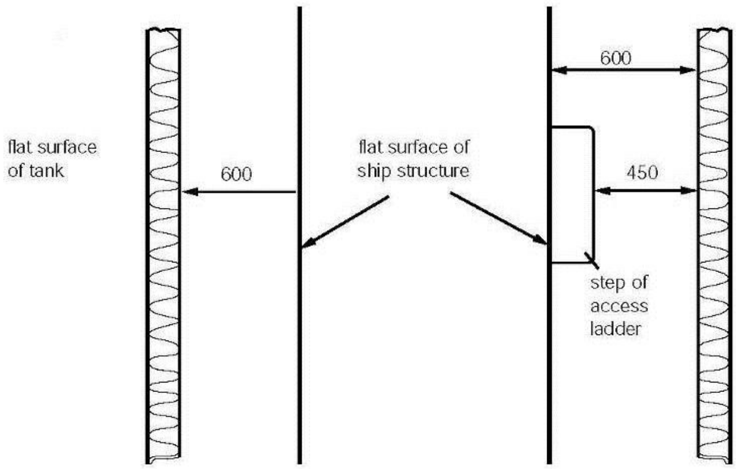
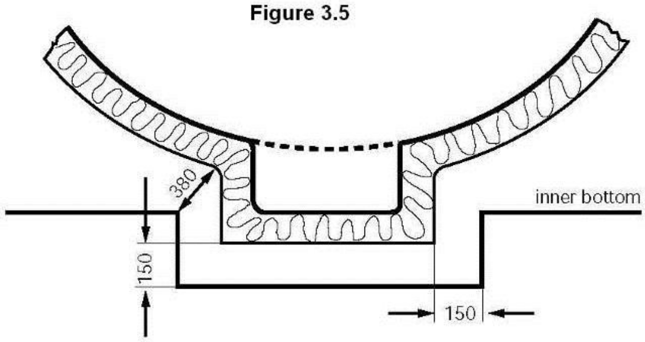


Figure 3.5



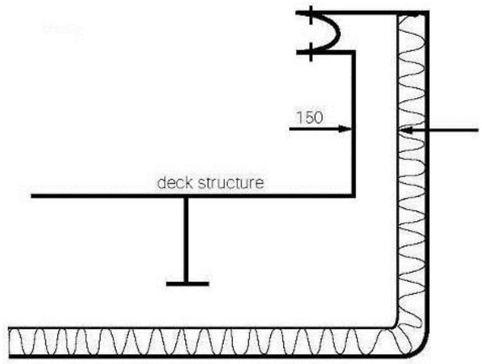


Figure 3.6

CHAPTER 4

CARGO CONTAINMENT

Goal

To ensure the safe containment of cargo under all design and operating conditions having regard to the nature of the cargo carried. This will include measures to:

.1 provide strength to withstand defined loads;

.2 maintain the cargo in a liquid state;

.3 design for or protect the hull structure from low temperature exposure; and

.4 prevent the ingress of water or air into the cargo containment system.

4.1 Definitions

4.1.1 *A cold spot* is a part of the hull or thermal insulation surface where a localized temperature decrease occurs with respect to the allowable minimum temperature of the hull or of its adjacent hull structure, or to design capabilities of cargo pressure/temperature control systems required in chapter 7.

4.1.2 *Design vapour pressure* "P_0" is the maximum gauge pressure, at the top of the tank, to be used in the design of the tank.

4.1.3 *Design temperature* for selection of materials is the minimum temperature at which cargo may be loaded or transported in the cargo tanks.

4.1.4 *Independent tanks* are self-supporting tanks. They do not form part of the ship's hull and are not essential to the hull strength. There are three categories of independent tank, which are referred to in 4.21, 4.22 and 4.23.

4.1.5 *Membrane tanks* are non-self-supporting tanks that consist of a thin liquid and gastight layer (membrane) supported through insulation by the adjacent hull structure. Membrane tanks are covered in 4.24.

4.1.6 *Integral tanks* are tanks that form a structural part of the hull and are influenced in the same manner by the loads that stress the adjacent hull structure. Integral tanks are covered in 4.25.

4.1.7 *Semi-membrane tanks* are non-self-supporting tanks in the loaded condition and consist of a layer, parts of which are supported through insulation by the adjacent hull structure. Semi-membrane tanks are covered in 4.26.

4.1.8 In addition to the definitions in 1.2, the definitions given in this chapter shall apply throughout the Code.

4.2 Application

Unless otherwise specified in part E, the requirements of parts A to D shall apply to all types of tanks, including those covered in part F.

PART A
CARGO CONTAINMENT

4.3 Functional requirements

4.3.1 The design life of the cargo containment system shall not be less than the design life of the ship.

4.3.2 Cargo containment systems shall be designed for North Atlantic environmental conditions and relevant long-term sea state scatter diagrams for unrestricted navigation. Lesser environmental conditions, consistent with the expected usage, may be accepted by the Administration for cargo containment systems used exclusively for restricted navigation. Greater environmental conditions may be required for cargo containment systems operated in conditions more severe than the North Atlantic environment.

4.3.3 Cargo containment systems shall be designed with suitable safety margins:

.1 to withstand, in the intact condition, the environmental conditions anticipated for the cargo containment system's design life and the loading conditions appropriate for them, which include full homogeneous and partial load conditions, partial filling within defined limits and ballast voyage loads; and

.2 being appropriate for uncertainties in loads, structural modelling, fatigue, corrosion, thermal effects, material variability, ageing and construction tolerances.

4.3.4 The cargo containment system structural strength shall be assessed against failure modes, including but not limited to plastic deformation, buckling and fatigue. The specific design conditions which shall be considered for the design of each cargo containment system are given in 4.21 to 4.26. There are three main categories of design conditions:

.1 Ultimate design conditions – the cargo containment system structure and its structural components shall withstand loads liable to occur during its construction, testing and anticipated use in service, without loss of structural integrity. The design shall take into account proper combinations of the following loads:

.1 internal pressure;

.2 external pressure;

.3 dynamic loads due to the motion of the ship;

.4 thermal loads;

.5 sloshing loads;

.6 loads corresponding to ship deflections;

.7 tank and cargo weight with the corresponding reaction in way of supports;

.8 insulation weight;

.9 loads in way of towers and other attachments; and

.10 test loads.

.2 Fatigue design conditions – the cargo containment system structure and its structural components shall not fail under accumulated cyclic loading.

.3 The cargo containment system shall meet the following criteria:

.1 Collision – the cargo containment system shall be protectively located in accordance with 2.4.1 and withstand the collision loads specified in 4.15.1 without deformation of the supports, or the tank structure in way of the supports, likely to endanger the tank structure.

.2 Fire – the cargo containment systems shall sustain, without rupture, the rise in internal pressure specified in 8.4.1 under the fire scenarios envisaged therein.

.3 Flooded compartment causing buoyancy on tank – the anti-flotation arrangements shall sustain the upward force, specified in 4.15.2, and there shall be no endangering plastic deformation to the hull.

4.3.5 Measures shall be applied to ensure that scantlings required meet the structural strength provisions and be maintained throughout the design life. Measures may include, but are not limited to, material selection, coatings, corrosion additions, cathodic protection and inerting. Corrosion allowance need not be required in addition to the thickness resulting from the structural analysis. However, where there is no environmental control, such as inerting around the cargo tank, or where the cargo is of a corrosive nature, the Administration or recognized organization acting on its behalf may require a suitable corrosion allowance.

4.3.6 An inspection/survey plan for the cargo containment system shall be developed and approved by the Administration or recognized organization acting on its behalf. The inspection/survey plan shall identify areas that need inspection during surveys throughout the cargo containment system's life and, in particular, all necessary in-service survey and maintenance that was assumed when selecting cargo containment system design parameters. Cargo containment systems shall be designed, constructed and equipped to provide adequate means of access to areas that need inspection as specified in the inspection/survey plan. Cargo containment systems, including all associated internal equipment, shall be designed and built to ensure safety during operations, inspection and maintenance (see 3.5).

4.4 Cargo containment safety principles

4.4.1 The containment systems shall be provided with a full secondary liquid-tight barrier capable of safely containing all potential leakages through the primary barrier and, in conjunction with the thermal insulation system, of preventing lowering of the temperature of the ship structure to an unsafe level.

4.4.2 However, the size and configuration or arrangement of the secondary barrier may be reduced where an equivalent level of safety is demonstrated in accordance with the requirements of 4.4.3 to 4.4.5, as applicable.

4.4.3 Cargo containment systems for which the probability for structural failures to develop into a critical state has been determined to be extremely low, but where the possibility of leakages through the primary barrier cannot be excluded, shall be equipped with a partial secondary barrier and small leak protection system capable of safely handling and disposing of the leakages. The arrangements shall comply with the following requirements:

.1 failure developments that can be reliably detected before reaching a critical state (e.g. by gas detection or inspection) shall have a sufficiently long development time for remedial actions to be taken; and

.2 failure developments that cannot be safely detected before reaching a critical state shall have a predicted development time that is much longer than the expected lifetime of the tank.

4.4.4 No secondary barrier is required for cargo containment systems, e.g. type C independent tanks, where the probability for structural failures and leakages through the primary barrier is extremely low and can be neglected.

4.4.5 No secondary barrier is required where the cargo temperature at atmospheric pressure is at or above -10°C.

4.5 Secondary barriers in relation to tank types

Secondary barriers in relation to the tank types defined in 4.21 to 4.26 shall be provided in accordance with the following table.

Cargo temperature at atmospheric pressure	**-10°C and above**	**Below -10°C down to -55°C**	**Below -55°C**
Basic tank type	No secondary barrier required	Hull may act as secondary barrier	Separate secondary barrier where required
Integral		Tank type not normally allowed[1]	
Membrane		Complete secondary barrier	
Semi-membrane		Complete secondary barrier[2]	
Independent:			
-type A		Complete secondary barrier	
-type B		Partial secondary barrier	
-type C		No secondary barrier required	

Note 1: A complete secondary barrier shall normally be required if cargoes with a temperature at atmospheric pressure below -10°C are permitted in accordance with 4.25.1.

Note 2: In the case of semi-membrane tanks that comply in all respects with the requirements applicable to type B independent tanks, except for the manner of support, the Administration may, after special consideration, accept a partial secondary barrier.

4.6 Design of secondary barriers

4.6.1 Where the cargo temperature at atmospheric pressure is not below -55°C, the hull structure may act as a secondary barrier based on the following:

.1 the hull material shall be suitable for the cargo temperature at atmospheric pressure as required by 4.19.1.4; and

.2 the design shall be such that this temperature will not result in unacceptable hull stresses.

4.6.2 The design of the secondary barrier shall be such that:

.1 it is capable of containing any envisaged leakage of liquid cargo for a period of 15 days, unless different criteria apply for particular voyages, taking into account the load spectrum referred to in 4.18.2.6;

.2 physical, mechanical, or operational events within the cargo tank that could cause failure of the primary barrier shall not impair the due function of the secondary barrier, or vice versa;

.3 failure of a support or an attachment to the hull structure will not lead to loss of liquid tightness of both the primary and secondary barriers;

.4 it is capable of being periodically checked for its effectiveness by means acceptable to the Administration or recognized organization acting on its behalf. This may be by means of a visual inspection or a pressure/vacuum test or other suitable means carried out according to a documented procedure agreed with the Administration or the recognized organization acting on its behalf;

.5 the methods required in .4 above shall be approved by the Administration or recognized organization acting on its behalf and shall include, where applicable to the test procedure:

  .1 details on the size of defect acceptable and the location within the secondary barrier, before its liquid-tight effectiveness is compromised;

  .2 accuracy and range of values of the proposed method for detecting defects in .1 above;

  .3 scaling factors to be used in determining the acceptance criteria, if full scale model testing is not undertaken; and

  .4 effects of thermal and mechanical cyclic loading on the effectiveness of the proposed test; and

.6 the secondary barrier shall fulfil its functional requirements at a static angle of heel of 30°.

4.7 Partial secondary barriers and primary barrier small leak protection system

4.7.1 Partial secondary barriers as permitted in 4.4.3 shall be used with a small leak protection system and meet all the requirements in 4.6.2. The small leak protection system shall include means to detect a leak in the primary barrier, provision such as a spray shield to deflect any liquid cargo down into the partial secondary barrier, and means to dispose of the liquid, which may be by natural evaporation.

4.7.2 The capacity of the partial secondary barrier shall be determined, based on the cargo leakage corresponding to the extent of failure resulting from the load spectrum referred to in 4.18.2.6, after the initial detection of a primary leak. Due account may be taken of liquid evaporation, rate of leakage, pumping capacity and other relevant factors.

4.7.3 The required liquid leakage detection may be by means of liquid sensors, or by an effective use of pressure, temperature or gas detection systems, or any combination thereof.

4.8 Supporting arrangements

4.8.1 The cargo tanks shall be supported by the hull in a manner that prevents bodily movement of the tank under the static and dynamic loads defined in 4.12 to 4.15, where applicable, while allowing contraction and expansion of the tank under temperature variations and hull deflections without undue stressing of the tank and the hull.

4.8.2 Anti-flotation arrangements shall be provided for independent tanks and capable of withstanding the loads defined in 4.15.2 without plastic deformation likely to endanger the hull structure.

4.8.3 Supports and supporting arrangements shall withstand the loads defined in 4.13.9 and 4.15, but these loads need not be combined with each other or with wave-induced loads.

4.9 Associated structure and equipment

4.9.1 Cargo containment systems shall be designed for the loads imposed by associated structure and equipment. This includes pump towers, cargo domes, cargo pumps and piping, stripping pumps and piping, nitrogen piping, access hatches, ladders, piping penetrations, liquid level gauges, independent level alarm gauges, spray nozzles, and instrumentation systems (such as pressure, temperature and strain gauges).

4.10 Thermal insulation

4.10.1 Thermal insulation shall be provided, as required, to protect the hull from temperatures below those allowable (see 4.19.1) and limit the heat flux into the tank to the levels that can be maintained by the pressure and temperature control system applied in chapter 7.

4.10.2 In determining the insulation performance, due regard shall be given to the amount of the acceptable boil-off in association with the reliquefaction plant on board, main propulsion machinery or other temperature control system.

PART B
DESIGN LOADS

4.11 General

This section defines the design loads to be considered with regard to the requirements in 4.16, 4.17 and 4.18. This includes:

.1 load categories (permanent, functional, environmental and accidental) and the description of the loads;

.2 the extent to which these loads shall be considered depending on the type of tank, and is more fully detailed in the following paragraphs; and

.3 tanks, together with their supporting structure and other fixtures, that shall be designed taking into account relevant combinations of the loads described below.

4.12 Permanent loads

4.12.1 ***Gravity loads***

The weight of tank, thermal insulation, loads caused by towers and other attachments shall be considered.

4.12.2 ***Permanent external loads***

Gravity loads of structures and equipment acting externally on the tank shall be considered.

4.13 Functional loads

4.13.1 Loads arising from the operational use of the tank system shall be classified as functional loads. All functional loads that are essential for ensuring the integrity of the tank system, during all design conditions, shall be considered. As a minimum, the effects from the following criteria, as applicable, shall be considered when establishing functional loads:

.1 internal pressure;

.2 external pressure;

.3 thermally induced loads;

.4 vibration;

.5 interaction loads;

.6 loads associated with construction and installation;

.7 test loads;

.8 static heel loads; and

.9 weight of cargo.

4.13.2 ***Internal pressure***

.1 In all cases, including 4.13.2.2, P_o shall not be less than MARVS.

.2 For cargo tanks, where there is no temperature control and where the pressure of the cargo is dictated only by the ambient temperature, P_o shall not be less than the gauge vapour pressure of the cargo at a temperature of 45°C except as follows:

   .1 lower values of ambient temperature may be accepted by the Administration or recognized organization acting on its behalf for ships operating in restricted areas. Conversely, higher values of ambient temperature may be required; and

   .2 for ships on voyages of restricted duration, P_o may be calculated based on the actual pressure rise during the voyage, and account may be taken of any thermal insulation of the tank.

.3 Subject to special consideration by the Administration and to the limitations given in 4.21 to 4.26, for the various tank types, a vapour pressure P_h higher than P_o may be accepted for site specific conditions (harbour or other locations), where dynamic loads are reduced. Any relief valve setting resulting from this paragraph shall be recorded in the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk.

.4 The internal pressure P_{eq} results from the vapour pressure P_o or P_h plus the maximum associated dynamic liquid pressure P_{gd}, , but not including the effects of liquid sloshing loads. Guidance formulae for associated dynamic liquid pressure P_{gd} are given in 4.28.1.

4.13.3 ***External pressure***

External design pressure loads shall be based on the difference between the minimum internal pressure and the maximum external pressure to which any portion of the tank may be simultaneously subjected.

4.13.4 ***Thermally induced loads***

4.13.4.1 Transient thermally induced loads during cooling down periods shall be considered for tanks intended for cargo temperatures below -55°C.

4.13.4.2 Stationary thermally induced loads shall be considered for cargo containment systems where the design supporting arrangements or attachments and operating temperature may give rise to significant thermal stresses (see 7.2).

4.13.5 ***Vibration***

The potentially damaging effects of vibration on the cargo containment system shall be considered.

4.13.6 ***Interaction loads***

The static component of loads resulting from interaction between cargo containment system and the hull structure, as well as loads from associated structure and equipment, shall be considered.

4.13.7 ***Loads associated with construction and installation***

Loads or conditions associated with construction and installation, e.g. lifting, shall be considered.

4.13.8 ***Test loads***

Account shall be taken of the loads corresponding to the testing of the cargo containment system referred to in 4.21 to 4.26.

4.13.9 ***Static heel loads***

Loads corresponding to the most unfavourable static heel angle within the range 0° to 30° shall be considered.

4.13.10 ***Other loads***

Any other loads not specifically addressed, which could have an effect on the cargo containment system, shall be taken into account.

4.14 Environmental loads

Environmental loads are defined as those loads on the cargo containment system that are caused by the surrounding environment and that are not otherwise classified as a permanent, functional or accidental load.

4.14.1 ***Loads due to ship motion***

4.14.1.1 The determination of dynamic loads shall take into account the long-term distribution of ship motion in irregular seas, which the ship will experience during its operating life. Account may be taken of the reduction in dynamic loads due to necessary speed reduction and variation of heading.

4.14.1.2 The ship's motion shall include surge, sway, heave, roll, pitch and yaw. The accelerations acting on tanks shall be estimated at their centre of gravity and include the following components:

.1 vertical acceleration: motion accelerations of heave, pitch and, possibly, roll (normal to the ship base);

.2 transverse acceleration: motion accelerations of sway, yaw and roll and gravity component of roll; and

.3 longitudinal acceleration: motion accelerations of surge and pitch and gravity component of pitch.

4.14.1.3 Methods to predict accelerations due to ship motion shall be proposed and approved by the Administration or recognized organization acting on its behalf.

4.14.1.4 Guidance formulae for acceleration components are given in 4.28.2.

4.14.1.5 Ships for restricted service may be given special consideration.

4.14.2 ***Dynamic interaction loads***

Account shall be taken of the dynamic component of loads resulting from interaction between cargo containment systems and the hull structure, including loads from associated structures and equipment.

4.14.3 ***Sloshing loads***

4.14.3.1 The sloshing loads on a cargo containment system and internal components shall be evaluated based on allowable filling levels.

4.14.3.2 When significant sloshing-induced loads are expected to be present, special tests and calculations shall be required covering the full range of intended filling levels.

4.14.4 ***Snow and ice loads***

Snow and icing shall be considered, if relevant.

4.14.5 ***Loads due to navigation in ice***

Loads due to navigation in ice shall be considered for vessels intended for such service.

4.15 Accidental loads

Accidental loads are defined as loads that are imposed on a cargo containment system and its supporting arrangements under abnormal and unplanned conditions.

4.15.1 ***Collision loads***

The collision load shall be determined based on the cargo containment system under fully loaded condition with an inertial force corresponding to 0.5 g in the forward direction and 0.25 g in the aft direction, where "g" is gravitational acceleration.

4.15.2 ***Loads due to flooding on ship***

For independent tanks, loads caused by the buoyancy of an empty tank in a hold space flooded to the summer load draught shall be considered in the design of the anti-flotation chocks and the supporting hull structure.

PART C
STRUCTURAL INTEGRITY

4.16 General

4.16.1 The structural design shall ensure that tanks have an adequate capacity to sustain all relevant loads with an adequate margin of safety. This shall take into account the possibility of plastic deformation, buckling, fatigue and loss of liquid and gas tightness.

4.16.2 The structural integrity of cargo containment systems shall be demonstrated by compliance with 4.21 to 4.26, as appropriate, for the cargo containment system type.

4.16.3 The structural integrity of cargo containment system types that are of novel design and differ significantly from those covered by 4.21 to 4.26 shall be demonstrated by compliance with 4.27 to ensure that the overall level of safety provided in this chapter is maintained.

4.17 Structural analyses

4.17.1 ***Analysis***

4.17.1.1 The design analyses shall be based on accepted principles of statics, dynamics and strength of materials.

4.17.1.2 Simplified methods or simplified analyses may be used to calculate the load effects, provided that they are conservative. Model tests may be used in combination with, or instead of, theoretical calculations. In cases where theoretical methods are inadequate, model or full-scale tests may be required.

4.17.1.3 When determining responses to dynamic loads, the dynamic effect shall be taken into account where it may affect structural integrity.

4.17.2 ***Load scenarios***

4.17.2.1 For each location or part of the cargo containment system to be considered and for each possible mode of failure to be analysed, all relevant combinations of loads that may act simultaneously shall be considered.

4.17.2.2 The most unfavourable scenarios for all relevant phases during construction, handling, testing and in service, and conditions shall be considered.

4.17.3 When the static and dynamic stresses are calculated separately, and unless other methods of calculation are justified, the total stresses shall be calculated according to:

$$\sigma_x = \sigma_{x.st} \pm \sqrt{\sum \left(\sigma_{x.dyn}\right)^2}$$
$$\sigma_y = \sigma_{y.st} \pm \sqrt{\sum \left(\sigma_{y.dyn}\right)^2}$$
$$\sigma_z = \sigma_{z.st} \pm \sqrt{\sum \left(\sigma_{z.dyn}\right)^2}$$

$$\tau_{xy} = \tau_{xy.st} \pm \sqrt{\sum \left(\tau_{xy.dyn}\right)^2}$$
$$\tau_{xz} = \tau_{xz.st} \pm \sqrt{\sum \left(\tau_{xz.dyn}\right)^2}$$
$$\tau_{yz} = \tau_{yz.st} \pm \sqrt{\sum \left(\tau_{yz.dyn}\right)^2}$$

where:

$\sigma_{x.st}$, $\sigma_{y.st}$, $\sigma_{z.st}$, $\tau_{xy.st}$, $\tau_{xz.st}$ and $\tau_{yz.st}$ are static stresses; and
$\sigma_{x.dyn}$, $\sigma_{y.dyn}$, $\sigma_{z.dyn}$, $\tau_{xy.dyn}$, $\tau_{xz.dyn}$ and $\tau_{yz.dyn}$ are dynamic stresses,

each shall be determined separately from acceleration components and hull strain components due to deflection and torsion.

4.18 Design conditions

All relevant failure modes shall be considered in the design for all relevant load scenarios and design conditions. The design conditions are given in the earlier part of this chapter, and the load scenarios are covered by 4.17.2.

4.18.1 ***Ultimate design condition***

Structural capacity may be determined by testing, or by analysis, taking into account both the elastic and plastic material properties, by simplified linear elastic analysis or by the Code provisions.

4.18.1.1 Plastic deformation and buckling shall be considered.

4.18.1.2 Analysis shall be based on characteristic load values as follows:

Permanent loads:	Expected values
Functional loads:	Specified values
Environmental loads:	For wave loads: most probable largest load encountered during 10^8 wave encounters.

4.18.1.3 For the purpose of ultimate strength assessment, the following material parameters apply:

.1.1 R_e = specified minimum yield stress at room temperature (N/mm^2). If the stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies.

.1.2 R_m = specified minimum tensile strength at room temperature (N/mm^2).

For welded connections where under-matched welds, i.e. where the weld metal has lower tensile strength than the parent metal, are unavoidable, such as in some aluminium alloys, the respective R_e and R_m of the welds, after any applied heat treatment, shall be used. In such cases, the transverse weld tensile strength shall not be less than the actual yield strength of the parent metal. If this cannot be achieved, welded structures made from such materials shall not be incorporated in cargo containment systems.

.2 The above properties shall correspond to the minimum specified mechanical properties of the material, including the weld metal in the as-fabricated condition. Subject to special consideration by the Administration or recognized organization acting on its behalf, account may be taken of the enhanced yield stress and tensile strength at low temperature. The temperature on which the material properties are based shall be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required in 1.4.

4.18.1.4 The equivalent stress σ_C (von Mises, Huber) shall be determined by:

$$\sigma_c = \sqrt{\sigma_x{}^2 + \sigma_y{}^2 + \sigma_z{}^2 - \sigma_x\sigma_y - \sigma_x\sigma_z - \sigma_y\sigma_z + 3(\tau_{xy}{}^2 + \tau_{xz}{}^2 + \tau_{yz}{}^2)}$$

where:

σ_x = total normal stress in x-direction;
σ_y = total normal stress in y-direction;
σ_z = total normal stress in z-direction;
τ_{xy} = total shear stress in x-y plane;
τ_{xz} = total shear stress in x-z plane; and
τ_{yz} = total shear stress in y-z plane.

The above values shall be calculated as described in 4.17.3.

4.18.1.5 Allowable stresses for materials other than those covered by chapter 6 shall be subject to approval by the Administration or recognized organization acting on its behalf in each case.

4.18.1.6 Stresses may be further limited by fatigue analysis, crack propagation analysis and buckling criteria.

4.18.2 ***Fatigue design condition***

4.18.2.1 The fatigue design condition is the design condition with respect to accumulated cyclic loading.

4.18.2.2 Where a fatigue analysis is required, the cumulative effect of the fatigue load shall comply with:

$$\sum \frac{n_i}{N_i} + \frac{n_{Loading}}{N_{Loading}} \leq C_w$$

where:

n_i = number of stress cycles at each stress level during the life of the tank;
N_i = number of cycles to fracture for the respective stress level according to the Wohler (S-N) curve;
$n_{Loading}$ = number of loading and unloading cycles during the life of the tank, not to be less than 1000[6]. Loading and unloading cycles include a complete pressure and thermal cycle;
$N_{Loading}$ = number of cycles to fracture for the fatigue loads due to loading and unloading; and
C_w = maximum allowable cumulative fatigue damage ratio.

The fatigue damage shall be based on the design life of the tank but not less than 10^8 wave encounters.

[6] 1,000 cycles normally corresponds to 20 years of operation.

4.18.2.3 Where required, the cargo containment system shall be subject to fatigue analysis, considering all fatigue loads and their appropriate combinations for the expected life of the cargo containment system. Consideration shall be given to various filling conditions.

4.18.2.4.1 Design S-N curves used in the analysis shall be applicable to the materials and weldments, construction details, fabrication procedures and applicable state of the stress envisioned.

4.18.2.4.2 The S-N curves shall be based on a 97.6% probability of survival corresponding to the mean-minus-two-standard-deviation curves of relevant experimental data up to final failure. Use of S-N curves derived in a different way requires adjustments to the acceptable C_w values specified in 4.18.2.7 to 4.18.2.9.

4.18.2.5 Analysis shall be based on characteristic load values as follows:

Permanent loads:	Expected values
Functional loads:	Specified values or specified history
Environmental loads:	Expected load history, but not less than 10^8 cycles

If simplified dynamic loading spectra are used for the estimation of the fatigue life, they shall be specially considered by the Administration or recognized organization acting on its behalf.

4.18.2.6.1 Where the size of the secondary barrier is reduced, as is provided for in 4.4.3, fracture mechanics analyses of fatigue crack growth shall be carried out to determine:

.1 crack propagation paths in the structure;

.2 crack growth rate;

.3 the time required for a crack to propagate to cause a leakage from the tank;

.4 the size and shape of through thickness cracks; and

.5 the time required for detectable cracks to reach a critical state.

The fracture mechanics are, in general, based on crack growth data taken as a mean value plus two standard deviations of the test data.

4.18.2.6.2 In analysing crack propagation, the largest initial crack not detectable by the inspection method applied shall be assumed, taking into account the allowable non-destructive testing and visual inspection criterion, as applicable.

4.18.2.6.3 Crack propagation analysis under the condition specified in 4.18.2.7: the simplified load distribution and sequence over a period of 15 days may be used. Such distributions may be obtained as indicated in figure 4.4. Load distribution and sequence for longer periods, such as in 4.18.2.8 and 4.18.2.9 shall be approved by the Administration or recognized organization acting on its behalf.

4.18.2.6.4 The arrangements shall comply with 4.18.2.7 to 4.18.2.9, as applicable.

4.18.2.7 For failures that can be reliably detected by means of leakage detection:

C_w shall be less than or equal to 0.5.

Predicted remaining failure development time, from the point of detection of leakage till reaching a critical state, shall not be less than 15 days, unless different requirements apply for ships engaged in particular voyages.

4.18.2.8 For failures that cannot be detected by leakage but that can be reliably detected at the time of in-service inspections:

C_w shall be less than or equal to 0.5.

Predicted remaining failure development time, from the largest crack not detectable by in-service inspection methods until reaching a critical state, shall not be less than three times the inspection interval.

4.18.2.9 In particular locations of the tank, where effective defect or crack development detection cannot be assured, the following, more stringent, fatigue acceptance criteria shall be applied as a minimum:

C_w shall be less than or equal to 0.1.

Predicted failure development time, from the assumed initial defect until reaching a critical state, shall not be less than three times the lifetime of the tank.

4.18.3 ***Accident design condition***

4.18.3.1 The accident design condition is a design condition for accidental loads with extremely low probability of occurrence.

4.18.3.2 Analysis shall be based on the characteristic values as follows:

Permanent loads:	Expected values
Functional loads:	Specified values
Environmental loads:	Specified values
Accidental loads:	Specified values or expected values

4.18.3.3 Loads mentioned in 4.13.9 and 4.15 need not be combined with each other or with wave-induced loads.

PART D
MATERIALS AND CONSTRUCTION

4.19 Materials

Goal

To ensure that the cargo containment system, primary and secondary barriers, the thermal insulation, adjacent ship structure and other materials in the cargo containment system are constructed from materials of suitable properties for the conditions they will experience, both in normal service and in the event of failure of the primary barrier, where applicable.

4.19.1 ***Materials forming ship structure***

4.19.1.1 To determine the grade of plate and sections used in the hull structure, a temperature calculation shall be performed for all tank types when the cargo temperature is below -10°C. The following assumptions shall be made in this calculation:

.1 the primary barrier of all tanks shall be assumed to be at the cargo temperature;

.2 in addition to .1, where a complete or partial secondary barrier is required, it shall be assumed to be at the cargo temperature at atmospheric pressure for any one tank only;

.3 for worldwide service, ambient temperatures shall be taken as 5°C for air and 0ºC for seawater. Higher values may be accepted for ships operating in restricted areas and, conversely, lower values may be fixed by the Administration for ships trading to areas where lower temperatures are expected during the winter months;

.4 still air and seawater conditions shall be assumed, i.e. no adjustment for forced convection;

.5 degradation of the thermal insulation properties over the life of the ship due to factors such as thermal and mechanical ageing, compaction, ship motions and tank vibrations, as defined in 4.19.3.6 and 4.19.3.7, shall be assumed;

.6 the cooling effect of the rising boil-off vapour from the leaked cargo shall be taken into account, where applicable;

.7 credit for hull heating may be taken in accordance with 4.19.1.5, provided the heating arrangements are in compliance with 4.19.1.6;

.8 no credit shall be given for any means of heating, except as described in 4.19.1.5; and

.9 for members connecting inner and outer hulls, the mean temperature may be taken for determining the steel grade.

The ambient temperatures used in the design, described in this paragraph, shall be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required in 1.4.4.

4.19.1.2 The shell and deck plating of the ship and all stiffeners attached thereto shall be in accordance with recognized standards. If the calculated temperature of the material in the design condition is below -5°C due to the influence of the cargo temperature, the material shall be in accordance with table 6.5.

4.19.1.3 The materials of all other hull structures for which the calculated temperature in the design condition is below 0°C, due to the influence of cargo temperature and that do not form the secondary barrier, shall also be in accordance with table 6.5. This includes hull structure supporting the cargo tanks, inner bottom plating, longitudinal bulkhead plating, transverse bulkhead plating, floors, webs, stringers and all attached stiffening members.

4.19.1.4 The hull material forming the secondary barrier shall be in accordance with table 6.2. Where the secondary barrier is formed by the deck or side shell plating, the material grade required by table 6.2 shall be carried into the adjacent deck or side shell plating, where applicable, to a suitable extent.

4.19.1.5 Means of heating structural materials may be used to ensure that the material temperature does not fall below the minimum allowed for the grade of material specified in table 6.5. In the calculations required in 4.19.1.1, credit for such heating may be taken in accordance with the following:

.1 for any transverse hull structure;

.2 for longitudinal hull structure referred to in 4.19.1.2 and 4.19.1.3 where colder ambient temperatures are specified, provided the material remains suitable for the ambient temperature conditions of +5°C for air and 0°C for seawater with no credit taken in the calculations for heating; and

.3 as an alternative to .2, for longitudinal bulkhead between cargo tanks, credit may be taken for heating, provided the material remain suitable for a minimum design temperature of -30°C, or a temperature 30°C lower than that determined by 4.19.1.1 with the heating considered, whichever is less. In this case, the ship's longitudinal strength shall comply with SOLAS regulation II-1/3-1 for both when those bulkhead(s) are considered effective and not.

4.19.1.6 The means of heating referred to in 4.19.1.5 shall comply with the following requirements:

.1 the heating system shall be arranged so that, in the event of failure in any part of the system, standby heating can be maintained equal to not less than 100% of the theoretical heat requirement;

.2 the heating system shall be considered as an essential auxiliary. All electrical components of at least one of the systems provided in accordance with 4.19.1.5.1 shall be supplied from the emergency source of electrical power; and

.3 the design and construction of the heating system shall be included in the approval of the containment system by the Administration or recognized organization acting on its behalf.

4.19.2 ***Materials of primary and secondary barriers***

4.19.2.1 Metallic materials used in the construction of primary and secondary barriers not forming the hull, shall be suitable for the design loads that they may be subjected to, and be in accordance with, table 6.1, 6.2 or 6.3.

4.19.2.2 Materials, either non-metallic or metallic but not covered by tables 6.1, 6.2 and 6.3, used in the primary and secondary barriers may be approved by the Administration or recognized organization acting on its behalf, considering the design loads that they may be subjected to, their properties and their intended use.

4.19.2.3 Where non-metallic materials, including composites, are used for, or incorporated in the primary or secondary barriers, they shall be tested for the following properties, as applicable, to ensure that they are adequate for the intended service:

.1 compatibility with the cargoes;

.2 ageing;

.3 mechanical properties;

.4 thermal expansion and contraction;

.5 abrasion;

.6 cohesion;

.7 resistance to vibrations;

.8 resistance to fire and flame spread; and

.9 resistance to fatigue failure and crack propagation.

4.19.2.4 The above properties, where applicable, shall be tested for the range between the expected maximum temperature in service and +5°C below the minimum design temperature, but not lower than -196°C.

4.19.2.5.1 Where non-metallic materials, including composites, are used for the primary and secondary barriers, the joining processes shall also be tested as described above.

4.19.2.5.2 Guidance on the use of non-metallic materials in the construction of primary and secondary barriers is provided in appendix 4.

4.19.2.6 Consideration may be given to the use of materials in the primary and secondary barrier, which are not resistant to fire and flame spread, provided they are protected by a suitable system such as a permanent inert gas environment, or are provided with a fire-retardant barrier.

4.19.3 ***Thermal insulation and other materials used in cargo containment systems***

4.19.3.1 Load-bearing thermal insulation and other materials used in cargo containment systems shall be suitable for the design loads.

4.19.3.2 Thermal insulation and other materials used in cargo containment systems shall have the following properties, as applicable, to ensure that they are adequate for the intended service:

.1 compatibility with the cargoes;

.2 solubility in the cargo;

.3 absorption of the cargo;

.4 shrinkage;

.5 ageing;

.6 closed cell content;

.7 density;

.8 mechanical properties, to the extent that they are subjected to cargo and other loading effects, thermal expansion and contraction;

.9 abrasion;

.10 cohesion;

.11 thermal conductivity;

.12 resistance to vibrations;

.13 resistance to fire and flame spread; and

.14 resistance to fatigue failure and crack propagation.

4.19.3.3 The above properties, where applicable, shall be tested for the range between the expected maximum temperature in service and 5°C below the minimum design temperature, but not lower than -196°C.

4.19.3.4 Due to location or environmental conditions, thermal insulation materials shall have suitable properties of resistance to fire and flame spread and shall be adequately protected against penetration of water vapour and mechanical damage. Where the thermal insulation is located on or above the exposed deck, and in way of tank cover penetrations, it shall have suitable fire resistance properties in accordance with recognized standards or be covered with a material having low flame-spread characteristics and forming an efficient approved vapour seal.

4.19.3.5 Thermal insulation that does not meet recognized standards for fire resistance may be used in hold spaces that are not kept permanently inerted, provided its surfaces are covered with material with low flame-spread characteristics and that forms an efficient approved vapour seal.

4.19.3.6 Testing for thermal conductivity of thermal insulation shall be carried out on suitably aged samples.

4.19.3.7 Where powder or granulated thermal insulation is used, measures shall be taken to reduce compaction in service and to maintain the required thermal conductivity and also prevent any undue increase of pressure on the cargo containment system.

4.20 Construction processes

Goal

To define suitable construction processes and test procedures in order to ensure, as far as reasonably practical, that the cargo containment system will perform satisfactorily in service in accordance with the assumptions made at the design stage.

4.20.1 ***Weld joint design***

4.20.1.1 All welded joints of the shells of independent tanks shall be of the in-plane butt weld full penetration type. For dome-to-shell connections only, tee welds of the full penetration type may be used depending on the results of the tests carried out at the approval of the welding procedure. Except for small penetrations on domes, nozzle welds shall also be designed with full penetration.

4.20.1.2 Welding joint details for type C independent tanks, and for the liquid-tight primary barriers of type B independent tanks primarily constructed of curved surfaces, shall be as follows:

.1 all longitudinal and circumferential joints shall be of butt welded, full penetration, double vee or single vee type. Full penetration butt welds shall be obtained by double welding or by the use of backing rings. If used, backing rings shall be removed except from very small process pressure vessels. Other edge preparations may be permitted, depending on the results of the tests carried out at the approval of the welding procedure; and

.2 the bevel preparation of the joints between the tank body and domes and between domes and relevant fittings shall be designed according to a standard acceptable to the Administration or recognized organization acting on its behalf. All welds connecting nozzles, domes or other penetrations of the vessel and all welds connecting flanges to the vessel or nozzles shall be full penetration welds.

4.20.1.3 Where applicable, all the construction processes and testing, except that specified in 4.20.3, shall be done in accordance with the applicable provisions of chapter 6.

4.20.2 ***Design for gluing and other joining processes***

The design of the joint to be glued (or joined by some other process except welding) shall take account of the strength characteristics of the joining process.

4.20.3 ***Testing***

4.20.3.1 All cargo tanks and process pressure vessels shall be subjected to hydrostatic or hydropneumatic pressure testing in accordance with 4.21 to 4.26, as applicable for the tank type.

4.20.3.2 All tanks shall be subject to a tightness test which may be performed in combination with the pressure test referred to in 4.20.3.1.

4.20.3.3 Requirements with respect to inspection of secondary barriers shall be decided by the Administration or recognized organization acting on its behalf in each case, taking into account the accessibility of the barrier (see 4.6.2).

4.20.3.4 The Administration may require that for ships fitted with novel type B independent tanks, or tanks designed according to 4.27 at least one prototype tank and its supporting structures shall be instrumented with strain gauges or other suitable equipment to confirm stress levels. Similar instrumentation may be required for type C independent tanks, depending on their configuration and on the arrangement of their supports and attachments.

4.20.3.5 The overall performance of the cargo containment system shall be verified for compliance with the design parameters during the first full loading and discharging of the cargo, in accordance with the survey procedure and requirements in 1.4 and the requirements of the Administration or recognized organization acting on its behalf. Records of the performance of the components and equipment essential to verify the design parameters, shall be maintained and be available to the Administration.

4.20.3.6 Heating arrangements, if fitted in accordance with 4.19.1.5 and 4.19.1.6, shall be tested for required heat output and heat distribution.

4.20.3.7 The cargo containment system shall be inspected for cold spots during, or immediately following, the first loaded voyage. Inspection of the integrity of thermal insulation surfaces that cannot be visually checked shall be carried out in accordance with recognized standards.

PART E
TANK TYPES

4.21 Type A independent tanks

4.21.1 *Design basis*

4.21.1.1 Type A independent tanks are tanks primarily designed using classical ship-structural analysis procedures in accordance with recognized standards. Where such tanks are primarily constructed of plane surfaces, the design vapour pressure P_o shall be less than 0.07 MPa.

4.21.1.2 If the cargo temperature at atmospheric pressure is below -10°C, a complete secondary barrier shall be provided as required in 4.5. The secondary barrier shall be designed in accordance with 4.6.

4.21.2 *Structural analysis*

4.21.2.1 A structural analysis shall be performed taking into account the internal pressure as indicated in 4.13.2, and the interaction loads with the supporting and keying system as well as a reasonable part of the ship's hull.

4.21.2.2 For parts, such as supporting structures, not otherwise covered by the requirements of the Code, stresses shall be determined by direct calculations, taking into account the loads referred to in 4.12 to 4.15 as far as applicable, and the ship deflection in way of supporting structures.

4.21.2.3 The tanks with supports shall be designed for the accidental loads specified in 4.15. These loads need not be combined with each other or with environmental loads.

4.21.3 *Ultimate design condition*

4.21.3.1 For tanks primarily constructed of plane surfaces, the nominal membrane stresses for primary and secondary members (stiffeners, web frames, stringers, girders), when calculated by classical analysis procedures, shall not exceed the lower of R_m/2.66 or R_e/1.33 for nickel steels, carbon-manganese steels, austenitic steels and aluminium alloys, where R_m and R_e are defined in 4.18.1.3. However, if detailed calculations are carried out for the primary members, the equivalent stress σ_c, as defined in 4.18.1.4, may be increased over that indicated above to a stress acceptable to the Administration or recognized organization acting on its behalf. Calculations shall take into account the effects of bending, shear, axial and torsional deformation as well as the hull/cargo tank interaction forces due to the deflection of the double bottom and cargo tank bottoms.

4.21.3.2 Tank boundary scantlings shall meet at least the requirements of the Administration or recognized organization acting on its behalf for deep tanks taking into account the internal pressure as indicated in 4.13.2 and any corrosion allowance required by 4.3.5.

4.21.3.3 The cargo tank structure shall be reviewed against potential buckling.

4.21.4 *Accident design condition*

4.21.4.1 The tanks and the tank supports shall be designed for the accidental loads and design conditions specified in 4.3.4.3 and 4.15, as relevant.

4.21.4.2 When subjected to the accidental loads specified in 4.15, the stress shall comply with the acceptance criteria specified in 4.21.3, modified as appropriate, taking into account their lower probability of occurrence.

4.21.5 ***Testing***

All type A independent tanks shall be subjected to a hydrostatic or hydropneumatic test. This test shall be performed such that the stresses approximate, as far as practicable, the design stresses, and that the pressure at the top of the tank corresponds at least to the MARVS. When a hydropneumatic test is performed, the conditions shall simulate, as far as practicable, the design loading of the tank and of its support structure, including dynamic components, while avoiding stress levels that could cause permanent deformation.

4.22 Type B independent tanks

4.22.1 ***Design basis***

4.22.1.1 Type B independent tanks are tanks designed using model tests, refined analytical tools and analysis methods to determine stress levels, fatigue life and crack propagation characteristics. Where such tanks are primarily constructed of plane surfaces (prismatic tanks), the design vapour pressure P_o shall be less than 0.07 MPa.

4.22.1.2 If the cargo temperature at atmospheric pressure is below -10°C, a partial secondary barrier with a small leak protection system shall be provided as required in 4.5. The small leak protection system shall be designed according to 4.7.

4.22.2 ***Structural analysis***

4.22.2.1 The effects of all dynamic and static loads shall be used to determine the suitability of the structure with respect to:

.1 plastic deformation;

.2 buckling;

.3 fatigue failure; and

.4 crack propagation.

Finite element analysis or similar methods and fracture mechanics analysis, or an equivalent approach, shall be carried out.

4.22.2.2 A three-dimensional analysis shall be carried out to evaluate the stress levels, including interaction with the ship's hull. The model for this analysis shall include the cargo tank with its supporting and keying system, as well as a reasonable part of the hull.

4.22.2.3 A complete analysis of the particular ship accelerations and motions in irregular waves, and of the response of the ship and its cargo tanks to these forces and motions shall be performed, unless the data is available from similar ships.

4.22.3 ***Ultimate design condition***

4.22.3.1 Plastic deformation

4.22.3.1.1 For type B independent tanks, primarily constructed of bodies of revolution, the allowable stresses shall not exceed:

$\sigma_m \leq f$
$\sigma_L \leq 1.5f$
$\sigma_b \leq 1.5F$
$\sigma_L+\sigma_b \leq 1.5F$
$\sigma_m+\sigma_b \leq 1.5F$
$\sigma_m+\sigma_b+\sigma_g \leq 3.0F$
$\sigma_L+\sigma_b+\sigma_g \leq 3.0F$

where:

σ_m = equivalent primary general membrane stress;

σ_L = equivalent primary local membrane stress;

σ_b = equivalent primary bending stress;

σ_g = equivalent secondary stress;

f = the lesser of (R_m / A) or (R_e / B); and

F = the lesser of (R_m / C) or (R_e / D),

with R_m and R_e as defined in 4.18.1.3. With regard to the stresses σ_m, σ_L, σ_b and σ_g, the definition of stress categories in 4.28.3 are referred. The values A and B shall be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk and shall have at least the following minimum values:

	Nickel steels and carbon manganese steels	**Austenitic steels**	**Aluminium alloys**
A	3	3.5	4
B	2	1.6	1.5
C	3	3	3
D	1.5	1.5	1.5

The above figures may be altered, taking into account the design condition considered in acceptance with the Administration.

4.22.3.1.2 For type B independent tanks, primarily constructed of plane surfaces, the allowable membrane equivalent stresses applied for finite element analysis shall not exceed:

.1 for nickel steels and carbon-manganese steels, the lesser of R_m/2 or R_e/1.2;

.2 for austenitic steels, the lesser of R_m/2.5 or R_e/1.2; and

.3 for aluminium alloys, the lesser of R_m/2.5 or R_e /1.2.

The above figures may be amended, taking into account the locality of the stress, stress analysis methods and design condition considered in acceptance with the Administration.

4.22.3.1.3 The thickness of the skin plate and the size of the stiffener shall not be less than those required for type A independent tanks.

4.22.3.2 ***Buckling***

Buckling strength analyses of cargo tanks subject to external pressure and other loads causing compressive stresses shall be carried out in accordance with recognized standards. The method shall adequately account for the difference in theoretical and actual buckling stress as a result of plate edge misalignment, lack of straightness or flatness, ovality and deviation from true circular form over a specified arc or chord length, as applicable.

4.22.4 ***Fatigue design condition***

4.22.4.1 Fatigue and crack propagation assessment shall be performed in accordance with 4.18.2. The acceptance criteria shall comply with 4.18.2.7, 4.18.2.8 or 4.18.2.9, depending on the detectability of the defect.

4.22.4.2 Fatigue analysis shall consider construction tolerances.

4.22.4.3 Where deemed necessary by the Administration, model tests may be required to determine stress concentration factors and fatigue life of structural elements.

4.22.5 ***Accident design condition***

4.22.5.1 The tanks and the tank supports shall be designed for the accidental loads and design conditions specified in 4.3.4.3 and 4.15, as applicable.

4.22.5.2 When subjected to the accidental loads specified in 4.15, the stress shall comply with the acceptance criteria specified in 4.22.3, modified as appropriate, taking into account their lower probability of occurrence.

4.22.6 ***Testing***

Type B independent tanks shall be subjected to a hydrostatic or hydropneumatic test as follows:

.1 the test shall be performed as required in 4.21.5 for type A independent tanks; and

.2 in addition, the maximum primary membrane stress or maximum bending stress in primary members under test conditions shall not exceed 90% of the yield strength of the material (as fabricated) at the test temperature. To ensure that this condition is satisfied, when calculations indicate that this stress exceeds 75% of the yield strength, the prototype test shall be monitored by the use of strain gauges or other suitable equipment.

4.22.7 ***Marking***

Any marking of the pressure vessel shall be achieved by a method that does not cause unacceptable local stress raisers.

4.23 Type C independent tanks

4.23.1 ***Design basis***

4.23.1.1 The design basis for type C independent tanks is based on pressure vessel criteria modified to include fracture mechanics and crack propagation criteria. The minimum design pressure defined in 4.23.1.2 is intended to ensure that the dynamic stress is sufficiently low, so that an initial surface flaw will not propagate more than half the thickness of the shell during the lifetime of the tank.

4.23.1.2 The design vapour pressure shall not be less than:

P_o $=0.2 + AC(\rho_r)^{1.5}$ (MPa)

where:

$$A = 0.00185\left(\frac{\sigma_m}{\Delta\sigma_A}\right)^2$$

with:

σ_m = design primary membrane stress;

$\Delta\sigma_A$ = allowable dynamic membrane stress (double amplitude at probability level Q = 10^{-8}) and equal to:

- 55 N/mm^2 for ferritic-perlitic, martensitic and austenitic steel;
- 25 N/mm^2 for aluminium alloy (5083-O);

C = a characteristic tank dimension to be taken as the greatest of the following:

h, 0.75b or 0.45ℓ,

with:

h = height of tank (dimension in ship's vertical direction) (m);

b = width of tank (dimension in ship's transverse direction)(m);

ℓ = length of tank (dimension in ship's longitudinal direction) (m);

ρ_r = the relative density of the cargo (ρ_r = 1 for fresh water) at the design temperature.

When a specified design life of the tank is longer than 10^8 wave encounters, $\Delta\sigma_A$ shall be modified to give equivalent crack propagation corresponding to the design life.

4.23.1.3 The Administration may allocate a tank complying with the criteria of type C tank minimum design pressure as in 4.23.1.2, to a type A or type B, dependent on the configuration of the tank and the arrangement of its supports and attachments.

4.23.2 ***Shell thickness***

4.23.2.1 The shell thickness shall be as follows:

.1 For pressure vessels, the thickness calculated according to 4.23.2.4 shall be considered as a minimum thickness after forming, without any negative tolerance.

.2 For pressure vessels, the minimum thickness of shell and heads including corrosion allowance, after forming, shall not be less than 5 mm for carbon-manganese steels and nickel steels, 3 mm for austenitic steels or 7 mm for aluminium alloys.

.3 The welded joint efficiency factor to be used in the calculation according to 4.23.2.4 shall be 0.95 when the inspection and the non-destructive testing referred to in 6.5.6.5 are carried out. This figure may be increased up to 1 when account is taken of other considerations, such as the material used, type of joints, welding procedure and type of loading. For process pressure vessels, the Administration or recognized organization acting on its behalf may accept partial non-destructive examinations, but not less than those of 6.5.6.5, depending on such factors as the material used, the design temperature, the nil-ductility transition temperature of the material, as fabricated, and the type of joint and welding procedure, but in this case an efficiency factor of not more than 0.85 shall be adopted. For special materials, the above-mentioned factors shall be reduced, depending on the specified mechanical properties of the welded joint.

4.23.2.2 The design liquid pressure defined in 4.13.2 shall be taken into account in the internal pressure calculations.

4.23.2.3 The design external pressure P_e, used for verifying the buckling of the pressure vessels, shall not be less than that given by:

$P_e = P_1+P_2+P_3+P_4$ (MPa),

where:

P_1 = setting value of vacuum relief valves. For vessels not fitted with vacuum relief valves, P_1 shall be specially considered, but shall not, in general, be taken as less than 0.025 MPa;

P_2 = the set pressure of the pressure relief valves (PRVs) for completely closed spaces containing pressure vessels or parts of pressure vessels; elsewhere P_2=0;

P_3 = compressive actions in or on the shell due to the weight and contraction of thermal insulation, weight of shell including corrosion allowance and other miscellaneous external pressure loads to which the pressure vessel may be subjected. These include, but are not limited to, weight of domes, weight of towers and piping, effect of product in the partially filled condition, accelerations and hull deflection. In addition, the local effect of external or internal pressures or both shall be taken into account; and

P_4 = external pressure due to head of water for pressure vessels or part of pressure vessels on exposed decks; elsewhere P_4 = 0.

4.23.2.4 Scantlings based on internal pressure shall be calculated as follows: the thickness and form of pressure-containing parts of pressure vessels, under internal pressure, as defined in 4.13.2, including flanges, shall be determined. These calculations shall in all cases be based on accepted pressure vessel design theory. Openings in pressure-containing parts of pressure vessels shall be reinforced in accordance with recognized standards.

4.23.2.5 Stress analysis in respect of static and dynamic loads shall be performed as follows:

.1 Pressure vessel scantlings shall be determined in accordance with 4.23.2.1 to 4.23.2.4 and 4.23.3.

.2 Calculations of the loads and stresses in way of the supports and the shell attachment of the support shall be made. Loads referred to in 4.12 to 4.15 shall be used, as applicable. Stresses in way of the supporting structures shall be to a recognized standard acceptable to the Administration or recognized organization acting on its behalf. In special cases, a fatigue analysis may be required by the Administration or recognized organization acting on its behalf.

.3 If required by the Administration or recognized organization acting on its behalf, secondary stresses and thermal stresses shall be specially considered.

4.23.3 ***Ultimate design condition***

4.23.3.1 Plastic deformation

For type C independent tanks, the allowable stresses shall not exceed:

$\sigma_m \leq f$
$\sigma_L \leq 1.5f$
$\sigma_b \leq 1.5f$
$\sigma_L+\sigma_b \leq 1.5f$
$\sigma_m+\sigma_b \leq 1.5f$
$\sigma_m+\sigma_b+\sigma_g \leq 3.0f$
$\sigma_L+\sigma_b+\sigma_g \leq 3.0f,$

where:

σ_m = equivalent primary general membrane stress;
σ_L = equivalent primary local membrane stress;
σ_b = equivalent primary bending stress;
σ_g = equivalent secondary stress; and

f = the lesser of R_m/A or R_e/B,

with R_m and R_e as defined in 4.18.1.3. With regard to the stresses σ_m, σ_L, σ_b *and* σ_g, the definition of stress categories in 4.28.3 are referred. The values A and B shall be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk and shall have at least the following minimum values:

	Nickel steels and carbon-manganese steels	**Austenitic steels**	**Aluminium alloys**
A	3	3.5	4
B	1.5	1.5	1.5

4.23.3.2 Buckling criteria shall be as follows: the thickness and form of pressure vessels subject to external pressure and other loads causing compressive stresses shall be based on calculations using accepted pressure vessel buckling theory and shall adequately account for the difference in theoretical and actual buckling stress as a result of plate edge misalignment, ovality and deviation from true circular form over a specified arc or chord length.

4.23.4 ***Fatigue design condition***

For large type C independent tanks, where the cargo at atmospheric pressure is below -55°C, the Administration or recognized organization acting on its behalf may require additional verification to check their compliance with 4.23.1.1 regarding static and dynamic stress.

4.23.5 *Accident design condition*

4.23.5.1 The tanks and the tank supporting structures shall be designed for the accidental loads and design conditions specified in 4.3.4.3 and 4.15, as applicable.

4.23.5.2 When subjected to the accidental loads specified in 4.15, the stress shall comply with the acceptance criteria specified in 4.23.3.1, modified as appropriate taking into account their lower probability of occurrence.

4.23.6 *Testing*

4.23.6.1 Each pressure vessel shall be subjected to a hydrostatic test at a pressure measured at the top of the tanks, of not less than 1.5 P_o. In no case during the pressure test shall the calculated primary membrane stress at any point exceed 90% of the yield stress of the material. To ensure that this condition is satisfied where calculations indicate that this stress will exceed 0.75 times the yield strength, the prototype test shall be monitored by the use of strain gauges or other suitable equipment in pressure vessels other than simple cylindrical and spherical pressure vessels.

4.23.6.2 The temperature of the water used for the test shall be at least 30°C above the nil-ductility transition temperature of the material, as fabricated.

4.23.6.3 The pressure shall be held for 2 h per 25 mm of thickness, but in no case less than 2 h.

4.23.6.4 Where necessary for cargo pressure vessels, a hydropneumatic test may be carried out under the conditions prescribed in 4.23.6.1 to 4.23.6.3.

4.23.6.5 Special consideration may be given to the testing of tanks in which higher allowable stresses are used, depending on service temperature. However, the requirements of 4.23.6.1 shall be fully complied with.

4.23.6.6 After completion and assembly, each pressure vessel and its related fittings shall be subjected to an adequate tightness test which may be performed in combination with the pressure testing referred to in 4.23.6.1.

4.23.6.7 Pneumatic testing of pressure vessels other than cargo tanks shall only be considered on an individual case basis. Such testing shall only be permitted for those vessels designed or supported such that they cannot be safely filled with water, or for those vessels that cannot be dried and are to be used in a service where traces of the testing medium cannot be tolerated.

4.23.7 *Marking*

The required marking of the pressure vessel shall be achieved by a method that does not cause unacceptable local stress raisers.

4.24 Membrane tanks

4.24.1 *Design basis*

4.24.1.1 The design basis for membrane containment systems is that thermal and other expansion or contraction is compensated for without undue risk of losing the tightness of the membrane.

4.24.1.2 A systematic approach based on analysis and testing shall be used to demonstrate that the system will provide its intended function in consideration of the events identified in service as specified in 4.24.2.1.

4.24.1.3 If the cargo temperature at atmospheric pressure is below -10°C, a complete secondary barrier shall be provided as required in 4.5. The secondary barrier shall be designed according to 4.6.

4.24.1.4 The design vapour pressure P_o shall not normally exceed 0.025 MPa. If the hull scantlings are increased accordingly and consideration is given, where appropriate, to the strength of the supporting thermal insulation, P_o may be increased to a higher value, but less than 0.07 MPa.

4.24.1.5 The definition of membrane tanks does not exclude designs such as those in which non-metallic membranes are used or where membranes are included or incorporated into the thermal insulation.

4.24.1.6 The thickness of the membranes shall not normally exceed 10 mm.

4.24.1.7 The circulation of inert gas throughout the primary insulation space and the secondary insulation space, in accordance with 9.2.1, shall be sufficient to allow for effective means of gas detection.

4.24.2 ***Design considerations***

4.24.2.1 Potential incidents that could lead to loss of fluid tightness over the life of the membranes shall be evaluated. These include, but are not limited to:

- .1 Ultimate design events:
  - .1 tensile failure of membranes;
  - .2 compressive collapse of thermal insulation;
  - .3 thermal ageing;
  - .4 loss of attachment between thermal insulation and hull structure;
  - .5 loss of attachment of membranes to thermal insulation system;
  - .6 structural integrity of internal structures and their supporting structures; and
  - .7 failure of the supporting hull structure.
- .2 Fatigue design events:
  - .1 fatigue of membranes including joints and attachments to hull structure;
  - .2 fatigue cracking of thermal insulation;
  - .3 fatigue of internal structures and their supporting structures; and
  - .4 fatigue cracking of inner hull leading to ballast water ingress.
- .3 Accident design events:
  - .1 accidental mechanical damage (such as dropped objects inside the tank while in service);

.2 accidental overpressurization of thermal insulation spaces;

.3 accidental vacuum in the tank; and

.4 water ingress through the inner hull structure.

Designs where a single internal event could cause simultaneous or cascading failure of both membranes are unacceptable.

4.24.2.2 The necessary physical properties (mechanical, thermal, chemical, etc.) of the materials used in the construction of the cargo containment system shall be established during the design development in accordance with 4.24.1.2.

4.24.3 ***Loads and load combinations***

Particular consideration shall be given to the possible loss of tank integrity due to either an overpressure in the interbarrier space, a possible vacuum in the cargo tank, the sloshing effects, hull vibration effects, or any combination of these events.

4.24.4 ***Structural analyses***

4.24.4.1 Structural analyses and/or testing for the purpose of determining the ultimate strength and fatigue assessments of the cargo containment and associated structures, e.g. structures as defined in 4.9, shall be performed. The structural analysis shall provide the data required to assess each failure mode that has been identified as critical for the cargo containment system.

4.24.4.2 Structural analyses of the hull shall take into account the internal pressure as indicated in 4.13.2. Special attention shall be paid to deflections of the hull and their compatibility with the membrane and associated thermal insulation.

4.24.4.3 The analyses referred to in 4.24.4.1 and 4.24.4.2 shall be based on the particular motions, accelerations and response of ships and cargo containment systems.

4.24.5 ***Ultimate design condition***

4.24.5.1 The structural resistance of every critical component, subsystem or assembly shall be established, in accordance with 4.24.1.2, for in-service conditions.

4.24.5.2 The choice of strength acceptance criteria for the failure modes of the cargo containment system, its attachments to the hull structure and internal tank structures, shall reflect the consequences associated with the considered mode of failure.

4.24.5.3 The inner hull scantlings shall meet the requirements for deep tanks, taking into account the internal pressure as indicated in 4.13.2 and the specified appropriate requirements for sloshing load as defined in 4.14.3.

4.24.6 ***Fatigue design condition***

4.24.6.1 Fatigue analysis shall be carried out for structures inside the tank, i.e. pump towers, and for parts of membrane and pump tower attachments, where failure development cannot be reliably detected by continuous monitoring.

4.24.6.2 The fatigue calculations shall be carried out in accordance with 4.18.2, with relevant requirements depending on:

.1 the significance of the structural components with respect to structural integrity; and

.2 availability for inspection.

4.24.6.3 For structural elements for which it can be demonstrated by tests and/or analyses that a crack will not develop to cause simultaneous or cascading failure of both membranes, C_w shall be less than or equal to 0.5.

4.24.6.4 Structural elements subject to periodic inspection, and where an unattended fatigue crack can develop to cause simultaneous or cascading failure of both membranes, shall satisfy the fatigue and fracture mechanics requirements stated in 4.18.2.8.

4.24.6.5 Structural element not accessible for in-service inspection, and where a fatigue crack can develop without warning to cause simultaneous or cascading failure of both membranes, shall satisfy the fatigue and fracture mechanics requirements stated in 4.18.2.9.

4.24.7 ***Accident design condition***

4.24.7.1 The containment system and the supporting hull structure shall be designed for the accidental loads specified in 4.15. These loads need not be combined with each other or with environmental loads.

4.24.7.2 Additional relevant accident scenarios shall be determined based on a risk analysis. Particular attention shall be paid to securing devices inside tanks.

4.24.8 ***Design development testing***

4.24.8.1 The design development testing required in 4.24.1.2 shall include a series of analytical and physical models of both the primary and secondary barriers, including corners and joints, tested to verify that they will withstand the expected combined strains due to static, dynamic and thermal loads. This will culminate in the construction of a prototype-scaled model of the complete cargo containment system. Testing conditions considered in the analytical and physical models shall represent the most extreme service conditions the cargo containment system will be likely to encounter over its life. Proposed acceptance criteria for periodic testing of secondary barriers required in 4.6.2 may be based on the results of testing carried out on the prototype-scaled model.

4.24.8.2 The fatigue performance of the membrane materials and representative welded or bonded joints in the membranes shall be determined by tests. The ultimate strength and fatigue performance of arrangements for securing the thermal insulation system to the hull structure shall be determined by analyses or tests.

4.24.9 ***Testing***

4.24.9.1 In ships fitted with membrane cargo containment systems, all tanks and other spaces that may normally contain liquid and are adjacent to the hull structure supporting the membrane, shall be hydrostatically tested.

4.24.9.2 All hold structures supporting the membrane shall be tested for tightness before installation of the cargo containment system.

4.24.9.3 Pipe tunnels and other compartments that do not normally contain liquid need not be hydrostatically tested.

4.25 Integral tanks

4.25.1 *Design basis*

Integral tanks that form a structural part of the hull and are affected by the loads that stress the adjacent hull structure shall comply with the following:

.1 the design vapour pressure P_o as defined in 4.1.2 shall not normally exceed 0.025 MPa. If the hull scantlings are increased accordingly, P_o may be increased to a higher value, but less than 0.07 MPa;

.2 integral tanks may be used for products, provided the boiling point of the cargo is not below -10°C. A lower temperature may be accepted by the Administration or recognized organization acting on its behalf subject to special consideration, but in such cases a complete secondary barrier shall be provided; and

.3 products required by chapter 19 to be carried in type 1G ships shall not be carried in integral tanks.

4.25.2 *Structural analysis*

The structural analysis of integral tanks shall be in accordance with recognized standards.

4.25.3 *Ultimate design condition*

4.25.3.1 The tank boundary scantlings shall meet the requirements for deep tanks, taking into account the internal pressure as indicated in 4.13.2.

4.25.3.2 For integral tanks, allowable stresses shall normally be those given for hull structure in the requirements of the Administration or recognized organization acting on its behalf.

4.25.4 *Accident design condition*

4.25.4.1 The tanks and the tank supports shall be designed for the accidental loads specified in 4.3.4.3 and 4.15, as relevant.

4.25.4.2 When subjected to the accidental loads specified in 4.15, the stress shall comply with the acceptance criteria specified in 4.25.3, modified as appropriate, taking into account their lower probability of occurrence.

4.25.5 *Testing*

All integral tanks shall be hydrostatically or hydropneumatically tested. The test shall be performed so that the stresses approximate, as far as practicable, to the design stresses and that the pressure at the top of the tank corresponds at least to the MARVS.

4.26 Semi-membrane tanks

4.26.1 *Design basis*

4.26.1.1 Semi-membrane tanks are non-self-supporting tanks when in the loaded condition and consist of a layer, parts of which are supported through thermal insulation by the adjacent hull structure, whereas the rounded parts of this layer connecting the above-mentioned supported parts are designed also to accommodate the thermal and other expansion or contraction.

4.26.1.2 The design vapour pressure P_o shall not normally exceed 0.025 MPa. If the hull scantlings are increased accordingly, and consideration is given, where appropriate, to the strength of the supporting thermal insulation, P_o may be increased to a higher value, but less than 0.07 MPa.

4.26.1.3 For semi-membrane tanks the relevant requirements in this section for independent tanks or for membrane tanks shall be applied as appropriate.

4.26.1.4 In the case of semi-membrane tanks that comply in all respects with the requirements applicable to type B independent tanks, except for the manner of support, the Administration may, after special consideration, accept a partial secondary barrier.

PART F
CARGO CONTAINMENT SYSTEMS OF NOVEL CONFIGURATION

4.27 Limit state design for novel concepts

4.27.1 Cargo containment systems that are of a novel configuration that cannot be designed using sections 4.21 to 4.26 shall be designed using this section and parts A and B of this chapter, and also parts C and D, as applicable. Cargo containment system design according to this section shall be based on the principles of limit state design which is an approach to structural design that can be applied to established design solutions as well as novel designs. This more generic approach maintains a level of safety similar to that achieved for known containment systems as designed using 4.21 to 4.26.

4.27.2.1 The limit state design is a systematic approach where each structural element is evaluated with respect to possible failure modes related to the design conditions identified in 4.3.4. A limit state can be defined as a condition beyond which the structure, or part of a structure, no longer satisfies the requirements.

4.27.2.2 For each failure mode, one or more limit states may be relevant. By consideration of all relevant limit states, the limit load for the structural element is found as the minimum limit load resulting from all the relevant limit states. The limit states are divided into the three following categories:

.1 Ultimate limit states (ULS), which correspond to the maximum load-carrying capacity or, in some cases, to the maximum applicable strain or deformation; under intact (undamaged) conditions.

.2 Fatigue limit states (FLS), which correspond to degradation due to the effect of time varying (cyclic) loading.

.3 Accident limit states (ALS), which concern the ability of the structure to resist accidental situations.

4.27.3 The procedure and relevant design parameters of the limit state design shall comply with the Standards for the Use of limit state methodologies in the design of cargo containment systems of novel configuration (LSD Standard), as set out in appendix 5.

PART G
GUIDANCE

4.28 Guidance notes for chapter 4

4.28.1 *Guidance to detailed calculation of internal pressure for static design purpose*

4.28.1.1 This section provides guidance for the calculation of the associated dynamic liquid pressure for the purpose of static design calculations. This pressure may be used for determining the internal pressure referred to in 4.13.2.4, where:

.1 (P_{gd})max is the associated liquid pressure determined using the maximum design accelerations.

.2 $(P_{gd}$ site)max is the associated liquid pressure determined using site specific accelerations.

.3 P_{eq} should be the greater of P_{eq1} and P_{eq2} calculated as follows:

$P_{eq1} = P_o + (P_{gd})$max (MPa),

$P_{eq2} = P_h + (P_{gd}$ site)max (MPa).

4.28.1.2 The internal liquid pressures are those created by the resulting acceleration of the centre of gravity of the cargo due to the motions of the ship referred to in 4.14.1. The value of internal liquid pressure P_{gd} resulting from combined effects of gravity and dynamic accelerations should be calculated as follows:

$$P_{gd}=\alpha_{\beta} Z_{\beta} \frac{\rho}{1.02\times 10} \quad \text{(MPa)},$$

where:

a_{β} = dimensionless acceleration (i.e. relative to the acceleration of gravity), resulting from gravitational and dynamic loads, in an arbitrary direction β (see figure 4.1).

For large tanks, an acceleration ellipsoid taking account of transverse vertical and longitudinal accelerations, should be used.

Z_{β} = largest liquid height (m) above the point where the pressure is to be determined measured from the tank shell in the β direction (see figure 4.2).

Tank domes considered to be part of the accepted total tank volume shall be taken into account when determining Z_{β}, unless the total volume of tank domes V_d does not exceed the following value:

$$V_d = V_t\left(\frac{100-FL}{FL}\right)$$

with:

V_t = tank volume without any domes; and
FL = filling limit according to chapter 15.

ρ = maximum cargo density (kg/m^3) at the design temperature.

The direction that gives the maximum value (P_{gd})max or (P_{gd}site)max should be considered. The above formula applies only to full tanks.

4.28.1.3 Equivalent calculation procedures may be applied.

4.28.2 ***Guidance formulae for acceleration components***

4.28.2.1 The following formulae are given as guidance for the components of acceleration due to ship's motions corresponding to a probability level of 10^{-8} in the North Atlantic and apply to ships with a length exceeding 50 m and at or near their service speed:

- vertical acceleration, as defined in 4.14.1:

$$a_z = \pm a_0 \sqrt{1 + \left(5.3 - \frac{45}{L_0}\right)^2 \left(\frac{x}{L_0} + 0.05\right)^2 \left(\frac{0.6}{C_B}\right)^{1.5} + \left(\frac{0.6yK^{1.5}}{B}\right)^2},$$

- transverse acceleration, as defined in 4.14.1:

$$a_y = \pm a_0 \sqrt{0.6 + 2.5\left(\frac{x}{L_0} + 0.05\right)^2 + K\left(1 + 0.6K\frac{z}{B}\right)^2}$$

- longitudinal acceleration, as defined in 4.14.1:

$$a_x = \pm a_0 \sqrt{0.06 + A^2 - 0.25A},$$

where:

$$a_0 = 0.2\frac{V}{\sqrt{L_0}} + \frac{34 - \left(\frac{600}{L_0}\right)}{L_0}$$

L_0 = length of the ship for determination of scantlings as defined in recognized standards (m);

C_B = block coefficient;

B = greatest moulded breadth of the ship (m);

x = longitudinal distance (m) from amidships to the centre of gravity of the tank with contents; x is positive forward of amidships, negative aft of amidships;

y = transverse distance (m) from centreline to the centre of gravity of the tank with contents;

z = vertical distance (m) from the ship's actual waterline to the centre of gravity of tank with contents; z is positive above and negative below the waterline;

K = 1 in general. For particular loading conditions and hull forms, determination of K according to the following formula may be necessary:

K = 13GM/B, where $K \geq 1$ and GM = metacentric height (m);

$$A = \left(0.7 - \frac{L_0}{1200} + 5\frac{z}{L_0}\right)\left(\frac{0.6}{C_B}\right)$$; and

V = service speed (knots);

a_x, a_y, a_z = maximum dimensionless accelerations (i.e. relative to the acceleration of gravity) in the respective directions. They are considered as acting separately for calculation purposes, and a_z does not include the component due to the static weight, a_y includes the component due to the static weight in the transverse direction due to rolling and a_x includes the component due to the static weight in the longitudinal direction due to pitching. The accelerations derived from the above formulae are applicable only to ships at or near their service speed, not while at anchor or otherwise near stationary in exposed locations.

4.28.3 ***Stress categories***

4.28.3.1 For the purpose of stress evaluation, stress categories are defined in this section as follows.

4.28.3.2 *Normal stress* is the component of stress normal to the plane of reference.

4.28.3.3 *Membrane stress* is the component of normal stress that is uniformly distributed and equal to the average value of the stress across the thickness of the section under consideration.

4.28.3.4 *Bending stress* is the variable stress across the thickness of the section under consideration, after the subtraction of the membrane stress.

4.28.3.5 *Shear stress* is the component of the stress acting in the plane of reference.

4.28.3.6 *Primary stress* is a stress produced by the imposed loading, which is necessary to balance the external forces and moments. The basic characteristic of a primary stress is that it is not self-limiting. Primary stresses that considerably exceed the yield strength will result in failure or at least in gross deformations.

4.28.3.7 *Primary general membrane stress* is a primary membrane stress that is so distributed in the structure that no redistribution of load occurs as a result of yielding.

4.28.3.8 *Primary local membrane stress* arises where a membrane stress produced by pressure or other mechanical loading and associated with a primary or a discontinuity effect produces excessive distortion in the transfer of loads for other portions of the structure. Such a stress is classified as a primary local membrane stress, although it has some characteristics of a secondary stress. A stress region may be considered as local, if:

$S_1 \leq 0.5\sqrt{Rt}$ and
$S_2 \geq 2.5\sqrt{Rt}$,

where:

S_1 = distance in the meridional direction over which the equivalent stress exceeds 1.1*f*;

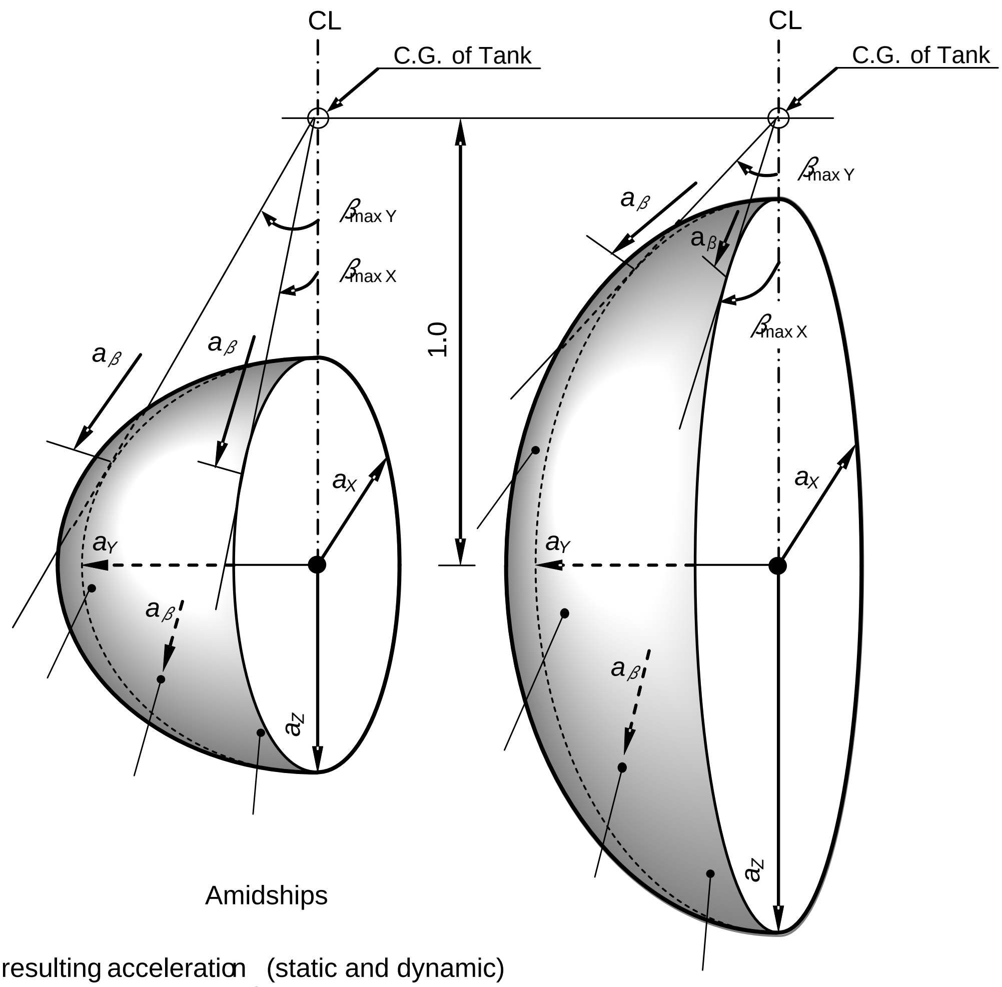
S_2 = distance in the meridional direction to another region where the limits for primary general membrane stress are exceeded;

R = mean radius of the vessel;

t = wall thickness of the vessel at the location where the primary general membrane stress limit is exceeded; and

f = allowable primary general membrane stress.

4.28.3.9 *Secondary stress* is a normal stress or shear stress developed by constraints of adjacent parts or by self-constraint of a structure. The basic characteristic of a secondary stress is that it is self-limiting. Local yielding and minor distortions can satisfy the conditions that cause the stress to occur.



a_β = resulting acceleration (static and dynamic) in arbitrary direction β
a_X = longitudinal component of acceleration
a_Y = transverse component of acceleration
a_Z = vertical component of acceleration

Figure 4.1 – Acceleration ellipsoid

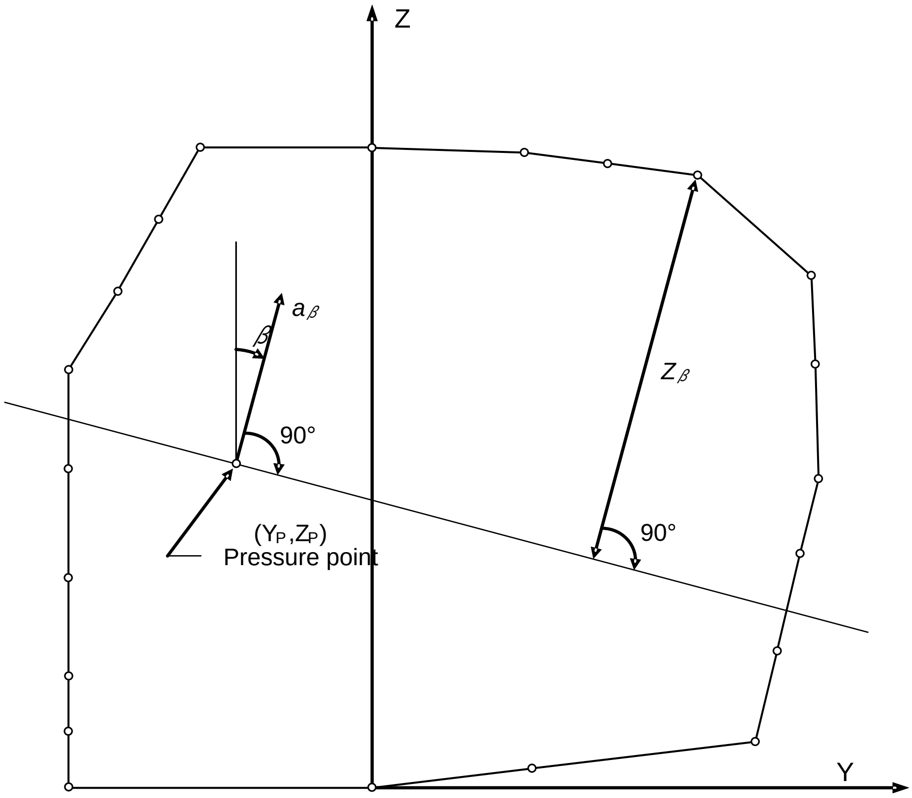


Figure 4.2 – Determination of internal pressure heads

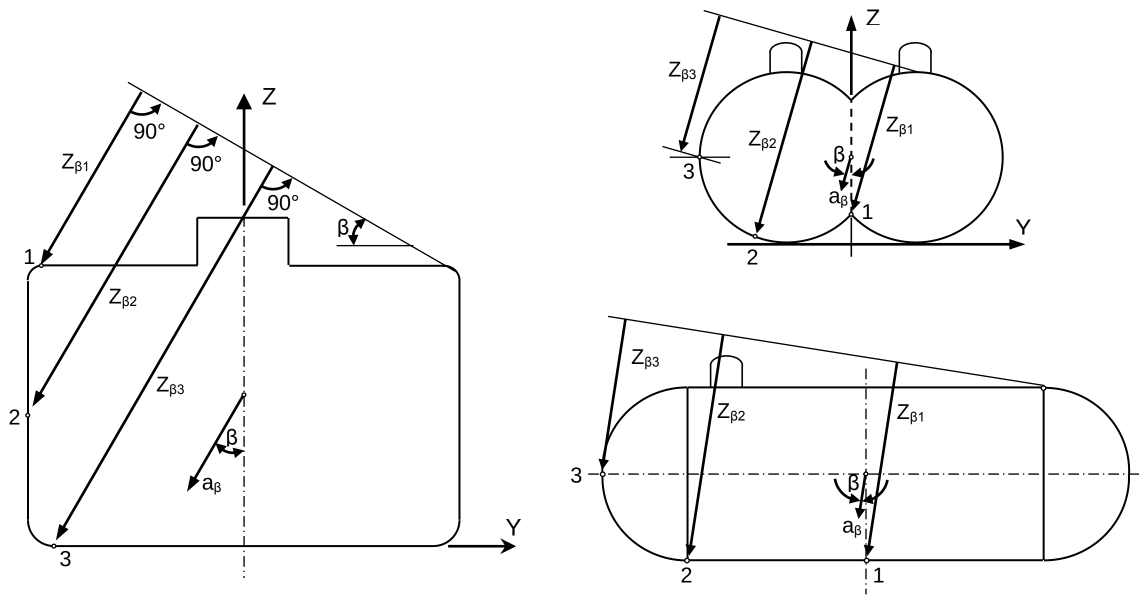
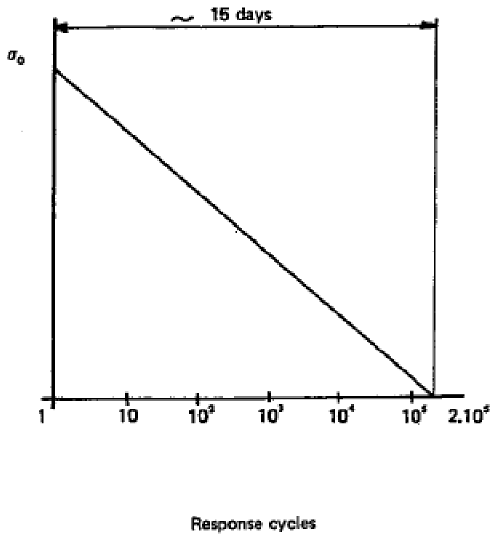


Figure 4.3 – Determination of liquid height Z_β for points 1, 2 and 3



σ_o = most probable maximum stress over the life of the ship

Response cycle scale is logarithmic; the value of 2.10^5 is given as an example of estimate.

Figure 4.4 – Simplified load distribution

CHAPTER 5

PROCESS PRESSURE VESSELS AND LIQUID, VAPOUR AND PRESSURE PIPING SYSTEMS

Goal

To ensure the safe handling of all cargo and process liquid and vapour, under all operating conditions, to minimize the risk to the ship, crew and to the environment, having regard to the nature of the products involved. This will:

.1 ensure the integrity of process pressure vessels, piping systems and cargo hoses;

.2 prevent the uncontrolled transfer of cargo;

.3 ensure reliable means to fill and empty the containment systems; and

.4 prevent pressure or vacuum excursions of cargo containment systems, beyond design parameters, during cargo transfer operations.

5.1 General

5.1.1 The requirements of this chapter shall apply to products and process piping, including vapour piping, gas fuel piping and vent lines of safety valves or similar piping. Auxiliary piping systems not containing cargo are exempt from the general requirements of this chapter.

5.1.2 The requirements for type C independent tanks provided in chapter 4 may also apply to process pressure vessels. If so required, the term "pressure vessels" as used in chapter 4, covers both type C independent tanks and process pressure vessels.

5.1.3 Process pressure vessels include surge tanks, heat exchangers and accumulators that store or treat liquid or vapour cargo.

5.2 System requirements

5.2.1 The cargo handling and cargo control systems shall be designed taking into account the following:

.1 prevention of an abnormal condition escalating to a release of liquid or vapour cargo;

.2 the safe collection and disposal of cargo fluids released;

.3 prevention of the formation of flammable mixtures;

.4 prevention of ignition of flammable liquids or gases and vapours released; and

.5 limiting the exposure of personnel to fire and other hazards.

5.2.2 ***Arrangements: general***

5.2.2.1 Any piping system that may contain cargo liquid or vapour shall:

.1 be segregated from other piping systems, except where interconnections are required for cargo-related operations such as purging, gas-freeing or inerting. The requirements of 9.4.4 shall be taken into account with regard to preventing back-flow of cargo. In such cases, precautions shall be taken to ensure that cargo or cargo vapour cannot enter other piping systems through the interconnections;

.2 except as provided in chapter 16, not pass through any accommodation space, service space or control station or through a machinery space other than a cargo machinery space;

.3 be connected to the cargo containment system directly from the weather decks except where pipes installed in a vertical trunkway or equivalent are used to traverse void spaces above a cargo containment system and except where pipes for drainage, venting or purging traverse cofferdams;

.4 be located in the cargo area above the weather deck except for bow or stern loading and unloading arrangements in accordance with 3.8, emergency cargo jettisoning piping systems in accordance with 5.3.1, turret compartment systems in accordance with 5.3.3 and except in accordance with chapter 16; and

.5 be located inboard of the transverse tank location requirements of 2.4.1, except for athwartship shore connection piping not subject to internal pressure at sea or emergency cargo jettisoning piping systems.

5.2.2.2 Suitable means shall be provided to relieve the pressure and remove liquid cargo from loading and discharging crossover headers; likewise, any piping between the outermost manifold valves and loading arms or cargo hoses to the cargo tanks, or other suitable location, prior to disconnection.

5.2.2.3 Piping systems carrying fluids for direct heating or cooling of cargo shall not be led outside the cargo area unless a suitable means is provided to prevent or detect the migration of cargo vapour outside the cargo area (see 13.6.2.6).

5.2.2.4 Relief valves discharging liquid cargo from the piping system shall discharge into the cargo tanks. Alternatively, they may discharge to the cargo vent mast, if means are provided to detect and dispose of any liquid cargo that may flow into the vent system. Where required to prevent overpressure in downstream piping, relief valves on cargo pumps shall discharge to the pump suction.

5.3 Arrangements for cargo piping outside the cargo area

5.3.1 ***Emergency cargo jettisoning***

If fitted, an emergency cargo jettisoning piping system shall comply with 5.2.2, as appropriate, and may be led aft, external to accommodation spaces, service spaces or control stations or machinery spaces, but shall not pass through them. If an emergency cargo jettisoning piping system is permanently installed, a suitable means of isolating the piping system from the cargo piping shall be provided within the cargo area.

5.3.2 ***Bow and stern loading arrangements***

5.3.2.1 Subject to the requirements of 3.8, this section and 5.10.1, cargo piping may be arranged to permit bow or stern loading and unloading.

5.3.2.2 Arrangements shall be made to allow such piping to be purged and gas-freed after use. When not in use, the spool pieces shall be removed and the pipe ends blank-flanged. The vent pipes connected with the purge shall be located in the cargo area.

5.3.3 ***Turret compartment transfer systems***

For the transfer of liquid or vapour cargo through an internal turret arrangement located outside the cargo area, the piping serving this purpose shall comply with 5.2.2, as applicable, 5.10.2 and the following:

.1 piping shall be located above the weather deck, except for the connection to the turret;

.2 portable arrangements shall not be permitted; and

.3 arrangements shall be made to allow such piping to be purged and gas-freed after use. When not in use, the spool pieces for isolation from the cargo piping shall be removed and the pipe ends blank-flanged. The vent pipes connected with the purge shall be located in the cargo area.

5.3.4 ***Gas fuel piping systems***

Gas fuel piping in machinery spaces shall comply with all applicable sections of this chapter in addition to the requirements of chapter 16.

5.4 Design pressure

5.4.1 The design pressure P_o, used to determine minimum scantlings of piping and piping system components, shall be not less than the maximum gauge pressure to which the system may be subjected in service. The minimum design pressure used shall not be less than 1 MPa gauge, except for open-ended lines or pressure relief valve discharge lines, where it shall be not less than the lower of 0.5 MPa gauge, or 10 times the relief valve set pressure.

5.4.2 The greater of the following design conditions shall be used for piping, piping systems and components, based on the cargoes being carried:

.1 for vapour piping systems or components that may be separated from their relief valves and which may contain some liquid, the saturated vapour pressure at a design temperature of 45°C. Higher or lower values may be used (see 4.13.2.2); or

.2 for systems or components that may be separated from their relief valves and which contain only vapour at all times, the superheated vapour pressure at 45°C. Higher or lower values may be used (see 4.13.2.2), assuming an initial condition of saturated vapour in the system at the system operating pressure and temperature; or

.3 the MARVS of the cargo tanks and cargo processing systems; or

.4 the pressure setting of the associated pump or compressor discharge relief valve; or

.5 the maximum total discharge or loading head of the cargo piping system considering all possible pumping arrangements or the relief valve setting on a pipeline system.

5.4.3 Those parts of the liquid piping systems that may be subjected to surge pressures shall be designed to withstand this pressure.

5.4.4 The design pressure of the outer pipe or duct of gas fuel systems shall not be less than the maximum working pressure of the inner gas pipe. Alternatively, for gas fuel piping systems with a working pressure greater than 1 MPa, the design pressure of the outer duct shall not be less than the maximum built-up pressure arising in the annular space considering the local instantaneous peak pressure in way of any rupture and the ventilation arrangements.

5.5 Cargo system valve requirements

5.5.1.1 Every cargo tank and piping system shall be fitted with manually operated valves for isolation purposes as specified in this section.

5.5.1.2 In addition, remotely operated valves shall also be fitted, as appropriate, as part of the emergency shutdown (ESD) system the purpose of which is to stop cargo flow or leakage in the event of an emergency when cargo liquid or vapour transfer is in progress. The ESD system is intended to return the cargo system to a safe static condition so that any remedial action can be taken. Due regard shall be given in the design of the ESD system to avoid the generation of surge pressures within the cargo transfer pipework. The equipment to be shut down on ESD activation includes manifold valves during loading or discharge, any pump or compressor, etc., transferring cargo internally or externally (e.g. to shore or another ship/barge) and cargo tank valves, if the MARVS exceeds 0.07 MPa.

5.5.2 *Cargo tank connections*

5.5.2.1 All liquid and vapour connections, except for safety relief valves and liquid level gauging devices, shall have shutoff valves located as close to the tank as practicable. These valves shall provide full closure and shall be capable of local manual operation. They may also be capable of remote operation.

5.5.2.2 For cargo tanks with a MARVS exceeding 0.07 MPa gauge, the above connections shall also be equipped with remotely controlled ESD valves. These valves shall be located as close to the tank as practicable. A single valve may be substituted for the two separate valves, provided the valve complies with the requirements of 18.10.2 and provides full closure of the line.

5.5.3 ***Cargo manifold connections***

5.5.3.1 One remotely controlled ESD valve shall be provided at each cargo transfer connection in use to stop liquid and vapour transfer to or from the ship. Transfer connections not in use shall be isolated with suitable blank flanges.

5.5.3.2 If the cargo tank MARVS exceeds 0.07 MPa, an additional manual valve shall be provided for each transfer connection in use, and may be inboard or outboard of the ESD valve to suit the ship's design.

5.5.4 Excess flow valves may be used in lieu of ESD valves, if the diameter of the protected pipe does not exceed 50 mm. Excess flow valves shall close automatically at the rated closing flow of vapour or liquid as specified by the manufacturer. The piping including fittings, valves and appurtenances protected by an excess flow valve shall have a capacity greater than the rated closing flow of the excess flow valve. Excess flow valves may be designed with a bypass not exceeding the area of a 1 mm diameter circular opening to allow equalization of pressure after a shutdown activation.

5.5.5 Cargo tank connections for gauging or measuring devices need not be equipped with excess flow valves or ESD valves, provided that the devices are constructed so that the outward flow of tank contents cannot exceed that passed by a 1.5 mm diameter circular hole.

5.5.6 All pipelines or components which may be isolated in a liquid full condition shall be protected with relief valves for thermal expansion and evaporation.

5.5.7 All pipelines or components which may be isolated automatically due to a fire with a liquid volume of more than 0.05 m^3 entrapped shall be provided with PRVs sized for a fire condition.

5.6 Cargo transfer arrangements

5.6.1 Where cargo transfer is by means of cargo pumps that are not accessible for repair with the tanks in service, at least two separate means shall be provided to transfer cargo from each cargo tank, and the design shall be such that failure of one cargo pump or means of transfer will not prevent the cargo transfer by another pump or pumps, or other cargo transfer means.

5.6.2 The procedure for transfer of cargo by gas pressurization shall preclude lifting of the relief valves during such transfer. Gas pressurization may be accepted as a means of transfer of cargo for those tanks where the design factor of safety is not reduced under the conditions prevailing during the cargo transfer operation. If the cargo tank relief valves or set pressure are changed for this purpose, as it is permitted in accordance with 8.2.7 and 8.2.8, the new set pressure shall not exceed P_h as is defined in 4.13.2.

5.6.3 ***Vapour return connections***

Connections for vapour return to the shore installations shall be provided.

5.6.4 ***Cargo tank vent piping systems***

The pressure relief system shall be connected to a vent piping system designed to minimize the possibility of cargo vapour accumulating on the decks, or entering accommodation spaces, service spaces, control stations and machinery spaces, or other spaces where it may create a dangerous condition.

5.6.5 ***Cargo sampling connections***

5.6.5.1 Connections to cargo piping systems for taking cargo liquid samples shall be clearly marked and shall be designed to minimize the release of cargo vapours. For vessels permitted to carry toxic products, the sampling system shall be of a closed loop design to ensure that cargo liquid and vapour are not vented to atmosphere.

5.6.5.2 Liquid sampling systems shall be provided with two valves on the sample inlet. One of these valves shall be of the multi-turn type to avoid accidental opening, and shall be spaced far enough apart to ensure that they can isolate the line if there is blockage, by ice or hydrates for example.

5.6.5.3 On closed loop systems, the valves on the return pipe shall also comply with 5.6.5.2.

5.6.5.4 The connection to the sample container shall comply with recognized standards and be supported so as to be able to support the weight of a sample container. Threaded connections shall be tack-welded, or otherwise locked, to prevent them being unscrewed during the normal connection and disconnection of sample containers. The sample connection shall be fitted with a closure plug or flange to prevent any leakage when the connection is not in use.

5.6.5.5 Sample connections used only for vapour samples may be fitted with a single valve in accordance with 5.5, 5.8 and 5.13, and shall also be fitted with a closure plug or flange.

5.6.5.6 Sampling operations shall be undertaken as prescribed in 18.9.

5.6.6 ***Cargo filters***

The cargo liquid and vapour systems shall be capable of being fitted with filters to protect against damage by extraneous objects. Such filters may be permanent or temporary, and the standards of filtration shall be appropriate to the risk of debris, etc., entering the cargo system. Means shall be provided to indicate that filters are becoming blocked, and to isolate, depressurize and clean the filters safely.

5.7 Installation requirements

5.7.1 ***Design for expansion and contraction***

Provision shall be made to protect the piping, piping system and components and cargo tanks from excessive stresses due to thermal movement and from movements of the tank and hull structure. The preferred method outside the cargo tanks is by means of offsets, bends or loops, but multi-layer bellows may be used if offsets, bends or loops are not practicable.

5.7.2 ***Precautions against low temperature***

Low temperature piping shall be thermally isolated from the adjacent hull structure, where necessary, to prevent the temperature of the hull from falling below the design temperature of the hull material. Where liquid piping is dismantled regularly, or where liquid leakage may be anticipated, such as at shore connections and at pump seals, protection for the hull beneath shall be provided.

5.7.3 ***Water curtain***

For cargo temperatures below -110°C, a water distribution system shall be fitted in way of the hull under the shore connections to provide a low-pressure water curtain for additional protection of the hull steel and the ship's side structure. This system is in addition to the requirements of 11.3.1.4, and shall be operated when cargo transfer is in progress.

5.7.4 ***Bonding***

Where tanks or cargo piping and piping equipment are separated from the ship's structure by thermal isolation, provision shall be made for electrically bonding both the piping and the tanks. All gasketed pipe joints and hose connections shall be electrically bonded. Except where bonding straps are used, it shall be demonstrated that the electrical resistance of each joint or connection is less than 1MΩ.

5.8 Piping fabrication and joining details

5.8.1 ***General***

The requirements of this section apply to piping inside and outside the cargo tanks. Relaxation from these requirements may be accepted, in accordance with recognized standards for piping inside cargo tanks and open-ended piping.

5.8.2 ***Direct connections***

The following direct connection of pipe lengths, without flanges, may be considered:

.1 butt-welded joints with complete penetration at the root may be used in all applications. For design temperatures colder than -10°C, butt welds shall be either double welded or equivalent to a double welded butt joint. This may be accomplished by use of a backing ring, consumable insert or inert gas backup on the first pass. For design pressures in excess of 1 MPa and design temperatures of -10°C or colder, backing rings shall be removed;

.2 slip-on welded joints with sleeves and related welding, having dimensions in accordance with recognized standards, shall only be used for instrument lines and open-ended lines with an external diameter of 50 mm or less and design temperatures not colder than -55°C; and

.3 screwed couplings complying with recognized standards shall only be used for accessory lines and instrumentation lines with external diameters of 25 mm or less.

5.8.3 ***Flanged connections***

5.8.3.1 Flanges in flanged connections shall be of the welded neck, slip-on or socket welded type.

5.8.3.2 Flanges shall comply with recognized standards for their type, manufacture and test. For all piping, except open ended, the following restrictions apply:

.1 for design temperatures colder than -55°C, only welded-neck flanges shall be used; and

.2 for design temperatures colder than -10°C, slip-on flanges shall not be used in nominal sizes above 100 mm and socket welded flanges shall not be used in nominal sizes above 50 mm.

5.8.4 ***Expansion joints***

Where bellows and expansion joints are provided in accordance with 5.7.1, the following requirements apply:

.1 if necessary, bellows shall be protected against icing; and

.2 slip joints shall not be used except within the cargo tanks.

5.8.5 ***Other connections***

Piping connections shall be joined in accordance with 5.8.2 to 5.8.4, but for other exceptional cases the Administration may consider alternative arrangements.

5.9 Welding, post-weld heat treatment and non-destructive testing

5.9.1 ***General***

Welding shall be carried out in accordance with 6.5.

5.9.2 ***Post-weld heat treatment***

Post-weld heat treatment shall be required for all butt welds of pipes made with carbon, carbon-manganese and low alloy steels. The Administration or recognized organization acting on its behalf may waive the requirements for thermal stress relieving of pipes with wall thickness less than 10 mm in relation to the design temperature and pressure of the piping system concerned.

5.9.3 ***Non-destructive testing***

In addition to normal controls before and during the welding, and to the visual inspection of the finished welds, as necessary for proving that the welding has been carried out correctly and according to the requirements of this paragraph, the following tests shall be required:

.1 100% radiographic or ultrasonic inspection of butt-welded joints for piping systems with design temperatures colder than -10°C, or with inside diameters of more than 75 mm, or wall thicknesses greater than 10 mm;

.2 when such butt-welded joints of piping sections are made by automatic welding procedures approved by the Administration or recognized organization acting on its behalf, then a progressive reduction in the extent of radiographic or ultrasonic inspection can be agreed, but in no case to less than 10% of each joint. If defects are revealed, the extent of examination shall be increased to 100% and shall include inspection of previously accepted welds. This approval can only be granted if well-documented quality assurance procedures and records are available to assess the ability of the manufacturer to produce satisfactory welds consistently; and

.3 for other butt-welded joints of pipes not covered by 5.9.3.1 and 5.9.3.2, spot radiographic or ultrasonic inspection or other non-destructive tests shall be carried out depending upon service, position and materials. In general, at least 10% of butt-welded joints of pipes shall be subjected to radiographic or ultrasonic inspection.

5.10 Installation requirements for cargo piping outside the cargo area

5.10.1 ***Bow and stern loading arrangements***

The following requirements shall apply to cargo piping and related piping equipment located outside the cargo area:

.1 cargo piping and related piping equipment outside the cargo area shall have only welded connections. The piping outside the cargo area shall run on the weather decks and shall be at least 0.8 m inboard, except for athwartships shore connection piping. Such piping shall be clearly identified and fitted with a shutoff valve at its connection to the cargo piping system within the cargo area. At this location, it shall also be capable of being separated by means of a removable spool piece and blank flanges, when not in use; and

.2 the piping shall be full penetration butt-welded and subjected to full radiographic or ultrasonic inspection, regardless of pipe diameter and design temperature. Flange connections in the piping shall only be permitted within the cargo area and at the shore connection.

5.10.2 ***Turret compartment transfer systems***

The following requirements shall apply to liquid and vapour cargo piping where it is run outside the cargo area:

.1 cargo piping and related piping equipment outside the cargo area shall have only welded connections; and

.2 the piping shall be full penetration butt-welded, and subjected to full radiographic or ultrasonic inspection, regardless of pipe diameter and design temperature. Flange connections in the piping shall only be permitted within the cargo area and at connections to cargo hoses and the turret connection.

5.10.3 ***Gas fuel piping***

Gas fuel piping, as far as practicable, shall have welded joints. Those parts of the gas fuel piping that are not enclosed in a ventilated pipe or duct according to 16.4.3, and are on the weather decks outside the cargo area, shall have full penetration butt-welded joints and shall be subjected to full radiographic or ultrasonic inspection.

5.11 Piping system component requirements

5.11.1 Piping scantlings. Piping systems shall be designed in accordance with recognized standards.

5.11.2.1 The following criteria shall be used for determining pipe wall thickness.

5.11.2.2 The wall thickness of pipes shall not be less than:

$$t = \frac{t_0 + b + c}{1 - \frac{a}{100}} \qquad \text{(mm)}$$

where:

t_o = theoretical thickness, determined by the following formula:

$$t_0 = \frac{P \cdot D}{2K \cdot e + P} \qquad \text{(mm)}$$

with:

P = design pressure (MPa) referred to in 5.4;

D = outside diameter (mm);

K = allowable stress (N/mm²) referred to in 5.11.3;

e = efficiency factor equal to 1 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, that are considered equivalent to seamless pipes when non-destructive testing on welds is carried out in accordance with recognized standards. In other cases, an efficiency factor of less than 1, in accordance with recognized standards, may be required, depending on the manufacturing process;

b = allowance for bending (mm). The value of b shall be chosen so that the calculated stress in the bend, due to internal pressure only, does not exceed the allowable stress. Where such justification is not given, b shall be:

$$b = \frac{D \cdot t_0}{2.5r} \qquad \text{(mm),}$$

with:

r = mean radius of the bend (mm);

c = corrosion allowance (mm). If corrosion or erosion is expected, the wall thickness of the piping shall be increased over that required by other design requirements. This allowance shall be consistent with the expected life of the piping; and

a = negative manufacturing tolerance for thickness (%).

5.11.2.3 The minimum wall thickness shall be in accordance with recognized standards.

5.11.2.4 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to superimposed loads, the wall thickness shall be increased over that required by 5.11.2.2 or, if this is impracticable or would cause excessive local stresses, these loads may be reduced, protected against or eliminated by other design methods. Such superimposed loads may be due to: supporting structures, ship deflections, liquid pressure surge during transfer operations, the weight of suspended valves, reaction to loading arm connections, or otherwise.

5.11.3 ***Allowable stress***

5.11.3.1 For pipes, the allowable stress K referred to in the formula in 5.11.2 is the lower of the following values:

$$\frac{R_m}{A} \text{ or } \frac{R_e}{B}$$

where:

R_m = specified minimum tensile strength at room temperature (N/mm²); and

R_e = specified minimum yield stress at room temperature (N/mm²). If the stress-strain curve does not show a defined yield stress, the 0.2% proof stress applies.

The values of A and B shall be shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required in 1.4.4, and have values of at least A = 2.7 and B = 1.8.

5.11.4 ***High-pressure gas fuel outer pipes or ducting scantlings***

In fuel gas piping systems of design pressure greater than the critical pressure, the tangential membrane stress of a straight section of pipe or ducting shall not exceed the tensile strength divided by 1.5 (R_m /1.5) when subjected to the design pressure specified in 5.4. The pressure ratings of all other piping components shall reflect the same level of strength as straight pipes.

5.11.5 ***Stress analysis***

When the design temperature is -110°C or lower, a complete stress analysis, taking into account all the stresses due to the weight of pipes, including acceleration loads if significant, internal pressure, thermal contraction and loads induced by hog and sag of the ship for each branch of the piping system shall be submitted to the Administration. For temperatures above -110°C, a stress analysis may be required by the Administration in relation to such matters as the design or stiffness of the piping system and the choice of materials. In any case, consideration shall be given to thermal stresses even though calculations are not submitted. The analysis may be carried out according to a code of practice acceptable to the Administration.

5.11.6 ***Flanges, valves and fittings***

5.11.6.1 Flanges, valves and other fittings shall comply with recognized standards, taking into account the material selected and the design pressure defined in 5.4. For bellows expansion joints used in vapour service, a lower minimum design pressure may be accepted.

5.11.6.2 For flanges not complying with a recognized standard, the dimensions of flanges and related bolts shall be to the satisfaction of the Administration or recognized organization acting on its behalf.

5.11.6.3 All emergency shutdown valves shall be of the "fire closed" type (see 5.13.1.1 and 18.10.2).

5.11.6.4 The design and installation of expansion bellows shall be in accordance with recognized standards and be fitted with means to prevent damage due to over-extension or compression.

5.11.7 ***Ship's cargo hoses***

5.11.7.1 Liquid and vapour hoses used for cargo transfer shall be compatible with the cargo and suitable for the cargo temperature.

5.11.7.2 Hoses subject to tank pressure, or the discharge pressure of pumps or vapour compressors, shall be designed for a bursting pressure not less than five times the maximum pressure the hose will be subjected to during cargo transfer.

5.11.7.3 Each new type of cargo hose, complete with end-fittings, shall be prototype-tested at a normal ambient temperature, with 200 pressure cycles from zero to at least twice the specified maximum working pressure. After this cycle pressure test has been carried out, the prototype test shall demonstrate a bursting pressure of at least 5 times its specified maximum working pressure at the upper and lower extreme service temperature. Hoses used for prototype testing shall not be used for cargo service. Thereafter, before being placed in service, each new length of cargo hose produced shall be hydrostatically tested at ambient temperature to a pressure not less than 1.5 times its specified maximum working pressure, but not more than two fifths of its bursting pressure. The hose shall be stencilled, or otherwise marked, with the date of testing, its specified maximum working pressure and, if used in services other than ambient temperature services, its maximum and minimum service temperature, as applicable. The specified maximum working pressure shall not be less than 1 MPa gauge.

5.12 Materials

5.12.1 The choice and testing of materials used in piping systems shall comply with the requirements of chapter 6, taking into account the minimum design temperature. However, some relaxation may be permitted in the quality of material of open-ended vent piping, provided that the temperature of the cargo at the pressure relief valve setting is not lower than 55°C, and that no liquid discharge to the vent piping can occur. Similar relaxations may be permitted under the same temperature conditions to open-ended piping inside cargo tanks, excluding discharge piping and all piping inside membrane and semi-membrane tanks.

5.12.2 Materials having a melting point below 925°C shall not be used for piping outside the cargo tanks except for short lengths of pipes attached to the cargo tanks, in which case fire-resisting insulation shall be provided.

5.12.3 ***Cargo piping insulation system***

5.12.3.1 Cargo piping systems shall be provided with a thermal insulation system as required to minimize heat leak into the cargo during transfer operations and to protect personnel from direct contact with cold surfaces.

5.12.3.2 Where applicable, due to location or environmental conditions, insulation materials shall have suitable properties of resistance to fire and flame spread and shall be adequately protected against penetration of water vapour and mechanical damage.

5.12.4 Where the cargo piping system is of a material susceptible to stress corrosion cracking in the presence of a salt-laden atmosphere, adequate measures to avoid this occurring shall be taken by considering material selection, protection of exposure to salty water and/or readiness for inspection.

5.13 Testing requirements

5.13.1 ***Type testing of piping components***

5.13.1.1 Valves[7]

Each type of valve intended to be used at a working temperature below -55°C shall be subject to the following type tests:

.1 each size and type of valve shall be subjected to seat tightness testing over the full range of operating pressures for bi-directional flow and temperatures, at intervals, up to the rated design pressure of the valve. Allowable leakage rates shall be to the requirements of the Administration or recognized organization acting on its behalf. During the testing, satisfactory operation of the valve shall be verified;

.2 the flow or capacity shall be certified to a recognized standard for each size and type of valve;

.3 pressurized components shall be pressure tested to at least 1.5 times the rated pressure; and

.4 for emergency shutdown valves, with materials having melting temperatures lower than 925°C, the type testing shall include a fire test to a standard acceptable to the Administration.

5.13.1.2 Expansion bellows

The following type tests shall be performed on each type of expansion bellows intended for use on cargo piping outside the cargo tank and where required by the Administration or recognized organization acting on its behalf, on those installed within the cargo tanks:

.1 elements of the bellows, not pre-compressed, shall be pressure tested at not less than five times the design pressure without bursting. The duration of the test shall not be less than 5 min;

2 a pressure test shall be performed on a type expansion joint, complete with all the accessories such as flanges, stays and articulations, at the minimum design temperature and twice the design pressure at the extreme displacement conditions recommended by the manufacturer, without permanent deformation;

.3 a cyclic test (thermal movements) shall be performed on a complete expansion joint, which shall withstand at least as many cycles under the conditions of pressure, temperature, axial movement, rotational movement and transverse movement as it will encounter in actual service. Testing at ambient temperature is permitted when this testing is at least as severe as testing at the service temperature; and

[7] Refer to SIGTTO Publication on "The Selection and Testing of Valves for LNG Applications".

.4 a cyclic fatigue test (ship deformation) shall be performed on a complete expansion joint, without internal pressure, by simulating the bellows movement corresponding to a compensated pipe length, for at least 2,000,000 cycles at a frequency not higher than 5 Hz. This test is only required when, due to the piping arrangement, ship deformation loads are actually experienced.

5.13.2 ***System testing requirements***

5.13.2.1 The requirements of this section shall apply to piping inside and outside the cargo tanks.

5.13.2.2 After assembly, all cargo and process piping shall be subjected to a strength test with a suitable fluid. The test pressure shall be at least 1.5 times the design pressure (1.25 times the design pressure where the test fluid is compressible) for liquid lines and 1.5 times the maximum system working pressure (1.25 times the maximum system working pressure where the test fluid is compressible) for vapour lines. When piping systems or parts of systems are completely manufactured and equipped with all fittings, the test may be conducted prior to installation on board the ship. Joints welded on board shall be tested to at least 1.5 times the design pressure.

5.13.2.3 After assembly on board, each cargo and process piping system shall be subjected to a leak test using air, or other suitable medium, to a pressure depending on the leak detection method applied.

5.13.2.4 In double wall gas-fuel piping systems, the outer pipe or duct shall also be pressure tested to show that it can withstand the expected maximum pressure at gas pipe rupture.

5.13.2.5 All piping systems, including valves, fittings and associated equipment for handling cargo or vapours, shall be tested under normal operating conditions not later than at the first loading operation, in accordance with recognized standards.

5.13.3 ***Emergency shutdown valves***

The closing characteristics of emergency shutdown valves used in liquid cargo piping systems shall be tested to demonstrate compliance with 18.10.2.1.3. This testing may be carried out on board after installation.

CHAPTER 6

MATERIALS OF CONSTRUCTION AND QUALITY CONTROL

Goal

To identify the required properties, testing standards and stability of metallic and non-metallic materials and fabrication processes used in the construction of cargo containment and piping systems to ensure they serve the functions for which they have been selected, as required in chapters 4 and 5.

6.1 Definitions

6.1.1 Where reference is made in this chapter to A, B, D, E, AH, DH, EH and FH hull structural steels, these steel grades are hull structural steels according to recognized standards.

6.1.2 *A piece* is the rolled product from a single slab or billet or from a single ingot, if this is rolled directly into plates, strips, sections or bars.

6.1.3 *A batch* is the number of items or pieces to be accepted or rejected together, on the basis of the tests to be carried out on a sampling basis. The size of a batch is given in the recognized standards.

6.1.4 *Controlled rolling (CR)* is a rolling procedure in which the final deformation is carried out in the normalizing temperature range, resulting in a material condition generally equivalent to that obtained by normalizing.

6.1.5 *Thermo-mechanical controlled processing (TMCP)* is a procedure that involves strict control of both the steel temperature and the rolling reduction. Unlike CR, the properties conferred by TMCP cannot be reproduced by subsequent normalizing or other heat treatment. The use of accelerated cooling on completion of TMCP may also be accepted, subject to approval by the Administration. The same applies for the use of tempering after completion of TMCP.

6.1.6 *Accelerated cooling (AcC)* is a process that aims to improve mechanical properties by controlled cooling with rates higher than air cooling, immediately after the final TMCP operation. Direct quenching is excluded from accelerated cooling. The material properties conferred by TMCP and AcC cannot be reproduced by subsequent normalizing or other heat treatment.

6.2 Scope and general requirements

6.2.1 This chapter gives the requirements for metallic and non-metallic materials used in the construction of the cargo system. This includes requirements for joining processes, production process, personnel qualification, NDT and inspection and testing including production testing. The requirements for rolled materials, forgings and castings are given in 6.4 and tables 6.1, to 6.5. The requirements for weldments are given in 6.5, and the guidance for non-metallic materials is given in appendix 4. A quality assurance/quality control programme shall be implemented to ensure that the requirements of 6.2 are complied with.

6.2.2 The manufacture, testing, inspection and documentation shall be in accordance with recognized standards and the specific requirements given in the Code.

6.2.3 Where post-weld heat treatment is specified or required, the properties of the base material shall be determined in the heat-treated condition, in accordance with the applicable table of this chapter, and the weld properties shall be determined in the heat treated condition in accordance with 6.5. In cases where a post-weld heat treatment is applied, the test requirements may be modified at the discretion of the Administration.

6.3 General test requirements and specifications

6.3.1 *Tensile test*

6.3.1.1 Tensile testing shall be carried out in accordance with recognized standards.

6.3.1.2 Tensile strength, yield stress and elongation shall be to the satisfaction of the Administration. For carbon-manganese steel and other materials with definitive yield points, consideration shall be given to the limitation of the yield to tensile ratio.

6.3.2 *Toughness test*

6.3.2.1 Acceptance tests for metallic materials shall include Charpy V-notch toughness tests, unless otherwise specified by the Administration. The specified Charpy V-notch requirements are minimum average energy values for three full size (10 mm × 10 mm) specimens and minimum single energy values for individual specimens. Dimensions and tolerances of Charpy V-notch specimens shall be in accordance with recognized standards. The testing and requirements for specimens smaller than 5 mm in size shall be in accordance with recognized standards. Minimum average values for subsized specimens shall be:

Charpy V-notch specimen size (mm)	**Minimum average energy of three specimens**
10 x 10	KV
10 x 7.5	5/6 KV
10 x 5	2/3 KV

where:

KV = the energy values (J) specified in tables 6.1 to 6.4.

Only one individual value may be below the specified average value, provided it is not less than 70% of that value.

6.3.2.2 For base metal, the largest size Charpy V-notch specimens possible for the material thickness shall be machined with the specimens located as near as practicable to a point midway between the surface and the centre of the thickness and the length of the notch perpendicular to the surface as shown in figure 6.1.

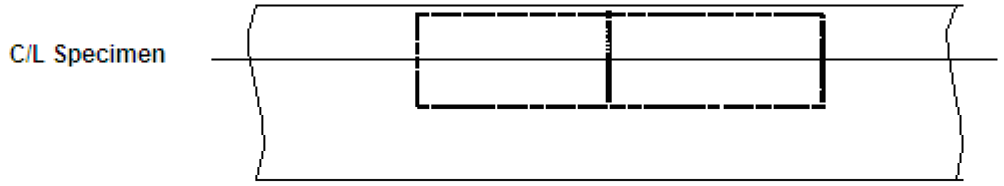


Figure 6.1 – Orientation of base metal test specimen

6.3.2.3 For a weld test specimen, the largest size Charpy V-notch specimens possible for the material thickness shall be machined, with the specimens located as near as practicable to a point midway between the surface and the centre of the thickness. In all cases, the distance from the surface of the material to the edge of the specimen shall be approximately 1 mm or greater. In addition, for double-V butt welds, specimens shall be machined closer to the surface of the second welded section. The specimens shall be taken generally at each of the following locations, as shown in figure 6.2, on the centreline of the welds, the fusion line and 1 mm, 3 mm and 5 mm from the fusion line.

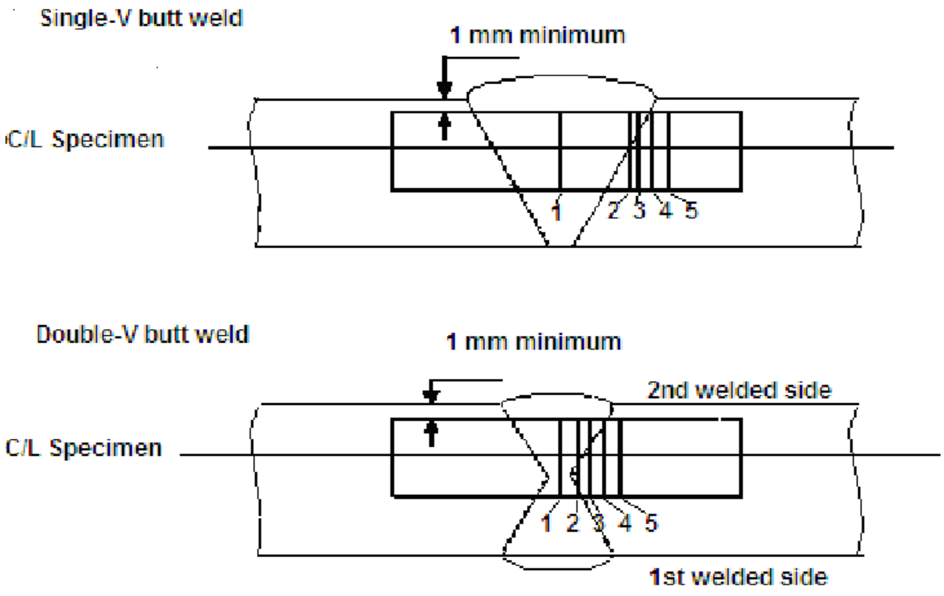


Figure 6.2 – Orientation of weld test specimen

Notch locations in figure 6.2:

.1 Centreline of the weld.

.2 Fusion line.

.3 In heat-affected zone (HAZ), 1 mm from the fusion line.

.4 In HAZ, 3 mm from the fusion line.

.5 In HAZ, 5 mm from the fusion line.

6.3.2.4 If the average value of the three initial Charpy V-notch specimens fails to meet the stated requirements, or the value for more than one specimen is below the required average value, or when the value for one specimen is below the minimum value permitted for a single specimen, three additional specimens from the same material may be tested and the results be combined with those previously obtained to form a new average. If this new average complies with the requirements and if no more than two individual results are lower than the required average and no more than one result is lower than the required value for a single specimen, the piece or batch may be accepted.

6.3.3 ***Bend test***

6.3.3.1 The bend test may be omitted as a material acceptance test, but is required for weld tests. Where a bend test is performed, this shall be done in accordance with recognized standards.

6.3.3.2 The bend tests shall be transverse bend tests, which may be face, root or side bends at the discretion of the Administration. However, longitudinal bend tests may be required in lieu of transverse bend tests in cases where the base material and weld metal have different strength levels.

6.3.4 ***Section observation and other testing***

Macrosection, microsection observations and hardness tests may also be required by the Administration, and they shall be carried out in accordance with recognized standards, where required.

6.4 Requirements for metallic materials

6.4.1 ***General requirements for metallic materials***

6.4.1.1 The requirements for materials of construction are shown in the tables as follows:

.1 Table 6.1: Plates, pipes (seamless and welded), sections and forgings for cargo tanks and process pressure vessels for design temperatures not lower than 0°C.

.2 Table 6.2: Plates, sections and forgings for cargo tanks, secondary barriers and process pressure vessels for design temperatures below 0°C and down to -55°C.

.3 Table 6.3: Plates, sections and forgings for cargo tanks, secondary barriers and process pressure vessels for design temperatures below -55°C and down to -165°C.

.4 Table 6.4: Pipes (seamless and welded), forgings and castings for cargo and process piping for design temperatures below 0°C and down to -165°C.

.5 Table 6.5: Plates and sections for hull structures required by 4.19.1.2 and 4.19.1.3.

Table 6.1

PLATES, PIPES (SEAMLESS AND WELDED) See notes 1 and 2**, SECTIONS AND FORGINGS FOR CARGO TANKS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES NOT LOWER THAN 0°C**	
CHEMICAL COMPOSITION AND HEAT TREATMENT	
◆ Carbon-manganese steel	
◆ Fully killed fine grain steel	
◆ Small additions of alloying elements by agreement with the Administration	
◆ Composition limits to be approved by the Administration	
◆ Normalized, or quenched and tempered See note 4	
TENSILE AND TOUGHNESS (IMPACT) TEST REQUIREMENTS	
Sampling frequency	
◆ Plates	Each "piece" to be tested
◆ Sections and forgings	Each "batch" to be tested.
Mechanical properties	
◆ Tensile properties	Specified minimum yield stress not to exceed 410 N/mm^2 See note 5
Toughness (Charpy V-notch test)	
◆ Plates	Transverse test pieces. Minimum average energy value (KV) 27J
◆ Sections and forgings	Longitudinal test pieces. Minimum average energy (KV) 41J

	Thickness t (mm)	Test temperature (°C)
◆ Test temperature	$t \le 20$	0
	$20 < t \le 40$ See note 3	-20

Notes

1 For seamless pipes and fittings normal practice applies. The use of longitudinally and spirally welded pipes shall be specially approved by the Administration or recognized organization acting on its behalf.

2 Charpy V-notch impact tests are not required for pipes.

3 This table is generally applicable for material thicknesses up to 40 mm. Proposals for greater thicknesses shall be approved by the Administration or recognized organization acting on its behalf.

4 A controlled rolling procedure or TMCP may be used as an alternative.

5 Materials with specified minimum yield stress exceeding 410 N/mm^2 may be approved by the Administration or recognized organization acting on its behalf. For these materials, particular attention shall be given to the hardness of the welded and heat affected zones.

Table 6.2

PLATES, SECTIONS AND FORGINGS See note1 FOR CARGO TANKS, SECONDARY BARRIERS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES BELOW 0°C AND DOWN TO -55°C Maximum thickness 25 mm See note 2					
CHEMICAL COMPOSITION AND HEAT TREATMENT					
◆ Carbon-manganese steel					
◆ Fully killed, aluminium treated fine grain steel					
◆ Chemical composition (ladle analysis)					
C	Mn	Si	S	P	
0.16%max See note 3	0.7-1.60%	0.1-0.50%	0.025% max	0.025% max	
Optional additions: Alloys and grain refining elements may be generally in accordance with the following:					
Ni	Cr	Mo	Cu	Nb	V
0.8% max	0.25% max	0.08% max	0.35% max	0.05% max	0.1% max
Al content total 0.02% min (Acid soluble 0.015% min)					
◆ Normalized, or quenched and tempered See note 4					
TENSILE AND TOUGHNESS (IMPACT) TEST REQUIREMENTS					
Sampling frequency					
◆ Plates	Each "piece" to be tested				
◆ Sections and forgings	Each "batch" to be tested				
Mechanical properties					
◆ Tensile properties	Specified minimum yield stress not to exceed 410 N/mm^2 See note 5				
Toughness (Charpy V-notch test)					
◆ Plates	Transverse test pieces. Minimum average energy value (KV) 27J				
◆ Sections and forgings	Longitudinal test pieces. Minimum average energy (KV) 41J				
◆ Test temperature	5°C below the design temperature or -20°C, whichever is lower				

Notes

1 The Charpy V-notch and chemistry requirements for forgings may be specially considered by the Administration.

2 For material thickness of more than 25 mm, Charpy V-notch tests shall be conducted as follows:

Material thickness (mm)	Test temperature (°C)
25 < t ≤ 30	10°C below design temperature or -20°C, whichever is lower
30 < t ≤ 35	15°C below design temperature or -20°C, whichever is lower
35 < t ≤ 40	20°C below design temperature
40 < t	Temperature approved by the Administration or recognized organization acting on its behalf

The impact energy value shall be in accordance with the table for the applicable type of test specimen.

Materials for tanks and parts of tanks which are completely thermally stress relieved after welding may be tested at a temperature 5°C below design temperature or -20°C, whichever is lower.

For thermally stress relieved reinforcements and other fittings, the test temperature shall be the same as that required for the adjacent tank-shell thickness.

3 By special agreement with the Administration, the carbon content may be increased to 0.18% maximum, provided the design temperature is not lower than -40°C.

4 A controlled rolling procedure or TMCP may be used as an alternative.

5 Materials with specified minimum yield stress exceeding 410 N/mm^2 may be approved by the Administration or recognized organization acting on its behalf. For these materials, particular attention shall be given to the hardness of the welded and heat affected zones.

Guidance:

For materials exceeding 25 mm in thickness for which the test temperature is -60°C or lower, the application of specially treated steels or steels in accordance with table 6.3 may be necessary.

Table 6.3

PLATES, SECTIONS AND FORGINGS See note 1 **FOR CARGO TANKS, SECONDARY BARRIERS AND PROCESS PRESSURE VESSELS FOR DESIGN TEMPERATURES BELOW -55°C AND DOWN TO -165°C** See note 2 **Maximum thickness 25 mm** See notes 3 and 4		
Minimum design temperature (°C)	Chemical composition See note 5 and heat treatment	Impact test temperature (°C)
-60	1.5% nickel steel – normalized or normalized and tempered or quenched and tempered or TMCP See note 6	-65
-65	2.25% nickel steel – normalized or normalized and tempered or quenched and tempered or TMCP See notes 6 and 7	-70
-90	3.5% nickel steel – normalized or normalized and tempered or quenched and tempered or TMCP See notes 6 and 7	-95
-105	5% nickel steel – normalized or normalized and tempered or quenched and tempered See notes 6, 7 and 8	-110
-165	9% nickel steel – double normalized and tempered or quenched and tempered See note 6	-196
-165	Austenitic steels, such as types 304, 304L, 316, 316L, 321 and 347 solution treated See note 9	-196
-165	Aluminium alloys; such as type 5083 annealed	Not required
-165	Austenitic Fe-Ni alloy (36% nickel). Heat treatment as agreed	Not required

TENSILE AND TOUGHNESS (IMPACT) TEST REQUIREMENTS	
Sampling frequency	
◆ Plates	Each "piece" to be tested
◆ Sections and forgings	Each "batch" to be tested
Toughness (Charpy V-notch test)	
◆ Plates	Transverse test pieces. Minimum average energy value (KV) 27J
◆ Sections and forgings	Longitudinal test pieces. Minimum average energy (KV) 41J

Notes

1 The impact test required for forgings used in critical applications shall be subject to special consideration by the Administration.

2 The requirements for design temperatures below -165°C shall be specially agreed with the Administration.

3 For materials 1.5% Ni, 2.25% Ni, 3.5% Ni and 5% Ni, with thicknesses greater than 25 mm, the impact tests shall be conducted as follows:

Material thickness (mm)	Test temperature (°C)
$25 < t \leq 30$	10°C below design temperature
$30 < t \leq 35$	15°C below design temperature
$35 < t \leq 40$	20°C below design temperature

The energy value shall be in accordance with the table for the applicable type of test specimen. For material thickness of more than 40 mm, the Charpy V-notch values shall be specially considered.

4 For 9% Ni steels, austenitic stainless steels and aluminium alloys, thickness greater than 25 mm may be used.

5 The chemical composition limits shall be in accordance with recognized standards.

6 TMCP nickel steels will be subject to acceptance by the Administration.

7 A lower minimum design temperature for quenched and tempered steels may be specially agreed with the Administration.

8 A specially heat treated 5% nickel steel, for example triple heat treated 5% nickel steel, may be used down to -165°C, provided that the impact tests are carried out at -196°C.

9 The impact test may be omitted, subject to agreement with the Administration.

Table 6.4

PIPES (SEAMLESS AND WELDED) See note 1, FORGINGS See note 2 AND CASTINGS See note 2 FOR CARGO AND PROCESS PIPING FOR DESIGN TEMPERATURES BELOW 0°C AND DOWN TO -165°C See note 3 Maximum thickness 25 mm			
Minimum design temperature (°C)	Chemical composition See note 5 and heat treatment	Impact test	
		Test temp. (°C)	Minimum average energy (KV)
-55	Carbon-manganese steel. Fully killed fine grain. Normalized or as agreed See note 6	See note 4	27
-65	2.25% nickel steel. Normalized, normalized and tempered or quenched and tempered See note 6	-70	34
-90	3.5% nickel steel. Normalized, normalized and tempered or quenched and tempered See note 6	-95	34
-165	9% nickel steel See note 7. Double normalized and tempered or quenched and tempered	-196	41
	Austenitic steels, such as types 304. 304L, 316, 316L, 321 and 347. Solution treated See note 8	-196	41
	Aluminium alloys; such as type 5083 annealed		Not required
TENSILE AND TOUGHNESS (IMPACT) TEST REQUIREMENTS			
Sampling frequency			
◆ Each "batch" to be tested.			
Toughness (Charpy V-notch test)			
◆ Impact test: Longitudinal test pieces			

Notes

1 The use of longitudinally or spirally welded pipes shall be specially approved by the Administration.

2 The requirements for forgings and castings may be subject to special consideration by the Administration.

3 The requirements for design temperatures below -165°C shall be specially agreed with the Administration.

4 The test temperature shall be 5°C below the design temperature or -20°C, whichever is lower.

5 The composition limits shall be in accordance with recognized standards.

6 A lower design temperature may be specially agreed with the Administration for quenched and tempered materials.

7 This chemical composition is not suitable for castings.

8 Impact tests may be omitted, subject to agreement with the Administration.

Table 6.5

PLATES AND SECTIONS FOR HULL STRUCTURES REQUIRED BY 4.19.1.2 AND 4.19.1.3								
Minimum design temperature of hull structure (°C)	Maximum thickness (mm) for steel grades							
	A	B	D	E	AH	DH	EH	FH
0 and above See note 1 -5 and above See note 2	Recognized standards							
down to -5	15	25	30	50	25	45	50	50
down to -10	x	20	25	50	20	40	50	50
down to -20	x	x	20	50	x	30	50	50
down to -30	x	x	x	40	x	20	40	50
Below -30	In accordance with table 6.2, except that the thickness limitation given in table 6.2 and in note 2 of that table does not apply.							

Notes

"x" means steel grade not to be used.

1 For the purpose of 4.19.1.3.

2 For the purpose of 4.19.1.2.

6.5 Welding of metallic materials and non-destructive testing

6.5.1 *General*

6.5.1.1 This section shall apply to primary and secondary barriers only, including the inner hull where this forms the secondary barrier. Acceptance testing is specified for carbon, carbon-manganese, nickel alloy and stainless steels, but these tests may be adapted for other materials. At the discretion of the Administration, impact testing of stainless steel and aluminium alloy weldments may be omitted and other tests may be specially required for any material.

6.5.2 *Welding consumables*

6.5.2.1 Consumables intended for welding of cargo tanks shall be in accordance with recognized standards. Deposited weld metal tests and butt weld tests shall be required for all consumables. The results obtained from tensile and Charpy V-notch impact tests shall be in accordance with recognized standards. The chemical composition of the deposited weld metal shall be recorded for information.

6.5.3 *Welding procedure tests for cargo tanks and process pressure vessels*

6.5.3.1 Welding procedure tests for cargo tanks and process pressure vessels are required for all butt welds.

6.5.3.2 The test assemblies shall be representative of:

.1 each base material;

.2 each type of consumable and welding process; and

.3 each welding position.

6.5.3.3 For butt welds in plates, the test assemblies shall be so prepared that the rolling direction is parallel to the direction of welding. The range of thickness qualified by each welding procedure test shall be in accordance with recognized standards. Radiographic or ultrasonic testing may be performed at the option of the fabricator.

6.5.3.4 The following welding procedure tests for cargo tanks and process pressure vessels shall be carried out in accordance with 6.3, with specimens made from each test assembly:

.1 cross-weld tensile tests;

.2 longitudinal all-weld testing, where required by the recognized standards;

.3 transverse bend tests, which may be face, root or side bends. However, longitudinal bend tests may be required in lieu of transverse bend tests in cases where the base material and weld metal have different strength levels;

.4 one set of three Charpy V-notch impacts, generally at each of the following locations, as shown in figure 6.2:

.1 centreline of the weld;

.2 fusion line;

.3 1 mm from the fusion line;

.4 3 mm from the fusion line; and

.5 5 mm from the fusion line; and

.5 macrosection, microsection and hardness survey may also be required.

6.5.3.5 Each test shall satisfy the following requirements:

.1 tensile tests: cross-weld tensile strength shall not be less than the specified minimum tensile strength for the appropriate parent materials. For aluminium alloys, reference shall be made to 4.18.1.3 with regard to the requirements for weld metal strength of under-matched welds (where the weld metal has a lower tensile strength than the parent metal). In every case, the position of fracture shall be recorded for information;

.2 bend tests: no fracture is acceptable after a 180° bend over a former of a diameter four times the thickness of the test pieces; and

.3 Charpy V-notch impact tests: Charpy V-notch tests shall be conducted at the temperature prescribed for the base material being joined. The results of weld metal impact tests, minimum average energy (KV), shall be no less than 27 J. The weld metal requirements for subsize specimens and single energy values shall be in accordance with 6.3.2. The results of fusion line and heat-affected zone impact tests shall show a minimum average energy (KV) in accordance with the transverse or longitudinal requirements of the base material, whichever is applicable, and for subsize specimens, the minimum average energy (KV) shall be in accordance with 6.3.2. If the material thickness does not permit machining either full-size or standard subsize specimens, the testing procedure and acceptance standards shall be in accordance with recognized standards.

6.5.3.6 Procedure tests for fillet welding shall be in accordance with recognized standards. In such cases, consumables shall be so selected that exhibit satisfactory impact properties.

6.5.4 *Welding procedure tests for piping*

Welding procedure tests for piping shall be carried out and shall be similar to those detailed for cargo tanks in 6.5.3.

6.5.5 *Production weld tests*

6.5.5.1 For all cargo tanks and process pressure vessels, except integral and membrane tanks, production weld tests shall generally be performed for approximately each 50 m of butt-weld joints and shall be representative of each welding position. For secondary barriers, the same type production tests as required for primary tanks shall be performed, except that the number of tests may be reduced subject to agreement with the Administration. Tests, other than those specified in 6.5.5.2 to 6.5.5.5 may be required for cargo tanks or secondary barriers.

6.5.5.2 The production tests for type A and type B independent tanks and semi-membrane tanks shall include bend tests and, where required for procedure tests, one set of three Charpy V-notch tests. The tests shall be made for each 50 m of weld. The Charpy V-notch tests shall be made with specimens having the notch alternately located in the centre of the weld and in the heat-affected zone (most critical location based on procedure qualification results). For austenitic stainless steel, all notches shall be in the centre of the weld.

6.5.5.3 For type C independent tanks and process pressure vessels, transverse weld tensile tests are required in addition to the tests listed in 6.5.5.2. Tensile tests shall meet the requirements of 6.5.3.5.

6.5.5.4 The quality assurance/quality control programme shall ensure the continued conformity of the production welds as defined in the material manufacturers quality manual.

6.5.5.5 The test requirements for integral and membrane tanks are the same as the applicable test requirements listed in 6.5.3.

6.5.6 *Non-destructive testing*

6.5.6.1 All test procedures and acceptance standards shall be in accordance with recognized standards, unless the designer specifies a higher standard in order to meet design assumptions. Radiographic testing shall be used, in principle, to detect internal defects. However, an approved ultrasonic test procedure in lieu of radiographic testing may be conducted, but, in addition, supplementary radiographic testing at selected locations shall be carried out to verify the results. Radiographic and ultrasonic testing records shall be retained.

6.5.6.2 For type A independent tanks and semi-membrane tanks, where the design temperature is below -20°C, and for type B independent tanks, regardless of temperature, all full penetration butt welds of the shell plating of cargo tanks shall be subjected to non-destructive testing suitable to detect internal defects over their full length. Ultrasonic testing in lieu of radiographic testing may be carried out under the same conditions as described in 6.5.6.1.

6.5.6.3 Where the design temperature is higher than -20°C, all full penetration butt welds in way of intersections and at least 10% of the remaining full penetration welds of tank structures shall be subjected to radiographic testing or ultrasonic testing under the same conditions as described in 6.5.6.1.

6.5.6.4 In each case, the remaining tank structure, including the welding of stiffeners and other fittings and attachments, shall be examined by magnetic particle or dye penetrant methods, as considered necessary.

6.5.6.5 For type C independent tanks, the extent of non-destructive testing shall be total or partial according to recognized standards, but the controls to be carried out shall not be less than the following:

.1 Total non-destructive testing referred to in 4.23.2.1.3:

Radiographic testing:

.1 all butt welds over their full length;

Non-destructive testing for surface crack detection:

.2 all welds over 10% of their length;

.3 reinforcement rings around holes, nozzles, etc., over their full length.

As an alternative, ultrasonic testing as described in 6.5.6.1 may be accepted as a partial substitute for the radiographic testing. In addition, the Administration may require total ultrasonic testing on welding of reinforcement rings around holes, nozzles, etc.

.2 Partial non-destructive testing referred to in 4.23.2.1.3:

Radiographic testing:

.1 all butt-welded crossing joints and at least 10% of the full length of butt welds at selected positions uniformly distributed;

Non-destructive testing for surface crack detection:

.2 reinforcement rings around holes, nozzles, etc., over their full length;

Ultrasonic testing:

.3 as may be required by the Administration or recognized organization acting on its behalf in each instance.

6.5.6.6 The quality assurance/quality control programme shall ensure the continued conformity of the non-destructive testing of welds, as defined in the material manufacturer's quality manual.

6.5.6.7 Inspection of piping shall be carried out in accordance with the requirements of chapter 5.

6.5.6.8 The secondary barrier shall be non-destructive tested for internal defects as considered necessary. Where the outer shell of the hull is part of the secondary barrier, all sheer strake butts and the intersections of all butts and seams in the side shell shall be tested by radiographic testing.

6.6 Other requirements for construction in metallic materials

6.6.1 *General*

6.6.1.1 Inspection and non-destructive testing of welds shall be in accordance with the requirements of 6.5.5 and 6.5.6. Where higher standards or tolerances are assumed in the design, they shall also be satisfied.

6.6.2 *Independent tank*

6.6.2.1 For type C tanks and type B tanks primarily constructed of bodies of revolution, the tolerances relating to manufacture, such as out-of-roundness, local deviations from the true form, welded joints alignment and tapering of plates having different thicknesses, shall comply with recognized standards. The tolerances shall also be related to the buckling analysis referred to in 4.22.3.2 and 4.23.3.2.

6.6.2.2 For type C tanks of carbon and carbon-manganese steel, post-weld heat treatment shall be performed after welding, if the design temperature is below -10°C. Post-weld heat treatment in all other cases and for materials other than those mentioned above shall be to recognized standards. The soaking temperature and holding time shall be to the recognized standards.

6.6.2.3 In the case of type C tanks and large cargo pressure vessels of carbon or carbon-manganese steel, for which it is difficult to perform the heat treatment, mechanical stress relieving by pressurizing may be carried out as an alternative to the heat treatment and subject to the following conditions:

.1 complicated welded pressure vessel parts such as sumps or domes with nozzles, with adjacent shell plates shall be heat treated before they are welded to larger parts of the pressure vessel;

.2 the mechanical stress relieving process shall preferably be carried out during the hydrostatic pressure test required by 4.23.6, by applying a higher pressure than the test pressure required by 4.23.6.1. The pressurizing medium shall be water;

.3 for the water temperature, 4.23.6.2 applies;

.4 stress relieving shall be performed while the tank is supported by its regular saddles or supporting structure or, when stress relieving cannot be carried out on board, in a manner which will give the same stresses and stress distribution as when supported by its regular saddles or supporting structure;

.5 the maximum stress relieving pressure shall be held for 2 h per 25 mm of thickness, but in no case less than 2 h;

.6 the upper limits placed on the calculated stress levels during stress relieving shall be the following:

 .1 equivalent general primary membrane stress: 0.9 R_e;

 .2 equivalent stress composed of primary bending stress plus membrane stress: 1.35 R_e, where R_e is the specific lower minimum yield stress or 0.2% proof stress at test temperature of the steel used for the tank;

.7 strain measurements will normally be required to prove these limits for at least the first tank of a series of identical tanks built consecutively. The location of strain gauges shall be included in the mechanical stress relieving procedure to be submitted in accordance with 6.6.2.3;

.8 the test procedure shall demonstrate that a linear relationship between pressure and strain is achieved at the end of the stress relieving process when the pressure is raised again up to the design pressure;

.9 high-stress areas in way of geometrical discontinuities such as nozzles and other openings shall be checked for cracks by dye penetrant or magnetic particle inspection after mechanical stress relieving. Particular attention in this respect shall be paid to plates exceeding 30 mm in thickness;

.10 steels which have a ratio of yield stress to ultimate tensile strength greater than 0.8 shall generally not be mechanically stress relieved. If, however, the yield stress is raised by a method giving high ductility of the steel, slightly higher rates may be accepted upon consideration in each case;

.11 mechanical stress relieving cannot be substituted for heat treatment of cold formed parts of tanks, if the degree of cold forming exceeds the limit above which heat treatment is required;

.12 the thickness of the shell and heads of the tank shall not exceed 40 mm. Higher thicknesses may be accepted for parts which are thermally stress relieved;

.13 local buckling shall be guarded against, particularly when tori-spherical heads are used for tanks and domes; and

.14 the procedure for mechanical stress relieving shall be to a recognized standard.

6.6.3 *Secondary barriers*

During construction, the requirements for testing and inspection of secondary barriers shall be approved or accepted by the Administration or recognized organization acting on its behalf (see 4.6.2.5 and 4.6.2.6).

6.6.4 *Semi-membrane tanks*

For semi-membrane tanks, the relevant requirements in section 6.6 for independent tanks or for membrane tanks shall be applied as appropriate.

6.6.5 *Membrane tanks*

The quality assurance/quality control programme shall ensure the continued conformity of the weld procedure qualification, design details, materials, construction, inspection and production testing of components. These standards and procedures shall be developed during the prototype testing programme.

6.7 Non-metallic materials

6.7.1 *General*

The information in the attached appendix 4 is given for guidance in the selection and use of these materials, based on the experience to date.

CHAPTER 7

CARGO PRESSURE/TEMPERATURE CONTROL

Goal

To maintain the cargo tank pressure and temperature within design limits of the containment system and/or carriage requirements of the cargo.

7.1 Methods of control

7.1.1 With the exception of tanks designed to withstand full gauge vapour pressure of the cargo under conditions of the upper ambient design temperatures, cargo tanks' pressure and temperature shall be maintained at all times within their design range by either one, or a combination of, the following methods:

.1 reliquefaction of cargo vapours;

.2 thermal oxidation of vapours;

.3 pressure accumulation; and

.4 liquid cargo cooling.

7.1.2 For certain cargoes, where required by chapter 17, the cargo containment system shall be capable of withstanding the full vapour pressure of the cargo under conditions of the upper ambient design temperatures, irrespective of any system provided for dealing with boil-off gas.

7.1.3 Venting of the cargo to maintain cargo tank pressure and temperature shall not be acceptable except in emergency situations. The Administration may permit certain cargoes to be controlled by venting cargo vapours to the atmosphere at sea. This may also be permitted in port with the authorization of the port Administration.

7.2 Design of systems

For normal service, the upper ambient design temperature shall be:

- sea: 32°C
- air: 45°C

For service in particularly hot or cold zones, these design temperatures shall be increased or decreased, to the satisfaction of the Administration. The overall capacity of the system shall be such that it can control the pressure within the design conditions without venting to atmosphere.

7.3 Reliquefaction of cargo vapours

7.3.1 *General*

The reliquefaction system may be arranged in one of the following ways:

.1 a direct system, where evaporated cargo is compressed, condensed and returned to the cargo tanks;

.2 an indirect system, where cargo or evaporated cargo is cooled or condensed by refrigerant without being compressed;

.3 a combined system, where evaporated cargo is compressed and condensed in a cargo/refrigerant heat exchanger and returned to the cargo tanks; and

.4 if the reliquefaction system produces a waste stream containing methane during pressure control operations within the design conditions, these waste gases, as far as reasonably practicable, are disposed of without venting to atmosphere.

Note:

The requirements of chapters 17 and 19 may preclude the use of one or more of these systems or may specify the use of a particular system.

7.3.2 ***Compatibility***

Refrigerants used for reliquefaction shall be compatible with the cargo they may come into contact with. In addition, when several refrigerants are used and may come into contact, they shall be compatible with each other.

7.4 Thermal oxidation of vapours

7.4.1 ***General***

Maintaining the cargo tank pressure and temperature by means of thermal oxidation of cargo vapours, as defined in 1.2.52 and 16.2 shall be permitted only for LNG cargoes. In general:

.1 thermal oxidation systems shall exhibit no externally visible flame and shall maintain the uptake exhaust temperature below 535°C;

.2 arrangement of spaces where oxidation systems are located shall comply with 16.3 and supply systems shall comply with 16.4; and

.3 if waste gases coming from any other system are to be burnt, the oxidation system shall be designed to accommodate all anticipated feed gas compositions.

7.4.2 ***Thermal oxidation systems***

Thermal oxidation systems shall comply with the following:

.1 each thermal oxidation system shall have a separate uptake;

.2 each thermal oxidation system shall have a dedicated forced draught system; and

.3 combustion chambers and uptakes of thermal oxidation systems shall be designed to prevent any accumulation of gas.

7.4.3 ***Burners***

Burners shall be designed to maintain stable combustion under all design firing conditions.

7.4.4 ***Safety***

7.4.4.1 Suitable devices shall be installed and arranged to ensure that gas flow to the burner is cut off unless satisfactory ignition has been established and maintained.

7.4.4.2 Each oxidation system shall have provision to manually isolate its gas fuel supply from a safely accessible position.

7.4.4.3 Provision shall be made for automatic purging the gas supply piping to the burners by means of an inert gas, after the extinguishing of these burners.

7.4.4.4 In case of flame failure of all operating burners for gas or oil or for a combination thereof, the combustion chambers of the oxidation system shall be automatically purged before relighting.

7.4.4.5 Arrangements shall be made to enable the combustion chamber to be manually purged.

7.5 Pressure accumulation systems

The containment system insulation, design pressure or both shall be adequate to provide for a suitable margin for the operating time and temperatures involved. No additional pressure and temperature control system is required. Conditions for acceptance shall be recorded in the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required in 1.4.4.

7.6 Liquid cargo cooling

The bulk cargo liquid may be refrigerated by coolant circulated through coils fitted either inside the cargo tank or onto the external surface of the cargo tank.

7.7 Segregation

Where two or more cargoes that may react chemically in a dangerous manner are carried simultaneously, separate systems as defined in 1.2.47, each complying with availability criteria as specified in 7.8, shall be provided for each cargo. For simultaneous carriage of two or more cargoes that are not reactive to each other but where, due to properties of their vapour, separate systems are necessary, separation may be by means of isolation valves.

7.8 Availability

The availability of the system and its supporting auxiliary services shall be such that:

.1 in case of a single failure of a mechanical non-static component or a component of the control systems, the cargo tanks' pressure and temperature can be maintained within their design range without affecting other essential services;

.2 redundant piping systems are not required;

.3 heat exchangers that are solely necessary for maintaining the pressure and temperature of the cargo tanks within their design ranges shall have a standby heat exchanger, unless they have a capacity in excess of 25% of the largest required capacity for pressure control and they can be repaired on board without external resources. Where an additional and separate method of cargo tank pressure and temperature control is fitted that is not reliant on the sole heat exchanger, then a standby heat exchanger is not required; and

.4 for any cargo heating or cooling medium, provisions shall be made to detect the leakage of toxic or flammable vapours into an otherwise non-hazardous area or overboard in accordance with 13.6. Any vent outlet from this leak detection arrangement shall be to a non-hazardous area and be fitted with a flame screen.

CHAPTER 8

VENT SYSTEMS FOR CARGO CONTAINMENT

Goal

To protect cargo containment systems from harmful overpressure or underpressure at all times.

8.1 General

All cargo tanks shall be provided with a pressure relief system appropriate to the design of the cargo containment system and the cargo being carried. Hold spaces and interbarrier spaces, which may be subject to pressures beyond their design capabilities, shall also be provided with a suitable pressure relief system. Pressure control systems specified in chapter 7 shall be independent of the pressure relief systems.

8.2 Pressure relief systems

8.2.1 Cargo tanks, including deck tanks, shall be fitted with a minimum of two pressure relief valves (PRVs), each being of equal size within manufacturer's tolerances and suitably designed and constructed for the prescribed service.

8.2.2 Interbarrier spaces shall be provided with pressure relief devices[8]. For membrane systems, the designer shall demonstrate adequate sizing of interbarrier space PRVs.

8.2.3 The setting of the PRVs shall not be higher than the vapour pressure that has been used in the design of the tank. Where two or more PRVs are fitted, valves comprising not more than 50% of the total relieving capacity may be set at a pressure up to 5% above MARVS to allow sequential lifting, minimizing unnecessary release of vapour.

8.2.4 The following temperature requirements apply to PRVs fitted to pressure relief systems:

.1 PRVs on cargo tanks with a design temperature below 0°C shall be designed and arranged to prevent their becoming inoperative due to ice formation;

.2 the effects of ice formation due to ambient temperatures shall be considered in the construction and arrangement of PRVs;

.3 PRVs shall be constructed of materials with a melting point above 925°C. Lower melting point materials for internal parts and seals may be accepted, provided that fail-safe operation of the PRV is not compromised; and

.4 sensing and exhaust lines on pilot operated relief valves shall be of suitably robust construction to prevent damage.

[8] Refer to IACS Unified Interpretation GC9 entitled "Guidance for sizing pressure relief systems for interbarrier spaces", 1988.

8.2.5 ***Valve testing***

8.2.5.1 PRVs shall be type-tested. Type tests shall include:

.1 verification of relieving capacity;

.2 cryogenic testing when operating at design temperatures colder than -55°C;

.3 seat tightness testing; and

.4 pressure containing parts are pressure tested to at least 1.5 times the design pressure.

PRVs shall be tested in accordance with recognized standards[9].

8.2.5.2 Each PRV shall be tested to ensure that:

.1 it opens at the prescribed pressure setting, with an allowance not exceeding ± 10% for 0 to 0.15 MPa, ± 6% for 0.15 to 0.3 MPa, ± 3% for 0.3 MPa and above;

.2 seat tightness is acceptable; and

.3 pressure containing parts will withstand at least 1.5 times the design pressure.

8.2.6 PRVs shall be set and sealed by the Administration or recognized organization acting on its behalf, and a record of this action, including the valves' set pressure, shall be retained on board the ship.

8.2.7 Cargo tanks may be permitted to have more than one relief valve set pressure in the following cases:

.1 installing two or more properly set and sealed PRVs and providing means, as necessary, for isolating the valves not in use from the cargo tank; or

.2 installing relief valves whose settings may be changed by the use of a previously approved device not requiring pressure testing to verify the new set pressure. All other valve adjustments shall be sealed.

8.2.8 Changing the set pressure under the provisions of 8.2.7 and the corresponding resetting of the alarms referred to in 13.4.2 shall be carried out under the supervision of the master in accordance with approved procedures and as specified in the ship's operating manual. Changes in set pressure shall be recorded in the ship's log and a sign shall be posted in the cargo control room, if provided, and at each relief valve, stating the set pressure.

8.2.9 In the event of a failure of a cargo tank-installed PRV, a safe means of emergency isolation shall be available:

.1 Procedures shall be provided and included in the cargo operations manual (see 18.2).

.2 The procedures shall allow only one of the cargo tank installed PRVs to be isolated.

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9 ISO 21013-1:2008 – Cryogenic vessels – Pressure-relief accessories for cryogenic service – part 1: Recloseable pressure-relief valves; and ISO 4126-1; 2004 Safety devices for protection against excessive pressure – part 1 and part 4: Safety valves.

.3 Isolation of the PRV shall be carried out under the supervision of the master. This action shall be recorded in the ship's log and a sign posted in the cargo control room, if provided, and at the PRV.

.4 The tank shall not be loaded until the full relieving capacity is restored.

8.2.10 Each PRV installed on a cargo tank shall be connected to a venting system, which shall be:

.1 so constructed that the discharge will be unimpeded and directed vertically upwards at the exit;

.2 arranged to minimize the possibility of water or snow entering the vent system;

.3 arranged such that the height of vent exits shall not be less than B/3 or 6 m, whichever is the greater, above the weather deck; and

.4 6 m above working areas and walkways.

8.2.11.1 Cargo PRV vent exits shall be arranged at a distance at least equal to B or 25 m, whichever is less, from the nearest air intake, outlet or opening to accommodation spaces, service spaces and control stations, or other non-hazardous areas. For ships less than 90 m in length, smaller distances may be permitted.

8.2.11.2 All other vent outlets connected to the cargo containment system shall be arranged at a distance of at least 10 m from the nearest air intake, outlet or opening to accommodation spaces, service spaces and control stations, or other non-hazardous areas.

8.2.12 All other cargo vent outlets not dealt with in other chapters shall be arranged in accordance with 8.2.10, 8.2.11.1 and 8.2.11.2. Means shall be provided to prevent liquid overflow from vent mast outlets, due to hydrostatic pressure from spaces to which they are connected.

8.2.13 If cargoes that react in a dangerous manner with each other are carried simultaneously, a separate pressure relief system shall be fitted for each one.

8.2.14 In the vent piping system, means for draining liquid from places where it may accumulate shall be provided. The PRVs and piping shall be arranged so that liquid can, under no circumstances, accumulate in or near the PRVs.

8.2.15 Suitable protection screens of not more than 13 mm square mesh shall be fitted on vent outlets to prevent the ingress of extraneous objects without adversely affecting the flow. Other requirements for protection screens apply when carrying specific cargoes (see 17.9 and 17.21).

8.2.16 All vent piping shall be designed and arranged not to be damaged by the temperature variations to which it may be exposed, forces due to flow or the ship's motions.

8.2.17 PRVs shall be connected to the highest part of the cargo tank above deck level. PRVs shall be positioned on the cargo tank so that they will remain in the vapour phase at the filling limit (*FL*) as defined in chapter 15, under conditions of 15° list and 0.015L trim, where L is defined in 1.2.31.

8.2.18 The adequacy of the vent system fitted on tanks loaded in accordance with 15.5.2 shall be demonstrated by the Administration, taking into account the recommendations developed by the Organization[10]. A relevant certificate shall be permanently kept on board the ship. For the purposes of this paragraph, vent system means:

.1 the tank outlet and the piping to the PRV;

.2 the PRV; and

.3 the piping from the PRVs to the location of discharge to the atmosphere, including any interconnections and piping that joins other tanks.

8.3 Vacuum protection systems

8.3.1 Cargo tanks not designed to withstand a maximum external pressure differential 0.025 MPa, or tanks that cannot withstand the maximum external pressure differential that can be attained at maximum discharge rates with no vapour return into the cargo tanks, or by operation of a cargo refrigeration system, or by thermal oxidation, shall be fitted with:

.1 two independent pressure switches to sequentially alarm and subsequently stop all suction of cargo liquid or vapour from the cargo tank and refrigeration equipment, if fitted, by suitable means at a pressure sufficiently below the maximum external designed pressure differential of the cargo tank; or

.2 vacuum relief valves with a gas flow capacity at least equal to the maximum cargo discharge rate per cargo tank, set to open at a pressure sufficiently below the external design differential pressure of the cargo tank.

8.3.2 Subject to the requirements of chapter 17, the vacuum relief valves shall admit an inert gas, cargo vapour or air to the cargo tank and shall be arranged to minimize the possibility of the entrance of water or snow. If cargo vapour is admitted, it shall be from a source other than the cargo vapour lines.

8.3.3 The vacuum protection system shall be capable of being tested to ensure that it operates at the prescribed pressure.

8.4 Sizing of pressure relieving system

8.4.1 ***Sizing of pressure relief valves***

PRVs shall have a combined relieving capacity for each cargo tank to discharge the greater of the following, with not more than a 20% rise in cargo tank pressure above the MARVS:

8.4.1.1 The maximum capacity of the cargo tank inerting system, if the maximum attainable working pressure of the cargo tank inerting system exceeds the MARVS of the cargo tanks; or

8.4.1.2 Vapours generated under fire exposure computed using the following formula:

$$Q = FGA^{0.82} \quad (m^3/s),$$

where:

Q = minimum required rate of discharge of air at standard conditions of 273.15 Kelvin (K) and 0.1013 MPa;

[10] Refer to the *Guidelines for the evaluation of the adequacy of type C tank vent systems* (resolution A.829(19)).

F = fire exposure factor for different cargo types as follows:

- 1 for tanks without insulation located on deck;
- 0.5 for tanks above the deck, when insulation is approved by the Administration. Approval will be based on the use of a fireproofing material, the thermal conductance of insulation and its stability under fire exposure;
- 0.5 for uninsulated independent tanks installed in holds;
- 0.2 for insulated independent tanks in holds (or uninsulated independent tanks in insulated holds);
- 0.1 for insulated independent tanks in inerted holds (or uninsulated independent tanks in inerted, insulated holds);
- 0.1 for membrane and semi-membrane tanks. For independent tanks partly protruding through the weather decks, the fire exposure factor shall be determined on the basis of the surface areas above and below deck.

G = gas factor according to formula:

$$G = \frac{12.4}{LD}\sqrt{\frac{ZT}{M}}$$

with:

T = temperature in degrees Kelvin at relieving conditions, i.e. 120% of the pressure at which the pressure relief valve is set;

L = latent heat of the material being vaporized at relieving conditions, in kJ/kg;

D = a constant based on relation of specific heats *k* and is calculated as follows:

$$D = \sqrt{k\left(\frac{2}{k+1}\right)^{\frac{k+1}{k-1}}}$$

where:

k = ratio of specific heats at relieving conditions, and the value of which is between 1 and 2.2. If *k* is not known, *D* = 0.606 shall be used;

Z = compressibility factor of the gas at relieving conditions. If not known, *Z* = 1 shall be used; and

M = molecular mass of the product.

The gas factor of each cargo to be carried shall be determined and the highest value shall be used for PRV sizing.

A = external surface area of the tank (m^2), as defined in 1.2.14, for different tank types, as shown in figure 8.1.

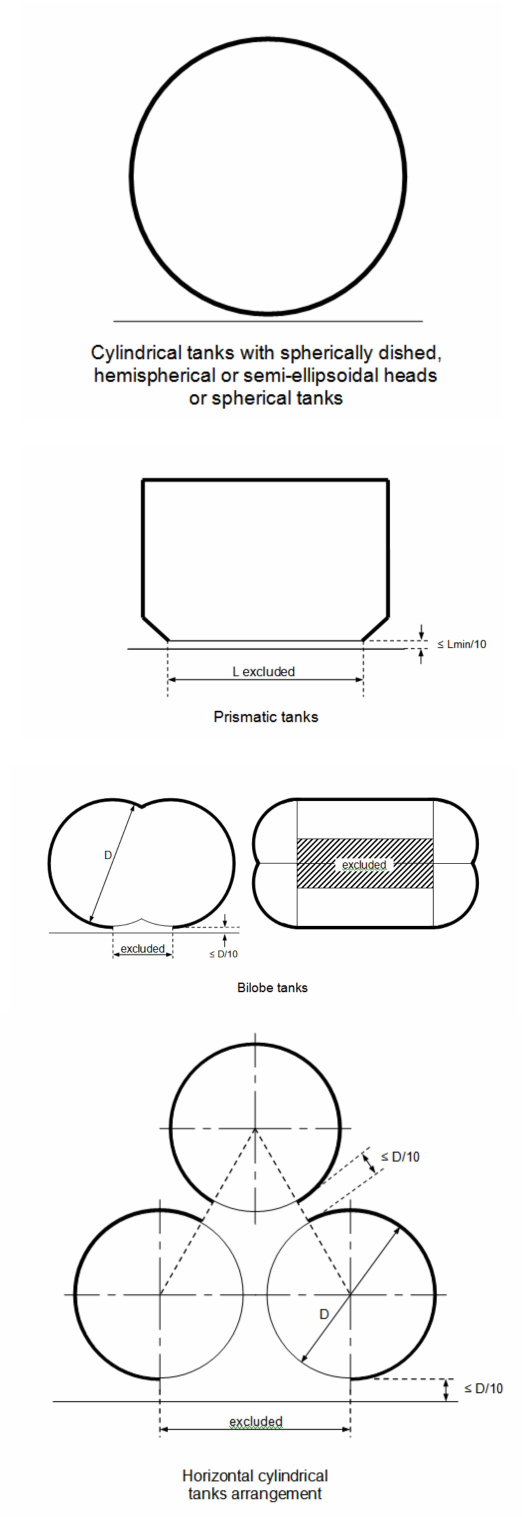

Figure 8.1

8.4.1.3 The required mass flow of air at relieving conditions is given by the formula:

$M_{air} = Q\ \rho_{\mathrm{air}}$ (kg/s),

where:

density of air (ρ_{air}) = 1.293 kg/m^3 (air at 273.15 K, 0.1013 MPa).

8.4.2 ***Sizing of vent pipe system***

Pressure losses upstream and downstream of the PRVs shall be taken into account when determining their size to ensure the flow capacity required by 8.4.1.

8.4.3 ***Upstream pressure losses***

8.4.3.1 The pressure drop in the vent line from the tank to the PRV inlet shall not exceed 3% of the valve set pressure at the calculated flow rate, in accordance with 8.4.1.

8.4.3.2 Pilot-operated PRVs shall be unaffected by inlet pipe pressure losses when the pilot senses directly from the tank dome.

8.4.3.3 Pressure losses in remotely sensed pilot lines shall be considered for flowing type pilots.

8.4.4 ***Downstream pressure losses***

8.4.4.1 Where common vent headers and vent masts are fitted, calculations shall include flow from all attached PRVs.

8.4.4.2 The built-up back pressure in the vent piping from the PRV outlet to the location of discharge to the atmosphere, and including any vent pipe interconnections that join other tanks, shall not exceed the following values:

.1 for unbalanced PRVs: 10% of MARVS;

.2 for balanced PRVs: 30% of MARVS; and

.3 for pilot operated PRVs: 50% of MARVS.

Alternative values provided by the PRV manufacturer may be accepted.

8.4.5 To ensure stable PRV operation, the blow-down shall not be less than the sum of the inlet pressure loss and 0.02 MARVS at the rated capacity.

CHAPTER 9

CARGO CONTAINMENT SYSTEM ATMOSPHERE CONTROL

Goal

To enable monitoring of the integrity of the containment system and to ensure that the atmosphere within the system and hold spaces is maintained in a safe condition at all times that the ship is in service.

9.1 Atmosphere control within the cargo containment system

9.1.1 A piping system shall be arranged to enable each cargo tank to be safely gas-freed, and to be safely filled with cargo vapour from a gas-free condition. The system shall be arranged to minimize the possibility of pockets of gas or air remaining after changing the atmosphere.

9.1.2 For flammable cargoes, the system shall be designed to eliminate the possibility of a flammable mixture existing in the cargo tank during any part of the atmosphere change operation by utilizing an inerting medium as an intermediate step.

9.1.3 Piping systems that may contain flammable cargoes shall comply with 9.1.1 and 9.1.2.

9.1.4 A sufficient number of gas sampling points shall be provided for each cargo tank and cargo piping system to adequately monitor the progress of atmosphere change. Gas sampling connections shall be fitted with a single valve above the main deck, sealed with a suitable cap or blank (see 5.6.5.5).

9.1.5 Inert gas utilized in these procedures may be provided from the shore or from the ship.

9.2 Atmosphere control within the hold spaces (cargo containment systems other than type C independent tanks)

9.2.1 Interbarrier and hold spaces associated with cargo containment systems for flammable gases requiring full or partial secondary barriers shall be inerted with a suitable dry inert gas and kept inerted with make-up gas provided by a shipboard inert gas generation system, or by shipboard storage, which shall be sufficient for normal consumption for at least 30 days.

9.2.2 Alternatively, subject to the restrictions specified in chapter 17, the spaces referred to in 9.2.1 requiring only a partial secondary barrier may be filled with dry air provided that the ship maintains a stored charge of inert gas or is fitted with an inert gas generation system sufficient to inert the largest of these spaces, and provided that the configuration of the spaces and the relevant vapour detection systems, together with the capability of the inerting arrangements, ensures that any leakage from the cargo tanks will be rapidly detected and inerting effected before a dangerous condition can develop. Equipment for the provision of sufficient dry air of suitable quality to satisfy the expected demand shall be provided.

9.2.3 For non-flammable gases, the spaces referred to in 9.2.1 and 9.2.2 may be maintained with a suitable dry air or inert atmosphere.

9.3 Environmental control of spaces surrounding type C independent tanks

Spaces surrounding cargo tanks that do not have secondary barriers shall be filled with suitable dry inert gas or dry air and be maintained in this condition with make-up inert gas provided by a shipboard inert gas generation system, shipboard storage of inert gas, or with dry air provided by suitable air drying equipment. If the cargo is carried at ambient temperature, the requirement for dry air or inert gas is not applicable.

9.4 Inerting

9.4.1 Inerting refers to the process of providing a non-combustible environment. Inert gases shall be compatible chemically and operationally at all temperatures likely to occur within the spaces and the cargo. The dew points of the gases shall be taken into consideration.

9.4.2 Where inert gas is also stored for firefighting purposes, it shall be carried in separate containers and shall not be used for cargo services.

9.4.3 Where inert gas is stored at temperatures below 0°C, either as a liquid or as a vapour, the storage and supply system shall be designed so that the temperature of the ship's structure is not reduced below the limiting values imposed on it.

9.4.4 Arrangements to prevent the backflow of cargo vapour into the inert gas system that are suitable for the cargo carried, shall be provided. If such plants are located in machinery spaces or other spaces outside the cargo area, two non-return valves or equivalent devices and, in addition, a removable spool piece shall be fitted in the inert gas main in the cargo area. When not in use, the inert gas system shall be made separate from the cargo system in the cargo area except for connections to the hold spaces or interbarrier spaces.

9.4.5 The arrangements shall be such that each space being inerted can be isolated and the necessary controls and relief valves, etc., shall be provided for controlling pressure in these spaces.

9.4.6 Where insulation spaces are continually supplied with an inert gas as part of a leak detection system, means shall be provided to monitor the quantity of gas being supplied to individual spaces.

9.5 Inert gas production on board

9.5.1 The equipment shall be capable of producing inert gas with an oxygen content at no time greater than 5% by volume, subject to the special requirements of chapter 17. A continuous-reading oxygen content meter shall be fitted to the inert gas supply from the equipment and shall be fitted with an alarm set at a maximum of 5% oxygen content by volume, subject to the requirements of chapter 17.

9.5.2 An inert gas system shall have pressure controls and monitoring arrangements appropriate to the cargo containment system.

9.5.3 Spaces containing inert gas generation plants shall have no direct access to accommodation spaces, service spaces or control stations, but may be located in machinery spaces. Inert gas piping shall not pass through accommodation spaces, service spaces or control stations.

9.5.4 Combustion equipment for generating inert gas shall not be located within the cargo area. Special consideration may be given to the location of inert gas generating equipment using a catalytic combustion process.

CHAPTER 10

ELECTRICAL INSTALLATIONS

Goal

To ensure that electrical installations are designed such as to minimize the risk of fire and explosion from flammable products, and that electrical generation and distribution systems relating to the safe carriage, handling and conditioning of cargo liquid and vapour are available.

10.1 Definitions

For the purpose of this chapter, unless expressly provided otherwise, the definitions below shall apply.

10.1.1 *Hazardous area* is an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of electrical apparatus[2].

10.1.1.1 *Zone 0 hazardous area* is an area in which an explosive gas atmosphere is present continuously or is present for long periods.

10.1.1.2 *Zone 1 hazardous area* is an area in which an explosive gas atmosphere is likely to occur in normal operation.

10.1.1.3 *Zone 2 hazardous area* is an area in which an explosive gas atmosphere is not likely to occur in normal operation and, if it does occur, is likely to do so infrequently and for a short period only.

10.1.2 *Non-hazardous area* is an area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of electrical apparatus.

10.2 General requirements

10.2.1 Electrical installations shall be such as to minimize the risk of fire and explosion from flammable products.

10.2.2 Electrical installations shall be in accordance with recognized standards.[3]

10.2.3 Electrical equipment or wiring shall not be installed in hazardous areas, unless essential for operational purposes or safety enhancement.

10.2.4 Where electrical equipment is installed in hazardous areas as provided in 10.2.3, it shall be selected, installed and maintained in accordance with standards not inferior to those acceptable to the Organization. Equipment for hazardous areas shall be evaluated and certified or listed by an accredited testing authority or notified body recognized by the Administration. Automatic isolation of non-certified equipment on detection of a flammable gas shall not be accepted as an alternative to the use of certified equipment.

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2 Examples of hazardous area zoning may be found in the International Electrotechnical Commission publication IEC 60092-502:1999. Electrical Installation in Ships – Tankers.

3 Refer to the recommendation published by the International Electrotechnical Commission in particular to publication IEC 60092-502:1999.

10.2.5 To facilitate the selection of appropriate electrical apparatus and the design of suitable electrical installations, hazardous areas are divided into zones in accordance with recognized standards.

10.2.6 Electrical generation and distribution systems, and associated control systems shall be designed such that a single fault will not result in the loss of ability to maintain cargo tank pressures, as required by 7.8.1, and hull structure temperature, as required by 4.19.1.6, within normal operating limits. Failure modes and effects shall be analysed and documented to a standard not inferior to those acceptable to the Administration[4].

10.2.7 The lighting system in hazardous areas shall be divided between at least two branch circuits. All switches and protective devices shall interrupt all poles or phases and shall be located in a non-hazardous area.

10.2.8 Electrical depth sounding or log devices and impressed current cathodic protection system anodes or electrodes shall be housed in gastight enclosures.

10.2.9 Submerged cargo pump motors and their supply cables may be fitted in cargo containment systems. Arrangements shall be made to automatically shut down the motors in the event of low-liquid level. This may be accomplished by sensing low pump discharge pressure, low motor current or low liquid level. This shutdown shall be alarmed at the cargo control station. Cargo pump motors shall be capable of being isolated from their electrical supply during gas-freeing operations.

CHAPTER 11

FIRE PROTECTION AND EXTINCTION

Goal

To ensure that suitable systems are provided to protect the ship and crew from fire in the cargo area.

11.1 Fire safety requirements

11.1.1 The requirements for tankers in SOLAS chapter II-2 shall apply to ships covered by the Code, irrespective of tonnage including ships of less than 500 gross tonnage, except that:

.1 regulations 4.5.1.6 and 4.5.10 do not apply;

.2 regulations 10.4 and 10.5 shall apply as they would apply to tankers of 2,000 gross tonnage and over;

.3 regulation 10.5.6 shall apply to ships of 2,000 gross tonnage and over;

[4] IEC 60812, Edition 2.0 2006-01 "Analysis techniques for system reliability – Procedure for failure mode and effects analysis (FMEA)".

.4 the following regulations of SOLAS chapter II-2 related to tankers do not apply and are replaced by chapters and sections of the Code as detailed below:

Regulation:	Replaced by:
10.10	11.6
4.5.1.1 and 4.5.1.2	Chapter 3
4.5.5	Relevant sections in the Code
10.8	11.3 and 11.4
10.9	11.5
10.2	11.2.1 to 11.2.4;

.5 regulations 13.3.4 and 13.4.3 shall apply to ships of 500 gross tonnage and over.

11.1.2 All sources of ignition shall be excluded from spaces where flammable vapour may be present, except as otherwise provided in chapters 10 and 16.

11.1.3 The provisions of this section shall apply in conjunction with chapter 3.

11.1.4 For the purposes of firefighting, any weather deck areas above cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forwardmost hold space shall be included in the cargo area.

11.2 Fire mains and hydrants

11.2.1 Irrespective of size, ships carrying products that are subject to the Code shall comply with the requirements of regulation II-2/10.2 of the SOLAS Convention, as applicable to cargo ships, except that the required fire pump capacity and fire main and water service pipe diameter shall not be limited by the provisions of regulations II-2/10.2.2.4.1 and II-2/10.2.1.3, when a fire pump is used to supply the water-spray system, as permitted by 11.3.3 of the Code. The capacity of this fire pump shall be such that these areas can be protected when simultaneously supplying two jets of water from fire hoses with 19 mm nozzles at a pressure of at least 0.5 MPa.

11.2.2 The arrangements shall be such that at least two jets of water can reach any part of the deck in the cargo area and those portions of the cargo containment system and tank covers that are above the deck. The necessary number of fire hydrants shall be located to satisfy the above arrangements and to comply with the requirements of regulations II-2/10.2.1.5.1 and II-2/10.2.3.3 of the SOLAS Convention, with hose lengths as specified in regulation II-2/10.2.3.1.1. In addition, the requirements of regulation II-2/10.2.1.6 shall be met at a pressure of at least 0.5 MPa gauge.

11.2.3 Stop valves shall be fitted in any crossover provided and in the fire main or mains in a protected location, before entering the cargo area and at intervals ensuring isolation of any damaged single section of the fire main, so that 11.2.2 can be complied with using not more than two lengths of hoses from the nearest fire hydrant. The water supply to the fire main serving the cargo area shall be a ring main supplied by the main fire pumps or a single main supplied by fire pumps positioned fore and aft of the cargo area, one of which shall be independently driven.

11.2.4 Nozzles shall be of an approved dual-purpose type (i.e. spray/jet type) incorporating a shutoff.

11.2.5 After installation, the pipes, valves, fittings and assembled system shall be subject to a tightness and function test.

11.3 Water-spray system

11.3.1 On ships carrying flammable and/or toxic products, a water-spray system, for cooling, fire prevention and crew protection shall be installed to cover:

.1 exposed cargo tank domes, any exposed parts of cargo tanks and any part of cargo tank covers that may be exposed to heat from fires in adjacent equipment containing cargo such as exposed booster pumps/heaters/re-gasification or re-liquefaction plants, hereafter addressed as gas process units, positioned on weather decks;

.2 exposed on-deck storage vessels for flammable or toxic products;

.3 gas process units positioned on deck;

.4 cargo liquid and vapour discharge and loading connections, including the presentation flange and the area where their control valves are situated, which shall be at least equal to the area of the drip trays provided;

.5 all exposed emergency shut-down (ESD) valves in the cargo liquid and vapour pipes, including the master valve for supply to gas consumers;

.6 exposed boundaries facing the cargo area, such as bulkheads of superstructures and deckhouses normally manned, cargo machinery spaces, store-rooms containing high fire-risk items and cargo control rooms. Exposed horizontal boundaries of these areas do not require protection unless detachable cargo piping connections are arranged above or below. Boundaries of unmanned forecastle structures not containing high fire-risk items or equipment do not require water-spray protection;

.7 exposed lifeboats, liferafts and muster stations facing the cargo area, regardless of distance to cargo area; and

.8 any semi-enclosed cargo machinery spaces and semi-enclosed cargo motor room.

Ships intended for operation as listed in 1.1.10 shall be subject to special consideration (see 11.3.3.2).

11.3.2.1 The system shall be capable of covering all areas mentioned in 11.3.1.1 to 11.3.1.8, with a uniformly distributed water application rate of at least 10 $\ell/m^2/min$ for the largest projected horizontal surfaces and 4 $\ell/m^2/min$ for vertical surfaces. For structures having no clearly defined horizontal or vertical surface, the capacity of the water-spray system shall not be less than the projected horizontal surface multiplied by 10 $\ell/m^2/min$.

11.3.2.2 On vertical surfaces, spacing of nozzles protecting lower areas may take account of anticipated rundown from higher areas. Stop valves shall be fitted in the main supply line(s) in the water-spray system, at intervals not exceeding 40 m, for the purpose of isolating damaged sections. Alternatively, the system may be divided into two or more sections that may be operated independently, provided the necessary controls are located together in a readily accessible position outside the cargo area. A section protecting any area included in 11.3.1.1 and .2 shall cover at least the entire athwartship tank grouping in that area. Any gas process unit(s) included in 11.3.1.3 may be served by an independent section.

11.3.3 The capacity of the water-spray pumps shall be capable of simultaneous protection of the greater of the following:

.1 any two complete athwartship tank groupings, including any gas process units within these areas; or

.2 for ships intended for operation as listed in 1.1.10, necessary protection subject to special consideration under 11.3.1 of any added fire hazard and the adjacent athwartship tank grouping,

in addition to surfaces specified in 11.3.1.4 to 11.3.1.8. Alternatively, the main fire pumps may be used for this service, provided that their total capacity is increased by the amount needed for the water-spray system. In either case, a connection, through a stop valve, shall be made between the fire main and water-spray system main supply line outside the cargo area.

11.3.4 The boundaries of superstructures and deckhouses normally manned, and lifeboats, liferafts and muster areas facing the cargo area, shall also be capable of being served by one of the fire pumps or the emergency fire pump, if a fire in one compartment could disable both fire pumps.

11.3.5 Water pumps normally used for other services may be arranged to supply the water-spray system main supply line.

11.3.6 All pipes, valves, nozzles and other fittings in the water-spray system shall be resistant to corrosion by seawater. Piping, fittings and related components within the cargo area (except gaskets) shall be designed to withstand 925°C. The water-spray system shall be arranged with in-line filters to prevent blockage of pipes and nozzles. In addition, means shall be provided to back-flush the system with fresh water.

11.3.7 Remote starting of pumps supplying the water-spray system and remote operation of any normally closed valves in the system shall be arranged in suitable locations outside the cargo area, adjacent to the accommodation spaces and readily accessible and operable in the event of fire in the protected areas.

11.3.8 After installation, the pipes, valves, fittings and assembled system shall be subject to a tightness and function test.

11.4 Dry chemical powder fire-extinguishing systems

11.4.1 Ships in which the carriage of flammable products is intended shall be fitted with fixed dry chemical powder fire-extinguishing systems, approved by the Administration based on the guidelines developed by the Organization[14], for the purpose of firefighting on the deck in the cargo area, including any cargo liquid and vapour discharge and loading connections on deck and bow or stern cargo handling areas, as applicable.

11.4.2 The system shall be capable of delivering powder from at least two hand hose lines, or a combination of monitor/hand hose lines, to any part of the exposed cargo liquid and vapour piping, load/unload connection and exposed gas process units.

[14] Refer to the *Guidelines for the approval of fixed dry chemical powder fire-extinguishing systems for the protection of ships carrying liquefied gases in bulk* (MSC.1/Circ.1315).

11.4.3 The dry chemical powder fire-extinguishing system shall be designed with not less than two independent units. Any part required to be protected by 11.4.2 shall be capable of being reached from not less than two independent units with associated controls, pressurizing medium fixed piping, monitors or hand hose lines. For ships with a cargo capacity of less than 1,000 m^3, only one such unit need be fitted. A monitor shall be arranged to protect any load/unload connection area and be capable of actuation and discharge both locally and remotely. The monitor is not required to be remotely aimed, if it can deliver the necessary powder to all required areas of coverage from a single position. One hose line shall be provided at both port- and starboard side at the end of the cargo area facing the accommodation and readily available from the accommodation.

11.4.4 The capacity of a monitor shall be not less than 10 kg/s. Hand hose lines shall be non-kinkable and be fitted with a nozzle capable of on/off operation and discharge at a rate not less than 3.5 kg/s. The maximum discharge rate shall allow operation by one man. The length of a hand hose line shall not exceed 33 m. Where fixed piping is provided between the powder container and a hand hose line or monitor, the length of piping shall not exceed that length which is capable of maintaining the powder in a fluidized state during sustained or intermittent use, and which can be purged of powder when the system is shut down. Hand hose lines and nozzles shall be of weather-resistant construction or stored in weather resistant housing or covers and be readily accessible.

11.4.5 Hand hose lines shall be considered to have a maximum effective distance of coverage equal to the length of hose. Special consideration shall be given where areas to be protected are substantially higher than the monitor or hand hose reel locations.

11.4.6 Ships fitted with bow/stern load/unload connections shall be provided with independent dry powder unit protecting the cargo liquid and vapour piping, aft or forward of the cargo area, by hose lines and a monitor covering the bow/stern load/unload complying with the requirements of 11.4.1 to 11.4.5.

11.4.7 Ships intended for operation as listed in 1.1.10 shall be subject to special consideration.

11.4.8 After installation, the pipes, valves, fittings and assembled systems shall be subjected to a tightness test and functional testing of the remote and local release stations. The initial testing shall also include a discharge of sufficient amounts of dry chemical powder to verify that the system is in proper working order. All distribution piping shall be blown through with dry air to ensure that the piping is free of obstructions.

11.5 Enclosed spaces containing cargo handling equipment

11.5.1 Enclosed spaces meeting the criteria of cargo machinery spaces in 1.2.10, and the cargo motor room within the cargo area of any ship, shall be provided with a fixed fire-extinguishing system complying with the provisions of the FSS Code and taking into account the necessary concentrations/application rate required for extinguishing gas fires.

11.5.2 Enclosed spaces meeting the criteria of cargo machinery spaces in chapter 3.3, within the cargo area of ships that are dedicated to the carriage of a restricted number of cargoes, shall be protected by an appropriate fire-extinguishing system for the cargo carried.

11.5.3 Turret compartments of any ship shall be protected by internal water spray, with an application rate of not less than 10 ℓ/m^2/min of the largest projected horizontal surface. If the pressure of the gas flow through the turret exceeds 4 MPa, the application rate shall be increased to 20 ℓ/m^2/min. The system shall be designed to protect all internal surfaces.

11.6 Firefighter's outfits

11.6.1 Every ship carrying flammable products shall carry firefighter's outfits complying with the requirements of regulation II-2/10.10 of the SOLAS Convention, as follows:

Total cargo capacity	Number of outfits
5,000 m^3 and below	4
Above 5,000 m^3	5

11.6.2 Additional requirements for safety equipment are given in chapter 14.

11.6.3 Any breathing apparatus required as part of a firefighter's outfit shall be a self-contained compressed air-operated breathing apparatus having a capacity of at least 1,200 ℓ of free air.

CHAPTER 12

ARTIFICIAL VENTILATION IN THE CARGO AREA

Goal

To ensure that arrangements are provided for enclosed spaces in the cargo area to control the accumulation of flammable and/or toxic vapours.

Scope

The requirements of this chapter replace the requirements of SOLAS regulations II-2/4.5.2.6 and 4.5.4.1, as amended.

12.1 Spaces required to be entered during normal cargo handling operations

12.1.1 Electric motor rooms, cargo compressor and pump-rooms, spaces containing cargo handling equipment and other enclosed spaces where cargo vapours may accumulate shall be fitted with fixed artificial ventilation systems capable of being controlled from outside such spaces. The ventilation shall be run continuously to prevent the accumulation of toxic and/or flammable vapours, with a means of monitoring acceptable to the Administration to be provided. A warning notice requiring the use of such ventilation prior to entering shall be placed outside the compartment.

12.1.2 Artificial ventilation inlets and outlets shall be arranged to ensure sufficient air movement through the space to avoid accumulation of flammable, toxic or asphyxiant vapours, and to ensure a safe working environment.

12.1.3 The ventilation system shall have a capacity of not less than 30 changes of air per hour, based upon the total volume of the space. As an exception, non-hazardous cargo control rooms may have eight changes of air per hour.

12.1.4 Where a space has an opening into an adjacent more hazardous space or area, it shall be maintained at an overpressure. It may be made into a less hazardous space or non-hazardous space by overpressure protection in accordance with recognized standards.

12.1.5 Ventilation ducts, air intakes and exhaust outlets serving artificial ventilation systems shall be positioned in accordance with recognized standards[15].

12.1.6 Ventilation ducts serving hazardous areas shall not be led through accommodation, service and machinery spaces or control stations, except as allowed in chapter 16.

12.1.7 Electric motors' driving fans shall be placed outside the ventilation ducts that may contain flammable vapours. Ventilation fans shall not produce a source of ignition in either the ventilated space or the ventilation system associated with the space. For hazardous areas, ventilation fans and ducts, adjacent to the fans, shall be of non-sparking construction, as defined below:

.1 impellers or housing of non-metallic construction, with due regard being paid to the elimination of static electricity;

.2 impellers and housing of non-ferrous materials;

.3 impellers and housing of austenitic stainless steel; and

.4 ferrous impellers and housing with design tip clearance of not less than 13 mm.

Any combination of an aluminium or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and shall not be used in these places.

12.1.8 Where fans are required by this chapter, full required ventilation capacity for each space shall be available after failure of any single fan, or spare parts shall be provided comprising a motor, starter spares and complete rotating element, including bearings of each type.

12.1.9 Protection screens of not more than 13 mm square mesh shall be fitted to outside openings of ventilation ducts.

12.1.10 Where spaces are protected by pressurization, the ventilation shall be designed and installed in accordance with recognized standards[16].

12.2 Spaces not normally entered

12.2.1 Enclosed spaces where cargo vapours may accumulate shall be capable of being ventilated to ensure a safe environment when entry into them is necessary. This shall be capable of being achieved without the need for prior entry.

12.2.2 For permanent installations, the capacity of 8 air changes per hour shall be provided and for portable systems, the capacity of 16 air changes per hour.

12.2.3 Fans or blowers shall be clear of personnel access openings, and shall comply with 12.1.7.

[15] Refer to the recommendation published by the International Electrotechnical Commission, in particular, to publication IEC 60092-502:1999.

[16] Refer to the recommendation published by the International Electrotechnical Commission, in particular, to publication IEC 60092-502:1999.

CHAPTER 13

INSTRUMENTATION AND AUTOMATION SYSTEMS

Goal

To ensure that the instrumentation and automation systems provides for the safe carriage, handling and conditioning of cargo liquid and vapour.

13.1 General

13.1.1 Each cargo tank shall be provided with a means for indicating level, pressure and temperature of the cargo. Pressure gauges and temperature indicating devices shall be installed in the liquid and vapour piping systems, in cargo refrigeration installations.

13.1.2 If loading and unloading of the ship is performed by means of remotely controlled valves and pumps, all controls and indicators associated with a given cargo tank shall be concentrated in one control position.

13.1.3 Instruments shall be tested to ensure reliability under the working conditions, and recalibrated at regular intervals. Test procedures for instruments and the intervals between recalibration shall be in accordance with manufacturer's recommendations.

13.2 Level indicators for cargo tanks

13.2.1 Each cargo tank shall be fitted with liquid level gauging device(s), arranged to ensure that a level reading is always obtainable whenever the cargo tank is operational. The device(s) shall be designed to operate throughout the design pressure range of the cargo tank and at temperatures within the cargo operating temperature range.

13.2.2 Where only one liquid level gauge is fitted, it shall be arranged so that it can be maintained in an operational condition without the need to empty or gas-free the tank.

13.2.3 Cargo tank liquid level gauges may be of the following types, subject to special requirements for particular cargoes shown in column "g" in the table of chapter 19:

.1 indirect devices, which determine the amount of cargo by means such as weighing or in-line flow metering;

.2 closed devices which do not penetrate the cargo tank, such as devices using radio-isotopes or ultrasonic devices;

.3 closed devices which penetrate the cargo tank, but which form part of a closed system and keep the cargo from being released, such as float type systems, electronic probes, magnetic probes and bubble tube indicators. If closed gauging device is not mounted directly onto the tank, it shall be provided with a shutoff valve located as close as possible to the tank; and

.4 restricted devices which penetrate the tank and, when in use, permit a small quantity of cargo vapour or liquid to escape to the atmosphere, such as fixed tube and slip tube gauges. When not in use, the devices shall be kept completely closed. The design and installation shall ensure that no dangerous escape of cargo can take place when opening the device. Such gauging devices shall be so designed that the maximum opening does not exceed 1.5 mm diameter or equivalent area, unless the device is provided with an excess flow valve.

13.3 Overflow control

13.3.1 Except as provided in 13.3.4, each cargo tank shall be fitted with a high liquid level alarm operating independently of other liquid level indicators and giving an audible and visual warning when activated.

13.3.2 An additional sensor operating independently of the high liquid level alarm shall automatically actuate a shutoff valve in a manner that will both avoid excessive liquid pressure in the loading line and prevent the tank from becoming liquid full.

13.3.3 The emergency shutdown valve referred to in 5.5 and 18.10 may be used for this purpose. If another valve is used for this purpose, the same information as referred to in 18.10.2.1.3 shall be available on board. During loading, whenever the use of these valves may possibly create a potential excess pressure surge in the loading system, alternative arrangements such as limiting the loading rate shall be used.

13.3.4 A high liquid level alarm and automatic shut-off of cargo tank filling need not be required, when the cargo tank:

.1 is a pressure tank with a volume not more than 200 m^3; or

.2 is designed to withstand the maximum possible pressure during the loading operation, and such pressure is below that of the set pressure of the cargo tank relief valve.

13.3.5 The position of the sensors in the tank shall be capable of being verified before commissioning. At the first occasion of full loading after delivery and after each dry-docking, testing of high-level alarms shall be conducted by raising the cargo liquid level in the cargo tank to the alarm point.

13.3.6 All elements of the level alarms, including the electrical circuit and the sensor(s), of the high, and overfill alarms, shall be capable of being functionally tested. Systems shall be tested prior to cargo operation in accordance with 18.6.2.

13.3.7 Where arrangements are provided for overriding the overflow control system, they shall be such that inadvertent operation is prevented. When this override is operated, continuous visual indication shall be given at the relevant control station(s) and the navigation bridge.

13.4 Pressure monitoring

13.4.1 The vapour space of each cargo tank shall be provided with a direct reading gauge. Additionally, an indirect indication shall be provided at the control position required by 13.1.2. Maximum and minimum allowable pressures shall be clearly indicated.

13.4.2 A high-pressure alarm and, if vacuum protection is required, a low-pressure alarm shall be provided on the navigation bridge and at the control position required by 13.1.2. Alarms shall be activated before the set pressures are reached.

13.4.3 For cargo tanks fitted with PRVs which can be set at more than one set pressure in accordance with 8.2.7, high-pressure alarms shall be provided for each set pressure.

13.4.4 Each cargo-pump discharge line and each liquid and vapour cargo manifold shall be provided with at least one pressure indicator.

13.4.5 Local-reading manifold pressure indication shall be provided to indicate the pressure between ship's manifold valves and hose connections to the shore.

13.4.6 Hold spaces and interbarrier spaces without open connection to the atmosphere shall be provided with pressure indication.

13.4.7 All pressure indications provided shall be capable of indicating throughout the operating pressure range.

13.5 Temperature indicating devices

13.5.1 Each cargo tank shall be provided with at least two devices for indicating cargo temperatures, one placed at the bottom of the cargo tank and the second near the top of the tank, below the highest allowable liquid level. The lowest temperature for which the cargo tank has been designed, as shown on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required by 1.4.4, shall be clearly indicated by means of a sign on or near the temperature indicating devices.

13.5.2 The temperature indicating devices shall be capable of providing temperature indication across the expected cargo operating temperature range of the cargo tanks.

13.5.3 Where thermowells are fitted, they shall be designed to minimize failure due to fatigue in normal service.

13.6 Gas detection

13.6.1 Gas detection equipment shall be installed to monitor the integrity of the cargo containment, cargo handling and ancillary systems, in accordance with this section.

13.6.2 A permanently installed system of gas detection and audible and visual alarms shall be fitted in:

.1 all enclosed cargo and cargo machinery spaces (including turrets compartments) containing gas piping, gas equipment or gas consumers;

.2 other enclosed or semi-enclosed spaces where cargo vapours may accumulate, including interbarrier spaces and hold spaces for independent tanks other than type C tanks;

.3 airlocks;

.4 spaces in gas-fired internal combustion engines, referred to in 16.7.3.3;

.5 ventilation hoods and gas ducts required by chapter 16;

.6 cooling/heating circuits, as required by 7.8.4;

.7 inert gas generator supply headers; and

.8 motor rooms for cargo handling machinery.

13.6.3 Gas detection equipment shall be designed, installed and tested in accordance with recognized standards[17] and shall be suitable for the cargoes to be carried in accordance with column "*f*" in table of chapter 19.

[17] IEC 60079-29-1 – Explosive atmospheres – Gas detectors – Performance requirements of detectors for flammable gases.

13.6.4 Where indicated in column "*f*" in the table of chapter 19 ships certified for carriage of non-flammable products, oxygen deficiency monitoring shall be fitted in cargo machinery spaces and cargo tank hold spaces. Furthermore, oxygen deficiency monitoring equipment shall be installed in enclosed or semi-enclosed spaces containing equipment that may cause an oxygen-deficient environment such as nitrogen generators, inert gas generators or nitrogen cycle refrigerant systems.

13.6.5 In the case of toxic products or both toxic and flammable products, except when column "*i*" in the table of chapter 19 refers to 17.5.3, portable equipment can be used for the detection of toxic products as an alternative to a permanently installed system. This equipment shall be used prior to personnel entering the spaces listed in 13.6.2 and at 30-minute intervals while they remain in the space.

13.6.6 In the case of gases classified as toxic products, hold spaces and interbarrier spaces shall be provided with a permanently installed piping system for obtaining gas samples from the spaces. Gas from these spaces shall be sampled and analysed from each sampling head location.

13.6.7 Permanently installed gas detection shall be of the continuous detection type, capable of immediate response. Where not used to activate safety shutdown functions required by 13.6.9 and chapter 16, sampling type detection may be accepted.

13.6.8 When sampling type gas detection equipment is used, the following requirements shall be met:

.1 the gas detection equipment shall be capable of sampling and analysing for each sampling head location sequentially at intervals not exceeding 30 min;

.2 individual sampling lines from sampling heads to the detection equipment shall be fitted; and

.3 pipe runs from sampling heads shall not be led through non-hazardous spaces except as permitted by 13.6.9.

13.6.9 The gas detection equipment may be located in a non-hazardous space, provided that the detection equipment such as sample piping, sample pumps, solenoids and analysing units are located in a fully enclosed steel cabinet with the door sealed by a gasket. The atmosphere within the enclosure shall be continuously monitored. At gas concentrations above 30% lower flammable limit (LFL) inside the enclosure, the gas detection equipment shall be automatically shut down.

13.6.10 Where the enclosure cannot be arranged directly on the forward bulkhead, sample pipes shall be of steel or equivalent material and be routed on their shortest way. Detachable connections, except for the connection points for isolating valves required in 13.6.11 and analysing units, are not permitted.

13.6.11 When gas sampling equipment is located in a non-hazardous space, a flame arrester and a manual isolating valve shall be fitted in each of the gas sampling lines. The isolating valve shall be fitted on the non-hazardous side. Bulkhead penetrations of sample pipes between hazardous and non-hazardous areas shall maintain the integrity of the division penetrated. The exhaust gas shall be discharged to the open air in a non-hazardous area.

13.6.12 In every installation, the number and the positions of detection heads shall be determined with due regard to the size and layout of the compartment, the compositions and densities of the products intended to be carried and the dilution from compartment purging or ventilation and stagnant areas.

13.6.13 Any alarms status within a gas detection system required by this section shall initiate an audible and visible alarm:

.1 on the navigation bridge;

.2 at the relevant control station(s) where continuous monitoring of the gas levels is recorded; and

.3 at the gas detector readout location.

13.6.14 In the case of flammable products, the gas detection equipment provided for hold spaces and interbarrier spaces that are required to be inerted shall be capable of measuring gas concentrations of 0% to 100% by volume.

13.6.15 Alarms shall be activated when the vapour concentration by volume reaches the equivalent of 30% LFL in air.

13.6.16 For membrane containment systems, the primary and secondary insulation spaces shall be able to be inerted and their gas content analysed individually[18]. The alarm in the secondary insulation space shall be set in accordance with 13.6.15, that in the primary space is set at a value approved by the Administration or recognized organization acting on its behalf.

13.6.17 For other spaces described by 13.6.2, alarms shall be activated when the vapour concentration reaches 30% LFL and safety functions required by chapter 16 shall be activated before the vapour concentration reaches 60% LFL. The crankcases of internal combustion engines that can run on gas shall be arranged to alarm before 100% LFL.

13.6.18 Gas detection equipment shall be so designed that it may readily be tested. Testing and calibration shall be carried out at regular intervals. Suitable equipment for this purpose shall be carried on board and be used in accordance with the manufacturer's recommendations. Permanent connections for such test equipment shall be fitted.

13.6.19 Every ship shall be provided with at least two sets of portable gas detection equipment that meet the requirement of 13.6.3 or an acceptable national or international standard.

13.6.20 A suitable instrument for the measurement of oxygen levels in inert atmospheres shall be provided.

13.7 Additional requirements for containment systems requiring a secondary barrier

13.7.1 *Integrity of barriers*

Where a secondary barrier is required, permanently installed instrumentation shall be provided to detect when the primary barrier fails to be liquid-tight at any location or when liquid cargo is in contact with the secondary barrier at any location. This instrumentation shall consist of appropriate gas detecting devices according to 13.6. However, the instrumentation need not be capable of locating the area where liquid cargo leaks through the primary barrier or where liquid cargo is in contact with the secondary barrier.

[18] Gas Concentrations in the Insulation Spaces of Membrane LNG Carriers, March 2007 (published by SIGTTO).

13.7.2 ***Temperature indication devices***

13.7.2.1 The number and position of temperature-indicating devices shall be appropriate to the design of the containment system and cargo operation requirements.

13.7.2.2 When cargo is carried in a cargo containment system with a secondary barrier, at a temperature lower than -55°C, temperature-indicating devices shall be provided within the insulation or on the hull structure adjacent to cargo containment systems. The devices shall give readings at regular intervals and, where applicable, alarm of temperatures approaching the lowest for which the hull steel is suitable.

13.7.2.3 If cargo is to be carried at temperatures lower than -55°C, the cargo tank boundaries, if appropriate for the design of the cargo containment system, shall be fitted with a sufficient number of temperature-indicating devices to verify that unsatisfactory temperature gradients do not occur.

13.7.2.4 For the purposes of design verification and determining the effectiveness of the initial cooldown procedure on a single or series of similar ships, one tank shall be fitted with devices in excess of those required in 13.7.2.1. These devices may be temporary or permanent and only need to be fitted to the first ship, when a series of similar ships is built.

13.8 Automation systems

13.8.1 The requirements of this section shall apply where automation systems are used to provide instrumented control, monitoring/alarm or safety functions required by this Code.

13.8.2 Automation systems shall be designed, installed and tested in accordance with recognized standards[19].

13.8.3 Hardware shall be capable of being demonstrated to be suitable for use in the marine environment by type approval or other means.

13.8.4 Software shall be designed and documented for ease of use, including testing, operation and maintenance.

13.8.5 The user interface shall be designed such that the equipment under control can be operated in a safe and effective manner at all times.

13.8.6 Automation systems shall be arranged such that a hardware failure or an error by the operator does not lead to an unsafe condition. Adequate safeguards against incorrect operation shall be provided.

13.8.7 Appropriate segregation shall be maintained between control, monitoring/alarm and safety functions to limit the effect of single failures. This shall be taken to include all parts of the automation systems that are required to provide specified functions, including connected devices and power supplies.

13.8.8 Automation systems shall be arranged such that the software configuration and parameters are protected against unauthorized or unintended change.

13.8.9 A management of change process shall be applied to safeguard against unexpected consequences of modification. Records of configuration changes and approvals shall be maintained on board.

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[19] Refer to the recommendations for computer-based systems contained in the standard published by the International Electrotechnical Commission, IEC 60092-504:2001 "Electrical installations in ships – Special features – Control and instrumentation".

13.8.10 Processes for the development and maintenance of integrated systems shall be in accordance with recognized standards[20]. These processes shall include appropriate risk identification and management.

13.9 System integration

13.9.1 Essential safety functions shall be designed such that risks of harm to personnel or damage to the installation or the environment are reduced to a level acceptable to the Administration, both in normal operation and under fault conditions. Functions shall be designed to fail-safe. Roles and responsibilities for integration of systems shall be clearly defined and agreed by relevant parties.

13.9.2 Functional requirements of each component subsystem shall be clearly defined to ensure that the integrated system meets the functional and specified safety requirements and takes account of any limitations of the equipment under control.

13.9.3 Key hazards of the integrated system shall be identified using appropriate risk-based techniques.

13.9.4 The integrated system shall have a suitable means of reversionary control.

13.9.5 Failure of one part of the integrated system shall not affect the functionality of other parts, except for those functions directly dependent on the defective part.

13.9.6 Operation with an integrated system shall be at least as effective as it would be with individual stand-alone equipment or systems.

13.9.7 The integrity of essential machinery or systems, during normal operation and fault conditions, shall be demonstrated.

CHAPTER 14

PERSONNEL PROTECTION

Goal

To ensure that protective equipment is provided for ship staff, considering both routine operations or emergency situations and possible short- or long-term effects of the product being handled.

14.1 Protective equipment

14.1.1 Suitable protective equipment, including eye protection to a recognized national or international standard, shall be provided for protection of crew members engaged in normal cargo operations, taking into account the characteristics of the products being carried.

14.1.2 Personal protective and safety equipment required in this chapter shall be kept in suitable, clearly marked lockers located in readily accessible places.

14.1.3 The compressed air equipment shall be inspected at least once a month by a responsible officer and the inspection logged in the ship's records. This equipment shall also be inspected and tested by a competent person at least once a year.

[20] Refer to the International Electrotechnical Commission standard ISO/IEC 15288:2008 Systems and software engineering – System life cycle processes, and ISO 17894:2005 Ships and marine technology – Computer applications – General principles for the development and use of programmable electronic systems in marine applications.

14.2 First-aid equipment

14.2.1 A stretcher that is suitable for hoisting an injured person from spaces below deck shall be kept in a readily accessible location.

14.2.2 The ship shall have onboard medical first-aid equipment, including oxygen resuscitation equipment, based on the requirements of the Medical First Aid Guide (MFAG) for the cargoes listed on the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk shown in appendix 2.

14.3 Safety equipment

14.3.1 Sufficient, but not less than three complete sets of safety equipment shall be provided in addition to the firefighter's outfits required by 11.6.1. Each set shall provide adequate personal protection to permit entry and work in a gas-filled space. This equipment shall take into account the nature of the cargoes, listed on the International Certificate of Fitness for the Carriage of Liquified Gases in Bulk shown in appendix 2.

14.3.2 Each complete set of safety equipment shall consist of:

.1 one self-contained positive pressure air-breathing apparatus incorporating full face mask, not using stored oxygen and having a capacity of at least 1,200 ℓ of free air. Each set shall be compatible with that required by 11.6.1;

.2 protective clothing, boots and gloves to a recognized standard;

.3 steel-cored rescue line with belt; and

.4 explosion-proof lamp.

14.3.3 An adequate supply of compressed air shall be provided and shall consist of:

.1 at least one fully charged spare air bottle for each breathing apparatus required by 14.3.1;

.2 an air compressor of adequate capacity capable of continuous operation, suitable for the supply of high-pressure air of breathable quality; and

.3 a charging manifold capable of dealing with sufficient spare breathing apparatus air bottles for the breathing apparatus required by 14.3.1.

14.4 Personal protection requirements for individual products

14.4.1 Requirements of this section shall apply to ships carrying products for which those paragraphs are listed in column "*i*" in the table of chapter 19.

14.4.2 Suitable respiratory and eye protection for emergency escape purposes shall be provided for every person on board, subject to the following:

.1 filter-type respiratory protection is unacceptable;

.2 self-contained breathing apparatus shall have at least a duration of service of 15 min; and

.3 emergency escape respiratory protection shall not be used for firefighting or cargo-handling purposes and shall be marked to that effect.

14.4.3 One or more suitably marked decontamination showers and eyewash stations shall be available on deck, taking into account the size and layout of the ship. The showers and eyewashes shall be operable in all ambient conditions.

14.4.4 The protective clothing required under 14.3.2.2 shall be gastight.

CHAPTER 15

FILLING LIMITS FOR CARGO TANKS

Goal

To determine the maximum quantity of cargo that can be loaded.

15.1 Definitions

15.1.1 *Filling limit (FL)* means the maximum liquid volume in a cargo tank relative to the total tank volume when the liquid cargo has reached the reference temperature.
15.1.2 *Loading limit (LL)* means the maximum allowable liquid volume relative to the tank volume to which the tank may be loaded.

15.1.3 *Reference temperature* means (for the purposes of this chapter only):

.1 when no cargo vapour pressure/temperature control, as referred to in chapter 7, is provided, the temperature corresponding to the vapour pressure of the cargo at the set pressure of the PRVs; and

.2 when a cargo vapour pressure/temperature control, as referred to in chapter 7, is provided, the temperature of the cargo upon termination of loading, during transport or at unloading, whichever is the greatest.

15.1.4 *Ambient design temperature for unrestricted service* means sea temperature of 32°C and air temperature of 45°C. However, lesser values of these temperatures may be accepted by the Administration for ships operating in restricted areas or on voyages of restricted duration, and account may be taken in such cases of any insulation of the tanks. Conversely, higher values of these temperatures may be required for ships permanently operating in areas of high-ambient temperature.

15.2 General requirements

The maximum filling limit of cargo tanks shall be so determined that the vapour space has a minimum volume at reference temperature allowing for:

.1 tolerance of instrumentation such as level and temperature gauges;

.2 volumetric expansion of the cargo between the PRV set pressure and the maximum allowable rise stated in 8.4; and

.3 an operational margin to account for liquid drained back to cargo tanks after completion of loading, operator reaction time and closing time of valves, see 5.5 and 18.10.2.1.4.

15.3 Default filling limit

The default value for the filling limit (*FL*) of cargo tanks is 98% at the reference temperature. Exceptions to this value shall meet the requirements of 15.4.

15.4 Determination of increased filling limit

15.4.1 A filling limit greater than the limit of 98% specified in 15.3 may be permitted under the trim and list conditions specified in 8.2.17, providing:

.1 no isolated vapour pockets are created within the cargo tank;

.2 the PRV inlet arrangement shall remain in the vapour space; and

.3 allowances need to be provided for:

.1 volumetric expansion of the liquid cargo due to the pressure increase from the MARVS to full flow relieving pressure in accordance with 8.4.1;

.2 an operational margin of minimum 0.1% of tank volume; and

.3 tolerances of instrumentation such as level and temperature gauges.

15.4.2 In no case shall a filling limit exceeding 99.5% at reference temperature be permitted.

15.5 Maximum loading limit

15.5.1 The maximum loading limit (*LL*) to which a cargo tank may be loaded shall be determined by the following formula:

$$LL = FL \frac{\rho_R}{\rho_L}$$

where:

LL = loading limit as defined in 15.1.2, expressed in percentage;

FL = filling limit as specified in 15.3 or 15.4 expressed in percentage;

ρ_R = relative density of cargo at the reference temperature; and

ρ_L = relative density of cargo at the loading temperature.

15.5.2 The Administration may allow type C tanks to be loaded according to the formula in 15.5.1 with the relative density ρ_R as defined below, provided that the tank vent system has been approved in accordance with 8.2.18:

ρ_R = relative density of cargo at the highest temperature that the cargo may reach upon termination of loading, during transport, or at unloading, under the ambient design temperature conditions described in 15.1.4.

This paragraph does not apply to products requiring a type 1G ship.

15.6 Information to be provided to the master

15.6.1 A document shall be provided to the ship, specifying the maximum allowable loading limits for each cargo tank and product, at each applicable loading temperature and maximum reference temperature. The information in this document shall be approved by the Administration or recognized organization acting on its behalf.

15.6.2 Pressures at which the PRVs have been set shall also be stated in the document.

15.6.3 A copy of the above document shall be permanently kept on board by the master.

CHAPTER 16

USE OF CARGO AS FUEL

Goal

To ensure the safe use of cargo as fuel.

16.1 General

Except as provided for in 16.9, methane (LNG) is the only cargo whose vapour or boil-off gas may be utilized in machinery spaces of category A, and, in these spaces, it may be utilized only in systems such as boilers, inert gas generators, internal combustion engines, gas combustion unit and gas turbines.

16.2 Use of cargo vapour as fuel

This section addresses the use of cargo vapour as fuel in systems such as boilers, inert gas generators, internal combustion engines, gas combustion units and gas turbines.

16.2.1 For vaporized LNG, the fuel supply system shall comply with the requirements of 16.4.1, 16.4.2 and 16.4.3.

16.2.2 For vaporized LNG, gas consumers shall exhibit no visible flame and shall maintain the uptake exhaust temperature below 535°C.

16.3 Arrangement of spaces containing gas consumers

16.3.1 Spaces in which gas consumers are located shall be fitted with a mechanical ventilation system that is arranged to avoid areas where gas may accumulate, taking into account the density of the vapour and potential ignition sources. The ventilation system shall be separated from those serving other spaces.

16.3.2 Gas detectors shall be fitted in these spaces, particularly where air circulation is reduced. The gas detection system shall comply with the requirements of chapter 13.

16.3.3 Electrical equipment located in the double wall pipe or duct specified in 16.4.3 shall comply with the requirements of chapter 10.

16.3.4 All vents and bleed lines that may contain or be contaminated by gas fuel shall be routed to a safe location external to the machinery space and be fitted with a flame screen.

16.4 Gas fuel supply

16.4.1 *General*

16.4.1.1 The requirements of this section shall apply to gas fuel supply piping outside of the cargo area. Fuel piping shall not pass through accommodation spaces, service spaces, electrical equipment rooms or control stations. The routeing of the pipeline shall take into account potential hazards, due to mechanical damage, in areas such as stores or machinery handling areas.

16.4.1.2 Provision shall be made for inerting and gas-freeing that portion of the gas fuel piping systems located in the machinery space.

16.4.2 *Leak detection*

Continuous monitoring and alarms shall be provided to indicate a leak in the piping system in enclosed spaces and shut down the relevant gas fuel supply.

16.4.3 *Routeing of fuel supply pipes*

Fuel piping may pass through or extend into enclosed spaces other than those mentioned in 16.4.1, provided it fulfils one of the following conditions:

.1 it is of a double-wall design with the space between the concentric pipes pressurized with inert gas at a pressure greater than the gas fuel pressure. The master gas fuel valve, as required by 16.4.6, closes automatically upon loss of inert gas pressure; or

.2 it is installed in a pipe or duct equipped with mechanical exhaust ventilation having a capacity of at least 30 air changes per hour and is arranged to maintain a pressure less than the atmospheric pressure. The mechanical ventilation is in accordance with chapter 12, as applicable. The ventilation is always in operation when there is fuel in the piping and the master gas fuel valve, as required by 16.4.6, closes automatically if the required air flow is not established and maintained by the exhaust ventilation system. The inlet or the duct may be from a non-hazardous machinery space, and the ventilation outlet is in a safe location.

16.4.4 *Requirements for gas fuel with pressure greater than 1 MPa*

16.4.4.1 Fuel delivery lines between the high-pressure fuel pumps/compressors and consumers shall be protected with a double-walled piping system capable of containing a high pressure line failure, taking into account the effects of both pressure and low temperature. A single-walled pipe in the cargo area up to the isolating valve(s) required by 16.4.6 is acceptable.

16.4.4.2 The arrangement in 16.4.3.2 may also be acceptable providing the pipe or trunk is capable of containing a high pressure line failure, according to the requirements of 16.4.7 and taking into account the effects of both pressure and possible low temperature and providing both inlet and exhaust of the outer pipe or trunk are in the cargo area.

16.4.5 ***Gas consumer isolation***

The supply piping of each gas consumer unit shall be provided with gas fuel isolation by automatic double block and bleed, vented to a safe location, under both normal and emergency operation. The automatic valves shall be arranged to fail to the closed position on loss of actuating power. In a space containing multiple consumers, the shutdown of one shall not affect the gas supply to the others.

16.4.6 ***Spaces containing gas consumers***

16.4.6.1 It shall be possible to isolate the gas fuel supply to each individual space containing a gas consumer(s) or through which fuel gas supply piping is run, with an individual master valve, which is located within the cargo area. The isolation of gas fuel supply to a space shall not affect the gas supply to other spaces containing gas consumers if they are located in two or more spaces, and it shall not cause loss of propulsion or electrical power.

16.4.6.2 If the double barrier around the gas supply system is not continuous due to air inlets or other openings, or if there is any point where single failure will cause leakage into the space, the individual master valve for the space shall operate under the following circumstances:

.1 automatically by:

  .1 gas detection within the space;

  .2 leak detection in the annular space of a double-walled pipe;

  .3 leak detection in other compartments inside the space, containing single-walled gas piping;

  .4 loss of ventilation in the annular space of a double-walled pipe; and

  .5 loss of ventilation in other compartments inside the space, containing single-walled gas piping; and

.2 manually from within the space, and at least one remote location.

16.4.6.3 If the double barrier around the gas supply system is continuous, an individual master valve located in the cargo area may be provided for each gas consumer inside the space. The individual master valve shall operate under the following circumstances:

.1 automatically by:

  .1 leak detection in the annular space of a double-walled pipe served by that individual master valve;

  .2 leak detection in other compartments containing single-walled gas piping that is part of the supply system served by the individual master valve; and

  .3 loss of ventilation or loss of pressure in the annular space of a double-walled pipe; and

.2 manually from within the space, and at least one remote location.

16.4.7 ***Piping and ducting construction***

Gas fuel piping in machinery spaces shall comply with 5.1 to 5.9, as applicable. The piping shall, as far as practicable, have welded joints. Those parts of the gas fuel piping that are not enclosed in a ventilated pipe or duct according to 16.4.3, and are on the weather decks outside the cargo area, shall have full penetration butt-welded joints and shall be fully radiographed.

16.4.8 ***Gas detection***

Gas detection systems provided in accordance with the requirements of this chapter shall activate the alarm at 30% LFL and shut down the master gas fuel valve required by 16.4.6 at not more than 60% LFL (see 13.6.17).

16.5 Gas fuel plant and related storage tanks

16.5.1 ***Provision of gas fuel***

All equipment (heaters, compressors, vaporizers, filters, etc.) for conditioning the cargo and/or cargo boil off vapour for its use as fuel, and any related storage tanks, shall be located in the cargo area. If the equipment is in an enclosed space, the space shall be ventilated according to 12.1 and be equipped with a fixed fire-extinguishing system, according to 11.5, and with a gas detection system according to 13.6, as applicable.

16.5.2 ***Remote stops***

16.5.2.1 All rotating equipment utilized for conditioning the cargo for its use as fuel shall be arranged for manual remote stop from the engine-room. Additional remote stops shall be located in areas that are always easily accessible, typically cargo control room, navigation bridge and fire control station.

16.5.2.2 The fuel supply equipment shall be automatically stopped in the case of low suction pressure or fire detection. Unless expressly provided otherwise, the requirements of 18.10 need not apply to gas fuel compressors or pumps when used to supply gas consumers.

16.5.3 ***Heating and cooling mediums***

If the heating or cooling medium for the gas fuel conditioning system is returned to spaces outside the cargo area, provisions shall be made to detect and alarm the presence of cargo/cargo vapour in the medium. Any vent outlet shall be in a safe position and fitted with an effective flame screen of an approved type.

16.5.4 ***Piping and pressure vessels***

Piping or pressure vessels fitted in the gas fuel supply system shall comply with chapter 5.

16.6 Special requirements for main boilers

16.6.1 ***Arrangements***

16.6.1.1 Each boiler shall have a separate exhaust uptake.

16.6.1.2 Each boiler shall have a dedicated forced draught system. A crossover between boiler force draught systems may be fitted for emergency use providing that any relevant safety functions are maintained.

16.6.1.3 Combustion chambers and uptakes of boilers shall be designed to prevent any accumulation of gaseous fuel.

16.6.2 ***Combustion equipment***

16.6.2.1 The burner systems shall be of dual type, suitable to burn either: oil fuel or gas fuel alone, or oil and gas fuel simultaneously.

16.6.2.2 Burners shall be designed to maintain stable combustion under all firing conditions.

16.6.2.3 An automatic system shall be fitted to change over from gas fuel operation to oil fuel operation without interruption of the boiler firing, in the event of loss of gas fuel supply.

16.6.2.4 Gas nozzles and the burner control system shall be configured such that gas fuel can only be ignited by an established oil fuel flame, unless the boiler and combustion equipment is designed and approved by recognized organization to light on gas fuel.

16.6.3 ***Safety***

16.6.3.1 There shall be arrangements to ensure that gas fuel flow to the burner is automatically cut-off, unless satisfactory ignition has been established and maintained.

16.6.3.2 On the pipe of each gas-burner, a manually operated shut-off valve shall be fitted.

16.6.3.3 Provisions shall be made for automatically purging the gas supply piping to the burners, by means of an inert gas, after the extinguishing of these burners.

16.6.3.4 The automatic fuel changeover system required by 16.6.2.3 shall be monitored with alarms to ensure continuous availability.

16.6.3.5 Arrangements shall be made that, in case of flame failure of all operating burners, the combustion chambers of the boilers are automatically purged before relighting.

16.6.3.6 Arrangements shall be made to enable the boilers to be manually purged.

16.7 Special requirements for gas-fired internal combustion engines

Dual fuel engines are those that employ gas fuel (with pilot oil) and oil fuel. Oil fuels may include distillate and residual fuels. Gas only engines are those that employ gas fuel only.

16.7.1 ***Arrangements***

16.7.1.1 When gas is supplied in a mixture with air through a common manifold, flame arrestors shall be installed before each cylinder head.

16.7.1.2 Each engine shall have its own separate exhaust.

16.7.1.3 The exhausts shall be configured to prevent any accumulation of unburnt gaseous fuel.

16.7.1.4 Unless designed with the strength to withstand the worst case overpressure due to ignited gas leaks, air inlet manifolds, scavenge spaces, exhaust system and crank cases shall be fitted with suitable pressure relief systems. Pressure relief systems shall lead to a safe location, away from personnel.

16.7.1.5 Each engine shall be fitted with vent systems independent of other engines for crankcases, sumps and cooling systems.

16.7.2 ***Combustion equipment***

16.7.2.1 Prior to admission of gas fuel, correct operation of the pilot oil injection system on each unit shall be verified.

16.7.2.2 For a spark ignition engine, if ignition has not been detected by the engine monitoring system within an engine specific time after opening of the gas supply valve, this shall be automatically shut off and the starting sequence terminated. It shall be ensured that any unburnt gas mixture is purged from the exhaust system.

16.7.2.3 For dual-fuel engines fitted with a pilot oil injection system, an automatic system shall be fitted to change over from gas fuel operation to oil fuel operation with minimum fluctuation of the engine power.

16.7.2.4 In the case of unstable operation on engines with the arrangement in 16.7.2.3 when gas firing, the engine shall automatically change to oil fuel mode.

16.7.3 ***Safety***

16.7.3.1 During stopping of the engine, the gas fuel shall be automatically shut off before the ignition source.

16.7.3.2 Arrangements shall be provided to ensure that there is no unburnt gas fuel in the exhaust gas system prior to ignition.

16.7.3.3 Crankcases, sumps, scavenge spaces and cooling system vents shall be provided with gas detection (see 13.6.17).

16.7.3.4 Provision shall be made within the design of the engine to permit continuous monitoring of possible sources of ignition within the crank case. Instrumentation fitted inside the crankcase shall be in accordance with the requirements of chapter 10.

16.7.3.5 A means shall be provided to monitor and detect poor combustion or misfiring that may lead to unburnt gas fuel in the exhaust system during operation. In the event that it is detected, the gas fuel supply shall be shut down. Instrumentation fitted inside the exhaust system shall be in accordance with the requirements of chapter 10.

16.8 Special requirements for gas turbine

16.8.1 ***Arrangements***

16.8.1.1 Each turbine shall have its own separate exhaust.

16.8.1.2 The exhausts shall be appropriately configured to prevent any accumulation of unburnt gas fuel.

16.8.1.3 Unless designed with the strength to withstand the worst case overpressure due to ignited gas leaks, pressure relief systems shall be suitably designed and fitted to the exhaust system, taking into consideration explosions due to gas leaks. Pressure relief systems within the exhaust uptakes shall be lead to a non-hazardous location, away from personnel.

16.8.2 ***Combustion equipment***

An automatic system shall be fitted to change over easily and quickly from gas fuel operation to oil fuel operation with minimum fluctuation of the engine power.

16.8.3 ***Safety***

16.8.3.1 Means shall be provided to monitor and detect poor combustion that may lead to unburnt gas fuel in the exhaust system during operation. In the event that it is detected, the gas fuel supply shall be shut down.

16.8.3.2 Each turbine shall be fitted with an automatic shutdown device for high exhaust temperatures.

16.9 Alternative fuels and technologies

16.9.1 If acceptable to the Administration, other cargo gases may be used as fuel, providing that the same level of safety as natural gas in this Code is ensured.

16.9.2 The use of cargoes identified as toxic products shall not be permitted.

16.9.3 For cargoes other than LNG, the fuel supply system shall comply with the requirements of 16.4.1, 16.4.2, 16.4.3 and 16.5, as applicable, and shall include means for preventing condensation of vapour in the system.

16.9.4 Liquefied gas fuel supply systems shall comply with 16.4.5.

16.9.5 In addition to the requirements of 16.4.3.2, both ventilation inlet and outlet shall be in a non-hazardous area external to the machinery space.

CHAPTER 17

SPECIAL REQUIREMENTS

Goal

To set out the additional requirements in respect of specific cargoes.

17.1 General

The requirements of this chapter are applicable where reference thereto is made in column "*i*" in the table of chapter 19. These requirements are additional to the general requirements of the Code.

17.2 Materials of construction

Materials that may be exposed to cargo during normal operations shall be resistant to the corrosive action of the gases. In addition, the following materials of construction for cargo tanks and associated pipelines, valves, fittings and other items of equipment normally in direct contact with the cargo liquid or vapour shall not be used for certain products as specified in column "*i*" in the table of chapter 19:

.1 mercury, copper and copper-bearing alloys, and zinc;

.2 copper, silver, mercury, magnesium and other acetylide-forming metals;

.3 aluminium and aluminium-bearing alloys;

.4 copper, copper alloys, zinc and galvanized steel;

.5 aluminium, copper and alloys of either; and

.6 copper and copper-bearing alloys with greater than 1% copper.

17.3 Independent tanks

17.3.1 Products shall be carried in independent tanks only.

17.3.2 Products shall be carried in type C independent tanks, and the requirements of 7.1.2 shall apply. The design pressure of the cargo tank shall take into account any padding pressure or vapour discharge unloading pressure.

17.4 Refrigeration systems

17.4.1 Only the indirect system described in 7.3.1.2 shall be used.

17.4.2 For a ship engaged in the carriage of products that readily form dangerous peroxides, recondensed cargo shall not be allowed to form stagnant pockets of uninhibited liquid. This may be achieved either by:

.1 using the indirect system described in 7.3.1.2, with the condenser inside the cargo tank; or

.2 using the direct system or combined system described in 7.3.1.1 and .3 respectively, or the indirect system described in 7.3.1.2 with the condenser outside the cargo tank, and designing the condensate system to avoid any places in which liquid could collect and be retained. Where this is impossible, inhibited liquid shall be added upstream of such a place.

17.4.3 If the ship is to consecutively carry products as specified in 17.4.2 with a ballast passage between, all uninhibited liquid shall be removed prior to the ballast voyage. If a second cargo is to be carried between such consecutive cargoes, the reliquefaction system shall be thoroughly drained and purged before loading the second cargo. Purging shall be carried out using either inert gas or vapour from the second cargo, if compatible. Practical steps shall be taken to ensure that polymers or peroxides do not accumulate in the cargo system.

17.5 Cargoes requiring type 1G ship

17.5.1 All butt-welded joints in cargo piping exceeding 75 mm in diameter shall be subject to 100% radiography.

17.5.2 Gas sampling lines shall not be led into or through non-hazardous areas. Alarms referred to in 13.6.2 shall be activated when the vapour concentration reaches the threshold limiting value.

17.5.3 The alternative of using portable gas detection equipment in accordance with 13.6.5 shall not be permitted.

17.5.4 Cargo control rooms shall be located in a non-hazardous area and, additionally, all instrumentation shall be of the indirect type.

17.5.5 Personnel shall be protected against the effects of a major cargo release by the provision of a space within the accommodation area that is designed and equipped to the satisfaction of the Administration.

17.5.6 Notwithstanding the requirements in 3.2.4.3, access to forecastle spaces shall not be permitted through a door facing the cargo area, unless airlock in accordance with 3.6 is provided.

17.5.7 Notwithstanding the requirements in 3.2.7, access to control rooms and machinery spaces of turret systems shall not be permitted through doors facing the cargo area.

17.6 Exclusion of air from vapour spaces

Air shall be removed from cargo tanks and associated piping before loading and, then, subsequently excluded by:

.1 introducing inert gas to maintain a positive pressure. Storage or production capacity of the inert gas shall be sufficient to meet normal operating requirements and relief valve leakage. The oxygen content of inert gas shall, at no time, be greater than 0.2% by volume; or

.2 control of cargo temperatures such that a positive pressure is maintained at all times.

17.7 Moisture control

For gases that are non-flammable and may become corrosive or react dangerously with water, moisture control shall be provided to ensure that cargo tanks are dry before loading and that, during discharge, dry air or cargo vapour is introduced to prevent negative pressures. For the purposes of this paragraph, dry air is air that has a dew point of -45°C or below at atmospheric pressure.

17.8 Inhibition

Care shall be taken to ensure that the cargo is sufficiently inhibited to prevent self-reaction (e.g. polymerization or dimerization) at all times during the voyage. Ships shall be provided with a certificate from the manufacturer stating:

.1 name and amount of inhibitor added;

.2 date inhibitor was added and the normally expected duration of its effectiveness;

.3 any temperature limitations affecting the inhibitor; and

.4 the action to be taken should the length of the voyage exceed the effective lifetime of the inhibitors.

17.9 Flame screens on vent outlets

When carrying a cargo referenced to this section, cargo tank vent outlets shall be provided with readily renewable and effective flame screens or safety heads of an approved type. Due attention shall be paid in the design of flame screens and vent heads, to the possibility of the blockage of these devices by the freezing of cargo vapour or by icing up in adverse weather conditions. Flame screens shall be removed and replaced by protection screens, in accordance with 8.2.15, when carrying cargoes not referenced to this section.

17.10 Maximum allowable quantity of cargo per tank

When carrying a cargo referenced to this section, the quantity of the cargo shall not exceed 3,000 m^3 in any one tank.

17.11 Cargo pumps and discharge arrangements

17.11.1 The vapour space of cargo tanks equipped with submerged electric motor pumps shall be inerted to a positive pressure prior to loading, during carriage and during unloading of flammable liquids.

17.11.2 The cargo shall be discharged only by deepwell pumps or by hydraulically operated submerged pumps. These pumps shall be of a type designed to avoid liquid pressure against the shaft gland.

17.11.3 Inert gas displacement may be used for discharging cargo from type C independent tanks, provided the cargo system is designed for the expected pressure.

17.12 Ammonia

17.12.1 Anhydrous ammonia may cause stress corrosion cracking in containment and process systems made of carbon-manganese steel or nickel steel. To minimize the risk of this occurring, measures detailed in 17.12.2 to 17.12.8 shall be taken, as appropriate.

17.12.2 Where carbon-manganese steel is used, cargo tanks, process pressure vessels and cargo piping shall be made of fine-grained steel with a specified minimum yield strength not exceeding 355 N/mm^2, and with an actual yield strength not exceeding 440 N/mm^2. One of the following constructional or operational measures shall also be taken:

.1 lower strength material with a specified minimum tensile strength not exceeding 410 N/mm^2 shall be used; or

.2 cargo tanks, etc., shall be post-weld stress relief heat treated; or

.3 carriage temperature shall be maintained, preferably at a temperature close to the product's boiling point of -33°C, but in no case at a temperature above -20°C; or

.4 the ammonia shall contain not less than 0.1% w/w water, and the master shall be provided with documentation confirming this.

17.12.3 If carbon-manganese steels with higher yield properties are used other than those specified in 17.12.2, the completed cargo tanks, piping, etc., shall be given a post-weld stress relief heat treatment.

17.12.4 Process pressure vessels and piping of the condensate part of the refrigeration system shall be given a post-weld stress relief heat treatment when made of materials mentioned in 17.12.1.

17.12.5 The tensile and yield properties of the welding consumables shall exceed those of the tank or piping material by the smallest practical amount.

17.12.6 Nickel steel containing more than 5% nickel and carbon-manganese steel, not complying with the requirements of 17.12.2 and 17.12.3, are particularly susceptible to ammonia stress corrosion cracking and shall not be used in containment and piping systems for the carriage of this product.

17.12.7 Nickel steel containing not more than 5% nickel may be used, provided the carriage temperature complies with the requirements specified in 17.12.2.3.

17.12.8 To minimize the risk of ammonia stress corrosion cracking, it is advisable to keep the dissolved oxygen content below 2.5 ppm w/w. This can best be achieved by reducing the average oxygen content in the tanks prior to the introduction of liquid ammonia to less than the values given as a function of the carriage temperature *T* in the table below:

T (°C)	**O_2 (% v/v)**
-30 and below	0.9
-20	0.5
-10	0.28
0	0.16
10	0.1
20	0.05
30	0.03

Oxygen percentages for intermediate temperatures may be obtained by direct interpolation.

17.13 Chlorine

17.13.1 *Cargo containment system*

17.13.1.1 The capacity of each tank shall not exceed 600 m^3 and the total capacity of all cargo tanks shall not exceed 1,200 m^3.

17.13.1.2 The tank design vapour pressure shall not be less than 1.35 MPa (see 7.1.2 and 17.3.2).

17.13.1.3 Parts of tanks protruding above the upper deck shall be provided with protection against thermal radiation, taking into account total engulfment by fire.

17.13.1.4 Each tank shall be provided with two PRVs. A bursting disc of appropriate material shall be installed between the tank and the PRVs. The rupture pressure of the bursting disc shall be 0.1 MPa lower than the opening pressure of the pressure relief valve, which shall be set at the design vapour pressure of the tank but not less than 1.35 MPa gauge. The space between the bursting disc and the relief valve shall be connected through an excess flow valve to a pressure gauge and a gas detection system. Provisions shall be made to keep this space at or near the atmospheric pressure during normal operation.

17.13.1.5 Outlets from PRVs shall be arranged in such a way as to minimize the hazards on board the ship as well as to the environment. Leakage from the relief valves shall be led through the absorption plant to reduce the gas concentration as far as possible. The relief valve exhaust line shall be arranged at the forward end of the ship to discharge outboard at deck level with an arrangement to select either port or starboard side, with a mechanical interlock to ensure that one line is always open.

17.13.1.6 The Administration and the port Administration may require that chlorine is carried in a refrigerated state at a specified maximum pressure.

17.13.2 *Cargo piping systems*

17.13.2.1 Cargo discharge shall be performed by means of compressed chlorine vapour from shore, dry air or another acceptable gas, or fully submerged pumps. Cargo discharge compressors on board ships shall not be used for this. The pressure in the vapour space of the tank during discharging shall not exceed 1.05 MPa gauge.

17.13.2.2 The design pressure of the cargo piping system shall be not less than 2.1 MPa gauge. The internal diameter of the cargo pipes shall not exceed 100 mm. Only pipe bends shall be accepted for compensation of pipeline thermal movement. The use of flanged joints shall be restricted to a minimum and, when used, the flanges shall be of the welding neck type with tongue and groove.

17.13.2.3 Relief valves of the cargo piping system shall discharge to the absorption plant, and the flow restriction created by this unit shall be taken into account when designing the relief valve system (see 8.4.3 and 8.4.4).

17.13.3 ***Materials***

17.13.3.1 The cargo tanks and cargo piping systems shall be made of steel suitable for the cargo and for a temperature of -40ºC, even if a higher transport temperature is intended to be used.

17.13.3.2 The tanks shall be thermally stress relieved. Mechanical stress relief shall not be accepted as an equivalent.

17.13.4 ***Instrumentation: safety devices***

17.13.4.1 The ship shall be provided with a chlorine absorbing plant with a connection to the cargo piping system and the cargo tanks. The absorbing plant shall be capable of neutralizing at least 2% of the total cargo capacity at a reasonable absorption rate.

17.13.4.2 During the gas-freeing of cargo tanks, vapours shall not be discharged to the atmosphere.

17.13.4.3 A gas detecting system shall be provided that is capable of monitoring chlorine concentrations of at least 1 ppm by volume. Sample points shall be located:

.1 near the bottom of the hold spaces;

.2 in the pipes from the safety relief valves;

.3 at the outlet from the gas absorbing plant;

.4 at the inlet to the ventilation systems for the accommodation, service and machinery spaces and control stations; and

.5 on deck – at the forward end, midships and the after end of the cargo area. This is only required to be used during cargo handling and gas-freeing operations.

The gas detection system shall be provided with an audible and visual alarm with a set point of 5 ppm.

17.13.4.4 Each cargo tank shall be fitted with a high-pressure alarm giving an audible alarm at a pressure equal to 1.05 MPa gauge.

17.13.5 ***Personnel protection***

The enclosed space required by 17.5.5 shall meet the following requirements:

.1 the space shall be easily and quickly accessible from the weather decks and from accommodation spaces by means of air locks, and shall be capable of being rapidly closed gastight;

.2 one of the decontamination showers required by 14.4.3 shall be located near the weather deck airlock to the space;

.3 the space shall be designed to accommodate the entire crew of the ship and be provided with a source of uncontaminated air for a period of not less than 4 h; and

.4 one set of oxygen therapy equipment shall be carried in the space.

17.13.6 ***Filling limits for cargo tanks***

17.13.6.1 The requirements of 15.1.3.2 do not apply when it is intended to carry chlorine.

17.13.6.2 The chlorine content of the gas in the vapour space of the cargo tank after loading shall be greater than 80% by volume.

17.14 Ethylene oxide

17.14.1 For the carriage of ethylene oxide, the requirements of 17.18 shall apply, with the additions and modifications as given in this section.

17.14.2 Deck tanks shall not be used for the carriage of ethylene oxide.

17.14.3 Stainless steels types 416 and 442, as well as cast iron, shall not be used in ethylene oxide cargo containment and piping systems.

17.14.4 Before loading, tanks shall be thoroughly and effectively cleaned to remove all traces of previous cargoes from tanks and associated pipework, except where the immediate prior cargo has been ethylene oxide, propylene oxide or mixtures of these products. Particular care shall be taken in the case of ammonia in tanks made of steel other than stainless steel.

17.14.5 Ethylene oxide shall be discharged only by deepwell pumps or inert gas displacement. The arrangement of pumps shall comply with 17.18.15.

17.14.6 Ethylene oxide shall be carried refrigerated only and maintained at temperatures of less than 30°C.

17.14.7 PRVs shall be set at a pressure of not less than 0.55 MPa gauge. The maximum set pressure shall be specially approved by the Administration.

17.14.8 The protective padding of nitrogen gas, as required by 17.18.27, shall be such that the nitrogen concentration in the vapour space of the cargo tank will, at no time, be less than 45% by volume.

17.14.9 Before loading, and at all times when the cargo tank contains ethylene oxide liquid or vapour, the cargo tank shall be inerted with nitrogen.

17.14.10 The water-spray system required by 17.18.29 and that required by 11.3 shall operate automatically in a fire involving the cargo containment system.

17.14.11 A jettisoning arrangement shall be provided to allow the emergency discharge of ethylene oxide in the event of uncontrollable self-reaction.

17.15 Separate piping systems

Separate piping systems, as defined in 1.2.47, shall be provided.

17.16 Methyl acetylene-propadiene mixtures

17.16.1 Methyl acetylene-propadiene mixtures shall be suitably stabilized for transport. Additionally, upper limits of temperatures and pressure during the refrigeration shall be specified for the mixtures.

17.16.2 Examples of acceptable stabilized compositions are:

.1 Composition 1:

.1 maximum methyl acetylene to propadiene molar ratio of 3 to 1;

.2 maximum combined concentration of methyl acetylene and propadiene of 65 mol%;

.3 minimum combined concentration of propane, butane, and isobutane of 24 mol%, of which at least one third (on a molar basis) shall be butanes and one third propane;

.4 maximum combined concentration of propylene and butadiene of 10 mol%;

.2 Composition 2:

.1 maximum methyl acetylene and propadiene combined concentration of 30 mol%;

.2 maximum methyl acetylene concentration of 20 mol%;

.3 maximum propadiene concentration of 20 mol%;

.4 maximum propylene concentration of 45 mol%;

.5 maximum butadiene and butylenes combined concentration of 2 mol%;

.6 minimum saturated C4 hydrocarbon concentration of 4 mol%; and

.7 minimum propane concentration of 25 mol%.

17.16.3 Other compositions may be accepted, provided the stability of the mixture is demonstrated to the satisfaction of the Administration.

17.16.4 If a ship has a direct vapour compression refrigeration system, this shall comply with the following requirements, subject to pressure and temperature limitations depending on the composition. For the example compositions given in 17.16.2, the following features shall be provided:

.1 a vapour compressor that does not raise the temperature and pressure of the vapour above 60°C and 1.75 MPa gauge during its operation, and that does not allow vapour to stagnate in the compressor while it continues to run;

.2 discharge piping from each compressor stage or each cylinder in the same stage of a reciprocating compressor shall have:

.1 two temperature-actuated shutdown switches set to operate at 60ºC or less;

.2 a pressure-actuated shutdown switch set to operate at 1.75 MPa gauge or less; and

.3 a safety relief valve set to relieve at 1.8 MPa gauge or less;

.3 the relief valve required by .2.3 shall vent to a mast meeting the requirements of 8.2.10, 8.2.11 and 8.2.15 and shall not relieve into the compressor suction line; and

.4 an alarm that sounds in the cargo control position and in the navigation bridge when a high-pressure switch, or a high-temperature switch, operates.

17.16.5 The piping system, including the cargo refrigeration system, for tanks to be loaded with methyl acetylene-propadiene mixtures shall be either independent (as defined in 1.2.28) or separate (as defined in 1.2.47) from piping and refrigeration systems for other tanks. This segregation shall apply to all liquid and vapour vent lines and any other possible connections, such as common inert gas supply lines.

17.17 Nitrogen

Materials of construction and ancillary equipment such as insulation shall be resistant to the effects of high oxygen concentrations caused by condensation and enrichment at the low temperatures attained in parts of the cargo system. Due consideration shall be given to ventilation in areas where condensation might occur, to avoid the stratification of oxygen-enriched atmosphere.

17.18 Propylene oxide and mixtures of ethylene oxide-propylene oxide with ethylene oxide content of not more than 30% by weight

17.18.1 Products transported under the provisions of this section shall be acetylene-free.

17.18.2 Unless cargo tanks are properly cleaned, these products shall not be carried in tanks that have contained as one of the three previous cargoes any product known to catalyse polymerization, such as:

.1 anhydrous ammonia and ammonia solutions;

.2 amines and amine solutions; and

.3 oxidizing substances (e.g. chlorine).

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

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

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

17.18.6 Tanks for the carriage of these products shall be of steel or stainless steel construction.

17.18.7 Tanks that have contained these products may be used for other cargoes after thorough cleaning of tanks and associated pipework systems by washing or purging.

17.18.8 All valves, flanges, fittings and accessory equipment shall be of a type suitable for use with these products and shall be constructed of steel or stainless steel in accordance with recognized standards. Disc or disc faces, seats and other wearing parts of valves shall be made of stainless steel containing not less than 11% chromium.

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

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

17.18.11 The following materials are generally found unsatisfactory for use in gaskets, packing and similar uses in containment systems for these products and would require testing before being approved:

.1 neoprene or natural rubber, if it comes into contact with the products;

.2 asbestos or binders used with asbestos; and

.3 materials containing oxides of magnesium, such as mineral wools.

17.18.12 Filling and discharge piping shall extend to within 100 mm of the bottom of the tank or any sump.

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

17.18.14 During discharging operations, the pressure in the cargo tank shall be maintained above 0.007 MPa gauge.

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

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

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

17.18.18 Hold spaces shall be monitored for these products. Hold spaces surrounding type A and type B independent tanks shall also be inerted and monitored for oxygen. The oxygen content of these spaces shall be maintained below 2% by volume. Portable sampling equipment is satisfactory.

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

17.18.20 Tanks shall be designed for the maximum pressure expected to be encountered during loading, carriage or unloading of cargo.

17.18.21 Tanks for the carriage of propylene oxide with a design vapour pressure of less than 0.06 MPa, and tanks for the carriage of ethylene oxide-propylene oxide mixtures with a design vapour pressure of less than 0.12 MPa, shall have a cooling system to maintain the cargo below the reference temperature. The reference temperatures are referred to in 15.1.3.

17.18.22 Pressure relief valve settings shall not be less than 0.02 MPa gauge; and for type C independent tanks not greater than 0.7 MPa gauge for the carriage of propylene oxide and not greater than 0.53 MPa gauge for the carriage of ethylene oxide-propylene oxide mixtures.

17.18.23 The piping system for tanks to be loaded with these products shall be completely separate from piping systems for all other tanks, including empty tanks, and from all cargo compressors. If the piping system for the tanks to be loaded with these products is not independent, as defined in 1.2.28, the required piping separation shall be accomplished by the removal of spool pieces, valves, or other pipe sections and the installation of blank flanges at these locations. The required separation applies to all liquid and vapour piping, liquid and vapour vent lines and any other possible connections such as common inert gas supply lines.

17.18.24 The products shall be transported only in accordance with cargo handling plans approved by the Administration. Each intended loading arrangement shall be shown on a separate cargo handling plan. Cargo handling plans shall show the entire cargo piping system and the locations for installation of the blank flanges needed to meet the above piping separation requirements. A copy of each approved cargo handling plan shall be kept on board the ship. The International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk shall be endorsed to include references to the approved cargo handling plans.

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

17.18.26 The maximum allowable loading limits for each tank shall be indicated for each loading temperature that may be applied, in accordance with 15.5.

17.18.27 The cargo shall be carried under a suitable protective padding of nitrogen gas. An automatic nitrogen make-up system shall be installed to prevent the tank pressure falling below 0.007 MPa gauge in the event of product temperature fall due to ambient conditions or malfunctioning of refrigeration system. Sufficient nitrogen shall be available on board to satisfy the demand of the automatic pressure control. Nitrogen of commercially pure quality (99.9% by volume) shall be used for padding. A battery of nitrogen bottles, connected to the cargo tanks through a pressure reduction valve, satisfies the intention of the expression "automatic" in this context.

17.18.28 The cargo tank vapour space shall be tested prior to and after loading to ensure that the oxygen content is 2% by volume or less.

17.18.29 A water-spray system of sufficient capacity shall be provided to blanket effectively the area surrounding the loading manifold, the exposed deck piping associated with product handling and the tank domes. The arrangement of piping and nozzles shall be such as to give a uniform distribution rate of 10l/m^2/min. The arrangement shall ensure that any spilled cargo is washed away.

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

17.18.31 When ambient temperatures permit, a pressurized water hose ready for immediate use shall be available during loading and unloading operations, in addition to the above water-spray requirements.

17.19 Vinyl chloride

In cases where polymerization of vinyl chloride is prevented by addition of an inhibitor, 17.8 is applicable. In cases where no inhibitor has been added, or the inhibitor concentration is insufficient, any inert gas used for the purposes of 17.6 shall contain no more oxygen than 0.1% by volume. Before loading is started, inert gas samples from the tanks and piping shall be analysed. When vinyl chloride is carried, a positive pressure shall always be maintained in the tanks and during ballast voyages between successive carriages.

17.20 Mixed C4 cargoes

17.20.1 Cargoes that may be carried individually under the requirements of this Code, notably butane, butylenes and butadiene, may be carried as mixtures subject to the provisions of this section. These cargoes may variously be referred to as "Crude C4", "Crude butadiene", "Crude steam-cracked C4", "Spent steam-cracked C4", "C4 stream", "C4 raffinate", or may be shipped under a different description. In all cases, the material safety data sheets (MSDS) shall be consulted as the butadiene content of the mixture is of prime concern as it is potentially toxic and reactive. While it is recognized that butadiene has a relatively low vapour pressure, if such mixtures contain butadiene they shall be regarded as toxic and the appropriate precautions applied.

17.20.2 If the mixed C4 cargo shipped under the terms of this section contains more than 50% (mole) of butadiene, the inhibitor precautions in 17.8 shall apply.

17.20.3 Unless specific data on liquid expansion coefficients is given for the specific mixture loaded, the filling limit restrictions of chapter 15 shall be calculated as if the cargo contained 100% concentration of the component with the highest expansion ratio.

17.21 Carbon dioxide: high purity

17.21.1 Uncontrolled pressure loss from the cargo can cause "sublimation" and the cargo will change from the liquid to the solid state. The precise "triple point" temperature of a particular carbon dioxide cargo shall be supplied before loading the cargo, and will depend on the purity of that cargo, and this shall be taken into account when cargo instrumentation is adjusted. The set pressure for the alarms and automatic actions described in this section shall be set to at least 0.05 MPa above the triple point for the specific cargo being carried. The "triple point" for pure carbon dioxide occurs at 0.5 MPa gauge and -54.4°C.

17.21.2 There is a potential for the cargo to solidify in the event that a cargo tank relief valve, fitted in accordance with 8.2, fails in the open position. To avoid this, a means of isolating the cargo tank safety valves shall be provided and the requirements of 8.2.9.2 do not apply when carrying this carbon dioxide. Discharge piping from safety relief valves shall be designed so they remain free from obstructions that could cause clogging. Protective screens shall not be fitted to the outlets of relief valve discharge piping, so the requirements of 8.2.15 do not apply.

17.21.3 Discharge piping from safety relief valves are not required to comply with 8.2.10, but shall be designed so they remain free from obstructions that could cause clogging. Protective screens shall not be fitted to the outlets of relief valve discharge piping, so the requirements of 8.2.15 do not apply.

17.21.4 Cargo tanks shall be continuously monitored for low pressure when a carbon dioxide cargo is carried. An audible and visual alarm shall be given at the cargo control position and on the bridge. If the cargo tank pressure continues to fall to within 0.05 MPa of the "triple point" for the particular cargo, the monitoring system shall automatically close all cargo manifold liquid and vapour valves and stop all cargo compressors and cargo pumps. The emergency shutdown system required by 18.10 may be used for this purpose.

17.21.5 All materials used in cargo tanks and cargo piping system shall be suitable for the lowest temperature that may occur in service, which is defined as the saturation temperature of the carbon dioxide cargo at the set pressure of the automatic safety system described in 17.21.1.

17.21.6 Cargo hold spaces, cargo compressor rooms and other enclosed spaces where carbon dioxide could accumulate shall be fitted with continuous monitoring for carbon dioxide build-up. This fixed gas detection system replaces the requirements of 13.6, and hold spaces shall be monitored permanently even if the ship has type C cargo containment.

17.22 Carbon dioxide: reclaimed quality

17.22.1 The requirements of 17.21 also apply to this cargo. In addition, the materials of construction used in the cargo system shall also take account of the possibility of corrosion, in case the reclaimed quality carbon dioxide cargo contains impurities such as water, sulphur dioxide, etc., which can cause acidic corrosion or other problems.

CHAPTER 18

OPERATING REQUIREMENTS

Goal

To ensure that all ship staff involved in cargo operations have sufficient information about cargo properties and operating the cargo system so they can conduct cargo operations safely.

18.1 General

18.1.1 Those involved in liquefied gas carrier operations shall be made aware of the special requirements associated with, and precautions necessary for, their safe operation.

18.1.2 A copy of the Code, or national regulations incorporating the provisions of the Code, shall be on board every ship covered by the Code.

18.2 Cargo operations manuals

18.2.1 The ship shall be provided with copies of suitably detailed cargo system operation manuals approved by the Administration such that trained personnel can safely operate the ship with due regard to the hazards and properties of the cargoes that are permitted to be carried.

18.2.2 The content of the manuals shall include, but not be limited to:

.1 overall operation of the ship from dry-dock to dry-dock, including procedures for cargo tank cooldown and warm-up, transfer (including ship-to-ship transfer), cargo sampling, gas-freeing, ballasting, tank cleaning and changing cargoes;

.2 cargo temperature and pressure control systems;

.3 cargo system limitations, including minimum temperatures (cargo system and inner hull), maximum pressures, transfer rates, filling limits and sloshing limitations;

.4 nitrogen and inert gas systems;

.5 firefighting procedures: operation and maintenance of firefighting systems and use of extinguishing agents;

.6 special equipment needed for the safe handling of the particular cargo;

.7 fixed and portable gas detection;

.8 control, alarm and safety systems;

.9 emergency shutdown systems;

.10 procedures to change cargo tank pressure relief valve set pressures in accordance with 8.2.8 and 4.13.2.3; and

.11 emergency procedures, including cargo tank relief valve isolation, single tank gas-freeing and entry and emergency ship-to-ship transfer operations.

18.3 Cargo information

18.3.1 Information shall be on board and available to all concerned in the form of a cargo information data sheet(s) giving the necessary data for the safe carriage of cargo. Such information shall include, for each product carried:

.1 a full description of the physical and chemical properties necessary for the safe carriage and containment of the cargo;

.2 reactivity with other cargoes that are capable of being carried on board in accordance with the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk;

.3 the actions to be taken in the event of cargo spills or leaks;

.4 countermeasures against accidental personal contact;

.5 firefighting procedures and firefighting media;

.6 special equipment needed for the safe handling of the particular cargo; and

.7 emergency procedures.

18.3.2 The physical data supplied to the master, in accordance with 18.3.1.1, shall include information regarding the relative cargo density at various temperatures to enable the calculation of cargo tank filling limits in accordance with the requirements of chapter 15.

18.3.3 Contingency plans in accordance with 18.3.1.3, for spillage of cargo carried at ambient temperature, shall take account of potential local temperature reduction such as when the escaped cargo has reduced to atmospheric pressure and the potential effect of this cooling on hull steel.

18.4 Suitability for carriage

18.4.1 The master shall ascertain that the quantity and characteristics of each product to be loaded are within the limits indicated in the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk required by 1.4, and in the Loading and Stability Information booklet required by 2.2.5, and that products are listed in the International Certificate of Fitness for the Carriage of Liquefied Gases in Bulk as required under section 4 of the certificate.

18.4.2 Care shall be taken to avoid dangerous chemical reactions if cargoes are mixed. This is of particular significance in respect of:

.1 tank cleaning procedures required between successive cargoes in the same tank; and

.2 simultaneous carriage of cargoes that react when mixed. This shall be permitted only if the complete cargo systems including, but not limited to, cargo pipework, tanks, vent systems and refrigeration systems are separated as defined in 1.2.47.

18.4.3 Where products are required to be inhibited, the certificate required by 17.8 shall be supplied before departure, otherwise the cargo shall not be transported.

18.5 Carriage of cargo at low temperature

When carrying cargoes at low temperatures:

.1 the cooldown procedure laid down for that particular tank, piping and ancillary equipment shall be followed closely;

.2 loading shall be carried out in such a manner as to ensure that design temperature gradients are not exceeded in any cargo tank, piping or other ancillary equipment; and

.3 if provided, the heating arrangements associated with the cargo containment systems shall be operated in such a manner as to ensure that the temperature of the hull structure does not fall below that for which the material is designed.

18.6 Cargo transfer operations

18.6.1 A pre-cargo operations meeting shall take place between ship personnel and the persons responsible at the transfer facility. Information exchanged shall include the details of the intended cargo transfer operations and emergency procedures. A recognized industry checklist shall be completed for the intended cargo transfer and effective communications shall be maintained throughout the operation.

18.6.2 Essential cargo handling controls and alarms shall be checked and tested prior to cargo transfer operations.

18.7 Personnel training

18.7.1 Personnel shall be adequately trained in the operational and safety aspects of liquefied gas carriers as required by the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978, as amended, the International Safety Management Code and the Medical First Aid Guide (MFAG). As a minimum:

.1 all personnel shall be adequately trained in the use of protective equipment provided on board and have basic training in the procedures, appropriate to their duties, necessary under emergency conditions; and

.2 officers shall be trained in emergency procedures to deal with conditions of leakage, spillage or fire involving the cargo and a sufficient number of them shall be instructed and trained in essential first aid for the cargoes carried.

18.8 Entry into enclosed spaces[21]

18.8.1 Under normal operational circumstances, personnel shall not enter cargo tanks, hold spaces, void spaces or other enclosed spaces where gas may accumulate, unless the gas content of the atmosphere in such space is determined by means of fixed or portable equipment to ensure oxygen sufficiency and the absence of toxic atmosphere.

18.8.2 If it is necessary to gas-free and aerate a hold space surrounding a type A cargo tank for routine inspection, and flammable cargo is carried in the cargo tank, the inspection shall be conducted when the tank contains only the minimum amount of cargo "heel" to keep the cargo tank cold. The hold shall be re-inerted as soon as the inspection is completed.

[21] Refer to the *Revised recommendations for entering enclosed spaces aboard ships*, adopted by the Organization by resolution A.1050(27).

18.8.3 Personnel entering any space designated as a hazardous area on a ship carrying flammable products shall not introduce any potential source of ignition into the space, unless it has been certified gas-free and is maintained in that condition.

18.9 Cargo sampling

18.9.1 Any cargo sampling shall be conducted under the supervision of an officer who shall ensure that protective clothing appropriate to the hazards of the cargo is used by everyone involved in the operation.

18.9.2 When taking liquid cargo samples, the officer shall ensure that the sampling equipment is suitable for the temperatures and pressures involved, including cargo pump discharge pressure, if relevant.

18.9.3 The officer shall ensure that any cargo sample equipment used is connected properly to avoid any cargo leakage.

18.9.4 If the cargo to be sampled is a toxic product, the officer shall ensure that a "closed loop" sampling system as defined in 1.2.15 is used to minimize any cargo release to atmosphere.

18.9.5 After sampling operations are completed, the officer shall ensure that any sample valves used are closed properly and the connections used are correctly blanked.

18.10 Cargo emergency shutdown (ESD) system

18.10.1 ***General***

18.10.1.1 A cargo emergency shutdown system shall be fitted to stop cargo flow in the event of an emergency, either internally within the ship, or during cargo transfer to ship or shore. The design of the ESD system shall avoid the potential generation of surge pressures within cargo transfer pipe work (see 18.10.2.1.4).

18.10.1.2 Auxiliary systems for conditioning the cargo that use toxic or flammable liquids or vapours shall be treated as cargo systems for the purposes of ESD. Indirect refrigeration systems using an inert medium, such as nitrogen, need not be included in the ESD function.

18.10.1.3 The ESD system shall be activated by the manual and automatic initiations listed in table 18.1. Any additional initiations shall only be included in the ESD system if it can be shown that their inclusion does not reduce the integrity and reliability of the system overall.

18.10.1.4 Ship's ESD systems shall incorporate a ship-shore link in accordance with recognized standards[22].

18.10.1.5 A functional flow chart of the ESD system and related systems shall be provided in the cargo control station and on the navigation bridge.

18.10.2 ***ESD valve requirements***

18.10.2.1 General

18.10.2.1.1 The term *ESD valve* means any valve operated by the ESD system.

[22] ISO 28460:2010 Petroleum and natural gas industries – Installation and equipment for liquefied natural gas – Ship-to-shore interface and port operations.

18.10.2.1.2 ESD valves shall be remotely operated, be of the fail-closed type (closed on loss of actuating power), be capable of local manual closure and have positive indication of the actual valve position. As an alternative to the local manual closing of the ESD valve, a manually operated shut-off valve in series with the ESD valve shall be permitted. The manual valve shall be located adjacent to the ESD valve. Provisions shall be made to handle trapped liquid should the ESD valve close while the manual valve is also closed.

18.10.2.1.3 ESD valves in liquid piping systems shall close fully and smoothly within 30 s of actuation. Information about the closure time of the valves and their operating characteristics shall be available on board, and the closing time shall be verifiable and repeatable.

18.10.2.1.4 The closing time of the valve referred to in 13.3.1 to 13.3.3 (i.e. time from shutdown signal initiation to complete valve closure) shall not be greater than:

$$\frac{3600U}{LR} \quad \text{(second)}$$

where:

U = ullage volume at operating signal level (m^3);

LR = maximum loading rate agreed between ship and shore facility (m^3/h).

The loading rate shall be adjusted to limit surge pressure on valve closure to an acceptable level, taking into account the loading hose or arm, the ship and the shore piping systems, where relevant.

18.10.2.2 Ship-shore and ship-ship manifold connections

One ESD valve shall be provided at each manifold connection. Cargo manifold connections not being used for transfer operations shall be blanked with blank flanges rated for the design pressure of the pipeline system.

18.10.2.3 Cargo system valves

If cargo system valves as defined in section 5.5 are also ESD valves within the meaning of 18.10, then the requirements of 18.10 shall apply.

18.10.3 ***ESD system controls***

18.10.3.1 As a minimum, the ESD system shall be capable of manual operation by a single control on the bridge and either in the control position required by 13.1.2 or the cargo control room, if installed, and no less than two locations in the cargo area.

18.10.3.2 The ESD system shall be automatically activated on detection of a fire on the weather decks of the cargo area and/or cargo machinery spaces. As a minimum, the method of detection used on the weather decks shall cover the liquid and vapour domes of the cargo tanks, the cargo manifolds and areas where liquid piping is dismantled regularly. Detection may be by means of fusible elements designed to melt at temperatures between 98°C and 104°C, or by area fire detection methods.

18.10.3.3 Cargo machinery that is running shall be stopped by activation of the ESD system in accordance with the cause and effect matrix in table 18.1.

18.10.3.4 The ESD control system shall be configured so as to enable the high-level testing required in 13.3.5 to be carried out in a safe and controlled manner. For the purpose of the testing, cargo pumps may be operated while the overflow control system is overridden. Procedures for level alarm testing and re-setting of the ESD system after completion of the high-level alarm testing shall be included in the operation manual required by 18.2.1.

Table 18.1 – ESD functional arrangements

	Pumps		**Compressor systems**				**Valves**	**Link**
Shutdown action → **Initiation ↓**	Cargo pumps/ cargo booster pumps	Spray/ stripping pumps	Vapour return compressors	Fuel gas compressors	Reliquefaction plant***, including condensate return pumps, if fitted	Gas combustion unit	ESD valves	Signal to ship/ shore link****
Emergency push buttons (see 18.10.3.1)	✓	✓	✓	Note 2	✓	✓	✓	✓
Fire detection on deck or in compressor house* (see 18.10.3.2)	✓	✓	✓	✓	✓	✓	✓	✓
High level in cargo tank (see 13.3.2 and 13.3.3)	✓	✓	✓	Note 1 Note 2	Note1 Note 3	Note 1	Note 6	✓
Signal from ship/shore link (see 18.10.1.4)	✓	✓	✓	Note 2	Note 3	n/a	✓	n/a
Loss of motive power to ESD valves**	✓	✓	✓	Note 2	Note 3	n/a	✓	✓
Main electric power failure ("blackout")	Note 7	Note 7	Note 7	Note 7	Note 7	Note 7	✓	✓
Level alarm override (see 13.3.7)	Note 4	Note 4 Note 5	✓	Note 1	Note1	Note 1	✓	✓

Note 1: These items of equipment can be omitted from these specific automatic shutdown initiators, provided the equipment inlets are protected against cargo liquid ingress.

Note 2: If the fuel gas compressor is used to return cargo vapour to shore, it shall be included in the ESD system when operating in this mode.

Note 3: If the reliquefaction plant compressors are used for vapour return/shore line clearing, they shall be included in the ESD system when operating in that mode.

Note 4: The override system permitted by 13.3.7 may be used at sea to prevent false alarms or shutdowns. When level alarms are overridden, operation of cargo pumps and the opening of manifold ESD valves shall be inhibited except when high-level alarm testing is carried out in accordance with 13.3.5 (see 18.10.3.4).

Note 5: Cargo spray or stripping pumps used to supply forcing vaporizer may be excluded from the ESD system only when operating in that mode.

Note 6: The sensors referred to in 13.3.2 may be used to close automatically the tank filling valve for the individual tank where the sensors are installed, as an alternative to closing the ESD valve referred to in 18.10.2.2. If this option is adopted, activation of the full ESD system shall be initiated when the high-level sensors in all the tanks to be loaded have been activated.

Note 7: These items of equipment shall be designed not to restart upon recovery of main electric power and without confirmation of safe conditions.

* Fusible plugs, electronic point temperature monitoring or area fire detection may be used for this purpose on deck.

** Failure of hydraulic, electric or pneumatic power for remotely operated ESD valve actuators.

*** Indirect refrigeration systems which form part of the reliquefaction plant do not need to be included in the ESD function if they employ an inert medium such as nitrogen in the refrigeration cycle.

**** Signal need not indicate the event initiating ESD.

✓ Functional requirement.

N/A Not applicable.

18.10.4 ***Additional shutdowns***

18.10.4.1 The requirements of 8.3.1.1 to protect the cargo tank from external differential pressure may be fulfilled by using an independent low pressure trip to activate the ESD system, or, as minimum, to stop any cargo pumps or compressors.

18.10.4.2 An input to the ESD system from the overflow control system required by 13.3 may be provided to stop any cargo pumps or compressors' running at the time a high level is detected, as this alarm may be due to inadvertent internal transfer of cargo from tank to tank.

18.10.5 ***Pre-operations testing***

Cargo emergency shutdown and alarm systems involved in cargo transfer shall be checked and tested before cargo handling operations begin.

18.11 Hot work on or near cargo containment systems

18.11.1 Special fire precautions shall be taken in the vicinity of cargo tanks and, particularly, insulation systems that may be flammable or contaminated with hydrocarbons or that may give off toxic fumes as a product of combustion.

18.12 Additional operating requirements

Additional operating requirements will be found in the following paragraphs of the Code:
2.2.2, 2.2.5, 2.2.8, 3.8.4, 3.8.5, 5.3.2, 5.3.3.3, 5.7.3, 7.1, 8.2.7, 8.2.8, 8.2.9, 9.2, 9.3, 9.4.4, 12.1.1, 13.1.3, 13.3.6, 13.6.18, 14.3.3, 15.3, 15.6, 16.6.3, 17.4.2, 17.6, 17.7, 17.9, 17.10, 17.11, 17.12, 17.13, 17.14, 17.16, 17.18, 17.19, 17.21, 17.22.

CHAPTER 19

SUMMARY OF MINIMUM REQUIREMENTS

Explanatory notes to the summary of minimum requirements

Product name *(column a)*	The product name shall be used in the shipping document for any cargo offered for bulk shipments. Any additional name may be included in brackets after the product name. In some cases, the product names are not identical with the names given in previous issues of the Code.
(column b)	*Deleted*
Ship type *(column c)*	1: Ship type 1G (2.1.2.1) 2: Ship type 2G (2.1.2.2) 3: Ship type 2PG (2.1.2.3) 4: Ship type 3G (2.1.2.4)
Independent tank type C required *(column d)*	Type C independent tank (4.23)
Tank environmental control *(column e)*	Inert: Inerting (9.4) Dry: Drying (17.7) - : No special requirements under the Code
Vapour detection *(column f)*	F: Flammable vapour detection T: Toxic vapour detection F+T: Flammable and toxic vapour detection A: Asphixiant
Gauging *(column g)*	I: Indirect or closed (13.2.3.1 and .2) R: Indirect, closed or restricted (13.2.3.1, .2, .3 and .4) C: Indirect or closed (13.2.3.1, .2 and .3)
(column h)	*Deleted*
Special requirements *(column i)*	When specific reference is made to chapters 14 and/or 17, these requirements shall be additional to the requirements in any other column.
Refrigerant gases	Non-toxic and non-flammable gases

Unless otherwise specified, gas mixtures containing less than 5% total acetylenes may be transported with no further requirements than those provided for the major components.

a ***Product name***	*b*	*c* ***Ship type***	*d* ***Independent tank type C required***	*e* ***Control of vapour space within cargo tanks***	*f* ***Vapour detection***	*g* ***Gauging***	*h*	*i* ***Special requirements***
Acetaldehyde		2G/2PG	-	Inert	F + T	C		14.4.2, 14.3.3.1, 17.4.1, 17.6.1
Ammonia, anhydrous		2G/2PG	-	-	T	C		14.4, 17.2.1, 17.12
Butadiene (all isomers)		2G/2PG	-	-	F + T	C		14.4, 17.2.2, 17.4.2, 17.4.3, 17.6, 17.8
Butane (all isomers)		2G/2PG	-	-	F	R		
Butane-propane mixture		2G/2PG	-	-	F	R		
Butylenes (all isomers)		2G/2PG	-	-	F	R		
Carbon Dioxide (high purity)		3G	-	-	A	R		17.21
Carbon Dioxide (Reclaimed quality)		3G	-	-	A	R		17.22
Chlorine		1G	Yes	Dry	T	I		14.4, 17.3.2, 17.4.1, 17.5, 17.7, 17.9, 17.13
Diethyl ether*		2G/2PG	-	Inert	F + T	C		14.4.1, 14.4.2, 17.2.6, 17.3.1, 17.6.1, 17.9, 17.10, 17.11.2, 17.11.3
Dimethylamine		2G/2PG	-	-	F + T	C		14.4, 17.2.1
Dimethyl Ether		2G/2PG			F + T	C		
Ethane		2G	-	-	F	R		
Ethyl Chloride		2G/2PG	-	-	F +T	C		
Ethylene		2G	-	-	F	R		
Ethylene oxide		1G	Yes	Inert	F +T	C		14.4, 17.2.2, 17.3.2, 17.4.1, 17.5, 17.6.1, 17.14

a	b	c	d	e	f	g	h	i
Product name		***Ship type***	***Independent tank type C required***	***Control of vapour space within cargo tanks***	***Vapour detection***	***Gauging***		***Special requirements***
Ethylene oxide-propylene oxide mixtures with ethylene oxide content of not more than 30% by weight*		2G/2PG	-	Inert	F +T	C		14.4.2, 17.3.1, 17.4.1, 17.6.1, 17.9, 17.10, 17.18
Isoprene* (all isomers)		2G/2PG	-	-	F	R		14.4.2, 17.8, 17.9, 17.11.1
Isoprene (part refined)*		2G/2PG	-	-	F	R		14.4.2, 17.8, 17.9, 17.11.1
Isopropylamine*		2G/2PG	-	-	F +T	C		14.4.1, 14.4.2, 17.2.4, 17.9, 17.10, 17.11.1, 17.15
Methane (LNG)		2G	-	-	F	C		
Methyl acetylene-propadiene mixtures		2G/2PG	-	-	F	R		17.16
Methyl bromide		1G	Yes	-	F + T	C		14.4, 17.2.3, 17.3.2, 17.4.1, 17.5
Methyl chloride		2G/ 2PG	-	-	F + T	C		17.2.3
Mixed C4 Cargoes		2G/2PG	-	-	F + T	C		14.4, 17.2.2, 17.4.2, 17.4.3, 17.6, 17.20
Monoethylamine*		2G/2PG	-	-	F + T	C		14.4, 17.2.1, 17.3.1, 17.9, 17.10, 17.11.1, 17.15
Nitrogen		3G	-	-	A	C		17.17
Pentane (all isomers)*		2G/2PG	-	-	F	R		17.9, 17.11
Pentene (all isomers)*		2G/2PG	-	-	F	R		17.9, 17.11
Propane		2G/2PG	-	-	F	R		
Propylene		2G/2PG	-	-	F	R		

a ***Product name***	*b*	*c* ***Ship type***	*d* ***Independent tank type C required***	*e* ***Control of vapour space within cargo tanks***	*f* ***Vapour detection***	*g* ***Gauging***	*h*	*i* ***Special requirements***
Propylene oxide*		2G/2PG	-	Inert	F + T	C		14.4.2, 17.3.1, 17.4.1, 17.6.1, 17.9, 17.10, 17.18
Refrigerant gases		3G	-	-	-	R		
Sulphur dioxide		1G	Yes	Dry	T	C		14.4, 17.3.2, 17.4.1, 17.5, 17.7
Vinyl chloride		2G/2PG	-	-	F + T	C		14.4.1, 14.4.2, 17.2.2, 17.2.3, 17.3.1, 17.6, 17.19
Vinyl ethyl ether*		2G/2PG	-	Inert	F + T	C		14.4.1, 14.4.2, 17.2.2, 17.3.1, 17.6.1, 17.8, 17.9, 17.10, 17.11.2, 17.11.3
Vinylidene chloride*		2G/2PG	-	Inert	F + T	C		14.4.1, 14.4.2, 17.2.5, 17.6.1, 17.8, 17.9, 17.10

* This cargo is also covered by the IBC Code.

APPENDIX 1

IGC CODE PRODUCT DATA REPORTING FORM

Characteristics of products proposed for transport on the IGC Code ships

1 PRODUCT IDENTITY

Product name

The product name should be used in the shipping document for any cargo offered for bulk shipments. Any additional name may be included in brackets after the product name.

1.1 Other names and identification numbers

Main trade name : ______
Main chemical name : ______
Chemical formula : ______
C.A.S number : ______
EHS number : ______
BMR number : ______
RTECS number : ______

1.2 Associated synonyms

Structure

Synonym name	Type

1.3 Composition

Component name	%	Type

2 Physical properties

Property	Units	Qual	Lower value	Upper value	Reference/ comments
Molecular weight					
Density at 20°C	(kg/m^3)				
Flash point (c.c.)	(°C)				
Boiling point	(°C)				
Water solubility at 20°C	(mg/l)				
Vapour pressure at 20°C	(Pa)				
Auto-ignition temperature	(°C)				
Explosion limits	(% v/v)				
MESG	(mm)				

3 Relevant chemical properties

Water reactivity	(0 - 2)	
0 = No reactivity 1 = Reactive 2 = Highly	Details	

Does the product react with air to cause a potentially hazardous situation (Y/N)	
If so, provide details	
Reference	

Is an inhibitor or stabilizer needed to prevent a hazardous reaction? (Y/N)	
If so, provide details	
Reference	

4 Mammalian toxicity

4.1 Acute toxicity

		Qual	Lower value	Upper value	Species	Reference/ comments
Oral (mg/kg)	LD_{50}					
Dermal (mg/kg)	LD_{50}					
Inhalation (mg/l/4h)	LD_{50}					

4.2 Corrosivity and irritation

	Units	Qual.	Lower Value	Upper Value	Reference/ Comments
Skin corrosion time	(hours)				

	Resultant observation	Species	Reference/ Comments
Skin irritation (4-hour exposure)			
Eye irritation			

Not irritating, slightly irritating, mildly irritating, moderately irritating, severely irritating or corrosive

4.3 Sensitization

			Reference/Comments
Respiratory sensitizer (in humans)	(Y/N)		
Skin sensitization	(Y/N)		

4.4 Other specific long-term effects

Reference/Comments			
Carcinogen	(Y/N)		
Mutagen	(Y/N)		
Toxic to reproduction	(Y/N)		
Other long term	(Y/N)		

4.5 Other relevant mammalian toxicity

5 Proposed carriage requirements

Column in the IGC Code	Property	Value
c	Ship type	
d	Type C independent tank required	
e	Control of vapour space within cargo tank	
f	Vapour detection	
g	Gauging	
i	Special requirements	

APPENDIX 2

MODEL FORM OF INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF LIQUEFIED GASES IN BULK

INTERNATIONAL CERTIFICATE OF FITNESS FOR
THE CARRIAGE OF LIQUEFIED GASES IN BULK

(Official seal)

Issued under the provisions of the

INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT
OF SHIPS CARRYING LIQUEFIED GASES IN BULK

under the authority of the Government of

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

Particulars of ship[1]

Name of ship	....
Distinctive number or letters	....
IMO number[2]	....
Port of registry	....
Cargo capacity (m^3)	....
Ship type[3] (Code paragraph 2.1.2)	....
Date on which keel was laid or on which the ship was at a similar stage of construction or, in the case of a converted ship, date on which conversion to a gas carrier was commenced	…………………..

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

……
……

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

……
……..

THIS IS TO CERTIFY:

1 That the ship has been surveyed in accordance with the provisions of section 1.4 of the Code.

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

3 That the following design criteria have been used:

.1 ambient air temperature ……………………………………………………°C[4]

.2 ambient water temperature………………………………………………°C[4]

.3

Tank type and number	Stress factors[5]				Materials[5]	MARVS[6]
	A	B	C	D		
Cargo piping						

Note: Tank numbers referred to in this list are identified on attachment 2, signed and dated tank plan.

.4 Mechanical properties of the cargo tank materials were determined at ….°C[7].

4 That the ship is suitable for the carriage in bulk of the following products provided that all the relevant operational provisions of the Code are observed[8].

Products	**Conditions of carriage (tank numbers, etc.)**	**Minimum temperature**
Continued on attachment 1, additional signed and dated sheets. Tank numbers referred to in this list are identified on attachment 2, signed and dated tank plan.		

5 That, in accordance with 1.4/2.6.2*, the provisions of the Code are modified in respect of the ship in the following manner:

……………………………………………………………………………………………….

6 That the ship shall be loaded:

.1* only in accordance with loading conditions verified compliant with intact and damage stability requirements using the approved stability instrument fitted in accordance with paragraph 2.2.6 of the Code;

.2* where a dispensation permitted by paragraph 2.2.7 of the Code applies and the approved stability instrument required by paragraph 2.2.6 of the Code is not fitted, loading shall be made in accordance with one or more of the following approved methods:

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

.ii * in accordance with loading conditions verified remotely using an approved means…………………; or

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

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

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

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

This Certificate is valid until ……………………..………………..…………………………….
subject to surveys in accordance with 1.4 of the Code.

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

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

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

………….……
(Date of issue)

(Seal or stamp of the authority, as appropriate)

* Delete as appropriate.

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

Notes on completion of certificate:

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

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

3. Any entry shall be related to all relevant recommendations, e.g. an entry "type 2G" shall mean type 2G in all respects prescribed by the Code.

4. The ambient temperature required for the purposes of 4.19.1.1 is to be inserted.

5. The stress factors and materials acceptable under 4.22.3.1 and 4.23.3.1 of the Code are to be inserted.

6. All relief valve settings assigned in accordance with 4.13.2 are to be inserted.

7. Temperatures accepted by the Administration or recognized organization acting on its behalf for the purposes of 4.18.1.3 are to be inserted.

8. Only products listed in chapter 19 of the Code or products that have been evaluated by the Administration in accordance with paragraph 1.1.6.1, or their compatible mixtures having physical proportions within the limitations of tank design, shall be listed. In respect of the latter "new products", any special requirements provisionally agreed under the tripartite agreement shall be indicated in an addendum to the certificate.

ENDORSEMENT FOR ANNUAL AND INTERMEDIATE SURVEYS

THIS IS TO CERTIFY that at a survey required by 1.4.2 of the Code the ship was found to comply with the relevant provisions of the Code.

Annual survey: Signed: …………………………………………
(Signature of duly authorized official)

Place: ………………………………...............

Date *(dd/mm/yyyy):* ……………………………....

(Seal or stamp of the Authority, as appropriate)

Annual/Intermediate* survey: Signed: …………………………………………
(Signature of duly authorized official)

Place: ………………………………………………

Date *(dd/mm/yyyy)*: ………………………………

(Seal or stamp of the Authority, as appropriate)

Annual/Intermediate* survey: Signed: …………………………………………
(Signature of duly authorized official)

Place: ……………………………………………..

Date *(dd/mm/yyyy)*: ……………………………...

(Seal or stamp of the Authority, as appropriate)

Annual survey: Signed: …………………………………………
(Signature of duly authorized official)

Place: ………………………………………………

Date *(dd/mm/yyyy)*: ……………………………….

(Seal or stamp of the Authority, as appropriate)

* Delete as appropriate.

ANNUAL/INTERMEDIATE SURVEY IN ACCORDANCE WITH PARAGRAPH 1.4.6.8.3

THIS IS TO CERTIFY that, at an annual/intermediate* survey in accordance with paragraph 1.4.6.8.3 of the Code, the ship was found to comply with the relevant provisions of the Code:

Signed: …………………………………
(Signature of duly authorized official)

Place: …………………………………..

Date *(dd/mm/yyyy)*: ………………….

(Seal or stamp of the Authority, as appropriate)

ENDORSEMENT TO EXTEND THE CERTIFICATE IF VALID FOR LESS THAN 5 YEARS WHERE PARAGRAPH 1.4.6.3 APPLIES

The ship complies with the relevant provisions of the Code, and this Certificate shall, in accordance with paragraph 1.4.6.3 of the Code, be accepted as valid until.............................

Signed: …………………………………
(Signature of duly authorized official)

Place: ………………………………......

Date *(dd/mm/yyyy)*: ………………......

(Seal or stamp of the Authority, as appropriate)

ENDORSEMENT WHERE THE RENEWAL SURVEY HAS BEEN COMPLETED AND PARAGRAPH 1.4.6.4 APPLIES

The ship complies with the relevant provisions of the Code, and this Certificate shall, in accordance with paragraph 1.4.6.4 of the Code, be accepted as valid until.............................

Annual survey:

Signed: …………………………………
(Signature of duly authorized official)

Place: …………………………………

Date *(dd/mm/yyyy)*: …………………

(Seal or stamp of the Authority, as appropriate)

* Delete as appropriate.

ENDORSEMENT TO EXTEND THE VALIDITY OF THE CERTIFICATE UNTIL REACHING THE PORT OF SURVEY OR FOR A PERIOD OF GRACE WHERE PARAGRAPH 1.4.6.5 OR 1.4.6.6 APPLIES

This Certificate shall, in accordance with paragraph 1.4.6.5/1.4.6.6* of the Code, be accepted as valid until ……………………….

Signed: …………………………………
(Signature of duly authorized official)

Place: …………………………………

Date *(dd/mm/yyyy)*: …………………

(Seal or stamp of the Authority, as appropriate)

ENDORSEMENT FOR ADVANCEMENT OF ANNIVERSARY DATE WHERE PARAGRAPH 1.4.6.8 APPLIES

In accordance with paragraph 1.4.6.8 of the Code, the new anniversary date is …………….

Signed: …………………………………
(Signature of duly authorized official)

Place: …………………………………

Date *(dd/mm/yyyy)*: …………………

(Seal or stamp of the Authority, as appropriate)

In accordance with paragraph 1.4.6.8, the new anniversary date is ……………………………

Signed: …………………………………
(Signature of duly authorized official)

Place: …………………………………

Date *(dd/mm/yyyy)*: …………………

(Seal or stamp of the Authority, as appropriate)

* Delete as appropriate.

**ATTACHMENT 1
TO THE INTERNATIONAL CERTIFICATE OF FITNESS FOR
THE CARRIAGE OF LIQUEFIED GASES IN BULK**

Continued list of products to those specified in paragraph 4 of the certificate, and their conditions of carriage.

Products	**Conditions of carriage (tank numbers, etc.)**	**Minimum temperature**

Date: ……………………. (as for Certificate)

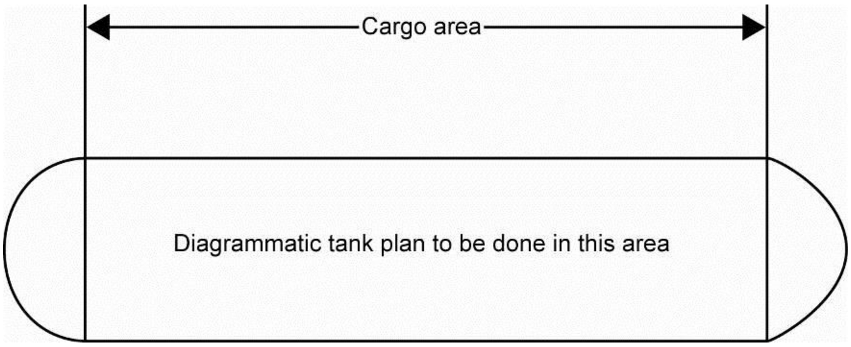
…………………………………………….. (Signature of official issuing the Certificate and/or seal of issuing authority)

ATTACHMENT 2
TO THE INTERNATIONAL CERTIFICATE OF FITNESS FOR
THE CARRIAGE OF LIQUEFIED GASES IN BULK

TANK PLAN (specimen)

Name of ship:

Distinctive number or letters:



Date: ……………………… (dd/mm/yyyy) (as for Certificate)

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

APPENDIX 3

EXAMPLE OF AN ADDENDUM TO THE INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF LIQUEFIED GASES IN BULK

Addendum to Certificate No.:	Issued at: dd/mm/yyyy

Issued in pursuance of the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, as amended, under the authority of the Government of:

…………………………………….………..

Name of ship	**Distinctive number or letters**	**IMO number**	**Port of registry**	**Cargo capacity (m^3)**	**Ship type**

THIS IS TO CERTIFY:

That the ship meets the requirements for the carriage in bulk of the following product(s), provided that all relevant operational provisions of the Code are observed:

Product	**Conditions of carriage (tank numbers, etc.)**	**Minimum temperature**	**MARVS**

The transportation of this product is permitted between the following countries:

The issuance of this Addendum is based on document: ………………………………………..

The Tripartite Agreement for this product is valid until: (dd/mm/yyyy)……..………………….

This Addendum will remain in force until: (dd/mm/yyyy)…………………………………………

Place and date of issue: (dd/mm/yyyy)…………………………………..…………………….

Signed: ………………..………………….
(signature of authorized official)

APPENDIX 4

NON-METALLIC MATERIALS

1 General

1.1 The guidance given in this appendix is in addition to the requirements of 4.19, where applicable to non-metallic materials.

1.2 The manufacture, testing, inspection and documentation of non-metallic materials should in general comply with recognized standards, and with the specific requirements of this Code, as applicable.

1.3 When selecting a non-metallic material, the designer should ensure that it has properties appropriate to the analysis and specification of the system requirements. A material can be selected to fulfil one or more requirements.

1.4 A wide range of non-metallic materials may be considered. Therefore, the section below on material selection criteria cannot cover every eventuality and should be considered as guidance.

2 Material selection criteria

2.1 Non-metallic materials may be selected for use in various parts of liquefied gas carrier cargo systems based on consideration of the following basic properties:

.1 insulation – the ability to limit heat flow;

.2 load bearing – the ability to contribute to the strength of the containment system;

.3 tightness – the ability to provide liquid and vapour tight barriers;

.4 joining – the ability to be joined (for example by bonding, welding or fastening).

2.2 Additional considerations may apply depending on the specific system design.

3 Properties of materials

3.1 Flexibility of insulating material is the ability of an insulating material to be bent or shaped easily without damage or breakage.

3.2 Loose fill material is a homogeneous solid generally in the form of fine particles, such as a powder or beads, normally used to fill the voids in an inaccessible space to provide an effective insulation.

3.3 Nanomaterial is a material with properties derived from its specific microscopic structure.

3.4 Cellular material is a material type containing cells that are either open, closed or both and which are dispersed throughout its mass.

3.5 Adhesive material is a product that joins or bonds two adjacent surfaces together by an adhesive process.

3.6 Other materials are materials that are not characterized in this section of the Code and should be identified and listed. The relevant tests used to evaluate the suitability of material for use in the cargo system should be identified and documented.

4 Material selection and testing requirements

4.1 *Material specification*

4.1.1 When the initial selection of a material has been made, tests should be conducted to validate the suitability of this material for the use intended.

4.1.2 The material used should clearly be identified and the relevant tests should be fully documented.

4.1.3 Materials should be selected according to their intended use. They should:

.1 be compatible with all the products that may be carried;

.2 not be contaminated by any cargo nor react with it;

.3 not have any characteristics or properties affected by the cargo; and

.4 be capable to withstand thermal shocks within the operating temperature range.

4.2 *Material testing*

The tests required for a particular material depend on the design analysis, specification and intended duty. The list of tests below is for illustration. Any additional tests required, for example in respect of sliding, damping and galvanic insulation, should be identified clearly and documented. Materials selected according to 4.1 of this appendix should be tested further according to the following table:

Function	Insulation	Load bearing structural	Tightness	Joining
Mechanical tests		X		X
Tightness tests			X	
Thermal tests	X			

Thermal shock testing should submit the material and/or assembly to the most extreme thermal gradient it will experience when in service.

4.2.1 Inherent properties of materials

4.2.1.1 Tests should be carried out to ensure that the inherent properties of the material selected will not have any negative impact in respect of the use intended.

4.2.1.2 For all selected materials, the following properties should be evaluated:

.1 density; example standard ISO 845; and

.2 linear coefficient of thermal expansion (LCTE); example standard ISO 11359 across the widest specified operating temperature range. However, for loose fill material the volumetric coefficient of thermal expansion (VCTE) should be evaluated, as this is more relevant.

4.2.1.3 Irrespective of its inherent properties and intended duty, all materials selected should be tested for the design service temperature range down to 5°C below the minimum design temperature, but not lower than -196°C.

4.2.1.4 Each property evaluation test should be performed in accordance with recognized standards. Where there are no such standards, the test procedure proposed should be fully detailed and submitted to the Administration for acceptance. Sampling should be sufficient to ensure a true representation of the properties of the material selected.

4.2.2 Mechanical tests

4.2.2.1 The mechanical tests should be performed in accordance with the following table.

Mechanical tests	Load bearing structural
Tensile	ISO 527 ISO 1421 ISO 3346 ISO 1926
Shearing	ISO 4587 ISO 3347 ISO 1922 ISO 6237
Compressive	ISO 604 ISO 844 ISO 3132
Bending	ISO 3133 ISO 14679
Creep	ISO 7850

4.2.2.2 If the chosen function for a material relies on particular properties such as tensile, compressive and shear strength, yield stress, modulus or elongation, these properties should be tested to a recognized standard. If the properties required are assessed by numerical simulation according to a high order behaviour law, the testing should be performed to the satisfaction of the Administration.

4.2.2.3 Creep may be caused by sustained loads, for example cargo pressure or structural loads. Creep testing should be conducted based on the loads expected to be encountered during the design life of the containment system.

4.2.3 Tightness tests

4.2.3.1 The tightness requirement for the material should relate to its operational functionality.

4.2.3.2 Tightness tests should be conducted to give a measurement of the material's permeability in the configuration corresponding to the application envisaged (e.g. thickness and stress conditions) using the fluid to be retained (e.g. cargo, water vapour or trace gas).

4.2.3.3 The tightness tests should be based on the tests indicated as examples in the following table.

Tightness tests	**Tightness**
Porosity/Permeability	ISO 15106 ISO 2528 ISO 2782

4.2.4 Thermal conductivity tests

4.2.4.1 Thermal conductivity tests should be representative of the lifecycle of the insulation material so its properties over the design life of the cargo system can be assessed. If these properties are likely to deteriorate over time, the material should be aged as best possible in an environment corresponding to its lifecycle, for example operating temperature, light, vapour and installation (e.g. packaging, bags, boxes, etc.).

4.2.4.2 Requirements for the absolute value and acceptable range of thermal conductivity and heat capacity should be chosen taking into account the effect on the operational efficiency of the cargo containment system. Particular attention should also be paid to the sizing of the associated cargo handling system and components such as safety relief valves plus vapour return and handling equipment.

4.2.4.3 Thermal tests should be based on the tests indicated as examples in the following table or their equivalents:

Thermal tests	Insulating
Thermal conductivity	ISO 8301 ISO 8302
Heat capacity	x

4.2.5 Physical tests

4.2.5.1 In addition to the requirements of 4.19.2.3 and 4.19.3.2, the following table provides guidance and information on some of the additional physical tests that may be considered.

Physical tests	**Flexible insulating**	**Loose fill**	**Nano-material**	**Cellular**	**Adhesive**
Particle size		x			
Closed cells content				ISO 4590	
Absorption/Desorption	ISO 12571	x	x	ISO 2896	
Viscosity					ISO 2555 ISO 2431
Open time					ISO 10364
Thixotropic properties					x
Hardness					ISO 868

4.2.5.2 Requirements for loose fill material segregation should be chosen considering its potential adverse effect on the material properties (density, thermal conductivity) when subjected to environmental variations such as thermal cycling and vibration.

4.2.5.3 Requirements for a material with closed cell structures should be based on its eventual impact on gas flow and buffering capacity during transient thermal phases.

4.2.5.4 Similarly, adsorption and absorption requirements should take into account the potential adverse effect an uncontrolled buffering of liquid or gas may have on the system.

5 Quality assurance and quality control (QA/QC)

5.1 ***General***

5.1.1 Once a material has been selected, after testing as outlined in section 4 of this appendix, a detailed quality assurance/quality control (QA/QC) programme should be applied to ensure the continued conformity of the material during installation and service. This programme should consider the material starting from the manufacturer's quality manual (QM) and then follow it throughout the construction of the cargo system.

5.1.2 The QA/QC programme should include the procedure for fabrication, storage, handling and preventive actions to guard against exposure of a material to harmful effects. These may include, for example, the effect of sunlight on some insulation materials or the contamination of material surfaces by contact with personal products such as hand creams. The sampling methods and the frequency of testing in the QA/QC programme should be specified to ensure the continued conformity of the material selected throughout its production and installation.

5.1.3 Where powder or granulated insulation is produced, arrangements should be made to prevent compacting of the material due to vibrations.

5.2 *QA/QC during component manufacture*

The QA/QC programme in respect of component manufacture should include, as a minimum but not limited to, the following items.

5.2.1 Component identification

5.2.1.1 For each material, the manufacturer should implement a marking system to clearly identify the production batch. The marking system should not interfere, in any way, with the properties of the product.

5.2.1.2 The marking system should ensure complete traceability of the component and should include:

.1 date of production and potential expiry date;

.2 manufacturer's references;

.3 reference specification;

.4 reference order; and

.5 when necessary, any potential environmental parameters to be maintained during transportation and storage.

5.2.2 Production sampling and audit method

5.2.2.1 Regular sampling is required during production to ensure the quality level and continued conformity of a selected material.

5.2.2.2 The frequency, the method and the tests to be performed should be defined in QA/QC programme; for example, these tests will usually cover, inter alia, raw materials, process parameters and component checks.

5.2.2.3 Process parameters and results of the production QC tests should be in strict accordance with those detailed in the QM for the material selected.

5.2.2.4 The objective of the audit method as described in the QM is to control the repeatability of the process and the efficacy of the QA/QC programme.

5.2.2.5 During auditing, auditors should be provided with free access to all production and QC areas. Audit results should be in accordance with the values and tolerances as stated in the relevant QM.

6 Bonding and joining process requirement and testing

6.1 *Bonding procedure qualification*

6.1.1 The bonding procedure specification and qualification test should be defined in accordance with recognized standards.

6.1.2 The bonding procedures should be fully documented before work commences to ensure the properties of the bond are acceptable.

6.1.3 The following parameters should be considered when developing a bonding procedure specification:

.1 surface preparation;

.2 materials storage and handling prior to installation;

.3 covering-time;

.4 open-time;

.5 mixing ratio, deposited quantity;

.6 environmental parameters (temperature, humidity); and

.7 curing pressure, temperature and time.

6.1.4 Additional requirements may be included as necessary to ensure acceptable results.

6.1.5 The bonding procedures specification should be validated by an appropriate procedure qualification testing programme.

6.2 *Personnel qualifications*

6.2.1 Personnel involved in bonding processes should be trained and qualified to recognized standards.

6.2.2 Regular tests should be made to ensure the continued performance of people carrying out bonding operations to ensure a consistent quality of bonding.

7 Production bonding tests and controls

7.1 *Destructive testing*

During production, representative samples should be taken and tested to check that they correspond to the required level of strength as required for the design.

7.2 *Non-destructive testing*

7.2.1 During production, tests which are not detrimental to bond integrity should be performed using an appropriate technique such as:

.1 visual examination;

.2 internal defects detection (for example acoustic, ultrasonic or shear test); and

.3 local tightness testing.

7.2.2 If the bonds have to provide tightness as part of their design function, a global tightness test of the cargo containment system should be completed after the end of the erection in accordance with the designer's and QA/QC programme.

7.2.3 The QA/QC standards should include acceptance standards for the tightness of the bonded components when built and during the lifecycle of the containment system.

APPENDIX 5

STANDARD FOR THE USE OF LIMIT STATE METHODOLOGIES IN THE DESIGN OF CARGO CONTAINMENT SYSTEMS OF NOVEL CONFIGURATION

1 General

1.1 The purpose of this standard is to provide procedures and relevant design parameters of limit state design of cargo containment systems of a novel configuration in accordance with section 4.27 of this Code.

1.2 Limit state design is a systematic approach where each structural element is evaluated with respect to possible failure modes related to the design conditions identified in section 4.3.4 of this Code. A limit state can be defined as a condition beyond which the structure, or part of a structure, no longer satisfies the requirements.

1.3 The limit states are divided into the three following categories:

.1 Ultimate Limit States (ULS), which correspond to the maximum load-carrying capacity or, in some cases, to the maximum applicable strain, deformation or instability in structure resulting from buckling and plastic collapse; under intact (undamaged) conditions;

.2 Fatigue Limit States (FLS), which correspond to degradation due to the effect of cyclic loading; and

.3 Accident Limit States (ALS), which concern the ability of the structure to resist accident situations.

1.4 Part A through part D of chapter 4 of this Code shall be complied with as applicable depending on the cargo containment system concept.

2 Design format

2.1 The design format in this standard is based on a Load and Resistance Factor Design format. The fundamental principle of the Load and Resistance Factor Design format is to verify that design load effects, L_d , do not exceed design resistances, R_d , for any of the considered failure modes in any scenario:

$$L_d \leq R_d$$

A design load F_{dk} is obtained by multiplying the characteristic load by a load factor relevant for the given load category:

$$F_{dk} = \gamma_f \cdot F_k$$

where:

γ_f is load factor; and

F_k is the characteristic load as specified in part B and part C of chapter 4 of this Code.

A design load effect L_d (e.g. stresses, strains, displacements and vibrations) is the most unfavourable combined load effect derived from the design loads, and may be expressed by:

$$L_d = q\left(F_{d1}, F_{d2}, ..., F_{dN}\right)$$

where q denotes the functional relationship between load and load effect determined by structural analyses.

The design resistance R_d is determined as follows:

$$R_d = \frac{R_k}{\gamma_R \cdot \gamma_C}$$

where:

R_k is the characteristic resistance. In case of materials covered by chapter 6 of this Code, it may be, but not limited to, specified minimum yield stress, specified minimum tensile strength, plastic resistance of cross sections, and ultimate buckling strength;

γ_R is the resistance factor, defined as $\gamma_R = \gamma_m \cdot \gamma_s$;

γ_m is the partial resistance factor to take account of the probabilistic distribution of the material properties (material factor);

γ_s is the partial resistance factor to take account of the uncertainties on the capacity of the structure, such as the quality of the construction, method considered for determination of the capacity including accuracy of analysis; and

γ_C is the consequence class factor, which accounts for the potential results of failure with regard to release of cargo and possible human injury.

2.2 Cargo containment design shall take into account potential failure consequences. Consequence classes are defined in table 1, to specify the consequences of failure when the mode of failure is related to the Ultimate Limit State, the Fatigue Limit State, or the Accident Limit State.

Table 1: Consequence classes

Consequence class	Definition
Low	Failure implies minor release of the cargo.
Medium	Failure implies release of the cargo and potential for human injury.
High	Failure implies significant release of the cargo and high potential for human injury/fatality.

3 Required analyses

3.1 Three dimensional finite element analyses shall be carried out as an integrated model of the tank and the ship hull, including supports and keying system as applicable. All the failure modes shall be identified to avoid unexpected failures. Hydrodynamic analyses shall be carried out to determine the particular ship accelerations and motions in irregular waves, and the response of the ship and its cargo containment systems to these forces and motions.

3.2 Buckling strength analyses of cargo tanks subject to external pressure and other loads causing compressive stresses shall be carried out in accordance with recognized standards. The method shall adequately account for the difference in theoretical and actual buckling stress as a result of plate out of flatness, plate edge misalignment, straightness, ovality and deviation from true circular form over a specified arc or chord length, as relevant.

3.3 Fatigue and crack propagation analysis shall be carried out in accordance with paragraph 5.1 of this standard.

4 Ultimate Limit States

4.1 Structural resistance may be established by testing or by complete analysis taking account of both elastic and plastic material properties. Safety margins for ultimate strength shall be introduced by partial factors of safety taking account of the contribution of stochastic nature of loads and resistance (dynamic loads, pressure loads, gravity loads, material strength, and buckling capacities).

4.2 Appropriate combinations of permanent loads, functional loads and environmental loads including sloshing loads shall be considered in the analysis. At least two load combinations with partial load factors as given in table 2 shall be used for the assessment of the ultimate limit states.

Table 2: Partial load factors

Load combination	Permanent loads	Functional loads	Environmental loads
'*a*'	1.1	1.1	0.7
'*b*'	1.0	1.0	1.3

The load factors for permanent and functional loads in load combination '*a*' are relevant for the normally well-controlled and/or specified loads applicable to cargo containment systems such as vapour pressure, cargo weight, system self-weight, etc. Higher load factors may be relevant for permanent and functional loads where the inherent variability and/or uncertainties in the prediction models are higher.

4.3 For sloshing loads, depending on the reliability of the estimation method, a larger load factor may be required by the Administration or recognized organization acting on its behalf.

4.4 In cases where structural failure of the cargo containment system are considered to imply high potential for human injury and significant release of cargo, the consequence class factor shall be taken as $\gamma_C = 1.2$. This value may be reduced if it is justified through risk analysis and subject to the approval by the Administration or recognized organization acting on its behalf. The risk analysis shall take account of factors including, but not limited to, provision of full or partial secondary barrier to protect hull structure from the leakage and less hazards associated with intended cargo. Conversely, higher values may be fixed by the Administration or recognized organization acting on its behalf, for example, for ships carrying more hazardous or higher pressure cargo. The consequence class factor shall in any case not be less than 1.0.

4.5 The load factors and the resistance factors used shall be such that the level of safety is equivalent to that of the cargo containment systems as described in sections 4.21 to 4.26 of this Code. This may be carried out by calibrating the factors against known successful designs.

4.6 The material factor γ_m shall in general reflect the statistical distribution of the mechanical properties of the material, and needs to be interpreted in combination with the specified characteristic mechanical properties. For the materials defined in chapter 6 of this Code, the material factor γ_m may be taken as:

1.1 when the characteristic mechanical properties specified by the recognized organization typically represents the lower 2.5% quantile in the statistical distribution of the mechanical properties; or

1.0 when the characteristic mechanical properties specified by the recognized organization represents a sufficiently small quantile such that the probability of lower mechanical properties than specified is extremely low and can be neglected.

4.7 The partial resistance factors γ_{si} shall in general be established based on the uncertainties in the capacity of the structure considering construction tolerances, quality of construction, the accuracy of the analysis method applied, etc.

4.7.1 For design against excessive plastic deformation using the limit state criteria given in paragraph 4.8 of this standard, the partial resistance factors γ_{si} shall be taken as follows:

$$\gamma_{s1} = 0.76 \cdot \frac{B}{\kappa_1}$$

$$\gamma_{s2} = 0.76 \cdot \frac{D}{\kappa_2}$$

$$\kappa_1 = Min\left(\frac{R_m}{R_e} \cdot \frac{B}{A};1.0\right)$$

$$\kappa_2 = Min\left(\frac{R_m}{R_e} \cdot \frac{D}{C};1.0\right)$$

Factors A, B, C and D are defined in section 4.22.3.1 of this Code. R_m and R_e are defined in section 4.18.1.3 of this Code.

The partial resistance factors given above are the results of calibration to conventional type B independent tanks.

4.8 ***Design against excessive plastic deformation***

4.8.1 Stress acceptance criteria given below refer to elastic stress analyses.

4.8.2 Parts of cargo containment systems where loads are primarily carried by membrane response in the structure shall satisfy the following limit state criteria:

$$\sigma_m \leq f$$

$$\sigma_L \leq 1.5f$$

$$\sigma_b \leq 1.5F$$

$$\sigma_L + \sigma_b \leq 1.5F$$

$$\sigma_m + \sigma_b \leq 1.5F$$

$$\sigma_m + \sigma_b + \sigma_g \le 3.0F$$
$$\sigma_L + \sigma_b + \sigma_g \le 3.0F$$

where:

σ_m = equivalent primary general membrane stress
σ_L = equivalent primary local membrane stress
σ_b = equivalent primary bending stress
σ_g = equivalent secondary stress

$$f = \frac{R_e}{\gamma_{s1} \cdot \gamma_m \cdot \gamma_C}$$
$$F = \frac{R_e}{\gamma_{s2} \cdot \gamma_m \cdot \gamma_C}$$

With regard to the stresses σ_m, σ_L, σ_b and σ_g, see also the definition of stress categories in section 4.28.3 of this Code.

Guidance Note:

The stress summation described above shall be carried out by summing up each stress component ($\sigma_x, \sigma_y, \tau_{xy}$), and subsequently the equivalent stress shall be calculated based on the resulting stress components as shown in the example below.

$$\sigma_L + \sigma_b = \sqrt{(\sigma_{Lx} + \sigma_{bx})^2 - (\sigma_{Lx} + \sigma_{bx})(\sigma_{Ly} + \sigma_{by}) + (\sigma_{Ly} + \sigma_{by})^2 + 3(\tau_{Lxy} + \tau_{bxy})^2}$$

4.8.3 Parts of cargo containment systems where loads are primarily carried by bending of girders, stiffeners and plates, shall satisfy the following limit state criteria:

$\sigma_{ms} + \sigma_{bp} \le 1.25F$ (See notes 1, 2)
$\sigma_{ms} + \sigma_{bp} + \sigma_{bs} \le 1.25F$ (See note 2)
$\sigma_{ms} + \sigma_{bp} + \sigma_{bs} + \sigma_{bt} + \sigma_g \le 3.0F$

Note 1: The sum of equivalent section membrane stress and equivalent membrane stress in primary structure ($\sigma_{ms} + \sigma_{bp}$) will normally be directly available from three-dimensional finite element analyses.

Note 2: The coefficient, 1.25, may be modified by the Administration or recognized organization acting on its behalf considering the design concept, configuration of the structure, and the methodology used for calculation of stresses.

where:

σ_{ms} = equivalent section membrane stress in primary structure

σ_{bp} = equivalent membrane stress in primary structure and stress in secondary and tertiary structure caused by bending of primary structure

σ_{bs} = section bending stress in secondary structure and stress in tertiary structure caused by bending of secondary structure

σ_{bt} = section bending stress in tertiary structure

σ_{g} = equivalent secondary stress

$$f = \frac{R_e}{\gamma_{s1} \cdot \gamma_m \cdot \gamma_C}$$

$$F = \frac{R_e}{\gamma_{s2} \cdot \gamma_m \cdot \gamma_C}$$

The stresses σ_{ms}, σ_{bp}, σ_{bs}, and σ_{bt} are defined in 4.8.4. For a definition of σ_g, see section 4.28.3 of this Code.

> **Guidance Note:**
>
> The stress summation described above shall be carried out by summing up each stress component ($\sigma_x, \sigma_y, \tau_{xy}$), and subsequently the equivalent stress shall be calculated based on the resulting stress components.

Skin plates shall be designed in accordance with the requirements of the Administration or recognized organization acting on its behalf. When membrane stress is significant, the effect of the membrane stress on the plate bending capacity shall be appropriately considered in addition.

4.8.4 Section stress categories

Normal stress is the component of stress normal to the plane of reference.

Equivalent section membrane stress is the component of the normal stress that is uniformly distributed and equal to the average value of the stress across the cross section of the structure under consideration. If this is a simple shell section, the section membrane stress is identical to the membrane stress defined in paragraph 4.8.2 of this standard.

Section bending stress is the component of the normal stress that is linearly distributed over a structural section exposed to bending action, as illustrated in figure 1.

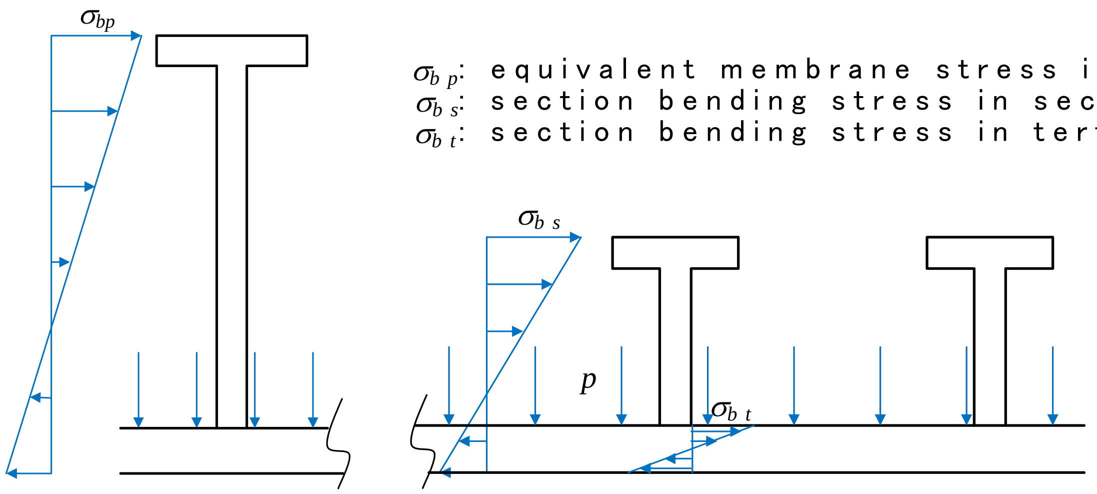


Figure 1: Definition of the three categories of section stress
(Stresses σ_{bp} and σ_{bs} are normal to the cross section shown.)

4.9 The same factors γ_C, γ_m, γ_{si} shall be used for design against buckling unless otherwise stated in the applied recognized buckling standard. In any case the overall level of safety shall not be less than given by these factors.

5 Fatigue Limit States

5.1 Fatigue design condition as described in section 4.18.2 of this Code shall be complied with as applicable depending on the cargo containment system concept. Fatigue analysis is required for the cargo containment system designed under section 4.27 of this Code and this standard.

5.2 The load factors for FLS shall be taken as 1.0 for all load categories.

5.3 Consequence class factor γ_C and resistance factor γ_R shall be taken as 1.0.

5.4 Fatigue damage shall be calculated as described in sections 4.18.2.2 to 4.18.2.5 of this Code. The calculated cumulative fatigue damage ratio for the cargo containment systems shall be less than or equal to the values given in table 3.

Table 3: Maximum allowable cumulative fatigue damage ratio

	Consequence class		
C_W	Low	Medium	High
	1.0	0.5	0.5*

Note*: Lower value shall be used in accordance with sections 4.18.2.7 to 4.18.2.9 of this Code, depending on the detectability of defect or crack, etc.

5.5 Lower values may be fixed by the Administration or recognized organization acting on its behalf, for example for tank structures where effective detection of defect or crack cannot be assured, and for ships carrying more hazardous cargo.

5.6 Crack propagation analyses are required in accordance with sections 4.18.2.6 to 4.18.2.9 of this Code. The analysis shall be carried out in accordance with methods laid down in a standard recognized by the Administration or recognized organization acting on its behalf.

6 Accident Limit States

6.1 Accident design condition as described in section 4.18.3 of this Code shall be complied with as applicable, depending on the cargo containment system concept.

6.2 Load and resistance factors may be relaxed compared to the ultimate limit state considering that damages and deformations can be accepted as long as this does not escalate the accident scenario.

6.3 The load factors for ALS shall be taken as 1.0 for permanent loads, functional loads and environmental loads.

6.4 Loads mentioned in section 4.13.9 (Static heel loads) and section 4.15 (Collision and Loads due to flooding on ship) of this Code need not be combined with each other or with environmental loads, as defined in section 4.14 of this Code.

6.5 Resistance factor γ_R shall in general be taken as 1.0.

6.6 Consequence class factors γ_C shall in general be taken as defined in paragraph 4.4 of this standard, but may be relaxed considering the nature of the accident scenario.

6.7 The characteristic resistance R_k shall in general be taken as for the ultimate limit state, but may be relaxed considering the nature of the accident scenario.

6.8 Additional relevant accident scenarios shall be determined based on a risk analysis.

7 Testing

7.1 Cargo containment systems designed according to this standard shall be tested to the same extent as described in section 4.20.3 of this Code, as applicable depending on the cargo containment system concept."

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ANNEX 7

RESOLUTION MSC.371(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS AND OIL TANKERS, 2011 (2011 ESP CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution A.1049(27), by which the Assembly adopted the International Code on the Enhanced Programme of Inspections During Surveys of Bulk Carriers and Oil Tankers (hereinafter referred to as "the 2011 ESP Code"), which became effective upon entry into force of the associated amendments to regulation XI-1/2 of the International Convention for the Safety of Life at Sea (SOLAS), 1974 (hereinafter referred to as "the Convention"), adopted by resolution MSC.325(90),

HAVING CONSIDERED, at its ninety-third session, amendments to the 2011 ESP Code proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the 2011 ESP Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the amendments shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES Contracting Governments to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS AND OIL TANKERS, 2011 (2011 ESP CODE)

ANNEX A
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS

Part A
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING SINGLE-SIDE SKIN CONSTRUCTION

1 – General

1 At the end of paragraph 1.2.6, the following sentence is added:

"For transversely framed bulk carriers, a transverse section includes adjacent frames and their end connections in way of transverse sections."

2 In paragraph 1.2.7, the words "structural areas" are inserted between the words "identifiable critical" and "and/or suspect areas".

3 At the end of paragraph 1.2.9, the words "a gauged (or measured) thickness between t_{net} + 0.5 mm and t_{net}" are replaced by the words "a measured thickness between t_{ren} + 0.5mm and t_{ren}. Renewal thickness (t_{ren}) is the minimum allowable thickness, in mm, below which renewal of structural members is to be carried out."

4 In paragraph 1.2.11 the figure "10" is inserted between the words "hard scale at" and "per cent".

5 At the beginning of paragraph 1.2.17, the words "*Special consideration or*" are inserted before the words "*specially considered*".

6 The following new paragraph 1.2.18 is added after existing paragraph 1.2.17:

"1.2.18 *Pitting corrosion* is defined as scattered corrosion spots/areas with local material reductions which are greater than the general corrosion in the surrounding area. Pitting intensity is defined in figure 2 of annex 15."

7 The following new paragraph 1.3.3 is added after existing paragraph 1.3.2:

"1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weather tight integrity after evaluation of the surrounding structure and impose an associated condition of classification or recommendation with a specific time limit in order to complete the permanent repair and retain classification."

2 – Renewal survey

8 At the end of paragraph 2.1.1, the following sentence is added:

"When the renewal survey is commenced prior to the fourth annual survey, the entire survey is to be completed within 15 months if such work is to be credited to the renewal survey."

9 The following new paragraph 2.3.3 is added after existing paragraph 2.3.2:

"2.3.3 For bulk carriers built under IACS Common Structural Rules (CSR), the identified substantial corrosion areas may be:

.1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition; or alternatively

.2 required to be measured at annual intervals."

3 – Annual survey

10 At the end of paragraphs 3.4.1.3, 3.4.2.3 and 3.5, the following sentence is added:

"For bulk carriers built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition;"

4 – Intermediate survey

11 In the second sentence of paragraph 4.2.1.3, the words "hard protective" are inserted between the words "breakdown of" and "coating".

12 At the end of paragraph 4.2.3.3, the following new sentence and explanatory note are added:

"For bulk carriers built under IACS Common Structural Rules, the identified substantial corrosion areas may be:

.1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition; or alternatively

.2 required to be measured at annual intervals."

Explanatory note:

For existing bulk carriers, where owners may elect to coat or recoat cargo holds as noted above, consideration may be given to the extent of the close-up surveys and thickness measurement. Prior to the coating of cargo holds of existing ships, scantlings should be ascertained in the presence of a surveyor."

13 The following new paragraph 4.2.3.4 is added after existing paragraph 4.2.3.3:

"4.2.3.4 Where hard protective coating is fitted in cargo holds and is found in GOOD condition, the extent of the close-up surveys and thickness measurements may be specially considered."

6 – Documentation on board

14 At the end of paragraph 6.3.2, the following text is added:

"(for CSR bulk carriers, these plans are to include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition is also to be clearly indicated on the plans. The midship section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for hold transverse section in all cargo holds)."

Part B
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF BULK CARRIERS HAVING DOUBLE-SIDE SKIN CONSTRUCTION

1 – General

15 At the end of paragraph 1.2.6, the following sentence is added:

"For transversely framed bulk carriers, a transverse section includes adjacent frames and their end connections in way of transverse sections."

16 At the end of paragraph 1.2.9, the words "a gauged (or measured) thickness between t_{net} + 0.5 mm and t_{net}" are replaced by the words "a measured thickness between t_{ren} + 0.5mm and t_{ren}. Renewal thickness (t_{ren}) is the minimum allowable thickness, in mm, below which renewal of structural members is to be carried out".

17 At the beginning of paragraph 1.2.17, the words "*Special consideration or*" are inserted before the words "*specially considered*".

18 The following new paragraph 1.3.3 is added after the existing paragraph 1.3.2:

"1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weather tight integrity after evaluation of the surrounding structure and impose an associated condition of classification or recommendation with a specific time limit in order to complete the permanent repair and retain classification."

2 – Renewal survey

19 At the end of paragraph 2.1.1, the following sentence is added:

"When the renewal survey is commenced prior to the fourth annual survey, the entire survey is to be completed within 15 months if such work is to be credited to the renewal survey."

20 The following new paragraph 2.3.3 is added after the existing paragraph 2.3.2:

"2.3.3 For bulk carriers built under IACS Common Structural Rules (CSR), the identified substantial corrosion areas may be:

.1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition; or alternatively

.2 required to be measured at annual intervals."

3 – Annual survey

21 At the end of paragraphs 3.4.1.2, 3.4.2.2 and 3.5, the following sentence is added:

"For bulk carriers built under the IACS Common Structural Rules, the annual thickness gauging may be omitted where a protective coating has been applied in accordance with the coating manufacturer's requirements and is maintained in good condition;"

4 – Intermediate survey

22 At the end of paragraph 4.2.3.3, the following new sentence and explanatory note are added:

"For bulk carriers built under IACS Common Structural Rules, the identified substantial corrosion areas may be:

.1 protected by coating applied in accordance with the coating manufacturer's requirements and examined at annual intervals to confirm the coating in way is still in good condition; or alternatively

.2 required to be measured at annual intervals.~~"~~

Explanatory note:

For existing bulk carriers, where owners may elect to coat or recoat cargo holds as noted above, consideration may be given to the extent of the close-up surveys and thickness measurement. Prior to the coating of cargo holds of existing ships, scantlings should be ascertained in the presence of a surveyor."

6 – Documentation on board

23 At the end of paragraph 6.3.1.2, the following text is added:

"(for CSR bulk carriers, these plans are to include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition is also to be clearly indicated on the plans. The midship section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for hold transverse section in all cargo holds)."

ANNEX B

CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS

Part A
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF DOUBLE-HULL OIL TANKERS

1 – General

24 At the end of paragraph 1.2.6, the following sentence is added:

> "For transversely framed oil tankers, a transverse section includes adjacent frames and their end connections in way of transverse sections."

25 In paragraph 1.2.7, the words "structural areas" are inserted between the words "identifiable critical" and "and/or suspect areas".

26 At the end of paragraph 1.2.9, the words "a gauged (or measured) thickness between t_{net} + 0.5 mm and t_{net}" are replaced by the words "a measured thickness between t_{ren} + 0.5mm and t_{ren}. Renewal thickness (t_{ren}) is the minimum allowable thickness, in mm, below which renewal of structural members is to be carried out".

27 In the first sentence of paragraph 1.2.10, the word "protective" is inserted between the words "full hard" and "coating".

28 At the beginning of paragraph 1.2.16, the words "*Special consideration or*" are inserted before the words "*specially considered*".

29 At the end of paragraph 1.3.1.5, the words "(combination carriers)" are added.

30 The following new paragraph 1.3.3 is added after existing paragraph 1.3.2:

> "1.3.3 Where the damage found on the structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weathertight integrity after evaluation of the surrounding structure and impose an associated condition of classification or recommendation with a specific time limit in order to complete the permanent repair and retain classification."

2 – Renewal survey

31 At the end of paragraph 2.1.1, the following sentence is added:

> "When the renewal survey is commenced prior to the fourth annual survey, the entire survey is to be completed within 15 months if such work is to be credited to the renewal survey."

32 The following new paragraph 2.1.6 is added after existing paragraph 2.1.5:

"2.1.6 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces should not be acceptable."

33 At the end of paragraph 2.5.2, the words "should have thickness measurements taken." are replaced by the words "are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken".

3 – Annual survey

34 At the end of paragraph 3.5.2, the following sentence is added:

"For oil tankers built under IACS Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out."

4 – Intermediate survey

35 The following new paragraph 4.1.4 is added after existing paragraph 4.1.3 and the existing paragraph 4.1.4 is renumbered as 4.1.5:

"4.1.4 For oil tankers built under IACS Common Structural Rules, the identified substantial corrosion areas are required to be examined and additional thickness measurements are to be carried out."

6 – Documentation on board

36 At the end of paragraph 6.3.2, the following text is added:

"(for CSR ships these plans are to include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition is also to be clearly indicated on the plans. The midship section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for the tank transverse section in all cargo tanks)."

Part B
CODE ON THE ENHANCED PROGRAMME OF INSPECTIONS DURING SURVEYS OF OIL TANKERS OTHER THAN DOUBLE-HULL OIL TANKERS

1 – General

37 At the end of paragraph 1.2.5, the following sentence is added:

"For transversely framed oil tankers, a transverse section includes adjacent frames and their end connections in way of transverse sections."

38 In paragraph 1.2.6, the words "structural areas" are inserted between the words "identifiable critical" and "and/or suspect areas".

39 At the beginning of paragraph 1.2.15, the words *"Special consideration or*" are added before the words "*specially considered"*.

40 The following new paragraph 1.3.3 is added after the existing paragraph 1.3.2:

"1.3.3 Where the damage found on structure mentioned in paragraph 1.3.1 above is isolated and of a localized nature which does not affect the ship's structural integrity (as for example a minor hole in a cross-deck strip), consideration may be given by the surveyor to allow an appropriate temporary repair to restore watertight or weather tight integrity after evaluation of the surrounding structure and impose an associated condition of classification or recommendation with a specific time limit in order to complete the permanent repair and retain classification."

2 – Renewal survey

41 At the end of paragraph 2.1.1, the following sentence is added:

"When the renewal survey is commenced prior to the fourth annual survey, the entire survey is to be completed within 15 months if such work is to be credited to the renewal survey."

42 The following new paragraph 2.1.7 is added after existing paragraph 2.1.6:

"2.1.7 Concurrent crediting to both intermediate survey and renewal survey for surveys and thickness measurements of spaces should not be acceptable."

43 At the end of paragraph 2.5.2, the words "should have thickness measurements taken" are replaced by the words "are to be examined. Areas of substantial corrosion identified at previous surveys are to have thickness measurements taken."

6 – Documentation on board

44 At the end of paragraph 6.3.1, the following text is added:

"(for CSR ships these plans are to include for each structural element both the as-built and renewal thickness. Any thickness for voluntary addition is also to be clearly indicated on the plans. The midship section plan to be supplied on board the ship is to include the minimum allowable hull girder sectional properties for hold transverse section in all cargo tanks)."

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ANNEX 8

RESOLUTION MSC.372(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG) CODE

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution MSC.122(75) by which it adopted the International Maritime Dangerous Goods Code (hereinafter referred to as "the IMDG Code"), which has become mandatory under chapter VII of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended (hereinafter referred to as "the Convention"),

NOTING ALSO article VIII(b) and regulation VII/1.1 of the Convention concerning amendment procedure for amending the IMDG Code,

HAVING CONSIDERED, at its ninety-third session, amendments to the IMDG Code, proposed and circulated in accordance with article VIII(b)(i) of the Convention,

1 ADOPTS, in accordance with article VIII(b)(iv) of the Convention, amendments to the IMDG Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article VIII(b)(vi)(2)(bb) of the Convention, that the said amendments shall be deemed to have been accepted on 1 July 2015, unless prior to that date, more than one third of the Contracting Governments to the Convention or Contracting Governments the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3 INVITES Contracting Governments to the Convention to note that, in accordance with article VIII(b)(vii)(2) of the Convention, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 AGREES that Contracting Governments to the Convention may apply the aforementioned amendments in whole or in part on a voluntary basis as from 1 January 2015;

5 REQUESTS the Secretary-General, in conformity with article VIII(b)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Contracting Governments to the Convention;

6 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Contracting Governments to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL MARITIME DANGEROUS GOODS (IMDG) CODE

Table of Contents

Insert a new section as "7.1.5 Stowage Codes".

Insert a new section as "7.1.6 Handling Codes".

Insert a new section as "7.2.8 Segregation Codes".

PART 1
GENERAL PROVISIONS, DEFINITIONS AND TRAINING

Chapter 1.1– General provisions

1.1.1 Application and implementation of the Code

1.1.1.9 Insert a new paragraph 1.1.1.9 to read as follows:

"1.1.1.9 ***Lamps containing dangerous goods***

The following lamps are not subject to this Code provided that they do not contain radioactive material and do not contain mercury in quantities above those specified in special provision 366 of chapter 3.3:

.1 Lamps that are collected directly from individuals and households when transported to a collection or recycling facility;

.2 Lamps each containing not more than 1 g of dangerous goods and packaged so that there is not more than 30 g of dangerous goods per package, provided that:

(i) the lamps are manufactured according to a certified quality management system;

Note: The application of ISO 9001:2008 may be considered acceptable for this purpose.

and

(ii) each lamp is either individually packed in inner packagings, separated by dividers, or surrounded with cushioning material to protect the lamps and packed into strong outer packagings meeting the general provisions of 4.1.1.1 and capable of passing a 1.2 m drop test.

.3 Used, damaged or defective lamps each containing not more than 1 g of dangerous goods with not more than 30 g of dangerous goods per package when transported from a collection or recycling facility. The lamps shall be packed in strong outer packagings sufficient for preventing release of the contents under normal conditions of transport meeting the general provisions of 4.1.1.1 and that are capable of passing a drop test of not less than 1.2 m.

Note: lamps containing gases of class 2.2. are addressed in 2.2.2.6.4 and lamps containing radioactive material are addressed in 2.7.2.2.2.2.

.4 Lamps containing only gases of class 2.2 (according to 2.2.2.2) provided they are packaged so that the projectile effects of any rupture of the bulb will be contained within the package."

1.1.2 Conventions

1.1.2.3 International Convention for Safe Containers, 1972, as amended

1.1.2.3 Insert a new 1.1.2.3 with the following:

"1.1.2.3 International Convention for Safe Containers, 1972, as amended

1.1.2.3.1 Regulations 1 and 2 of Annex I to the International Convention for Safe Containers (CSC), 1972, as amended, deal with safety approval plates and maintenance and examination of containers, and are reproduced in full.

Annex I
Regulations for the testing, inspection, approval and maintenance of containers

Chapter I
Regulations common to all systems of approval

Regulation 1
Safety Approval Plate

1 (a) A Safety Approval Plate conforming to the specifications set out in the appendix to this annex shall be permanently affixed to every approved container at a readily visible place, adjacent to any other approval plate issued for official purposes, where it would not be easily damaged.

(b) On each container, all maximum operating gross mass markings shall be consistent with the maximum operating gross mass information on the Safety Approval Plate.

(c) The owner of the container shall remove the Safety Approval Plate on the container if:

(i) the container has been modified in a manner which would void the original approval and the information found on the Safety Approval Plate, or

(ii) the container is removed from service and is not being maintained in accordance with the Convention, or

(iii) the approval has been withdrawn by the Administration.

2 (a) The plate shall contain the following information in at least the English or French language:

CSC SAFETY APPROVAL

Country of approval and approval reference

Date (month and year) of manufacture

Manufacturer's identification number of the container or, in the case of existing containers for which that number is unknown, the number allotted by the Administration

Maximum operating gross mass (kg and lb)

Allowable stacking load for 1.8*g* (kg and lb)

Transverse racking test force (newtons).

(b) A blank space should be reserved on the plate for insertion of end-wall and/or side-wall strength values (factors) in accordance with paragraph 3 of this regulation and annex II, tests 6 and 7. A blank space should also be reserved on the plate for the first and subsequent maintenance examination dates (month and year) when used.

3 Where the Administration considers that a new container satisfies the requirements of the present Convention in respect of safety and if, for such container, the end-wall and/or side-wall strength values (factors) are designed to be greater or less than those stipulated in annex II, such values shall be indicated on the Safety Approval Plate. Where the stacking or racking values are less than 192,000 kg or 150 kN, respectively, the container shall be considered as having limited stacking or racking capacity and shall be conspicuously marked, as required under the relevant standards*, at or before their next scheduled examination or before any other date approved by the Administration, provided this is not later than 1 July 2015.

4 The presence of the Safety Approval Plate does not remove the necessity of displaying such labels or other information as may be required by other regulations which may be in force.

5 A container, the construction of which was completed prior to 1 July 2014, may retain the Safety Approval Plate as permitted by the Convention prior to that date as long as no structural modifications occur to that container.

Regulation 2
Maintenance and examination

1 The owner of the container shall be responsible for maintaining it in safe condition.

2 (a) The owner of an approved container shall examine the container or have it examined in accordance with the procedure either prescribed or approved by the Contracting Party concerned, at intervals appropriate to operating conditions.

(b) The date (month and year) before which a new container shall undergo its first examination shall be marked on the Safety Approval Plate.

(c) The date (month and year) before which the container shall be re-examined shall be clearly marked on the container on or as close as practicable to the Safety Approval Plate and in a manner acceptable to that Contracting Party which prescribed or approved the particular examination procedure involved.

(d) The interval from the date of manufacture to the date of the first examination shall not exceed five years. Subsequent examination of new containers and re-examination of existing containers shall be at intervals of not more than 30 months. All examinations shall determine whether the container has any defects which could place any person in danger.

3 (a) As an alternative to paragraph 2, the Contracting Party concerned may approve a continuous examination programme if satisfied, on evidence submitted by the owner, that such a programme provides a standard of safety not inferior to the one set out in paragraph 2 above.

(b) To indicate that the container is operated under an approved continuous examination programme, a mark showing the letters ACEP and the identification of the Contracting Party which has granted approval of the programme shall be displayed on the container on or as close as practicable to the Safety Approval Plate.

(c) All examinations performed under such a programme shall determine whether a container has any defects which could place any person in danger. They shall be performed in connection with a major repair, refurbishment, or on-hire/off-hire interchange and in no case less than once every 30 months.

4 As a minimum approved programmes should be reviewed once every 10 years to ensure their continued viability. In order to ensure uniformity by all involved in the inspection of containers and their ongoing operational safety, the Contracting Party concerned shall ensure the following elements are covered in each prescribed periodic or approved continuous examination programme:

(a) methods, scope and criteria to be used during examinations;

(b) frequency of examinations;

(c) qualifications of personnel to carry out examinations;

(d) system of keeping records and documents that will capture:

(i) the owner's unique serial number of the container;

(ii) the date on which the examination was carried out;

(iii) identification of the competent person who carried out the examination;

(iv) the name and location of the organization where the examination was carried out;

(v) the results of the examination; and

(vi) in the case of a periodic examination scheme (PES), the next examination date (NED);

(e) a system for recording and updating the identification numbers of all containers covered by the appropriate examination scheme;

(f) methods and systems for maintenance criteria that addresses the design characteristics of the specific containers;

(g) provisions for maintaining leased containers if different than those used for owned containers; and

(h) conditions and procedures for adding containers into an already approved programme.

5 The Contracting Party shall carry out periodic audits of approved programmes to ensure compliance with the provisions approved by the Contracting Party. The Contracting Party shall withdraw any approval when the conditions of approval are no longer complied with.

6 For the purpose of this regulation, the Contracting Party concerned is the Contracting Party of the territory in which the owner is domiciled or has his head office. However, in the event that the owner is domiciled or has his head office in a country the government of which has not yet made arrangements for prescribing or approving an examination scheme and until such time as the arrangements have been made, the owner may use the procedure prescribed or approved by the Administration of a Contracting Party which is prepared to act as the Contracting Party concerned. The owner shall comply with the conditions for the use of such procedures set by the Administration in question.

7 Administrations shall make information on approved continuous examination programmes publicly available."

Chapter 1.2 – Definitions, units of measurement and abbreviations

1.2.1 Definitions

In all the definitions, whenever the term "for the transport of Class 7 material" is used, replace it with "for the transport of radioactive material".

Amend the following definitions as indicated:

Design: in the first sentence, insert "fissile material excepted under 2.7.3.5.6 after "the description of".

Exclusive use: replace "and unloading is carried" with "and unloading and shipment are carried" and insert ", where so required by the provisions of this Code;" after "consignee".

Freight container: replace the last two sentences with the following:

"In addition: Small freight container means a freight container that has an internal volume of not more than 3 m^3. Large freight container means a freight container that has an internal volume of more than 3 m^3.".

GHS: in the reference for GHS, replace Rev.4 with "Rev.5"

Manual of Test and Criteria, add at the end "and Amend.2".

Multiple-element gas container: replace "and bundles" with "or bundles".

Radiation level: amend the end of the definition to read: "millisieverts per hour or microsieverts per hour;".

Add the following new definitions in alphabetical order:

"*Large salvage packaging* means a special packaging which:

.1 is designed for mechanical handling; and

.2 exceeds 400 kg net mass or 450 litres capacity but has a volume of not more than 3 m³;

into which damaged, defective or leaking dangerous goods packages, or dangerous goods that have spilled or leaked are placed for purposes of transport for recovery or disposal;"

"*Management system*, for the transport of radioactive material, means a set of interrelated or interacting elements (system) for establishing policies and objectives and enabling the objectives to be achieved in an efficient and effective manner;"

"*Neutron radiation detector* is a device that detects neutron radiation. In such a device, a gas may be contained in a hermetically sealed electron tube transducer that converts neutron radiation into a measureable electric signal;"

"*Radiation detection system* is an apparatus that contains radiation detectors as components;".

Chapter 1.5 – General provisions concerning class 7

Replace the title with "GENERAL PROVISIONS CONCERNING RADIOACTIVE MATERIAL".

1.5.1 Scope and application

1.5.1.1 Amend the second and third sentences to read:

"These provisions are based on the IAEA "Regulations for the Safe Transport of Radioactive material, 2012 Edition, IAEA Safety Standards Series No. SSR–6, IAEA, Vienna (2012)". Explanatory material can be found in "Advisory material for the IAEA Regulations for the Safe Transport of Radioactive Material, IAEA Safety Standards Series No. TS-G-1.1 (Rev.2), IAEA, Vienna (2012)"."

1.5.1.2 In the second sentence of the last paragraph replace "imposing requirements" with "imposing conditions".

1.5.1.4 Amend the first sentence to read: "The provisions of this code do not apply to any of the following:" and insert a new subparagraph .4 to read as follows:

".4 Radioactive material in or on a person who is to be transported for medical treatment because the person has been subject to accidental or deliberate intake of radioactive material or to contamination;".

and renumber current subparagraphs .4 to .6 accordingly:

and replace new subparagraph .6 (former .5) with the following:

".6 Natural material and ores containing naturally occurring radionuclides (which may have been processed), provided the activity concentration of the material does not exceed 10 times the values specified in table 2.7.2.2.1, or calculated in accordance with 2.7.2.2.2.1 and 2.7.2.2.3 to 2.7.2.2.6. For natural materials and ores containing naturally occurring radionuclides that are not in secular equilibrium the calculation of the activity concentration shall be performed in accordance with 2.7.2.2.4;".

1.5.1.5 Specific provisions for the transport of excepted packages

1.5.1.5.1 Amend to read as follows:

"1.5.1.5.1 Excepted packages which may contain radioactive material in limited quantities, instruments, manufactured articles or empty packagings as specified in 2.7.2.4.1 shall be subject only to the following provisions of parts 5 to 7:

.1 The applicable provisions specified in 5.1.1.2, 5.1.2, 5.1.3.2, 5.1.5.2.2, 5.1.5.4, 5.2.1.7, 7.1.4.5.9, 7.1.4.5.10, 7.1.4.5.12, 7.8.4.1 to 7.8.4.6 and 7.8.9.1; and

.2 The requirements for excepted packages specified in 6.4.4,

except when the radioactive material possesses other hazardous properties and has to be classified in a class other than Class 7 in accordance with special provision 290 or 369 of Chapter 3.3, where the provisions listed in .1 and .2 above apply only as relevant and in addition to those relating to the main class or division."

1.5.1.5.2 Insert a new second sentence to read as follows:

"If the excepted package contains fissile material, one of the fissile exceptions provided by 2.7.2.3.5 shall apply and the requirements of 5.1.5.5 shall be met."

1.5.2 Radiation protection programme

1.5.2.4 Amend the end of the introductory sentence to read "that the effective dose either:" and insert "or" at the end of subparagraph .1.

1.5.3 Quality assurance

1.5.3 Amend to read as follows:

"1.5.3 Management system

1.5.3.1 A management system based on international, national or other standards acceptable to the competent authority shall be established and implemented for all activities within the scope of this Code, as identified in 1.5.1.3, to ensure compliance with the relevant provisions of this Code. Certification that the design specification has been fully implemented shall be available to the competent authority. The manufacturer, consignor or user shall be prepared:

.1 to provide facilities for inspection during manufacture and use; and

.2 to demonstrate compliance with this Code to the competent authority.

Where competent authority approval is required, such approval shall take into account and be contingent upon the adequacy of the management system."

1.5.4 Special arrangement

1.5.4.2 Replace "Class 7" with "radioactive material", twice.

1.5.6 Non-compliance

1.5.6.1 In the introductory sentence, delete "a" before "non-compliance". In .1 amend the introductory sentence to read:

> "The consignor, consignee, carrier and any organization involved during transport who may be affected, as appropriate, shall be informed of the non-compliance:"

and in .2(iv), delete "and" at the end of the sentence.

PART 2
CLASSIFICATION

Chapter 2.0 – Introduction

2.0.1 Classes, divisions, packing groups

2.0.1.2 Marine pollutants

2.0.1.2.1 Amend paragraph 2.0.1.2.1 to read as follows:

> "Many of the substances assigned to classes 1 to 6.2, 8 and 9 are deemed as being *marine pollutants* (see chapter 2.10)."

2.0.1.3 Add the following new paragraph at the end:

> "Articles are not assigned to packing groups. For packing purposes any requirement for a specific packaging performance level is set out in the applicable packing instruction.".

2.0.3 Classification of substances, mixtures and solutions with multiple hazards (precedence of hazard characteristics)

2.0.3.5 Amend the last sentence to read as follows:

> "For radioactive material in excepted packages, except for UN 3507, URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, special provision 290 of Chapter 3.3 applies."

Chapter 2.1 – Class 1 – Explosives

2.1.0 Introductory notes (these notes are not mandatory)

Amend Note 2 in 2.1.3.5.5 to read as follows:

> "**Note 2**: "Flash composition" in this table refers to pyrotechnic substances in powder form or as pyrotechnic units as presented in the firework that are used to produce an aural effect or used as a bursting charge, or propellant charge unless the time taken for the pressure rise is demonstrated to be more than 6 ms for 0.5 g of pyrotechnic substance in the HSL Flash Composition Test in appendix 7 of the Manual of Tests and Criteria."

Chapter 2. 2 – Class 2 – Gases

2.2.1 Definitions and general provisions

2.2.1.2 Add a new indent .5 to read as follows:

"*.5* *Adsorbed gas* – a gas which when packaged for transport is adsorbed onto a solid porous material resulting in an internal receptacle pressure of less than 101.3 kPa at 20°C and less than 300 kPa at 50°C."

2.2.2 Class subdivisions

2.2.2.6 Delete subparagraph ".4" and add the following note at the end:

"Note: This exemption does not apply to lamps. For lamps see 1.1.1.9".

Chapter 2.3 – Class 3 – Flammable liquids

2.3.2 Assignment of packing group

2.3.2.2 and 2.3.2.3 Replace existing paragraphs with the following:

"2.3.2.2 Viscous flammable liquids such as paints, enamels, lacquers, varnishes, adhesives and polishes having a flash point of less than 23°C may be placed in packing group III in conformity with the procedures prescribed in the Manual of Tests and Criteria, Part III, sub-section 32.3, provided that:

.1 The viscosity expressed as the flowtime in seconds and flash point are in accordance with the following table:

*Flow-time **t** in seconds*	*Jet diameter (mm)*	*Flash point, closed-cup (°C)*
$20 < t \leq 60$	4	above 17
$60 < t \leq 100$	4	above 10
$20 < t \leq 32$	6	above 5
$32 < t \leq 44$	6	above -1
$44 < t \leq 100$	6	above -5
$100 < t$	6	no limit

.2 Less than 3% of the clear solvent layer separates in the solvent separation test;

.3 The mixture or any separated solvent does not meet the criteria for Class 6.1 or Class 8;

.4 The substances are packed in receptacles of not more than 30-litre capacity.

2.3.2.3 *Reserved.*"

2.3.2.5 At the beginning, replace "Viscous substances" with "Viscous liquids". Amend the fourth indent to read as follows:

"- are packed in receptacles of not more than 30-litre capacity".

Chapter 2.4 – Class 4 – Flammable solids; substances liable to spontaneous combustion; substances which, in contact with water, emit flammable gases

2.4.4 Class 4.3 – Substances which, in contact with water, emit flammable gases

2.4.4.1 Definitions and properties

2.4.4.1.2 Replace "light bulbs" with "lamps"

Chapter 2.5 – Class 5 – Oxidizing substances and organic peroxides

2.5.1 Definitions and general provisions

2.5.2 Class 5.1 – Oxidizing substances

2.5.2.2 Oxidizing solids

2.5.2.2.1 *Classification of solid substances of class 5.1*

2.5.2.2.1.1 Amend to read as follows:

"2.5.2.2.1.1 Tests are performed to measure the potential for the solid substance to increase the burning rate or burning intensity of a combustible substance when the two are thoroughly mixed. The procedure is given in the Manual of Tests and Criteria, part III, sub-section 34.4.1 (test O.1) or alternatively, in sub-section 34.4.3 (test O.3). Tests are conducted on the substance to be evaluated mixed with dry fibrous cellulose in mixing ratios of 1:1 and 4:1, by mass, of sample to cellulose. The burning characteristics of the mixtures are compared:

.1 in the test O.1, with the standard 3:7 mixture, by mass, of potassium bromate to cellulose. If the burning time is equal to or less than this standard mixture, the burning times shall be compared with those from the packing group I or II reference standards, 3:2 and 2:3 ratios, by mass, of potassium bromate to cellulose respectively; or

.2 in the test O.3, with the standard 1:2 mixture, by mass, of calcium peroxide to cellulose. If the burning rate is equal to or greater than this standard mixture, the burning rates shall be compared with those from the packing group I or II reference standards 3:1 and 1:1 ratios, by mass, of calcium peroxide to cellulose, respectively."

2.5.2.2.1.2 Amend to read as follows:

"2.5.2.2.1.2 The classification test results are assessed on the basis of:

.1 the comparison of the mean burning time (for the test O.1) or burning rate (for the test O.3) with those of the reference mixtures; and

.2 whether the mixture of substance and cellulose ignites and burns."

2.5.2.2.1.3 Amend to read as follows:

"2.5.2.2.1.3 A solid substance is classified in Class 5.1 if the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits:

.1 in the test O.1, a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose ; or

.2 in the test O.3, a mean burning rate equal to or greater than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose."

2.5.2.2.2 *Assignment of packing groups*

2.5.2.2.2 Amend to read as follows:

"2.5.2.2.2 Assignment of packing groups

Solid oxidizing substances are assigned to a packing group according to one of the test procedures in the Manual of Tests and Criteria, Part III, sub-section 34.4.1 (test O.1) or sub-section 34.4.3 (test O.3), in accordance with the following criteria:

.1 Test O.1:

(i) Packing group I: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time less than the mean burning time of a 3:2 mixture, by mass, of potassium bromate and cellulose;

(ii) Packing group II: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 2:3 mixture (by mass) of potassium bromate and cellulose, and the criteria for packing group I are not met;

(iii) Packing group III: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning time equal to or less than the mean burning time of a 3:7 mixture (by mass) of potassium bromate and cellulose , and the criteria for packing groups I and II are not met;

(iv) Not Class 5.1: any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits mean burning times greater than that of a 3:7 mixture (by mass) of potassium bromate and cellulose.

.2 Test O.3:

(i) Packing group I: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate greater than the mean burning rate of a 3:1 mixture (by mass) of calcium peroxide and cellulose;

(ii) Packing group II: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate equal to or greater than the mean burning rate of a 1:1 mixture (by mass) of calcium peroxide and cellulose, and the criteria for packing group I are not met;

(iii) Packing group III: any substance which, in the 4:1 or 1:1 sample-to-cellulose ratio (by mass) tested, exhibits a mean burning rate equal to or greater than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose, and the criteria for packing groups I and II are not met;

(iv) Not Class 5.1: any substance which, in both the 4:1 and 1:1 sample-to-cellulose ratio (by mass) tested, does not ignite and burn, or exhibits a mean burning rate less than the mean burning rate of a 1:2 mixture (by mass) of calcium peroxide and cellulose."

2.5.2.3.1.1 At the end of the second sentence after "3.4.4.2" insert "(test O.2)".

Chapter 2.6 – Class 6 – Toxic and infectious substances

2.6.3 Class 6.2 – Infectious substances

2.6.3.2.3 *Exemptions*

2.6.3.2.3.5 Amend to read as follows:

"2.6.3.2.3.5 Dried blood spots, collected by applying a drop of blood onto absorbent material, are not subject to the provisions of this Code."

and insert two new paragraphs 2.6.3.2.3.6 and 2.6.3.2.3.7 to read as follows and renumber existing paragraphs accordingly:

"2.6.3.2.3.6 Faecal occult blood screening samples are not subject to the provisions of this Code.

2.6.3.2.3.7 Blood or blood components which have been collected for the purposes of transfusion or for the preparation of blood products to be used for transfusion or transplantation and any tissues or organs intended for use in transplantation as well as samples drawn in connection with such purposes are not subject to the provisions of this Code."

Chapter 2.7 – Class 7 – Radioactive material

2.7.1.3 Definitions of specific terms

2.7.1.3 Amend the definitions hereafter as follows:

Fissile nuclides: Amend the end of the introductory text before subparagraph .1 to read: "of fissile material are the following:".

In subparagraph .1, delete "and".

Insert the following new subparagraphs and text:

".3 material with fissile nuclides less than a total of 0.25 g;

.4 any combination of .1, .2 and/or .3.

These exclusions are only valid if there is no other material with fissile nuclides in the package or in the consignment if shipped unpackaged."

Surface contaminated object: at the end, replace "surfaces" with "surface".

2.7.2 Classification

2.7.2.1 General provisions

2.7.2.1.1 Amend to read as follows:

"Radioactive material shall be assigned to one of the UN numbers specified in table 2.7.2.1.1, in accordance with 2.7.2.4.2 to 2.7.2.5, taking into account the material characteristics determined in 2.7.2.3."

Table 2.7.2.1.1 – Assignment of UN Numbers

2.7.2.1.1 Amend the table as follows:

Table 2.7.2.1.1 Add a new heading row to read:
"

UN Nos.	Proper shipping name and description

For UN Nos. 2912, 3321, 3322, 2913, 2915, 3332, 2916, 2917, 3323, 2919 and 2978, insert a reference to a new note "b" after "fissile-excepted".

Under the headings "Excepted packages" and "Uranium hexafluoride" add the following new entry:

"UN 3507 URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE less than 0.1 kg per package, non-fissile or fissile-excepted[b,c]"

Add the following table notes "a", "b" and "c" after the table:

"[a] *The proper shipping name is found in the column "proper shipping name and description" and is restricted to that part shown in capital letters. In the* *cases of UN Nos. 2909, 2911, 2913 and 3326, where alternative proper shipping names are separated by the word "or" only the relevant proper shipping name shall be used.*

[b] *The term "fissile-excepted" refers only to material excepted under 2.7.2.3.5.*

[c] *For UN No. 3507, see also special provision 369 in Chapter 3.3.*"

2.7.2.2 Determination of activity level

2.7.2.2.1 In .2, insert "limits" after "concentration".

Table 2.7.2.2.1 In the heading of column 4 insert "limit" after "concentration". In (a) after the table, in the introductory sentence, replace "from daughter radionuclides" with "from their progeny".

2.7.2.2.2 Amend the text before the table to read as follows:

"2.7.2.2.2 For individual radionuclides:

.1 Which are not listed in table 2.7.2.2.1 the determination of the basic radionuclide values referred to in 2.7.2.2.1 shall require multilateral approval. For these radionuclides, activity concentration limits for exempt material and activity limits for exempt consignments shall be calculated in accordance with the principles established in the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No.115, IAEA, Vienna (1996). It is permissible to use an A_2 value calculated using a dose coefficient for the appropriate lung absorption type as recommended by the International Commission on Radiological Protection, if the chemical forms of each radionuclide under both normal and accident conditions of transport are taken into consideration. Alternatively, the radionuclide values in table 2.7.2.2.2 may be used without obtaining competent authority approval;

.2 In instruments or articles in which the radioactive material is enclosed or is included as a component part of the instrument or other manufactured article and which meet 2.7.2.4.1.3.3, alternative basic radionuclide values to those in table 2.7.2.2.1 for the activity limit for an exempt consignment are permitted and shall require multilateral approval. Such alternative activity limits for an exempt consignment shall be calculated in accordance with the principles set out in the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No.115, IAEA, Vienna (1996)."

Table 2.7.2.2.2 – Basic radionuclide values for unknown radionuclides or mixtures

In the table for 2.7.2.2.2, in the heading of the fourth column, insert "limit" after "concentration".

2.7.2.2.4 In the introductory sentence delete "the determination of" and in the legend for X(i) and X_m replace "concentration" with "concentration limit".

2.7.2.3 Determination of other material characteristics

2.7.2.3.1 *Low specific activity (LSA) material*

2.7.2.3.1.2.1 In subparagraph "(i)", delete "which are intended to be processed for the use of these radionuclides".

2.7.2.3.1.2.1 Subparagraph "(iii)" to read:

> "(iii) radioactive material for which the A2 value is unlimited. Fissile material may be included only if excepted under 2.7.2.3.5;".

2.7.2.3.1.2.1 (iv), replace ", excluding fissile material not excepted under 2.7.2.3.5" with ". Fissile material may be included only if excepted under 2.7.2.3.5".

2.7.2.3.1.2.2 In subparagraph "(i)", delete "or".

2.7.2.3.1.2.3 In the introductory sentence, replace "meeting the requirements" with "that meet the requirements".

2.7.2.3.1.2.3 In subparagraph "(i)" replace "bitumen, ceramic, etc." with "bitumen and ceramic".

2.7.2.3.2 *Surface contaminated object (SCO)*

2.7.2.3.2.1 At the end of subparagraph "(ii)", replace "and" with "or".

2.7.2.3.2.2 At the end of subparagraph "(ii)", replace "and" with "or".

2.7.2.3.3 *Special form radioactive material*

2.7.2.3.3.6.1 Amend subparagraph ".1" to read as follows:

> ".1 The tests prescribed in 2.7.2.3.3.5.1 and 2.7.2.3.3.5.2 provided that the specimens are alternatively subjected to the impact test prescribed in ISO 2919:2012: "Radiation Protection – Sealed Radioactive Sources – General requirements and classification":
>
> (i) The Class 4 impact test if the mass of the special form radioactive material is less than 200 g; and
>
> (ii) The Class 5 impact test if the mass of the special form radioactive material is equal to or more than 200 g but less than 500 g;".

2.7.2.3.3.6.2 Replace the reference "ISO 2919:1999" with "ISO 2919:2012".

2.7.2.3.3.8.2 Replace "which are acceptable" with "provided that they are acceptable".

2.7.2.3 Determination of other material characteristics

2.7.2.3.5 Fissile material

2.7.2.3.5 Amend the first paragraph to read as follows:

"Fissile material and packages containing fissile material shall be classified under the relevant entry as "FISSILE" in accordance with table 2.7.2.1.1 unless excepted by one of the provisions of subparagraphs .1 to .6 below and transported subject to the requirements of 5.1.5.5. All provisions apply only to material in packages that meets the requirements of 6.4.7.2 unless unpackaged material is specifically allowed in the provision."

2.7.2.3.5 *Fissile material*

2.7.2.3.5 Delete current subparagraphs ".1" and ".4". Current ".2" and ".3" are renumbered as ".1" and ".2" respectively.

2.7.2.3.5 Insert the following new subparagraphs ".3 to .6":

".3 Uranium with a maximum uranium enrichment of 5% by mass uranium-235 provided:

(i) there is no more than 3.5 g of uranium-235 per package;

(ii) the total plutonium and uranium-233 content does not exceed 1% of the mass of uranium-235 per package;

(iii) Transport of the package is subject to the consignment limit provided in 5.1.5.5.3;

.4 Fissile nuclides with a total mass not greater than 2.0 g per package provided the package is transported subject to the consignment limit provided in 5.1.5.5.4;

.5 Fissile nuclides with a total mass not greater than 45 g either packaged or unpackaged subject to limits provided in 5.1.5.5.5; and

.6 A fissile material that meets the requirements of 5.1.5.5.2, 2.7.2.3.6 and 5.1.5.2.1.".

Table 2.7.2.3.5 – Consignment mass limits for exceptions from the requirements for packages containing fissile material

Table 2.7.2.3.5 is deleted.

Insert a new paragraph 2.7.2.3.6 to read as follows:

"2.7.2.3.6 A fissile material excepted from classification as "FISSILE" under 2.7.2.3.5.6 shall be subcritical without the need for accumulation control under the following conditions:

.1 The conditions of 6.4.11.1 (a);

.2 The conditions consistent with the assessment provisions stated in 6.4.11.12 (b) and 6.4.11.13 (b) for packages; and

.3 The conditions specified in 6.4.11.11 (a), if transported by air."

2.7.2.4 Classification of packages or unpacked material

2.7.2.4.1 *Classification as excepted package*

2.7.2.4.1.1 Amend to read as follows:

"2.7.2.4.1.1 A package may be classified as an excepted package if it meets one of the following conditions:

.1 It is an empty package having contained radioactive material;

.2 It contains instruments or articles not exceeding the activity limits specified in columns (2) and (3) of table 2.7.2.4.1.2;

.3 It contains articles manufactured of natural uranium, depleted uranium or natural thorium;

.4 It contains radioactive material not exceeding the activity limits specified in column (4) of table 2.7.2.4.1.2; or

.5 It contains less than 0.1 kg of uranium hexafluoride not exceeding the activity limits specified in column (4) of table 2.7.2.4.1.2."

2.7.2.4.1.3 In the introductory sentence replace "only if" with "provided that".

2.7.2.4.1.3.2 Replace "except" with "on its external surface except for the following:"

and amend (ii) to read as follows:

"(ii) consumer products that either have received regulatory approval in accordance with 1.5.1.4.5 or do not individually exceed the activity limit for an exempt consignment in table 2.7.2.2.1 (column 5), provided such products are transported in a package that bears the marking "RADIOACTIVE" on its internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; "

and insert a new subparagraph "(iii)" under ".2" to read as follows:

"(iii) Other instruments or articles too small to bear the marking "RADIOACTIVE", provided that they are transported in a package that bears the marking "RADIOACTIVE" on its internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; and".

2.7.2.4.1.4.2 Amend to read as follows:

".2 The package bears the marking "RADIOACTIVE" on either:

(i) An internal surface in such a manner that a warning of the presence of radioactive material is visible on opening the package; or

(ii) The outside of the package, where it is impractical to mark an internal surface."

Insert a new 2.7.2.4.1.5 to read as follows:

"2.7.2.4.1.5 Uranium hexafluoride not exceeding the limits specified in column 4 of table 2.7.2.4.1.2 may be classified under UN 3507 URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, less than 0.1 kg per package, non-fissile or fissile-excepted provided that:

.1 The mass of uranium hexafluoride in the package is less than 0.1 kg; and

.2 The conditions of 2.7.2.4.5.1 and 2.7.2.4.1.4.1 and 2.7.2.4.1.4.2 are met."

and existing paragraph 2.7.2.4.1.5 is renumbered as "2.7.2.4.1.7".

2.7.2.4.1.6 Replace "only if" with "provided that".

2.7.2.4.1.7 (former 2.7.2.4.1.5) In the introductory sentence replace "only if" with "provided that".

2.7.2.4.4 *Classification as Type A package*

2.7.2.4.4 In the sentence before the subparagraphs, replace "activities greater than the following:" with "activities greater than either of the following:".

2.7.2.4.4.1 Delete "or".

2.7.2.4.4 In the legend for the formula where "C(j)", delete "and".

2.7.2.4.5 *Classification of uranium hexafluoride*

2.7.2.4.5 Amend to read as follows:

"2.7.2.4.5 *Classification of uranium hexafluoride*

2.7.2.4.5.1 Uranium hexafluoride shall only be assigned to:

.1 UN No.2977, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE;

.2 UN No.2978, RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, non-fissile or fissile-excepted; or

.3 UN No.3507, URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE less than 0.1 kg per package, non-fissile or fissile-excepted.

2.7.2.4.5.2 The contents of a package containing uranium hexafluoride shall comply with the following requirements:

.1 For UN Nos. 2977 and 2978, the mass of uranium hexafluoride shall not be different from that allowed for the package design, and for UN 3507, the mass of uranium hexafluoride shall be less than 0.1 kg;

.2 The mass of uranium hexafluoride shall not be greater than a value that would lead to an ullage smaller than 5% at the maximum temperature of the package as specified for the plant systems where the package shall be used; and

.3 The uranium hexafluoride shall be in solid form and the internal pressure shall not be above atmospheric pressure when presented for transport."

2.7.2.4.6 *Classification as Type B(U), Type B(M) or Type C packages*

2.7.2.4.6.1 Replace "competent authority approval certificate" with "competent authority certificate of approval".

2.7.2.4.6.2 Amend to read:

"2.7.2.4.6.2 The contents of a Type B(U), Type B(M) or Type C package shall be as specified in the certificate of approval".

2.7.2.4.6.3 is deleted.

2.7.2.4.6.4 is deleted.

Chapter 2.9 – Miscellaneous dangerous substances and articles (class 9) and environmentally hazardous substances

Amend "Note 2" to read as follows:

"Although the environmentally hazardous substances (aquatic environment) criteria apply to all hazard classes, except for class 7 (see paragraphs 2.10.2.3, 2.10.2.5 and 2.10.3.2), the criteria have been included in this chapter."

2.9.2 Assignment to class 9

2.9.2.2 Under "Substances which, on inhalation as fine dust, may endanger health", replace all three entries by:

"2212 ASBESTOS, AMPHIBOLE (amosite, tremolite, actinolite, anthophyllite, crocidolite)

2590 ASBESTOS, CHRYSOTILE".

replace the existing heading "Electric double layer capacitors" with "Capacitors",

and replace the existing entry under this heading with the following two entries:

"3499 CAPACITOR, ELECTRIC DOUBLE LAYER (with an energy storage capacity greater than 0.3Wh)

3508 CAPACITOR, ASYMMETRIC (with an energy storage capacity greater than 0.3Wh)."

Under "Life-saving appliances", replace the three entries for UN No.3268 by:

"3268 SAFETY DEVICES, electrically initiated".

For "Other substances or articles presenting a danger during transport, but not meeting the definitions of another class", add the following new entry with the corresponding footnote:

"3509 PACKAGING DISCARDED, EMPTY, UNCLEANED**"

Footnote: "** This entry shall not be used for sea transport. Discarded packaging shall meet the requirements of 4.1.1.11."

2.9.4 Lithium batteries

2.9.4.1 Replace the second sentence with the following:

"Cells and batteries manufactured according to a type meeting the requirements of subsection 38.3 of the Manual of Tests and Criteria, Revision 3, Amendment 1 or any subsequent revision and amendment applicable at the date of the type testing may continue to be transported, unless otherwise provided in this Code.

Cell and battery types only meeting the requirements of the Manual of Tests and Criteria, Revision 3, are no longer valid. However, cells and batteries manufactured in conformity with such types before 1 July 2003 may continue to be transported if all other applicable requirements are fulfilled."

and amend the note to read as follows:

"**Note:** Batteries shall be of a type proved to meet the testing requirements of the *Manual of Tests and Criteria*, part III, sub-section 38.3, irrespective of whether the cells of which they are composed are of a tested type."

Chapter 2.10 – Marine Pollutants

2.10.2 General provisions

2.10.2.4 Amend to read as follows:

"2.10.2.4 Column 4 of the Dangerous Goods List also provides information on marine pollutants using the symbol **P** for single entries. The absence of the symbol P or the presence of a "-" in that column does not preclude the application of 2.10.3."

2.10.2.7 Add a new paragraph 2.10.2.7 as follows:

"*2.10.2.7 Marine pollutants packaged in single or combination packagings containing a net quantity per single or inner packaging of 5 l or less for* *liquids or having a net mass per single or inner packaging of 5 kg or less for solids are not subject to any other provisions of this Code relevant to marine pollutants provided the packagings meet the general provisions of 4.1.1.1, 4.1.1.2 and 4.1.1.4 to 4.1.1.8. In the case of marine pollutants also meeting the criteria for inclusion in another hazard class all provisions of this Code relevant to any additional hazards continue to apply*."

2.10.3 Classification

2.10.3.2 Add a new paragraph "2.10.3.2" to read as follows:

"2.10.3.2 The classification criteria of 2.9.3 are not applicable to substances or materials of class 7."

PART 3
DANGEROUS GOODS LIST, SPECIAL PROVISIONS AND EXEMPTIONS

3.1 General

3.1.2 Proper shipping names

3.1.2.9 Marine pollutants

3.1.2.9.1 Replace the existing paragraph 3.1.2.9.1 to read as follows:

"3.1.2.9.1 For the purpose of documentation, the Proper Shipping Name of generic or "not otherwise specified" (N.O.S.) entries which are classified as marine pollutants in accordance with 2.10.3, shall be supplemented with the recognized chemical name of the constituent which most predominantly contributes to the classification as marine pollutant."

3.1.4 Segregation groups

3.1.4.1 In the paragraph, replace the words "column 16" with "column 16b".

Chapter 3.2 – Dangerous Goods List

3.2.1 Structure of the dangerous goods list

3.2.1 The following sentence is added at the end of column 4: "The absence of the symbol **P** or the presence of a "-" in that column does not preclude the application of 2.10.3."

3.2.1 The text for column 16 "column 16 Stowage and segregation – this column contains the stowage and segregation provisions as prescribed in part 7." is replaced with the following:

"Column 16a Stowage and handling – this column contains the stowage and handling codes as specified in 7.1.5 and 7.1.6.

Column 16 b Segregation – this column contains the segregation codes as specified in 7.2.8."

Dangerous Goods List

Replace the existing "column 16" with column "16a Stowage and handling" and "column "16b Segregation" as follows:

REORGANIZATION OF COLUMN 16 IN THE DANGEROUS GOODS LIST OF THE IMDG CODE

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
1	2	3	4	5	(16a)	(16b)
	3.1.2	"2.0	"2.0	2.0.1.3	7.1, 7.3-7.7	7.2-7.7
0004	AMMONIUM PICRATE dry or wetted with less than 10% water, by mass	1.1D			Category 04 SW1	SG27 SG31
0005	CARTRIDGES FOR WEAPONS with bursting charge	1.1F			Category 05 SW1	
0006	CARTRIDGES FOR WEAPONS with bursting charge	1.1E			Category 04 SW1	
0007	CARTRIDGES FOR WEAPONS with bursting charge	1.2F			Category 05 SW1	
0009	AMMUNITION, INCENDIARY with or without burster, expelling charge or propelling charge	1.2G			Category 03 SW1	
0010	AMMUNITION, INCENDIARY with or without burster, expelling charge or propelling charge	1.3G			Category 03 SW1	
0012	CARTRIDGES FOR WEAPONS, INERT PROJECTILE or CARTRIDGES, SMALL ARMS	1.4S			Category 01 SW1	
0014	CARTRIDGES FOR WEAPONS, BLANK or CARTRIDGES, SMALL ARMS, BLANK	1.4S			Category 01 SW1	
0015	AMMUNITION, SMOKE with or without burster, expelling charge or propelling charge	1.2G			Category 03 SW1	
0016	AMMUNITION, SMOKE with or without burster, expelling charge or propelling charge	1.3G			Category 03 SW1	
0018	AMMUNITION, TEAR-PRODUCING with burster, expelling charge or propelling charge	1.2G			Category 03 SW1	SG2
0019	AMMUNITION, TEAR-PRODUCING with burster, expelling charge or propelling charge	1.3G			Category 03 SW1	SG3
0020	AMMUNITION, TOXIC with burster, expelling charge or propelling charge	1.2K			Category 05 SW1	
0021	AMMUNITION, TOXIC with burster, expelling charge or propelling charge	1.3K			Category 05 SW1	
0027	BLACK POWDER (GUNPOWDER) granular, or as a meal	1.1D			Category 04 SW1	
0028	BLACK POWDER (GUNPOWDER), COMPRESSED or BLACK POWDER (GUNPOWDER) IN PELLETS	1.1D			Category 04 SW1	
0029	DETONATORS, NON-ELECTRIC for blasting	1.1B			Category 05 SW1	
0030	DETONATORS, ELECTRIC for blasting	1.1B			Category 05 SW1	
0033	BOMBS with bursting charge	1.1F			Category 05 SW1	
0034	BOMBS with bursting charge	1.1D			Category 04 SW1	
0035	BOMBS with bursting charge	1.2D			Category 04 SW1	
0037	BOMBS, PHOTO-FLASH	1.1F			Category 05 SW1	
0038	BOMBS, PHOTO-FLASH	1.1D			Category 04 SW1	

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
0039	BOMBS, PHOTO-FLASH	1.2G			Category 03 SW1	
0042	BOOSTERS without detonator	1.1D			Category 04 SW1	
0043	BURSTERS explosive	1.1D			Category 04 SW1	
0044	PRIMERS, CAP TYPE	1.4S			Category 01 SW1	
0048	CHARGES, DEMOLITION	1.1D			Category 04 SW1	
0049	CARTRIDGES, FLASH	1.1G			Category 03 SW1	
0050	CARTRIDGES, FLASH	1.3G			Category 03 SW1	
0054	CARTRIDGES, SIGNAL	1.3G			Category 03 SW1	
0055	CASES, CARTRIDGE, EMPTY, WITH PRIMER	1.4S			Category 01 SW1	
0056	CHARGES, DEPTH	1.1D			Category 04 SW1	
0059	CHARGES, SHAPED without detonator	1.1D			Category 04 SW1	
0060	CHARGES, SUPPLEMENTARY, EXPLOSIVE	1.1D			Category 04 SW1	
0065	CORD, DETONATING flexible	1.1D			Category 04 SW1	
0066	CORD, IGNITER	1.4G			Category 02 SW1	
0070	CUTTERS, CABLE, EXPLOSIVE	1.4S			Category 01 SW1	
0072	CYCLOTRIMETHYLENETRINITRAMINE, (CYCLONITE), (RDX), (HEXOGEN), WETTED with not less than 15% water, by mass	1.1D			Category 04 SW1	
0073	DETONATORS FOR AMMUNITION	1.1B			Category 05 SW1	
0074	DIAZODINITROPHENOL, WETTED with not less than 40% water or mixture of alcohol and water, by mass	1.1A			Category 05 SW1	
0075	DIETHYLENEGLYCOL DINITRATE, DESENSITIZED with not less than 25% non-volatile water-insoluble phlegmatizer, by mass	1.1D			Category 04 SW1	
0076	DINITROPHENOL dry or wetted with less than 15% water, by mass	1.1D			Category 04 SW1	SG31
0077	DINITROPHENOLATES alkali metals, dry or wetted with less than 15% water, by mass	1.3C			Category 04 SW1	SG31
0078	DINITRORESORCINOL dry or wetted with less than 15% water, by mass	1.1D			Category 04 SW1	SG31
0079	HEXANITRODIPHENYLAMINE (DIPICRYLAMINE), (HEXYL)	1.1D			Category 04 SW1	
0081	EXPLOSIVE, BLASTING, TYPE A	1.1D			Category 04 SW1	SG34
0082	EXPLOSIVE, BLASTING, TYPE B	1.1D			Category 04 SW1	SG34
0083	EXPLOSIVE, BLASTING, TYPE C	1.1D			Category 04 SW1	SG28
0084	EXPLOSIVE, BLASTING, TYPE D	1.1D			Category 04 SW1	

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
0092	FLARES, SURFACE	1.3G			Category 03 SW1	
0093	FLARES, AERIAL	1.3G			Category 03 SW1	
0094	FLASH POWDER	1.1G			Category 03 SW1	
0099	FRACTURING DEVICES,EXPLOSIVE for oil wells, without detonator	1.1D			Category 04 SW1	
0101	FUSE, NON-DETONATING	1.3G			Category 03 SW1	
0102	CORD (FUSE), DETONATING metal-clad	1.2D			Category 04 SW1	
0103	FUSE, IGNITER tubular, metal-clad	1.4G			Category 02 SW1	
0104	CORD (FUSE), DETONATING, MILD EFFECT metal-clad	1.4D			Category 02 SW1	
0105	FUSE, SAFETY	1.4S			Category 01 SW1	
0106	FUZES, DETONATING	1.1B			Category 05 SW1	
0107	FUZES, DETONATING	1.2B			Category 05 SW1	
0110	GRENADES, PRACTICE hand or rifle	1.4S			Category 01 SW1	
0113	GUANYL NITROSAMINOGUANYLIDENE HYDRAZINE, WETTED with not less than 30% water, by mass	1.1A			Category 05 SW1	
0114	GUANYL NITROSAMINOGUANYLTETRAZENE (TETRAZENE), WETTED with not less than 30% water or mi	1.1A			Category 05 SW1	
0118	HEXOLITE (HEXOTOL) dry or wetted with less than 15% water, by mass	1.1D			Category 04 SW1	
0121	IGNITERS	1.1G			Category 03 SW1	
0124	JET PERFORATING GUNS, CHARGED oil well, without detonator	1.1D			Category 04 SW1	
0129	LEAD AZIDE, WETTED with not less than 20% water, or mixture of alcohol and water, by mas	1.1A			Category 05 SW1	
0130	LEAD STYPHNATE (LEAD TRINITRORESORCINATE), WETTED with not less than 20% water, or mixtu	1.1A			Category 05 SW1	
0131	LIGHTERS, FUSE	1.4S			Category 01 SW1	
0132	DEFLAGRATING METAL SALTS OF AROMATIC NITRODERIVATIVES, N.O.S.	1.3C			Category 04 SW1	SG31
0133	MANNITOL HEXANITRATE (NITROMANNITE), WETTED with not less than 40% water, or mixture of alcohol and water, by mass	1.1D			Category 04 SW1	
0135	MERCURY FULMINATE, WETTED with not less than 20% water, or mixture of alcohol and water, by mass	1.1A			Category 05 SW1	
0136	MINES with bursting charge	1.1F			Category 05 SW1	
0137	MINES with bursting charge	1.1D			Category 04 SW1	
0138	MINES with bursting charge	1.2D			Category 04 SW1	

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
0143	NITROGLYCERIN, DESENSITIZED with not less than 40% non-volatile water-insoluble phlegmatizer, by mass	1.1D			Category 04 SW1	
0144	NITROGLYCERIN SOLUTION IN ALCOHOL with more than 1% but not more than 10% nitroglycerin	1.1D			Category 04 SW1	
0146	NITROSTARCH dry or wetted, with less than 20% water, by mass	1.1D			Category 04 SW1	
0147	NITRO UREA	1.1D			Category 04 SW1	
0150	PENTAERYTHRITE TETRANITRATE (PENTAERYTHRITOL TETRANITRATE; PETN), WETTED with not less than 25% water, by mass or PENTAERYTHRITE TETRA NITRATE (PENTAERYTHRITOL TETRANITRATE; PETN), DESENSITIZED with not less than 15% phlegmatizer, by mass	1.1D			Category 04 SW1	
0151	PENTOLITE dry or wetted with less than 15% water, by mass	1.1D			Category 04 SW1	
0153	TRINITROANILINE (PICRAMIDE)	1.1D			Category 04 SW1	
0154	TRINITROPHENOL (PICRIC ACID) dry or wetted with less than 30% water, by mass	1.1D			Category 04 SW1	SG31
0155	TRINITROCHLOROBENZENE (PICRYL CHLORIDE)	1.1D			Category 04 SW1	
0159	POWDER CAKE (POWDER PASTE), WETTED with not less than 25% water, by mass	1.3C			Category 04 SW1	
0160	POWDER, SMOKELESS	1.1C			Category 04 SW1	
0161	POWDER, SMOKELESS	1.3C			Category 04 SW1	
0167	PROJECTILES with bursting charge	1.1F			Category 05 SW1	
0168	PROJECTILES with bursting charge	1.1D			Category 04 SW1	
0169	PROJECTILES with bursting charge	1.2D			Category 04 SW1	
0171	AMMUNITION, ILLUMINATING with or without burster, expelling charge or propelling charge	1.2G			Category 03 SW1	
0173	RELEASE DEVICES, EXPLOSIVE	1.4S			Category 01 SW1	
0174	RIVETS, EXPLOSIVE	1.4S			Category 01 SW1	
0180	ROCKETS with bursting charge	1.1F			Category 05 SW1	
0181	ROCKETS with bursting charge	1.1E			Category 04 SW1	
0182	ROCKETS with bursting charge	1.2E			Category 04 SW1	
0183	ROCKETS with inert head	1.3C			Category 04 SW1	
0186	ROCKET MOTORS	1.3C			Category 04 SW1	
0190	SAMPLES, EXPLOSIVE other than initiating explosive	1			Category 05 SW1	

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
0191	SIGNAL DEVICES, HAND	1.4G			Category 02 SW1	
0192	SIGNALS, RAILWAY TRACK, EXPLOSIVE	1.1G			Category 03 SW1	
0193	SIGNALS, RAILWAY TRACK, EXPLOSIVE	1.4S			Category 01 SW1	
0194	SIGNALS, DISTRESS ship	1.1G			Category 03 SW1	
0195	SIGNALS, DISTRESS ship	1.3G			Category 03 SW1	
0196	SIGNALS, SMOKE	1.1G			Category 03 SW1	
0197	SIGNALS, SMOKE	1.4G			Category 02 SW1	
0204	SOUNDING DEVICES, EXPLOSIVE	1.2F			Category 05 SW1	
0207	TETRANITROANILINE	1.1D			Category 04 SW1	
0208	TRINITROPHENYLMETHYLNITR AMINE (TETRYL)	1.1D			Category 04 SW1	
0209	TRINITROTOLUENE (TNT) dry or wetted with less than 30% water, by mass	1.1D			Category 04 SW1	
0212	TRACERS FOR AMMUNITION	1.3G			Category 03 SW1	
0213	TRINITROANISOLE	1.1D			Category 04 SW1	
0214	TRINITROBENZENE dry or wetted with less than 30% water, by mass	1.1D			Category 04 SW1	
0215	TRINITROBENZOIC ACID dry or wetted with less than 30% water, by mass	1.1D			Category 04 SW1	
0216	TRINITRO-m-CRESOL	1.1D			Category 04 SW1	SG31
0217	TRINITRONAPHTHALENE	1.1D			Category 04 SW1	
0218	TRINITROPHENETOLE	1.1D			Category 04 SW1	
0219	TRINITRORESORCINOL (STYPHNIC ACID) dry or wetted with less than 20% water, or mixture of	1.1D			Category 04 SW1	SG27
0220	UREA NITRATE dry or wetted with less than 20% water, by mass	1.1D			Category 04 SW1	
0221	WARHEADS, TORPEDO with bursting charge	1.1D			Category 04 SW1	
0222	AMMONIUM NITRATE with more than 0.2% by mass of combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance	1.1D			Category 04 SW1	SG27
0224	BARIUM AZIDE, dry or wetted with less than 50% water, by mass	1.1A			Category 05 SW1	
0225	BOOSTERS WITH DETONATOR	1.1B			Category 05 SW1	
0226	CYCLOTETRAMETHYLENETETR A NITRAMINE (HMX; OCTOGEN), WETTED with not less than 15% water, by mass	1.1D			Category 04 SW1	
0234	SODIUM DINITRO-ortho-CRESOLATE dry or wetted with less than 15% water, by mass	1.3C			Category 04 SW1	SG31

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
0235	SODIUM PICRAMATE dry or wetted with less than 20% water, by mass	1.3C			Category 04 SW1	SG31
0236	ZIRCONIUM PICRAMATE dry or wetted with less than 20% water, by mass	1.3C			Category 04 SW1	SG31
0237	CHARGES, SHAPED, FLEXIBLE, LINEAR	1.4D			Category 02 SW1	
0238	ROCKETS, LINE-THROWING	1.2G			Category 03 SW1	
0240	ROCKETS, LINE-THROWING	1.3G			Category 03 SW1	
0241	EXPLOSIVE, BLASTING, TYPE E	1.1D			Category 04 SW1	SG34
0242	CHARGES, PROPELLING, FOR CANNON	1.3C			Category 04 SW1	
0243	AMMUNITION, INCENDIARY, WHITE PHOSPHORUS with burster, expelling charge or propelling ch	1.2H			Category 05 SW1	
0244	AMMUNITION, INCENDIARY, WHITE PHOSPHORUS with burster, expelling charge or propelling ch	1.3H			Category 05 SW1	
0245	AMMUNITION, SMOKE, WHITE PHOSPHORUS with burster, expelling charge or propelling charge	1.2H			Category 05 SW1	
0246	AMMUNITION, SMOKE, WHITE PHOSPHORUS with burster, expelling charge or propelling charge	1.3H			Category 05 SW1	
0247	AMMUNITION, INCENDIARY liquid or gel, with burster, expelling charge or propelling charg	1.3J			Category 05 SW1	
0248	CONTRIVANCES, WATER-ACTIVATED with burster, expelling charge or propelling charge	1.2L			Category 05 SW1	
0249	CONTRIVANCES, WATER-ACTIVATED with burster, expelling charge or propelling charge	1.3L			Category 05 SW1	
0250	ROCKET MOTORS WITH HYPERGOLIC LIQUIDS with or without expelling charge	1.3L			Category 05 SW1	
0254	AMMUNITION, ILLUMINATING with or without burster, expelling charge or propelling charge	1.3G			Category 03 SW1	
0255	DETONATORS, ELECTRIC for blasting	1.4B			Category 05 SW1	
0257	FUZES, DETONATING	1.4B			Category 05 SW1	
0266	OCTOLITE (OCTOL) dry or wetted with less than 15% water, by mass	1.1D			Category 04 SW1	
0267	DETONATORS, NON-ELECTRIC for blasting	1.4B			Category 05 SW1	
0268	BOOSTERS WITH DETONATOR	1.2B			Category 05 SW1	
0271	CHARGES, PROPELLING	1.1C			Category 04 SW1	
0272	CHARGES, PROPELLING	1.3C			Category 04 SW1	
0275	CARTRIDGES, POWER DEVICE	1.3C			Category 04 SW1	
0276	CARTRIDGES, POWER DEVICE	1.4C			Category 02 SW1	
0277	CARTRIDGES, OIL WELL	1.3C			Category 04 SW1	

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0278	CARTRIDGES, OIL WELL	1.4C			Category 02 SW1	
0279	CHARGES, PROPELLING, FOR CANNON	1.1C			Category 04 SW1	
0280	ROCKET MOTORS	1.1C			Category 04 SW1	
0281	ROCKET MOTORS	1.2C			Category 04 SW1	
0282	NITROGUANIDINE (PICRITE) dry or wetted with less than 20% water, by mass	1.1D			Category 04 SW1	
0283	BOOSTERS without detonator	1.2D			Category 04 SW1	
0284	GRENADES hand or rifle, with bursting charge	1.1D			Category 04 SW1	
0285	GRENADES hand or rifle, with bursting charge	1.2D			Category 04 SW1	
0286	WARHEADS, ROCKET with bursting charge	1.1D			Category 04 SW1	
0287	WARHEADS, ROCKET with bursting charge	1.2D			Category 04 SW1	
0288	CHARGES, SHAPED, FLEXIBLE, LINEAR	1.1D			Category 04 SW1	
0289	CORD, DETONATING flexible	1.4D			Category 02 SW1	
0290	CORD(FUSE), DETONATING metal-clad	1.1D			Category 04 SW1	
0291	BOMBS with bursting charge	1.2F			Category 05 SW1	
0292	GRENADES hand or rifle, with bursting charge	1.1F			Category 05 SW1	
0293	GRENADES hand or rifle, with bursting charge	1.2F			Category 05 SW1	
0294	MINES with bursting charge	1.2F			Category 05 SW1	
0295	ROCKETS with bursting charge	1.2F			Category 05 SW1	
0296	SOUNDING DEVICES, EXPLOSIVE	1.1F			Category 05 SW1	
0297	AMMUNITION, ILLUMINATING with or without burster, expelling charge or propelling charge	1.4G			Category 02 SW1	
0299	BOMBS, PHOTO-FLASH	1.3G			Category 03 SW1	
0300	AMMUNITION, INCENDIARY with or without burster, expelling charge or propelling charge	1.4G			Category 02 SW1	
0301	AMMUNITION, TEAR-PRODUCING with burster, expelling charge or propelling charge	1.4G			Category 02 SW1	SG74
0303	AMMUNITION, SMOKE with or without burster, expelling charge or propelling charge	1.4G			Category 02 SW1	
0305	FLASH POWDER	1.3G			Category 03 SW1	
0306	TRACERS FOR AMMUNITION	1.4G			Category 02 SW1	
0312	CARTRIDGES, SIGNAL	1.4G			Category 02 SW1	
0313	SIGNALS, SMOKE	1.2G			Category 03 SW1	

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0314	IGNITERS	1.2G			Category 03 SW1	
0315	IGNITERS	1.3G			Category 03 SW1	
0316	FUZES, IGNITING	1.3G			Category 03 SW1	
0317	FUZES, IGNITING	1.4G			Category 02 SW1	
0318	GRENADES, PRACTICE hand or rifle	1.3G			Category 03 SW1	
0319	PRIMERS, TUBULAR	1.3G			Category 03 SW1	
0320	PRIMERS, TUBULAR	1.4G			Category 02 SW1	
0321	CARTRIDGES FOR WEAPONS with bursting charge	1.2E			Category 04 SW1	
0322	ROCKET MOTORS WITH HYPERGOLIC LIQUIDS with or without expelling charge	1.2L			Category 05 SW1	
0323	CARTRIDGES, POWER DEVICE	1.4S			Category 01 SW1	
0324	PROJECTILES with bursting charge	1.2F			Category 05 SW1	
0325	IGNITERS	1.4G			Category 02 SW1	
0326	CARTRIDGES FOR WEAPONS, BLANK	1.1C			Category 04 SW1	
0327	CARTRIDGES FOR WEAPONS, BLANK or CARTRIDGES, SMALL ARMS, BLANK	1.3C			Category 04 SW1	
0328	CARTRIDGES FOR WEAPONS, INERT PROJECTILE	1.2C			Category 04 SW1	
0329	TORPEDOES with bursting charge	1.1E			Category 04 SW1	
0330	TORPEDOES with bursting charge	1.1F			Category 05 SW1	
0331	EXPLOSIVE, BLASTING, TYPE B (AGENT, BLASTING, TYPE B)	1.5D			Category 03 SW1	SG34
0332	EXPLOSIVE, BLASTING, TYPE E (AGENT, BLASTING, TYPE E)	1.5D			Category 03 SW1	SG34
0333	FIREWORKS	1.1G			Category 03 SW1	
0334	FIREWORKS	1.2G			Category 03 SW1	
0335	FIREWORKS	1.3G			Category 03 SW1	
0336	FIREWORKS	1.4G			Category 02 SW1	
0337	FIREWORKS	1.4S			Category 01 SW1	
0338	CARTRIDGES FOR WEAPONS, BLANK or CARTRIDGES, SMALL ARMS, BLANK	1.4C			Category 02 SW1	
0339	CARTRIDGES FOR WEAPONS, INERT PROJECTILE or CARTRIDGES, SMALL ARMS	1.4C			Category 02 SW1	
0340	NITROCELLULOSE dry or wetted with less than 25% water (or alcohol), by mass	1.1D			Category 04 SW1	
0341	NITROCELLULOSE unmodified or plasticized with less than 18% plasticizing substance, by mass	1.1D			Category 04 SW1	

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0342	NITROCELLULOSE, WETTED with not less than 25% alcohol, by mass	1.3C			Category 04 SW1	
0343	NITROCELLULOSE, PLASTICIZED with not less than 18% plasticizing substance, by mass	1.3C			Category 04 SW1	
0344	PROJECTILES with bursting charge	1.4D			Category 02 SW1	
0345	PROJECTILES inert, with tracer	1.4S			Category 01 SW1	
0346	PROJECTILES with burster or expelling charge	1.2D			Category 04 SW1	
0347	PROJECTILES with burster or expelling charge	1.4D			Category 02 SW1	
0348	CARTRIDGES FOR WEAPONS with bursting charge	1.4F			Category 05 SW1	
0349	ARTICLES, EXPLOSIVE, N.O.S.	1.4S			Category 01 SW1	
0350	ARTICLES, EXPLOSIVE, N.O.S.	1.4B			Category 05 SW1	
0351	ARTICLES, EXPLOSIVE, N.O.S.	1.4C			Category 02 SW1	
0352	ARTICLES, EXPLOSIVE, N.O.S.	1.4D			Category 02 SW1	
0353	ARTICLES, EXPLOSIVE, N.O.S.	1.4G			Category 02 SW1	
0354	ARTICLES, EXPLOSIVE, N.O.S.	1.1L	See SP943		Category 05 SW1	
0355	ARTICLES, EXPLOSIVE, N.O.S.	1.2L	See SP943		Category 05 SW1	
0356	ARTICLES, EXPLOSIVE, N.O.S.	1.3L	See SP943		Category 05 SW1	
0357	SUBSTANCES, EXPLOSIVE, N.O.S.	1.1L			Category 05 SW1	
0358	SUBSTANCES, EXPLOSIVE, N.O.S.	1.2L			Category 05 SW1	
0359	SUBSTANCES, EXPLOSIVE, N.O.S.	1.3L			Category 05 SW1	
0360	DETONATOR ASSEMBLIES, NON-ELECTRIC for blasting	1.1B			Category 05 SW1	
0361	DETONATOR ASSEMBLIES, NON-ELECTRIC for blasting	1.4B			Category 05 SW1	
0362	AMMUNITION, PRACTICE	1.4G			Category 02 SW1	
0363	AMMUNITION, PROOF	1.4G			Category 02 SW1	
0364	DETONATORS FOR AMMUNITION	1.2B			Category 05 SW1	
0365	DETONATORS FOR AMMUNITION	1.4B			Category 05 SW1	
0366	DETONATORS FOR AMMUNITION	1.4S			Category 01 SW1	
0367	FUZES, DETONATING	1.4S			Category 01 SW1	
0368	FUZES, IGNITING	1.4S			Category 01 SW1	
0369	WARHEADS, ROCKET with bursting charge	1.1F			Category 05 SW1	

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0370	WARHEADS, ROCKET with burster or expelling charge	1.4D			Category 02 SW1	
0371	WARHEADS, ROCKET with burster or expelling charge	1.4F			Category 05 SW1	
0372	GRENADES, PRACTICE hand or rifle	1.2G			Category 03 SW1	
0373	SIGNAL DEVICES, HAND	1.4S			Category 01 SW1	
0374	SOUNDING DEVICES, EXPLOSIVE	1.1D			Category 04 SW1	
0375	SOUNDING DEVICES, EXPLOSIVE	1.2D			Category 04 SW1	
0376	PRIMERS, TUBULAR	1.4S			Category 01 SW1	
0377	PRIMERS, CAP TYPE	1.1B			Category 05 SW1	
0378	PRIMERS, CAP TYPE	1.4B			Category 05 SW1	
0379	CASES, CARTRIDGE, EMPTY, WITH PRIMER	1.4C			Category 02 SW1	
0380	ARTICLES, PYROPHORIC	1.2L			Category 05 SW1	
0381	CARTRIDGES, POWER DEVICE	1.2C			Category 04 SW1	
0382	COMPONENTS, EXPLOSIVE TRAIN, N.O.S.	1.2B			Category 05 SW1	
0383	COMPONENTS, EXPLOSIVE TRAIN, N.O.S.	1.4B			Category 05 SW1	
0384	COMPONENTS, EXPLOSIVE TRAIN, N.O.S.	1.4S			Category 01 SW1	
0385	5-NITROBENZOTRIAZOL	1.1D			Category 04 SW1	
0386	TRINITROBENZENESULPHONIC ACID	1.1D			Category 04 SW1	SG31
0387	TRINITROFLUORENONE	1.1D			Category 04 SW1	
0388	TRINITROTOLUENE (TNT) AND TRINITROBENZENE MIXTURE or TRINITROTOLUENE (TNT) AND HEXANITROSTILBENE MIXTURE	1.1D			Category 04 SW1	
0389	TRINITROTOLUENE (TNT) MIXTURE CONTAINING TRINITROBENZENE AND HEXANITROSTILBENE	1.1D			Category 04 SW1	
0390	TRITONAL	1.1D			Category 04 SW1	
0391	CYCLOTRIMETHYLENETRINITRAMINE (CYCLONITE; HEXOGEN; RDX) AND CYCLOTETRAMETHYLENETETRANITRAMINE (HMX; OCTOGEN) MIXTURE, WETTED with not less than 15% water, by mass or CYCLOTRIMETHYLENETRINITRAMINE (CYCLONITE; HEXOGEN; RDX) AND CYCLOTETRAMETHYLENETETRANITRAMINE (HMX; OCTOGEN) MIXTURE, DESENSITIZED with not less than 10% phlegmatizer, by mass	1.1D			Category 04 SW1	

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0392	HEXANITROSTILBENE	1.1D			Category 04 SW1	
0393	HEXOTONAL	1.1D			Category 04 SW1	
0394	TRINITRORESORCINOL (STYPHNIC ACID), WETTED with not less than 20% water, or mixture of a	1.1D			Category 04 SW1	SG31
0395	ROCKET MOTORS, LIQUID FUELLED	1.2J			Category 05 SW1	SG67
0396	ROCKET MOTORS, LIQUID FUELLED	1.3J			Category 05 SW1	SG67
0397	ROCKETS, LIQUID FUELLED with bursting charge	1.1J			Category 05 SW1	SG67
0398	ROCKETS, LIQUID FUELLED with bursting charge	1.2J			Category 05 SW1	SG67
0399	BOMBS WITH FLAMMABLE LIQUID with bursting charge	1.1J			Category 05 SW1	SG67
0400	BOMBS WITH FLAMMABLE LIQUID with bursting charge	1.2J			Category 05 SW1	SG67
0401	DIPICRYL SULPHIDE dry or wetted with less than 10% water, by mass	1.1D			Category 04 SW1	
0402	AMMONIUM PERCHLORATE	1.1D			Category 04 SW1	SG27
0403	FLARES, AERIAL	1.4G			Category 02 SW1	
0404	FLARES, AERIAL	1.4S			Category 01 SW1	
0405	CARTRIDGES, SIGNAL	1.4S			Category 01 SW1	
0406	DINITROSOBENZENE	1.3C			Category 04 SW1	
0407	TETRAZOL-1-ACETIC ACID	1.4C			Category 02 SW1	
0408	FUZES, DETONATING with protective features	1.1D			Category 04 SW1	
0409	FUZES, DETONATING with protective features	1.2D			Category 04 SW1	
0410	FUZES, DETONATING with protective features	1.4D			Category 02 SW1	
0411	PENTAERYTHRITE TETRANITRATE (PENTAERYTHRITOL TETRANITRATE; PETN) with not less than 7% wax, by mass	1.1D			Category 04 SW1	
0412	CARTRIDGES FOR WEAPONS with bursting charge	1.4E			Category 03 SW1	
0413	CARTRIDGES FOR WEAPONS, BLANK	1.2C			Category 04 SW1	
0414	CHARGES, PROPELLING, FOR CANNON	1.2C			Category 04 SW1	
0415	CHARGES, PROPELLING	1.2C			Category 04 SW1	
0417	CARTRIDGES FOR WEAPONS, INERT PROJECTILE or CARTRIDGES, SMALL ARMS	1.3C			Category 04 SW1	
0418	FLARES, SURFACE	1.1G			Category 03 SW1	
0419	FLARES, SURFACE	1.2G			Category 03 SW1	

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0420	FLARES, AERIAL	1.1G			Category 03 SW1	
0421	FLARES, AERIAL	1.2G			Category 03 SW1	
0424	PROJECTILES inert, with tracer	1.3G			Category 03 SW1	
0425	PROJECTILES inert, with tracer	1.4G			Category 02 SW1	
0426	PROJECTILES with burster or expelling charge	1.2F			Category 05 SW1	
0427	PROJECTILES with burster or expelling charge	1.4F			Category 05 SW1	
0428	ARTICLES, PYROTECHNIC for technical purposes	1.1G			Category 03 SW1	
0429	ARTICLES, PYROTECHNIC for technical purposes	1.2G			Category 03 SW1	
0430	ARTICLES, PYROTECHNIC for technical purposes	1.3G			Category 03 SW1	
0431	ARTICLES, PYROTECHNIC for technical purposes	1.4G			Category 02 SW1	
0432	ARTICLES, PYROTECHNIC for technical purposes	1.4S			Category 01 SW1	
0433	POWDER CAKE (POWDER PASTE), WETTED with not less than 17% alcohol, by mass	1.1C			Category 04 SW1	
0434	PROJECTILES with burster or expelling charge	1.2G			Category 03 SW1	
0435	PROJECTILES with burster or expelling charge	1.4G			Category 02 SW1	
0436	ROCKETS with expelling charge	1.2C			Category 04 SW1	
0437	ROCKETS with expelling charge	1.3C			Category 04 SW1	
0438	ROCKETS with expelling charge	1.4C			Category 02 SW1	
0439	CHARGES, SHAPED without detonator	1.2D			Category 04 SW1	
0440	CHARGES, SHAPED without detonator	1.4D			Category 02 SW1	
0441	CHARGES, SHAPED without detonator	1.4S			Category 01 SW1	
0442	CHARGES, EXPLOSIVE, COMMERCIAL without detonator	1.1D			Category 04 SW1	
0443	CHARGES, EXPLOSIVE, COMMERCIAL without detonator	1.2D			Category 04 SW1	
0444	CHARGES, EXPLOSIVE, COMMERCIAL without detonator	1.4D			Category 02 SW1	
0445	CHARGES, EXPLOSIVE, COMMERCIAL without detonator	1.4S			Category 01 SW1	
0446	CASES, COMBUSTIBLE, EMPTY, WITHOUT PRIMER	1.4C			Category 02 SW1	
0447	CASES, COMBUSTIBLE, EMPTY, WITHOUT PRIMER	1.3C			Category 04 SW1	
0448	5-MERCAPTOTETRAZOL-1-ACETIC ACID	1.4C			Category 02 SW1	
0449	TORPEDOES, LIQUID-FUELLED with or without bursting charge	1.1J			Category 05 SW1	SG67

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0450	TORPEDOES, LIQUID-FUELLED with inert head	1.3J			Category 05 SW1	SG67
0451	TORPEDOES with bursting charge	1.1D			Category 04 SW1	
0452	GRENADES, PRACTICE hand or rifle	1.4G			Category 02 SW1	
0453	ROCKETS, LINE-THROWING	1.4G			Category 02 SW1	
0454	IGNITERS	1.4S			Category 01 SW1	
0455	DETONATORS, NON-ELECTRIC for blasting	1.4S			Category 01 SW1	
0456	DETONATORS, ELECTRIC for blasting	1.4S			Category 01 SW1	
0457	CHARGES, BURSTING, PLASTICS BONDED	1.1D			Category 04 SW1	
0458	CHARGES, BURSTING, PLASTICS BONDED	1.2D			Category 04 SW1	
0459	CHARGES, BURSTING, PLASTICS BONDED	1.4D			Category 02 SW1	
0460	CHARGES, BURSTING, PLASTICS BONDED	1.4S			Category 01 SW1	
0461	COMPONENTS, EXPLOSIVE TRAIN, N.O.S.	1.1B			Category 05 SW1	
0462	ARTICLES, EXPLOSIVE, N.O.S.	1.1C			Category 04 SW1	
0463	ARTICLES, EXPLOSIVE, N.O.S.	1.1D			Category 04 SW1	
0464	ARTICLES, EXPLOSIVE, N.O.S.	1.1E			Category 04 SW1	
0465	ARTICLES, EXPLOSIVE, N.O.S.	1.1F			Category 05 SW1	
0466	ARTICLES, EXPLOSIVE, N.O.S.	1.2C			Category 04 SW1	
0467	ARTICLES, EXPLOSIVE, N.O.S.	1.2D			Category 04 SW1	
0468	ARTICLES, EXPLOSIVE, N.O.S.	1.2E			Category 04 SW1	
0469	ARTICLES, EXPLOSIVE, N.O.S.	1.2F			Category 05 SW1	
0470	ARTICLES, EXPLOSIVE, N.O.S.	1.3C			Category 04 SW1	
0471	ARTICLES, EXPLOSIVE, N.O.S.	1.4E			Category 03 SW1	
0472	ARTICLES, EXPLOSIVE, N.O.S.	1.4F			Category 05 SW1	
0473	SUBSTANCES, EXPLOSIVE, N.O.S.	1.1A			Category 05 SW1	
0474	SUBSTANCES, EXPLOSIVE, N.O.S.	1.1C			Category 04 SW1	
0475	SUBSTANCES, EXPLOSIVE, N.O.S.	1.1D			Category 04 SW1	
0476	SUBSTANCES, EXPLOSIVE, N.O.S.	1.1G			Category 03 SW1	
0477	SUBSTANCES, EXPLOSIVE, N.O.S.	1.3C			Category 04 SW1	

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0478	SUBSTANCES, EXPLOSIVE, N.O.S.	1.3G			Category 03 SW1	
0479	SUBSTANCES, EXPLOSIVE, N.O.S.	1.4C			Category 02 SW1	
0480	SUBSTANCES, EXPLOSIVE, N.O.S.	1.4D			Category 02 SW1	
0481	SUBSTANCES, EXPLOSIVE, N.O.S.	1.4S			Category 01 SW1	
0482	SUBSTANCES, EXPLOSIVE, VERY INSENSITIVE (SUBSTANCES, EVI), N.O.S.	1.5D			Category 03 SW1	
0483	CYCLOTRIMETHYLENETRINITRAMINE (CYCLONITE; HEXOGEN; RDX), DESENSITIZED	1.1D			Category 04 SW1	
0484	CYCLOTETRAMETHYLENETETRANITRAMINE (OCTOGEN; HMX), DESENSITIZED	1.1D			Category 04 SW1	
0485	SUBSTANCES, EXPLOSIVE, N.O.S.	1.4G			Category 02 SW1	
0486	ARTICLES, EXPLOSIVE, EXTREMELY INSENSITIVE (ARTICLES, EEI)	1.6N			Category 03 SW1	
0487	SIGNALS, SMOKE	1.3G			Category 03 SW1	
0488	AMMUNITION, PRACTICE	1.3G			Category 03 SW1	
0489	DINITROGLYCOLURIL (DINGU)	1.1D			Category 04 SW1	
0490	NITROTRIAZOLONE (NTO)	1.1D			Category 04 SW1	
0491	CHARGES, PROPELLING	1.4C			Category 02 SW1	
0492	SIGNALS, RAILWAY TRACK, EXPLOSIVE	1.3G			Category 03 SW1	
0493	SIGNALS, RAILWAY TRACK, EXPLOSIVE	1.4G			Category 02 SW1	
0494	JET PERFORATING GUNS, CHARGED oil well, without detonator	1.4D			Category 02 SW1	
0495	PROPELLANT, LIQUID	1.3C			Category 04 SW1	
0496	OCTONAL	1.1D			Category 04 SW1	
0497	PROPELLANT, LIQUID	1.1C			Category 04 SW1	
0498	PROPELLANT, SOLID	1.1C			Category 04 SW1	
0499	PROPELLANT, SOLID	1.3C			Category 04 SW1	
0500	DETONATOR ASSEMBLIES, NON-ELECTRIC for blasting	1.4S			Category 01 SW1	
0501	PROPELLANT, SOLID	1.4C			Category 02 SW1	
0502	ROCKETS with inert head	1.2C			Category 04 SW1	
0503	AIR BAG INFLATORS or AIR BAG MODULES or SEAT-BELT PRETENSIONERS	1.4G			Category 02 SW1	
0504	1H-TETRAZOLE	1.1D			Category 04 SW1	
0505	SIGNALS, DISTRESS, ship	1.4G			Category 02 SW1	

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0506	SIGNALS, DISTRESS, ship	1.4S			Category 01 SW1	
0507	SIGNALS, SMOKE	1.4S			Category 01 SW1	
0508	1-HYDROXYBENZOTRIAZOLE, ANHYDROUS, dry or wetted with less than 20% water, by mass	1.3C			Category 04 SW1	
0509	POWDER, SMOKELESS	1.4C			Category 02 SW1	
1001	ACETYLENE, DISSOLVED	2.1			Category D SW1 SW2	SG46
1002	AIR, COMPRESSED	2.2			Category A	
1003	AIR, REFRIGERATED LIQUID	2.2	5.1		Category D	
1005	AMMONIA, ANHYDROUS	2.3	8		Category D SW2	SG35 SG46
1006	ARGON, COMPRESSED	2.2			Category A	
1008	BORON TRIFLUORIDE	2.3	8		Category D SW2	
1009	BROMOTRIFLUOROMETHANE (REFRIGERANT GAS R 13B1)	2.2			Category A	
1010	BUTADIENES, STABILIZED or BUTADIENES AND HYDROCARBON MIXTURE, STABILIZED with more than 40% butadienes	2.1			Category B SW2	
1011	BUTANE	2.1			Category E SW2	
1012	BUTYLENE	2.1			Category E SW2	
1013	CARBON DIOXIDE	2.2			Category A	
1016	CARBON MONOXIDE, COMPRESSED	2.3	2.1		Category D SW2	
1017	CHLORINE	2.3	5.1/8 P		Category D SW2	SG6 SG19
1018	CHLORODIFLUOROMETHANE (REFRIGERANT GAS R 22)	2.2			Category A	
1020	CHLOROPENTAFLUOROETHANE (REFRIGERANT GAS R 115)	2.2			Category A	
1021	1-CHLORO-1,2,2,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 124)	2.2			Category A	
1022	CHLOROTRIFLUOROMETHANE (REFRIGERANT GAS R 13)	2.2			Category A	
1023	COAL GAS, COMPRESSED	2.3	2.1		Category D SW2	
1026	CYANOGEN	2.3	2.1		Category D SW2	
1027	CYCLOPROPANE	2.1			Category E SW2	
1028	DICHLORODIFLUOROMETHANE (REFRIGERANT GAS R 12)	2.2			Category A	
1029	DICHLOROFLUOROMETHANE (REFRIGERANT GAS R 21)	2.2			Category A	
1030	1,1-DIFLUOROETHANE (REFRIGERANT GAS R 152a)	2.1			Category B SW2	
1032	DIMETHYLAMINE, ANHYDROUS	2.1			Category D SW2	
1033	DIMETHYL ETHER	2.1			Category B SW2	
1035	ETHANE	2.1			Category E SW2	

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1036	ETHYLAMINE	2.1			Category D SW2	
1037	ETHYL CHLORIDE	2.1			Category B SW2	
1038	ETHYLENE, REFRIGERATED LIQUID	2.1			Category D SW2	
1039	ETHYL METHYL ETHER	2.1			Category B SW2	
1040	ETHYLENE OXIDE or ETHYLENE OXIDE WITH NITROGEN up to a total pressure of 1MPa (10 bar) at 50°C	2.3	2.1		Category D SW2	
1041	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with more than 9% but not more than 87% ethyle	2.1			Category B SW2	
1043	FERTILIZER AMMONIATING SOLUTION with free ammonia	2.2			Category E SW2	
1044	FIRE EXTINGUISHERS with compressed or liquefied gas	2.2			Category A	
1045	FLUORINE, COMPRESSED	2.3	5.1/8		Category D SW2	SG6 SG19
1046	HELIUM, COMPRESSED	2.2			Category A	
1048	HYDROGEN BROMIDE, ANHYDROUS	2.3	8		Category D SW2	
1049	HYDROGEN, COMPRESSED	2.1			Category E SW2	SG46
1050	HYDROGEN CHLORIDE, ANHYDROUS	2.3	8		Category D SW2	
1051	HYDROGEN CYANIDE, STABILIZED containing less than 3% water	6.1	3P	I	Category D SW2	
1052	HYDROGEN FLUORIDE, ANHYDROUS	8	6.1	I	Category D SW2	
1053	HYDROGEN SULPHIDE	2.3	2.1		Category D SW2	
1055	ISOBUTYLENE	2.1			Category E SW2	
1056	KRYPTON, COMPRESSED	2.2			Category A	
1057	LIGHTERS or LIGHTER REFILLS containing flammable gas	2.1			Category B SW2	
1058	LIQUEFIED GASES non-flammable, charged with nitrogen, carbon dioxide or air	2.2			Category A	
1060	METHYLACETYLENE AND PROPADIENE MIXTURE, STABILIZED	2.1			Category B SW2	
1061	METHYLAMINE, ANHYDROUS	2.1			Category B SW2	
1062	METHYL BROMIDE with not more than 2.0% chloropicrin	2.3			Category D SW2	
1063	METHYL CHLORIDE (REFRIGERANT GAS R 40)	2.1			Category D SW2	
1064	METHYL MERCAPTAN	2.3	2.1 P		Category D SW2	
1065	NEON, COMPRESSED	2.2			Category A	
1066	NITROGEN, COMPRESSED	2.2			Category A	
1067	DINITROGEN TETROXIDE (NITROGEN DIOXIDE)	2.3	5.1/8		Category D SW2	SG6 SG19
1069	NITROSYL CHLORIDE	2.3	8		Category D SW2	

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1070	NITROUS OXIDE	2.2	5.1		Category A SW2	
1071	OIL GAS, COMPRESSED	2.3	2.1		Category D SW2	
1072	OXYGEN, COMPRESSED	2.2	5.1		Category A	
1073	OXYGEN, REFRIGERATED LIQUID	2.2	5.1		Category D	
1075	PETROLEUM GASES, LIQUEFIED	2.1			Category E SW2	
1076	PHOSGENE	2.3	8		Category D SW2	
1077	PROPYLENE	2.1			Category E SW2	
1078	REFRIGERANT GAS, N.O.S.	2.2			Category A	
1079	SULPHUR DIOXIDE	2.3	8		Category D SW2	
1080	SULPHUR HEXAFLUORIDE	2.2			Category A	
1081	TETRAFLUOROETHYLENE, STABILIZED	2.1			Category E SW2	
1082	TRIFLUOROCHLOROETHYLENE, STABILIZED	2.3	2.1		Category D SW2	
1083	TRIMETHYLAMINE, ANHYDROUS	2.1			Category B SW2	
1085	VINYL BROMIDE, STABILIZED	2.1			Category B SW2	
1086	VINYL CHLORIDE, STABILIZED	2.1			Category B SW2	
1087	VINYL METHYL ETHER, STABILIZED	2.1			Category B SW2	
1088	ACETAL	3		II	Category E	
1089	ACETALDEHYDE	3		I	Category E	
1090	ACETONE (ACETONE SOLUTIONS)	3		II	Category E	
1091	ACETONE OILS	3		II	Category B	
1092	ACROLEIN, STABILIZED	6.1	3P	I	Category D SW2	
1093	ACRYLONITRILE, STABILIZED	3	6.1	I	Category E SW2	
1098	ALLYL ALCOHOL	6.1	3	I	Category D SW2	
1099	ALLYL BROMIDE	3	6.1 P	I	Category B SW2	
1100	ALLYL CHLORIDE	3	6.1	I	Category E SW2	
1104	AMYL ACETATES	3		III	Category A	
1105	PENTANOLS	3		II	Category B	
1105	PENTANOLS	3		III	Category A	
1106	AMYLAMINES	3	8	II	Category B	
1106	AMYLAMINES	3	8	III	Category A	
1107	AMYL CHLORIDES	3		II	Category B	
1108	1-PENTENE (n-AMYLENE)	3		I	Category E	
1109	AMYL FORMATES	3		III	Category A	
1110	n-AMYL METHYL KETONE	3		III	Category A	

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1111	AMYL MERCAPTANS	3		II	Category B	SG50 SG57
1112	AMYL NITRATES	3		III	Category A SW2	
1113	AMYL NITRITE	3		II	Category E SW2	
1114	BENZENE	3		II	Category B SW2	
1120	BUTANOLS	3		II	Category B	
1120	BUTANOLS	3		III	Category A	
1123	BUTYL ACETATES	3		II	Category B	
1123	BUTYL ACETATES	3		III	Category A	
1125	n-BUTYLAMINE	3	8	II	Category B SW2	
1126	1-BROMOBUTANE	3		II	Category B SW2	
1127	CHLOROBUTANES	3		II	Category B	
1128	n-BUTYL FORMATE	3		II	Category B	
1129	BUTYRALDEHYDE	3		II	Category B	
1130	CAMPHOR OIL	3		III	Category A	
1131	CARBON DISULPHIDE	3	6.1	I	Category D SW2	SG63
1133	ADHESIVES containing flammable liquid	3		I	Category E	
1133	ADHESIVES containing flammable liquid	3		II	Category B	
1133	ADHESIVES containing flammable liquid	3		III	Category A	
1134	CHLOROBENZENE	3		III	Category A	
1135	ETHYLENE CHLOROHYDRIN	6.1	3	I	Category D SW2	
1136	COAL TAR DISTILLATES, FLAMMABLE	3		II	Category B	
1136	COAL TAR DISTILLATES, FLAMMABLE	3		III	Category A	
1139	COATING SOLUTION (includes surface treatments or coatings used for industrial purposes such as vehicle under-coating, drum or barrel lining)	3		I	Category E	
1139	COATING SOLUTION (includes surface treatments or coatings used for industrial purposes such as vehicle under-coating, drum or barrel lining)	3		II	Category B	
1139	COATING SOLUTION (includes surface treatments or coatings used for industrial purposes such as vehicle under-coating, drum or barrel lining)	3		III	Category A	
1143	CROTONALDEHYDE or CROTONALDEHYDE, STABILIZED	6.1	3P	I	Category D SW2	
1144	CROTONYLENE	3		I	Category E	
1145	CYCLOHEXANE	3		II	Category E	
1146	CYCLOPENTANE	3		II	Category E	
1147	DECAHYDRONAPHTHALENES	3		III	Category A	
1148	DIACETONE ALCOHOL	3		II	Category B	
1148	DIACETONE ALCOHOL	3		III	Category A	
1149	DIBUTYL ETHERS	3		III	Category A	

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1150	1,2-DICHLOROETHYLENE	3		II	Category B	
1152	DICHLOROPENTANES	3		III	Category A	
1153	ETHYLENE GLYCOL DIETHYL ETHER	3		II	Category A	
1153	ETHYLENE GLYCOL DIETHYL ETHER	3		III	Category A	
1154	DIETHYLAMINE	3	8	II	Category E SW2	
1155	DIETHYL ETHER (ETHYL ETHER)	3		I	Category E SW2	
1156	DIETHYL KETONE	3		II	Category B	
1157	DIISOBUTYL KETONE	3		III	Category A	
1158	DIISOPROPYLAMINE	3	8	II	Category B	
1159	DIISOPROPYL ETHER	3		II	Category E SW2	
1160	DIMETHYLAMINE, AQUEOUS SOLUTION	3	8	II	Category B	SG35
1161	DIMETHYL CARBONATE	3		II	Category B	
1162	DIMETHYLDICHLOROSILANE	3	8	II	Category B SW2	
1163	DIMETHYLHYDRAZINE, UNSYMMETRICAL	6.1	3/8P	I	Category D SW2	SG5 SG8 SG13 SG35
1164	DIMETHYL SULPHIDE	3		II	Category E SW2	
1165	DIOXANE	3		II	Category B	
1166	DIOXOLANE	3		II	Category B SW2	
1167	DIVINYL ETHER, STABILIZED	3		I	Category E SW2	
1169	EXTRACTS, AROMATIC, LIQUID	3		II	Category B	
1169	EXTRACTS, AROMATIC, LIQUID	3		III	Category A	
1170	ETHANOL (ETHYL ALCOHOL) or ETHANOL SOLUTION (ETHYL ALCOHOL SOLUTION)	3		II	Category A	
1170	ETHANOL (ETHYL ALCOHOL) or ETHANOL SOLUTION (ETHYL ALCOHOL SOLUTION)	3		III	Category A	
1171	ETHYLENE GLYCOL MONOETHYL ETHER	3		III	Category A	
1172	ETHYLENE GLYCOL MONOETHYL ETHER ACETATE	3		III	Category A	
1173	ETHYL ACETATE	3		II	Category B	
1175	ETHYLBENZENE	3		II	Category B	
1176	ETHYL BORATE	3		II	Category B	
1177	2-ETHYLBUTYL ACETATE	3		III	Category A	
1178	2-ETHYLBUTYRALDEHYDE	3		II	Category B	
1179	ETHYL BUTYL ETHER	3		II	Category B	
1180	ETHYL BUTYRATE	3		III	Category A	
1181	ETHYL CHLOROACETATE	6.1	3	II	Category A	
1182	ETHYL CHLOROFORMATE	6.1	"3/8	I	Category D SW2	SG5 SG8
1183	ETHYLDICHLOROSILANE	4.3	"3/8	I	Category D SW2	SG5 SG7 SG8 SG13

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1184	ETHYLENE DICHLORIDE	3	6.1	II	Category B SW2	
1185	ETHYLENEIMINE, STABILIZED	6.1	3	I	Category D SW2	
1188	ETHYLENE GLYCOL MONOMETHYL ETHER	3		III	Category A	
1189	ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE	3		III	Category A	
1190	ETHYL FORMATE	3		II	Category E	
1191	OCTYL ALDEHYDES	3		III	Category A	
1192	ETHYL LACTATE	3		III	Category A	
1193	ETHYL METHYL KETONE (METHYL ETHYL KETONE)	3		II	Category B	
1194	ETHYL NITRITE SOLUTION	3	6.1	I	Category D SW2	
1195	ETHYL PROPIONATE	3		II	Category B	
1196	ETHYLTRICHLOROSILANE	3	8	II	Category B SW2	
1197	EXTRACTS, FLAVOURING, LIQUID	3		II	Category B	
1197	EXTRACTS, FLAVOURING, LIQUID	3		III	Category A	
1198	FORMALDEHYDE SOLUTION, FLAMMABLE	3	8	III	Category A SW2	
1199	FURALDEHYDES	6.1	3	II	Category A	
1201	FUSEL OIL	3		II	Category B	
1201	FUSEL OIL	3		III	Category A	
1202	GAS OIL or DIESEL FUEL or HEATING OIL, LIGHT	3		III	Category A	
1203	MOTOR SPIRIT or GASOLINE or PETROL	3		II	Category E	
1204	NITROGLYCERIN SOLUTION IN ALCOHOL with not more than 1% nitroglycerin	3		II	Category B	
1206	HEPTANES	3		II	Category B	
1207	HEXALDEHYDE	3		III	Category A	
1208	HEXANES	3		II	Category E	
1210	PRINTING INK flammable or PRINTING INK RELATED MATERIAL (including printing ink thinning or reducing compound), flammable	3		I	Category E	
1210	PRINTING INK flammable or PRINTING INK RELATED MATERIAL (including printing ink thinning or reducing compound), flammable	3		II	Category B	
1210	PRINTING INK flammable or PRINTING INK RELATED MATERIAL (including printing ink thinning or reducing compound), flammable	3		III	Category A	
1212	ISOBUTANOL (ISOBUTYL ALCOHOL)	3		III	Category A	
1213	ISOBUTYL ACETATE	3		II	Category B	
1214	ISOBUTYLAMINE	3	8	II	Category B SW2	
1216	ISOOCTENES	3		II	Category B	
1218	ISOPRENE, STABILIZED	3		I	Category E	
1219	ISOPROPANOL (ISOPROPYL ALCOHOL)	3		II	Category B	
1220	ISOPROPYL ACETATE	3		II	Category B	

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1221	ISOPROPYLAMINE	3	8	I	Category E SW2	
1222	ISOPROPYL NITRATE	3		II	Category D	
1223	KEROSENE	3		III	Category A	
1224	KETONES, LIQUID, N.O.S.	3		II	Category B	
1224	KETONES, LIQUID, N.O.S.	3		III	Category A	
1228	MERCAPTANS, LIQUID, FLAMMABLE, TOXIC, N.O.S. or MERCAPTAN MIXTURE, LIQUID, FLAMMABLE, TO	3	6.1	II	Category B SW2	SG50 SG57
1228	MERCAPTANS, LIQUID, FLAMMABLE, TOXIC, N.O.S. or MERCAPTAN MIXTURE, LIQUID, FLAMMABLE, N.O.S	3	6.1	III	Category B SW2	SG50 SG57
1229	MESITYL OXIDE	3		III	Category A	
1230	METHANOL	3	6.1	II	Category B SW2	
1231	METHYL ACETATE	3		II	Category B	
1233	METHYLAMYL ACETATE	3		III	Category A	
1234	METHYLAL	3		II	Category E	
1235	METHYLAMINE, AQUEOUS SOLUTION	3		II	Category E	SG35 SG54
1237	METHYL BUTYRATE	3		II	Category B	
1238	METHYL CHLOROFORMATE	6.1	"3/8	I	Category D SW2	SG5 SG8
1239	METHYL CHLOROMETHYL ETHER	6.1	3	I	Category D SW2	
1242	METHYLDICHLOROSILANE	4.3	"3/8	I	Category D SW2	SG5 SG7 SG8 SG13
1243	METHYL FORMATE	3		I	Category E	
1244	METHYLHYDRAZINE	6.1	"3/8	I	Category D SW2	SG5 SG8 SG13 SG35
1245	METHYL ISOBUTYL KETONE	3		II	Category B	
1246	METHYL ISOPROPENYL KETONE, STABILIZED	3		II	Category B	
1247	METHYL METHACRYLATE MONOMER, STABILIZED	3		II	Category B SW2	
1248	METHYL PROPIONATE	3		II	Category B	
1249	METHYL PROPYL KETONE	3		II	Category B	
1250	METHYLTRICHLOROSILANE	3	8	II	Category B SW2	
1251	METHYL VINYL KETONE, STABILIZED	6.1	"3/8	I	Category D SW2	SG5 SG8
1259	NICKEL CARBONYL	6.1	3P	I	Category D SW2	SG63
1261	NITROMETHANE	3		II	Category A	
1262	OCTANES	3		II	Category B	
1263	PAINT (including paint, lacquer, enamel, stain, shellac solutions, varnish, polish, liquid filler and liquid lacquer base) or PAINT RELATED MATERIAL (including paint thinning or reducing compound)	3		I	Category E	

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1263	PAINT (including paint, lacquer, enamel, stain, shellac solutions, varnish, polish, liquid filler and liquid lacquer base) or PAINT RELATED MATERIAL (including paint thinning or reducing compound)	3		II	Category B	
1263	PAINT (including paint, lacquer, enamel, stain, shellac solutions, varnish, polish, liquid filler and liquid lacquer base) or PAINT RELATED MATERIAL (including paint thinning or reducing compound)	3		III	Category A	
1264	PARALDEHYDE	3		III	Category A	
1265	PENTANES, liquid	3		I	Category E	
1265	PENTANES, liquid	3		II	Category E	
1266	PERFUMERY PRODUCTS with flammable solvents	3		II	Category B	
1266	PERFUMERY PRODUCTS with flammable solvents	3		III	Category A	
1267	PETROLEUM CRUDE OIL	3		I	Category E	
1267	PETROLEUM CRUDE OIL	3		II	Category B	
1267	PETROLEUM CRUDE OIL	3		III	Category A	
1268	PETROLEUM DISTILLATES, N.O.S. or PETROLEUM PRODUCTS, N.O.S.	3		I	Category E	
1268	PETROLEUM DISTILLATES, N.O.S. or PETROLEUM PRODUCTS, N.O.S.	3		II	Category B	
1268	PETROLEUM DISTILLATES, N.O.S. or PETROLEUM PRODUCTS, N.O.S.	3		III	Category A	
1272	PINE OIL	3		III	Category A	
1274	n-PROPANOL (PROPYL ALCOHOL, NORMAL)	3		II	Category B	
1274	n-PROPANOL (PROPYL ALCOHOL, NORMAL)	3		III	Category A	
1275	PROPIONALDEHYDE	3		II	Category E	
1276	n-PROPYL ACETATE	3		II	Category B	
1277	PROPYLAMINE	3	8	II	Category E SW2	
1278	1-CHLOROPROPANE	3		II	Category E	
1279	1,2-DICHLOROPROPANE	3		II	Category B	
1280	PROPYLENE OXIDE	3		I	Category E SW2	
1281	PROPYL FORMATES	3		II	Category B	
1282	PYRIDINE	3		II	Category B SW2	
1286	ROSIN OIL	3		II	Category B	
1286	ROSIN OIL	3		III	Category A	
1287	RUBBER SOLUTION	3		II	Category B	
1287	RUBBER SOLUTION	3		III	Category A	
1288	SHALE OIL	3		II	Category B	
1288	SHALE OIL	3		III	Category A	
1289	SODIUM METHYLATE SOLUTION in alcohol	3	8	II	Category B	
1289	SODIUM METHYLATE SOLUTION in alcohol	3	8	III	Category A	
1292	TETRAETHYL SILICATE	3		III	Category A	
1293	TINCTURES, MEDICINAL	3		II	Category B	

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1293	TINCTURES, MEDICINAL	3		III	Category A	
1294	TOLUENE	3		II	Category B	
1295	TRICHLOROSILANE	4.3	"8/3	I	Category D SW2	SG5 SG7 SG8 SG13 SG72
1296	TRIETHYLAMINE	3	8	II	Category B SW2	
1297	TRIMETHYLAMINE, AQUEOUS SOLUTION not more than 50% trimethylamine, by mass	3	8	I	Category D SW2	SG54
1297	TRIMETHYLAMINE, AQUEOUS SOLUTION not more than 50% trimethylamine, by mass	3	8	II	Category B SW2	SG54
1297	TRIMETHYLAMINE, AQUEOUS SOLUTION not more than 50% trimethylamine, by mass	3	8	III	Category A SW2	SG54
1298	TRIMETHYLCHLOROSILANE	3	8	II	Category E SW2	
1299	TURPENTINE	3		III	Category A	
1300	TURPENTINE SUBSTITUTE	3		II	Category B	
1300	TURPENTINE SUBSTITUTE	3		III	Category A	
1301	VINYL ACETATE, STABILIZED	3		II	Category B	
1302	VINYL ETHYL ETHER, STABILIZED	3		I	Category D	
1303	VINYLIDENE CHLORIDE, STABILIZED	3	P	I	Category E SW2	
1304	VINYL ISOBUTYL ETHER, STABILIZED	3		II	Category B	
1305	VINYLTRICHLOROSILANE	3	8	II	Category B SW2	
1306	WOOD PRESERVATIVES, LIQUID	3		II	Category B	
1306	WOOD PRESERVATIVES, LIQUID	3		III	Category A	
1307	XYLENES	3		II	Category B	
1307	XYLENES	3		III	Category A	
1308	ZIRCONIUM, SUSPENDED IN A FLAMMABLE LIQUID	3		I	Category D	
1308	ZIRCONIUM, SUSPENDED IN A FLAMMABLE LIQUID	3		II	Category B	
1308	ZIRCONIUM, SUSPENDED IN A FLAMMABLE LIQUID	3		III	Category B	
1309	ALUMINIUM POWDER, COATED	4.1		II	Category A H1	SG17 SG32 SG35 SG36 SG52
1309	ALUMINIUM POWDER, COATED	4.1		III	Category A H1	SG17 SG32 SG35 SG36 SG52
1310	AMMONIUM PICRATE, WETTED with not less than 10% water, by mass	4.1		I	Category D	SG7 SG30
1312	BORNEOL	4.1		III	Category A	
1313	CALCIUM RESINATE	4.1		III	Category A	
1314	CALCIUM RESINATE, FUSED	4.1		III	Category A	
1318	COBALT RESINATE, PRECIPITATED	4.1		III	Category A	
1320	DINITROPHENOL, WETTED with not less than 15% water, by mass	4.1		I	Category E	SG7 SG30

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1321	DINITROPHENOLATES, WETTED with not less than 15% water, by mass	4.1	6.1P	I	Category E	SG7 SG30
1322	DINITRORESORCINOL, WETTED with not less than 15% water, by mass	4.1		I	Category E	SG7 SG30
1323	FERROCERIUM	4.1		II	Category A	
1324	FILMS, NITROCELLULOSE BASE gelatin coated, except scrap	4.1		III	Category D	SG7
1325	FLAMMABLE SOLID, ORGANIC, N.O.S.	4.1		II	Category B	
1325	FLAMMABLE SOLID, ORGANIC, N.O.S.	4.1		III	Category B	
1326	HAFNIUM POWDER, WETTED with not less than 25% water (a visible excess of water must be present) (a) mechanically produced, particle size less than 53 microns; (b) chemically produced, particle size less than 840 microns	4.1		II	Category E	SG17
1327	HAY, STRAW or BHUSA	4.1			Category A SW10	SG23
1328	HEXAMETHYLENETETRAMINE	4.1		III	Category A	
1330	MANGANESE RESINATE	4.1		III	Category A	
1331	MATCHES, 'STRIKE ANYWHERE'	4.1		III	Category B	
1332	METALDEHYDE	4.1		III	Category A	
1333	CERIUM slabs, ingots or rods	4.1		II	Category A	SG15 SG17
1334	NAPHTHALENE, CRUDE or NAPHTHALENE, REFINED	4.1		III	Category A SW23	
1336	NITROGUANIDINE (PICRITE), WETTED with not less than 20% water, by mass	4.1		I	Category E	SG7 SG30
1337	NITROSTARCH, WETTED with not less than 20% water, by mass	4.1		I	Category D	SG7 SG30
1338	PHOSPHORUS, AMORPHOUS	4.1		III	Category A	SG17
1339	PHOSPHORUS HEPTASULPHIDE free from yellow or white phosphorus	4.1		II	Category B	SG17
1340	PHOSPHORUS PENTASULPHIDE free from yellow or white phosphorus	4.3		II	Category D	
1341	PHOSPHORUS SESQUISULPHIDE free from yellow or white phosphorus	4.1		II	Category B	SG17
1343	PHOSPHORUS TRISULPHIDE free from yellow or white phosphorus	4.1		II	Category B	SG17
1344	TRINITROPHENOL (PICRIC ACID), WETTED with not less than 30% water, by mass	4.1		I	Category E	SG7 SG30
1345	RUBBER SCRAP powdered or granulated, not exceeding 840 microns and rubber content exceeding 45% or RUBBER SHODDY powdered or granulated, not exceeding 840 microns and rubber content exceeding 45%	4.1		II	Category A	
1346	SILICON POWDER, AMORPHOUS	4.1		III	Category A	SG17
1347	SILVER PICRATE, WETTED with not less than 30% water, by mass	4.1		I	Category D	SG7 SG30
1348	SODIUM DINITRO-o-CRESOLATE, WETTED with not less than 15% water, by mass	4.1	6.1P	I	Category E	SG7 SG30
1349	SODIUM PICRAMATE, WETTED with not less than 20% water, by mass	4.1		I	Category E	SG7 SG30

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1350	SULPHUR	4.1		III	Category A SW1 SW23	SG17
1352	TITANIUM POWDER, WETTED with not less than 25% water (a visible excess of water must be present) (a) mechanically produced, particle size less than 53 microns; (b) chemically produced, particle size less than 840 microns	4.1		II	Category E	SG17
1353	FIBRES or FABRICS IMPREGNATED WITH WEAKLY NITRATED NITROCELLULOSE, N.O.S.	4.1		III	Category D	
1354	TRINITROBENZENE, WETTED with not less than 30% water, by mass	4.1		I	Category E	SG7 SG30
1355	TRINITROBENZOIC ACID, WETTED with not less than 30% water, by mass	4.1		I	Category E	SG7 SG30
1356	TRINITROTOLUENE (TNT), WETTED with not less than 30% water, by mass	4.1		I	Category E	SG7 SG30
1357	UREA NITRATE, WETTED with not less than 20% water, by mass	4.1		I	Category E	SG7 SG30
1358	ZIRCONIUM POWDER, WETTED with not less than 25% water (a visible excess of water must be present) (a) mechanically produced, particle size less than 53 microns; (b) chemically produced, particle size less than 840 microns	4.1		II	Category E	SG17
1360	CALCIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
1361	CARBON animal or vegetable origin	4.2		II	Category A SW1 H2	
1361	CARBON animal or vegetable origin	4.2		III	Category A SW1 H2	
1362	CARBON, ACTIVATED	4.2		III	Category A SW1 H2	
1363	COPRA	4.2		III	Category A SW1 SW9 H1	
1364	COTTON WASTE, OILY	4.2		III	Category A	SG41
1365	COTTON, WET	4.2		III	Category A	
1369	p-NITROSODIMETHYLANILINE	4.2		II	Category D	SG29
1372	FIBRES ANIMAL or FIBRES VEGETABLE burnt, wet or damp	4.2		III	Category A	
1373	FIBRES or FABRICS, ANIMAL or VEGETABLE or SYNTHETIC N.O.S. with oil	4.2		III	Category A	
1374	FISHMEAL, UNSTABILIZED (FISHSCRAP, UNSTABILIZED) High hazard. Unrestricted moisture content, Unrestricted fat content in excess of 12%, by mass; unrestricted fat content in excess of 15%, by mass, in the case of antioxidant treated fishmeal or fishscrap	4.2		II	Category B SW1 SW24	SG65
1374	FISHMEAL, UNSTABILIZED (FISHSCRAP, UNSTABILIZED) High hazard Unrestricted moisture content, Unrestricted fat content in excess of 12%, by mass; unrestricted fat content in excess of 15%, by mass, in the case of antioxidant treated fishmeal or fishscrap	4.2		III	Category A SW1 SW24	
1376	IRON OXIDE, SPENT or IRON SPONGE, SPENT obtained from coal gas purification	4.2		III	Category E	

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1378	METAL CATALYST, WETTED with a visible excess of liquid	4.2		II	Category C	
1379	PAPER, UNSATURATED OIL TREATED incompletely dried (including carbon paper)	4.2		III	Category A	
1380	PENTABORANE	4.2	6.1	I	Category D	
1381	PHOSPHORUS, WHITE or YELLOW, DRY or UNDER WATER or IN SOLUTION	4.2	6.1P	I	Category E	
1382	POTASSIUM SULPHIDE, ANHYDROUS or POTASSIUM SULPHIDE with less than 30% water of crystall	4.2		II	Category A	SG35
1383	PYROPHORIC METAL, N.O.S. or PYROPHORIC ALLOY, N.O.S.	4.2		I	Category D	
1384	SODIUM DITHIONITE (SODIUM HYDROSULPHITE)	4.2		II	Category E H1	
1385	SODIUM SULPHIDE, ANHYDROUS or SODIUM SULPHIDE with less than 30% water of crystallizatio	4.2		II	Category A	SG35
1386	SEED CAKE, containing vegetable oil (a) mechanically expelled seeds, containing more tha	4.2		III	Category E SW1 SW25 H1	
1386	SEED CAKE, containing vegetable oil (b) solvent extractions and expelled seeds, containi	4.2		III	Category A SW1 SW25 H1	
1387	WOOL WASTE, WET	4.2		III	Category A	
1389	ALKALI METAL AMALGAM, LIQUID	4.3		I	Category D	SG35
1390	ALKALI METAL AMIDE	4.3		II	Category E SW2	SG35
1391	ALKALI METAL DISPERSION or ALKALINE EARTH METAL DISPERSION	4.3		I	Category D	SG35
1392	ALKALINE EARTH METAL AMALGAM, LIQUID	4.3		I	Category D	SG35
1393	ALKALINE EARTH METAL ALLOY, N.O.S.	4.3		II	Category E	SG35
1394	ALUMINIUM CARBIDE	4.3		II	Category A	SG35
1395	ALUMINIUM FERROSILICON POWDER	4.3	6.1	II	Category A SW2 SW5 H1	SG32 SG35 SG36
1396	ALUMINIUM POWDER, UNCOATED	4.3		II	Category A	SG32 SG35 SG36
1396	ALUMINIUM POWDER, UNCOATED	4.3		III	Category A	SG32 SG35 SG36
1397	ALUMINIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
1398	ALUMINIUM SILICON POWDER, UNCOATED	4.3		III	Category A SW2 SW5 H1	SG32 SG35 SG36
1400	BARIUM	4.3		II	Category E	SG35
1401	CALCIUM	4.3		II	Category E	SG35
1402	CALCIUM CARBIDE	4.3		I	Category B	SG35
1402	CALCIUM CARBIDE	4.3		II	Category B	SG35
1403	CALCIUM CYANAMIDE with more than 0.1% calcium carbide	4.3		III	Category A	SG35
1404	CALCIUM HYDRIDE	4.3		I	Category E	SG35
1405	CALCIUM SILICIDE	4.3		II	Category B SW5 H1	SG35
1405	CALCIUM SILICIDE	4.3		III	Category B SW5 H1	SG35

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1407	CAESIUM	4.3		I	Category D	SG35
1408	FERROSILICON with 30% or more but less than 90% silicon	4.3	6.1	III	Category A SW2 SW5 H1	SG35 SG36
1409	METAL HYDRIDES, WATER-REACTIVE, N.O.S.	4.3		I	Category D	SG35
1409	METAL HYDRIDES, WATER-REACTIVE, N.O.S.	4.3		II	Category D	SG35
1410	LITHIUM ALUMINIUM HYDRIDE	4.3		I	Category E	SG35
1411	LITHIUM ALUMINIUM HYDRIDE, ETHEREAL	4.3	3	I	Category D SW2	
1413	LITHIUM BOROHYDRIDE	4.3		I	Category E	SG35
1414	LITHIUM HYDRIDE	4.3		I	Category E	SG35
1415	LITHIUM	4.3		I	Category E	SG35
1417	LITHIUM SILICON	4.3		II	Category A SW5 H1	
1418	MAGNESIUM POWDER or MAGNESIUM ALLOYS POWDER	4.3	4.2	I	Category A	SG32 SG35
1418	MAGNESIUM POWDER or MAGNESIUM ALLOYS POWDER	4.3	4.2	II	Category A	SG32 SG35
1418	MAGNESIUM POWDER or MAGNESIUM ALLOYS POWDER	4.3	4.2	III	Category A	SG32 SG35
1419	MAGNESIUM ALUMINIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
1420	POTASSIUM METAL ALLOYS, LIQUID	4.3		I	Category D	SG35
1421	ALKALI METAL ALLOY, LIQUID, N.O.S.	4.3		I	Category D	SG35
1422	POTASSIUM SODIUM ALLOYS, LIQUID	4.3		I	Category D	SG35
1423	RUBIDIUM	4.3		I	Category D	SG35
1426	SODIUM BOROHYDRIDE	4.3		I	Category E	SG35
1427	SODIUM HYDRIDE	4.3		I	Category E	SG35
1428	SODIUM	4.3		I	Category D	SG35
1431	SODIUM METHYLATE	4.2	8	II	Category B	
1432	SODIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
1433	STANNIC PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
1435	ZINC ASHES	4.3		III	Category A	
1436	ZINC POWDER or ZINC DUST	4.3	4.2	I	Category A	SG35 SG36
1436	ZINC POWDER or ZINC DUST	4.3	4.2	II	Category A	SG35 SG36
1436	ZINC POWDER or ZINC DUST	4.3	4.2	III	Category A	SG35 SG36
1437	ZIRCONIUM HYDRIDE	4.1		II	Category E	
1438	ALUMINIUM NITRATE	5.1		III	Category A	
1439	AMMONIUM DICHROMATE	5.1		II	Category A	SG35
1442	AMMONIUM PERCHLORATE	5.1		II	Category E	SG49 SG60
1444	AMMONIUM PERSULPHATE	5.1		III	Category A	

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1445	BARIUM CHLORATE, SOLID	5.1	6.1	II	Category A	SG38 SG49
1446	BARIUM NITRATE	5.1	6.1	II	Category A	
1447	BARIUM PERCHLORATE, SOLID	5.1	6.1	II	Category A	SG38 SG49
1448	BARIUM PERMANGANATE	5.1	6.1	II	Category D	SG38 SG49 SG60
1449	BARIUM PEROXIDE	5.1	6.1	II	Category A H1	SG16 SG35 SG59
1450	BROMATES, INORGANIC, N.O.S.	5.1		II	Category A	SG38 SG49
1451	CAESIUM NITRATE	5.1		III	Category A	
1452	CALCIUM CHLORATE	5.1		II	Category A	SG38 SG49
1453	CALCIUM CHLORITE	5.1		II	Category A	SG38 SG49
1454	CALCIUM NITRATE	5.1		III	Category A SW23	
1455	CALCIUM PERCHLORATE	5.1		II	Category A	SG38 SG49
1456	CALCIUM PERMANGANATE	5.1		II	Category D	SG38 SG49 SG60
1457	CALCIUM PEROXIDE	5.1		II	Category A H1	SG16 SG35 SG59
1458	CHLORATE AND BORATE MIXTURE	5.1		II	Category A	SG38 SG49
1458	CHLORATE AND BORATE MIXTURE	5.1		III	Category A	SG38 SG49
1459	CHLORATE AND MAGNESIUM CHLORIDE MIXTURE, SOLID	5.1		II	Category A	SG38 SG49
1459	CHLORATE AND MAGNESIUM CHLORIDE MIXTURE, SOLID	5.1		III	Category A	SG38 SG49
1461	CHLORATES, INORGANIC, N.O.S.	5.1		II	Category A	SG38 SG49
1462	CHLORITES, INORGANIC, N.O.S.	5.1		II	Category A	SG38 SG49
1463	CHROMIUM TRIOXIDE, ANHYDROUS	5.1	6.1/8	II	Category A	SG6 SG16 SG19
1465	DIDYMIUM NITRATE	5.1		III	Category A	
1466	FERRIC NITRATE	5.1		III	Category A	
1467	GUANIDINE NITRATE	5.1		III	Category A	SG45
1469	LEAD NITRATE	5.1	6.1P	II	Category A	
1470	LEAD PERCHLORATE, SOLID	5.1	6.1P	II	Category A	SG38 SG49
1471	LITHIUM HYPOCHLORITE, DRY or LITHIUM HYPOCHLORITE MIXTURE	5.1		II	Category A SW1 SW8	SG35 SG38 SG49 SG53 SG60

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1471	LITHIUM HYPOCHLORITE, DRY or LITHIUM HYPOCHLORITE MIXTURE	5.1		III	Category A SW1 SW8	SG35 SG38 SG49 SG53 SG60
1472	LITHIUM PEROXIDE	5.1		II	Category A H1	SG16 SG35 SG59
1473	MAGNESIUM BROMATE	5.1		II	Category A	SG38 SG49
1474	MAGNESIUM NITRATE	5.1		III	Category A SW23	
1475	MAGNESIUM PERCHLORATE	5.1		II	Category A	SG38 SG49
1476	MAGNESIUM PEROXIDE	5.1		II	Category A H1	SG16 SG35 SG59
1477	NITRATES, INORGANIC, N.O.S.	5.1		II	Category A	SG38 SG49
1477	NITRATES, INORGANIC, N.O.S.	5.1		III	Category A	SG38 SG49
1479	OXIDIZING SOLID, N.O.S.	5.1		I	Category D	SG38 SG49 SG60 SG61
1479	OXIDIZING SOLID, N.O.S.	5.1		II	Category B	SG38 SG49 SG60 SG61
1479	OXIDIZING SOLID, N.O.S.	5.1		III	Category B	SG38 SG49 SG60 SG61
1481	PERCHLORATES, INORGANIC, N.O.S.	5.1		II	Category A	SG38 SG49
1481	PERCHLORATES, INORGANIC, N.O.S.	5.1		III	Category A	SG38 SG49
1482	PERMANGANATES, INORGANIC, N.O.S.	5.1		II	Category D	SG38 SG49 SG60
1482	PERMANGANATES, INORGANIC, N.O.S.	5.1		III	Category D	SG38 SG49 SG60
1483	PEROXIDES, INORGANIC, N.O.S.	5.1		II	Category A H1	SG16 SG35 SG59
1483	PEROXIDES, INORGANIC, N.O.S.	5.1		III	Category A H1	SG16 SG35 SG59
1484	POTASSIUM BROMATE	5.1		II	Category A	SG38 SG49
1485	POTASSIUM CHLORATE	5.1		II	Category A	SG38 SG49
1486	POTASSIUM NITRATE	5.1		III	Category A SW23	
1487	POTASSIUM NITRATE AND SODIUM NITRITE MIXTURE	5.1		II	Category A	SG38 SG49
1488	POTASSIUM NITRITE	5.1		II	Category A	SG38 SG49
1489	POTASSIUM PERCHLORATE	5.1		II	Category A	SG38 SG49

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1490	POTASSIUM PERMANGANATE	5.1		II	Category D	SG38 SG49 SG60
1491	POTASSIUM PEROXIDE	5.1		I	Category B H1	SG16 SG35 SG59
1492	POTASSIUM PERSULPHATE	5.1		III	Category A	SG39 SG49
1493	SILVER NITRATE	5.1		II	Category A	
1494	SODIUM BROMATE	5.1		II	Category A	SG38 SG49
1495	SODIUM CHLORATE	5.1		II	Category A	SG38 SG49
1496	SODIUM CHLORITE	5.1		II	Category A	SG38 SG49
1498	SODIUM NITRATE	5.1		III	Category A SW23	
1499	SODIUM NITRATE AND POTASSIUM NITRATE MIXTURE	5.1		III	Category A SW23	
1500	SODIUM NITRITE	5.1	6.1	III	Category A	SG38 SG49
1502	SODIUM PERCHLORATE	5.1		II	Category A	SG38 SG49
1503	SODIUM PERMANGANATE	5.1		II	Category D	SG38 SG49 SG60
1504	SODIUM PEROXIDE	5.1		I	Category B H1	SG16 SG35 SG59
1505	SODIUM PERSULPHATE	5.1		III	Category A	SG39 SG49
1506	STRONTIUM CHLORATE	5.1		II	Category A	SG38 SG49
1507	STRONTIUM NITRATE	5.1		III	Category A	
1508	STRONTIUM PERCHLORATE	5.1		II	Category A	SG38 SG49
1509	STRONTIUM PEROXIDE	5.1		II	Category A H1	SG16 SG35 SG59
1510	TETRANITROMETHANE	6.1	5.1	I	Category D SW2	SG16
1511	UREA HYDROGEN PEROXIDE	5.1	8	III	Category A H1	
1512	ZINC AMMONIUM NITRITE	5.1			Category	
1513	ZINC CHLORATE	5.1		II	Category A	SG38 SG49
1514	ZINC NITRATE	5.1		II	Category A	
1515	ZINC PERMANGANATE	5.1		II	Category D	SG38 SG49 SG60
1516	ZINC PEROXIDE	5.1		II	Category A H1	SG16 SG35 SG59
1517	ZIRCONIUM PICRAMATE, WETTED with not less than 20% water, by mass	4.1		I	Category D	SG7 SG30
1541	ACETONE CYANOHYDRIN, STABILIZED	6.1	P	I	Category D SW1 SW2	SG35 SG36

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1544	ALKALOIDS, SOLID, N.O.S. or ALKALOIDS SALTS, SOLID, N.O.S.	6.1		I	Category A	
1544	ALKALOIDS, SOLID, N.O.S. or ALKALOIDS SALTS, SOLID, N.O.S.	6.1		II	Category A	
1544	ALKALOIDS, SOLID, N.O.S. or ALKALOIDS SALTS, SOLID, N.O.S.	6.1		III	Category A	
1545	ALLYL ISOTHIOCYANATE, STABILIZED	6.1	3	II	Category D SW2	
1546	AMMONIUM ARSENATE	6.1		II	Category A	SG36
1547	ANILINE	6.1		II	Category A SW2	SG35
1548	ANILINE HYDROCHLORIDE	6.1		III	Category A	
1549	ANTIMONY COMPOUND, INORGANIC, SOLID, N.O.S.	6.1		III	Category A	
1550	ANTIMONY LACTATE	6.1		III	Category A	
1551	ANTIMONY POTASSIUM TARTRATE	6.1		III	Category A	
1553	ARSENIC ACID, LIQUID	6.1		I	Category B	SG33
1554	ARSENIC ACID, SOLID	6.1		II	Category A	
1555	ARSENIC BROMIDE	6.1		II	Category A SW1 SW2 H2	
1556	ARSENIC COMPOUND, LIQUID, N.O.S. inorganic, including: Arsenates, n.o.s.,Arsenites, n.o.s., and Arsenic sulphides, n.o.s.	6.1		I	Category B SW2	SG70
1556	ARSENIC COMPOUND, LIQUID, N.O.S. inorganic, including: Arsenates, n.o.s.,Arsenites, n.o.s., and Arsenic sulphides, n.o.s.	6.1		II	Category B SW2	SG70
1556	ARSENIC COMPOUND, LIQUID, N.O.S. inorganic, including: Arsenates, n.o.s.,Arsenites, n.o.s., and Arsenic sulphides, n.o.s.	6.1		III	Category B SW2	SG70
1557	ARSENIC COMPOUND, SOLID, N.O.S. inorganic, including: Arsenates, n.o.s.; Arsenites, n.o.s.; and Arsenic sulphides, n.o.s.	6.1		I	Category A	SG70
1557	ARSENIC COMPOUND, SOLID, N.O.S. inorganic, including: Arsenates, n.o.s.; Arsenites, n.o.s.; and Arsenic sulphides, n.o.s.	6.1		II	Category A	SG70
1557	ARSENIC COMPOUND, SOLID, N.O.S. inorganic, including: Arsenates, n.o.s.; Arsenites, n.o.s.; and Arsenic sulphides, n.o.s.	6.1		III	Category A	SG70
1558	ARSENIC	6.1		II	Category A	
1559	ARSENIC PENTOXIDE	6.1		II	Category A	
1560	ARSENIC TRICHLORIDE	6.1		I	Category B SW2	
1561	ARSENIC TRIOXIDE	6.1		II	Category A	
1562	ARSENICAL DUST	6.1		II	Category A	
1564	BARIUM COMPOUND, N.O.S.	6.1		II	Category A	
1564	BARIUM COMPOUND, N.O.S.	6.1		III	Category A	
1565	BARIUM CYANIDE	6.1	P	I	Category A SW2	SG35
1566	BERYLLIUM COMPOUND, N.O.S.	6.1		II	Category A	

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1566	BERYLLIUM COMPOUND, N.O.S.	6.1		III	Category A	
1567	BERYLLIUM POWDER	6.1	4.1	II	Category A	
1569	BROMOACETONE	6.1	3P	II	Category D SW2	
1570	BRUCINE	6.1		I	Category A	
1571	BARIUM AZIDE, WETTED with not less than 50% water, by mass	4.1	6.1	I	Category D	SG7 SG30
1572	CACODYLIC ACID	6.1		II	Category E	SG35
1573	CALCIUM ARSENATE	6.1	P	II	Category A	
1574	CALCIUM ARSENATE AND CALCIUM ARSENITE MIXTURE, SOLID	6.1	P	II	Category A	
1575	CALCIUM CYANIDE	6.1	P	I	Category A SW2	SG35
1577	CHLORODINITROBENZENES, LIQUID	6.1	P	II	Category A	SG15
1578	CHLORONITROBENZENES, SOLID	6.1		II	Category A	
1579	4-CHLORO-o-TOLUIDINE HYDROCHLORIDE, SOLID	6.1		III	Category A	
1580	CHLOROPICRIN	6.1	P	I	Category D SW2	
1581	CHLOROPICRIN AND METHYL BROMIDE MIXTURE with more than 2% chloropicrin	2.3			Category D SW1 SW2	
1582	CHLOROPICRIN AND METHYL CHLORIDE MIXTURE	2.3			Category D SW1 SW2	
1583	CHLOROPICRIN MIXTURE, N.O.S.	6.1		I	Category C SW2	
1583	CHLOROPICRIN MIXTURE, N.O.S.	6.1		II	Category C SW2	
1583	CHLOROPICRIN MIXTURE, N.O.S.	6.1		III	Category C SW2	
1585	COPPER ACETOARSENITE	6.1	P	II	Category A	
1586	COPPER ARSENITE	6.1	P	II	Category A	
1587	COPPER CYANIDE	6.1	P	II	Category A	SG35
1588	CYANIDES, INORGANIC, SOLID, N.O.S.	6.1	P	I	Category A	SG35
1588	CYANIDES, INORGANIC, SOLID, N.O.S.	6.1	P	II	Category A	SG35
1588	CYANIDES, INORGANIC, SOLID, N.O.S.	6.1	P	III	Category A	SG35
1589	CYANOGEN CHLORIDE, STABILIZED	2.3	8P		Category D SW2	
1590	DICHLOROANILINES, LIQUID	6.1	P	II	Category A SW2	
1591	o-DICHLOROBENZENE	6.1		III	Category A	
1593	DICHLOROMETHANE	6.1		III	Category A	
1594	DIETHYL SULPHATE	6.1		II	Category C	
1595	DIMETHYL SULPHATE	6.1	8	I	Category D SW2	
1596	DINITROANILINES	6.1		II	Category A	SG15
1597	DINITROBENZENES, LIQUID	6.1		II	Category A	SG15
1597	DINITROBENZENES, LIQUID	6.1		III	Category A	SG15
1598	DINITRO-o-CRESOL	6.1	P	II	Category A	
1599	DINITROPHENOL SOLUTION	6.1	P	II	Category A	SG30

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1599	DINITROPHENOL SOLUTION	6.1	P	III	Category A	SG30
1600	DINITROTOLUENES, MOLTEN	6.1		II	Category C	
1601	DISINFECTANT, SOLID, TOXIC, N.O.S.	6.1		I	Category A SW2	
1601	DISINFECTANT, SOLID, TOXIC, N.O.S.	6.1		II	Category A SW2	
1601	DISINFECTANT, SOLID, TOXIC, N.O.S.	6.1		III	Category A SW2	
1602	DYE, LIQUID, TOXIC, N.O.S. or DYE INTERMEDIATE, LIQUID, TOXIC, N.O.S.	6.1		I	Category A	
1602	DYE, LIQUID, TOXIC, N.O.S. or DYE INTERMEDIATE, LIQUID, TOXIC, N.O.S.	6.1		II	Category A	
1602	DYE, LIQUID, TOXIC, N.O.S. or DYE INTERMEDIATE, LIQUID, TOXIC, N.O.S.	6.1		III	Category A	
1603	ETHYL BROMOACETATE	6.1	3	II	Category D SW2	
1604	ETHYLENEDIAMINE	8	3	II	Category A SW2	SG35
1605	ETHYLENE DIBROMIDE	6.1		I	Category D SW2	
1606	FERRIC ARSENATE	6.1	P	II	Category A	
1607	FERRIC ARSENITE	6.1	P	II	Category A	
1608	FERROUS ARSENATE	6.1	P	II	Category A	
1611	HEXAETHYL TETRAPHOSPHATE	6.1	P	II	Category E SW2	
1612	HEXAETHYL TETRAPHOSPHATE AND COMPRESSED GAS MIXTURE	2.3			Category D SW2	
1613	HYDROCYANIC ACID, AQUEOUS SOLUTION (HYDROGEN CYANIDE, AQUEOUS SOLUTION) with not more th	6.1	P	I	Category D SW2	
1614	HYDROGEN CYANIDE, STABILIZED containing less than 3% water and absorbed in a porous iner	6.1	P	I	Category D SW1 SW2	
1616	LEAD ACETATE	6.1	P	III	Category A	
1617	LEAD ARSENATES	6.1	P	II	Category A	
1618	LEAD ARSENITES	6.1	P	II	Category A	
1620	LEAD CYANIDE	6.1	P	II	Category A	SG35
1621	LONDON PURPLE	6.1	P	II	Category A	
1622	MAGNESIUM ARSENATE	6.1	P	II	Category A	
1623	MERCURIC ARSENATE	6.1	P	II	Category A	
1624	MERCURIC CHLORIDE	6.1	P	II	Category A	
1625	MERCURIC NITRATE	6.1	P	II	Category A	
1626	MERCURIC POTASSIUM CYANIDE	6.1	P	I	Category A	SG35
1627	MERCUROUS NITRATE	6.1	P	II	Category A	
1629	MERCURY ACETATE	6.1	P	II	Category A	
1630	MERCURY AMMONIUM CHLORIDE	6.1	P	II	Category A	
1631	MERCURY BENZOATE	6.1	P	II	Category A	
1634	MERCURY BROMIDES	6.1	P	II	Category A	
1636	MERCURY CYANIDE	6.1	P	II	Category A	SG35

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1637	MERCURY GLUCONATE	6.1	P	II	Category A	
1638	MERCURY IODIDE	6.1	P	II	Category A	
1639	MERCURY NUCLEATE	6.1	P	II	Category A	
1640	MERCURY OLEATE	6.1	P	II	Category A	
1641	MERCURY OXIDE	6.1	P	II	Category A	
1642	MERCURY OXYCYANIDE, DESENSITIZED	6.1	P	II	Category A	SG15 SG35
1643	MERCURY POTASSIUM IODIDE	6.1	P	II	Category A	
1644	MERCURY SALICYLATE	6.1	P	II	Category A	
1645	MERCURY SULPHATE	6.1	P	II	Category A	
1646	MERCURY THIOCYANATE	6.1	P	II	Category A	
1647	METHYL BROMIDE AND ETHYLENE DIBROMIDE MIXTURE, LIQUID	6.1	P	I	Category D SW2	
1648	ACETONITRILE	3		II	Category B SW2	
1649	MOTOR FUEL ANTI-KNOCK MIXTURE	6.1	P	I	Category D SW1 SW2	
1650	beta-NAPHTHYLAMINE, SOLID	6.1		II	Category A	
1651	NAPHTHYLTHIOUREA	6.1		II	Category A	
1652	NAPHTHYLUREA	6.1		II	Category A	
1653	NICKEL CYANIDE	6.1	P	II	Category A	SG35
1654	NICOTINE	6.1		II	Category A	
1655	NICOTINE COMPOUND, SOLID, N.O.S. or NICOTINE PREPARATION, SOLID, N.O.S.	6.1		I	Category B	
1655	NICOTINE COMPOUND, SOLID, N.O.S. or NICOTINE PREPARATION, SOLID, N.O.S.	6.1		II	Category A	
1655	NICOTINE COMPOUND, SOLID, N.O.S. or NICOTINE PREPARATION, SOLID, N.O.S.	6.1		III	Category A	
1656	NICOTINE HYDROCHLORIDE, LIQUID or SOLUTION	6.1		II	Category A	
1656	NICOTINE HYDROCHLORIDE, LIQUID or SOLUTION	6.1		III	Category A	
1657	NICOTINE SALICYLATE	6.1		II	Category A	
1658	NICOTINE SULPHATE SOLUTION	6.1		II	Category A	
1658	NICOTINE SULPHATE SOLUTION	6.1		III	Category A	
1659	NICOTINE TARTRATE	6.1		II	Category A	
1660	NITRIC OXIDE, COMPRESSED	2.3	5.1/8		Category D SW2	SG6 SG19
1661	NITROANILINES (o-, m-, p-)	6.1		II	Category A	
1662	NITROBENZENE	6.1		II	Category A SW2	
1663	NITROPHENOLS (o-, m-, p-)	6.1		III	Category A	
1664	NITROTOLUENES, LIQUID	6.1		II	Category A	
1665	NITROXYLENES, LIQUID	6.1		II	Category A	
1669	PENTACHLOROETHANE	6.1	P	II	Category A SW2	
1670	PERCHLOROMETHYL MERCAPTAN	6.1	P	I	Category D SW2	
1671	PHENOL, SOLID	6.1		II	Category A	

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1672	PHENYLCARBYLAMINE CHLORIDE	6.1		I	Category D SW2	
1673	PHENYLENEDIAMINES (o-, m-, p-)	6.1		III	Category A	
1674	PHENYLMERCURIC ACETATE	6.1	P	II	Category A	
1677	POTASSIUM ARSENATE	6.1		II	Category A	
1678	POTASSIUM ARSENITE	6.1		II	Category A	
1679	POTASSIUM CUPROCYANIDE	6.1	P	II	Category A	SG35
1680	POTASSIUM CYANIDE, SOLID	6.1	P	I	Category B	SG35
1683	SILVER ARSENITE	6.1	P	II	Category A	
1684	SILVER CYANIDE	6.1	P	II	Category A SW2	SG35
1685	SODIUM ARSENATE	6.1		II	Category A	
1686	SODIUM ARSENITE, AQUEOUS SOLUTION	6.1		II	Category A	
1686	SODIUM ARSENITE, AQUEOUS SOLUTION	6.1		III	Category A	
1687	SODIUM AZIDE	6.1		II	Category A	SG15 SG30 SG35
1688	SODIUM CACODYLATE	6.1		II	Category A	SG35
1689	SODIUM CYANIDE, SOLID	6.1	P	I	Category B	SG35
1690	SODIUM FLUORIDE, SOLID	6.1		III	Category A	SG35
1691	STRONTIUM ARSENITE	6.1		II	Category A	
1692	STRYCHNINE or STRYCHNINE SALTS	6.1	P	I	Category A	
1693	TEAR GAS SUBSTANCE, LIQUID, N.O.S.	6.1		I	Category D SW2	
1693	TEAR GAS SUBSTANCE, LIQUID, N.O.S.	6.1		II	Category D SW2	
1694	BROMOBENZYL CYANIDES, LIQUID	6.1		I	Category D SW1 SW2 H2	SG35
1695	CHLOROACETONE, STABILIZED	6.1	"3/8P	I	Category D SW2	SG5 SG8
1697	CHLOROACETOPHENONE, SOLID	6.1		II	Category D SW1 SW2 H2	
1698	DIPHENYLAMINE CHLOROARSINE	6.1	P	I	Category D SW2	
1699	DIPHENYLCHLOROARSINE, LIQUID	6.1	P	I	Category D SW2	
1700	TEAR GAS CANDLES	6.1	4.1	II	Category D SW2	
1701	XYLYL BROMIDE, LIQUID	6.1		II	Category D SW2	
1702	1,1,2,2-TETRACHLOROETHANE	6.1	P	II	Category A SW2	
1704	TETRAETHYL DITHIOPYROPHOSPHATE	6.1	P	II	Category D SW2	
1707	THALLIUM COMPOUND, N.O.S.	6.1	P	II	Category A	
1708	TOLUIDINES, LIQUID	6.1		II	Category A	
1709	2,4-TOLUYLENEDIAMINE, SOLID	6.1		III	Category A	
1710	TRICHLOROETHYLENE	6.1		III	Category A SW2	

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1711	XYLIDINES, LIQUID	6.1		II	Category A	
1712	ZINC ARSENATE or ZINC ARSENITE or ZINC ARSENATE, ZINC ARSENITE MIXTURE	6.1		II	Category A	
1713	ZINC CYANIDE	6.1	P	I	Category A	SG35
1714	ZINC PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
1715	ACETIC ANHYDRIDE	8	3	II	Category A SW2	
1716	ACETYL BROMIDE	8		II	Category C SW2	
1717	ACETYL CHLORIDE	3	8	II	Category B SW2	
1718	BUTYL ACID PHOSPHATE	8		III	Category A	
1719	CAUSTIC ALKALI LIQUID, N.O.S.	8		II	Category A	SG22 SG35
1719	CAUSTIC ALKALI LIQUID, N.O.S.	8		III	Category A	SG22 SG35
1722	ALLYL CHLOROFORMATE	6.1	"3/8	I	Category D SW2	SG5 SG8
1723	ALLYL IODIDE	3	8	II	Category B SW2	
1724	ALLYLTRICHLOROSILANE, STABILIZED	8	3	II	Category C SW2	
1725	ALUMINIUM BROMIDE, ANHYDROUS	8		II	Category A SW2	
1726	ALUMINIUM CHLORIDE, ANHYDROUS	8		II	Category A SW2	
1727	AMMONIUM HYDROGENDIFLUORIDE, SOLID	8		II	Category A SW1 SW2	SG35
1728	AMYLTRICHLOROSILANE	8		II	Category C SW2	
1729	ANISOYL CHLORIDE	8		II	Category C SW2	
1730	ANTIMONY PENTACHLORIDE, LIQUID	8		II	Category C SW2	
1731	ANTIMONY PENTACHLORIDE SOLUTION	8		II	Category C SW2	
1731	ANTIMONY PENTACHLORIDE SOLUTION	8		III	Category C SW2	
1732	ANTIMONY PENTAFLUORIDE	8	6.1	II	Category D SW2	SG6 SG8 SG10 SG12
1733	ANTIMONY TRICHLORIDE	8		II	Category C SW2	
1736	BENZOYL CHLORIDE	8		II	Category C SW2	
1737	BENZYL BROMIDE	6.1		II	Category D SW2 H1	
1738	BENZYL CHLORIDE	6.1	8	II	Category D SW2 H1	
1739	BENZYL CHLOROFORMATE	8	P	I	Category D SW2	

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1740	HYDROGENDIFLUORIDES, SOLID, N.O.S.	8		II	Category A SW1 SW2	SG35
1740	HYDROGENDIFLUORIDES, SOLID, N.O.S.	8		III	Category A SW1 SW2	SG35
1741	BORON TRICHLORIDE	2.3	8		Category D SW1 SW2	
1742	BORON TRIFLUORIDE ACETIC ACID COMPLEX, LIQUID	8		II	Category A	
1743	BORON TRIFLUORIDE PROPIONIC ACID COMPLEX, LIQUID	8		II	Category A	
1744	BROMINE or BROMINE SOLUTION	8	6.1	I	Category D SW1 SW2 H2	SG6 SG16 SG17 SG19
1745	BROMINE PENTAFLUORIDE	5.1	6.1/8	I	Category D SW1 SW2	SG6 SG16 SG19
1746	BROMINE TRIFLUORIDE	5.1	6.1/8	I	Category D SW1 SW2	SG6 SG16 SG19
1747	BUTYLTRICHLOROSILANE	8	3	II	Category C SW2	
1748	CALCIUM HYPOCHLORITE, DRY or CALCIUM HYPOCHLORITE MIXTURE, DRY with more than 39% available chlorine (8.8% available oxygen)	5.1		II	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
1748	CALCIUM HYPOCHLORITE, DRY or CALCIUM HYPOCHLORITE MIXTURE, DRY with more than 39% available chlorine (8.8% available oxygen)	5.1		III	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
1749	CHLORINE TRIFLUORIDE	2.3	5.1/8		Category D SW2	SG6 SG19
1750	CHLOROACETIC ACID SOLUTION	6.1	8	II	Category C SW2	
1751	CHLOROACETIC ACID, SOLID	6.1	8	II	Category C SW2	
1752	CHLOROACETYL CHLORIDE	6.1	8	I	Category D SW2	
1753	CHLOROPHENYLTRICHLOROSI LANE	8	P	II	Category C SW2	
1754	CHLOROSULPHONIC ACID (with or without sulphur trioxide)	8		I	Category C SW2	
1755	CHROMIC ACID SOLUTION	8		II	Category C SW2	SG6 SG8 SG10 SG12
1755	CHROMIC ACID SOLUTION	8		III	Category C SW2	SG6 SG8 SG10 SG12
1756	CHROMIC FLUORIDE, SOLID	8		II	Category A	SG35
1757	CHROMIC FLUORIDE SOLUTION	8		II	Category A	
1757	CHROMIC FLUORIDE SOLUTION	8		III	Category A	
1758	CHROMIUM OXYCHLORIDE	8		I	Category C SW2	SG6 SG16 SG17 SG19

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1759	CORROSIVE SOLID, N.O.S.	8		I	Category B	
1759	CORROSIVE SOLID, N.O.S.	8		II	Category A	
1759	CORROSIVE SOLID, N.O.S.	8		III	Category A	
1760	CORROSIVE LIQUID, N.O.S.	8		I	Category B SW2	
1760	CORROSIVE LIQUID, N.O.S.	8		II	Category B SW2	
1760	CORROSIVE LIQUID, N.O.S.	8		III	Category A SW2	
1761	CUPRIETHYLENEDIAMINE SOLUTION	8	6.1 P	II	Category A	
1761	CUPRIETHYLENEDIAMINE SOLUTION	8	6.1 P	III	Category A	
1762	CYCLOHEXENYLTRICHLOROSILANE	8		II	Category C SW2	
1763	CYCLOHEXYLTRICHLOROSILANE	8		II	Category C SW2	
1764	DICHLOROACETIC ACID	8		II	Category A	
1765	DICHLOROACETYL CHLORIDE	8		II	Category D SW2	
1766	DICHLOROPHENYLTRICHLOROSILANE	8	P	II	Category C SW2	
1767	DIETHYLDICHLOROSILANE	8	3	II	Category C SW2	
1768	DIFLUOROPHOSPHORIC ACID, ANHYDROUS	8		II	Category A SW2	
1769	DIPHENYLDICHLOROSILANE	8		II	Category C SW2	
1770	DIPHENYLMETHYL BROMIDE	8		II	Category D SW2	
1771	DODECYLTRICHLOROSILANE	8		II	Category C SW2	
1773	FERRIC CHLORIDE, ANHYDROUS	8		III	Category A	
1774	FIRE EXTINGUISHER CHARGES corrosive liquid	8		II	Category A	
1775	FLUOROBORIC ACID	8		II	Category A	
1776	FLUOROPHOSPHORIC ACID, ANHYDROUS	8		II	Category A	
1777	FLUOROSULPHONIC ACID	8		I	Category D SW2	
1778	FLUOROSILICIC ACID	8		II	Category A	
1779	FORMIC ACID with more than 85% acid, by mass	8	3	II	Category A SW2	
1780	FUMARYL CHLORIDE	8		II	Category C SW2	
1781	HEXADECYLTRICHLOROSILANE	8		II	Category C SW2	
1782	HEXAFLUOROPHOSPHORIC ACID	8		II	Category A	
1783	HEXAMETHYLENEDIAMINE SOLUTION	8		II	Category A	
1783	HEXAMETHYLENEDIAMINE SOLUTION	8		III	Category A	
1784	HEXYLTRICHLOROSILANE	8		II	Category C SW2	
1786	HYDROFLUORIC ACID AND SULPHURIC ACID MIXTURE	8	6.1	I	Category D SW2	
1787	HYDRIODIC ACID	8		II	Category C	

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1787	HYDRIODIC ACID	8		III	Category C	
1788	HYDROBROMIC ACID	8		II	Category C	
1788	HYDROBROMIC ACID	8		III	Category C	
1789	HYDROCHLORIC ACID	8		II	Category C	
1789	HYDROCHLORIC ACID	8		III	Category C	
1790	HYDROFLUORIC ACID solution, with more than 60% hydrogen fluoride	8	6.1	I	Category D SW1 SW2 H2	
1790	HYDROFLUORIC ACID solution, with not more than 60% hydrogen fluoride	8	6.1	II	Category D SW1 SW2 H2	
1791	HYPOCHLORITE SOLUTION	8		II	Category B	SG20
1791	HYPOCHLORITE SOLUTION	8		III	Category B	SG20
1792	IODINE MONOCHLORIDE	8		II	Category D SW2	SG6 SG16 SG17 SG19
1793	ISOPROPYL ACID PHOSPHATE	8		III	Category A	
1794	LEAD SULPHATE with more than 3% free acid	8		II	Category A	
1796	NITRATING ACID MIXTURE with more than 50% nitric acid	8	5.1	I	Category D SW2	SG16
1796	NITRATING ACID MIXTURE with not more than 50% nitric acid	8		II	Category D SW2	
1798	NITROHYDROCHLORIC ACID	8		I	Category D SW2	SG6 SG16 SG17 SG19
1799	NONYLTRICHLOROSILANE	8		II	Category C SW2	
1800	OCTADECYLTRICHLOROSILAN E	8		II	Category C SW2	
1801	OCTYLTRICHLOROSILANE	8		II	Category C SW2	
1802	PERCHLORIC ACID with not more than 50% acid, by mass	8	5.1	II	Category C	SG16
1803	PHENOLSULPHONIC ACID, LIQUID	8		II	Category C SW15	
1804	PHENYLTRICHLOROSILANE	8		II	Category C SW2	
1805	PHOSPHORIC ACID SOLUTION	8		III	Category A	
1806	PHOSPHORUS PENTACHLORIDE	8		II	Category C SW2	SG6 SG8 SG10 SG12
1807	PHOSPHORUS PENTOXIDE	8		II	Category A	
1808	PHOSPHORUS TRIBROMIDE	8		II	Category C SW2	
1809	PHOSPHORUS TRICHLORIDE	6.1	8	I	Category D SW2	
1810	PHOSPHORUS OXYCHLORIDE	6.1	8	I	Category D SW2	
1811	POTASSIUM HYDROGEN DIFLUORIDE, SOLID	8	6.1	II	Category A SW1 SW2	SG35
1812	POTASSIUM FLUORIDE, SOLID	6.1		III	Category A	SG35
1813	POTASSIUM HYDROXIDE, SOLID	8		II	Category A	SG35

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1814	POTASSIUM HYDROXIDE SOLUTION	8		II	Category A	SG35
1814	POTASSIUM HYDROXIDE SOLUTION	8		III	Category A	SG35
1815	PROPIONYL CHLORIDE	3	8	II	Category B SW2	
1816	PROPYLTRICHLOROSILANE	8	3	II	Category C SW2	
1817	PYROSULPHURYL CHLORIDE	8		II	Category C SW2	
1818	SILICON TETRACHLORIDE	8		II	Category C SW2	SG72
1819	SODIUM ALUMINATE SOLUTION	8		II	Category A	SG35
1819	SODIUM ALUMINATE SOLUTION	8		III	Category A	SG35
1823	SODIUM HYDROXIDE, SOLID	8		II	Category A	SG35
1824	SODIUM HYDROXIDE SOLUTION	8		II	Category A	SG35
1824	SODIUM HYDROXIDE SOLUTION	8		III	Category A	SG35
1825	SODIUM MONOXIDE	8		II	Category A	SG35
1826	NITRATING ACID MIXTURE, SPENT with more than 50% nitric acid	8	5.1	I	Category D SW2	SG16
1826	NITRATING ACID MIXTURE, SPENT with not more than 50% nitric acid	8		II	Category D SW2	
1827	STANNIC CHLORIDE, ANHYDROUS	8		II	Category C	
1828	SULPHUR CHLORIDES	8		I	Category C SW2	
1829	SULPHUR TRIOXIDE, STABILIZED	8		I	Category C SW2	
1830	SULPHURIC ACID with more than 51% acid	8		II	Category C SW15	
1831	SULPHURIC ACID, FUMING	8	6.1	I	Category C SW2 SW15	
1832	SULPHURIC ACID, SPENT	8		II	Category C SW15	
1833	SULPHUROUS ACID	8		II	Category B SW2	
1834	SULPHURYL CHLORIDE	6.1	8	I	Category D SW2	
1835	TETRAMETHYLAMMONIUM HYDROXIDE SOLUTION	8		II	Category A	SG35
1835	TETRAMETHYLAMMONIUM HYDROXIDE SOLUTION	8		III	Category A	SG35
1836	THIONYL CHLORIDE	8		I	Category C SW2	
1837	THIOPHOSPHORYL CHLORIDE	8		II	Category C SW2	
1838	TITANIUM TETRACHLORIDE	6.1	8	I	Category D SW2	
1839	TRICHLOROACETIC ACID, SOLID	8		II	Category A	
1840	ZINC CHLORIDE SOLUTION	8		III	Category A	
1841	ACETALDEHYDE AMMONIA	9		III	Category A	SG29
1843	AMMONIUM DINITRO-o-CRESOLATE, SOLID	6.1	P	II	Category B	SG15 SG16 SG30 SG63
1845	CARBON DIOXIDE, SOLID (DRY ICE)	9			Category C SW2	

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1846	CARBON TETRACHLORIDE	6.1	P	II	Category A SW2	
1847	POTASSIUM SULPHIDE, HYDRATED with not less than 30% water of crystallization	8		II	Category A	SG35
1848	PROPIONIC ACID with not less than 10% and less than 90% acid, by mass	8		III	Category A	
1849	SODIUM SULPHIDE, HYDRATED with not less than 30% water	8		II	Category A	SG35
1851	MEDICINE, LIQUID, TOXIC, N.O.S.	6.1		II	Category C SW2	
1851	MEDICINE, LIQUID, TOXIC, N.O.S.	6.1		III	Category C SW2	
1854	BARIUM ALLOYS, PYROPHORIC	4.2		I	Category D	
1855	CALCIUM, PYROPHORIC or CALCIUM ALLOYS, PYROPHORIC	4.2		I	Category D	
1856	RAGS, OILY	4.2			Category A	
1857	TEXTILE WASTE, WET	4.2		III	Category A	
1858	HEXAFLUOROPROPYLENE (REFRIGERANT GAS R 1216)	2.2			Category A	
1859	SILICON TETRAFLUORIDE	2.3	8		Category D SW2	
1860	VINYL FLUORIDE, STABILIZED	2.1			Category E SW2	
1862	ETHYL CROTONATE	3		II	Category B	
1863	FUEL, AVIATION, TURBINE ENGINE	3		I	Category E	
1863	FUEL, AVIATION, TURBINE ENGINE	3		II	Category B	
1863	FUEL, AVIATION, TURBINE ENGINE	3		III	Category A	
1865	n-PROPYL NITRATE	3		II	Category D	SG6 SG8 SG10 SG12
1866	RESIN SOLUTION flammable	3		I	Category E	
1866	RESIN SOLUTION flammable	3		II	Category B	
1866	RESIN SOLUTION flammable	3		III	Category A	
1868	DECABORANE	4.1	6.1	II	Category A	SG17
1869	MAGNESIUM or MAGNESIUM ALLOYS with more than 50% magnesium in pellets, turnings or ribbons	4.1		III	Category A	SG17 SG32 SG35 SG36 SG52
1870	POTASSIUM BOROHYDRIDE	4.3		I	Category E	SG35
1871	TITANIUM HYDRIDE	4.1		II	Category E	
1872	LEAD DIOXIDE	5.1		III	Category A	
1873	PERCHLORIC ACID with more than 50% but not more than 72% acid, by mass	5.1	8	I	Category D	SG16
1884	BARIUM OXIDE	6.1		III	Category A	
1885	BENZIDINE	6.1		II	Category A	
1886	BENZYLIDENE CHLORIDE	6.1		II	Category D SW2	
1887	BROMOCHLOROMETHANE	6.1		III	Category A	
1888	CHLOROFORM	6.1		III	Category A SW2	

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1889	CYANOGEN BROMIDE	6.1	8P	I	Category D SW2	SG35
1891	ETHYL BROMIDE	6.1		II	Category B SW2 SW5	
1892	ETHYLDICHLOROARSINE	6.1	P	I	Category D SW2	
1894	PHENYLMERCURIC HYDROXIDE	6.1	P	II	Category A	
1895	PHENYLMERCURIC NITRATE	6.1	P	II	Category A	
1897	TETRACHLOROETHYLENE	6.1	P	III	Category A SW2	
1898	ACETYL IODIDE	8		II	Category C SW2	
1902	DIISOOCTYL ACID PHOSPHATE	8		III	Category A	
1903	DISINFECTANT, LIQUID, CORROSIVE, N.O.S.	8		I	Category B	
1903	DISINFECTANT, LIQUID, CORROSIVE, N.O.S.	8		II	Category B	
1903	DISINFECTANT, LIQUID, CORROSIVE, N.O.S.	8		III	Category A	
1905	SELENIC ACID	8		I	Category A	
1906	SLUDGE ACID	8		II	Category C SW15	
1907	SODA LIME with more than 4% sodium hydroxide	8		III	Category A	SG35
1908	CHLORITE SOLUTION	8		II	Category B	SG6 SG8 SG10 SG12 SG20
1908	CHLORITE SOLUTION	8		III	Category B	SG6 SG8 SG10 SG12 SG20
1910	CALCIUM OXIDE	8			-	
1911	DIBORANE	2.3	2.1		Category D SW2	SG46
1912	METHYL CHLORIDE AND METHYLENE CHLORIDE MIXTURE	2.1			Category D SW2	
1913	NEON, REFRIGERATED LIQUID	2.2			Category D	
1914	BUTYL PROPIONATES	3		III	Category A	
1915	CYCLOHEXANONE	3		III	Category A	
1916	2,2'-DICHLORODIETHYL ETHER	6.1	3	II	Category A	
1917	ETHYL ACRYLATE, STABILIZED	3		II	Category B SW2	
1918	ISOPROPYLBENZENE	3		III	Category A	
1919	METHYL ACRYLATE, STABILIZED	3		II	Category B	
1920	NONANES	3		III	Category A	
1921	PROPYLENEIMINE, STABILIZED	3	6.1	I	Category B SW2	
1922	PYRROLIDINE	3	8	II	Category B SW2	SG35
1923	CALCIUM DITHIONITE (CALCIUM HYDROSULPHITE)	4.2		II	Category E H1	
1928	METHYLMAGNESIUM BROMIDE IN ETHYL ETHER	4.3	3	I	Category D	
1929	POTASSIUM DITHIONITE (POTASSIUM HYDROSULPHITE)	4.2		II	Category E H1	

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1931	ZINC DITHIONITE (ZINC HYDROSULPHITE)	9		III	Category A H1	SG11 SG20
1932	ZIRCONIUM, SCRAP	4.2		III	Category D	
1935	CYANIDE SOLUTION, N.O.S.	6.1	P	I	Category B SW2	SG35
1935	CYANIDE SOLUTION, N.O.S.	6.1	P	II	Category A SW2	SG35
1935	CYANIDE SOLUTION, N.O.S.	6.1	P	III	Category A SW2	SG35
1938	BROMOACETIC ACID SOLUTION	8		II	Category A SW2	
1938	BROMOACETIC ACID SOLUTION	8		III	Category A SW2	
1939	PHOSPHORUS OXYBROMIDE, SOLID	8		II	Category C SW1 SW2 H2	
1940	THIOGLYCOLIC ACID	8		II	Category A	
1941	DIBROMODIFLUOROMETHANE	9		III	Category A SW1	
1942	AMMONIUM NITRATE with not more than 0.2% total combustible material, including any organ	5.1		III	Category C SW1 SW14 SW23	SG16 SG42 SG45 SG47 SG48 SG51 SG56 SG58 SG59 SG61
1944	MATCHES, SAFETY (book, card or strike on box)	4.1		III	Category A	
1945	MATCHES, WAX 'VESTA'	4.1		III	Category B	
1950	AEROSOLS	2	SP63		- SW1 SW22	SG69
1951	ARGON, REFRIGERATED LIQUID	2.2			Category D	
1952	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with not more than 9% ethylene oxide	2.2			Category A	
1953	COMPRESSED GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1		Category D SW2	
1954	COMPRESSED GAS, FLAMMABLE, N.O.S.	2.1			Category D SW2	
1955	COMPRESSED GAS, TOXIC, N.O.S.	2.3			Category D SW2	
1956	COMPRESSED GAS, N.O.S.	2.2			Category A	
1957	DEUTERIUM, COMPRESSED	2.1			Category E SW2	
1958	1,2-DICHLORO-1,1,2,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 114)	2.2			Category A	
1959	1,1-DIFLUOROETHYLENE (REFRIGERANT GAS R 1132a)	2.1			Category E SW2	
1961	ETHANE, REFRIGERATED LIQUID	2.1			Category D SW2	
1962	ETHYLENE	2.1			Category E SW2	
1963	HELIUM, REFRIGERATED LIQUID	2.2			Category D	

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1964	HYDROCARBON GAS MIXTURE, COMPRESSED, N.O.S.	2.1			Category E SW2	
1965	HYDROCARBON GAS MIXTURE, LIQUEFIED, N.O.S.	2.1			Category E SW2	
1966	HYDROGEN, REFRIGERATED LIQUID	2.1			Category D SW2	SG46
1967	INSECTICIDE GAS, TOXIC, N.O.S.	2.3			Category D SW2	
1968	INSECTICIDE GAS, N.O.S.	2.2			Category A	
1969	ISOBUTANE	2.1			Category E SW2	
1970	KRYPTON, REFRIGERATED LIQUID	2.2			Category D	
1971	METHANE, COMPRESSED or NATURAL GAS, COMPRESSED with high methane content	2.1			Category E SW2	
1972	METHANE, REFRIGERATED LIQUID or NATURAL GAS, REFRIGERATED LIQUID with high methane conte	2.1			Category D SW2	
1973	CHLORODIFLUOROMETHANE AND CHLOROPENTAFLUOROETHANE MIXTURE with a fixed boiling point, with approximately 49% chlorodifluoromethane (REFRIGERANT GAS R 502)	2.2			Category A	
1974	CHLORODIFLUOROBROMOMETHANE (REFRIGERANT GAS R 12B1)	2.2			Category A	
1975	NITRIC OXIDE AND DINITROGEN TETROXIDE MIXTURE (NITRIC OXIDE AND NITROGEN DIOXIDE MIXTURE	2.3			Category D SW2	SG6 SG19
1976	OCTAFLUOROCYCLOBUTANE (REFRIGERANT GAS RC 318)	2.2			Category A	
1977	NITROGEN, REFRIGERATED LIQUID	2.2			Category D	
1978	PROPANE	2.1			Category E SW2	
1982	TETRAFLUOROMETHANE (REFRIGERANT GAS R 14)	2.2			Category A	
1983	1-CHLORO-2,2,2-TRIFLUOROETHANE (REFRIGERANT GAS R 133a)	2.2			Category A	
1984	TRIFLUOROMETHANE (REFRIGERANT GAS R 23)	2.2			Category A	
1986	ALCOHOLS, FLAMMABLE, TOXIC, N.O.S.	3	6.1	I	Category E SW2	
1986	ALCOHOLS, FLAMMABLE, TOXIC, N.O.S.	3	6.1	II	Category B SW2	
1986	ALCOHOLS, FLAMMABLE, TOXIC, N.O.S.	3	6.1	III	Category A	
1987	ALCOHOLS, N.O.S.	3		II	Category B	
1987	ALCOHOLS, N.O.S.	3		III	Category A	
1988	ALDEHYDES, FLAMMABLE, TOXIC, N.O.S.	3	6.1	I	Category E SW2	
1988	ALDEHYDES, FLAMMABLE, TOXIC, N.O.S.	3	6.1	II	Category B SW2	
1988	ALDEHYDES, FLAMMABLE, TOXIC, N.O.S.	3	6.1	III	Category A	
1989	ALDEHYDES, N.O.S.	3		I	Category E	
1989	ALDEHYDES, N.O.S.	3		II	Category B	
1989	ALDEHYDES, N.O.S.	3		III	Category A	
1990	BENZALDEHYDE	9		III	Category A	

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1991	CHLOROPRENE, STABILIZED	3	6.1	I	Category D SW2	
1992	FLAMMABLE LIQUID, TOXIC, N.O.S.	3	6.1	I	Category E SW2	
1992	FLAMMABLE LIQUID, TOXIC, N.O.S.	3	6.1	II	Category B SW2	
1992	FLAMMABLE LIQUID, TOXIC, N.O.S.	3	6.1	III	Category A	
1993	FLAMMABLE LIQUID, N.O.S.	3		I	Category E	
1993	FLAMMABLE LIQUID, N.O.S.	3		II	Category B	
1993	FLAMMABLE LIQUID, N.O.S.	3		III	Category A	
1994	IRON PENTACARBONYL	6.1	3	I	Category D SW2	
1999	TARS, LIQUID, including road oils and cutback bitumens	3		II	Category B	
1999	TARS, LIQUID, including road oils and cutback bitumens	3		III	Category A	
2000	CELLULOID in block, rods, rolls, sheets, tubes, etc., except scrap	4.1		III	Category A	
2001	COBALT NAPHTHENATES, POWDER	4.1		III	Category A	
2002	CELLULOID, SCRAP	4.2		III	Category D	
2004	MAGNESIUM DIAMIDE	4.2		II	Category C	
2006	PLASTICS, NITROCELLULOSE-BASED, SELF-HEATING, N.O.S.	4.2		III	Category C	
2008	ZIRCONIUM POWDER, DRY	4.2		I	Category D	
2008	ZIRCONIUM POWDER, DRY	4.2		II	Category D	
2008	ZIRCONIUM POWDER, DRY	4.2		III	Category D	
2009	ZIRCONIUM, DRY finished sheets, strip or coiled wire	4.2		III	Category D	
2010	MAGNESIUM HYDRIDE	4.3		I	Category E	SG35
2011	MAGNESIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
2012	POTASSIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
2013	STRONTIUM PHOSPHIDE	4.3	6.1	I	Category E SW2 SW5	SG35
2014	HYDROGEN PEROXIDE, AQUEOUS SOLUTION with not less than 20% but not more than 60% hydroge	5.1	8	II	Category D SW1	SG16 SG59 SG72
2015	HYDROGEN PEROXIDE, STABILIZED or HYDROGEN PEROXIDE, AQUEOUS SOLUTION, STABILIZED with mo	5.1	8	I	Category D SW1	SG16 SG59
2016	AMMUNITION, TOXIC, NON-EXPLOSIVE without burster or expelling charge, non-fuzed	6.1		II	Category E SW2 H1	
2017	AMMUNITION, TEAR-PRODUCING, NON-EXPLOSIVE without burster or expelling charge, non-fuzed	6.1		II	Category E SW2 H1	
2018	CHLOROANILINES, SOLID	6.1		II	Category A	
2019	CHLOROANILINES, LIQUID	6.1		II	Category A	SG35
2020	CHLOROPHENOLS, SOLID	6.1		III	Category A	
2021	CHLOROPHENOLS, LIQUID	6.1		III	Category A	
2022	CRESYLIC ACID	6.1	8	II	Category B	

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2023	EPICHLOROHYDRIN	6.1	3P	II	Category A SW2	
2024	MERCURY COMPOUND, LIQUID, N.O.S.	6.1	P	I	Category B SW2	
2024	MERCURY COMPOUND, LIQUID, N.O.S.	6.1	P	II	Category B SW2	
2024	MERCURY COMPOUND, LIQUID, N.O.S.	6.1	P	III	Category B SW2	
2025	MERCURY COMPOUND, SOLID, N.O.S.	6.1	P	I	Category A	
2025	MERCURY COMPOUND, SOLID, N.O.S.	6.1	P	II	Category A	
2025	MERCURY COMPOUND, SOLID, N.O.S.	6.1	P	III	Category A	
2026	PHENYLMERCURIC COMPOUND, N.O.S.	6.1	P	I	Category A	
2026	PHENYLMERCURIC COMPOUND, N.O.S.	6.1	P	II	Category A	
2026	PHENYLMERCURIC COMPOUND, N.O.S.	6.1	P	III	Category A	
2027	SODIUM ARSENITE, SOLID	6.1		II	Category A	
2028	BOMBS, SMOKE, NON-EXPLOSIVE with corrosive liquid, without initiating device	8		II	Category E SW2	
2029	HYDRAZINE, ANHYDROUS	8	3/6.1	I	Category D SW2	SG5 SG8 SG35
2030	HYDRAZINE, AQUEOUS SOLUTION with more than 37% hydrazine, by mass	8	6.1	I	Category D SW2	SG35
2030	HYDRAZINE, AQUEOUS SOLUTION with more than 37% hydrazine, by mass	8	6.1	II	Category D SW2	SG35
2030	HYDRAZINE, AQUEOUS SOLUTION with more than 37% hydrazine, by mass	8	6.1	III	Category D SW2	SG35
2031	NITRIC ACID other than red fuming, with more than 70% nitric acid	8	5.1	I	Category D	SG6 SG16 SG17 SG19
2031	NITRIC ACID other than red fuming, with at least 65% but not more than 70% nitric acid	8	5.1	II	Category D	SG6 SG16 SG17 SG19
2031	NITRIC ACID other than red fuming, with less than 65% nitric acid	8		II	Category D	
2032	NITRIC ACID, RED FUMING	8	5.1/6.1	I	Category D SW2	SG6 SG16 SG17 SG19
2033	POTASSIUM MONOXIDE	8		II	Category A	SG22 SG35
2034	HYDROGEN AND METHANE MIXTURE, COMPRESSED	2.1			Category E SW2	SG46
2035	1,1,1-TRIFLUOROETHANE (REFRIGERANT GAS R 143a)	2.1			Category B SW2	
2036	XENON	2.2			Category A	
2037	RECEPTACLES, SMALL, CONTAINING GAS (GAS CARTRIDGES) without a release device, non refill	2			Category B SW2	
2038	DINITROTOLUENES, LIQUID	6.1		II	Category A	
2044	2,2-DIMETHYLPROPANE	2.1			Category E SW2	
2045	ISOBUTYL ALDEHYDE (ISOBUTYRALDEHYDE)	3		II	Category E SW2	

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2046	CYMENES	3	P	III	Category A	
2047	DICHLOROPROPENES	3		II	Category B	
2047	DICHLOROPROPENES	3		III	Category A	
2048	DICYCLOPENTADIENE	3		III	Category A	
2049	DIETHYLBENZENES	3		III	Category A	
2050	DIISOBUTYLENES, ISOMERIC COMPOUNDS	3		II	Category B	
2051	2-DIMETHYLAMINOETHANOL	8	3	II	Category A	
2052	DIPENTENE	3	P	III	Category A	
2053	METHYL ISOBUTYL CARBINOL	3		III	Category A	
2054	MORPHOLINE	8	3	I	Category A	
2055	STYRENE MONOMER, STABILIZED	3		III	Category A	
2056	TETRAHYDROFURAN	3		II	Category B	
2057	TRIPROPYLENE	3		II	Category B	
2057	TRIPROPYLENE	3		III	Category A	
2058	VALERALDEHYDE	3		II	Category B	
2059	NITROCELLULOSE SOLUTION, FLAMMABLE with not more than 12.6% nitrogen, by dry mass, and n	3		I	Category E	
2059	NITROCELLULOSE SOLUTION, FLAMMABLE with not more than 12.6% nitrogen, by dry mass, and n	3		II	Category B	
2059	NITROCELLULOSE SOLUTION, FLAMMABLE with not more than 12.6% nitrogen, by dry mass, and n	3		III	Category A	
2067	AMMONIUM NITRATE BASED FERTILIZER	5.1		III	Category C SW1 SW14 SW23	SG16 SG42 SG45 SG47 SG48 SG51 SG56 SG58 SG59 SG61
2071	AMMONIUM NITRATE BASED FERTILIZER	9		III	Category A SW26	
2073	AMMONIA SOLUTION relative density less than 0.880 at 15°C in water, with more than 35% b	2.2			Category E SW2	SG35 SG46
2074	ACRYLAMIDE, SOLID	6.1		III	Category A SW1 H2	
2075	CHLORAL, ANHYDROUS, STABILIZED	6.1		II	Category D SW2	
2076	CRESOLS, LIQUID	6.1	8	II	Category B	
2077	alpha-NAPHTHYLAMINE	6.1		III	Category A	
2078	TOLUENE DIISOCYANATE	6.1		II	Category C SW1 SW2	
2079	DIETHYLENETRIAMINE	8		II	Category A SW2	SG35
2186	HYDROGEN CHLORIDE, REFRIGERATED LIQUID	2.3	8		-	
2187	CARBON DIOXIDE, REFRIGERATED LIQUID	2.2			Category D	
2188	ARSINE	2.3	2.1		Category D SW2	

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2189	DICHLOROSILANE	2.3	2.1/8		Category D SW2	SG4 SG9 SG72
2190	OXYGEN DIFLUORIDE, COMPRESSED	2.3	5.1/8		Category D SW2 H1	SG6 SG19
2191	SULPHURYL FLUORIDE	2.3			Category D SW2	
2192	GERMANE	2.3	2.1		Category D SW2	
2193	HEXAFLUOROETHANE (REFRIGERANT GAS R 116)	2.2			Category A	
2194	SELENIUM HEXAFLUORIDE	2.3	8		Category D SW2	
2195	TELLURIUM HEXAFLUORIDE	2.3	8		Category D SW2	
2196	TUNGSTEN HEXAFLUORIDE	2.3	8		Category D SW2	
2197	HYDROGEN IODIDE, ANHYDROUS	2.3	8		Category D SW2	
2198	PHOSPHORUS PENTAFLUORIDE	2.3	8		Category D SW2	
2199	PHOSPHINE	2.3	2.1		Category D SW2	
2200	PROPADIENE, STABILIZED	2.1			Category B SW2	
2201	NITROUS OXIDE, REFRIGERATED LIQUID	2.2			Category D SW2	
2202	HYDROGEN SELENIDE, ANHYDROUS	2.3	2.1		Category D SW2	
2203	SILANE	2.1			Category E SW2	SG43 SG46
2204	CARBONYL SULPHIDE	2.3			Category D SW2	
2205	ADIPONITRILE	6.1		III	Category A	
2206	ISOCYANATES, TOXIC, N.O.S. or ISOCYANATE SOLUTION, TOXIC, N.O.S.	6.1		II	Category E SW1 SW2	
2206	ISOCYANATES, TOXIC, N.O.S. or ISOCYANATE SOLUTION, TOXIC, N.O.S.	6.1		III	Category E SW1 SW2	
2208	CALCIUM HYPOCHLORITE MIXTURE, DRY with more than 10% but not more than 39% available chlorine	5.1		III	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
2209	FORMALDEHYDE SOLUTION with not less than 25% formaldehyde	8		III	Category A	
2210	MANEB or MANEB PREPARATION with not less than 60% maneb	4.2	4.3 P	III	Category A	SG29
2211	POLYMERIC BEADS, EXPANDABLE evolving flammable vapour	9		III	Category E SW1 SW6	SG5 SG14
2212	BLUE ASBESTOS (crocidolite) or BROWN ASBESTOS (amosite, mysorite)	9		II	Category A SW2	SG29
2213	PARAFORMALDEHYDE	4.1		III	Category A SW23	
2214	PHTHALIC ANHYDRIDE with more than 0.05% of maleic anhydride	8		III	Category A	

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2215	MALEIC ANHYDRIDE	8		III	Category A	SG50 SG57
2215	MALEIC ANHYDRIDE, MOLTEN	8		III	Category A	SG50 SG57
2216	FISHMEAL (FISHSCRAP), STABILIZED Anti-oxidant treated. Moisture content greater than 5% but not exceeding 12%, by mass. Fat content not more than 15%	9		III	Category B SW24	SG18 SG65
2217	SEED CAKE with not more than 1.5% oil and not more than 11% moisture	4.2		III	Category A SW1 SW4 H1	
2218	ACRYLIC ACID, STABILIZED	8	3	II	Category C SW1 SW2	
2219	ALLYL GLYCIDYL ETHER	3		III	Category A	
2222	ANISOLE	3		III	Category A	
2224	BENZONITRILE	6.1		II	Category A SW2	SG35
2225	BENZENESULPHONYL CHLORIDE	8		III	Category A SW2	
2226	BENZOTRICHLORIDE	8		II	Category A SW2	
2227	n-BUTYL METHACRYLATE, STABILIZED	3		III	Category A	
2232	2-CHLOROETHANAL	6.1		I	Category D SW2	
2233	CHLOROANISIDINES	6.1		III	Category A	
2234	CHLOROBENZOTRIFLUORIDES	3		III	Category A SW2	
2235	CHLOROBENZYL CHLORIDES, LIQUID	6.1	P	III	Category A	
2236	3-CHLORO-4-METHYLPHENYLISOCYANATE, LIQUID	6.1		II	Category B SW2	
2237	CHLORONITROANILINES	6.1	P	III	Category A	
2238	CHLOROTOLUENES	3		III	Category A	
2239	CHLOROTOLUIDINES, SOLID	6.1		III	Category A	
2240	CHROMOSULPHURIC ACID	8		I	Category B SW2	SG6 SG16 SG17 SG19
2241	CYCLOHEPTANE	3		II	Category B SW2	
2242	CYCLOHEPTENE	3		II	Category B	
2243	CYCLOHEXYL ACETATE	3		III	Category A	
2244	CYCLOPENTANOL	3		III	Category A	
2245	CYCLOPENTANONE	3		III	Category A	
2246	CYCLOPENTENE	3		II	Category E	
2247	n-DECANE	3		III	Category A	
2248	DI-n-BUTYLAMINE	8	3	II	Category A	
2249	DICHLORODIMETHYL ETHER, SYMMETRICAL	6.1	3	I	Category D SW2	
2250	DICHLOROPHENYL ISOCYANATES	6.1		II	Category B SW1 SW2	

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2251	BICYCLO[2.2.1]HEPTA-2,5-DIENE, STABILIZED (2,5-NORBORNADIENE, STABILIZED)	3		II	Category D	
2252	1,2-DIMETHOXYETHANE	3		II	Category B	
2253	N,N-DIMETHYLANILINE	6.1		II	Category A	
2254	MATCHES, FUSEE	4.1		III	Category A	
2256	CYCLOHEXENE	3		II	Category E	
2257	POTASSIUM	4.3		I	Category D	SG35
2258	1,2-PROPYLENEDIAMINE	8	3	II	Category A SW2	
2259	TRIETHYLENETETRAMINE	8		II	Category B SW2	SG35
2260	TRIPROPYLAMINE	3	8	III	Category A SW2	
2261	XYLENOLS, SOLID	6.1		II	Category A	
2262	DIMETHYLCARBAMOYL CHLORIDE	8		II	Category A SW2	
2263	DIMETHYLCYCLOHEXANES	3		II	Category B	
2264	N,N-DIMETHYLCYCLOHEXYLAMINE	8	3	II	Category A SW2	
2265	N,N-DIMETHYLFORMAMIDE	3		III	Category A	
2266	N,N-DIMETHYL PROPYLAMINE	3	8	II	Category B SW2	
2267	DIMETHYL THIOPHOSPHORYL CHLORIDE	6.1	8	II	Category B SW1	
2269	3,3'-IMINODIPROPYLAMINE	8		III	Category A	
2270	ETHYLAMINE, AQUEOUS SOLUTION with not less than 50% but not more than 70% ethylamine	3	8	II	Category B SW2	SG35
2271	ETHYL AMYL KETONES	3		III	Category A	
2272	N-ETHYLANILINE	6.1		III	Category A	SG17 SG35
2273	2-ETHYLANILINE	6.1		III	Category A	SG17 SG35
2274	N-ETHYL-N-BENZYLANILINE	6.1		III	Category A	
2275	2-ETHYLBUTANOL	3		III	Category A	
2276	2-ETHYLHEXYLAMINE	3	8	III	Category A SW2	
2277	ETHYL METHACRYLATE, STABILIZED	3		II	Category B	
2278	n-HEPTENE	3		II	Category B	
2279	HEXACHLOROBUTADIENE	6.1	P	III	Category A	
2280	HEXAMETHYLENEDIAMINE, SOLID	8		III	Category A SW1 H2	
2280	HEXAMETHYLENEDIAMINE, MOLTEN	8		III	Category A SW1 H2	
2281	HEXAMETHYLENE DIISOCYANATE	6.1		II	Category C SW2 H1	
2282	HEXANOLS	3		III	Category A	
2283	ISOBUTYL METHACRYLATE, STABILIZED	3		III	Category A	
2284	ISOBUTYRONITRILE	3	6.1	II	Category E SW2	

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2285	ISOCYANATOBENZOTRIFLUORIDES	6.1	3	II	Category D SW1 SW2	
2286	PENTAMETHYLHEPTANE	3		III	Category A	
2287	ISOHEPTENES	3		II	Category B	
2288	ISOHEXENES	3		II	Category E	
2289	ISOPHORONEDIAMINE	8		III	Category A	
2290	ISOPHORONE DIISOCYANATE	6.1		III	Category B SW2	
2291	LEAD COMPOUND, SOLUBLE, N.O.S.	6.1	P	III	Category A	
2293	4-METHOXY-4-METHYLPENTAN-2-ONE	3		III	Category A	
2294	N-METHYLANILINE	6.1		III	Category A	
2295	METHYL CHLOROACETATE	6.1	3	I	Category D	
2296	METHYLCYCLOHEXANE	3		II	Category B	
2297	METHYLCYCLOHEXANONES	3		III	Category A	
2298	METHYLCYCLOPENTANE	3		II	Category B	
2299	METHYL DICHLOROACETATE	6.1		III	Category A	
2300	2-METHYL-5-ETHYLPYRIDINE	6.1		III	Category A	
2301	2-METHYLFURAN	3		II	Category E	
2302	5-METHYLHEXAN-2-ONE	3		III	Category A	
2303	ISOPROPENYLBENZENE	3		III	Category A	
2304	NAPHTHALENE, MOLTEN	4.1		III	Category C	
2305	NITROBENZENESULPHONIC ACID	8		II	Category A	
2306	NITROBENZOTRIFLUORIDES, LIQUID	6.1	P	II	Category A SW2	
2307	3-NITRO-4-CHLOROBENZOTRIFLUORIDE	6.1	P	II	Category A SW2	
2308	NITROSYLSULPHURIC ACID, LIQUID	8		II	Category D SW2	SG6 SG16 SG17 SG19
2309	OCTADIENE	3		II	Category B	
2310	PENTANE-2,4-DIONE	3	6.1	III	Category A	
2311	PHENETIDINES	6.1		III	Category A	
2312	PHENOL, MOLTEN	6.1		II	Category B SW2	
2313	PICOLINES	3		III	Category A SW2	
2315	POLYCHLORINATED BIPHENYLS, LIQUID	9	P	II	Category A	SG50
2316	SODIUM CUPROCYANIDE, SOLID	6.1	P	I	Category A	SG35
2317	SODIUM CUPROCYANIDE SOLUTION	6.1	P	I	Category B SW2	SG35
2318	SODIUM HYDROSULPHIDE with less than 25% water of crystallization	4.2		II	Category A	SG35
2319	TERPENE HYDROCARBONS, N.O.S.	3		III	Category A	
2320	TETRAETHYLENEPENTAMINE	8		III	Category A	SG35
2321	TRICHLOROBENZENES, LIQUID	6.1	P	III	Category A	

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2322	TRICHLOROBUTENE	6.1	P	II	Category A SW1 SW2	
2323	TRIETHYL PHOSPHITE	3		III	Category A	
2324	TRIISOBUTYLENE	3		III	Category A	
2325	1,3,5-TRIMETHYLBENZENE	3		III	Category A	
2326	TRIMETHYLCYCLOHEXYLAMINE	8		III	Category A	
2327	TRIMETHYLHEXAMETHYLENEDIAMINES	8		III	Category A	
2328	TRIMETHYLHEXAMETHYLENE DIISOCYANATE	6.1		III	Category B	
2329	TRIMETHYL PHOSPHITE	3		III	Category A	
2330	UNDECANE	3		III	Category A	
2331	ZINC CHLORIDE, ANHYDROUS	8		III	Category A	
2332	ACETALDEHYDE OXIME	3		III	Category A	
2333	ALLYL ACETATE	3	6.1	II	Category E SW2	
2334	ALLYLAMINE	6.1	3	I	Category D SW2	
2335	ALLYL ETHYL ETHER	3	6.1	II	Category E SW2	
2336	ALLYL FORMATE	3	6.1	I	Category E SW2	
2337	PHENYL MERCAPTAN	6.1	3	I	Category D SW2	SG35
2338	BENZOTRIFLUORIDE	3		II	Category B SW2	
2339	2-BROMOBUTANE	3		II	Category B SW2	
2340	2-BROMOETHYL ETHYL ETHER	3		II	Category B SW2	
2341	1-BROMO-3-METHYLBUTANE	3		III	Category A	
2342	BROMOMETHYLPROPANES	3		II	Category B	
2343	2-BROMOPENTANE	3		II	Category B	
2344	BROMOPROPANES	3		II	Category B SW2	
2344	BROMOPROPANES	3		III	Category A	
2345	3-BROMOPROPYNE	3		II	Category D SW2	
2346	BUTANEDIONE	3		II	Category B	
2347	BUTYL MERCAPTANS	3		II	Category B	SG35 SG50 SG57
2348	BUTYL ACRYLATES, STABILIZED	3		III	Category A	
2350	BUTYL METHYL ETHER	3		II	Category B	
2351	BUTYL NITRITES	3		II	Category B SW2	
2351	BUTYL NITRITES	3		III	Category A SW2	
2352	BUTYL VINYL ETHER, STABILIZED	3		II	Category B SW2	
2353	BUTYRYL CHLORIDE	3	8	II	Category C SW2	

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2354	CHLOROMETHYL ETHYL ETHER	3	6.1	II	Category E SW2	
2356	2-CHLOROPROPANE	3		I	Category E	
2357	CYCLOHEXYLAMINE	8	3	II	Category A SW2	
2358	CYCLOOCTATETRAENE	3		II	Category B	
2359	DIALLYLAMINE	3	6.1/8	II	Category B SW2	SG5 SG8
2360	DIALLYL ETHER	3	6.1	II	Category E	
2361	DIISOBUTYLAMINE	3	8	III	Category A	
2362	1,1-DICHLOROETHANE	3		II	Category B SW2	
2363	ETHYL MERCAPTAN	3	P	I	Category E	SG50 SG57
2364	n-PROPYLBENZENE	3		III	Category A	
2366	DIETHYL CARBONATE	3		III	Category A	
2367	alpha-METHYLVALERALDEHYDE	3		II	Category B	
2368	alpha-PINENE	3		III	Category A	
2370	1-HEXENE	3		II	Category E	
2371	ISOPENTENES	3		I	Category E	
2372	1,2-DI(DIMETHYLAMINO)ETHANE	3		II	Category B	
2373	DIETHOXYMETHANE	3		II	Category B	
2374	3,3-DIETHOXYPROPENE	3		II	Category B	
2375	DIETHYL SULPHIDE	3		II	Category E	
2376	2,3-DIHYDROPYRAN	3		II	Category B	
2377	1,1-DIMETHOXYETHANE	3		II	Category B	
2378	2-DIMETHYLAMINOACETONITRILE	3	6.1	II	Category A SW2	SG35
2379	1,3-DIMETHYLBUTYLAMINE	3		II	Category B	SG35
2380	DIMETHYLDIETHOXYSILANE	3		II	Category B	
2381	DIMETHYL DISULPHIDE	3	6.1	II	Category B SW2	
2382	DIMETHYLHYDRAZINE, SYMMETRICAL	6.1	3P	I	Category D SW2	SG17 SG35
2383	DIPROPYLAMINE	3	8	II	Category B	
2384	DI-n-PROPYL ETHER	3		II	Category B	
2385	ETHYL ISOBUTYRATE	3		II	Category B	
2386	1-ETHYLPIPERIDINE	3	8	II	Category B	SG35
2387	FLUOROBENZENE	3		II	Category B	
2388	FLUOROTOLUENES	3		II	Category B	
2389	FURAN	3		I	Category E SW2	
2390	2-IODOBUTANE	3		II	Category B	
2391	IODOMETHYLPROPANES	3		II	Category B	
2392	IODOPROPANES	3		III	Category A	
2393	ISOBUTYL FORMATE	3		II	Category B	
2394	ISOBUTYL PROPIONATE	3		III	Category B	

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2395	ISOBUTYRYL CHLORIDE	3	8	II	Category C SW2	
2396	METHACRYLALDEHYDE, STABILIZED	3	6.1	II	Category E SW2	
2397	3-METHYLBUTAN-2-ONE	3		II	Category B	
2398	METHYL tert-BUTYL ETHER	3		II	Category E	
2399	1-METHYLPIPERIDINE	3	8	II	Category B	SG35
2400	METHYL ISOVALERATE	3		II	Category B	
2401	PIPERIDINE	8	3	I	Category D	SG35
2402	PROPANETHIOLS	3		II	Category E	SG50 SG57
2403	ISOPROPENYL ACETATE	3		II	Category B	
2404	PROPIONITRILE	3	6.1	II	Category E SW2	
2405	ISOPROPYL BUTYRATE	3		III	Category A	
2406	ISOPROPYL ISOBUTYRATE	3		II	Category B	
2407	ISOPROPYL CHLOROFORMATE	6.1	"3/8	I	Category D SW2	SG5 SG8
2409	ISOPROPYL PROPIONATE	3		II	Category B	
2410	1,2,3,6-TETRAHYDROPYRIDINE	3		II	Category B	
2411	BUTYRONITRILE	3	6.1	II	Category E SW2	
2412	TETRAHYDROTHIOPHENE	3		II	Category B	
2413	TETRAPROPYL ORTHOTITANATE	3		III	Category A	
2414	THIOPHENE	3		II	Category B SW2	
2416	TRIMETHYL BORATE	3		II	Category B	
2417	CARBONYL FLUORIDE	2.3			Category D SW2	
2418	SULPHUR TETRAFLUORIDE	2.3	8		Category D SW2	SG35
2419	BROMOTRIFLUOROETHYLENE	2.1			Category B SW2	
2420	HEXAFLUOROACETONE	2.3	8		Category D SW2	
2421	NITROGEN TRIOXIDE	2.3	"5.1/8		Category D SW2	SG6 SG19
2422	OCTAFLUOROBUT-2-ENE (REFRIGERANT GAS R 1318)	2.2			Category A	
2424	OCTAFLUOROPROPANE (REFRIGERANT GAS R 218)	2.2			Category A	
2426	AMMONIUM NITRATE, LIQUID (hot concentrated solution)	5.1			Category D	SG42 SG45 SG47 SG48 SG51 SG56 SG58 SG59 SG61
2427	POTASSIUM CHLORATE, AQUEOUS SOLUTION	5.1		II	Category B	SG38 SG49 SG62
2427	POTASSIUM CHLORATE, AQUEOUS SOLUTION	5.1		III	Category B	SG38 SG49 SG62

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2428	SODIUM CHLORATE, AQUEOUS SOLUTION	5.1		II	Category B	SG38 SG49 SG62
2428	SODIUM CHLORATE, AQUEOUS SOLUTION	5.1		III	Category B	SG38 SG49 SG62
2429	CALCIUM CHLORATE, AQUEOUS SOLUTION	5.1		II	Category B	SG38 SG49 SG62
2429	CALCIUM CHLORATE, AQUEOUS SOLUTION	5.1		III	Category B	SG38 SG49 SG62
2430	ALKYLPHENOLS, SOLID, N.O.S. (including C2-C12 homologues)	8		I	Category B	
2430	ALKYLPHENOLS, SOLID, N.O.S. (including C2-C12 homologues)	8		II	Category B	
2430	ALKYLPHENOLS, SOLID, N.O.S. (including C2-C12 homologues)	8		III	Category A	
2431	ortho-ANISIDINE	6.1		III	Category A	
2432	N,N-DIETHYLANILINE	6.1		III	Category A	
2433	CHLORONITROTOLUENES, LIQUID	6.1	P	III	Category A	SG6 SG8 SG10 SG12
2434	DIBENZYLDICHLOROSILANE	8		II	Category C SW2	
2435	ETHYLPHENYLDICHLOROSILANE	8		II	Category C	
2436	THIOACETIC ACID	3		II	Category B	
2437	METHYLPHENYLDICHLOROSILANE	8		II	Category C SW2	
2438	TRIMETHYLACETYL CHLORIDE	6.1	"3/8	I	Category D SW1 SW2	SG5 SG8
2439	SODIUM HYDROGENDIFLUORIDE	8		II	Category A SW1 SW2 H2	SG35
2440	STANNIC CHLORIDE PENTAHYDRATE	8		III	Category A	
2441	TITANIUM TRICHLORIDE, PYROPHORIC or TITANIUM TRICHLORIDE MIXTURE, PYROPHORIC	4.2	8	I	Category D SW2	
2442	TRICHLOROACETYL CHLORIDE	8		II	Category D SW2	
2443	VANADIUM OXYTRICHLORIDE	8		II	Category C SW2	
2444	VANADIUM TETRACHLORIDE	8		I	Category C SW2	
2446	NITROCRESOLS, SOLID	6.1		III	Category A	
2447	PHOSPHORUS, WHITE, MOLTEN	4.2	6.1P	I	Category D	
2448	SULPHUR, MOLTEN	4.1		III	Category C	SG17
2451	NITROGEN TRIFLUORIDE	2.2	5.1		Category D SW2	
2452	ETHYLACETYLENE, STABILIZED	2.1			Category B SW2	
2453	ETHYL FLUORIDE (REFRIGERANT GAS R 161)	2.1			Category E SW2	

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2454	METHYL FLUORIDE (REFRIGERANT GAS R 41)	2.1			Category E SW2	
2455	METHYL NITRITE	2.2			-	
2456	2-CHLOROPROPENE	3		I	Category E	
2457	2,3-DIMETHYLBUTANE	3		II	Category E	
2458	HEXADIENES	3		II	Category B	
2459	2-METHYL-1-BUTENE	3		I	Category E	
2460	2-METHYL-2-BUTENE	3		II	Category E	
2461	METHYLPENTADIENES	3		II	Category E	
2463	ALUMINIUM HYDRIDE	4.3		I	Category E	
2464	BERYLLIUM NITRATE	5.1	6.1	II	Category A	
2465	DICHLOROISOCYANURIC ACID, DRY or DICHLOROISOCYANURIC ACID, SALTS	5.1		II	Category A H1	
2466	POTASSIUM SUPEROXIDE	5.1		I	Category E H1	SG16 SG35 SG59
2468	TRICHLOROISOCYANURIC ACID, DRY	5.1		II	Category A H1	
2469	ZINC BROMATE	5.1		III	Category A	SG38 SG49
2470	PHENYLACETONITRILE, LIQUID	6.1		III	Category A	SG35
2471	OSMIUM TETROXIDE	6.1		I	Category B SW2	
2473	SODIUM ARSANILATE	6.1		III	Category A	
2474	THIOPHOSGENE	6.1		I	Category D SW2	SG35
2475	VANADIUM TRICHLORIDE	8		III	Category A SW2	
2477	METHYL ISOTHIOCYANATE	6.1	3	I	Category D SW2	
2478	ISOCYANATES, FLAMMABLE, TOXIC, N.O.S. or ISOCYANATE SOLUTION, FLAMMABLE, TOXIC, N.O.S.	3	6.1	II	Category D SW2	
2478	ISOCYANATES, FLAMMABLE, TOXIC, N.O.S. or ISOCYANATE SOLUTION, FLAMMABLE, TOXIC, N.O.S.	3	6.1	III	Category A	
2480	METHYL ISOCYANATE	6.1	3	I	Category D SW2	SG35
2481	ETHYL ISOCYANATE	6.1	3	I	Category D SW2	SG35
2482	n-PROPYL ISOCYANATE	6.1	3	I	Category D SW2	
2483	ISOPROPYL ISOCYANATE	6.1	3	I	Category D SW2	
2484	tert-BUTYL ISOCYANATE	6.1	3	I	Category D SW2	
2485	n-BUTYL ISOCYANATE	6.1	3	I	Category D SW2	
2486	ISOBUTYL ISOCYANATE	6.1	3	I	Category D SW2	
2487	PHENYL ISOCYANATE	6.1	3	I	Category D SW2	
2488	CYCLOHEXYL ISOCYANATE	6.1	3	I	Category D SW2	

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2490	DICHLOROISOPROPYL ETHER	6.1		II	Category B	
2491	ETHANOLAMINE or ETHANOLAMINE SOLUTION	8		III	Category A	SG35
2493	HEXAMETHYLENEIMINE	3	8	II	Category B SW2	
2495	IODINE PENTAFLUORIDE	5.1	"6.1/8	I	Category D SW1 SW2	SG6 SG16 SG19 SG35
2496	PROPIONIC ANHYDRIDE	8		III	Category A	
2498	1,2,3,6-TETRAHYDROBENZALDEHYDE	3		III	Category A	
2501	TRIS-(1-AZIRIDINYL) PHOSPHINE OXIDE SOLUTION	6.1		II	Category A	
2501	TRIS-(1-AZIRIDINYL) PHOSPHINE OXIDE SOLUTION	6.1		III	Category A	
2502	VALERYL CHLORIDE	8	3	II	Category C SW2	
2503	ZIRCONIUM TETRACHLORIDE	8		III	Category A	
2504	TETRABROMOETHANE	6.1	P	III	Category A	
2505	AMMONIUM FLUORIDE	6.1		III	Category A	SG35
2506	AMMONIUM HYDROGEN SULPHATE	8		II	Category A SW2	
2507	CHLOROPLATINIC ACID, SOLID	8		III	Category A	
2508	MOLYBDENUM PENTACHLORIDE	8		III	Category C SW2	
2509	POTASSIUM HYDROGEN SULPHATE	8		II	Category A	
2511	2-CHLOROPROPIONIC ACID	8		III	Category A	
2512	AMINOPHENOLS (o-, m-, p-)	6.1		III	Category A	
2513	BROMOACETYL BROMIDE	8		II	Category C SW2	SG36
2514	BROMOBENZENE	3		III	Category A	
2515	BROMOFORM	6.1	P	III	Category A SW1 SW2 H2	
2516	CARBON TETRABROMIDE	6.1	P	III	Category A SW1	
2517	1-CHLORO-1,1-DIFLUOROETHANE (REFRIGERANT GAS R 142b)	2.1			Category B SW2	
2518	1,5,9-CYCLODODECATRIENE	6.1		III	Category A SW2	
2520	CYCLOOCTADIENES	3		III	Category A	
2521	DIKETENE, STABILIZED	6.1	3	I	Category D SW2	SG20 SG21
2522	2-DIMETHYLAMINOETHYL METHACRYLATE	6.1		II	Category D SW2	
2524	ETHYL ORTHOFORMATE	3		III	Category A	
2525	ETHYL OXALATE	6.1		III	Category A	
2526	FURFURYLAMINE	3	8	III	Category A SW2	
2527	ISOBUTYL ACRYLATE, STABILIZED	3		III	Category A	
2528	ISOBUTYL ISOBUTYRATE	3		III	Category A	
2529	ISOBUTYRIC ACID	3	8	III	Category A	

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2531	METHACRYLIC ACID, STABILIZED	8		II	Category C SW2	
2533	METHYL TRICHLOROACETATE	6.1		III	Category A	
2534	METHYLCHLOROSILANE	2.3	2.1/8		Category D SW2	SG4 SG9
2535	4-METHYLMORPHOLINE (N-METHYLMORPHOLINE)	3	8	II	Category B SW2	
2536	METHYLTETRAHYDROFURAN	3		II	Category B	
2538	NITRONAPHTHALENE	4.1		III	Category A	
2541	TERPINOLENE	3		III	Category A	
2542	TRIBUTYLAMINE	6.1		II	Category A	
2545	HAFNIUM POWDER, DRY	4.2		I	Category D	
2545	HAFNIUM POWDER, DRY	4.2		II	Category D	
2545	HAFNIUM POWDER, DRY	4.2		III	Category D	
2546	TITANIUM POWDER, DRY	4.2		I	Category D	
2546	TITANIUM POWDER, DRY	4.2		II	Category D	
2546	TITANIUM POWDER, DRY	4.2		III	Category D	
2547	SODIUM SUPEROXIDE	5.1		I	Category E H1	SG16 SG35 SG59
2548	CHLORINE PENTAFLUORIDE	2.3	5.1/8		Category D SW2	SG6 SG19
2552	HEXAFLUOROACETONE HYDRATE, LIQUID	6.1		II	Category B SW2	
2554	METHYLALLYL CHLORIDE	3		II	Category E	
2555	NITROCELLULOSE WITH WATER (not less than 25% water, by mass)	4.1		II	Category E	SG7 SG30
2556	NITROCELLULOSE WITH ALCOHOL (not less than 25% alcohol, by mass, and not more than 12.6%	4.1		II	Category D	SG7 SG30
2557	NITROCELLULOSE with not more than 12.6% nitrogen, by dry mass, MIXTURE WITH or WITHOUT PLASTICIZER, WITH or WITHOUT PIGMENT	4.1		II	Category D	SG7 SG30
2558	EPIBROMOHYDRIN	6.1	3P	I	Category D SW2	
2560	2-METHYLPENTAN-2-OL	3		III	Category A	
2561	3-METHYL-1-BUTENE	3		I	Category E	
2564	TRICHLOROACETIC ACID SOLUTION	8		II	Category B	
2564	TRICHLOROACETIC ACID SOLUTION	8		III	Category B	
2565	DICYCLOHEXYLAMINE	8		III	Category A	
2567	SODIUM PENTACHLOROPHENATE	6.1	P	II	Category A	
2570	CADMIUM COMPOUND	6.1		I	Category A	
2570	CADMIUM COMPOUND	6.1		II	Category A	
2570	CADMIUM COMPOUND	6.1		III	Category A	
2571	ALKYLSULPHURIC ACIDS	8		II	Category C SW15	
2572	PHENYLHYDRAZINE	6.1		II	Category A SW2	
2573	THALLIUM CHLORATE	5.1	6.1P	II	Category A	SG38 SG49

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2574	TRICRESYL PHOSPHATE with more than 3% ortho-isomer	6.1	P	II	Category A	
2576	PHOSPHORUS OXYBROMIDE, MOLTEN	8		II	Category C SW2	
2577	PHENYLACETYL CHLORIDE	8		II	Category C SW2	
2578	PHOSPHORUS TRIOXIDE	8		III	Category A SW1 H2	
2579	PIPERAZINE	8		III	Category A SW1 H2	SG35
2580	ALUMINIUM BROMIDE SOLUTION	8		III	Category A	
2581	ALUMINIUM CHLORIDE SOLUTION	8		III	Category A	
2582	FERRIC CHLORIDE SOLUTION	8		III	Category A	
2583	ALKYLSULPHONIC ACIDS, SOLID or ARYLSULPHONIC ACIDS, SOLID with more than 5% free sulphur	8		II	Category A	
2584	ALKYLSULPHONIC ACIDS, LIQUID or ARYLSULPHONIC ACIDS, LIQUID with more than 5% free sulph	8		II	Category B	
2585	ALKYLSULPHONIC ACIDS, SOLID or ARYLSULPHONIC ACIDS, SOLID with not more than 5% free sul	8		III	Category A	
2586	ALKYLSULPHONIC ACIDS, LIQUID or ARYLSULPHONIC ACIDS, LIQUID with not more than 5% free s	8		III	Category B	
2587	BENZOQUINONE	6.1		II	Category A	
2588	PESTICIDE, SOLID, TOXIC, N.O.S.	6.1		I	Category A SW2	
2588	PESTICIDE, SOLID, TOXIC, N.O.S.	6.1		II	Category A SW2	
2588	PESTICIDE, SOLID, TOXIC, N.O.S.	6.1		III	Category A SW2	
2589	VINYL CHLOROACETATE	6.1	3	II	Category A	
2590	WHITE ASBESTOS (chrysotile, actinolite, anthophyllite, tremolite)	9		III	Category A SW2	SG29
2591	XENON, REFRIGERATED LIQUID	2.2			Category D	
2599	CHLOROTRIFLUOROMETHANE AND TRIFLUOROMETHANE AZEOTROPIC MIXTURE with approximately 60% ch	2.2			Category A	
2601	CYCLOBUTANE	2.1			Category B SW2	
2602	DICHLORODIFLUOROMETHANE AND DIFLUOROETHANE AZEOTROPIC MIXTURE with approximately 74% dic	2.2			Category A	
2603	CYCLOHEPTATRIENE	3	6.1	II	Category E SW2	
2604	BORON TRIFLUORIDE DIETHYL ETHERATE	8	3	I	Category D SW2	
2605	METHOXYMETHYL ISOCYANATE	6.1	3	I	Category D SW2	
2606	METHYL ORTHOSILICATE	6.1	3	I	Category D SW2	
2607	ACROLEIN DIMER, STABILIZED	3		III	Category A SW2	
2608	NITROPROPANES	3		III	Category A	
2609	TRIALLYL BORATE	6.1		III	Category A H1	

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2610	TRIALLYLAMINE	3	8	III	Category A SW2	
2611	PROPYLENE CHLOROHYDRIN	6.1	3	II	Category A SW1 SW2 H2	
2612	METHYL PROPYL ETHER	3		II	Category E SW2	
2614	METHALLYL ALCOHOL	3		III	Category A	
2615	ETHYL PROPYL ETHERS	3		II	Category E	
2616	TRIISOPROPYL BORATE	3		II	Category B	
2616	TRIISOPROPYL BORATE	3		III	Category A	
2617	METHYLCYCLOHEXANOLS flammable	3		III	Category A	
2618	VINYLTOLUENES, STABILIZED	3		III	Category A	
2619	BENZYLDIMETHYLAMINE	8	3	II	Category A SW1 SW2	
2620	AMYL BUTYRATES	3		III	Category A	
2621	ACETYL METHYL CARBINOL	3		III	Category A	
2622	GLYCIDALDEHYDE	3	6.1	II	Category A SW2	
2623	FIRELIGHTERS, SOLID with flammable liquid	4.1		III	Category A	SG35
2624	MAGNESIUM SILICIDE	4.3		II	Category B SW5 H1	
2626	CHLORIC ACID, AQUEOUS SOLUTION with not more than 10% chloric acid	5.1		II	Category D	SG38 SG49
2627	NITRITES, INORGANIC, N.O.S.	5.1		II	Category A	SG38 SG49 SG62
2628	POTASSIUM FLUOROACETATE	6.1		I	Category E	
2629	SODIUM FLUOROACETATE	6.1		I	Category E	
2630	SELENATES or SELENITES	6.1		I	Category E	
2642	FLUOROACETIC ACID	6.1		I	Category E	
2643	METHYL BROMOACETATE	6.1		II	Category D SW2	
2644	METHYL IODIDE	6.1		I	Category D SW1 SW2 H2	
2645	PHENACYL BROMIDE	6.1		II	Category B SW2	
2646	HEXACHLOROCYCLOPENTADIENE	6.1		I	Category D SW2	
2647	MALONONITRILE	6.1		II	Category A SW1 H2	
2648	1,2-DIBROMOBUTAN-3-ONE	6.1		II	Category B SW2	
2649	1,3-DICHLOROACETONE	6.1		II	Category B SW1 SW2 H2	
2650	1,1-DICHLORO-1-NITROETHANE	6.1		II	Category A SW1 SW2 H2	SG17

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2651	4,4'-DIAMINODIPHENYLMETHANE	6.1	P	III	Category A	
2653	BENZYL IODIDE	6.1		II	Category B SW2 H2	
2655	POTASSIUM FLUOROSILICATE	6.1		III	Category A	SG35
2656	QUINOLINE	6.1		III	Category A SW1 H2	
2657	SELENIUM DISULPHIDE	6.1		II	Category A	
2659	SODIUM CHLOROACETATE	6.1		III	Category A	
2660	NITROTOLUIDINES (MONO)	6.1		III	Category A	
2661	HEXACHLOROACETONE	6.1		III	Category B SW1 SW2 H2	
2664	DIBROMOMETHANE	6.1		III	Category A	
2667	BUTYLTOLUENES	6.1		III	Category A	
2668	CHLOROACETONITRILE	6.1	3	I	Category D SW1 SW2 H2	SG35
2669	CHLOROCRESOLS SOLUTION	6.1		II	Category A SW1 H2	
2669	CHLOROCRESOLS SOLUTION	6.1		III	Category A SW1 H2	
2670	CYANURIC CHLORIDE	8		II	Category A SW1 SW2 H2	
2671	AMINOPYRIDINES (o-, m-, p-)	6.1		II	Category B SW1 SW2 H2	SG35
2672	AMMONIA SOLUTION relative density between 0.880 and 0.957 at 15ºC in water, with more than 10% but not more than 35% ammonia	8		III	Category A SW2 SW5	SG35
2673	2-AMINO-4-CHLOROPHENOL	6.1		II	Category A	
2674	SODIUM FLUOROSILICATE	6.1		III	Category A	SG35
2676	STIBINE	2.3	2.1		Category D SW2	
2677	RUBIDIUM HYDROXIDE SOLUTION	8		II	Category A	SG22 SG35
2677	RUBIDIUM HYDROXIDE SOLUTION	8		III	Category A	SG22 SG35
2678	RUBIDIUM HYDROXIDE, SOLID	8		II	Category A	SG22 SG35
2679	LITHIUM HYDROXIDE SOLUTION	8		II	Category A	SG22 SG35
2679	LITHIUM HYDROXIDE SOLUTION	8		III	Category A	SG22 SG35
2680	LITHIUM HYDROXIDE	8		II	Category A	SG35
2681	CAESIUM HYDROXIDE SOLUTION	8		II	Category A	SG22 SG35
2681	CAESIUM HYDROXIDE SOLUTION	8		III	Category A	SG22 SG35
2682	CAESIUM HYDROXIDE	8		II	Category A	SG22 SG35

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2683	AMMONIUM SULPHIDE SOLUTION	8	3/6.1	II	Category B SW1 H2	SG35 SG68
2684	3-DIETHYLAMINOPROPYLAMINE	3	8	III	Category A	
2685	N,N-DIETHYLETHYLENEDIAMINE	8	3	II	Category A	
2686	2-DIETHYLAMINOETHANOL	8	3	II	Category A	
2687	DICYCLOHEXYLAMMONIUM NITRITE	4.1		III	Category A	
2688	1-BROMO-3-CHLOROPROPANE	6.1		III	Category A	
2689	GLYCEROL-alpha-MONOCHLOROHYDRIN	6.1		III	Category A	
2690	N,n-BUTYLIMIDAZOLE	6.1		II	Category A	
2691	PHOSPHORUS PENTABROMIDE	8		II	Category B SW1 SW2 H2	SG36 SG37
2692	BORON TRIBROMIDE	8		I	Category C SW1 H2	
2693	BISULPHITES, AQUEOUS SOLUTION, N.O.S.	8		III	Category A SW2	SG35
2698	TETRAHYDROPHTHALIC ANHYDRIDES with more than 0.05% maleic anhydride	8		III	Category A	
2699	TRIFLUOROACETIC ACID	8		I	Category B SW1 SW2 H2	
2705	1-PENTOL	8		II	Category B	SG20 SG21
2707	DIMETHYLDIOXANES	3		II	Category B	
2707	DIMETHYLDIOXANES	3		III	Category A	
2709	BUTYLBENZENES	3		III	Category A	
2710	DIPROPYL KETONE	3		III	Category A	
2713	ACRIDINE	6.1		III	Category A	
2714	ZINC RESINATE	4.1		III	Category A	
2715	ALUMINIUM RESINATE	4.1		III	Category A	
2716	1,4-BUTYNEDIOL	6.1		III	Category A	SG35 SG36 SG55
2717	CAMPHOR synthetic	4.1		III	Category A	
2719	BARIUM BROMATE	5.1	6.1	II	Category A	SG38 SG49
2720	CHROMIUM NITRATE	5.1		III	Category A	
2721	COPPER CHLORATE	5.1		II	Category A	SG38 SG49
2722	LITHIUM NITRATE	5.1		III	Category A	
2723	MAGNESIUM CHLORATE	5.1		II	Category A	SG38 SG49
2724	MANGANESE NITRATE	5.1		III	Category A	
2725	NICKEL NITRATE	5.1		III	Category A	
2726	NICKEL NITRITE	5.1		III	Category A	SG38 SG49
2727	THALLIUM NITRATE	6.1	5.1P	II	Category A	
2728	ZIRCONIUM NITRATE	5.1		III	Category A	

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2729	HEXACHLOROBENZENE	6.1		III	Category A	
2730	NITROANISOLES, LIQUID	6.1		III	Category A	
2732	NITROBROMOBENZENES, LIQUID	6.1		III	Category A	
2733	AMINES, FLAMMABLE, CORROSIVE, N.O.S. or POLYAMINES, FLAMMABLE, CORROSIVE, N.O.S.	3	8	I	Category D SW2	SG35
2733	AMINES, FLAMMABLE, CORROSIVE, N.O.S. or POLYAMINES, FLAMMABLE, CORROSIVE, N.O.S.	3	8	II	Category B SW2	SG35
2733	AMINES, FLAMMABLE, CORROSIVE, N.O.S. or POLYAMINES, FLAMMABLE, CORROSIVE, N.O.S.	3	8	III	Category A SW2	SG35
2734	AMINES, LIQUID, CORROSIVE, FLAMMABLE, N.O.S. or POLYAMINES, LIQUID, CORROSIVE, FLAMMABLE	8	3	I	Category A	SG35
2734	AMINES, LIQUID, CORROSIVE, FLAMMABLE, N.O.S. or POLYAMINES, LIQUID, CORROSIVE, FLAMMABLE	8	3	II	Category A	SG35
2735	AMINES, LIQUID, CORROSIVE, N.O.S. or POLYAMINES, LIQUID, CORROSIVE, N.O.S.	8		I	Category A	SG35
2735	AMINES, LIQUID, CORROSIVE, N.O.S. or POLYAMINES, LIQUID, CORROSIVE, N.O.S.	8		II	Category A	SG35
2735	AMINES, LIQUID, CORROSIVE, N.O.S. or POLYAMINES, LIQUID, CORROSIVE, N.O.S.	8		III	Category A	SG35
2738	N-BUTYLANILINE	6.1		II	Category A	SG17
2739	BUTYRIC ANHYDRIDE	8		III	Category A	
2740	n-PROPYL CHLOROFORMATE	6.1	"3/8	I	Category B SW2	SG5 SG8
2741	BARIUM HYPOCHLORITE with more than 22% available chlorine	5.1	6.1	II	Category B	SG35 SG38 SG49 SG53 SG60
2742	CHLOROFORMATES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S.	6.1		II	Category A SW1 SW2 H1 H2	SG5 SG8
2743	n-BUTYL CHLOROFORMATE	6.1	"3/8	II	Category A SW1 SW2 H1 H2	SG5 SG8
2744	CYCLOBUTYL CHLOROFORMATE	6.1	"3/8	II	Category A SW1 SW2 H1 H2	SG5 SG8
2745	CHLOROMETHYL CHLOROFORMATE	6.1	8	II	Category A SW1 SW2 H1 H2	
2746	PHENYL CHLOROFORMATE	6.1	8	II	Category A SW1 SW2 H1 H2	
2747	tert-BUTYLCYCLOHEXYL CHLOROFORMATE	6.1		III	Category A SW1 H1 H2	

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2748	2-ETHYLHEXYL CHLOROFORMATE	6.1	8	II	Category A SW1 SW2 H1 H2	
2749	TETRAMETHYLSILANE	3		I	Category D	
2750	1,3-DICHLOROPROPANOL-2	6.1		II	Category A SW1 SW2 H2	
2751	DIETHYLTHIOPHOSPHORYL CHLORIDE	8		II	Category D SW1 SW2 H2	
2752	1,2-EPOXY-3-ETHOXYPROPANE	3		III	Category A	
2753	N-ETHYLBENZYLTOLUIDINES, LIQUID	6.1		III	Category A	
2754	N-ETHYLTOLUIDINES	6.1		II	Category A	
2757	CARBAMATE PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2757	CARBAMATE PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2757	CARBAMATE PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2758	CARBAMATE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2758	CARBAMATE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2759	ARSENICAL PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2759	ARSENICAL PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2759	ARSENICAL PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2760	ARSENICAL PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2760	ARSENICAL PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2761	ORGANOCHLORINE PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2761	ORGANOCHLORINE PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2761	ORGANOCHLORINE PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2762	ORGANOCHLORINE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2762	ORGANOCHLORINE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2763	TRIAZINE PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2763	TRIAZINE PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2763	TRIAZINE PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2764	TRIAZINE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2764	TRIAZINE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	

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2771	THIOCARBAMATE PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2771	THIOCARBAMATE PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2771	THIOCARBAMATE PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2772	THIOCARBAMATE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2772	THIOCARBAMATE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2775	COPPER BASED PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2775	COPPER BASED PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2775	COPPER BASED PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2776	COPPER BASED PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2776	COPPER BASED PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2777	MERCURY BASED PESTICIDE, SOLID, TOXIC	6.1	P	I	Category A SW2	
2777	MERCURY BASED PESTICIDE, SOLID, TOXIC	6.1	P	II	Category A SW2	
2777	MERCURY BASED PESTICIDE, SOLID, TOXIC	6.1	P	III	Category A SW2	
2778	MERCURY BASED PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1P	I	Category B SW2	
2778	MERCURY BASED PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1P	II	Category B SW2	
2779	SUBSTITUTED NITROPHENOL PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2779	SUBSTITUTED NITROPHENOL PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2779	SUBSTITUTED NITROPHENOL PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2780	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2780	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2781	BIPYRIDILIUM PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2781	BIPYRIDILIUM PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
2781	BIPYRIDILIUM PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2782	BIPYRIDILIUM PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2782	BIPYRIDILIUM PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2783	ORGANOPHOSPHORUS PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
2783	ORGANOPHOSPHORUS PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	

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2783	ORGANOPHOSPHORUS PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
2784	ORGANOPHOSPHORUS PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	I	Category B SW2	
2784	ORGANOPHOSPHORUS PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1	II	Category B SW2	
2785	4-THIAPENTANAL	6.1		III	Category D SW1	SG20 SG21
2786	ORGANOTIN PESTICIDE, SOLID, TOXIC	6.1	P	I	Category A SW2	
2786	ORGANOTIN PESTICIDE, SOLID, TOXIC	6.1	P	II	Category A SW2	
2786	ORGANOTIN PESTICIDE, SOLID, TOXIC	6.1	P	III	Category A SW2	
2787	ORGANOTIN PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1P	I	Category B SW2	
2787	ORGANOTIN PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23ºC	3	6.1P	II	Category B SW2	
2788	ORGANOTIN COMPOUND, LIQUID, N.O.S.	6.1	P	I	Category A SW2	
2788	ORGANOTIN COMPOUND, LIQUID, N.O.S.	6.1	P	II	Category A SW2	
2788	ORGANOTIN COMPOUND, LIQUID, N.O.S.	6.1	P	III	Category A SW2	
2789	ACETIC ACID, GLACIAL or ACETIC ACID SOLUTION, more than 80% acid, by mass	8	3	II	Category A	
2790	ACETIC ACID SOLUTION not less than 50% but not more than 80% acid, by mass	8		II	Category A	
2790	ACETIC ACID SOLUTION more than 10% and less than 50% acid, by mass	8		III	Category A	
2793	FERROUS METAL BORINGS, SHAVINGS, TURNINGS, or CUTTINGS in a form liable to self-heating	4.2		III	Category A	
2794	BATTERIES, WET, FILLED WITH ACID electric storage	8			Category A SW16	
2795	BATTERIES, WET, FILLED WITH ALKALI electric storage	8			Category A SW16	SG35
2796	SULPHURIC ACID with not more than 51% acid or BATTERY FLUID, ACID	8		II	Category B	
2797	BATTERY FLUID, ALKALI	8		II	Category A	SG22 SG35
2798	PHENYLPHOSPHORUS DICHLORIDE	8		II	Category B SW2	
2799	PHENYLPHOSPHORUS THIODICHLORIDE	8		II	Category B SW2	
2800	BATTERIES, WET, NON-SPILLABLE electric storage	8			Category A	
2801	DYE, LIQUID, CORROSIVE, N.O.S. or DYE INTERMEDIATE, LIQUID, CORROSIVE, N.O.S.	8		I	Category A	
2801	DYE, LIQUID, CORROSIVE, N.O.S. or DYE INTERMEDIATE, LIQUID, CORROSIVE, N.O.S.	8		II	Category A	
2801	DYE, LIQUID, CORROSIVE, N.O.S. or DYE INTERMEDIATE, LIQUID, CORROSIVE, N.O.S.	8		III	Category A	
2802	COPPER CHLORIDE	8	P	III	Category A	
2803	GALLIUM	8		III	Category B SW1	

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2805	LITHIUM HYDRIDE, FUSED SOLID	4.3		II	Category E	SG35
2806	LITHIUM NITRIDE	4.3		I	Category E	
2807	MAGNETIZED MATERIAL	9		III	-	
2809	MERCURY	8	6.1	III	Category B SW2	SG24
2810	TOXIC LIQUID, ORGANIC, N.O.S.	6.1		I	Category B SW2	
2810	TOXIC LIQUID, ORGANIC, N.O.S.	6.1		II	Category B SW2	
2810	TOXIC LIQUID, ORGANIC, N.O.S.	6.1		III	Category A SW2	
2811	TOXIC SOLID, ORGANIC, N.O.S.	6.1		I	Category B	
2811	TOXIC SOLID, ORGANIC, N.O.S.	6.1		II	Category B	
2811	TOXIC SOLID, ORGANIC, N.O.S.	6.1		III	Category A	
2812	SODIUM ALUMINATE, SOLID	8			-	
2813	WATER-REACTIVE SOLID, N.O.S.	4.3		I	Category E SW2	
2813	WATER-REACTIVE SOLID, N.O.S.	4.3		II	Category E SW2	
2813	WATER-REACTIVE SOLID, N.O.S.	4.3		III	Category E SW2	
2814	INFECTIOUS SUBSTANCE, AFFECTING HUMANS	6.2			SW7	
2815	N-AMINOETHYLPIPERAZINE	8		III	Category A SW1 H2	
2817	AMMONIUM HYDROGENDIFLUORIDE SOLUTION	8	6.1	II	Category B SW2	
2817	AMMONIUM HYDROGENDIFLUORIDE SOLUTION	8	6.1	III	Category B SW2	
2818	AMMONIUM POLYSULPHIDE SOLUTION	8	6.1	II	Category B SW1 SW2 H2	SG35
2818	AMMONIUM POLYSULPHIDE SOLUTION	8	6.1	III	Category B SW1 SW2 H2	SG35
2819	AMYL ACID PHOSPHATE	8		III	Category A	
2820	BUTYRIC ACID	8		III	Category A SW1 H2	
2821	PHENOL SOLUTION	6.1		II	Category A	
2821	PHENOL SOLUTION	6.1		III	Category A	
2822	2-CHLOROPYRIDINE	6.1		II	Category A SW2	
2823	CROTONIC ACID, SOLID	8		III	Category A SW1 H2	
2826	ETHYL CHLOROTHIOFORMATE	8	3P	II	Category A SW2	
2829	CAPROIC ACID	8		III	Category A	
2830	LITHIUM FERROSILICON	4.3		II	Category E SW2 SW5 H1	
2831	1,1,1-TRICHLOROETHANE	6.1		III	Category A SW2	
2834	PHOSPHOROUS ACID	8		III	Category A SW1	

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2835	SODIUM ALUMINIUM HYDRIDE	4.3		II	Category E	SG35
2837	BISULPHATES, AQUEOUS SOLUTION	8		II	Category A	
2837	BISULPHATES, AQUEOUS SOLUTION	8		III	Category A	
2838	VINYL BUTYRATE, STABILIZED	3		II	Category B	
2839	ALDOL	6.1		II	Category A SW1 H2	
2840	BUTYRALDOXIME	3		III	Category A	
2841	DI-n-AMYLAMINE	3	6.1	III	Category A	
2842	NITROETHANE	3		III	Category A	
2844	CALCIUM MANGANESE SILICON	4.3		III	Category A SW5 H1	SG35
2845	PYROPHORIC LIQUID, ORGANIC, N.O.S.	4.2		I	Category D	SG63
2846	PYROPHORIC SOLID, ORGANIC, N.O.S.	4.2		I	Category D	
2849	3-CHLOROPROPANOL-1	6.1		III	Category A	
2850	PROPYLENE TETRAMER	3		III	Category A	
2851	BORON TRIFLUORIDE DIHYDRATE	8		II	Category B SW1 SW2 H2	
2852	DIPICRYL SULPHIDE, WETTED with not less than 10% water, by mass	4.1		I	Category D	SG7 SG30
2853	MAGNESIUM FLUOROSILICATE	6.1		III	Category A	SG35
2854	AMMONIUM FLUOROSILICATE	6.1		III	Category A	SG35
2855	ZINC FLUOROSILICATE	6.1		III	Category A	SG35
2856	FLUOROSILICATES, N.O.S.	6.1		III	Category A	SG35
2857	REFRIGERATING MACHINES containing non-flammable, non-toxic gases or ammonia solution (UN2672)	2.2			Category A	
2858	ZIRCONIUM, DRY coiled wire, finished metal sheets, strip (thinner than 254 microns but not thinner than 18 microns)	4.1		III	Category A	
2859	AMMONIUM METAVANADATE	6.1		II	Category A	SG6 SG8 SG10 SG12
2861	AMMONIUM POLYVANADATE	6.1		II	Category A	SG6 SG8 SG10 SG12
2862	VANADIUM PENTOXIDE, non-fused form	6.1		III	Category A	
2863	SODIUM AMMONIUM VANADATE	6.1		II	Category A	
2864	POTASSIUM METAVANADATE	6.1		II	Category A	
2865	HYDROXYLAMINE SULPHATE	8		III	Category A	
2869	TITANIUM TRICHLORIDE MIXTURE	8		II	Category A SW2	
2869	TITANIUM TRICHLORIDE MIXTURE	8		III	Category A SW2	
2870	ALUMINIUM BOROHYDRIDE	4.2	4.3	I	Category D	
2870	ALUMINIUM BOROHYDRIDE IN DEVICES	4.2	4.3	I	Category D	
2871	ANTIMONY POWDER	6.1		III	Category A	
2872	DIBROMOCHLOROPROPANES	6.1		II	Category A	
2872	DIBROMOCHLOROPROPANES	6.1		III	Category A	

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2873	N,N-DI-n-BUTYLAMINOETHANOL	6.1		III	Category A	
2874	FURFURYL ALCOHOL	6.1		III	Category A	SG17 SG35
2875	HEXACHLOROPHENE	6.1		III	Category A	
2876	RESORCINOL	6.1		III	Category A	
2878	TITANIUM, SPONGE GRANULES or TITANIUM, SPONGE POWDERS	4.1		III	Category D	SG17
2879	SELENIUM OXYCHLORIDE	8	6.1	I	Category E SW2	
2880	CALCIUM HYPOCHLORITE, HYDRATED or CALCIUM HYPOCHLORITE, HYDRATED MIXTURE with not less than 5.5% but not more than 16% water	5.1		II	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
2880	CALCIUM HYPOCHLORITE, HYDRATED or CALCIUM HYPOCHLORITE, HYDRATED MIXTURE with not less than 5.5% but not more than 16% water	5.1		III	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
2881	METAL CATALYST, DRY	4.2		I	Category C	
2881	METAL CATALYST, DRY	4.2		II	Category C	
2881	METAL CATALYST, DRY	4.2		III	Category C	
2900	INFECTIOUS SUBSTANCE, AFFECTING ANIMALS only	6.2			SW7	
2901	BROMINE CHLORIDE	2.3	5.1/8		Category D SW2	SG6 SG19
2902	PESTICIDE, LIQUID, TOXIC, N.O.S.	6.1		I	Category B SW2	
2902	PESTICIDE, LIQUID, TOXIC, N.O.S.	6.1		II	Category B SW2	
2902	PESTICIDE, LIQUID, TOXIC, N.O.S.	6.1		III	Category A SW2	
2903	PESTICIDE, LIQUID, TOXIC, FLAMMABLE, N.O.S. flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
2903	PESTICIDE, LIQUID, TOXIC, FLAMMABLE, N.O.S. flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
2903	PESTICIDE, LIQUID, TOXIC, FLAMMABLE, N.O.S. flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
2904	CHLOROPHENOLATES, LIQUID or PHENOLATES, LIQUID	8		III	Category A	
2905	CHLOROPHENOLATES, SOLID or PHENOLATES, SOLID	8		III	Category A	
2907	ISOSORBIDE DINITRATE MIXTURE with not less than 60% lactose, mannose, starch, or calcium	4.1		II	Category E	SG7 SG30
2908	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - EMPTY PACKAGING	7	See SP290		Category A	
2909	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - ARTICLES MANUFACTURED FROM NATURAL URANIUM or D	7	See SP290		Category A	
2910	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - LIMITED QUANTITY OF MATERIAL	7	See SP290		Category A	
2911	RADIOACTIVE MATERIAL, EXCEPTED PACKAGE - INSTRUMENTS or ARTICLES	7	See SP290		Category A	
2912	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-I), non fissile or fissile-excepted	7	See SP172		Category A SW20	

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2913	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS(SCO-I or SCO-II), non fissile or fis	7	See SP172		Category A	
2915	RADIOACTIVE MATERIAL, TYPE A PACKAGE, non-special form, non fissile or fissile-excepted	7	See SP172		Category A SW20 SW21	
2916	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, non fissile or fissile-excepted	7	See SP172		Category A SW12	
2917	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, non fissile or fissile-excepted	7	See SP172		Category A SW12	
2919	RADIOACTIVE MATERIAL TRANSPORTED UNDER SPECIAL ARRANGEMENT, non fissile or fissile-excep	7	See SP172		Category A SW13	
2920	CORROSIVE LIQUID, FLAMMABLE, N.O.S.	8	3	I	Category C SW1 SW2	
2920	CORROSIVE LIQUID, FLAMMABLE, N.O.S.	8	3	II	Category C SW1 SW2	
2921	CORROSIVE SOLID, FLAMMABLE, N.O.S.	8	4.1	I	Category B SW1 H2	
2921	CORROSIVE SOLID, FLAMMABLE, N.O.S.	8	4.1	II	Category B SW1 H2	
2922	CORROSIVE LIQUID, TOXIC, N.O.S.	8	6.1	I	Category B SW2	
2922	CORROSIVE LIQUID, TOXIC, N.O.S.	8	6.1	II	Category B SW2	
2922	CORROSIVE LIQUID, TOXIC, N.O.S.	8	6.1	III	Category B SW2	
2923	CORROSIVE SOLID, TOXIC, N.O.S.	8	6.1	I	Category B SW2	
2923	CORROSIVE SOLID, TOXIC, N.O.S.	8	6.1	II	Category B SW2	
2923	CORROSIVE SOLID, TOXIC, N.O.S.	8	6.1	III	Category B SW2	
2924	FLAMMABLE LIQUID, CORROSIVE, N.O.S.	3	8	I	Category E SW2	
2924	FLAMMABLE LIQUID, CORROSIVE, N.O.S.	3	8	II	Category B SW2	
2924	FLAMMABLE LIQUID, CORROSIVE, N.O.S.	3	8	III	Category A SW2	
2925	FLAMMABLE SOLID, CORROSIVE, ORGANIC, N.O.S.	4.1	8	II	Category D SW2	
2925	FLAMMABLE SOLID, CORROSIVE, ORGANIC, N.O.S.	4.1	8	III	Category D SW2	
2926	FLAMMABLE SOLID, TOXIC, ORGANIC, N.O.S.	4.1	6.1	II	Category B SW2	
2926	FLAMMABLE SOLID, TOXIC, ORGANIC, N.O.S.	4.1	6.1	III	Category B SW2	
2927	TOXIC LIQUID, CORROSIVE, ORGANIC, N.O.S.	6.1	8	I	Category B SW2	
2927	TOXIC LIQUID, CORROSIVE, ORGANIC, N.O.S.	6.1	8	II	Category B SW2	
2928	TOXIC SOLID, CORROSIVE, ORGANIC, N.O.S.	6.1	8	I	Category B SW2	
2928	TOXIC SOLID, CORROSIVE, ORGANIC, N.O.S.	6.1	8	II	Category B SW2	

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2929	TOXIC LIQUID, FLAMMABLE, ORGANIC, N.O.S.	6.1	3	I	Category B SW2	
2929	TOXIC LIQUID, FLAMMABLE, ORGANIC, N.O.S.	6.1	3	II	Category B SW2	
2930	TOXIC SOLID, FLAMMABLE, ORGANIC, N.O.S.	6.1	4.1	I	Category B	
2930	TOXIC SOLID, FLAMMABLE, ORGANIC, N.O.S.	6.1	4.1	II	Category B	
2931	VANADYL SULPHATE	6.1		II	Category A	
2933	METHYL 2-CHLOROPROPIONATE	3		III	Category A	
2934	ISOPROPYL 2-CHLOROPROPIONATE	3		III	Category A	
2935	ETHYL 2-CHLOROPROPIONATE	3		III	Category A	
2936	THIOLACTIC ACID	6.1		II	Category A	
2937	alpha-METHYLBENZYL ALCOHOL, LIQUID	6.1		III	Category A	
2940	9-PHOSPHABICYCLONONANES (CYCLOOCTADIENE PHOSPHINES)	4.2		II	Category A	
2941	FLUOROANILINES	6.1		III	Category A	
2942	2-TRIFLUOROMETHYLANILINE	6.1		III	Category A	
2943	TETRAHYDROFURFURYLAMINE	3		III	Category A	
2945	N-METHYLBUTYLAMINE	3	8	II	Category B SW2	
2946	2-AMINO-5-DIETHYLAMINOPENTANE	6.1		III	Category A	
2947	ISOPROPYL CHLOROACETATE	3		III	Category A	
2948	3-TRIFLUOROMETHYLANILINE	6.1		II	Category A SW2	
2949	SODIUM HYDROSULPHIDE, HYDRATED with not less than 25% water of crystallization	8		II	Category A	SG35
2950	MAGNESIUM GRANULES, COATED particle size not less than 149 microns	4.3		III	Category A	SG35
2956	5-tert-BUTYL-2,4,6-TRINITRO-m-XYLENE (MUSK XYLENE)	4.1		III	Category D SW1 SW2 H2 H3	SG1
2965	BORON TRIFLUORIDE DIMETHYL ETHERATE	4.3	"3/8	I	Category D SW2	SG5 SG7 SG8 SG13
2966	THIOGLYCOL	6.1		II	Category A	
2967	SULPHAMIC ACID	8		III	Category A	
2968	MANEB, STABILIZED or MANEB PREPARATION, STABILIZED against self-heating	4.3		III	Category B	SG29 SG35
2969	CASTOR BEANS or CASTOR MEAL or CASTOR POMACE or CASTOR FLAKE	9		II	Category E SW2	SG10 SG18 SG29
2977	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE, FISSILE	7	8		Category A SW12	
2978	RADIOACTIVE MATERIAL, URANIUM HEXAFLUORIDE non fissile or fissile-excepted	7	8		Category A SW12	
2983	ETHYLENE OXIDE AND PROPYLENE OXIDE MIXTURE with not more than 30% ethylene oxide	3	6.1	I	Category E SW2	
2984	HYDROGEN PEROXIDE, AQUEOUS SOLUTION with not less than 8% but less than 20% hydrogen peroxide (stabilized as necessary)	5.1		III	Category B SW1	SG16 SG59 SG72

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2985	CHLOROSILANES, FLAMMABLE, CORROSIVE, N.O.S.	3	8	II	Category B SW2	
2986	CHLOROSILANES, CORROSIVE, FLAMMABLE, N.O.S.	8	3	II	Category C SW2	
2987	CHLOROSILANES, CORROSIVE, N.O.S.	8		II	Category C SW2	
2988	CHLOROSILANES, WATER-REACTIVE, FLAMMABLE, CORROSIVE, N.O.S.	4.3	"3/8	I	Category D SW2	SG5 SG7 SG8 SG13
2989	LEAD PHOSPHITE, DIBASIC	4.1		II	Category B	SG29
2989	LEAD PHOSPHITE, DIBASIC	4.1		III	Category B	SG29
2990	LIFE-SAVING APPLIANCES, SELF-INFLATING	9			Category A	SG18 SG71
2991	CARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE, flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
2991	CARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE, flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
2991	CARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE, flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
2992	CARBAMATE PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
2992	CARBAMATE PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
2992	CARBAMATE PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
2993	ARSENICAL PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
2993	ARSENICAL PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
2993	ARSENICAL PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
2994	ARSENICAL PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
2994	ARSENICAL PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
2994	ARSENICAL PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
2995	ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
2995	ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
2995	ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
2996	ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
2996	ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
2996	ORGANOCHLORINE PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
2997	TRIAZINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE, flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
2997	TRIAZINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE, flashpoint not less than 23ºC	6.1	3	II	Category B SW2	

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2997	TRIAZINE PESTICIDE, LIQUID, TOXIC, FLAMMABLE, flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
2998	TRIAZINE PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
2998	TRIAZINE PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
2998	TRIAZINE PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3005	THIOCARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
3005	THIOCARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
3005	THIOCARBAMATE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
3006	THIOCARBAMATE PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3006	THIOCARBAMATE PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3006	THIOCARBAMATE PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3009	COPPER BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1		I	Category B SW2	
3009	COPPER BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
3009	COPPER BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
3010	COPPER BASED PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3010	COPPER BASED PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3010	COPPER BASED PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3011	MERCURY BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3P	I	Category B SW2	
3011	MERCURY BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3P	II	Category B SW2	
3011	MERCURY BASED PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3P	III	Category A SW2	
3012	MERCURY BASED PESTICIDE, LIQUID, TOXIC	6.1	P	I	Category B SW2	
3012	MERCURY BASED PESTICIDE, LIQUID, TOXIC	6.1	P	II	Category B SW2	
3012	MERCURY BASED PESTICIDE, LIQUID, TOXIC	6.1	P	III	Category A SW2	
3013	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23º	6.1	3	I	Category B SW2	
3013	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23º	6.1	3	II	Category B SW2	
3013	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23º	6.1	3	III	Category A SW2	
3014	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3014	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	

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3014	SUBSTITUTED NITROPHENOL PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3015	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1		I	Category B SW2	
3015	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
3015	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
3016	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3016	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3016	BIPYRIDILIUM PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3017	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	I	Category B SW2	
3017	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
3017	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
3018	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3018	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3018	ORGANOPHOSPHORUS PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3019	ORGANOTIN PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3P	I	Category B SW2	
3019	ORGANOTIN PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3P	II	Category B SW2	
3019	ORGANOTIN PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3P	III	Category A SW2	
3020	ORGANOTIN PESTICIDE, LIQUID, TOXIC	6.1	P	I	Category B SW2	
3020	ORGANOTIN PESTICIDE, LIQUID, TOXIC	6.1	P	II	Category B SW2	
3020	ORGANOTIN PESTICIDE, LIQUID, TOXIC	6.1	P	III	Category A SW2	
3021	PESTICIDE, LIQUID, FLAMMABLE, TOXIC, N.O.S. flashpoint less than 23ºC	3	6.1	I	Category B SW2	
3021	PESTICIDE, LIQUID, FLAMMABLE, TOXIC, N.O.S. flashpoint less than 23ºC	3	6.1	II	Category B SW2	
3022	1,2-BUTYLENE OXIDE, STABILIZED	3		II	Category B	SG20 SG21
3023	2-METHYL-2-HEPTANETHIOL	6.1	3	I	Category D SW2	SG57
3024	COUMARIN DERIVATIVE PESTICIDE, LIQUID, FLAMMABLE, TOXIC, flashpoint less than 23ºC	3	6.1	I	Category B SW2	
3024	COUMARIN DERIVATIVE PESTICIDE, LIQUID, FLAMMABLE, TOXIC, flashpoint less than 23ºC	3	6.1	II	Category B SW2	
3025	COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	I	Category B SW2	

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3025	COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	II	Category B SW2	
3025	COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23ºC	6.1	3	III	Category A SW2	
3026	COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3026	COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3026	COUMARIN DERIVATIVE PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3027	COUMARIN DERIVATIVE PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
3027	COUMARIN DERIVATIVE PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
3027	COUMARIN DERIVATIVE PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
3028	BATTERIES, DRY, CONTAINING POTASSIUM HYDROXIDE, SOLID electric storage	8		III	Category A	SG35
3048	ALUMINIUM PHOSPHIDE PESTICIDE	6.1		I	Category E SW2 SW5	
3054	CYCLOHEXANETHIOL (CYCLOHEXYL MERCAPTAN)	3		III	Category A SW2	SG50 SG57
3055	2-(2-AMINOETHOXY) ETHANOL	8	8	III	Category A	
3056	n-HEPTALDEHYDE	3		III	Category A	
3057	TRIFLUOROACETYL CHLORIDE	2.3	8		Category D SW2	
3064	NITROGLYCERIN SOLUTION IN ALCOHOL with more than 1% but not more than 5% nitroglycerin	3		II	Category E	
3065	ALCOHOLIC BEVERAGES, with more than 70% alcohol by volume	3		II	Category A	
3065	ALCOHOLIC BEVERAGES, with more than 24% but not more than 70% alcohol by volume	3		III	Category A	
3066	PAINT (including paint, lacquer, enamel, stain, shellac, varnish, polish, liquid filler	8		II	Category B SW2	
3066	PAINT (including paint, lacquer, enamel, stain, shellac, varnish, polish, liquid filler	8		III	Category A SW2	
3070	ETHYLENE OXIDE AND DICHLORODIFLUOROMETHANE MIXTURE with not more than 12.5% ethylene oxi	2.2			Category A	
3071	MERCAPTANS, LIQUID, TOXIC, FLAMMABLE, N.O.S. or MERCAPTAN MIXTURE, LIQUID, TOXIC, FLAMMA	6.1	3	II	Category C SW2	SG57
3072	LIFE-SAVING APPLIANCES, NOT SELF-INFLATING containing dangerous goods as equipment	9			Category A	SG18 SG71
3073	VINYLPYRIDINES, STABILIZED	6.1	"3/8	II	Category C SW2	SG5 SG8 SG35
3077	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.	9		III	Category A SW23	
3078	CERIUM turnings or gritty powder	4.3		II	Category E	SG35
3079	METHACRYLONITRILE, STABILIZED	6.1	3	I	Category D SW2	

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3080	ISOCYANATES, TOXIC, FLAMMABLE, N.O.S or ISOCYANATE SOLUTION, TOXIC, FLAMMABLE, N.O.S.	6.1	3	II	Category D SW1 SW2	
3082	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.	9		III	Category A	
3083	PERCHLORYL FLUORIDE	2.3	5.1		Category D SW2	
3084	CORROSIVE SOLID, OXIDIZING, N.O.S.	8	5.1	I	Category C	
3084	CORROSIVE SOLID, OXIDIZING, N.O.S.	8	5.1	II	Category C	
3085	OXIDIZING SOLID, CORROSIVE, N.O.S.	5.1	8	I	Category D H1	SG38 SG49 SG60
3085	OXIDIZING SOLID, CORROSIVE, N.O.S.	5.1	8	II	Category B H1	SG38 SG49 SG60
3085	OXIDIZING SOLID, CORROSIVE, N.O.S.	5.1	8	III	Category B H1	SG38 SG49 SG60
3086	TOXIC SOLID, OXIDIZING, N.O.S.	6.1	5.1	I	Category C	
3086	TOXIC SOLID, OXIDIZING, N.O.S.	6.1	5.1	II	Category C	
3087	OXIDIZING SOLID, TOXIC, N.O.S.	5.1	5.1	I	Category D	SG38 SG49 SG60
3087	OXIDIZING SOLID, TOXIC, N.O.S.	5.1	6.1	II	Category B	SG38 SG49 SG60
3087	OXIDIZING SOLID, TOXIC, N.O.S.	5.1	6.1	III	Category B	SG38 SG49 SG60
3088	SELF-HEATING SOLID, ORGANIC, N.O.S.	4.2		II	Category C	
3088	SELF-HEATING SOLID, ORGANIC, N.O.S.	4.2		III	Category C	
3089	METAL POWDER, FLAMMABLE, N.O.S.	4.1		II	Category B	SG17
3089	METAL POWDER, FLAMMABLE, N.O.S.	4.1		III	Category B	SG17
3090	LITHIUM METAL BATTERIES (including lithium alloy batteries)	9		II	Category A	
3091	LITHIUM METAL BATTERIES CONTAINED IN EQUIPMENT or LITHIUM METAL BATTERIES PACKED WITH EQUIPMENT (including lithium alloy batteries)	9		II	Category A	
3092	1-METHOXY-2-PROPANOL	3		III	Category A	
3093	CORROSIVE LIQUID, OXIDIZING, N.O.S.	8	5.1	I	Category C	
3093	CORROSIVE LIQUID, OXIDIZING, N.O.S.	8	5.1	II	Category C	
3094	CORROSIVE LIQUID, WATER-REACTIVE, N.O.S.	8	4.3	I	Category D	
3094	CORROSIVE LIQUID, WATER-REACTIVE, N.O.S.	8	4.3	II	Category D	
3095	CORROSIVE SOLID, SELF-HEATING, N.O.S.	8	4.2	I	Category D	
3095	CORROSIVE SOLID, SELF-HEATING, N.O.S.	8	4.2	II	Category D	
3096	CORROSIVE SOLID, WATER-REACTIVE, N.O.S.	8	4.3	I	Category D	
3096	CORROSIVE SOLID, WATER-REACTIVE, N.O.S.	8	4.3	II	Category D	
3097	FLAMMABLE SOLID, OXIDIZING, N.O.S.	4.1	5.1	II	-	
3097	FLAMMABLE SOLID, OXIDIZING, N.O.S.	4.1	5.1	III	-	
3098	OXIDIZING LIQUID, CORROSIVE, N.O.S.	5.1	8	I	Category D H1	SG38 SG49 SG60

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3098	OXIDIZING LIQUID, CORROSIVE, N.O.S.	5.1	8	II	Category B H1	SG38 SG49 SG60
3098	OXIDIZING LIQUID, CORROSIVE, N.O.S.	5.1	8	III	Category B H1	SG38 SG49 SG60
3099	OXIDIZING LIQUID, TOXIC, N.O.S.	5.1	6.1	I	Category D	SG38 SG49 SG60
3099	OXIDIZING LIQUID, TOXIC, N.O.S.	5.1	6.1	II	Category B	SG38 SG49 SG60
3099	OXIDIZING LIQUID, TOXIC, N.O.S.	5.1	6.1	III	Category B	SG38 SG49 SG60
3100	OXIDIZING SOLID, SELF-HEATING, N.O.S.	5.1	4.2	I	-	
3100	OXIDIZING SOLID, SELF-HEATING, N.O.S.	5.1	4.2	II	-	
3101	ORGANIC PEROXIDE TYPE B, LIQUID	5.2	See SP181		Category D SW1	SG1 SG35 SG36
3102	ORGANIC PEROXIDE TYPE B, SOLID	5.2	See SP181		Category D SW1	SG1 SG35 SG36
3103	ORGANIC PEROXIDE TYPE C, LIQUID	5.2			Category D SW1	SG35 SG36
3104	ORGANIC PEROXIDE TYPE C, SOLID	5.2			Category D SW1	SG35 SG36
3105	ORGANIC PEROXIDE TYPE D, LIQUID	5.2			Category D SW1	SG35 SG36 SG72
3106	ORGANIC PEROXIDE TYPE D, SOLID	5.2			Category D SW1	SG35 SG36
3107	ORGANIC PEROXIDE TYPE E, LIQUID	5.2			Category D SW1	SG35 SG36 SG72
3108	ORGANIC PEROXIDE TYPE E, SOLID	5.2			Category D SW1	SG35 SG36
3109	ORGANIC PEROXIDE TYPE F, LIQUID	5.2			Category D SW1	SG35 SG36 SG72
3110	ORGANIC PEROXIDE TYPE F, SOLID	5.2			Category D SW1	SG35 SG36
3111	ORGANIC PEROXIDE TYPE B, LIQUID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG1 SG35 SG36
3112	ORGANIC PEROXIDE TYPE B, SOLID, TEMPERATURE CONTROLLED	5.2	See SP181		Category D SW1 SW3	SG1 SG35 SG36
3113	ORGANIC PEROXIDE TYPE C, LIQUID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3114	ORGANIC PEROXIDE TYPE C, SOLID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3115	ORGANIC PEROXIDE TYPE D, LIQUID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3116	ORGANIC PEROXIDE TYPE D, SOLID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3117	ORGANIC PEROXIDE TYPE E, LIQUID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3118	ORGANIC PEROXIDE TYPE E, SOLID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36

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3119	ORGANIC PEROXIDE TYPE F, LIQUID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3120	ORGANIC PEROXIDE TYPE F, SOLID, TEMPERATURE CONTROLLED	5.2			Category D SW1 SW3	SG35 SG36
3121	OXIDIZING SOLID, WATER-REACTIVE, N.O.S.	5.1	4.3	I	-	
3121	OXIDIZING SOLID, WATER-REACTIVE, N.O.S.	5.1	4.3	II	-	
3122	TOXIC LIQUID, OXIDIZING, N.O.S.	6.1	5.1	I	Category C	
3122	TOXIC LIQUID, OXIDIZING, N.O.S.	6.1	5.1	II	Category C	
3123	TOXIC LIQUID, WATER-REACTIVE, N.O.S.	6.1	4.3	I	Category D SW2	
3123	TOXIC LIQUID, WATER-REACTIVE, N.O.S.	6.1	4.3	II	Category D SW2	
3124	TOXIC SOLID, SELF-HEATING, N.O.S.	6.1	4.2	I	Category D SW2	
3124	TOXIC SOLID, SELF-HEATING, N.O.S.	6.1	4.2	II	Category D SW2	
3125	TOXIC SOLID, WATER-REACTIVE, N.O.S.	6.1	4.3	I	Category D SW2	
3125	TOXIC SOLID, WATER-REACTIVE, N.O.S.	6.1	4.3	II	Category D SW2	
3126	SELF-HEATING SOLID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	II	Category C	
3126	SELF-HEATING SOLID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	III	Category C	
3127	SELF-HEATING SOLID, OXIDIZING, N.O.S.	4.2	5.1	II	-	
3127	SELF-HEATING SOLID, OXIDIZING, N.O.S.	4.2	5.1	III	-	
3128	SELF-HEATING SOLID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	II	Category C	
3128	SELF-HEATING SOLID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	III	Category C	
3129	WATER-REACTIVE LIQUID, CORROSIVE, N.O.S.	4.3	8	I	Category D	
3129	WATER-REACTIVE LIQUID, CORROSIVE, N.O.S.	4.3	8	II	Category E SW5	
3129	WATER-REACTIVE LIQUID, CORROSIVE, N.O.S.	4.3	8	III	Category E	
3130	WATER-REACTIVE LIQUID, TOXIC, N.O.S.	4.3	6.1	I	Category D	
3130	WATER-REACTIVE LIQUID, TOXIC, N.O.S.	4.3	6.1	II	Category E SW5	
3130	WATER-REACTIVE LIQUID, TOXIC, N.O.S.	4.3	6.1	III	Category E SW5	
3131	WATER-REACTIVE SOLID, CORROSIVE, N.O.S.	4.3	8	I	Category D	
3131	WATER-REACTIVE SOLID, CORROSIVE, N.O.S.	4.3	8	II	Category E SW5	
3131	WATER-REACTIVE SOLID, CORROSIVE, N.O.S.	4.3	8	III	Category E SW5	
3132	WATER-REACTIVE SOLID, FLAMMABLE, N.O.S.	4.3	4.1	I	-	
3132	WATER-REACTIVE SOLID, FLAMMABLE, N.O.S.	4.3	4.1	II	-	
3132	WATER-REACTIVE SOLID, FLAMMABLE, N.O.S.	4.3	5.1	III	-	
3133	WATER-REACTIVE SOLID, OXIDIZING, N.O.S.	4.3	5.1	II	-	
3133	WATER-REACTIVE SOLID, OXIDIZING, N.O.S.	4.3	5.1	III	-	
3134	WATER-REACTIVE SOLID, TOXIC, N.O.S.	4.3	6.1	I	Category D	
3134	WATER-REACTIVE SOLID, TOXIC, N.O.S.	4.3	6.1	II	Category E SW5	

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3134	WATER-REACTIVE SOLID, TOXIC, N.O.S.	4.3	6.1	III	Category E SW5	
3135	WATER-REACTIVE SOLID, SELF-HEATING, N.O.S.	4.3	4.2	I	-	
3135	WATER-REACTIVE SOLID, SELF-HEATING, N.O.S.	4.3	4.2	II	-	
3135	WATER-REACTIVE SOLID, SELF-HEATING, N.O.S.	4.3	4.2	III	-	
3136	TRIFLUOROMETHANE, REFRIGERATED LIQUID	2.2			Category D	
3137	OXIDIZING SOLID, FLAMMABLE, N.O.S.	5.1	4.1	I	-	
3138	ETHYLENE, ACETYLENE AND PROPYLENE MIXTURE, REFRIGERATED LIQUID containing at least 71.5% ethylene, with not more than 22.5% acetylene and not more than 6% propylene	2.1			Category D SW2	SG46
3139	OXIDIZING LIQUID, N.O.S.	5.1		I	Category D	SG38 SG49 SG60
3139	OXIDIZING LIQUID, N.O.S.	5.1		II	Category B	SG38 SG49 SG60
3139	OXIDIZING LIQUID, N.O.S.	5.1		III	Category B	SG38 SG49 SG60
3140	ALKALOIDS, LIQUID, N.O.S. or ALKALOIDS SALTS, LIQUID, N.O.S.	6.1		I	Category A	
3140	ALKALOIDS, LIQUID, N.O.S. or ALKALOIDS SALTS, LIQUID, N.O.S.	6.1		II	Category A	
3140	ALKALOIDS, LIQUID, N.O.S. or ALKALOIDS SALTS, LIQUID, N.O.S.	6.1		III	Category A	
3141	ANTIMONY COMPOUND, INORGANIC, LIQUID, N.O.S.	6.1		III	Category A	
3142	DISINFECTANT, LIQUID, TOXIC, N.O.S.	6.1		I	Category A SW2	
3142	DISINFECTANT, LIQUID, TOXIC, N.O.S.	6.1		II	Category A SW2	
3142	DISINFECTANT, LIQUID, TOXIC, N.O.S.	6.1		III	Category A SW2	
3143	DYE, SOLID, TOXIC, N.O.S. or DYE INTERMEDIATE, SOLID, TOXIC, N.O.S.	6.1		I	Category A	
3143	DYE, SOLID, TOXIC, N.O.S. or DYE INTERMEDIATE, SOLID, TOXIC, N.O.S.	6.1		II	Category A	
3143	DYE, SOLID, TOXIC, N.O.S. or DYE INTERMEDIATE, SOLID, TOXIC, N.O.S.	6.1		III	Category A	
3144	NICOTINE COMPOUND, LIQUID, N.O.S. or NICOTINE PREPARATION, LIQUID, N.O.S.	6.1		I	Category B SW2	
3144	NICOTINE COMPOUND, LIQUID, N.O.S. or NICOTINE PREPARATION, LIQUID, N.O.S.	6.1		II	Category B SW2	
3144	NICOTINE COMPOUND, LIQUID, N.O.S. or NICOTINE PREPARATION, LIQUID, N.O.S.	6.1		III	Category B SW2	
3145	ALKYLPHENOLS, LIQUID, N.O.S. (including C2-C12 homologues)	8		I	Category B	
3145	ALKYLPHENOLS, LIQUID, N.O.S. (including C2-C12 homologues)	8		II	Category B	
3145	ALKYLPHENOLS, LIQUID, N.O.S. (including C2-C12 homologues)	8		III	Category A	
3146	ORGANOTIN COMPOUND, SOLID, N.O.S.	6.1	P	I	Category B SW2	
3146	ORGANOTIN COMPOUND, SOLID, N.O.S.	6.1	P	II	Category A SW2	

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3146	ORGANOTIN COMPOUND, SOLID, N.O.S.	6.1	P	III	Category A SW2	
3147	DYE, SOLID, CORROSIVE, N.O.S. or DYE INTERMEDIATE, SOLID, CORROSIVE, N.O.S.	8		I	Category A	
3147	DYE, SOLID, CORROSIVE, N.O.S. or DYE INTERMEDIATE, SOLID, CORROSIVE, N.O.S.	8		II	Category A	
3147	DYE, SOLID, CORROSIVE, N.O.S. or DYE INTERMEDIATE, SOLID, CORROSIVE, N.O.S.	8		III	Category A	
3148	WATER-REACTIVE LIQUID, N.O.S.	4.3		I	Category E SW2	
3148	WATER-REACTIVE LIQUID, N.O.S.	4.3		II	Category E SW2	
3148	WATER-REACTIVE LIQUID, N.O.S.	4.3		III	Category E SW2	
3149	HYDROGEN PEROXIDE AND PEROXYACETIC ACID MIXTURE, with acid(s), water and not more than 5	5.1	8	II	Category D SW1	SG16 SG59 SG72
3150	DEVICES, SMALL, HYDROCARBON GAS POWERED or HYDROCARBON GAS REFILLS FOR SMALL DEVICES wi	2.1			Category B SW2	
3151	POLYHALOGENATED BIPHENYLS, LIQUID or POLYHALOGENATED TERPHENYLS, LIQUID	9		II	Category A	SG50
3152	POLYHALOGENATED BIPHENYLS, SOLID or POLYHALOGENATED TERPHENYLS, SOLID	9	P	II	Category A	SG50
3153	PERFLUORO (METHYL VINYL ETHER)	2.1			Category E SW2	
3154	PERFLUORO (ETHYL VINYL ETHER)	2.1			Category E SW2	
3155	PENTACHLOROPHENOL	6.1	P	II	Category A	
3156	COMPRESSED GAS, OXIDIZING, N.O.S.	2.2	5.1		Category D	
3157	LIQUEFIED GAS, OXIDIZING, N.O.S.	2.2	5.1		Category D	
3158	GAS, REFRIGERATED LIQUID, N.O.S.	2.2			Category D	
3159	1,1,1,2-TETRAFLUOROETHANE (REFRIGERANT GAS R 134a)	2.2			Category A	
3160	LIQUEFIED GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1		Category D SW2	
3161	LIQUEFIED GAS, FLAMMABLE, N.O.S.	2.1			Category D SW2	
3162	LIQUEFIED GAS, TOXIC, N.O.S.	2.3			Category D SW2	
3163	LIQUEFIED GAS, N.O.S.	2.2			Category A	
3164	ARTICLES, PRESSURIZED, PNEUMATIC or HYDRAULIC (containing non-flammable gas)	2.2			Category A	
3165	AIRCRAFT HYDRAULIC POWER UNIT FUEL TANK (containing a mixture of anhydrous hydrazine and	3	"6.1/8	I	Category D SW2	SG5 SG8 SG13
3166	ENGINE, INTERNAL COMBUSTION or VEHICLE, FLAMMABLE GAS POWERED or VEHICLE, FLAMMABLE LIQU	9			Category A	
3167	GAS SAMPLE, NON-PRESSURIZED, FLAMMABLE, N.O.S., not refrigerated liquid	2.1			Category D	
3168	GAS SAMPLE, NON-PRESSURIZED, TOXIC, FLAMMABLE, N.O.S., not refrigerated liquid	2.3	2.1		Category D	

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3169	GAS SAMPLE, NON-PRESSURIZED, TOXIC, N.O.S., not refrigerated liquid	2.3			Category D	
3170	ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS	4.3		II	Category B SW5 H1	
3170	ALUMINIUM SMELTING BY-PRODUCTS or ALUMINIUM REMELTING BY-PRODUCTS	4.3		III	Category B SW5 H1	
3171	BATTERY-POWERED VEHICLE or BATTERY-POWERED EQUIPMENT	9			Category A	
3172	TOXINS, EXTRACTED FROM LIVING SOURCES, LIQUID, N.O.S.	6.1		I	Category B	
3172	TOXINS, EXTRACTED FROM LIVING SOURCES, LIQUID, N.O.S.	6.1		II	Category B	
3172	TOXINS, EXTRACTED FROM LIVING SOURCES, LIQUID, N.O.S.	6.1		III	Category A	
3174	TITANIUM DISULPHIDE	4.2		III	Category A	
3175	SOLIDS CONTAINING FLAMMABLE LIQUID, N.O.S.	4.1		II	Category B	
3176	FLAMMABLE SOLID, ORGANIC, MOLTEN, N.O.S.	4.1		II	Category C	
3176	FLAMMABLE SOLID, ORGANIC, MOLTEN, N.O.S.	4.1		III	Category C	
3178	FLAMMABLE SOLID, INORGANIC, N.O.S.	4.1		II	Category B	
3178	FLAMMABLE SOLID, INORGANIC, N.O.S.	4.1		III	Category B	
3179	FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S.	4.1	6.1	II	Category B SW2	
3179	FLAMMABLE SOLID, TOXIC, INORGANIC, N.O.S.	4.1	6.1	III	Category B SW2	
3180	FLAMMABLE SOLID, CORROSIVE, INORGANIC, N.O.S.	4.1	8	II	Category D SW2	
3180	FLAMMABLE SOLID, CORROSIVE, INORGANIC, N.O.S.	4.1	8	III	Category D SW2	
3181	METAL SALTS OF ORGANIC COMPOUNDS, FLAMMABLE, N.O.S.	4.1		II	Category B SW2	
3181	METAL SALTS OF ORGANIC COMPOUNDS, FLAMMABLE, N.O.S.	4.1		III	Category B SW2	
3182	METAL HYDRIDES, FLAMMABLE, N.O.S.	4.1		II	Category E	
3182	METAL HYDRIDES, FLAMMABLE, N.O.S.	4.1		III	Category E	
3183	SELF-HEATING LIQUID, ORGANIC, N.O.S.	4.2		II	Category C	
3183	SELF-HEATING LIQUID, ORGANIC, N.O.S.	4.2		III	Category C	
3184	SELF-HEATING LIQUID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	II	Category C	
3184	SELF-HEATING LIQUID, TOXIC, ORGANIC, N.O.S.	4.2	6.1	III	Category C	
3185	SELF-HEATING LIQUID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	II	Category C	
3185	SELF-HEATING LIQUID, CORROSIVE, ORGANIC, N.O.S.	4.2	8	III	Category C	
3186	SELF-HEATING LIQUID, INORGANIC, N.O.S.	4.2		II	Category C	
3186	SELF-HEATING LIQUID, INORGANIC, N.O.S.	4.2		III	Category C	
3187	SELF-HEATING LIQUID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	II	Category C	
3187	SELF-HEATING LIQUID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	III	Category C	
3188	SELF-HEATING LIQUID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	II	Category C	
3188	SELF-HEATING LIQUID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	III	Category C	
3189	METAL POWDER, SELF-HEATING, N.O.S.	4.2		II	Category C	

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3189	METAL POWDER, SELF-HEATING, N.O.S.	4.2		III	Category C	
3190	SELF-HEATING SOLID, INORGANIC, N.O.S.	4.2		II	Category C	
3190	SELF-HEATING SOLID, INORGANIC, N.O.S.	4.2		III	Category C	
3191	SELF-HEATING SOLID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	II	Category C	
3191	SELF-HEATING SOLID, TOXIC, INORGANIC, N.O.S.	4.2	6.1	III	Category C	
3192	SELF-HEATING SOLID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	II	Category C	
3192	SELF-HEATING SOLID, CORROSIVE, INORGANIC, N.O.S.	4.2	8	III	Category C	
3194	PYROPHORIC LIQUID, INORGANIC, N.O.S.	4.2		I	Category D	SG63
3200	PYROPHORIC SOLID, INORGANIC, N.O.S.	4.2		I	Category D	
3205	ALKALINE EARTH METAL ALCOHOLATES, N.O.S.	4.2		II	Category B	
3205	ALKALINE EARTH METAL ALCOHOLATES, N.O.S.	4.2		III	Category B	
3206	ALKALI METAL ALCOHOLATES, SELF-HEATING, CORROSIVE, N.O.S.	4.2	8	II	Category B	
3206	ALKALI METAL ALCOHOLATES, SELF-HEATING, CORROSIVE, N.O.S.	4.2	8	III	Category B	
3208	METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S.	4.3		I	Category E SW2	
3208	METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S.	4.3		II	Category E SW2	
3208	METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S.	4.3		III	Category E SW2	
3209	METALLIC SUBSTANCE, WATER-REACTIVE, SELF-HEATING, N.O.S.	4.3	4.2	I	Category E SW2	
3209	METALLIC SUBSTANCE, WATER-REACTIVE, SELF-HEATING, N.O.S.	4.3	4.2	II	Category E SW2	
3209	METALLIC SUBSTANCE, WATER-REACTIVE, SELF-HEATING, N.O.S.	4.3	4.2	III	Category E SW2	
3210	CHLORATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		II	Category B	SG38 SG49 SG62
3210	CHLORATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		III	Category B	SG38 SG49 SG62
3211	PERCHLORATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		II	Category B	SG38 SG49 SG62
3211	PERCHLORATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		III	Category B	SG38 SG49 SG62
3212	HYPOCHLORITES, INORGANIC, N.O.S.	5.1		II	Category D SW1 SW17	SG35 SG38 SG49 SG53 SG60
3213	BROMATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		II	Category B	SG38 SG49 SG62
3213	BROMATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		III	Category B	SG38 SG49 SG62
3214	PERMANGANATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		II	Category D	SG38 SG49 SG60 SG62

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3215	PERSULPHATES, INORGANIC, N.O.S.	5.1		III	Category A	SG40 SG49
3216	PERSULPHATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		III	Category A	SG38 SG49 SG62
3218	NITRATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		II	Category B	SG38 SG49 SG62
3218	NITRATES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		III	Category B	SG38 SG49 SG62
3219	NITRITES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		II	Category B	SG38 SG49 SG62
3219	NITRITES, INORGANIC, AQUEOUS SOLUTION, N.O.S.	5.1		III	Category B	SG38 SG49 SG62
3220	PENTAFLUOROETHANE (REFRIGERANT GAS R 125)	2.2			Category A	
3221	SELF-REACTIVE LIQUID TYPE B	4.1	See SP181		Category D SW1	SG1 SG35 SG36
3222	SELF-REACTIVE SOLID TYPE B	4.1	See SP181		Category D SW1	SG1 SG35 SG36
3223	SELF-REACTIVE LIQUID TYPE C	4.1			Category D SW1	SG35 SG36
3224	SELF-REACTIVE SOLID TYPE C	4.1			Category D SW1	SG35 SG36
3225	SELF-REACTIVE LIQUID TYPE D	4.1			Category D SW1	SG35 SG36
3226	SELF-REACTIVE SOLID TYPE D	4.1			Category D SW1	SG35 SG36
3227	SELF-REACTIVE LIQUID TYPE E	4.1			Category D SW1	SG35 SG36
3228	SELF-REACTIVE SOLID TYPE E	4.1			Category D SW1	SG35 SG36
3229	SELF-REACTIVE LIQUID TYPE F	4.1			Category D SW1	SG35 SG36
3230	SELF-REACTIVE SOLID TYPE F	4.1			Category D SW1	SG35 SG36
3231	SELF-REACTIVE LIQUID TYPE B, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG1 SG35 SG36
3232	SELF-REACTIVE SOLID TYPE B, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG1 SG35 SG36
3233	SELF-REACTIVE LIQUID TYPE C, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3234	SELF-REACTIVE SOLID TYPE C, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3235	SELF-REACTIVE LIQUID TYPE D, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3236	SELF-REACTIVE SOLID TYPE D, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3237	SELF-REACTIVE LIQUID TYPE E, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3238	SELF-REACTIVE SOLID TYPE E, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36

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3239	SELF-REACTIVE LIQUID TYPE F, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3240	SELF-REACTIVE SOLID TYPE F, TEMPERATURE CONTROLLED	4.1			Category D SW1 SW3	SG35 SG36
3241	2-BROMO-2-NITROPROPANE-1,3-DIOL	4.1		III	Category C SW1 SW2 H2 H3	
3242	AZODICARBONAMIDE	4.1		II	Category D	SG17 SG35 SG36
3243	SOLIDS CONTAINING TOXIC LIQUID, N.O.S.	6.1		II	Category B SW2	
3244	SOLIDS CONTAINING CORROSIVE LIQUID, N.O.S.	8		II	Category B SW2	
3245	GENETICALLY MODIFIED MICROORGANISMS or GENETICALLY MODIFIED ORGANISMS	9			SW7	SG50
3246	METHANESULPHONYL CHLORIDE	6.1	8	I	Category D SW2	
3247	SODIUM PEROXOBORATE, ANHYDROUS	5.1		II	Category A SW1 H1	
3248	MEDICINE, LIQUID, FLAMMABLE, TOXIC, N.O.S	3	6.1	II	Category B SW2	
3248	MEDICINE, LIQUID, FLAMMABLE, TOXIC, N.O.S	3	6.1	III	Category A	
3249	MEDICINE, SOLID, TOXIC, N.O.S.	6.1		II	Category C SW2	
3249	MEDICINE, SOLID, TOXIC, N.O.S.	6.1		III	Category C SW2	
3250	CHLOROACETIC ACID, MOLTEN	6.1	8	II	Category C SW2	
3251	ISOSORBIDE-5-MONONITRATE	4.1		III	Category D SW1 H2 H3	
3252	DIFLUOROMETHANE (REFRIGERANT GAS R 32)	2.1			Category D SW2	
3253	DISODIUM TRIOXOSILICATE	8		III	Category A	SG35
3254	TRIBUTYLPHOSPHANE	4.2		I	Category D	SG44
3255	tert-BUTYL HYPOCHLORITE	4.2	8	I	Category D	
3256	ELEVATED TEMPERATURE LIQUID, FLAMMABLE, N.O.S. with flashpoint above 60ºC, at or above i	3		III	Category A	
3257	ELEVATED TEMPERATURE LIQUID, N.O.S. at or above 100ºC and below its flashpoint (includin	9		III	Category A SW5	
3258	ELEVATED TEMPERATURE SOLID, N.O.S. at or above 240ºC	9		III	Category A SW5	
3259	AMINES, SOLID, CORROSIVE, N.O.S. or POLYAMINES, SOLID, CORROSIVE, N.O.S.	8		I	Category A	SG35
3259	AMINES, SOLID, CORROSIVE, N.O.S. or POLYAMINES, SOLID, CORROSIVE, N.O.S.	8		II	Category A	SG35
3259	AMINES, SOLID, CORROSIVE, N.O.S. or POLYAMINES, SOLID, CORROSIVE, N.O.S.	8		III	Category A	SG35
3260	CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S.	8		I	Category B	
3260	CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S.	8		II	Category B	

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3260	CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S.	8		III	Category A	
3261	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S.	8		I	Category B	
3261	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S.	8		II	Category B	
3261	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S.	8		III	Category A	
3262	CORROSIVE SOLID, BASIC, INORGANIC, N.O.S.	8		I	Category B	SG35
3262	CORROSIVE SOLID, BASIC, INORGANIC, N.O.S.	8		II	Category B	SG35
3262	CORROSIVE SOLID, BASIC, INORGANIC, N.O.S.	8		III	Category A	SG35
3263	CORROSIVE SOLID, BASIC,ORGANIC, N.O.S.	8		I	Category B	SG35
3263	CORROSIVE SOLID, BASIC,ORGANIC, N.O.S.	8		II	Category B	SG35
3263	CORROSIVE SOLID, BASIC,ORGANIC, N.O.S.	8		III	Category A	SG35
3264	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.	8		I	Category B SW2	
3264	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.	8		II	Category B SW2	
3264	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.	8		III	Category A SW2	
3265	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.	8		I	Category B SW2	
3265	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.	8		II	Category B SW2	
3265	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.	8		III	Category A SW2	
3266	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.	8		I	Category B SW2	SG35
3266	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.	8		II	Category B SW2	SG35
3266	CORROSIVE LIQUID, BASIC, INORGANIC, N.O.S.	8		III	Category A SW2	SG35
3267	CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S.	8		I	Category B SW2	SG35
3267	CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S.	8		II	Category B SW2	SG35
3267	CORROSIVE LIQUID, BASIC, ORGANIC, N.O.S.	8		III	Category A SW2	SG35
3268	AIR BAG INFLATORS or AIR BAG MODULES or SEAT-BELT PRETENSIONERS	9		III	Category A	
3269	POLYESTER RESIN KIT	3		II	Category B	
3269	POLYESTER RESIN KIT	3		III	Category A	
3270	NITROCELLULOSE MEMBRANE FILTERS with not more than 12.6% nitrogen, by dry mass	4.1		II	Category D	
3271	ETHERS, N.O.S.	3		II	Category B	
3271	ETHERS, N.O.S.	3		III	Category A	
3272	ESTERS, N.O.S.	3		II	Category B	
3272	ESTERS, N.O.S.	3		III	Category A	
3273	NITRILES, FLAMMABLE, TOXIC, N.O.S.	3	6.1	I	Category E SW2	SG35
3273	NITRILES, FLAMMABLE, TOXIC, N.O.S.	3	6.1	II	Category B SW2	SG35
3274	ALCOHOLATES SOLUTION, N.O.S. in alcohol	3	8	II	Category B	

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3275	NITRILES, TOXIC, FLAMMABLE, N.O.S.	6.1	3	I	Category B SW2	SG35
3275	NITRILES, TOXIC, FLAMMABLE, N.O.S.	6.1	3	II	Category B SW2	SG35
3276	NITRILES, TOXIC, LIQUID, N.O.S.	6.1		I	Category B	SG35
3276	NITRILES, TOXIC, LIQUID, N.O.S.	6.1		II	Category B	SG35
3276	NITRILES, TOXIC, LIQUID, N.O.S.	6.1		III	Category A	SG35
3277	CHLOROFORMATES, TOXIC, CORROSIVE, N.O.S.	6.1	8	II	Category A SW1 SW2 H1 H2	
3278	ORGANOPHOSPHORUS COMPOUND, TOXIC, LIQUID, N.O.S.	6.1		I	Category B	
3278	ORGANOPHOSPHORUS COMPOUND, TOXIC, LIQUID, N.O.S.	6.1		II	Category B	
3278	ORGANOPHOSPHORUS COMPOUND, TOXIC, LIQUID, N.O.S.	6.1		III	Category A	
3279	ORGANOPHOSPHORUS COMPOUND, TOXIC, FLAMMABLE N.O.S.	6.1	3	I	Category B SW2	
3279	ORGANOPHOSPHORUS COMPOUND, TOXIC, FLAMMABLE N.O.S.	6.1	3	II	Category B SW2	
3280	ORGANOARSENIC COMPOUND, LIQUID, N.O.S.	6.1		I	Category B	
3280	ORGANOARSENIC COMPOUND, LIQUID, N.O.S.	6.1		II	Category B	
3280	ORGANOARSENIC COMPOUND, LIQUID, N.O.S.	6.1		III	Category A	
3281	METAL CARBONYLS, LIQUID, N.O.S.	6.1		I	Category D SW2	
3281	METAL CARBONYLS, LIQUID, N.O.S.	6.1		II	Category B SW2	
3281	METAL CARBONYLS, LIQUID, N.O.S.	6.1		III	Category B SW2	
3282	ORGANOMETALLIC COMPOUND, TOXIC, LIQUID, N.O.S.	6.1		I	Category B	
3282	ORGANOMETALLIC COMPOUND, TOXIC, LIQUID, N.O.S.	6.1		II	Category B	
3282	ORGANOMETALLIC COMPOUND, TOXIC, LIQUID, N.O.S.	6.1		III	Category A	
3283	SELENIUM COMPOUND, SOLID, N.O.S.	6.1		I	Category B	
3283	SELENIUM COMPOUND, SOLID, N.O.S.	6.1		II	Category B	
3283	SELENIUM COMPOUND, SOLID, N.O.S.	6.1		III	Category A	
3284	TELLURIUM COMPOUND, N.O.S.	6.1		I	Category B	
3284	TELLURIUM COMPOUND, N.O.S.	6.1		II	Category B	
3284	TELLURIUM COMPOUND, N.O.S.	6.1		III	Category A	
3285	VANADIUM COMPOUND, N.O.S.	6.1		I	Category B	
3285	VANADIUM COMPOUND, N.O.S.	6.1		II	Category B	
3285	VANADIUM COMPOUND, N.O.S.	6.1		III	Category A	
3286	FLAMMABLE LIQUID, TOXIC, CORROSIVE, N.O.S.	3	6.1/8	I	Category E SW2	SG5 SG8
3286	FLAMMABLE LIQUID, TOXIC, CORROSIVE, N.O.S.	3	6.1/8	II	Category B SW2	SG5 SG8
3287	TOXIC LIQUID, INORGANIC, N.O.S.	6.1		I	Category B SW2	

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3287	TOXIC LIQUID, INORGANIC, N.O.S.	6.1		II	Category B SW2	
3287	TOXIC LIQUID, INORGANIC, N.O.S.	6.1		III	Category A SW2	
3288	TOXIC SOLID, INORGANIC, N.O.S.	6.1		I	Category B	
3288	TOXIC SOLID, INORGANIC, N.O.S.	6.1		II	Category B	
3288	TOXIC SOLID, INORGANIC, N.O.S.	6.1		III	Category A	
3289	TOXIC LIQUID, CORROSIVE, INORGANIC, N.O.S.	6.1	8	I	Category B SW2	
3289	TOXIC LIQUID, CORROSIVE, INORGANIC, N.O.S.	6.1	8	II	Category B SW2	
3290	TOXIC SOLID, CORROSIVE, INORGANIC, N.O.S.	6.1	8	I	Category B SW2	
3290	TOXIC SOLID, CORROSIVE, INORGANIC, N.O.S.	6.1	8	II	Category B SW2	
3291	CLINICAL WASTE, UNSPECIFIED, N.O.S. or (BIO) MEDICAL WASTE, N.O.S. or REGULATED MEDICAL	6.2		II	SW28	
3292	BATTERIES, CONTAINING SODIUM or CELLS, CONTAINING SODIUM	4.3		II	Category A	
3293	HYDRAZINE, AQUEOUS SOLUTION with not more than 37% hydrazine, by mass	6.1		III	Category A	SG35
3294	HYDROGEN CYANIDE, SOLUTION IN ALCOHOL with not more than 45% hydrogen cyanide	6.1	3P	I	Category D SW2	
3295	HYDROCARBONS, LIQUID, N.O.S.	3		I	Category E	
3295	HYDROCARBONS, LIQUID, N.O.S.	3		II	Category B	
3295	HYDROCARBONS, LIQUID, N.O.S.	3		III	Category A	
3296	HEPTAFLUOROPROPANE (REFRIGERANT GAS R 227)	2.2			Category A	
3297	ETHYLENE OXIDE AND CHLOROTETRAFLUOROETHANE MIXTURE with not more than 8.8% ethylene oxide	2.2			Category A	
3298	ETHYLENE OXIDE AND PENTAFLUOROETHANE MIXTURE with not more than 7.9% ethylene oxide	2.2			Category A	
3299	ETHYLENE OXIDE AND TETRAFLUOROETHANE MIXTURE with not more than 5.6% ethylene oxide	2.2			Category A	
3300	ETHYLENE OXIDE AND CARBON DIOXIDE MIXTURE with more than 87% ethylene oxide	2.3	2.1		Category D SW2	
3301	CORROSIVE LIQUID, SELF-HEATING, N.O.S.	8	4.2	I	Category D	
3301	CORROSIVE LIQUID, SELF-HEATING, N.O.S.	8	4.2	II	Category D	
3302	2-DIMETHYLAMINOETHYL ACRYLATE	6.1		II	Category D SW1	
3303	COMPRESSED GAS, TOXIC, OXIDIZING, N.O.S.	2.3	5.1		Category D SW2	
3304	COMPRESSED GAS, TOXIC, CORROSIVE, N.O.S.	2.3	8		Category D SW2	
3305	COMPRESSED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	2.3	2.1/8		Category D SW2	SG4 SG9
3306	COMPRESSED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	2.3	5.1/8		Category D SW2	SG6 SG19
3307	LIQUEFIED GAS, TOXIC, OXIDIZING, N.O.S.	2.3	5.1		Category D SW2	

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3308	LIQUEFIED GAS, TOXIC, CORROSIVE, N.O.S.	2.3	8		Category D SW2	
3309	LIQUEFIED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	2.3	2.1/8		Category D SW2	SG4 SG9
3310	LIQUEFIED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	2.3	5.1/8		Category D SW2	SG6 SG19
3311	GAS, REFRIGERATED LIQUID, OXIDIZING, N.O.S.	2.2	5.1		Category D	
3312	GAS, REFRIGERATED LIQUID, FLAMMABLE, N.O.S.	2.1			Category D SW2	
3313	ORGANIC PIGMENTS, SELF-HEATING	4.2		II	Category C	
3313	ORGANIC PIGMENTS, SELF-HEATING	4.2		III	Category C	
3314	PLASTICS MOULDING COMPOUND in dough, sheet or extruded rope form, evolving flammable vapour	9		III	Category E SW1 SW6	SG5 SG14
3315	CHEMICAL SAMPLE, TOXIC	6.1		I	Category D SW2	
3316	CHEMICAL KIT or FIRST AID KIT	9			Category A	
3317	2-AMINO-4,6-DINITROPHENOL, WETTED with not less than 20% water, by mass	4.1		I	Category D	SG7 SG30
3318	AMMONIA SOLUTION relative density less than 0.880 at 15°C in water, with more than 50% ammonia	2.3	8		Category D SW2	SG35 SG46
3319	NITROGLYCERIN MIXTURE, DESENSITIZED, SOLID, N.O.S. with more than 2% but not more than 10% nitroglycerin, by mass	4.1			Category E	
3320	SODIUM BOROHYDRIDE AND SODIUM HYDROXIDE SOLUTION with not more than 12% sodium borohydride and not more than 40% sodium hydroxide, by mass	8		II	Category A	SG35
3320	SODIUM BOROHYDRIDE AND SODIUM HYDROXIDE SOLUTION with not more than 12% sodium borohydride and not more than 40% sodium hydroxide, by mass	8		III	Category A	SG35
3321	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), non fissile or fissile-excepted	7	See SP172		Category A SW20	
3322	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-III), non fissile or fissile-excepted	7	See SP172		Category A SW20	
3323	RADIOACTIVE MATERIAL, TYPE C PACKAGE, non fissile or fissile-excepted	7	See SP172		Category A SW12	
3324	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY (LSA-II), FISSILE	7	See SP172		Category A SW12 SW20	
3325	RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY, (LSA-III), FISSILE	7	See SP172		Category A SW12	
3326	RADIOACTIVE MATERIAL, SURFACE CONTAMINATED OBJECTS (SCO-I or SCO-II), FISSILE	7	See SP172		Category A SW12	
3327	RADIOACTIVE MATERIAL, TYPE A PACKAGE, FISSILE, non-special form	7	See SP172		Category A SW12 SW20 SW21	
3328	RADIOACTIVE MATERIAL, TYPE B(U) PACKAGE, FISSILE	7	See SP172		Category A SW12	
3329	RADIOACTIVE MATERIAL, TYPE B(M) PACKAGE, FISSILE	7	See SP172		Category A SW12	
3330	RADIOACTIVE MATERIAL, TYPE C PACKAGE, FISSILE	7	See SP172		Category A SW12	
3331	RADIOACTIVE MATERIAL, TRANSPORTED UNDER SPECIAL ARRANGEMENT, FISSILE	7	See SP172		Category A SW13	

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3332	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, non fissile or fissile-excepted	7	See SP172		Category A	
3333	RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM, FISSILE	7	See SP172		Category A SW12	
3334	AVIATION REGULATED LIQUID, N.O.S.	9			-	
3335	AVIATION REGULATED SOLID, N.O.S.	9			-	
3336	MERCAPTANS, LIQUID, FLAMMABLE, N.O.S. or MERCAPTAN MIXTURE, LIQUID, FLAMMABLE, N.O.S.	3		I	Category E	SG50 SG57
3336	MERCAPTANS, LIQUID, FLAMMABLE, N.O.S. or MERCAPTAN MIXTURE, LIQUID, FLAMMABLE, N.O.S.	3		II	Category B	SG50 SG57
3336	MERCAPTANS, LIQUID, FLAMMABLE, N.O.S. or MERCAPTAN MIXTURE, LIQUID, FLAMMABLE, N.O.S.	3		III	Category B	SG50 SG57
3337	REFRIGERANT GAS R 404A	2.2			Category A	
3338	REFRIGERANT GAS R 407A	2.2			Category A	
3339	REFRIGERANT GAS R 407B	2.2			Category A	
3340	REFRIGERANT GAS R 407C	2.2			Category A	
3341	THIOUREA DIOXIDE	4.2		II	Category D	
3341	THIOUREA DIOXIDE	4.2		III	Category D	
3342	XANTHATES	4.2		II	Category D SW2	
3342	XANTHATES	4.2		III	Category D SW2	
3343	NITROGLYCERIN MIXTURE, DESENSITIZED, LIQUID, FLAMMABLE, N.O.S. with not more than 30% nitroglycerin, by mass	3			Category D	
3344	PENTAERYTHRITE TETRANITRATE (PENTAERYTHRITOL TETRANITRATE; PETN) MIXTURE, DESENSITIZED, SOLID, N.O.S. with more than 10% but not more than 20% PETN, by mass	4.1		II	Category E	
3345	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
3345	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
3345	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
3346	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23°C	3	6.1	I	Category B SW2	
3346	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23°C	3	6.1	II	Category B SW2	
3347	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not than 23°C	6.1	3	I	Category B SW2	
3347	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23°C	6.1	3	II	Category B SW2	
3347	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23°C	6.1	3	III	Category A SW2	

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3348	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3348	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3348	PHENOXYACETIC ACID DERIVATIVE PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3349	PYRETHROID PESTICIDE, SOLID, TOXIC	6.1		I	Category A SW2	
3349	PYRETHROID PESTICIDE, SOLID, TOXIC	6.1		II	Category A SW2	
3349	PYRETHROID PESTICIDE, SOLID, TOXIC	6.1		III	Category A SW2	
3350	PYRETHROID PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23°C	3	6.1	I	Category B SW2	
3350	PYRETHROID PESTICIDE, LIQUID, FLAMMABLE, TOXIC flashpoint less than 23°C	3	6.1	II	Category B SW2	
3351	PYRETHROID PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23°C	6.1	3	I	Category B SW2	
3351	PYRETHROID PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23°C	6.1	3	II	Category B SW2	
3351	PYRETHROID PESTICIDE, LIQUID, TOXIC, FLAMMABLE flashpoint not less than 23°C	6.1	3	III	Category A SW2	
3352	PYRETHROID PESTICIDE, LIQUID, TOXIC	6.1		I	Category B SW2	
3352	PYRETHROID PESTICIDE, LIQUID, TOXIC	6.1		II	Category B SW2	
3352	PYRETHROID PESTICIDE, LIQUID, TOXIC	6.1		III	Category A SW2	
3354	INSECTICIDE GAS, FLAMMABLE, N.O.S.	2.1			Category D	
3355	INSECTICIDE GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1		Category D SW2	
3356	OXYGEN GENERATOR, CHEMICAL	5.1		II	Category D	
3357	NITROGLYCERIN MIXTURE, DESENSITIZED, LIQUID, N.O.S with not more than 30% nitroglycerin,	3		II	Category D	
3358	REFRIGERATING MACHINES containing flammable, non-toxic, liquefied gas	2.1			Category D	
3359	FUMIGATED CARGO TRANSPORT UNIT	9			Category B SW2	
3360	FIBRES, VEGETABLE, DRY	4.1			Category A	
3361	CHLOROSILANES, TOXIC, CORROSIVE, N.O.S.	6.1	8	II	Category C SW2	
3362	CHLOROSILANES, TOXIC, CORROSIVE, FLAMMABLE, N.O.S.	6.1	"3/8	II	Category C SW2	SG5 SG8
3363	DANGEROUS GOODS IN MACHINERY or DANGEROUS GOODS IN APPARATUS	9			Category A	
3364	TRINITROPHENOL (PICRIC ACID), WETTED with not less than 10% water, by mass	4.1		I	Category E	SG7 SG30
3365	TRINITROCHLOROBENZENE (PICRYL CHLORIDE), WETTED with not less than 10% water by mass	4.1		I	Category E	SG7 SG30
3366	TRINITROTOLUENE (TNT), WETTED with not less than 10% water, by mass	4.1		I	Category E	SG7 SG30
3367	TRINITROBENZENE, WETTED with not less than 10% water, by mass	4.1		I	Category E	SG7 SG30

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3368	TRINITROBENZOIC ACID, WETTED with not less than 10% water, by mass	4.1		I	Category E	SG7 SG30
3369	SODIUM DINITRO-o-CRESOLATE, WETTED with not less than 10% water, by mass	4.1	6.1P	I	Category E	SG7 SG30
3370	UREA NITRATE, WETTED with not less than 10% water, by mass	4.1		I	Category E	SG7 SG30
3371	2-METHYLBUTANAL	3		II	Category B	
3373	BIOLOGICAL SUBSTANCE, CATEGORY B	6.2			Category C SW2 SW18	
3374	ACETYLENE, SOLVENT FREE	2.1			Category D SW1 SW2	SG46
3375	AMMONIUM NITRATE EMULSION or SUPENSION or GEL intermediate for blasting explosives	5.1		II	Category D SW1	SG16 SG42 SG45 SG47 SG48 SG51 SG56 SG58 SG59 SG61
3376	4-NITROPHENYLHYDRAZINE, with not less than 30% water, by mass	4.1		I	Category E	SG7 SG30
3377	SODIUM PERBORATE MONOHYDRATE	5.1		III	Category A SW1 SW23 H1	SG59
3378	SODIUM CARBONATE PEROXYHYDRATE	5.1		II	Category A SW1 H1	SG59
3378	SODIUM CARBONATE PEROXYHYDRATE	5.1		III	Category A SW1 SW23 H1	SG59
3379	DESENSITIZED EXPLOSIVE, LIQUID, N.O.S.	3		I	Category D	SG30
3380	DESENSITIZED EXPLOSIVE, SOLID, N.O.S.	4.1		I	Category D	SG7 SG30
3381	TOXIC BY INHALATION LIQUID, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m³ and saturated vapour concentration greater than or equal to 500 LC50	6.1		I	Category D SW2	
3382	TOXIC BY INHALATION LIQUID, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC50	6.1		I	Category D SW2	
3383	TOXIC BY INHALATION LIQUID, FLAMMABLE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m³ and saturated vapour concentration greater than or equal to 500 LC50	6.1	3	I	Category D SW2	
3384	TOXIC BY INHALATION LIQUID, FLAMMABLE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC50	6.1	3	I	Category D SW2	
3385	TOXIC BY INHALATION LIQUID, WATER-REACTIVE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m³ and saturated vapour concentration greater than or equal to 500 LC50	6.1	4.3	I	Category D SW2	

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3386	TOXIC BY INHALATION LIQUID, WATER-REACTIVE, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC50	6.1	4.3	I	Category D SW2	
3387	TOXIC BY INHALATION LIQUID, OXIDIZING, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m³ and saturated vapour concentration greater than or equal to 500 LC50	6.1	4.3	I	Category D SW2	
3388	TOXIC BY INHALATION LIQUID, OXIDIZING, N.O.S. with an inhalation toxicity lower than or equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC50	6.1	5.1	I	Category D SW2	
3389	TOXIC BY INHALATION LIQUID, CORROSIVE, N.O.S. with an inhalation toxicity lower than or equal to 200 ml/m³ and saturated vapour concentration greater than or equal to 500 LC50	6.1	8	I	Category D SW2	
3390	TOXIC BY INHALATION LIQUID, CORROSIVE, N.O.S. with an inhalation toxicity lower than equal to 1000 ml/m³ and saturated vapour concentration greater than or equal to 10 LC50	6.1	8	I	Category D SW2	
3391	ORGANOMETALLIC SUBSTANCE, SOLID, PYROPHORIC	4.2		I	Category D	
3392	ORGANOMETALLIC SUBSTANCE, LIQUID, PYROPHORIC	4.2		I	Category D	SG63
3393	ORGANOMETALLIC SUBSTANCE, SOLID, PYROPHORIC, WATER-REACTIVE	4.2	4.3	I	Category D	SG35
3394	ORGANOMETALLIC SUBSTANCE, LIQUID, PYROPHORIC, WATER-REACTIVE	4.2	4.3	I	Category D	SG35 SG63
3395	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE	4.3		I	Category E SW2	SG35
3395	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE	4.3		II	Category E SW2	SG35
3395	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE	4.3		III	Category E SW2	SG35
3396	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, FLAMMABLE	4.3	4.1	I	Category E SW2	SG35
3396	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, FLAMMABLE	4.3	4.1	II	Category E SW2	SG35
3396	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, FLAMMABLE	4.3	4.1	III	Category E SW2	SG35
3397	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, SELF-HEATING	4.3	4.2	I	Category E SW2	SG35
3397	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, SELF-HEATING	4.3	4.2	II	Category E SW2	SG35
3397	ORGANOMETALLIC SUBSTANCE, SOLID, WATER-REACTIVE, SELF-HEATING	4.3	4.2	III	Category E SW2	SG35
3398	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE	4.3		I	Category E SW2	SG35
3398	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE	4.3		II	Category E SW2	SG35
3398	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE	4.3		III	Category E SW2	SG35
3399	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE, FLAMMABLE	4.3	3	I	Category D SW2	SG35

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
3399	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE, FLAMMABLE	4.3	3	II	Category D SW2	SG35
3399	ORGANOMETALLIC SUBSTANCE, LIQUID, WATER-REACTIVE, FLAMMABLE	4.3	3	III	Category E SW2	SG35
3400	ORGANOMETALLIC SUBSTANCE, SOLID , SELF-HEATING	4.2		II	Category C	
3400	ORGANOMETALLIC SUBSTANCE, SOLID , SELF-HEATING	4.2		III	Category C	
3401	ALKALI METAL AMALGAM, SOLID	4.3		I	Category D	SG35
3402	ALKALINE EARTH METAL AMALGAM, SOLID	4.3		I	Category D	SG35
3403	POTASSIUM METAL ALLOYS, SOLID	4.3		I	Category D	SG35
3404	POTASSIUM SODIUM ALLOYS, SOLID	4.3		I	Category D	SG35
3405	BARIUM CHLORATE SOLUTION	5.1	6.1	II	Category A	SG38 SG49 SG62
3405	BARIUM CHLORATE SOLUTION	5.1	6.1	III	Category A	SG38 SG49 SG62
3406	BARIUM PERCHLORATE SOLUTION	5.1	6.1	II	Category A	SG38 SG49 SG62
3406	BARIUM PERCHLORATE SOLUTION	5.1	6.1	III	Category A	SG38 SG49 SG62
3407	CHLORATE AND MAGNESIUM CHLORIDE MIXTURE SOLUTION	5.1		II	Category A	SG38 SG49 SG62
3407	CHLORATE AND MAGNESIUM CHLORIDE MIXTURE SOLUTION	5.1		III	Category A	SG38 SG49 SG62
3408	LEAD PERCHLORATE SOLUTION	5.1	6.1P	II	Category A	SG38 SG49
3408	LEAD PERCHLORATE SOLUTION	5.1	6.1P	III	Category A	SG38 SG49
3409	CHLORONITROBENZENES, LIQUID	6.1		II	Category A	
3410	4-CHLORO-o-TOLUIDINE HYDROCHLORIDE SOLUTION	6.1		III	Category A	
3411	beta-NAPHTHYLAMINE SOLUTION	6.1		II	Category A	
3411	beta-NAPHTHYLAMINE SOLUTION	6.1		III	Category A	
3412	FORMIC ACID with not less than 10% but not more than 85% acid by mass	8		II	Category A SW2	
3412	FORMIC ACID with not less than 5% but less than 10% acid by mass	8		III	Category A SW2	
3413	POTASSIUM CYANIDE SOLUTION	6.1	P	I	Category B	SG35
3413	POTASSIUM CYANIDE SOLUTION	6.1	P	II	Category B	SG35
3413	POTASSIUM CYANIDE SOLUTION	6.1	P	III	Category A	SG35
3414	SODIUM CYANIDE SOLUTION	6.1	P	I	Category B	SG35
3414	SODIUM CYANIDE SOLUTION	6.1	P	II	Category B	SG35
3414	SODIUM CYANIDE SOLUTION	6.1	P	III	Category A	SG35
3415	SODIUM FLUORIDE SOLUTION	6.1		III	Category A	SG35
3416	CHLOROACETOPHENONE, LIQUID	6.1		II	Category D SW1 SW2 H2	

UN Number	PROPER SHIPPING NAME (Note: When there is more than one packing group or PSN the UN No. has been annotated with a, b, c)	Class or division	Subsidiary risk(s)	Packing Group	Stowage and Handling	Segregation
3417	XYLYL BROMIDE, SOLID	6.1		II	Category D SW2	
3418	2,4-TOLUYLENEDIAMINE SOLUTION	6.1		III	Category A	
3419	BORON TRIFLUORIDE ACETIC ACID COMPLEX, SOLID	8		II	Category A	
3420	BORON TRIFLUORIDE PROPIONIC ACID COMPLEX, SOLID	8		II	Category A	
3421	POTASSIUM HYDROGEN DIFLUORIDE SOLUTION	8	6.1	II	Category A SW1 SW2	SG35
3421	POTASSIUM HYDROGEN DIFLUORIDE SOLUTION	8	6.1	III	Category A SW1 SW2	SG35
3422	POTASSIUM FLUORIDE SOLUTION	6.1		III	Category A	SG35
3423	TETRAMETHYLAMMONIUM HYDROXIDE, SOLID	8		II	Category A	SG35
3424	AMMONIUM DINITRO-o-CRESOLATE SOLUTION	6.1	P	II	Category B	SG15 SG16 SG30 SG63
3424	AMMONIUM DINITRO-o-CRESOLATE SOLUTION	6.1	P	III	Category A	SG15 SG16 SG30 SG63
3425	BROMOACETIC ACID, SOLID	8		II	Category A	
3426	ACRYLAMIDE SOLUTION	6.1		III	Category A SW1 H2	
3427	CHLOROBENZYL CHLORIDES, SOLID	6.1		III	Category A	
3428	3-CHLORO-4-METHYLPHENYLISOCYANATE, SOLID	6.1		II	Category B SW2	
3429	CHLOROTOLUIDINES, LIQUID	6.1		III	Category A	
3430	XYLENOLS, LIQUID	6.1		II	Category A	
3431	NITROBENZOTRIFLUORIDES, SOLID	6.1		II	Category A SW2	
3432	POLYCHLORINATED BIPHENYLS, SOLID	9	P	II	Category A	SG50
3434	NITROCRESOLS, LIQUID	6.1		III	Category A	
3436	HEXAFLUOROACETONE HYDRATE, SOLID	6.1		II	Category B SW2	
3437	CHLOROCRESOLS, SOLID	6.1		II	Category A SW1 H2	
3438	alpha-METHYLBENZYL ALCOHOL, SOLID	6.1		III	Category A	
3439	NITRILES, TOXIC, SOLID, N.O.S.	6.1		I	Category B	SG35
3439	NITRILES, TOXIC, SOLID, N.O.S.	6.1		II	Category B	SG35
3439	NITRILES, TOXIC, SOLID, N.O.S.	6.1		III	Category A	SG35
3440	SELENIUM COMPOUND, LIQUID, N.O.S.	6.1		I	Category B	
3440	SELENIUM COMPOUND, LIQUID, N.O.S.	6.1		II	Category B	
3440	SELENIUM COMPOUND, LIQUID, N.O.S.	6.1		III	Category A	
3441	CHLORODINITROBENZENES, SOLID	6.1	P	II	Category A	SG15
3442	DICHLOROANILINES, SOLID	6.1	P	II	Category A SW2	
3443	DINITROBENZENES, SOLID	6.1		II	Category A	SG15
3444	NICOTINE HYDROCHLORIDE, SOLID	6.1		II	Category A	
3445	NICOTINE SULPHATE, SOLID	6.1		II	Category A	

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3446	NITROTOLUENES, SOLID	6.1		II	Category A	
3447	NITROXYLENES, SOLID	6.1		II	Category A	
3448	TEAR GAS SUBSTANCE, SOLID, N.O.S.	6.1		I	Category D SW2	
3448	TEAR GAS SUBSTANCE, SOLID, N.O.S.	6.1		II	Category D SW2	
3449	BROMOBENZYL CYANIDES, SOLID	6.1		I	Category D SW1 SW2 H2	SG35
3450	DIPHENYLCHLOROARSINE, SOLID	6.1	P	I	Category D SW2	
3451	TOLUIDINES, SOLID	6.1		II	Category A	
3452	XYLIDINES, SOLID	6.1		II	Category A	
3453	PHOSPHORIC ACID, SOLID	8		III	Category A	
3454	DINITROTOLUENES, SOLID	6.1		II	Category A	
3455	CRESOLS, SOLID	6.1	8	II	Category B	
3456	NITROSYLSULPHURIC ACID, SOLID	8		II	Category D SW2	SG6 SG16 SG17 SG19
3457	CHLORONITROTOLUENES, SOLID	6.1	P	III	Category A	SG6 SG8 SG10 SG12
3458	NITROANISOLES, SOLID	6.1		III	Category A	
3459	NITROBROMOBENZENES, SOLID	6.1		III	Category A	
3460	N-ETHYLBENZYLTOLUIDINES, SOLID	6.1		III	Category A	
3462	TOXINS, EXTRACTED FROM LIVING SOURCES, SOLID, N.O.S.	6.1		I	Category B	
3462	TOXINS, EXTRACTED FROM LIVING SOURCES, SOLID, N.O.S.	6.1		II	Category B	
3462	TOXINS, EXTRACTED FROM LIVING SOURCES, SOLID, N.O.S.	6.1		III	Category A	
3463	PROPIONIC ACID with not less than 90% acid by mass	8	3	II	Category A	
3464	ORGANOPHOSPHORUS COMPOUND, TOXIC, SOLID, N.O.S.	6.1		I	Category B	
3464	ORGANOPHOSPHORUS COMPOUND, TOXIC, SOLID, N.O.S.	6.1		II	Category B	
3464	ORGANOPHOSPHORUS COMPOUND, TOXIC, SOLID, N.O.S.	6.1		III	Category A	
3465	ORGANOARSENIC COMPOUND, SOLID, N.O.S.	6.1		I	Category B	
3465	ORGANOARSENIC COMPOUND, SOLID, N.O.S.	6.1		II	Category B	
3465	ORGANOARSENIC COMPOUND, SOLID, N.O.S.	6.1		III	Category A	
3466	METAL CARBONYLS, SOLID, N.O.S.	6.1		I	Category D SW2	
3466	METAL CARBONYLS, SOLID, N.O.S.	6.1		II	Category D SW2	
3466	METAL CARBONYLS, SOLID, N.O.S.	6.1		III	Category D SW2	
3467	ORGANOMETALLIC COMPOUND, TOXIC, SOLID, N.O.S.	6.1		I	Category B	
3467	ORGANOMETALLIC COMPOUND, TOXIC, SOLID, N.O.S.	6.1		II	Category B	

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3467	ORGANOMETALLIC COMPOUND, TOXIC, SOLID, N.O.S.	6.1		III	Category A	
3468	HYDROGEN IN A METAL HYDRIDE STORAGE SYSTEM or HYDROGEN IN A METAL HYDRIDE STORAGE SYSTEM	2.1			Category D	
3469	PAINT, FLAMMABLE, CORROSIVE (including paint, lacquer, enamel, stain, shellac, varnish,	3	8	I	Category E SW2	
3469	PAINT, FLAMMABLE, CORROSIVE (including paint, lacquer, enamel, stain, shellac, varnish,	3	8	II	Category B SW2	
3469	PAINT, FLAMMABLE, CORROSIVE (including paint, lacquer, enamel, stain, shellac, varnish,	3		III	Category A SW2	
3470	PAINT, CORROSIVE, FLAMMABLE (including paint, lacquer, enamel, stain, shellac, varnish,	8	3	II	Category B SW2	
3471	HYDROGENDIFLUORIDES SOLUTION, N.O.S.	8	6.1	II	Category A SW1 SW2	SG35
3471	HYDROGENDIFLUORIDES SOLUTION, N.O.S.	8	6.1	III	Category A SW1 SW2	SG35
3472	CROTONIC ACID, LIQUID	8		III	Category A SW1 H2	
3473	FUEL CELL CARTRIDGES or FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT or FUEL CELL CARTRID	3			Category A	
3474	1-HYDROXYBENZOTRIAZOLE MONOHYDRATE	4.1		I	Category D	SG7 SG30
3475	ETHANOL AND GASOLINE MIXTURE or ETHANOL AND MOTOR SPIRIT MIXTURE or ETHANOL AND PETROL MIXTURE, with more than 10% ethanolMIXTURE, with more than 10% ethanol	3		II	Category E	
3476	FUEL CELL CARTRIDGES or FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT or FUEL CELL CARTRIDGES PACKED WITH EQUIPMENT, containing water-reactive substances	4.3			Category A	
3477	FUEL CELL CARTRIDGES or FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT or FUEL CELL CARTRID	8			Category A	
3478	FUEL CELL CARTRIDGES or FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT or FUEL CELL CARTRIDGES PACKED WITH EQUIPMENT, containing liquefied flammable gas	2.1			Category B	
3479	FUEL CELL CARTRIDGES or FUEL CELL CARTRIDGES CONTAINED IN EQUIPMENT or FUEL CELL CARTRIDGES PACKED WITH EQUIPMENT, containing hydrogen in metal hydride	2.1			Category B	
3480	LITHIUM ION BATTERIES (including lithium ion polymer batteries)	9		II	Category A	
3481	LITHIUM ION BATTERIES CONTAINED IN EQUIPMENT or LITHIUM ION BATTERIES PACKED WITH EQUIPMENT (including lithium ion polymer batteries)	9		II	Category A	

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3482	ALKALI METAL DISPERSION, FLAMMABLE or ALKALINE EARTH METAL DISPERSION, FLAMMABLE	4.3	3	I	Category D	SG35
3483	MOTOR FUEL ANTI-KNOCK MIXTURE, FLAMMABLE	6.1	3	I	Category D SW1 SW2	
3484	HYDRAZINE, AQUEOUS SOLUTION, FLAMMABLE with more than 37% hydrazine, by mass	8	"3/6.1	I	Category D SW2	SG5 SG8 SG35
3485	CALCIUM HYPOCHLORITE, DRY, CORROSIVE or CALCIUM HYPOCHLORITE MIXTURE, DRY, CORROSIVE with more than 39% available chlorine (8.8% available oxygen)	5.1	8	II	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
3486	CALCIUM HYPOCHLORITE MIXTURE, DRY, CORROSIVE with more than 10% but not more than 39% available chlorine	5.1	8	III	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
3487	CALCIUM HYPOCHLORITE, HYDRATED, CORROSIVE or CALCIUM HYPOCHLORITE, HYDRATED MIXTURE, CORROSIVE, with not less than 5.5% but not more than 16% water	5.1	8	II	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
3487	CALCIUM HYPOCHLORITE, HYDRATED, CORROSIVE or CALCIUM HYPOCHLORITE, HYDRATED MIXTURE, CORROSIVE, with not less than 5.5% but not more than 16% water	5.1	8	III	Category D SW1 SW11	SG35 SG38 SG49 SG53 SG60
3488	TOXIC BY INHALATION LIQUID, FLAMMABLE, CORROSIVE, N.O.S. with an LC50 lower than or equal to 200 ml/m3 and saturated vapour concentration greater than or equal to 500 LC50	6.1	"3/8	I	Category D SW2	SG5 SG8
3489	TOXIC BY INHALATION LIQUID, FLAMMABLE, CORROSIVE, N.O.S. with an LC50 lower than or equal to 1000 ml/m3 and saturated vapour concentration greater than or equal to 10 LC50	6.1	"3/8	I	Category D SW2	SG5 SG8
3490	TOXIC BY INHALATION LIQUID, WATER-REACTIVE, FLAMMABLE, N.O.S. with an LC50 lower than or equal to 200 ml/m3 and saturated vapour concentration greater than or equal to 500 LC50	6.1	4.3/3	I	Category D SW2	SG5 SG7 SG13
3491	TOXIC BY INHALATION LIQUID, WATER-REACTIVE, FLAMMABLE, N.O.S. with an LC50 lower than or equal to 1000 ml/m3 and saturated vapour concentration greater than or equal to 10 LC50	6.1	4.3/3	I	Category D SW2	SG5 SG7 SG13
3494	PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC	3		I	Category D SW2	
3494	PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC	3		II	Category D SW2	
3494	PETROLEUM SOUR CRUDE OIL, FLAMMABLE, TOXIC	3		III	Category C SW2	
3495	IODINE	8	6.1	III	Category B SW2	SG37

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3496	BATTERIES, NICKEL-METAL HYDRIDE	9			Category A SW1	
3497	KRILL MEAL	4.2		II	Category B SW27	SG65
3497	KRILL MEAL	4.2		III	Category A	
3498	IODINE MONOCHLORIDE, LIQUID	8		II	Category D SW2	SG6 SG16 SG17 SG19
3499	CAPACITOR, electric double layer (with an energy storage capacity greater than 0.3 Wh)	9			Category A	
3500	CHEMICAL UNDER PRESSURE, N.O.S.	2.2			Category B	
3501	CHEMICAL UNDER PRESSURE, FLAMMABLE, N.O.S.	2.1			Category D SW2	
3502	CHEMICAL UNDER PRESSURE, TOXIC, N.O.S.	2.2	6.1		Category D SW2	
3503	CHEMICAL UNDER PRESSURE, CORROSIVE, N.O.S.	2.2	8		Category D SW2	
3504	CHEMICAL UNDER PRESSURE, FLAMMABLE, TOXIC, N.O.S.	2.1	6.1		Category D SW2	
3505	CHEMICAL UNDER PRESSURE, FLAMMABLE, CORROSIVE, N.O.S.	2.1	8		Category D SW2	
3506	MERCURY CONTAINED IN MANUFACTURED ARTICLES	8	6.1	III	Category B SW2	SG24

In the dangerous goods list, amend the following entries as follows:

0005	in column (1) and in column (18), the first existing row in the dangerous goods list "0005" is replaced with "0004".
0082	in column (9), delete "PP65".
0241	in column (9), delete "PP65".
0331	in column (9), delete "PP65".
0332	in column (9), delete "PP65".
0222	Amend column (2) to read "AMMONIUM NITRATE". In column (6) insert "370". In column (10) insert "IBC100"; In column (11), insert "B2, B3, B17".
0503	In column (2), amend name to read: "SAFETY DEVICES, PYROTECHNIC".
1005	in column (4) insert "P"
1008	In column (6), replace "-" with "373"
1043	in column (7b) amend the code to read "E0".
1044	in column (9), insert "PP91".
1051 PG I	in column (7b) amend the code to read "E0".
1082	in column (2), add "(REFRIGERANT GAS R 1113)" at the end.
1089 PG I	in column (7b) amend the code to read "E0".
1098	in column (4) insert "P"
1183 PG I	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1206	in column (4) insert "P".
1210	in column (6), insert "367".
1228 PG II	in column (7b) amend the code to read "E0".
1242 PG I	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1259 PG I	in column (7b) amend the code to read "E0".
1261 PG II	in column (7b) amend the code to read "E0".
1262	in column (4) insert "P"
1263	in column (6), insert "367".
1272	in column (4) insert "P"
1278 PG II	in column (7b) amend the code to read "E0".
1295 PG I	in column (16)a insert "H1" and in column (16b) "SG25" and "SG26"
1299	in column (4) insert "P"

1308 PG I	in column (7b) amend the code to read "E0".
1309 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1309 PG III	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1323	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1331 PG III	in column (7b) amend the code to read "E0".
1333 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1334	in column (4) insert "P"
1339 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1340 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1343 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1357	in column (6) delete "919"
1358 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1360 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1361 PG II and PG III	in column (7b) amend the code to read "E0".
1363 PG III	in column (7b) amend the code to read "E0".
1364 PG III	in column (7b) amend the code to read "E0".
1365 PG III	in column (7b) amend the code to read "E0".
1373 PG III	in column (7b) amend the code to read "E0".
1376 PG III	in column (7b) amend the code to read "E0"; in column (16a) insert "H1" and in column (16b) "SG26"
1378 PG II	in colum (7b) amend the code to read "E0".
1379 PG III	in column (7b) amend the code to read "E0".
1380 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1383 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1386 PG III	in column (7b) amend the code to read "E0".
1389 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1390 PG II	in column (16a) insert "H1" and in column (16b) "SG26"

1391 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1392 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1393 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1394 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1395 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1396 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1396 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1397 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1398 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1400 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1401 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1402 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1402 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1403 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1404 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1405 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1405 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1407 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1408 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1409 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1409 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1410 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1411 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1413 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1414 PG I	in column (16a) insert "H1" and in column (16b) "SG26"

1415 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1417 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
1418 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1418 PG II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1419 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1420 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1421 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1422 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1423 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1426 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1427 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1428 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1432 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1433 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1435 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1436 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
1449 PG II	in column (16a) replace "Category "A" with "Category C"; in column (16a) insert "H1" and in column (16b) "SG26" .
1457 PG II	in column (16a) replace "Category "A" with "Category C" and insert "H1"; in column (16)b "SG26"
1472 PG II	in column (16a) replace "Category "A" with "Category C" and insert "H1"; in column (16b) "SG26"
1476 PG II	in column (16a) replace "Category "A" with "Category C" and insert "H1"; in column (16b) "SG26"
1483 PG II and III	in column (16a) replace "Category "A" with "Category C" and insert "H1"; in column (16b) "SG26"
1491 PG I	in column (16a) replace "Category "B" with "Category C" and insert "H1"; in column (16b) "SG26"

1504 PG I	in column (16a) replace "Category B" with "Category C" and insert "H1"; in column (16b) "SG26"
1509 PG II	in column (16a) replace "Category "A" with "Category C" and insert "H1"; in column (16b) "SG26"
1516 PG II	in column (16a) replace "Category "A" with "Category C" and insert "H1"; in column (16b) "SG26"
1545 PG II	in column (7b) amend the code to read "E0".
1547	in column (4) insert "P"
1560 PG I	in column (7b) amend the code to read "E0".
1567 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1569 PG II	in column (7b) amend the code to read "E0".
1583 all packing groups	in column (7b) amend the code to read "E0".
1600	in column (4) insert "P"
1603 PG II	in column (7b) amend the code to read "E0".
1613 PG I	in column (7b) amend the code to read "E0".
1614 PG I	in colum (7b) amend the code to read "E0".
1649 PG I	in column (7b) amend the code to read "E0".
1672 PG I	in column (7b) amend the code to read "E0".
1693 PG I and PG II	in column (7b) amend the code to read "E0".
1694 PG I	in column (7b) amend the code to read "E0".
1697 PG II	in column (7b) amend the code to read "E0".
1698 PG I	in column (7b) amend the code to read "E0".
1699 PG I	in column (7b) amend the code to read "E0".
1700	in column (5), delete the packing group.
1701 PG II	in colum (7b) amend the code to read "E0".
1708	in column (4) insert "P"
1714 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1722 PG I	in column (7b) amend the code to read "E0".
1732 PG II	in column (7b) amend the code to read "E0".
1748	in column (4) insert "P"

1792 PG II	in column (7b) amend the code to read "E0".
1796 PG II	in colum (7b) amend the code to read "E0".
1802 PG II	in column (7b) amend the code to read "E0".
1806 PG II	in column (7b) amend the code to read "E0".
1808 PG II	in column (7b) amend the code to read "E0".
1826 PG II	in column (7b) amend the code to read "E0".
1832 PG II	in column (7b) amend the code to read "E0".
1837 PG II	in column (7b) amend the code to read "E0".
1840	in column (4) insert "P"
1854 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1855 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1868 PG II	in column (7b) amend the code to read "E0".
1869 PG III	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
1870 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1889 PG I	in column (7b) amend the code to read "E0".
1906 PG II	in column (7b) amend the code to read "E0".
1920	in column (4) insert "P"
1928 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
1932 PG III	in column (7b) amend the code to read "E0"; in column (16a) insert "H1" and in column (16b) "SG26"
1939 PG II	in colum (7b) amend the code to read "E0".
1942	Amend column (2) to read "AMMONIUM NITRATE with not more than 0.2% combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance".
2002 PG III	in column (7b) amend the code to read "E0".
2004 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
2006 PG III	in column (7b) amend the code to read "E0".
2008 PG II and III	in column (16a) insert "H1" and in column (16b) "SG26"
2009 PG III	in column (16a) insert "H1" and in column (16b) "SG26"

2010 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2011 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2012 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2013 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2016	in column (5), delete the packing group.
2017	in column (5), delete the packing group.
2030 PG II	in column (7b) amend the code to read "E0".
2038	in column (4) insert "P"
2073	in column (7b) amend the code to read "E0". in column (4) insert "P"
2208	in column (4) insert "P"
2210 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
2212 PG II	in column (2) amend the name to read "ASBESTOS, AMPHIBOLE (amosite, tremolite, actinolite, anthophyllite, crocidolite)"; in column (6) insert "274"; in colum (7b) amend the code to read "E0"; in column (16a) insert "H4"; in column (17) delete the fifth sentence "Crocidolite (blue asbestos) should be regarded as the most hazardous type of asbestos." and the last two sentences "If cleaning of cargo spaces must be carried out at sea, the safety procedures followed and standard of equipment used must be at least as effective as those which would be employed in a port. Until such cleaning is undertaken, the cargo spaces in which the asbestos has been carried should be closed and access to those spaces should be prohibited."
2217 PG III	in column (7b) amend the code to read "E0".
2218	in column (4) insert "P"
2241	in column (4) insert "P"
2249 PG I	in column (7b) amend the code to read "E0".
2254 PG III	in column (7b) amend the code to read "E0".
2257 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2295 PG I	in column (7b) amend the code to read "E0".
2304	in column (4) insert "P"
2325	in column (4) insert "P"
2331	in column (4) insert "P"

2363 PG I	in colum (7b) amend the code to read "E0".
2368	in column (4) insert "P"
2381 PG II	in column (4) insert "P" in colum (7b) amend the code to read "E0".
2404 PG II	in colum (7b) amend the code to read "E0".
2438 PG I	in column (7b) amend the code to read "E0".
2441 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2442 PG II	in column (7b) amend the code to read "E0".
2443 PG II	in column (7b) amend the code to read "E0".
2463 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2466 PG I	in column (16a) replace "Category E" with "Category D" and insert "H1"; in column (16b) "SG26"
2545 PG I, PG II and III	in column (16a) insert "H1" and in column (16b) "SG26"
2546 PG I, PG II and III	in column (16a) insert "H1" and in column (16b) "SG26"
2547 PG I	in column (16a) replace "Category E" with "Category D" and insert "H1"; in column (16b) "SG26"
2558 PG I	in colum (7b) amend the code to read "E0".
2590	in column (2) amend the name to read "ASBESTOS, CHRYSOTILE"; In column (16a) insert "H4" in column (17) delete the last two sentences "If cleaning of cargo spaces must be carried out at sea, the safety procedures followed and standard of equipment used must be at least as effective as those which would be employed in a port. Until such cleaning is undertaken, the cargo spaces in which the asbestos has been carried should be closed and access to those spaces should be prohibited."
2624 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
2626 PG II	in column (7b) amend the code to read "E0".
2672	in column (4) insert "P"
2691 PG II	in column (7b) amend the code to read "E0".
2709	in column (4) insert "P".
2740 PG I	in column (7b) amend the code to read "E0".
2743 PG II	in column (7b) amend the code to read "E0".

2749 PG I	in column (7b) amend the code to read "E0".
2793 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
2798 PG II	in column (7b) amend the code to read "E0".
2799 PG II	in column (7b) amend the code to read "E0".
2805 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
2813 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
2826 PG II	in column (7b) amend the code to read "E0".
2830 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
2835 PG II	in column (7b) amend the code to read "E0". in column (16a) insert "H1" and in column (16b) "SG26"
2844 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
2845 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2846 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
2850	in column (4) insert "P"
2858 PG III	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
2870 PG I (both entries)	in column (16a) insert "H1" and in column (16b) "SG26"
2878 PG III	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
2880 all packing groups	in column (4) insert "P"
2881 PG II	in column (7b) amend the code to read "E0".
2881 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
2910	in column (6) delete "325" and insert "368"
2950 PG III	in column (16a) insert "H1" and in column (16b) "SG26"
2956 PG III	in column (7b) amend the code to read "E0".
2965 PG I	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
2968 PG III	in column (16a) insert "H1" and in column (16b) "SG26"

2977	in column (6) delete special provision "172".
2978	in column (6) delete special provision "172".
2988	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
3048 PG I	in column (7b) amend the code to read "E0".
3066	in column (6), insert "367".
3077	in column (6), insert "969".
3078 PG II	in column (16a) insert "H1" and in column (16b) "SG26"
3082	in column (6) insert"969".
3089 PG II	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
3089 PGIII	in column (10) replace "IBC 06" by "IBC 08"; in column (11) insert "B2 and B4" in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
3090	in column (5), delete the packing group; in column (6) delete "957" and insert "376" and "377"; in column (8) insert "P908, P909", "LP903" and "LP904"; in column (16a) insert "SW19".
3091	in column (5), delete the packing group, in column (6) delete "957" and insert "376" and "377", in column (8) insert "P908, P909", "LP903" and "LP904" in column (16a) insert "SW19".
3094 PG I and PG II	in column (16a) insert "H1" and in column (16b) "SG26"
3096 PG I and PG II	in column (16a) insert "H1" and in column (16b) "SG26"
3097 PG II and PG III	in column (7b) amend the code to read "E0".
3100 PG II	in column (7b) amend the code to read "E0".
3121 PG I and PG II	in column (16a) insert "H1" and in column (16b) "SG26"
3121 PG II	in column (7b) amend the code to read "E0".
3122 PG I	in column (7b) amend the code to read "E0".
3123 PG I and PG II	in column (16a) insert "H1" and in column (16b) "SG26"
3123 PG I	in column (7b) amend the code to read "E0".
3125 PG I and II	in column (16a) insert "H1" and in column (16b) "SG26"

3127 PG II and PG III	in column (7b) amend the code to read "E0".
3129 PG I, PG II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3129 PG II	in column (7b) amend the code to read "E0".
3130 PG I, PG II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3130 PG II	in column (7b) amend the code to read "E0".
3131 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) SG26"
3132 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3133 PG II and PG III	in column (7b) amend the code to read "E0". in column (16a) insert "H1" and in column (16b) "SG26"
3134 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3135 PG I, II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3137 PG I	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
3148 PG I, PG II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3164	in column (6), insert "371".
3166	in column (6) insert "SP 970".
3170 PG II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3189 PG II and III	in column (16a) insert "H1" and in column (16b) "SG26"
3194 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3200 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3208 PG I and III	in column (16a) insert "H1" and in column (16b) "SG26"

3208 PG II	in column (7b) amend the code to read "E0"; in column (16a) insert "H1" and in column (16b) "SG26"
3209 PG I, PG II and PG III	in column (16a) insert "H1" and in column (16b) "SG26"
3242 PG II	in column (7b) amend the code to read "E0".
3251 PG III	in column (7b) amend the code to read "E0".
3268	in column (2), amend the name to read: "SAFETY DEVICES, electrically initiated" and in column (5), delete the packing group.
3292	in column (5), delete the packing group; in column (16a) insert "H1" and in column (16b) "SG26"
3294 PG I	in column (7b) amend the code to read "E0".
3315 PG I	in column (7b) amend the code to read "E0".
3316	delete the existing entry (note: the replacement for this entry is shown in the table for new entries)
3318	in column (4) insert "P"
3336 PG I	in column (7b) amend the code to read "E0".
3356	in column (5), delete the packing group.
3375	In column (8), replace "P099" by "P505"; in column (10) replace "IBC99" by "IBC02" and in column (11), insert "B16".
3378 PG II	In column (6) delete "967". (Amendment applies to the printed version only)
3385 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3386 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3391 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3392 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3393 PG I	in column (14) Insert "TP41". in column (16a) insert "H1" and in column (16b) "SG26"
3394 PG I	in column (14) Insert "TP41"; in column (16a) insert "H1" and in column (16b) "SG26"
3395 all packing groups	in column (14) Insert "TP41"; in column (16a) insert "H1" and in column (16b) "SG26"
3396 all packing groups	in column (14) Insert "TP41"; in column (16a) insert "H1" and in column (16b) "SG26"

3397 all packing groups	in column (14) Insert "TP41"; in column (16a) insert "H1" and in column (16b) "SG26"
3398 all packing groups	in column (14) Insert "TP41"; in column (16a) insert "H1" and in column (16b) "SG26"
3399 all packing groups	in column (14) Insert "TP41"; in column (16a) insert "H1" and in column (16b) "SG26"
3401 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3402 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3403 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3404 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3416 PG II	in column (7b) amend the code to read "E0".
3422	In column (15) replace "S-B" with "S-A".
3448 PG I and PG II	in column (7b) amend the code to read "E0".
3450 PG I	in column (7b) amend the code to read "E0".
3451	in column (4) insert "P"
3454	in column (4) insert "P"
3469	in column (6), insert "367".
3470	in column (6), insert "367".
3476	in column (16a) insert "H1" and in column (16b) "SG26"
3480	in column (5), delete the packing group; in column (6) delete "957" and insert "376" and "377"; in column (8) insert "P908, P909", "LP903" and "LP904"; in column (16a) insert "SW19".
3481	in column (5), delete the packing group; in column (6) delete "957" and insert "376" and "377"; in column (8) insert "P908, P909", "LP903" and "LP904" in column (16) insert "SW19".
3482 PG I	in column (16a) insert "H1" and in column (16b) "SG26"
3483 PG I	in column (7b) amend the code to read "E0"
3485	in column (4) insert "P"
3486	in column (4) insert "P"

3487 all packing groups	in column (4) insert "P"
3490 PG I	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
3491 PG I	in column (16a) insert "H1" and in column (16b) "SG25" and "SG26"
3498 PG II	in column (7b) amend the code to read "E0"
3499	In column (2) amend the proper shipping name to read as follows: "CAPACITOR, ELECTRIC DOUBLE LAYER (with an energy storage capacity greater than 0.3Wh)"
3506	in column (5), delete the packing group.

3.2.1 Dangerous Goods List

(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16a)	(16b)	(17)
3316		9	-	II	251 340	See SP 251	See SP 340	P901	-	-	-	-	-	-	F-A, S-P	Category A.		-
3316	CHEMICAL KIT or FIRST AID KIT	9		III	251 340	See SP 251	See SP 340	P901	-	-	-	-	-	-	F-A, S-P	Category A.		-
3507	URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, less than 0.1 kg per package, non-fissile or fissile-excepted	8	7	I	317 369	0	E0	P805	-	-	-	-	-	-	F-I, S-S	Category A, SW12		See 1.5.1.
3508	CAPACITOR, ASYMMETRIC (with an energy storage capacity greater than 0.3Wh)	9	-	-	372	0	E0	P003	-	-	-	-	-	-	--	Category A		Articles intended to store energy containing positive and negative electrodes comprised of different materials and an electrolyte. Asymetric capacitors may be transported in a charged state.
3509	PACKAGING DISCARDED, EMPTY, UNCLEANED	9			968	0	E0	-	-	-	-	-	-	-	--	-		This entry shall not be used for sea transport. Discarded packaging shall meet the requirements of 4.1.1.11. Discarded packaging means packagings, large packagings or intermediate bulk containers (IBC), or parts thereof, which have contained dangerous goods, other than radioactive material, which are transported for disposal, recycling or recovery of their material, other than reconditioning, repair, routine maintenance, remanufacturing or reuse, and which have been emptied to the extent that only residues of dangerous goods adhering to the packaging parts are present.
3510	ADSORBED GAS, FLAMMABLE, N.O.S.	2.1	-	-	274	0	E0	P208	-	-	-	-	-	-	F-D, S-U	Category D. SW2		-
3511	ADSORBED GAS, N.O.S.	2.2		-	274		E0	P208	-	-	-	-	-	-	F-C, S-V	Category A.		-
3512	ADSORBED GAS, TOXIC, N.O.S.	2.3		-	274	0	E0	P208	-	-	-	-	-	-	F-C, S-U	Category D. SW2		-
3513	ADSORBED GAS, OXIDIZING, N.O.S.	2.2	5.1	-	274	0	E0	P208	-	-	-	-	-	-	F-C. S-W	Category D.		-
3514	ADSORBED GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1	-	274	0	E0	P208	-	-	-	-	-	-	F-D, S,-U	Category D. SW2		-
3515	ADSORBED GAS, TOXIC, OXIDIZING, N.O.S.	2.3	5.1	-	274	0	E0	P208	-	-	-	-	-	-	F-C, S-W	Category D. SW2		-
3516	ADSORBED GAS, TOXIC, CORROSIVE, N.O.S.	2.3	8	-	274	0	E0	P208	-	-	-	-	-	-	F-C, S-U	Category D. SW2		-
3517	ADSORBED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	2.3	2.1 8	-	274	0	E0	P208	-	-	-	-	-	-	F-D, S-U	Category D. SW2 .	SG4 SG9	-

(1)	(2)	(3)	(4)	(5)	(6)	(7a)	(7b)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16a)	(16b)	(17)
3518	ADSORBED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	2.3	5.1 8	-	274	0	E0	P208	-	-	-	-	-	-	F-C, S-W	Category D. SW2	SG6 SG19	-
3519	BORON TRIFLUORIDE, ADSORBED	2.3	8	-		0	E0	P208	-	-	-	-	-	-	F-C, S-U	Category D. SW2		Non-flammable, toxic and corrosive gas. Forms dense white corrosive fumes in moist air. Reacts violently with water, evolving hydrogen fluoride, an irritating and corrosive gas apparent as white fumes. In the presence of moisture, highly corrosive to glass and most metals. Much heavier than air (2.35). Highly irritating to skin, eyes and mucous membranes.
3520	CHLORINE, ADSORBED	2.3	5.1 8	-		0	E0	P208	-	-	-	-	-	-	F-C, S-W	Category D. SW2	SG6 SG19	Non-flammable, toxic and corrosive yellow gas with a pungent odour. Corrosive to glass and to most metals. Much heavier than air (2.4). Highly irritating to skin, eyes and mucous membranes. Powerful oxidant which may cause fire.
3521	SILICON TETRAFLUORIDE, ADSORBED	2.3	8	-		0	E0	P208	-	-	-	-	-	-	F-C, S-U	Category D. SW2		Non-flammable, toxic and corrosive gas with a pungent odour. Corrosive to metals. In moist air, produces hydrogen fluoride. Much heavier than air (3.6). Highly irritating to skin, eyes and mucous membranes.
3522	ARSINE, ADSORBED	2.3	2.1	-		0	E0	P208	-	-	-	-	-	-	F-D, S-U	Category D. SW2.		Flammable, toxic, colourless gas with a garlic odour. Explosive limits: 3.9% to 77.8%. Much heavier than air (2.8).
3523	GERMANE, ADSORBED	2.3	2.1	-		0	E0	P208	-	-	-	-	-	-	F-D, S-U	Category D. SW2		Flammable, toxic, colourless gas with a pungent odour. Much heavier than air (2.6)
3524	PHOSPHORUS PENTAFLUORIDE, ADSORBED	2.3	8	-		0	E0	P208	-	-	-	-	-	-	F-C, S-U	Category D. SW2		Non-flammable, toxic and corrosive gas with an irritating odour. Reacts with water or moist air to produce toxic and corrosive fumes. Corrosive to glass and to most metals. Much heavier than air (4.3). Highly irritating to skin, eyes and mucous membranes.
3525	PHOSPHINE, ADSORBED	2.3	2.1	-		0	E0	P208	-	-	-	-	-	-	F-D, S-U	Category D. SW2		Flammable, toxic, colourless gas with a garlic odour. Ignites spontaneously in air. Heavier than air (1.2). Irritating to skin, eyes and mucous membranes.
3526	HYDROGEN SELENIDE, ADSORBED	2.3	2.1	-		0	E0	P208	-	-	-	-	-	-	F-D, S-U	Category D. SW2		Flammable, toxic, colourless gas with a disagreeable odour. Much heavier than air (2.8). Highly irritating to skin, eyes and mucous membranes.

Chapter 3.3 – Special provisions applicable to certain substances, materials or articles

Amend the following Special Provisions as indicated hereunder:

SP 66 Amend to read as follows:

"Cinnabar is not subject to the provisions of this Code".

SP 122 At the end, add: ", 4.1.4.2 packing instruction IBC520 and 4.2.5.2.6 portable tank instruction T23."

SP 135 Amend to read as follows:

"135 The dihydrated sodium salt of dichloroisocyanuric acid does not meet the criteria for inclusion in Class 5.1 and is not subject to the provisions of this Code unless meeting the criteria for inclusion in another Class or Division."

SP 172 Amend to read as follows:

"172 Where a radioactive material has (a) subsidiary risk(s):

.1 The substance shall be allocated to Packing Group I, II or III, if appropriate, by application of the packing group criteria provided in part 2 corresponding to the nature of the predominant subsidiary risk;

.2 Packages shall be labelled with subsidiary risk labels corresponding to each subsidiary risk exhibited by the material; corresponding placards shall be affixed to cargo transport units in accordance with the relevant provisions of 5.3.1;

.3 For the purposes of documentation and package marking, the proper shipping name shall be supplemented with the name of the constituents which most predominantly contribute to this (these) subsidiary risk(s) and which shall be enclosed in parenthesis;

.4 The dangerous goods transport document shall indicate the subsidiary class or division and, where assigned the packing group as required by 5.4.1.4.1.4 and 5.4.1.4.1.5.

For packing, see also 4.1.9.1.5."

SP 225 At the end, add:

"Fire extinguishers shall be manufactured, tested, approved and labelled according to the provisions applied in the country of manufacture. Fire extinguishers under this entry include:

.1 portable fire extinguishers for manual handling and operation;

.2 fire extinguishers for installation in aircraft;

.3 fire extinguishers mounted on wheels for manual handling;

.4 fire extinguishing equipment or machinery mounted on wheels or wheeled platforms or units transported similar to (small) trailers, and

.5 fire extinguishers composed of a non-rollable pressure drum and equipment, and handled e.g. by fork lift or crane when loaded or unloaded."

SP 235 Amend to read as follows:

"235 This entry applies to articles which contain Class 1 explosive substances and which may also contain dangerous goods of other classes. These articles are used to enhance safety in vehicles, vessels or aircraft – e.g. air bag inflators, air bag modules, seat-belt pretensioners, and pyromechanical devices."

SP 251 Insert the following new third paragraph after "to any individual substance in the kit":

"Where the kit contains only dangerous goods to which no packing group is assigned, no packing group need be indicated on the dangerous goods transport document."

SP 280 Amend to read as follows:

"280 This entry applies to safety devices for vehicles, vessels or aircraft, e.g. air bag inflators, air bag modules, seat-belt pretensioners, and pyromechanical devices, which contain dangerous goods of Class 1 or of other classes, when transported as component parts and if these articles as presented for transport have been tested in accordance with Test Series 6(c) of Part 1 of the Manual of Tests and Criteria, with no explosion of the device, no fragmentation of device casing or pressure receptacle, and no projection hazard nor thermal effect which would significantly hinder fire-fighting or emergency response efforts in the immediate vicinity. This entry does not apply to life saving appliances described in special provision 296 (UN Nos. 2990 and 3072)."

SP 289 Amend to read as follows:

"289 Safety devices, electrically initiated and safety devices, pyrotechnic installed in vehicles, vessels or aircraft or in completed components such as steering columns, door panels, seats, etc. are not subject to the provisions of this Code."

SP 306 Amend to read as follows:

"306 This entry may only be used for substances that are too insensitive for acceptance into Class 1 when tested in accordance with Test Series 2 (see Manual of Tests and Criteria, Part I)."

SP 309 Amend the last sentence to read as follows:

"Substances shall satisfactorily pass Tests 8(a), (b) and (c) of Test Series 8 of the Manual of Tests and Criteria, Part I, Section 18 and be approved by the competent authority."

SP 310 At the end, include a new "Note" to read as follows:

"For damage or defective lithium batteries and cells see SP 376"

SP 361 At the end of subparagraph .5 insert "except those manufactured before 1 January 2014;"

SP 363 In subparagraph .3, replace "loaded in an orientation" with "oriented"

SP 919 is deleted.

SP 957 Is deleted.

SP 961 Replace existing 961 with the following:

"SP 961 Internal combustion engines, fuel cell engines, vehicles, and battery-powered equipment are not subject to the provisions of this Code if any of the following conditions are met:

.1 Internal combustion engines, fuel cell engines vehicles, and battery-powered equipment are stowed on the vehicle, special category and ro-ro spaces or on the weather deck of a roll-on/roll-off ship or a cargo space designated by the Administration (flag State) in accordance with SOLAS 74, chapter II-2, regulation 20 as specifically designed and approved for the carriage of vehicles and there are no signs of leakage from the battery, engine, fuel cell, compressed gas cylinder or accumulator, or fuel tank when applicable. When packed in a cargo transport unit the exception does not apply to container cargo spaces of a ro-ro ship. Vehicles powered solely by lithium batteries and hybrid electric vehicles powered by both an internal combustion engine and lithium metal or ion batteries, the battery is of a type proved to meet the requirements of the United Nations Manual of Tests and Criteria, part III, subsection 38.3, unless otherwise approved by the competent Authority;

.2 Internal combustion engines, vehicles powered by a flammable liquid fuel with a flashpoint of 38°C or above, there are no leaks in any portion of the fuel system, the fuel tank(s) contains 450 ℓ of fuel or less and installed batteries are protected from short-circuit.

.3 Internal combustion engines with a fuel tank attached and vehicles powered by a flammable liquid fuel with a flashpoint less than 38°C, the fuel tank(s) are empty and installed batteries are protected from short circuit. The internal combustion engines or vehicle are considered to be empty of flammable liquid fuel when the fuel tank has been drained and the vehicle cannot be operated due to a lack of fuel. Engine components such as fuel lines, fuel filters and injectors do not need to be cleaned, drained or purged to be considered empty. The fuel tank does not need to be cleaned or purged;

.4 Internal combustion engines with an attached fuel tank and vehicles powered by a flammable gas (liquefied or compressed), the fuel tank(s) are empty and the positive pressure in the tank does not exceed 2 bar, the fuel shut-off or isolation valve is closed and secured, and installed batteries are protected from short circuit;

.5 Vehicles or battery powered equipment solely powered by a wet or dry electric storage battery or a sodium battery, and the battery is protected from short circuit;

.6 Internal combustion engines powered by a flammable liquid or flammable gas have been cleaned, drained and purged of all flammable liquids and gases or the engine has been sealed to prevent leakage of any residues; or

.7 Fuel cell engines are protected from inadvertent operation by closing fuel supply lines or by other means and the fuel supply reservoir has been drained and sealed. The fuel supply reservoir does not need to be cleaned or purged.

Notwithstanding above, dangerous goods required for the operation of the internal combustion engines or the vehicle or for the safety of the operator such as fire extinguishers, compressed gas cylinders, accumulators, airbag inflators, starter batteries, etc., shall be securely mounted. All other dangerous goods in the vehicle shall be separately packaged and consigned for transport, as appropriate, in accordance with this Code.

For fuel cell engines, all dangerous goods other than fuel and fuel cells shall be separately packaged and consigned for transport, as appropriate, in accordance with this Code."

SP 962 Replace 962 with the following:

"SP 962 internal combustion engines, vehicles, fuel cell engines, or battery powered equipment not meeting the conditions of special provision 961 shall be assigned to class 9 and shall meet the following requirements:

.1 internal combustion engines, vehicles, combustion engines, fuel cell engines or battery powered equipment shall not show signs of leakage from batteries, engines, fuel cells, compressed gas cylinders or accumulators, or fuel tank(s) when applicable;

.2 for flammable liquid powered vehicles and internal combustion engines the fuel tank(s) containing the flammable liquid shall not be more than one fourth full and in any case the flammable liquid shall not exceed 250 ℓ unless otherwise approved by the competent authority;

.3 for flammable gas powered vehicles and internal combustion engines, the fuel shut-off valve of the fuel tank(s) shall be securely closed;

.4 installed batteries shall be protected from damage, short circuit, and accidental activation during transport. Lithium ion or lithium metal batteries shall be of a type proved to meet the requirements of the United Nations Manual of Tests and Criteria, part III, subsection 38.3, unless otherwise approved by the competent authority; and

Notwithstanding above dangerous goods required for the operation of the internal combustion engines or the vehicle or for the safety of the operator such as fire extinguishers, compressed gas accumulators, airbag inflators, starter batteries, etc., shall be securely mounted.

The provisions of this Code relevant to marking, labelling, placarding and marine pollutants shall not apply."

SP 963 Replace the words "column 16" with "columns 16a and 16b"

Insert the following new special provisions:

"367 For the purposes of documentation and package marking:

The proper shipping name "Paint related material" may be used for consignments of packages containing "Paint" and "Paint related material" in the same package;

The proper shipping name "Paint related material, corrosive, flammable" may be used for consignments of packages containing "Paint, corrosive, flammable" and "Paint related material, corrosive, flammable" in the same package;

The proper shipping name "Paint related material, flammable, corrosive" may be used for consignments of packages containing "Paint, flammable, corrosive" and "Paint related material, flammable, corrosive" in the same package; and

The proper shipping name "Printing ink related material" may be used for consignments of packages containing "Printing Ink" and "Printing ink related material" in the same package."

"368 In the case of non-fissile or fissile-excepted uranium hexafluoride, the material shall be classified under UN 3507 or UN 2978."

"369 In accordance with 2.0.3.5, this radioactive material in an excepted package possessing corrosive properties is classified in Class 8 with a radioactive material subsidiary risk.

Uranium hexafluoride may be classified under this entry only if the conditions of 2.7.2.4.1.2, 2.7.2.4.1.5, 2.7.2.4.5.2 and, for fissile-excepted material, of 2.7.2.3.6 are met.

In addition to the provisions applicable to the transport of Class 8 substances, the provisions of 5.1.3.2, 5.1.5.2.2, 5.1.5.4.1.2, 7.1.4.5.9, 7.1.4.5.10, 7.1.4.5.12, and 7.8.4.1 to 7.8.4.6 shall apply.

No Class 7 label is required to be displayed."

"370 This entry applies to:

- ammonium nitrate with more than 0.2% combustible substances, including any organic substance calculated as carbon, to the exclusion of any added substance; and

- ammonium nitrate with not more than 0.2% combustible substances, including any organic substance calculated as carbon, to the exclusion of any added substance, that is not too sensitive for acceptance into

Class 1 when tested in accordance with Test Series 2 (see Manual of Tests and Criteria, Part I). See also UN No. 1942."

"371 .1 This entry also applies to articles, containing a small pressure receptacle with a release device. Such articles shall comply with the following requirements:

(a) The water capacity of the pressure receptacle shall not exceed 0.5 litres and the working pressure shall not exceed 25 bar at 15°C;

(b) The minimum burst pressure of the pressure receptacle shall be at least four times the pressure of the gas at 15°C;

(c) Each article shall be manufactured in such a way that unintentional firing or release is avoided under normal conditions of handling, packing, transport and use. This may be fulfilled by an additional locking device linked to the activator;

(d) Each article shall be manufactured in such a way as to prevent hazardous projections of the pressure receptacle or parts of the pressure receptacle;

(e) Each pressure receptacle shall be manufactured from material which will not fragment upon rupture;

(f) The design type of the article shall be subjected to a fire test. For this test, the provisions of paragraphs 16.6.1.2 except letter g, 16.6.1.3.1 to 16.6.1.3.6, 16.6.1.3.7 (b) and 16.6.1.3.8 of the Manual of Tests and Criteria shall be applied. It shall be demonstrated that the article relieves its pressure by means of a fire degradable seal or other pressure relief device, in such a way that the pressure receptacle will not fragment and that the article or fragments of the article do not rocket more than 10 m;

(g) The design type of the article shall be subjected to the following test. A stimulating mechanism shall be used to initiate one article in the middle of the packaging. There shall be no hazardous effects outside the package such as disruption of the package, metal fragments or a receptacle which passes through the packaging.

.2 The manufacturer shall produce technical documentation of the design type, manufacture as well as the tests and their results. The manufacturer shall apply procedures to ensure that articles produced in series are made of good quality, conform to the design type and are able to meet the requirements in .1. The manufacturer shall provide such information to the Competent Authority on request."

"372 This entry applies to asymmetric capacitors with an energy storage capacity greater than 0.3 Wh. Capacitors with an energy storage capacity of 0.3 Wh or less are not subject to the provisions of this Code.

Energy storage capacity means the energy stored in a capacitor, as calculated according to the following equation,

$$Wh = 1/2C_N(U_R^2 - U_L^2) \times (1/3600),$$

using the nominal capacitance (C_N), rated voltage (U_R) and rated lower limit voltage (U_L).

All asymmetric capacitors to which this entry applies shall meet the following conditions:

(a) Capacitors or modules shall be protected against short circuit;

(b) Capacitors shall be designed and constructed to safely relieve pressure that may build up in use, through a vent or a weak point in the capacitor casing. Any liquid which is released upon venting shall be contained by packaging or by equipment in which a capacitor is installed;

(c) Capacitors shall be marked with the energy storage capacity in Wh, except those manufactured before 1 January 2016;

(d) Capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods shall be designed to withstand a 95 kPa pressure differential;

Capacitors containing an electrolyte not meeting the classification criteria of any class or division of dangerous goods, including when configured in a module or when installed in equipment are not subject to other provisions of this Code. Capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods, with an energy storage capacity of 20 Wh or less, including when configured in a module, are not subject to other provisions of this Code when the capacitors are capable of withstanding a 1.2 metre drop test unpackaged on an unyielding surface without loss of contents.

Capacitors containing an electrolyte meeting the classification criteria of any class or division of dangerous goods that are not installed in equipment and with an energy storage capacity of more than 20 Wh are subject to this Code.

Capacitors installed in equipment and containing an electrolyte meeting the classification criteria of any class or division of dangerous goods, are not subject to other provisions of these Regulations provided that the equipment is packaged in a strong outer packaging constructed of suitable material, and of adequate strength and design, in relation to the packaging's intended use and in such a manner as to prevent accidental functioning of capacitors during transport. Large robust equipment containing capacitors may be offered for transport unpackaged or on pallets when capacitors are afforded equivalent protection by the equipment in which they are contained.

Note: Notwithstanding the provisions of this special provision, nickel-carbon asymmetric capacitors containing Class 8 alkaline electrolytes shall be transported as UN 2795, BATTERIES, WET, FILLED WITH ALKALI, electric storage."

"373 Neutron radiation detectors containing non-pressurized boron trifluoride gas may be transported under this entry provided that the following conditions are met:

.1 Each radiation detector shall meet the following conditions.

(i) The pressure in each detector shall not exceed 105 kPa absolute at 20°C;

(ii) The amount of gas shall not exceed 13 g per detector;

(iii) Each detector shall be manufactured under a registered quality assurance programme;

NOTE: The application of ISO 9001:2008 may be considered acceptable for this purpose.

(iv) Each neutron radiation detector shall be of welded metal construction with brazed metal to ceramic feed through assemblies. These detectors shall have a minimum burst pressure of 1800 kPa as demonstrated by design type qualification testing; and

(v) Each detector shall be tested to a 1×10^{-10} cm^3/s leaktightness standard before filling.

.2 Radiation detectors transported as individual components shall be transported as follows:

(i) Detectors shall be packed in a sealed intermediate plastics liner with sufficient absorbent material to absorb the entire gas contents;

(ii) They shall be packed in strong outer packaging. The completed package shall be capable of withstanding a 1.8 m drop test without leakage of gas contents from detectors;

(iii) The total amount of gas from all detectors per outer packaging shall not exceed 52 g.

.3 Completed neutron radiation detection systems containing detectors meeting the conditions of paragraph (a) shall be transported as follows:

(i) The detectors shall be contained in a strong sealed outer casing;

(ii) The casing shall contain sufficient absorbent material to absorb the entire gas contents;

(iii) The completed systems shall be packed in strong outer packagings capable of withstanding a 1.8 m drop test without leakage unless a system's outer casing affords equivalent protection.

Packing instruction P200 of 4.1.4.1 is not applicable.

The transport document shall include the following statement "Transport in accordance with special provision 373".

Neutron radiation detectors containing not more than 1 g of boron trifluoride, including those with solder glass joints, are not subject to this Code provided they meet the requirements in paragraph .1 and are packed in accordance with paragraph .2. Radiation detection systems containing such detectors are not subject to this Code provided they are packed in accordance with paragraph .3.

Nuclear radiation detectors shall be stowed in accordance with stowage Category A."

"SP 376 Lithium ion cells or batteries and lithium metal cells or batteries identified as being damaged or defective such that they do not conform to the type tested according to the applicable provisions of the Manual of Tests and Criteria shall comply with the requirements of this special provision.

For the purposes of this special provision, these may include, but are not limited to:

- Cells or batteries identified as being defective for safety reasons;

- Cells or batteries that have leaked or vented;

- Cells or batteries that cannot be diagnosed prior to transport; or

- Cells or batteries that have sustained physical or mechanical damage.

NOTE: In assessing a battery as damaged or defective, the type of battery and its previous use and misuse shall be taken into account.

Cells and batteries shall be transported according to the provisions applicable to UN 3090, UN 3091, UN 3480 and UN 3481, except special provision 230 and as otherwise stated in this special provision.

Packages shall be marked "DAMAGED/DEFECTIVE LITHIUM-ION BATTERIES" or "DAMAGED/DEFECTIVE LITHIUM METAL BATTERIES", as applicable.

Cells and batteries shall be packed in accordance with packing instructions P908 of 4.1.4.1 or LP904 of 4.1.4.3, as applicable.

Cells and batteries liable to rapidly disassemble, dangerously react, produce a flame or a dangerous evolution of heat or a dangerous emission of toxic, corrosive or flammable gases or vapours under normal conditions of transport shall not be transported except under conditions specified by the competent authority."

"SP 377 Lithium ion and lithium metal cells and batteries and equipment containing such cells and batteries transported for disposal or recycling, either packed together with or packed without non-lithium batteries, may be packaged in accordance with packing instruction P909 of 4.1.4.1.

These cells and batteries are not subject to the requirements of section 2.9.4.

Packages shall be marked "LITHIUM BATTERIES FOR DISPOSAL" or "LITHIUM BATTERIES FOR RECYCLING".

Identified damaged or defective batteries shall be transported in accordance with special provision 376 and packaged in accordance with P908 of 4.1.4.1 or LP904 of 4.1.4.3, as applicable."

"SP 968 This entry shall not be used for sea transport. Discarded packaging shall meet the requirements of 4.1.1.11."

"SP 969 Substances classified in accordance to 2.9.3 are subject to the provisions for marine pollutants. Substances which are transported under UN 3077 and 3082 but which do not meet the criteria of 2.9.3 (see 2.9.2.2) are not subject to the provisions for marine pollutants. However for substances that are identified as marine pollutants in this Code (see Index) but which no longer meet the criteria of 2.9.3, the provisions of 2.10.2.6 apply."

"SP 970 This entry only applies to internal combustion engines (including machinery or equipment powered by such engines) to fuel cell engines, and to vehicles powered by flammable liquid, flammable gas and fuel cells containing flammable liquid or gas (including hybrid electric vehicles, see SP 312 or SP 240). For the purposes of this entry vehicles are defined as road vehicles (e.g. cars, motorcycles), boats, aircraft, wheeled or tracked construction or farming equipment and any other self-propelled apparatus designed to carry one or more persons or goods. For internal combustion engines where the requirement of Special Provisions 961 or 962 are not met, an appropriate name and description shall be selected and the relevant provisions of this Code shall apply. If a vehicle is powered by a flammable liquid and a flammable gas internal combustion engine, it shall be assigned to UN 3166 VEHICLE, FLAMMABLE GAS POWERED."

Chapter 3.4 – Dangerous goods packed in limited quantities

3.4.1 General

3.4.1.2 In subparagraph ".5" delete the reference "5.3.2.3".

3.4.3 Stowage

3.4.3 In the paragraph, replace the words "column 16" with "column 16a".

3.4.4 Segregation

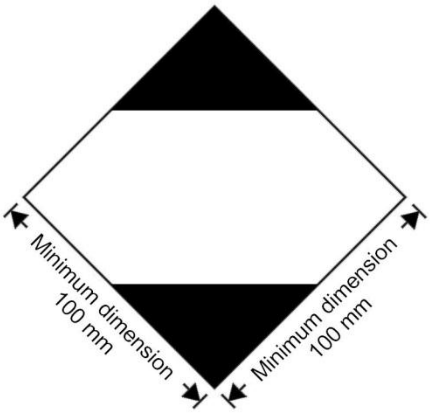
3.4.4.1 In subparagraph ".2" replace the words "column 16" with "column 16b"

3.4.5 Marking and placarding

Amend section 3.4.5.1 and 3.4.5.2 to read as follows:

"**3.4.5 Marking and Placarding**

3.4.5.1 Except for air transport, packages containing dangerous goods in limited quantities shall bear the marking shown below:



Marking for packages containing limited quantities

The marking shall be readily visible, legible and able to withstand open weather exposure without a substantial reduction in effectiveness. The marking shall be in the form of a square set at an angle of 45° (diamond-shaped). The top and bottom portions and the surrounding line shall be black. The centre area shall be white or a suitable contrasting background. The minimum dimensions shall be 100 mm x 100 mm and the minimum width of the line forming the diamond shall be 2 mm. Where dimensions are not specified, all features shall be in approximate proportion to those shown. If the size of the package so requires, the minimum outer dimensions shown above may be reduced to be not less than 50 mm x 50 mm provided the marking remains clearly visible. The minimum width of the line forming the diamond may be reduced to a minimum of 1 mm.

NOTE: The provisions of 3.4.5.1 of the IMDG Code amendment 36-12 may continue to be applied until 31 December 2016."

3.4.5.2 Packages containing dangerous goods packed in conformity with the provisions of Part 3, Chapter 4 of the ICAO Technical Instructions for the Transport of Dangerous Goods may bear the marking shown below to certify conformity with these provisions:

Marking for packages containing limited quantities conforming to Part 3, Chapter 4 of the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air.

The marking shall be readily visible, legible and able to withstand open weather exposure without a substantial reduction in effectiveness. The marking shall be in the form of a square set at an angle of 45° (diamond-shaped). The top and bottom portions and the surrounding line shall be black. The centre area shall be white or a suitable contrasting background. The minimum dimensions shall be 100 mm x 100 mm and the minimum width of the line forming the diamond shall be 2 mm. The symbol "Y" shall be placed in the centre of the mark and shall be clearly visible. Where dimensions are not specified, all features shall be in approximate proportion to those shown. If the size of the package so requires, the minimum outer dimensions shown above may be reduced to be not less than 50 mm x 50 mm provided the marking remains clearly visible. The minimum width of the line forming the diamond may be reduced to a minimum of 1 mm. The symbol "Y" shall remain in approximate proportion to that shown above.

Note: The provisions of 3.4.5.2 of IMDG Code (amendment 36-12) may continue to be applied until 31 December 2016."

3.4.5.3 Amend to read as follows:

"**3.4.5.3 Multimodal recognition of marks**

3.4.5.3.1 Packages containing dangerous goods bearing the marking shown in 3.4.5.2 with or without the additional labels and markings for air transport shall be deemed to meet the provisions of section 3.4.2 and need not bear the marking shown in 3.4.5.1.

3.4.5.3.2 Packages containing dangerous goods in limited quantities bearing the marking shown in 3.4.5.1 and conforming with the provisions of the ICAO Technical Instructions for the Safe Transport of Dangerous Goods by Air, including all necessary marks and labels specified in Parts 5 and 6, shall be deemed to meet the provisions of section 3.4.1 as appropriate and of section 3.4.2."

3.4.5.5 Placarding and marking of cargo transport units

3.4.5.5.3 Delete the existing paragraph and insert "reserve"

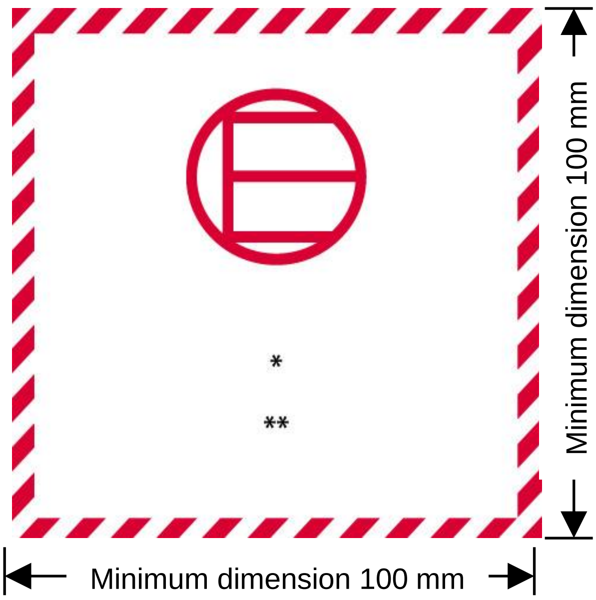
Chapter 3.5 – Dangerous goods packed in excepted quantities

3.5.4 Marking of packages

3.5.4.1 Delete the mark and the text below the mark.

3.5.4.2 and 3.5.4.3 Amend to read as follows:

"**3.5.4.2**



Excepted quantities mark

*	The Class or, when assigned, the Division number(s) shall be shown in this location.

**	The name of the consignor or of the consignee shall be shown in this location if not shown elsewhere on the package.

The marking shall be in the form of a square. The hatching and symbol shall be of the same colour, black or red, on white or suitable contrasting background. The minimum dimensions shall be 100 mm x 100 mm. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

3.5.4.3 An overpack containing dangerous goods in excepted quantities shall display the markings required by 3.5.4.1, unless such markings on packages within the overpack are clearly visible.

Note: The provisions of 3.5.4.1 and 3.5.4.2 of the IMDG Code (amendment 36-12) may continue to be applied until 31 December 2016."

3.5.7 Stowage

3.5.7.1 In the paragraph, replace the words "column 16" with "column 16a"

3.5.8 Segregation

3.5.8.1 In the paragraph, replace the words "column 16" with "column 16b"

3.5.8.2 In the paragraph, replace the words "column 16" with "column 16b"

Appendix A – List of generic and N.O.S. Proper Shipping Names

Add the following new entries in appendix A under the appropriate class in the general entries section:

Class or Division	Subsidiary Risk	UN No	Proper Shipping Name
2.1		3510	ADSORBED GAS, FLAMMABLE, N.O.S.
2.2		3511	ADSORBED GAS, N.O.S.
2.3		3512	ADSORBED GAS, TOXIC, N.O.S.
2.2	5.1	3513	ADSORBED GAS, OXIDIZING, N.O.S.
2.3	2.1	3514	ADSORBED GAS, TOXIC, FLAMMABLE, N.O.S.
2.3	5.1	3515	ADSORBED GAS, TOXIC, OXIDIZING, N.O.S.
2.3	8	3516	ADSORBED GAS, TOXIC, CORROSIVE, N.O.S.
2.3	2.1 + 8	3517	ADSORBED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.
2.3	5.1 + 8	3518	ADSORBED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.

Appendix B – Glossary of terms

Amend the entry for "AIR BAG INFLATORS, PYROTECHNIC or AIR BAG MODULES, PYROTECHNIC or SEAT-BELT PRETENSIONERS, PYROTECHNIC" to read:

> "SAFETY DEVICES, electrically initiated".

Amend the definition to read as follows:

> "Articles which contain pyrotechnic substances or dangerous goods of other classes and are used in vehicles, vessels or aircraft to enhance safety to persons. Examples are: air bag inflators, air bag modules, seat-belt pretensioners and pyromechanical devices. These pyromechanical devices are assembled components for tasks such as but not limited to separation, locking, or release-and-drive or occupant restraint. The term includes "SAFETY DEVICES, PYROTECHNIC"."

Alphabetical index

Amend the following entries as indicated hereunder:

Amend the entries for "AIR BAG INFLATORS, PYROTECHNIC or AIR BAG MODULES, PYROTECHNIC or SEAT-BELT PRETENSIONERS, PYROTECHNIC" to read as follows:

«Air bag inflators, see	1.4G 9	0503 3268»
«Air bag modules, see	1.4G 9	0503 3268»
«Seat-belt pretensioners, see	1.4G 9	0503 3268»

In the entries for "Actinolite", "Anthophyllite" and "Tremolite" in the UN No. column, replace "2590" with "2212".

Delete the entries for "Asbestos, blue or brown", "Asbestos, white", "Chryosotile", , "BLUE ASBESTOS (crocidolite)", "BROWN ASBESTOS (amosite, mysorite)", "WHITE ASBESTOS (chrysotile, actinolite, anthophyllite, tremolite)". (delete entries regardless names in the UN Regulations differs from those in the IMDG Code)

In the entry for "TRIFLUOROCHLOROETHYLENE, STABILIZED" UN No. 1082, add at the end "(REFRIGERANT GAS R 1113)".

In the entry for "AMMONIUM NITRATE", (UN 1942), amend the description to read as follows "AMMONIUM NITRATE with not more than 0.2% combustible substances, including any organic substance calculated as carbon, to the exclusion of any other added substance".

In the entry for "AMMONIUM NITRATE", (UN 0222), amend the description to read as follows "AMMONIUM NITRATE".

In the entry for "CAPACITOR, electric double layer…" (UN 3499), amend the description to read as follows: "CAPACITOR, ELECTRIC DOUBLE LAYER (with an energy storage capacity greater than 0.3Wh)".

Drazoxolon: Replace "see PESTICIDE, N.O.S." with "see ORGANOCHLORINE PESTICIDE".

Kelevan: Replace "see PESTICIDE, N.O.S." with "see ORGANOCHLORINE PESTICIDE".

Nabam: Replace "see THIOCARBAMATE PESTICIDE" with "see Note 1".

Oxamyl: Replace "see PESTICIDE, N.O.S." with "see CARBAMATE PESTICIDE".

In the entry for "AMMONIA, ANHYDROUS", UN (1005), insert "P" in the column for MP.

In the entries for "ALLYL ALCOHOL" and "Propenyl alcohol", UN (1098), insert "P" in the column for MP.

In the entry for "HEPTANES", UN (1206), insert "P" in the column for MP.

In the entries for "Hexane" and "2-Methylpentane", UN (1208), insert "P" in the column for MP.

In the entries for "Isooctane", "2-Methylheptane", "OCTANES" and "2,2,4-Trimethylpentane", UN (1262), insert "P" in the column for MP.

In the entry for "PINE OIL", UN (1272), insert "P" in the column for MP.

In the entry for "TURPENTINE", UN (1299), insert "P" in the column for MP.

In the entries for "Creosote salts", "NAPHTHALENE, CRUDE" and "NAPHTHALENE, REFINED", UN (1334), insert "P" in the column for MP.

In the entries for "Aminobenzene", "ANILINE", "Aniline oil" and "Phenylamine", UN (1547), insert "P" in the column for MP.

In the entries for "Methyldinitrobenzenes, molten" and "DINITROTOLUENES, MOLTEN", UN (1600), insert "P" in the column for MP.

In the entry for "TOLUIDINES, LIQUID", UN (1708), insert "P" in the column for MP.

In the entries for "CALCIUM HYPOCHLORITE, DRY with more than 39% available chlorine (8.8% available oxygen)" and "CALCIUM HYPOCHLORITE MIXTURE, DRY with more than 39% available chlorine (8.8% available oxygen", UN (1748), insert "P" in the column for MP.

In the entry for "Sodium hypochlorite solution ", UN (1791), insert "P" in the column for MP.

In the entry for "ZINC CHLORIDE SOLUTION", UN (1840), insert "P" in the column for MP.

In the entry for "NONANES", UN (1920), insert "P" in the column for MP.

Insert a new entry "2,4-Dichlorophenol,see," in the column for Substance, material or article, "P" in the column for MP, "6.1" in the column for Class, "2020" in the column for UN No..

In the entry for "DINITROTOLUENES, LIQUID" and "Methyldinitrobenzenes, liquid", UN (2038), insert "P" in the column for MP.

Insert a new entry "1,3-Dichloropropene, see" in the column for Substance, material or article, "P" in the column for MP, "3" in the column for Class, "2047" in the column for UN No..

In the entry for "AMMONIA SOLUTION relative density less than 0.880 at 15°C in water, with more than 35% but not more than 50% ammonia", UN (2073), insert "P" in the column for MP.

In the entries for "Bleaching powder" and "CALCIUM HYPOCHLORITE MIXTURE, DRY with more than 10% but not more than 39% available chlorine", UN (2208), insert "P" in the column for MP.

In the entries for "Propenoic acid, stabilized", "Acroleic acid, stabilized" and "ACRYLIC ACID, STABILIZED", UN (2218), insert "P" in the column for MP.

In the entries for "meta-Chlorotoluene" and "para-Chlorotoluene", delete "P", and in the entry for "ortho-Chlorotoluene", UN (2238) insert "P" in the column for MP.

In the entry for "CYCLOHEPTANE", UN (2241), insert "P" in the column for MP.

In the entry for "NAPHTHALENE, MOLTEN", UN (2304), insert "P" in the column for MP.

In the entries for "1,3,5-TRIMETHYLBENZENE" and "Mesitylene", UN (2325), insert "P" in the column for MP.

In the entry for "ZINC CHLORIDE, ANHYDROUS", UN (2331), insert "P" in the column for MP.

In the entry for "alpha-PINENE", UN (2368), insert "P" in the column for MP.

In the entries for "DIMETHYL DISULPHIDE", "Methyl disulphide" and "Methyldithiomethane", UN (2381), insert "P" in the column for MP.

In the entry for "AMMONIA SOLUTION relative density between 0.880 and 0.957 at 15°C in water, with more than 10% but not more than 35% ammonia, by mass", UN (2672), insert "P" in the column for MP.

In the entries for "BUTYLBENZENES", "Isobutylbenzene", "2-Methyl-2-phenylpropane", "1-Phenylbutane" and "2-Phenylbutane", UN (2709), insert "P" in the column for MP.

In the entries for "Dodecene", "PROPYLENE TETRAMER" and "Tetrapropylene", UN (2850), insert "P" in the column for MP.

In the entries for "CALCIUM HYPOCHLORITE, HYDRATED with not less than 5.5% but not more than 16% water" and "CALCIUM HYPOCHLORITE, HYDRATED MIXTURE with not less than 5.5% but not more than 16% water", UN (2880), insert "P" in the column for MP.

In the entry for "AMMONIA SOLUTION relative density less than 0.880 at 15° C in water, with more than 50% ammonia", UN (3318), insert "P" in the column for MP.

In the entry for "TOLUIDINES, SOLID", UN (3451), insert "P" in the column for MP.

In the entries for "DINITROTOLUENES, SOLID" and "Methyldinitrobenzenes, solid", UN (3454), insert "P" in the column for MP.

In the entry for "CALCIUM HYPOCHLORITE MIXTURE, DRY, CORROSIVE with more than 39% available chlorine (8.8% available oxygen)", UN (3485), insert "P" in the column for MP.

In the entry for "CALCIUM HYPOCHLORITE MIXTURE, DRY, CORROSIVE with more than 10% but not more than 39% available chlorine", UN (3486), insert "P" in the column for MP.

In the entries for "CALCIUM HYPOCHLORITE, HYDRATED MIXTURE, CORROSIVE with not less than 5.5% but not more than 16% water" and "CALCIUM HYPOCHLORITE, HYDRATED, CORROSIVE with not less than 5.5% but not more than 16% water", UN (3487), insert "P" in the column for MP.

Add the following new entries in alphabetical order:

Name and description	*Class*	*UN No.*
ADSORBED GAS, FLAMMABLE, N.O.S.	2.1	3510
ADSORBED GAS, N.O.S.	2.2	3511
ADSORBED GAS, OXIDIZING, N.O.S.	2.2	3513
ADSORBED GAS, TOXIC, CORROSIVE, N.O.S.	2.3	3516
ADSORBED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	2.3	3517
ADSORBED GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	3514
ADSORBED GAS, TOXIC, N.O.S.	2.3	3512
ADSORBED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	2.3	3518
ADSORBED GAS, TOXIC, OXIDIZING, N.O.S.	2.3	3515
Amphibole asbestos, see	9	2212
ARSINE, ADSORBED	2.3	3522
ASBESTOS, AMPHIBOLE	9	2212
ASBESTOS, CHRYSOTILE	9	2590
BORON TRIFLUORIDE, ADSORBED	2.3	3519
CAPACITOR, ASYMMETRIC, (with an energy storage capacity greater than 0.3Wh)	9	3508
CHLORINE, ADSORBED	2.3	3520
Chrysotile, see	9	2590
GERMANE, ADSORBED	2.3	3523
HYDROGEN SELENIDE, ADSORBED	2.3	3526

Name and description	*Class*	*UN No.*
Mercurous chloride, see	6.1	2025
PACKAGING DISCARDED, EMPTY, UNCLEANED	9	3509
PHOSPHINE, ADSORBED	2.3	3525
PHOSPHORUS PENTAFLUORIDE, ADSORBED	2.3	3524
SAFETY DEVICES, electrically initiated	9	3268
SAFETY DEVICES, PYROTECHNIC	1.4G	0503
SILICON TETRAFLUORIDE, ADSORBED	2.3	3521
URANIUM HEXAFLUORIDE, RADIOACTIVE MATERIAL, EXCEPTED PACKAGE, less than 0.1 kg per package, non-fissile or fissile-excepted	8	3507
Talcum with tremolite and/or actinolite, see	9	2212

PART 4
PACKING AND TANK PROVISIONS

Chapter 4.1 – Use of packagings, including intermediate bulk containers (IBCs) and large packagings

4.1.1 General provisions for the packing of dangerous goods in packagings, including IBCs and large packagings

4.1.1.3 In paragraph 4.1.1.3, in the third line, the reference "6.3.2" is replaced with "6.3.5".

4.1.1.5.2 Insert a new 4.1.1.5.2 to read as follows:

"4.1.1.5.2 Use of supplementary packagings within an outer packaging (e.g. an intermediate packaging or a receptacle inside a required inner packaging) additional to what is required by the packing instructions is authorized provided all relevant requirements are met, including those of 4.1.1.3, and, if appropriate, suitable cushioning is used to prevent movement within the packaging."

and the remaining paragraphs are renumbered accordingly.

4.1.4 List of packing instructions

4.1.4.1 Packing instructions concerning the use of packagings (except IBCs and large packagings)

P001 Insert a new last sentence in subparagraph (a) of PP1 as follows

"On roll-on/roll-off ships the unit loads may be carried in vehicles other than closed vehicles provided they are securely fenced to the full height of the cargo carried;"

P003 Add a new special packing provision PP91 to read as follows:

"PP91 For UN 1044, large fire extinguishers may also be transported unpackaged provided that the requirements of 4.1.3.8.1.1 to 4.1.3.8.1.5 are met, the valves are protected by one of the methods in accordance with 4.1.6.1.8.1 to 4.1.6.1.8.4 and other equipment mounted on the fire extinguisher is protected to prevent accidental activation. For the purpose of this special packing provision, "large fire extinguishers" means fire extinguishers as described in subparagraphs .3 to .5 of special provision 225 of Chapter 3.3."

P114(a) Under Outer Packagings, Drums: Before "fibre (1G)" insert "plywood (1D)".

P116 In the column for "outer packagings", amend the first entry for "bags" to read: "woven plastics (5H1, 5H2, 5H3)". Amend special packing provision PP65 to read: "*Deleted*".

P131 and P137 In the entry for "boxes", in the column for "outer packagings" add: "plastics, solid (4H2)".

P404 (1) Amend to read as follows:

(1)	**Combination packagings**	
	Outer packagings:	(1A1, 1A2, 1B1, 1B2, 1N1, 1N2, 1H1, 1H2, 1D, 1G, 4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G or 4H2)
	Inner packagings:	Metal receptacles with a maximum net mass of 15 kg each. Inner packagings shall be hermetically sealed and have threaded closures; Glass receptacles, with a maximum net mass of 1 kg each, having threaded closures with gaskets, cushioned on all sides and contained in hermetically sealed metal cans.
	Outer packagings shall have a maximum net mass of 125 kg.	

P501, P502 and P504 Amend the last entry under "Composite packaging" to read as follows:

"Glass receptacle in steel, aluminium, fibre or plywood drum (6PA1, 6PB1, 6PD1 or 6PG1) or in a steel, aluminium, wood or fibreboard box or in wickerwork hamper (6PA2, 6PB2, 6PC, 6PG2 or 6PD2) or in solid or expanded plastics packaging (6PH1 or 6PH2)."

P601 (2) and P602 (2) At the beginning, insert "or plastics" after "consisting of metal".

P650 Amend the diagram in paragraph (4) to read as follows:

P802 (3) Amend to read as follows:

"(3) Composite packagings: Glass receptacle in steel, aluminium or plywood drum (6PA1, 6PB1 or 6PD1) or in a steel, aluminium or wood box or in wickerwork hamper (6PA2, 6PB2, 6PC or 6PD2) or in solid plastics packaging (6PH2); maximum capacity: 60 litres."

P901 After "(see 3.3.1, special provision 251)", insert the following new sentence: "Where the kit contains only dangerous goods to which no packing group is assigned, packagings shall meet Packing Group II performance level."

P903 In paragraph (2), replace subparagraphs (a) and (b) with the following subparagraphs (a) to (c):

"(a) Strong outer packagings;

(b) Protective enclosures (e.g. fully enclosed or wooden slatted crates); or

(c) Pallets or other handling devices."

P904 Amend the diagram to read as follows:

P906 (2) Amend to read as follows:

"(2) For transformers and condensers and other devices:

(a) Packagings in accordance with packing instructions P001 or P002. The articles shall be secured with suitable cushioning material to prevent inadvertent movement during normal conditions of transport; or

(b) Leakproof packagings which are capable of containing, in addition to the devices, at least 1.25 times the volume of the liquid PCBs, polyhalogenated biphenyls or terphenyls present in them. There shall be sufficient absorbent material in the packagings to absorb at least 1.1 times the volume of liquid which is contained in the devices. In general, transformers and condensers shall be carried in leakproof metal packagings which are capable of holding, in addition to the transformers and condensers, at least 1.25 times the volume of the liquid present in them."

Insert the following new packing instructions:

P208	PACKING INSTRUCTION	P208
This instruction applies to Class 2 adsorbed gases.		

(1) The following packagings are authorized provided the general packing requirements of 4.1.6.1 are met:

Cylinders specified in Chapter 6.2 and in accordance with ISO 11513:2011 or ISO 9809-1:2010.

(2) The pressure of each filled cylinder shall be less than 101.3 kPa at 20°C and less than 300 kPa at 50°C.

(3) The minimum test pressure of the cylinder shall be 21 bar.

(4) The minimum burst pressure of the cylinder shall be 94.5 bar.

(5) The internal pressure at 65°C of the filled cylinder shall not exceed the test pressure of the cylinder.

(6) The adsorbent material shall be compatible with the cylinder and shall not form harmful or dangerous compounds with the gas to be adsorbed. The gas in combination with the adsorbent material shall not affect or weaken the cylinder or cause a dangerous reaction (e.g. a catalyzing reaction).

(7) The quality of the adsorbent material shall be verified at the time of each fill to assure the pressure and chemical stability requirements of this packing instruction are met each time an adsorbed gas package is offered for transport.

(8) The adsorbent material shall not meet the criteria of any of the Classes or Divisions in this Code.

(9) Requirements for cylinders and closures containing toxic gases with an LC_{50} less than or equal to 200 ml/m^3 (ppm) (see table 1) shall be as follows:

(a) Valve outlets shall be fitted with pressure retaining gas-tight plugs or caps having threads matching those of the valve outlets.

(b) Each valve shall either be of the packless type with non-perforated diaphragm, or be of a type which prevents leakage through or past the packing.

(c) Each cylinder and closure shall be tested for leakage after filling.

(d) Each valve shall be capable of withstanding the test pressure of the cylinder and be directly connected to the cylinder by either a taper-thread or other means which meets the requirements of ISO 10692-2:2001.

(e) Cylinders and valves shall not be fitted with a pressure relief device.

(10) Valve outlets for cylinders containing pyrophoric gases shall be fitted with gas-tight plugs or caps having threads matching those of the valve outlets.

(11) The filling procedure shall be in accordance with Annex A of ISO 11513:2011.

(12) The maximum period for periodic inspections shall be 5 years.

(13) Special packing provisions that are specific to a substance (see table 1).

Material compatibility

a: Aluminum alloy cylinders shall not be used.

d: When steel cylinders are used, only those bearing the "H" mark in accordance with 6.2.2.7.4 (p) are permitted.

Gas specific provisions

r: The filling ratio of this gas shall be limited such that, if complete decomposition occurs, the pressure does not exceed two thirds of the test pressure of the cylinder.

Material Compatibility for N.O.S Adsorbed Gas Entries

z: The construction materials of the cylinders and their accessories shall be compatible with the contents and shall not react to form harmful or dangerous compounds therewith.

P208	**PACKING INSTRUCTION**				**P208**
Table 1: ADSORBED GASES					
UN No.	Name and description	Class or Division	Subsidiary risk	LC_{50} ml/m^3	Special packing provisions
(1)	(2)	(3)	(4)	(5)	(6)
3510	ADSORBED GAS, FLAMMABLE, N.O.S.	2.1			z
3511	ADSORBED GAS, N.O.S.	2.2			z
3512	ADSORBED GAS, TOXIC, N.O.S.	2.3		≤ 5000	z
3513	ADSORBED GAS, OXIDIZING, N.O.S.	2.2	5.1		z
3514	ADSORBED GAS, TOXIC, FLAMMABLE, N.O.S.	2.3	2.1	≤ 5000	z
3515	ADSORBED GAS, TOXIC, OXIDIZING, N.O.S.	2.3	5.1	≤ 5000	z
3516	ADSORBED GAS, TOXIC, CORROSIVE, N.O.S.	2.3	8	≤ 5000	z
3517	ADSORBED GAS, TOXIC, FLAMMABLE, CORROSIVE, N.O.S.	2.3	2.1 8	≤ 5000	z
3518	ADSORBED GAS, TOXIC, OXIDIZING, CORROSIVE, N.O.S.	2.3	5.1 8	≤ 5000	z
3519	BORON TRIFLUORIDE, ADSORBED	2.3	8	387	a
3520	CHLORINE, ADSORBED	2.3	5.1 8	293	a
3521	SILICON TETRAFLUORIDE, ADSORBED	2.3	8	450	a
3522	ARSINE, ADSORBED	2.3	2.1	20	d
3523	GERMANE, ADSORBED	2.3	2.1	620	d, r
3524	PHOSPHORUS PENTAFLUORIDE, ADSORBED	2.3	8	190	
3525	PHOSPHINE, ADSORBED	2.3	2.1	20	d
3526	HYDROGEN SELENIDE, ADSORBED	2.3	2.1	2	

P505	PACKING INSTRUCTION		P505
This instruction applies to UN No. 3375			
The following packagings are authorized, provided that the general provisions of **4.1.1** and **4.1.3** are met:			
Combination packagings:	**Inner packaging maximum capacity**	**Outer packaging maximum net mass**	
Boxes (4B, 4C1, 4C2, 4D, 4G, 4H2) or drums (1B2, 1G, 1N2, 1H2, 1D) jerricans (3B2, 3H2) with glass, plastics or metal inner packagings	5 l	125 kg	
Single packagings:	**Maximum capacity**		
Drums			
aluminium (1B1, 1B2),	250 l		
plastics (1H1, 1H2)	250 l		
Jerricans			
aluminium (3B1, 3B2),	60 l		
plastics (3H1, 3H2)	60 l		
Composite packagings			
plastics receptacle with outer aluminium drum (6HB1)	250 l		
plastics receptacle with outer fibre, plastics or plywood drum (6HG1, 6HH1, 6HD1)	250 l		
plastics receptacle with outer aluminium crate or box or plastics receptacle with outer wooden, plywood, fibreboard or solid plastics box (6HB2, 6HC, 6HD2, 6HG2, 6HH2)	60 l		
glass receptacle with outer aluminium, fibre or plywood drum (6PB1, 6PG1, 6PD1) or with outer expanded plastics or solid plastics receptacles (6PH1, 6PH2) or with outer aluminium crate or box or with outer wooden or fibreboard box or with outer wickerwork hamper (6PB2, 6PC, 6PG2, 6PD2)	60 l		

P805	PACKING INSTRUCTION	P805
This instruction applies to UN 3507.		
The following packagings are authorized provided that the general provisions of **4.1.1** and **4.1.3** and the special packing provisions of **4.1.9.1.2**, **4.1.9.1.4** and **4.1.9.1.7** are met: Packagings consisting of: (a) Metal or plastics primary receptacle(s); in (b) Leakproof rigid secondary packaging(s); in (c) A rigid outer packaging: Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G); Boxes (4A, 4B, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2); Jerricans (3A2, 3B2, 3H2).		
Additional requirements: 1. Primary inner receptacles shall be packed in secondary packagings in a way that, under normal conditions of transport, they cannot break, be punctured or leak their contents into the secondary packaging. Secondary packagings shall be secured in outer packagings with suitable cushioning material to prevent movement. If multiple primary receptacles are placed in a single secondary packaging, they shall be either individually wrapped or separated so as to prevent contact between them.		

P805	PACKING INSTRUCTION	P805
2.	The contents shall comply with the provisions of 2.7.2.4.5.2;	
3.	The provisions of 6.4.4 shall be met.	
Special packing provision: In the case of fissile-excepted material, limits specified in 2.7.2.3.5 and 6.4.11.2 shall be met.		

P908	PACKING INSTRUCTION	P908
This instruction applies to UN Nos. 3090, 3091, 3480 and 3481.		
The following packagings are authorized for damaged or defective lithium ion cells and batteries and lithium metal cells and batteries including those contained in equipment, provided the general provisions of 4.1.1 and 4.1.3 are met: For cells and batteries and equipment containing cells and batteries: Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G) Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H1, 4H2) Jerricans (3A2, 3B2, 3H2) Packagings shall conform to the packing group II performance level. 1. Each cell or battery or equipment containing such cells or batteries shall be individually packed in inner packaging and placed inside of an outer packaging. The inner packaging or outer packaging shall be leak-proof to prevent the potential release of electrolyte. 2. Each inner packaging shall be surrounded by sufficient non-combustible and non-conductive thermal insulation material to protect against a dangerous evolution of heat. 3. Sealed packagings shall be fitted with a venting device when appropriate. 4. Appropriate measures shall be taken to minimize the effects of vibrations and shocks, prevent movement of the cells or batteries within the package that may lead to further damage and a dangerous condition during transport. Cushioning material that is non-combustible and non-conductive may also be used to meet this requirement. 5. Non combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured. For leaking cells or batteries, sufficient inert absorbent material shall be added to the inner or outer packaging to absorb any release of electrolyte. A cell or battery with a net mass of more than 30 kg shall be limited to one cell or battery per outer packaging.		
Additional requirements: Cells or batteries shall be protected against short circuit.		

<table>
<tr><th>P909</th><th>PACKING INSTRUCTION</th><th>P909</th></tr>
<tr><td colspan="3">This instruction applies to UN Nos. 3090, 3091, 3480 and 3481 transported for disposal or recycling, either packed together with or packed without non-lithium batteries:</td></tr>
<tr><td colspan="3">(1) Cells and batteries shall be packed in accordance with the following:
(a) The following packagings are authorized, provided that the general provisions of 4.1.1 and 4.1.3, are met:
Drums (1A2, 1B2, 1N2, 1H2, 1D, 1G);
Boxes (4A, 4B, 4N, 4C1, 4C2, 4D, 4F, 4G, 4H2); and
Jerricans (3A2, 3B2, 3H2).
(b) Packagings shall conform to the packing group II performance level.
(c) Metal packagings shall be fitted with a non-conductive lining material (e.g. plastics) of adequate strength for the intended use.
(2) However, lithium ion cells with a Watt-hour rating of not more than 20 Wh, lithium ion batteries with a Watt-hour rating of not more than 100 Wh, lithium metal cells with a lithium content of not more than 1 g and lithium metal batteries with an aggregate lithium content of not more than 2 g may be packed in accordance with the following:
(a) In strong outer packaging up to 30 kg gross mass meeting the general provisions of 4.1.1, except 4.1.1.3, and 4.1.3.
(b) Metal packagings shall be fitted with a non-conductive lining material (e.g. plastics) of adequate strength for the intended use.
(3) For cells or batteries contained in equipment, strong outer packagings constructed of suitable material, and of adequate strength and design in relation to the packaging capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3. Large equipment may be offered for transport unpackaged or on pallets when the cells or batteries are afforded equivalent protection by the equipment in which they are contained.
(4) In addition, for cells or batteries with a gross mass of 12 kg or more employing a strong, impact resistant outer casing, strong outer packagings constructed of suitable material and of adequate strength and design in relation to the packagings capacity and its intended use, may be used. Packagings need not meet the requirements of 4.1.1.3.</td></tr>
<tr><td colspan="3">Additional requirements:
1. Cells and batteries shall be designed or packed to prevent short circuits and the dangerous evolution of heat.
2. Protection against short circuits and the dangerous evolution of heat includes, but is not limited to:
-individual protection of the battery terminals,
-inner packaging to prevent contact between cells and batteries,
-batteries with recessed terminals designed to protect against short circuits, or
-the use of a non-conductive and non-combustible cushioning material to fill empty space between the cells or batteries in the packaging.
3. Cells and batteries shall be secured within the outer packaging to prevent excessive movement during transport (e.g. by using a non-combustible and non-conductive cushioning material or through the use of a tightly closed plastics bag).</td></tr>
</table>

4.1.4.2 Packing instructions concerning the use of IBCs

In IBC02, insert the following new special provision B16:

"B16 For UN 3375, IBCs of type 31A and 31N are not allowed without competent authority approval."

In IBC04, replace "and 21N" with ", 21N, 31A, 31B and 31N".

In IBC05 (1), replace "and 21N" with ", 21N, 31A, 31B and 31N".

In IBC05 (2), replace "and 21H2" with ", 21H2, 31H1 and 31H2".

In IBC05 (3), replace "and 21HZ1" with ", 21HZ1 and 31HZ1".

In IBC06 (1), IBC07 (1) and IBC08 (1), replace "and 21N" with ", 21N, 31A, 31B and 31N".

In IBC06 (2), IBC07 (2) and IBC08 (2), replace "and 21H2" with ", 21H2, 31H1 and 31H2".

In IBC06 (3), IBC07 (3) and IBC08 (3), replace "and 21HZ2" with "21HZ2 and 31HZ1".

IBC100, in the first line of packing instruction IBC100, insert "0222" after "0082". Insert the following special packing provisions:

"B2 For UN No. 0222 in IBCs other than metal or rigid plastics IBCs, the IBCs shall be transported in closed cargo transport units."

"B3 For UN No. 0222, flexible IBCs shall be sift-proof and water resistant or shall be fitted with a sift-proof and water resistant liner."

"B17 For UN No. 0222, metal IBCs are not authorized."

4.1.4.3 Special packing instructions concerning the use of large packagings

Insert the following new packing instructions:

LP903	**PACKING INSTRUCTION**	**LP903**
This instruction applies to UN Nos. 3090, 3091, 3480 and 3481		
The following large packagings are authorized for a single battery, including for a battery contained in equipment, provided that the general provisions of **4.1.1** and **4.1.3** are met: Rigid large packagings conforming to the packing group II performance level, made of: steel (50A); aluminium (50B); metal other than steel or aluminium (50N); rigid plastics (50H); natural wood (50C); plywood (50D); reconstituted wood (50F); rigid fibreboard (50G). The battery shall be packed so that the battery is protected against damage that may be caused by its movement or placement within the large packaging.		
Additional requirement: Batteries shall be protected against short circuit.		

LP904	PACKING INSTRUCTION	LP904
This instruction applies to UN Nos. 3090, 3091, 3480 and 3481		
The following large packagings are authorized for a single damaged or defective battery and for a single damaged or defective battery contained in equipment, provided the general provisions of 4.1.1 and 4.1.3 are met For batteries and equipment containing batteries: steel (50A) aluminium (50B) metal other than steel or aluminium (50N) rigid plastics (50H) plywood (50D) Packagings shall conform to the packing group II performance level. 1. Each battery or equipment containing such battery shall be individually packed in an inner packaging and placed inside of an outer packaging. The inner packaging or outer packaging shall be leak-proof to prevent the potential release of electrolyte. 2. Each inner packaging shall be surrounded by sufficient non-combustible and non-conductive thermal insulation material to protect against a dangerous evolution of heat. 3. Sealed packagings shall be fitted with a venting device when appropriate. 4. Appropriate measures shall be taken to minimize the effects of vibrations and shocks, prevent movement of the battery within the package that may lead to further damage and a dangerous condition during transport. Cushioning material that is non-combustible and non-conductive may also be used to meet this requirement. 5. Non combustibility shall be assessed according to a standard recognized in the country where the packaging is designed or manufactured. For leaking batteries, sufficient inert absorbent material shall be added to the inner or outer packaging to absorb any release of electrolyte.		
Additional requirements: Batteries shall be protected against short circuit**.**		

4.1.6 Special packing provisions for goods of class 2

4.1.6.1 General provisions

4.1.6.1.2 Replace "ISO 11114-1:1997" with "ISO 11114-1:2012".

4.1.9 Special packing provisions for class 7

4.1.9.1 General

4.1.9 Amend the title to read "Special packing provisions for radioactive material"

4.1.9.1.3 Delete ", other than an excepted package,".

4.1.9.1.6 Amend the introductory sentence to read as follows:

"Before a packaging is first used to transport radioactive material, it shall be confirmed that it has been manufactured in conformity with the design specifications to ensure compliance with the relevant provisions of is Code and any applicable certificate of approval. The following requirements shall also be fulfilled, if applicable:".

In subparagraph .1, replace "package" with "packaging".

In subparagraph .2, amend the beginning of the sentence to read as follows:

"For each packaging intended for use as a Type B(U), Type B(M) or Type C package and for each packaging intended to contain fissile material …".

In subparagraph.3, amend the text to read as follows:

".3 For each packaging intended to contain fissile material, it shall be ensured that the effectiveness of the criticality safety features is within the limits applicable to or specified for the design and in particular where, in order to comply with the requirements of 6.4.11.1 neutron poisons are specifically included, checks shall be performed to confirm the presence and distribution of those neutron poisons."

4.1.9.1.7 Insert a new paragraph to read as follows:

"4.1.9.1.7 Before each shipment of any package, it shall be ensured that the package contains neither:

.1 Radionuclides different from those specified for the package design; nor

.2 Contents in a form, or physical or chemical state different from those specified for the package design."

Current paragraphs 4.1.9.1.7 to 4.1.9.1.11 become new paragraphs 4.1.9.1.8 to 4.1.9.1.12.

4.1.9.1.8 (former 4.1.9.1.7) Amend to read as follows:

"4.1.9.1.8 Before each shipment of any package, it shall be ensured that all the requirements specified in the relevant provisions of this Code and in the applicable certificates of approval have been fulfilled. The following requirements shall also be fulfilled, if applicable:

.1 It shall be ensured that lifting attachments which do not meet the requirements of 6.4.2.2 have been removed or otherwise rendered incapable of being used for lifting the package, in accordance with 6.4.2.3;

.2 Each Type B(U), Type B(M) and Type C package shall be held until equilibrium conditions have been approached closely enough to demonstrate compliance with the requirements for temperature and pressure unless an exemption from these requirements has received unilateral approval;

.3 For each Type B(U), Type B(M) and Type C package, it shall be ensured by inspection and/or appropriate tests that all closures, valves and other openings of the containment system through which the radioactive contents might escape are properly closed and, where appropriate, sealed in the manner for which the demonstrations of compliance with the requirements of 6.4.8.8 and 6.4.10.3 were made;

.4 For packages containing fissile material the measurement specified in 6.4.11.5 (b) and the tests to demonstrate closure of each package as specified in 6.4.11.8 shall be performed."

4.1.9.2 Provisions and controls for transport of LSA material and SCO

4.1.9.2.2 Amend to read as follows:

"4.1.9.2.2 For LSA material and SCO which are or contain fissile material, which is not excepted under 2.7.2.3.5, the applicable requirements of 7.1.4.5.15 and 7.1.4.5.16 shall be met."

4.1.9.2.3 Insert a new paragraph 4.1.9.2.3 to read as follows:

"4.1.9.2.3 For LSA material and SCO which are or contain fissile material, the applicable requirements of 6.4.11.1 shall be met."

and current paragraphs 4.1.9.2.3 and 4.1.9.2.4 become new paragraphs 4.1.9.2.4 and 4.1.9.2.5 respectively. Table 4.1.9.2.4 is renumbered as 4.1.9.2.5.

4.1.9.2.4 (former 4.1.9.2.3) In .2, delete "and" at the end.

Add a new subparagraph .4 to read as follows:

".4 Unpackaged fissile material shall meet the requirements of 2.7.2.3.5.5"

4.1.9.2.5 (former 4.1.9.2.4) Replace "4.1.9.2.3" with "4.1.9.2.4" and "table 4.1.9.2.4" with "table 4.1.9.2.5".

Table 4.1.9.2.5 In note "a" under the table replace "4.1.9.2.3" with "4.1.9.2.4".

4.1.9.3 Packages containing fissile material

4.1.9.3 Amend to read as follows:

"4.1.9.3 The contents of packages containing fissile material shall be as specified for the package design either directly in the provisions of this Code or in the certificate of approval."

Chapter 4.2 – Use of portable tanks and multiple-element gas containers (MEGCs)

4.2.5 Portable tank instructions and special provisions

4.2.5.2.6 Portable tank instructions

4.2.5.2.6 Amend the header to the tabulated portable tank instructions for T1 – T22 to read as follows:

"These portable tank instructions apply to liquid and solid substances of Class 1 and Classes 3 to 9. The general provisions of section 4.2.1 and the requirements of section 6.7.2 shall be met."

4.2.5.2.6 In tank instruction T23, at the end of footnote § add: ""*CORROSIVE*" *subsidiary risk placard required (Model No 8, see 5.2.2.2.2).*"

4.2.5.3 Portable tank special provisions

4.2.5.3 In special provision TP32, paragraph (b), at the beginning, insert "For UN 3375 only,".

4.2.5.3 Add the following new portable tank special provision:

"TP41 The 2.5 year internal examination may be waived or substituted by other test methods or inspection procedures specified by the competent authority or its authorized body, provided that the portable tank is dedicated to the transport of the organometallic substances to which this tank special provision is assigned. However this examination is required when the conditions of 6.7.2.19.7 are met."

PART 5
CONSIGNMENT PROCEDURES

Chapter 5.1 – General provisions

5.1.2 Use of overpacks and unit loads

5.1.2.1 Add the following new sentence and note at the end:

"The lettering of the "OVERPACK" marking shall be at least 12 mm high.

Note: The size requirement for the "OVERPACK" marking shall apply as from 1 January 2016."

5.1.3 Empty uncleaned packagings or units

5.1.3.2 Replace "Packagings, including IBCs, and tanks" with "Freight containers, tanks, IBCs, as well as other packagings and overpacks,".

5.1.5 General provisions for class 7

5.1.5.1 Approval of shipments and notification

5.1.5.1.1 *General*

5.1.5.1.1 In the first sentence replace "for package designs" with "of package designs".

5.1.5.1.2 *Shipment approvals*

5.1.5.1.2 In subparagraph .4 replace "according to" with "in accordance with".

5.1.5.1.4 *Notifications*

5.1.5.1.4 In subparagraph .3 replace "for shipment approval" with "for approval of shipment (see 6.4.23.2)".

5.1.5.2 Certificates issued by competent authority

5.1.5.2.1 In .1, insert a new subparagraph .3 to read as follows:

".3 fissile material excepted under 2.7.2.3.5.6;".

and consequently, current subparagraphs .3 to .6 are renumbered as .4 to .7.

5.1.5.2.1 In subparagraph .5 (former .4) delete "all" and "replace "6.4.11.2" with "2.7.2.3.5, 6.4.11.2 or 6.4.11.3".

5.1.5.2.1 Insert new .4 and .5 to read as follows:

".4 Determination of the basic radionuclide values referred to in 2.7.2.2.1 for individual radionuclides which are not listed in table 2.7.2.2.1 (see 2.7.2.2.2 .1);

.5 Alternative activity limits for an exempt consignment of instruments or articles (see 2.7.2.2.2.2);.

5.1.5.2.1 Amend the second paragraph after subparagraphs .1 to .5 to read as follows:

"The certificates of approval for the package design and the shipment may be combined into a single certificate."

5.1.5.2.3 In the first sentence, amend the beginning of the sentence to read:

"For package designs where it is not required that a competent authority issue a certificate of approval, the consignor …"

5.1.5.3 Determination of transport index (TI) and criticality safety index (CSI)

5.1.5.3.4 In the first sentence, replace "and overpacks" with ", overpacks and freight containers".

In subparagraph .1, replace (twice) "or overpack" with ", overpack or freight container".

In subparagraph.5, insert "or freight container" after "overpack".

In the table in 5.1.5.3.4, replace "and overpacks" with ", overpacks and freight containers" and in note "b" to the table insert at end "except for freight containers (see table 7.1.4.5.3)".

5.1.5.3.5 Replace "design or shipment approval" with "approval of design or shipment".

5.1.5.4 Specific provisions for excepted packages

5.1.5.4 Amend the title to read "Specific provisions for excepted packages of radioactive material of Class 7".

5.1.5.4.1 After "excepted packages", insert "of radioactive material of Class 7".

5.1.5.4.2 Amend to read as follows:

"5.1.5.4.2 The documentation requirements of Chapter 5.4 do not apply to excepted packages of radioactive material of Class 7, except that:

.1 The UN number preceded by the letters "UN" and the name and address of the consignor and the consignee and, if relevant, the identification mark for each competent authority certificate of approval (see 5.4.1.5.7.1 7.) shall be shown on a transport document such as a bill of lading, air waybill or other similar document complying with the requirements of 5.4.1.2.1 to 5.4.1.2.4;

.2 The requirements of 5.4.1.6.2 and, if relevant, those of 5.4.1.5.7.1.7, 5.4.1.5.7.3 and 5.4.1.5.7.4 shall apply;

.3 The requirements of 5.4.2 and 5.4.4 shall apply."

5.1.5.4.3 Insert a new paragraph to read as follows:

"5.1.5.4.3 The requirements of 5.2.1.5.8 and 5.2.2.1.12.5 shall apply if relevant."

5.1.5.5 Specific provisions for the consignment of fissile material

Insert a new section 5.1.5.5 as follows:

"**5.1.5.5 Specific provisions for the consignment of fissile material**

Fissile material meeting one of the provisions of 2.7.2.3.5.1 to 2.7.2.3.5.6 shall meet the following requirements:

.1 Only one of the provisions of 2.7.2.3.5.1 to 2.7.2.3.5.6 is allowed per consignment;

.2 Only one approved fissile material in packages classified in accordance with 2.7.2.3.5.6 is allowed per consignment unless multiple materials are authorized in the certificate of approval;

.3 Fissile material in packages classified in accordance with 2.7.2.3.5.3 shall be transported in a consignment with no more than 45 g of fissile nuclides;

.4 Fissile material in packages classified in accordance with 2.7.2.3.5.4 shall be transported in a consignment with no more than 15 g of fissile nuclides;

.5 Unpackaged or packaged fissile material classified in accordance with 2.7.2.3.5.5 shall be transported under exclusive use on a conveyance with no more than 45 g of fissile nuclides."

Chapter 5.2 – Marking and labelling of packages including IBCs

5.2.1 Marking of packages including IBCs

5.2.1.1 Amend the second sentence to read as follows:

"The UN number and the letters "UN" shall be at least 12 mm high, except for packages of 30 litres capacity or less or of 30 kg maximum net mass and for cylinders of 60 litres water capacity when they shall be at least 6 mm in height and except for packages of 5 litres or 5 kg or less when they shall be of an appropriate size."

5.2.1.3 Add the following new sentence and note at the end:

"The lettering of the "SALVAGE" marking shall be at least 12 mm high.

NOTE: The size requirement for the "SALVAGE" marking shall apply as from 1 January 2016."

5.2.1.5 Special marking provisions for class 7

5.2.1.5 Replace "for Class 7" with "for radioactive material".

5.2.1.5.1 Insert the following sentence at the end:

"Each overpack shall be legibly and durably marked on the outside of the overpack with an identification of either the consignor or consignee, or both unless these markings of all packages within the overpack are clearly visible."

5.2.1.5.2 After "excepted packages" insert "of radioactive material of Class 7".

5.2.1.5.5 Amend the introductory sentence to read as follows:

"Each package which conforms to a design approved under one or more of paragraphs 5.1.5.2.1, 6.4.22.1 to 6.4.22.4, 6.4.23.4 to 6.4.23.7 and 6.4.24.2 shall be legibly and durably marked on the outside of the package with the following information:"

5.2.1.5.5 Amend .3 to read as follows:

".3 "Type B(U)", "Type B(M)" or "Type C", in the case of a Type B(U), Type B(M) or Type C package design"

5.2.1.5.5 Delete subparagraph 4.

5.2.1.5.7 Replace "4.1.9.2.3" with "4.1.9.2.4".

5.2.1.5.8 Replace "competent authority design or shipment approval" with "competent authority approval of design or shipment".

5.2.1.6 Special marking provisions for marine pollutants

5.2.1.6.1 Replace existing paragraph with the following:

"5.2.1.6.1 "Except as provided in 2.10.2.7, packages containing marine pollutants meeting the criteria of 2.9.3 shall be durably marked with the marine pollutant mark."

5.2.1.6.3 Amend 5.2.1.6.3 and figure to read as follows:

"5.2.1.6.3 The marine pollutant mark shall be as shown in the figure below.

Marine Pollutant Mark

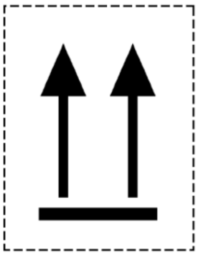
The marking shall be in the form of a square set at an angle of 45° (diamond-shaped). The symbol (fish and tree) shall be black on white or suitable contrasting background. The minimum dimensions shall be 100 mm x 100 mm and the minimum width of line forming the diamond shall be 2 mm. If the size of the package so requires, the dimensions/line thickness may be reduced, provided the marking remains clearly visible. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

NOTE 1: The labelling provisions of 5.2.2 apply in addition to any requirement for packages to bear the marine pollutant mark.

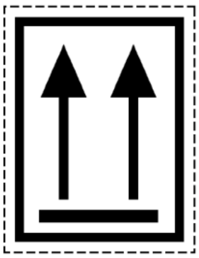
NOTE 2: The provisions of 5.2.1.6.3 of IMDG Code (Amendment 36-12) may continue to be applied until 31 December 2016."

5.2.1.7 Amend the figures and caption below to read as follows:

"



or



Two black or red arrows on white or suitable contrasting background.
The rectangular border is optional
All features shall be in approximate proportion to those shown."

5.2.2 Labelling of packages including IBCs

5.2.2.1 Labelling provisions

5.2.2.1.12 Special provisions for the labelling of radioactive material

5.2.2.1.12.1 Amend the first and second sentences to read as follows:

> "Except when enlarged labels are used in accordance with 5.3.1.1.5.1, each package, overpack and freight container containing radioactive material shall bear the labels conforming to the applicable models Nos. 7A, 7B or 7C, according to the appropriate category. Labels shall be affixed to two opposite sides on the outside of the package or overpack or on the outside of all four sides of a freight container or tank."

5.2.2.1.12.1 In the fourth sentence amend "under 6.4.11.2" read "under the provisions of 2.7.2.3.5", replace "which conform to model" with "conforming to model"; replace the last phrase of the fourth sentence with the following:

> "such labels, where applicable shall be affixed adjacent to the labels conforming to the applicable model Nos. 7A, 7B or 7C."

5.2.2.1.12.2 In the introductory sentence, replace "Nos. 7A, 7B and 7C" with "the applicable model No. 7A, 7B or 7C".

5.2.2.1.12.2 In .2, amend the last sentence to read as follows:

> "For fissile material, the total mass of fissile nuclides in units of grams (g), or multiples thereof, may be used in place of activity".

5.2.2.1.12.3 Amend to read as follows:

> "5.2.2.1.12.3 Each label conforming to the model No. 7E shall be completed with the criticality safety index (CSI) as stated in the certificate of approval applicable in the countries through or into which the consignment is transported and issued by the competent authority or as specified in 6.4.11.2 or 6.4.11.3."

5.2.2.1.12.4 Amend to read as follows:

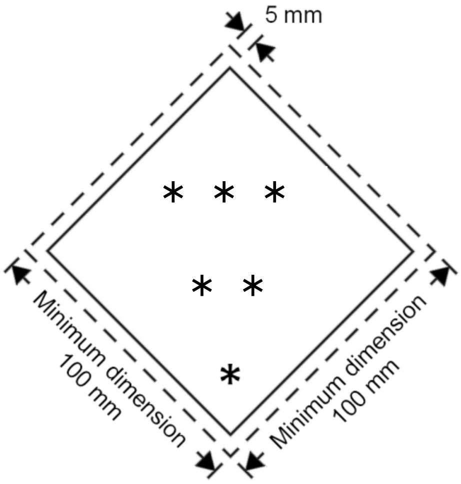
> "5.2.2.1.12.4 For overpacks and freight containers, the label conforming to model No. 7E shall bear the sum of the criticality safety indexes of all the packages contained therein".

5.2.2.1.12.5 Replace "competent authority design or shipment approval" with "competent authority approval of design or shipment".

5.2.2.2 Provisions for labels

5.2.2.2.1.1 Amend to read as follows:

> "5.2.2.2.1.1 Labels shall be configured as shown in the figure below:



Class/division label

* The class or, for divisions 5.1 and 5.2, the Division number shall be shown in the bottom corner

** Additional text/numbers/letters shall (if mandatory) or may (if optional) be shown in this bottom half

*** The class or division symbol or, for divisions 1.4, 1.5 and 1.6, the division number and for Model No 7E the word "FISSILE" shall be shown in this top half".

5.2.2.2.1.1.1 Labels shall be displayed on a background of contrasting colour, or shall have either a dotted or solid outer boundary line.

5.2.2.2.1.1.2 The label shall be in the form of a square set at an angle of 45° (diamond-shaped). The minimum dimensions shall be 100 mm x 100 mm and the minimum width of the line inside the edge forming the diamond shall be 2 mm. The line inside the edge shall be parallel and 5 mm from the outside of that line to the edge of the label. The line inside the edge on the upper half of the label shall be the same colour as the symbol and the line inside the edge on the lower half of the label shall be the same colour as the class or division number in the bottom corner. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

5.2.2.2.1.1.3 If the size of the package so requires the dimensions may be reduced, provided the symbols and other elements of the label remain clearly visible. The line inside the edge shall remain 5 mm to the edge of the label. The minimum width of the line inside the edge shall remain 2 mm. Dimensions for cylinders shall comply with 5.2.2.2.1.2.

NOTE: The provisions of 5.2.2.2.1.1 of the IMDG Code (Amendment 36-12) may continue to be applied until 31 December 2016. When so applied, 5.2.2.2.1.1.1, 5.2.2.2.1.1.2 and 5.2.2.2.1.1.3 shall not apply until 31 December 2016."

5.2.2.2.2 Specimen Labels

5.2.2.2.2 Insert a new "note" under the heading as follows:

> **"Note:** Labels shall satisfy the provisions below and conform, in terms of colour, symbols and general format, to the models shown in 5.2.2.2.2. Corresponding models required for other modes of transport, with minor variations which do not affect the obvious meaning of the label, are also acceptable."

The following symbols within the IMDG Code, should be replaced by those used by the UN Recommendations:

> Class 2.1, Class 2.3, No. 3, No. 4, Class 4.3, Class 5.1, Class 5.2, Class 6 and Class 8.

Chapter 5.3 – Placarding and marking of cargo transport units

5.3.1 Placarding

5.3.1.1 Placarding provisions

5.3.1.1.4 ***Placarding requirements***

5.3.1.1.4.1 Replace the existing subparagraph ".1" with the following:

> ".1 a freight container, semi-trailer or portable tank: one on each side and one on each end of the unit. Portable tanks having a capacity of less than 3,000 litres may be placarded or, alternatively, may be labeled instead, on only two opposite sides."

5.3.1.1.5 *Special provisions for class 7*

5.3.1.1.5.1 Amend the last sentence to read as follows:

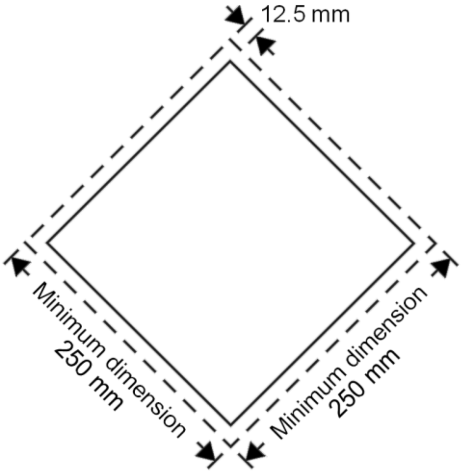
> "Instead of using both labels and placards, it is permitted as an alternative to use enlarged labels only, as shown in label models Nos. 7A, 7B and 7C, except having the minimum size shown in figure 5.3.1."

5.3.1.1.5.2 In the introductory sentence replace "No." with "Nos.", "or 7E" with "and 7E" and "(Model 7D)" with "(model No.7D)".

5.3.1.2 Specifications for placards

5.3.1.2.1 Amend to read as follows:

> "5.3.1.2.1 Except as provided in 5.3.1.2.2 for the Class 7 placard, and in 5.3.2.3.2 for the marine pollutant mark, a placard shall be configured as shown in the figure below.



Placard (except for class 7)

The placard shall be in the form of a square set at an angle of 45° (diamond-shaped). The minimum dimensions shall be 250 mm x 250 mm (to the edge of the placard). The line inside the edge shall be parallel and 12.5 mm from the outside of that line to the edge of the placard. The symbol and line inside the edge shall correspond in colour to the label for the class or division of the dangerous goods in question. The class or division symbol/numeral shall be positioned and sized in proportion to those prescribed in 5.2.2.2 for the corresponding class or division of the dangerous goods in question. The placard shall display the number of the class or division (and for goods in Class 1, the compatibility group letter) of the dangerous goods in question in the manner prescribed in 5.2.2.2 for the corresponding label, in digits not less than 25 mm high. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

NOTE: The provisions of 5.3.1.2.1 from the IMDG Code (amendment 36-12) may continue to be applied until 31 December 2016."

5.3.2 Marking of cargo transport units

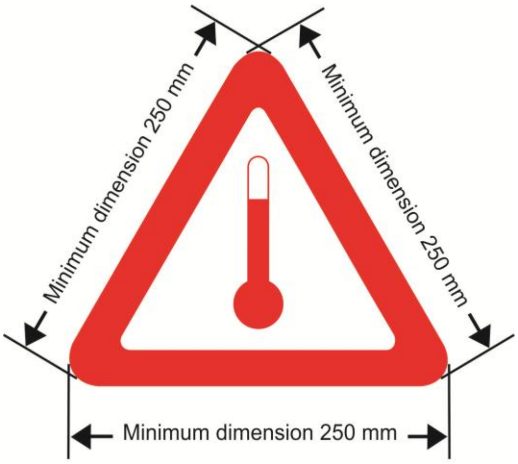
5.3.2.0.2 Insert a new second new sentence as follows:

"This may be reduced to 12 mm for portable tank containers with a capacity of less than 3,000 litres."

5.3.2.2 Elevated temperature substances

5.3.2.2.1 Amend to read as follows:

"5.3.2.2.1 Cargo transport units containing a substance that is transported or offered for transport in a liquid state at a temperature equal to or exceeding 100°C, in a solid state at a temperature equal to or exceeding 240°C shall bear on each side and on each end the mark shown in the figure below.



Mark for transport at elevated temperature

The marking shall be an equilateral triangle. The colour of the mark shall be red. The minimum dimension of the sides shall be 250 mm except for portable tanks with a capacity of less than 3,000 litres where the sides may be reduced to 100 mm. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

Note: The provisions of 5.3.2.2 of the IMDG Code (Amendment 36-12) may continue to be applied until 31 December 2016."

5.3.2.3 Marine pollutant mark

5.3.2.3 Replace existing paragraph under 5.3.2.3 with the following:

"5.3.2.3.1 Except as provided in 2.10.2.7, cargo transport units containing marine pollutants shall clearly display the marine pollutant mark in locations indicated in 5.3.1.1.4.1"

5.3.2.3.2 The marine pollutant mark for cargo transport units shall be as described in 5.2.1.6.3, except that the minimum dimensions shall be 250 mm x 250 mm. For portable tanks with a capacity of less than 3,000 litres, the dimensions may be reduced to 100 mm x 100 mm."

Chapter 5.4 – Documentation

5.4.1 Dangerous goods transport information

5.4.1.4.3 Information which supplements the Proper Shipping Name in the dangerous goods description

5.4.1.4.3 Replace existing subparagraph ".5" with the following:

".5 Marine pollutants: Except as provided in 2.10.2.7, if the goods to be transported are marine pollutants, the goods shall be identified as "MARINE POLLUTANT", and for generic or "not otherwise specified" (N.O.S.) entries the Proper Shipping Name shall be supplemented with the recognized chemical name of the marine pollutant (see 3.1.2.9). The term "MARINE POLLUTANT" may be supplemented with the term "ENVIRONMENTALLY HAZARDOUS";

5.4.1.5 Information required in addition to the dangerous goods description

5.4.1.5.7 *Radioactive material*

5.4.1.5.7.1 Amend subparagraph .6 to read as follows:

".6 For fissile material:

(i) Shipped under one exception of 2.7.2.3.5.1 to 2.7.2.3.5.6, reference to that paragraph;

(ii) Shipped under 2.7.2.3.5.1 to 2.7.2.3.5.5, the total mass of fissile nuclides;

(iii) Contained in a package for which one of 6.4.11.2 (a) to (c) or 6.4.11.3 is applied, reference to that paragraph;

(iv) The criticality safety index, where applicable."

5.4.1.5.7.1 In subparagraph .7, replace "competent authority approval certificate" with "competent authority certificate of approval" and insert "fissile material excepted under 2.7.2.3.5.6," before "special arrangement".

5.4.1.5.7.3 Replace "competent authorities design or shipment approval" with "competent authority approval of design or shipment".

5.4.1.6 Certification

5.4.1.6.1 In the text of the certification, after "above", insert "/ below*".

and insert the following footnote:

"* as appropriate".

5.4.1.5.12 Transport of solid dangerous goods in bulk containers

5.4.1.5.12 At the end replace the sentence "Bulk container BK2 approved by the competent authority of …" with the following:

"Bulk container BK(x) approved by the competent authority of …".

and at the end insert the following note:

Note: "(x)" shall be replaced with "1" or "2", as appropriate.

5.4.2 Container/vehicle packing certificate

5.4.2.1.8 Amend to read as follows:

".8 When substances presenting a risk of asphyxiation are used for cooling or conditioning purposes (such as dry ice (UN 1845) or nitrogen, refrigerated liquid (UN 1977) or argon, refrigerated liquid (UN 1951)), the container/vehicle is externally marked in accordance with 5.5.3.6; and".

5.4.3 Documentation required aboard the ship

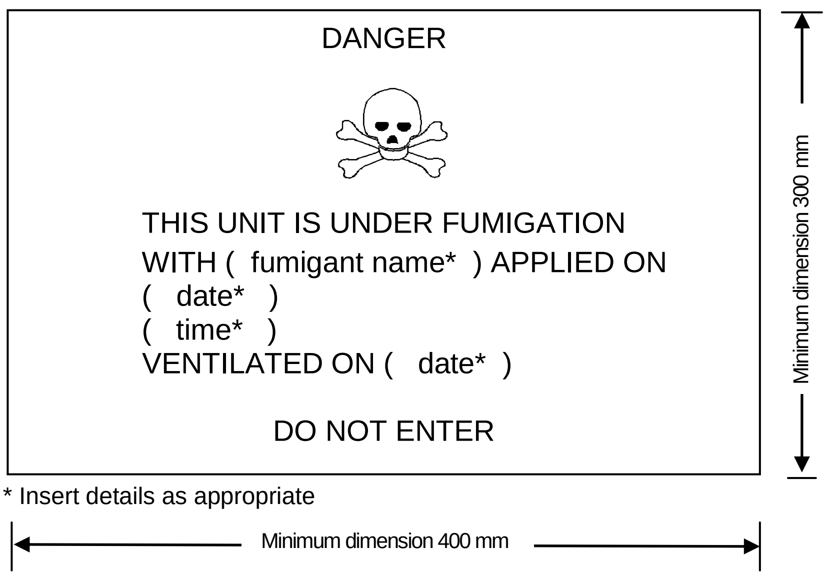
5.4.3.1 The footnote reference in the paragraph "* FAL.2/Circ.52/Rev.1 may be used for this purpose" is replaced with "Resolution FAL. 10(35), adopted on 16 January 2009, amendments to the annex to the convention on facilitation of international maritime traffic, 1965".

Chapter 5.5 – Special provisions

5.5.2.3 Marking and placarding

Amend 5.5.2.3.2 as follows:

"5.5.2.3.2 The fumigation warning mark shall be as shown in the figure below.



Fumigation warning mark

The marking shall be a rectangle. The minimum dimensions shall be 400 mm wide x 300 mm high and the minimum width of the outer line shall be 2 mm. The marking shall be in black print on a white background with lettering not less than 25 mm high. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

Note: The provisions of 5.5.2.3.2 of the IMDG Code (Amendment 36-12) may continue to be applied until 31 December 2016."

5.5.3 Special provisions applicable to packages and cargo transport units containing substances presenting a risk of asphyxiation when used for cooling or conditioning purposes (such as dry ice (UN 1845) or nitrogen, refrigerated liquid (UN 1977) or argon, refrigerated liquid (UN 1951))

5.5.3.1 Scope

5.5.3 Add a new subparagraph 5.5.3.1.4 to read as follows:

"5.5.3.1.4 Cargo transport units containing substances used for cooling or conditioning purposes include cargo transport units containing substances used for cooling or conditioning purposes inside packages as well as cargo transport units with unpackaged substances used for cooling or conditioning purposes."

5.5.3.2 General

5.5.3.2.2 Amend the first sentence as follows:

"5.5.3.2.2 When dangerous goods are loaded in cargo transport units containing substances used for cooling or conditioning purposes any provisions of these Regulations relevant to these dangerous goods apply in addition to the provisions of this section."

5.5.3.2.4 Amend to read as follows:

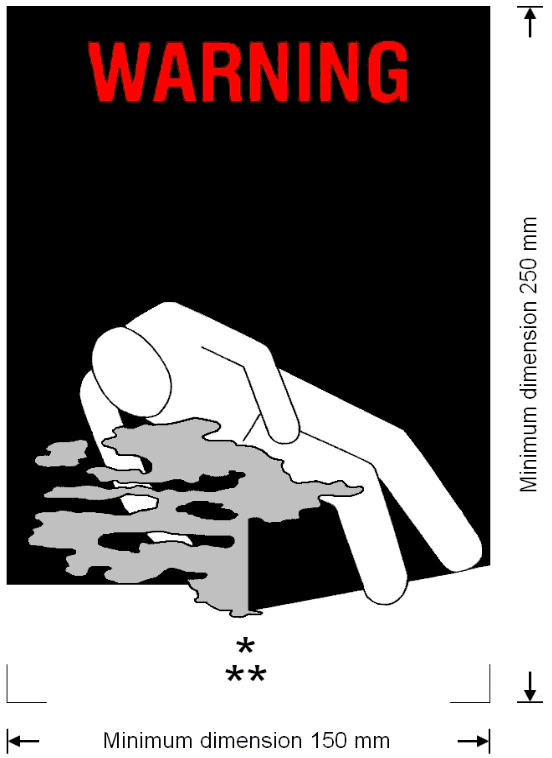
"5.5.3.2.4 Persons engaged in the handling or transport of cargo transport units containing substances used for cooling or conditioning purposes shall be trained commensurate with their responsibilities."

5.5.3.6 Marking of cargo transport units

5.5.3.6.1 Add "purposes" after "cooling or conditioning" in the first sentence.

5.5.3.6.2 Amend paragraph to read as follows:

"5.5.3.6.2 The warning mark shall be as shown in the figure below



Coolant/conditioning warning mark for cargo transport units

* Insert proper shipping name of the coolant/conditioner. The lettering shall be in capitals, all be on one line and shall be at least 25 mm high. If the length of the proper shipping name is too long to fit in the space provided, the lettering may be reduced to the maximum size possible to fit. For example: CARBON DIOXIDE, SOLID.

** Insert "AS COOLANT" or "AS CONDITIONER" as appropriate. The lettering shall be in capitals, all be on one line and be at least 25 mm high.

The marking shall be a rectangle. The minimum dimensions shall be 150 mm wide x 250 mm high. The word "WARNING" shall be in red or white and be at least 25 mm high. Where dimensions are not specified, all features shall be in approximate proportion to those shown.

NOTE: The provisions of 5.5.3.6.2 of the IMDG Code (Amendment 36-12) may continue to be applied until 31 December 2016."

5.5.3.7 Documentation

5.5.3.7.1 Replace "that have been cooled or conditioned" with "containing or have contained substances used for cooling or conditioning purposes".

PART 6
CONSTRUCTION AND TESTING OF PACKAGINGS, INTERMEDIATE BULK CONTAINERS (IBCs), LARGE PACKAGINGS, PORTABLE TANKS, MULTIPLE-ELEMENT GAS CONTAINERS (MEGCs) AND ROAD TANK VEHICLES

Chapter 6.1 – Provisions for the construction and testing of packagings (other than for class 6.2 substances)

6.1.1 Applicability and general provisions

6.1.1.1 Applicability

6.1.1.1.4 Amend to read "Packagings for liquids, other than combination packagings, with capacity exceeding 450 L".

6.1.3 Marking

6.1.3.1(e) Insert a reference to note "*" at the centre of the symbol and add the following note under the symbol:

> "* The last two digits of the year of manufacture may be displayed at that place. In such a case, the two digits of the year in the type approval marking and in the inner circle of the clock shall be identical."

and insert a new Note at the end to read as follows:

> "**NOTE**: Other methods that provide the minimum required information in a durable, visible and legible form are also acceptable."

Chapter 6.2 – Provisions for the construction and testing of pressure receptacles, aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas

6.2.1 General provisions

6.2.1.1 Design and construction

6.2.1.1.5 Add the following new last sentence:

> "The test pressure of a cylinder for an adsorbed gas shall be in accordance with packing instruction P208."

6.2.2 Provisions for UN pressure receptacles

6.2.2 Add the following new second sentence:

> "Manufacture of new pressure receptacles or service equipment according to any particular standard in 6.2.2.1 and 6.2.2.3 is not permitted after the date shown in the right hand column of the tables."

Renumber the existing NOTE as "NOTE 1".

Add the following new note:

"**NOTE 2:** UN pressure receptacles and service equipment constructed according to standards applicable at the date of manufacture may continue in use subject to the periodic inspection provisions of this Code."

6.2.2.1 Design, construction and initial inspection and test

6.2.2.1.1 In the table, add a new third column. Add a new first row with the following text:

Reference	Title	Applicable for manufacture

For ISO Standards "ISO 9809-1:1999", "ISO 9809-2:2000"and "ISO 9809-3:2000", in the third column, add "Until 31 December 2018".

After ISO Standard "ISO 9809-1:1999" add the following new standard:

ISO 9809-1:2010	Gas cylinders -- Refillable seamless steel gas cylinders -- Design, construction and testing -- Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa	Until further notice

After ISO Standard "ISO 9809-2:2000" add the following new standard:

ISO 9809-2:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 2: Quenched and tempered steel cylinders with tensile strength greater than or equal to 1 100 MPa	Until further notice

After ISO Standard "ISO 9809-3:2000" add the following new standard:

ISO 9809-3:2010	Gas cylinders -- Refillable seamless steel gas cylinders -- Design, construction and testing -- Part 3: Normalized steel cylinders	Until further notice

For all the other standards, in the column "Applicable for manufacture", add "Until further notice".

6.2.2.1.2 In the table, add a new third column. Add a new first row with the following text:

Reference	Title	Applicable for manufacture

For ISO Standard "ISO 11120:1999", in the column "Applicable for manufacture", add "Until further notice".

6.2.2.1.3 Amend the first table to read as follows:

Reference	Title	Applicable for manufacture
ISO 9809-1:1999	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa ***NOTE:*** *The note concerning the F factor in section 7.3 of this standard shall not be applied for UN cylinders.*	Until 31 December 2018
ISO 9809-1:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa	Until further notice
ISO 9809-3:2000	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders	Until 31 December 2018
ISO 9809-3:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 3: Normalized steel cylinders	Until further notice

6.2.2.1.3 (second table), 6.2.2.1.4 and 6.2.2.1.5 In the tables, add a new third column. Add a new first row with the following text:

Reference	Title	Applicable for manufacture

For all the standards, in the column "Applicable for manufacture", add "Until further notice".

6.2.2.1.6 After 6.2.2.1.5 insert the following new paragraphs:

"6.2.2.1.6 The standard shown below applies for the design, construction and initial inspection and test of UN bundles of cylinders. Each cylinder in a UN bundle of cylinders shall be a UN cylinder complying with the requirements of 6.2.2. The inspection requirements related to the conformity assessment system and approval for UN bundles of cylinders shall be in accordance with 6.2.2.5.

Reference	Title	Applicable for manufacture
ISO 10961:2010	Gas cylinders – Cylinder bundles – Design, manufacture, testing and inspection	Until further notice

NOTE: Changing one or more cylinders of the same design type, including the same test pressure, in an existing UN bundle of cylinders does not require re-certification of the existing bundle."

"6.2.2.1.7 The following standards apply for the design, construction and initial inspection and test of UN cylinders for adsorbed gases except that the inspection requirements related to the conformity assessment system and approval shall be in accordance with 6.2.2.5.

Reference	Title	Applicable for manufacture
ISO 11513:2011	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection	Until further notice
ISO 9809-1:2010	Gas cylinders – Refillable seamless steel gas cylinders – Design, construction and testing – Part 1: Quenched and tempered steel cylinders with tensile strength less than 1 100 MPa	Until further notice

".

6.2.2.2 Materials

6.2.2.2 Replace "ISO 11114-1:1997" with "ISO 11114-1:2012". In the title for standard "ISO 11114-1:2012", delete "Transportable". Delete the note at the end.

6.2.2.3 Service equipment

6.2.2.3 Amend the first table to read as follows:

Reference	Title	Applicable for manufacture
ISO 11117:1998	Gas cylinders – Valve protection caps and valve guards for industrial and medical gas cylinders – Design, construction and tests	Until 31 December 2014
ISO 11117:2008 + Cor 1:2009	Gas cylinders − Valve protection caps and valve guards − Design, construction and tests	Until further notice
ISO 10297:1999	Gas cylinders – Refillable gas cylinder valves – Specification and type testing	Until 31 December 2008
ISO 10297:2006	Gas cylinders – Refillable gas cylinder valves – Specification and type testing	Until further notice
ISO 13340:2001	Transportable gas cylinders – Cylinders valves for non-refillable cylinders – Specification and prototype testing	Until further notice

6.2.2.3 In the second table, add a new third column. Add a new first row with the following text:

Reference	Title	Applicable for manufacture

For ISO Standard "ISO 16111:2008", in the column "Applicable for manufacture", add "Until further notice".

6.2.2.4 In the table, add a new third column. Add a new first row with the following text:

Reference	Title	Applicable

For all standards, in the column "Applicable", add "Until further notice".

6.2.2.4 Periodic inspection and test

6.2.2.4 In the table of standards for periodic inspection and test, after the entry for "ISO 10462:2005" add the following new entry:

ISO 11513:2011	Gas cylinders – Refillable welded steel cylinders containing materials for sub-atmospheric gas packaging (excluding acetylene) – Design, construction, testing, use and periodic inspection	Until further notice

6.2.2.7 Marking of refillable UN pressure receptacles

6.2.2.7 Amend the note to read as follows:

"**Note:** Marking requirements for UN metal hydride storage systems are given in 6.2.2.9 and marking requirements for UN bundles of cylinders are given in 6.2.2.10."

6.2.2.7.4 In subparagraph (p) replace "ISO 11114-1:1997" with "ISO 11114-1:2012".

6.2.2.7.9 Is deleted.

6.2.2.9 Marking of UN metal hydride storage systems

6.2.2.9.2 In subparagraph (j) replace "ISO 11114-1:1997" with "ISO 11114-1:2012".

6.2.2.10 Marking of bundles of cylinders

Add the following new section:

"**6.2.2.10 Marking of bundles of cylinders**

6.2.2.10.1 Individual cylinders in a bundle of cylinders shall be marked in accordance with 6.2.2.7.

6.2.2.10.2 Refillable UN bundles of cylinders shall be marked clearly and legibly with certification, operational, and manufacturing marks. These marks shall be permanently affixed (e.g. stamped, engraved, or etched) on a plate permanently attached to the frame of the bundle of cylinders. Except for the UN packaging symbol, the minimum size of the marks shall be 5 mm. The minimum size of the UN packaging symbol shall be 10 mm.

6.2.2.10.3 The following marks shall be applied:

(a) The certification marks specified in 6.2.2.7.2 (a), (b), (c), (d) and (e);

(b) The operational marks specified in 6.2.2.7.3 (f), (i), (j) and the total of the mass of the frame of the bundle and all permanently attached parts (cylinders, manifold, fittings and valves). Bundles intended for the carriage of UN 1001 acetylene, dissolved and UN 3374 acetylene, solvent free shall bear the tare mass as specified in clause B.4.2 of ISO 10961:2010; and

(c) The manufacturing marks specified in 6.2.2.7.4 (n), (o) and, where applicable, (p).

6.2.2.10.4 The marks shall be placed in three groups:

(a) The manufacturing marks shall be the top grouping and shall appear consecutively in the sequence given in 6.2.2.10.3 (c);

(b) The operational marks in 6.2.2.10.3 (b) shall be the middle grouping and the operational mark specified in 6.2.2.7.3 (f) shall be immediately preceded by the operational mark specified in 6.2.2.7.3 (i) when the latter is required;

(c) Certification marks shall be the bottom grouping and shall appear in the sequence given in 6.2.2.10.3 (a)."

6.2.4 Provisions for aerosol dispensers, small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas

6.2.4 In the heading, delete the word "flammable". Insert the following text after the heading:

"Each filled aerosol dispenser or gas cartridge or fuel cell cartridge shall be subjected to a test in a hot water bath in accordance with 6.2.4.1 or an approved water bath alternative in accordance with 6.2.4.2."

6.2.4.1 Small receptacles containing gas (gas cartridges) and fuel cell cartridges containing liquefied flammable gas

Delete 6.2.4.1, 6.2.4.1.1 and 6.2.4.1.2, heading 6.2.4.2 and the text under this heading.

Renumber heading 6.2.4.2.1 as 6.2.4.1.

6.2.4.2 Aerosol dispensers

6.2.4.2.1 *Hot water bath test*

6.2.4.2.1.1 Renumber as 6.2.4.1.1. In the first sentence, after "capacity of the aerosol dispenser" insert ", gas cartridge or fuel cell cartridge". In the second sentence, after "to heat or if aerosol dispensers" insert "gas cartridges or fuel cell cartridges" and after "one aerosol dispenser," insert "gas cartridge or fuel cell cartridge".

6.2.4.2.1.2 Renumber as 6.2.4.1.2. After the first "aerosol dispenser" insert ", receptacle or fuel cell cartridge". After the second "aerosol dispenser" insert ", gas cartridge or fuel cell cartridge".

Renumber heading 6.2.4.2.2 as 6.2.4.2 and, in the text under this heading, replace "of 6.2.4.2.2.1, 6.2.4.2.2.2 and 6.2.4.2.2.3" by "of 6.2.4.2.1 and, as appropriate, 6.2.4.2.2 or 6.2.4.2.3".

6.2.4.2.2 *Alternative methods*

6.2.4.2.2.1 Renumber as 6.2.4.2.1. In the first sentence, after "Aerosol dispenser" insert ", gas cartridge or fuel cell cartridge". In the second sentence, after "that all aerosol dispensers" insert ", gas cartridges or fuel cell cartridges" In indent (f) insert the following text at the end ", gas cartridges or fuel cell cartridges".

Before 6.2.4.2.2.2, insert the following text "6.2.4.2.2 Aerosol dispensers".

6.2.4.2.2.2 *Pressure and leak testing of aerosol dispensers before filling*

6.2.4.2.2.2 Renumber as 6.2.4.2.2.1. Replace "Every" with "Each" at the beginning of the first sentence.

6.2.4.2.2.3 *Testing of the aerosol dispensers after filling*

6.2.4.2.2.3 Renumber as 6.2.4.2.2.2.

Add a new 6.2.4.2.3 to read as follows:

"6.2.4.2.3 Gas cartridges and fuel cell cartridges

6.2.4.2.3.1 Pressure testing of gas cartridges and fuel cell cartridges

Each gas cartridge or fuel cell cartridge shall be subjected to a test pressure equal to or in excess of the maximum expected in the filled receptacle at 55°C (50°C if the liquid phase does not exceed 95% of the capacity of the receptacle at 50°C). This test pressure shall be that specified for the gas cartridge or fuel cell cartridge and shall not be less than two thirds the design pressure of the gas cartridge or fuel cell cartridge. If any gas cartridge or fuel cell cartridge shows evidence of leakage at a rate equal to or greater than 3.3 x 10^{-2} mbar.l.s^{-1} at the test pressure or distortion or any other defect, it shall be rejected.

6.2.4.2.3.2 Leak testing gas cartridges and fuel cell cartridges

Prior to filling and sealing, the filler shall ensure that the closures (if any), and the associated sealing equipment are closed appropriately and the specified gas is used.

Each filled gas cartridge or fuel cell cartridge shall be checked for the correct mass of gas and shall be leak tested. The leak detection equipment shall be sufficiently sensitive to detect at least a leak rate of 2.0 x 10^{-3} mbar.l.s^{-1} at 20°C.

Any gas cartridge or fuel cell cartridge that has gas masses not in conformity with the declared mass limits or shows evidence of leakage or deformation, shall be rejected."

Chapter 6.4 – Provisions for the construction, testing and approval of packages and material of class 7

In the title, replace "class 7" with "radioactive material".

6.4.2 General provisions

6.4.2.11 Insert a new paragraph 6.4.2.11 to read as follows:

"6.4.2.11 A package shall be so designed that it provides sufficient shielding to ensure that, under routine conditions of transport and with the maximum radioactive contents that the package is designed to contain, the radiation level at any point on the external surface of the package would not exceed the values specified in 2.7.2.4.1.2, 4.1.9.1.10 and 4.1.9.1.11, as applicable, with account taken of 7.1.4.5.3.3 and 7.1.4.5.5".

Current paragraphs 6.4.2.11 and 6.4.2.12 become 6.4.2.12 and 6.4.2.13 respectively.

6.4.3 Additional provisions for packages transported by air

6.4.3.3 Replace "leakage" with "loss or dispersal of radioactive contents from the containment system,".

6.4.6 Provisions for packages containing uranium hexafluoride

6.4.6.1 Amend the first sentence to read as follows:

> "Packages designed to contain uranium hexafluoride shall meet the requirements which pertain to the radioactive and fissile properties of the material prescribed elsewhere in this Code."

6.4.6.2 In subparagraphs .1 and .3, insert at the end: "except as allowed in 6.4.6.4".

6.4.6.4 In the introductory sentence replace "the approval of the competent authority" with "multilateral approval" and insert "the packages are designed:" at the end, after "if".

and in subparagraphs (a) and (b) delete "the packages are designed" and replace "and" with "and/or" at the end. In subparagraph (c), delete "for packaged designed" and replace "hexafluoride, the packages" with "hexafluoride and the packages".

6.4.8 Provisions for Type B(U) packages

6.4.8.1 Amend to read as follows:

> "6.4.8.1 Type B(U) packages shall be designed to meet the requirements specified in 6.4.2, the requirements specified in 6.4.3 if carried by air, and of 6.4.7.2 to 6.4.7.15, except as specified in 6.4.7.14 (a), and, in addition, the requirements specified in 6.4.8.2 to 6.4.8.15."

6.4.8.2 Amend the end of the introductory paragraph to read: "…which may cause one or more of the following:". And in (a) and (b), delete "or" at the end.

6.4.8.8 In subparagraph (b), replace "and the tests in" with "and either the test in."

6.4.9 Provisions for Type B(M) packages

6.4.9.1 In the first sentence, replace "6.4.8.4, 6.4.8.5 and 6.4.8.6," with "6.4.8.4 to 6.4.8.6". And in the second sentence, insert "6.4.8.4 and" after "packages specified in".

6.4.10 Provisions for Type C packages

6.4.10.3 Amend to read as follows:

> "6.4.10.3 A package shall be so designed that, if it were at the maximum normal operating pressure and subjected to:
>
> (a) The tests specified in 6.4.15, it would restrict the loss of radioactive contents to not more than 10^{-6} A_2 per hour; and
>
> (b) The test sequences in 6.4.20.1,

(i) it would retain sufficient shielding to ensure that the radiation level at 1 m from the surface of the package would not exceed 10 mSv/h with the maximum radioactive contents which the package is designed to contain; and

(ii) it would restrict the accumulated loss of radioactive contents in a period of 1 week to not more than 10 A_2 for krypton-85 and not more than A_2 for all other radionuclides."

The text of last paragraph remains unchanged.

6.4.11 Provisions for packages containing fissile material

6.4.11.1 In (a), insert "routine," before "normal".

6.4.11.1 Amend (b)(i) to read as follows: "of 6.4.7.2 except for unpackaged material when specifically allowed by 2.7.2.3.5.5;".

6.4.11.1 In (b)(ii) delete "and" at the end.

6.4.11.1 Amend (b)(iii) to read as follows: "of 6.4.7.3 unless the material is excepted by 2.7.2.3.5;".

6.4.11.1 Insert a new (b) (iv) to read as follows:

"(iv) of 6.4.11.4 to 6.4.11.14, unless the material is excepted by 2.7.2.3.5, 6.4.11.2 or 6.4.11.3."

6.4.11.2 Amend to read as follows:

"6.4.11.2 Packages containing fissile material that meet the provisions of subparagraph (d) and one of the provisions of (a) to (c) below are excepted from the requirements of 6.4.11.4 to 6.4.11.14.

(a) Packages containing fissile material in any form provided that:

(i) The smallest external dimension of the package is not less than 10 cm;

(ii) The criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 5 \times \left(\frac{Mass\text{ of U-235 in package (g)}}{\text{Z}} + \frac{Mass\text{ of other fissile nuclides * in package (g)}}{280} \right)$$

* Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package

where the values of Z are taken from table 6.4.11.2.

(iii) The CSI of any package does not exceed 10;

(b) Packages containing fissile material in any form provided that:

(i) The smallest external dimension of the package is not less than 30 cm;

(ii) The package, after being subjected to the tests specified in 6.4.15.1 to 6.4.15.6;

- Retains its fissile material contents;

- Preserves the minimum overall outside dimensions of the package to at least 30 cm;

- Prevents the entry of a 10 cm cube.

(iii) The criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \left(\frac{\textit{Mass} \text{ of U-235 in package (g)}}{\text{Z}} + \frac{\textit{Mass} \text{ of other fissile nuclides * in package (g)}}{280} \right)$$

* Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package.

where the values of Z are taken from table 6.4.11.2.

(iv) The criticality safety index of any package does not exceed 10;

(c) Packages containing fissile material in any form provided that:

(i) The smallest external dimension of the package is not less than 10 cm;

(ii) The package, after being subjected to the tests specified in 6.4.15.1 to 6.4.15.6;

- Retains its fissile material contents;

- Preserves the minimum overall outside dimensions of the package to at least 10 cm;

- Prevents the entry of a 10 cm cube.

(iii) The CSI of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \left(\frac{\textit{Mass} \text{ of U-235 in package (g)}}{450} + \frac{\textit{Mass} \text{ of other fissile nuclides * in package (g)}}{280} \right)$$

* Plutonium may be of any isotopic composition provided that the amount of Pu-241 is less than that of Pu-240 in the package.

(iv) The maximum mass of fissile nuclides in any package does not exceed 15 g;

(d) The total mass of beryllium, hydrogenous material enriched in deuterium, graphite and other allotropic forms of carbon in an individual package shall not be greater than the mass of fissile nuclides in the package except where their total concentration does not exceed 1 g in any 1,000 g of material. Beryllium incorporated in copper alloys up to 4% in weight of the alloy does not need to be considered."

Table 6.4.11.2 Insert a new table 6.4.11.2 to read as follows:

"Table 6.4.11.2 Values of Z for calculation of criticality safety index in accordance with 6.4.11.2

Enrichement[a]	*Z*
Uranium enriched up to 1.5%	2200
Uranium enriched up to 5%	850
Uranium enriched up to 10%	660
Uranium enriched up to 20%	580
Uranium enriched up to 100%	450

[a] *If a package contains uranium with varying enrichments of U-235, then the value corresponding to the highest enrichment shall be used for Z.*

"

6.4.11.3 Insert a new paragraph 6.4.11.3 to read as follows:

"6.4.11.3 Packages containing not more than 1 000 g of plutonium are excepted from the application of 6.4.11.4 to 6.4.11.14 provided that:

(a) Not more than 20% of the plutonium by mass is fissile nuclides;

(b) The criticality safety index of the package is calculated using the following formula:

$$CSI = 50 \times 2 \times \frac{\text{mass of plutonium(g)}}{1000}$$

(c) If uranium is present with the plutonium, the mass of uranium shall be no more than 1% of the mass of the plutonium."

Current paragraphs 6.4.11.3 to 6.4.11.13 become new paragraphs 6.4.11.4 to 6.4.11.14.

6.4.11.4 (former 6.4.11.3) Replace "6.4.11.7 to 6.4.11.12" with "6.4.11.8 to 6.4.11.13".

6.4.11.5 (former 6.4.11.4) Replace "6.4.11.7 to 6.4.11.12" with "6.4.11.8 to 6.4.11.13" and insert "either" at the end of the introductory sentence.

6.4.11.8 (former 6.4.11.7), in the last sentence of the introductory paragraph, insert "either of" before "the following:" and in subparagraph (a) and (b) (i), replace "6.4.11.12 (b)" with "6.4.11.13 (b)".

6.4.11.9 (former 6.4.11.8), in the last sentence replace "6.4.11.12 (b)" with "6.4.11.13 (b)" and "6.4.11.9 (c)" with "6.4.11.10 (c)".

6.4.11.10 (former 6.4.11.9) In the introductory sentence replace "6.4.11.7 and 6.4.11.8" with "6.4.11.8 and 6.4.11.9".

6.4.11.10 (former 6.4.11.9) In subparagraph (b), replace "6.4.11.11 (b)" with "6.4.11.12 (b)". In (c), replace "6.4.11.12 (b)" with "6.4.11.13 (b)".

6.4.11.11 (former 6.4.11.10) In subparagraph (b), replace "6.4.11.9" with "6.4.11.10" and "6.4.11.7" with "6.4.11.8".

6.4.11.13 (former 6.4.11.12) In subparagraph (c), replace "6.4.11.12 (b)" with "6.4.11.13(b)".

6.4.11.14 (former 6.4.11.13) Replace "6.4.11.11 and 6.4.11.12" with "6.4.11.12 and 6.4.11.13".

6.4.13 Testing the integrity of the containment system and shielding and evaluating criticality safety

6.4.13 In subparagraph (c) replace "6.4.11.13" with "6.4.11.14".

6.4.15 Test for demonstrating ability to withstand normal conditions of transport

6.4.15.5 In subparagraph (a), amend the beginning to read: "The equivalent of 5 times …".

6.4.17 Tests for demonstrating ability to withstand accident conditions of transport

6.4.17.2 In the introductory paragraph, replace "6.4.11.12" with "6.4.11.13".

6.4.17.2 In subparagraph (b), move the phrase "so as to suffer maximum damage" to the end of the sentence after "on the target".

6.4.17.2 In subparagraph (c), insert the following new third sentence: "The lower face of the steel plate shall have its edges and corners rounded off to a radius of not more than 6 mm."

6.4.19 Water leakage test for packages containing fissile material

6.4.19.1 Replace "6.4.11.7 to 6.4.11.12" with "6.4.11.8 to 6.4.11.13".

6.4.19.2 Replace "6.4.11.12" with "6.4.11.13".

6.4.20 Tests for Type C packages

6.4.20.2 In the first sentence, insert "vertical" before "solid". In the second sentence replace "the probe to the surface of the specimen shall be as to cause" with "the package specimen and the impact point on the package surface shall be such as to cause".

6.4.22 Approvals of package designs and materials

6.4.22.4 Amend to read as follows:

"6.4.22.4 Each package design for fissile material which is not excepted by any of the paragraphs 2.7.2.3.5.1 to 2.7.2.3.5.6, 6.4.11.2 and 6.4.11.3 shall require multilateral approval."

6.4.22.6 Insert a new paragraph 6.4.22.6 to read as follows:

"6.4.22.6 The design for a fissile material excepted from "FISSILE" classification in accordance with 2.7.2.3.5.6 shall require multilateral approval.

6.4.22.7 Insert a new paragraph to read as follows:

"6.4.22.7 Alternative activity limits for an exempt consignment of instruments or articles in accordance with 2.7.2.2.2.2 shall require multilateral approval."

6.4.23 Applications for approval and approvals for radioactive material transport

6.4.23.2 In the introductory sentence replace "shipment approval" with "approval of shipment".

In subparagraph .3, amend the end of the paragraph to read as follows:

"… referred to in the certificate of approval for the package design, if applicable, issued under 5.1.5.2.1.1.3, 5.1.5.2.1.1.6 or 5.1.5.2.1.1.7, are to be put into effect.".

6.4.23.4 In (f), insert "nuclear" after "irradiated" and replace "6.4.11.4 (b)" with "6.4.11.5 (b)". In (i), replace "quality assurance programme" with "management system" and "1.1.2.3.1" with "1.5.3.1".

6.4.23.5 In the introductory sentence, delete "for package approval".

in subparagraph (a), replace "6.4.8.4, 6.4.8.5, 6.4.8.6" with "6.4.8.4 to 6.4.8.6".

and in subparagraph (d), amend the beginning of the sentence to read: "a statement of the range".

6.4.23.6 Replace "quality assurance programme" with "management system".

6.4.23.7 Replace "quality assurance programme" with "management system".

6.4.23.8 In subparagraph (d) replace "quality assurance programme" with "management system".

6.4.23.9 Insert a new paragraph to read as follows:

"6.4.23.9 An application for approval of design for fissile material excepted from "FISSILE" classification in accordance with table 2.7.2.1.1, under 2.7.2.3.5.6 shall include:

(a) A detailed description of the material; particular reference shall be made to both physical and chemical states;

(b) A statement of the tests that have been carried out and their results, or evidence based on calculation methods to show that the material is capable of meeting the requirements specified in 2.7.2.3.6;

(c) A specification of the applicable management system as required in 1.5.3.1;

(d) A statement of specific actions to be taken prior to shipment."

6.4.23.10 Insert a new paragraph to read as follows:

"6.4.23.10 An application for approval of alternative activity limits for an exempt consignment of instruments or articles shall include:

(a) An identification and detailed description of the instrument or article, its intended uses and the radionuclide(s) incorporated;

(b) The maximum activity of the radionuclide(s) in the instrument or article;

(c) Maximum external radiation levels arising from the instrument or article;

(d) The chemical and physical forms of the radionuclide(s) contained in the instrument or article;

(e) Details of the construction and design of the instrument or article, particularly as related to the containment and shielding of the radionuclide in routine, normal and accident conditions of transport;

(f) The applicable management system, including the quality testing and verification procedures to be applied to radioactive sources, components and finished products to ensure that the maximum specified activity of radioactive material or the maximum radiation levels specified for the instrument or article are not exceeded, and that the instruments or articles are constructed according to the design specifications;

(g) The maximum number of instruments or articles expected to be shipped per consignment and annually;

(h) Dose assessments in accordance with the principles and methodologies set out in the International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources, Safety Series No.115, IAEA, Vienna (1996), including individual doses to transport workers and members of the public and, if appropriate, collective doses arising from routine, normal and accident conditions of transport, based on representative transport scenarios the consignments are subject to."

Current paragraphs 6.4.23.9 to 6.4.23.11 become new paragraphs 6.4.23.11 to 6.4.23.13.

6.4.23.11 (former 6.4.23.9), in the introductory sentence, replace "approval certificate" with "certificate of approval".

6.4.23.11 (former 6.4.23.9) (a), replace "6.4.23.10 (b)" with "6.4.23.12 (b).

6.4.23.11 (former 6.4.23.9) (b) Insert "or alternative activity limit for exempt consignment" at the end of the first sentence. Amend the second sentence to read: "The identification mark of the approval of shipment shall be clearly related to the identification mark of the approval of design."

6.4.23.11 (former 6.4.23.9) (c) In the introductory sentence, replace "types of approval certificates" with "types of certificate of approval". Insert the following line between those corresponding to LD and T: "FE Fissile material complying with the requirements of 2.7.2.3.6". Add the following line at the end of the list: "AL Alternative activity limits for an exempt consignment of instruments or articles".

6.4.23.11 (former 6.4.23.9) (d) Insert "certificates of approval of" before "package design", delete (twice) "approval certificates" after "radioactive material", and replace "6.4.24.2 to 6.4.24.4" with "6.4.24.2 to 6.4.24.5".

6.4.23.12 (former 6.4.23.10) In the introductory sentence replace "type codes" with "identification marks".

6.4.23.12 (former 6.4.23.10) (a) Replace "6.4.23.9 (a), (b), (c) and (d)" with "6.4.23.11 (a), (b), (c) and (d)"; "design approval" with "approval of design", and "shipment approval" with "the approval of shipment".

6.4.23.12 (former 6.4.23.10) (a) For A/132/B(M)F-96, replace "package design approval certificate" with "certificate of approval for the package design".

6.4.23.12 (former 6.4.23.10) (a) For A/132/B(M)F-96T, replace "shipment approval" with "approval of shipment".

6.4.23.12 (former 6.4.23.10) (a) For A/137/X, replace "a special arrangement approval" with "an approval of special arrangement".

6.4.23.12 (former 6.4.23.10) (a) For A/139/IF-96 and A/145/H(U)-96, replace "package design approval certificate" with "certificate of approval for the package design".

6.4.23.12 (former 6.4.23.10) (b) Replace "according to 6.4.23.16" with "in accordance with 6.4.23.20".

6.4.23.12 (former 6.4.23.10) (c) Replace (twice) "package design approval certificate" with "certificate of approval for the package design"; and "approval certificate" with "certificate of approval" in the last sentence.

6.4.23.13 (former 6.4.23.11) In the introductory sentence replace "approval certificate" with "certificate of approval" and in (i) replace "quality assurance programme" with "management system".

6.4.23.14 Insert a new paragraph to read as follows:

"6.4.23.14 Each certificate of approval issued by a competent authority for material excepted from classification as "FISSILE" shall include the following information:

(a) Type of certificate;

(b) The competent authority identification mark;

(c) The issue date and an expiry date;

(d) List of applicable national and international regulations, including the edition of the IAEA Regulations for the Safe Transport of Radioactive Material under which the exception is approved;

(e) A description of the excepted material;

(f) Limiting specifications for the excepted material;

(g) A specification of the applicable management system as required in 1.5.3.1;

(h) Reference to information provided by the applicant relating to specific actions to be taken prior to shipment;

(i) If deemed appropriate by the competent authority, reference to the identity of the applicant;

(j) Signature and identification of the certifying official;

(k) Reference to documentation that demonstrates compliance with 2.7.2.3.6."

Current paragraphs 6.4.23.12 to 6.4.23.14 become new paragraphs 6.4.23.15 to 6.4.23.17.

6.4.23.15 (former 6.4.23.12), in the introductory sentence replace "approval certificate" with "certificate of approval".

6.4.23.15 (former 6.4.23.12) (j), replace "amounts" with "mass" and amend the end of the paragraph to read as follows: "… special form radioactive material, low dispersible radioactive material or fissile material excepted under 2.7.2.3.5.6 if applicable;".

6.4.23.15 (former 6.4.23.12) (k)(v), replace "6.4.11.4 (b)" with "6.4.11.5(b)".

6.4.23.15 (former 6.4.23.12) (r), replace "quality assurance programme" with "management system".

6.4.23.16 (former 6.4.23.13), in the introductory sentence, replace "approval certificate" with "certificate of approval".

6.4.23.16 (former 6.4.23.13) (i), replace "design approval certificate(s)" with "certificate(s) of approval of design".

6.4.23.16 (former 6.4.23.13) (g), replace "amounts" with "mass" and amend the end of the paragraph to read as follows: "…special form radioactive material, low dispersible radioactive material or fissile material excepted under 2.7.2.3.5.6 if applicable;".

6.4.23.16 (former 6.4.23.13) (l), replace "quality assurance programme" with "management system".

6.4.23.17 (former 6.4.23.14), in the introductory sentence, replace "approval certificate" with "certificate of approval".

6.4.23.17 (former 6.4.23.14) (h), replace "shipment approval" with "approval of shipment".

6.4.23.17 (former 6.4.23.14) (l), amend the end of the second sentence to read as follows: "… mass in grams (for fissile material the total mass of fissile nuclides or the mass for each fissile nuclide, when appropriate) and whether special form radioactive material, low dispersible radioactive material or fissile material excepted under 2.7.2.3.5.6, if applicable;".

6.4.23.17 (former 6.4.23.14) (n), amend the introductory sentence to read as follows: "For package designs containing fissile material which require multilateral approval of the package design in accordance with 6.4.22.4:".

6.4.23.17 (former 6.4.23.14) (n)(vi), replace "6.4.11.4 (b)" with "6.4.11.5 (b)".

6.4.23.17 (former 6.4.23.14) (t), replace "quality assurance programme" with "management system".

6.4.23.18 Insert a new paragraph 6.4.23.18 to read as follows:

"6.4.23.18 Each certificate issued by a competent authority for alternative activity limits for an exempt consignment of instruments or articles according to 5.1.5.2.1.4 shall include the following information:

(a) Type of certificate;

(b) The competent authority identification mark;

(c) The issue date and an expiry date;

(d) List of applicable national and international regulations, including the edition of the IAEA Regulations for the Safe Transport of Radioactive Material under which the exemption is approved;

(e) The identification of the instrument or article;

(f) A description of the instrument or article;

(g) Design specifications for the instrument or article;

(h) A specification of the radionuclide(s), the approved alternative activity limit(s) for the exempt consignment(s) of the instrument(s) or article(s);

(i) Reference to documentation that demonstrates compliance with 2.7.2.2.2.2;

(j) If deemed appropriate by the competent authority, reference to the identity of the applicant;

(k) Signature and identification of the certifying official."

Current paragraphs 6.4.23.15 and 6.4.23.16 become 6.4.23.19 and 6.4.23.20 respectively.

6.4.24 Transitional measures for class 7

6.4.24.1 Amend to read as follows:

"Packages not requiring competent authority approval of design (excepted packages, Type IP-1, Type IP-2, Type IP-3 and Type A packages) shall meet these Regulations in full, except that packages that meet the requirements of the 1985 or 1985 (as amended 1990) Editions of IAEA Regulations for the Safe Transport of Radioactive Material (IAEA Safety Series No.6):

(a) May continue in transport provided that they were prepared for transport prior to 31 December 2003, and subject to the requirements of 6.4.24.4, if applicable;

(b) May continue to be used provided that:

(i) They were not designed to contain uranium hexafluoride;

(ii) The applicable requirements of 1.5.3.1 of this Code are applied;

(iii) The activity limits and classification in Chapter 2.7 of these Regulations are applied;

(iv) The requirements and controls for transport in Parts 1, 3, 4, 5 and 7 of this Code are applied;

(v) The packaging was not manufactured or modified after 31 December 2003."

6.4.24.2 Amend to read as follows:

"6.4.24.2 Packages requiring competent authority approval of the design shall meet the provisions of this Code in full unless the following conditions are met:

(a) The packagings were manufactured to a package design approved by the competent authority under the provisions of the 1973 or 1973 (as amended) or the 1985 or 1985 (as amended 1990) Editions of IAEA Safety Series No.6);

(b) The package design is subject to multilateral approval;

(c) The applicable requirements of 1.5.3.1 of this Code are applied;

(d) The activity limits and classification in Chapter 2.7 of this Code are applied;

(e) The requirements and controls for transport in in Parts 1, 3, 4, 5 and 7 of this Code are applied;

(f) For a package containing fissile material and transported by air, the requirement of 6.4.11.11 is met;

(g) For packages that meet the requirements of the 1973 or 1973 (as amended) Editions of IAEA Safety Series No. 6:

(i) The packages retain sufficient shielding to ensure that the radiation level at 1 m from the surface of the package would not exceed 10 mSv/h in the accident conditions of transport defined in the 1973 Revised or 1973 Revised (as amended) Editions of IAEA Safety Series No.6 with the maximum radioactive contents which the package is authorized to contain;

(ii) The packages do not utilize continuous venting;

(iii) A serial number in accordance with the provision of 5.2.1.5.5 is assigned to and marked on the outside of each packaging."

6.4.24.3 Amend to read as follows:

"No new manufacture of packagings to a package design meeting the provisions of the 1973, 1973 (as amended), 1985, and 1985 (as amended 1990) Editions of IAEA Safety Series No.6 shall be permitted to commence."

6.4.24.4 Insert a new paragraph to read as follows:

"6.4.24.4 Packages excepted from the requirements for fissile materials under the Regulations annexed to the 16th revised edition or the seventeenth revised edition of the United Nations Recommendations on the Transport of Dangerous Goods (2009 Edition of IAEA Safety Standard Series No.TS-R-1)

6.4.24.4 Packages containing fissile material that is excepted from classification as "FISSILE" according to 2.7.2.3.5.1 (i) or (iii) of the IMDG Code amendment 35-10) or amendment 36-12, (paragraphs 417 (a) (i) or (iii) of the 2009 Edition of IAEA Regulations for the Safe Transport of Radioactive Material) prepared for transport before 31 December 2014 may continue in transport and may continue to be classified as non-fissile or fissile-excepted except that the consignment limits in table 2.7.2.3.5 of these editions shall apply to the conveyance. The consignment shall be transported under exclusive use."

and current paragraph 6.4.24.4 becomes new 6.4.24.5.

6.4.24.5 (former 6.4.24.4) In the first sentence, replace "programme of quality assurance" with "management system". Replace the last sentence with the following: "No new manufacture of such special form radioactive material shall be permitted to commence."

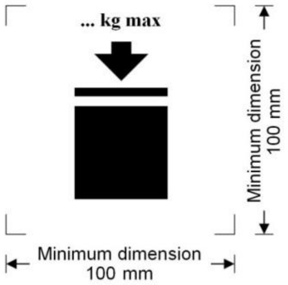
Chapter 6.5 – Provisions for the construction and testing of intermediate bulk containers (IBCs)

6.5.2 Marking

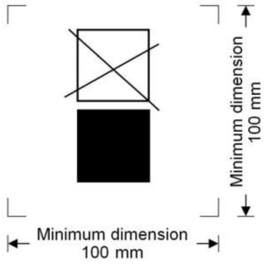
6.5.2.2 Additional marking

Amend 6.5.2.2.2 to read as follows:

"6.5.2.2.2 The maximum permitted stacking load applicable when the IBC is in use shall be displayed on a symbol as shown in the figures below. The symbol shall be durable and clearly visible.



IBCs capable of being stacked



IBCs NOT capable of being stacked

The minimum dimensions shall be 100 mm x 100 mm. The letters and numbers indicating the mass shall be at least 12 mm high. The area within the printer's marks indicated by the dimensional arrows shall be square. Where dimensions are not specified, all features shall be in approximate proportion to those shown. The mass marked above the symbol shall not exceed the load imposed during the design type test (see 6.5.6.6.4) divided by 1.8.

NOTE: The provisions of 6.5.2.2.2 shall apply to all IBCs manufactured, repaired or remanufactured as from 1 January 2011. The provisions of 6.5.2.2.2 of the IMDG Code (Amendment 36-12) may continue to be applied to all IBCs manufactured, repaired or remanufactured between 1 January 2011 and 31 December 2016."

6.5.2.2.4 After "The date of the manufacture of the plastics inner receptacle may alternatively be marked on the inner receptacle adjacent to the remainder of the marking." add the following new sentence: "In such a case, the two digits of the year in the primary marking and in the inner circle of the clock shall be identical.". At the end, add a new "Note" to read as follows:

"**Note**: Other methods that provide the minimum required information in a durable, visible and legible form are also acceptable."

Chapter 6.6 – Provisions for the construction and testing of large packagings

6.6.2 Code for designating types of large packagings

6.6.2.2 At the beginning, replace "The letter "W"" with "The letters "T" or "W"" and insert a new second sentence to read as follows: "The letter "T" signifies a large salvage packaging conforming to the requirements of 6.6.5.1.9."

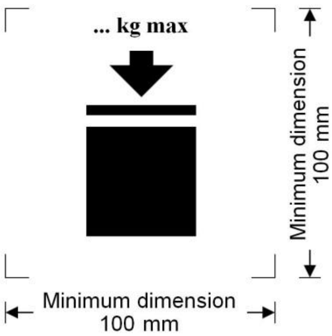
6.6.3 Marking

6.6.3.2 Insert a new second example to read as follows:

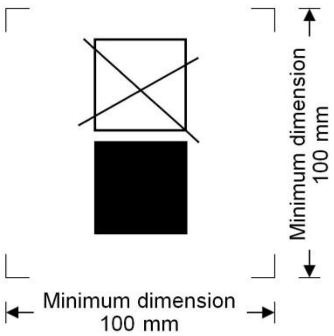
" u n *50AT/Y/05/01/B/PQRS 2500/1000* *For a large steel salvage packaging suitable for stacking; stacking load: 2 500 kg; maximum gross mass: 1,000 kg*."

Amend 6.6.3.3 to read as follows:

"6.6.3.3 The maximum permitted stacking load applicable when the large packaging is in use shall be displayed on a symbol as shown in the figures below. The symbol shall be durable and clearly visible.



Large packagings capable of being stacked



Large packagings NOT capable of being stacked

The minimum dimensions shall be 100 mm x 100 mm. The letters and numbers indicating the mass shall be at least 12 mm high. The area within the printer's marks indicated by the dimensional arrows shall be square. Where dimensions are not specified, all features shall be in approximate proportion to those shown. The mass marked above the symbol shall not exceed the load imposed during the design type test (see 6.6.5.3.3.4) divided by 1.8.

"**NOTE:** The provisions of 6.6.3.3 shall apply to all large packagings manufactured, repaired or remanufactured as from 1 January 2015. The provisions of 6.6.3.3 of the IMDG Code (Amendment 36-12) may continue to be applied to all IBCs manufactured, repaired or remanufactured between 1 January 2015 and 31 December 2016."

6.6.5 Test provisions for large packagings

6.6.5.1 Performance and frequency of test

6.6.5.1.9 Insert the following new paragraph to read as follows:

"6.6.5.1.9 *Large salvage packagings*

Large salvage packagings shall be tested and marked in accordance with the provisions applicable to packing group II large packagings intended for the transport of solids or inner packagings, except as follows:

(a) The test substance used in performing the tests shall be water, and the large salvage packagings shall be filled to not less than 98% of their maximum capacity. It is permissible to use additives, such as bags of lead shot, to achieve the requisite total package mass so long as they are placed so that the test results are not affected. Alternatively, in performing the drop test, the drop height may be varied in accordance with 6.6.5.3.4.4.2 (b);

(b) Large salvage packagings shall, in addition, have been successfully subjected to the leakproofness test at 30 kPa, with the results of this test reflected in the test report required by 6.6.5.4; and

(c) Large salvage packagings shall be marked with the letter "T" as described in 6.6.2.2."

Chapter 6.7 – Provisions for the design, construction, inspection and testing of portable tanks and multiple-element gas containers (ME GCs)

6.7.2 Provisions for the design, construction, inspection and testing of portable tanks intended for the transport of substances of class 1 and classes 3 to 9

6.7.2.20.2, 6.7.3.16.2 and 6.7.5.13.2 Replace "shall be marked" with "shall be durably marked".

6.7.5 Provisions for the design, construction, inspection and testing of multiple-element gas containers (MEGCs) intended for the transport of non-refrigerated gases

6.7.5.2.4.1 Replace "ISO 11114-1:1997" with "ISO 11114-1:2012".

Chapter 6.9 - Provisions for the design, construction, inspection and testing of bulk containers

6.9.4.6 Delete the footnote "*" assigned to BK, and insert the following note at the end:

Note: "(x)" shall be replaced with "1" or "2", as appropriate.

PART 7
PROVISIONS CONCERNING TRANSPORT OPERATIONS

Chapter 7.1 – General stowage provisions

7.1.3 Stowage categories

7.1.3.1 Stowage categories for class 1

7.1.3.1 In the paragraph replace the words "column 16" with "16a".

7.1.3.2 Stowage categories for classes 2 to 9

7.1.3.2 In the paragraph replace the words "column 16" with "16a".

7.1.4 Special stowage provisions

7.1.4.1 Stowage of empty uncleaned packagings, including IBCs and large packagings

7.1.4.1 In the paragraph replace the words "column 16" with "16a"

7.1.4.5 Stowage of goods of class 7

7.1.4.5.2 Replace "approval certificate" with "certificate of approval".

7.1.4.5.3.1 In the table amend the two first rows under the heading to read as follows:

Freight container	
Small freight container	50
Large freight container	50

and in the note "a" to the table, replace "7.1.4.5.6" with "7.1.4.5.5".

7.1.4.5.3.4 In the table amend the two first rows under the heading to read as follows:

Freight container		
Small freight container	50	n.a
Large freight container	50	100

Amend the end of note "b" to the table to read as follows: "… and stowed so as to maintain a spacing of at least 6 m from other groups."

and amend the end of the first sentence of note "c" to the table to read as follows: "… and stowed so as to maintain a spacing of at least 6 m from other groups."

7.1.4.5.10 Amend the end of the paragraph to read as follows:

"… and shall not be re-used unless the following conditions are fulfilled:

.1 the non-fixed contamination shall not exceed the limits specified in 4.1.9.1.2;

.2 the radiation level resulting from the fixed contamination shall not exceed 5 μSv/h at the surface."

7.1.4.5.13.2 Delete " to the critical group".

7.1.5 Stowage Codes

7.1.5 Insert a new 7.1.5 with the following:

"7.1.5 Stowage Codes

The stowage codes given in column 16a of the dangerous goods list are as specified below:

Stowage Code	Description
SW1	Protected from sources of heat.
SW2	Clear of living quarters.
SW3	Shall be transported under temperature control.
SW4	Surface ventilation is required to assist in removing any residual solvent vapour.
SW5	If under deck, stow in a mechanically ventilated space.
SW6	When stowed under-deck, mechanical ventilation shall be in accordance with SOLAS regulation II-2/19 (II-2/54) for flammable liquids with flashpoint below 23°C c.c.
SW7	As approved by the competent authorities of the countries involved in the shipment
SW8	Ventilation may be required. The possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency, and the consequent risk to the stability of the ship through flooding of the cargo spaces, shall be considered before loading.
SW9	Provide a good through ventilation for bagged cargo. Double strip stowage is recommended. The illustration in 7.6.2.7.2.3 shows how this can be achieved. During the voyage regular temperature readings shall be taken at varying depths in the hold and recorded. If the temperature of the cargo exceeds the ambient temperature and continues to increase, ventilation shall be closed down.

Stowage Code	Description
SW10	Unless carried in closed cargo transport units, bales shall be properly covered by tarpaulins or the like. Cargo spaces shall be clean, dry and free from oil or grease. Ventilator cowls leading into the cargo space shall have sparking-preventing screens. All other openings, entrances and hatches leading to the cargo space shall be securely closed. During temporary interruption of loading, when the hatch remains uncovered, a fire-watch shall be kept. During loading or discharge, smoking in the vicinity shall be prohibited and fire-fighting appliances kept ready for immediate operation.
SW11	Cargo transport units shall be shaded from direct sunlight. Packages in cargo transport units shall be stowed so as to allow for adequate air circulation throughout the cargo.
SW12	taking account of any supplementary requirements specified in the transport documents.
SW13	taking account of any supplementary requirements specified in the competent authority approval certificate(s).
SW14	Category A only if the special stowage provisions of 7.4.1.4 and 7.6.2.8.4 are complied with
SW15	For metal drums, stowage category B.
SW16	For unit loads in open cargo transport units, stowage category B.
SW17	Category E, for closed cargo transport unit and pallet boxes only. Ventilation may be required. The possible need to open hatches in case of fire to provide maximum ventilation and to apply water in an emergency, and the consequent risk to the stability of the ship through flooding of the cargo space, shall be considered before loading.
SW18	Category A, when transported in accordance with P650.
SW19	For batteries transported in accordance with SP 376 or SP 377 Category C, unless transported on a short international voyage.
SW20	For uranyl nitrate hexahydrate solution stowage category D applies.
SW21	For uranium metal pyrophoric and thorium metal pyrophoric stowage category D applies.
SW22	For AEROSOLS with a maximum capacity of 1 litre: Category A. For AEROSOLS with a capacity above 1 litre: Category B. For WASTE AEROSOLS: Category C, Clear of living quarters.
SW23	When transported in BK3 bulk container, see 7.6.2.12 and 7.7.3.9.
SW24	For special stowage provisions see 7.4.1.3 and 7.6.2.7.2.

Stowage Code	Description
SW25	For special stowage provisions see 7.6.2.7.3.
SW26	For special stowage provisions see 7.4.1.4 and 7.6.2.11.1.1.
SW27	For special stowage provisions see 7.6.2.7.2.1.
SW28	As approved by the competent authority of the country of origin.

"

7.1.6 Handling Codes

7.1.6 Insert a new 7.1.6 with the following:

"7.1.6 Handling Codes

The handling codes given in column 16a of the dangerous goods list are as specified below:

Handling Codes	Description
H1	Keep as dry as reasonably practicable
H2	Keep as cool as reasonably practicable
H3	During transport, it should be stowed (or kept) in a cool ventilated place
H4	If cleaning of cargo spaces has to be carried out at sea, the safety procedures followed and standard of equipment used shall be at least as effective as those employed as industry best practice in a port. Until such cleaning is undertaken, the cargo spaces in which the asbestos has been carried shall be closed and access to those spaces shall be prohibited.

"

Chapter 7.2 – General segregation provisions

7.2.3 Segregation provisions

7.2.3.1 In the paragraph, replace twice the words "column 16" with "column 16b".

7.2.3.4 In the paragraph, replace the words "column 16" with "column 16b".

7.2.4 Segregation table

in the row "Flammable gases 2.1" versus column of class 4.3 replace "X" with "2".

in the row "Flammable liquid 3" versus column of class 4.3 replace "1" with "2".

in the row "Substances which, in contact with water, emit flammable gases 4.3" versus column 2.1 replace "X" with "2".

in the row "Substances which, in contact with water, emit flammable gases 4.3" versus column 3 replace "1" with "2".

7.2.5 Segregation groups

7.2.3.1 In the paragraph, replace the words "column 16 (stowage and segregation)" with "column 16b"

7.2.6 Special segregation provisions and exemptions

7.2.6.4 In the paragraph, replace the words "column 16" with "column 16b".
and in "examples" replace "column 16" with "column 16b".

7.2.8 Segregation Codes

7.2.8 Insert a new 7.2.8 with the following:

"7.2.8 Segregation Codes

The segregation codes given in column 16b of the dangerous goods list are as specified below:

Segregation Codes	**Description**
SG1	For packages carrying a subsidiary risk of class 1, segregation as for class 1, division 1.3.
SG2	Segregation as for class 1.2G
SG3	Segregation as for Class 1.3G
SG4	Segregation as for class 2.1
SG5	Segregation as for class 3
SG6	Segregation as for class 5.1
SG7	Stow "away from" class 3
SG8	Stow "away from" class 4.1
SG9	Stow "away from" class 4.3
SG10	Stow "away from" class 5.1
SG11	Stow "away from" class 6.2
SG12	Stow "away from" class 7
SG13	Stow "away from" class 8

Segregation Codes	Description
SG14	Stow "separated from" class 1 except for division 1.4S
SG15	Stow "separated from" class 3
SG16	Stow "separated from" class 4.1
SG17	Stow "separated from" class 5.1
SG18	Stow "separated from" class 6.2
SG19	Stow "separated from" class 7
SG20	Stow "away from" acids
SG21	Stow "away from" alkalis
SG22	Stow "away from" ammonium salts
SG23	Stow "away from" animal or vegetable oils
SG24	Stow "away from" azides
SG25	Stow "separated from" goods of classes 2.1 and 3.
SG26	In addition: from goods of classes 2.1 and 3 when stowed on deck of a containership a minimum distance of two container spaces athwartship shall be maintained, when stowed on ro-ro ships a distance of 6 m athwartship shall be maintained.
SG27	Stow "away from" explosives containing chlorates or perchlorates
SG28	Stow "away from" ammonium compounds and explosives containing ammonium compounds or salts
SG29	Segregation from foodstuffs as in 7.3.4.2.2, 7.6.3.1.2 or 7.7.3.7.
SG30	Stow "away from" heavy metals and their salts
SG31	Stow "away from" lead and its compounds
SG32	Stow "away from" liquid halogenated hydrocarbons
SG33	Stow "away from" powdered metals
SG34	When containing ammonium compounds, "away from" chlorates or perchlorates and explosives containing chlorates or perchlorates.
SG35	Stow "separated from" acids.

Segregation Codes	Description
SG36	Stow "separated from" alkalis.
SG37	Stow "separated from" ammonia.
SG38	Stow "separated from" ammonium compounds.
SG39	Stow "separated from" ammonium compounds other than AMMONIUM PERSULPHATE (UN 1444).
SG40	Stow "separated from" ammonium compounds other than mixtures of ammonium persulphates and/or potassium persulphates and/or sodium persulphates.
SG41	Stow "separated from" animal or vegetable oil.
SG42	Stow "separated from" bromates.
SG43	Stow "separated from" bromine.
SG44	Stow "separated from" CARBON TETRACHLORIDE (UN 1846).
SG45	Stow "separated from" chlorates.
SG46	Stow "separated from" chlorine.
SG47	Stow "separated from" chlorites.
SG48	Stow "separated from" combustible material (particularly liquids). Combustible material does not include packing materials or dunnage.
SG49	Stow "separated from" cyanides
SG50	Segregation from foodstuffs as in 7.3.4.2.1, 7.6.3.1.2 or 7.7.3.6.
SG51	Stow "separated from" hypochlorites
SG52	Stow "separated from" iron oxide
SG53	Stow "separated from" liquid organic substances
SG54	Stow "separated from" mercury and mercury compounds
SG55	Stow "separated from" mercury salts
SG56	Stow "separated from" nitrites
SG57	Stow "separated from" odour-absorbing cargoes

Segregation Codes	Description
SG58	Stow "separated from" perchlorates
SG59	Stow "separated from" permanganates
SG60	Stow "separated from" peroxides
SG61	Stow "separated from" powdered metals
SG62	Stow "separated from" sulphur
SG63	Stow "separated longitudinally by an intervening complete compartment or hold from" Class 1.
SG64	*Reserved*
SG65	Stow "separated by a complete compartment or hold from" class 1 except for division 1.4.
SG66	*Reserved*
SG67	Stow "separated from" division 1.4 and "separated longitudinally by an intervening complete compartment of hold from" divisions 1.1, 1.2, 1.3, 1.5 and 1.6 except from explosives of compatibility group J.
SG68	If flashpoint 60°C c.c. or below, segregation as for class 3, but "away from" class 4.1.
SG69	For AEROSOLS with a maximum capacity of 1 litre: Segregation as for class 9. Stow "separated from" class 1 except for division 1.4. For AEROSOLS with a capacity above 1 litre: Segregation as for the appropriate subdivision of class 2. For WASTE AEROSOLS: Segregation as for the appropriate subdivision of class 2.
SG70	For arsenic sulphides, "separated from" acids
SG71	Within the appliance, to the extent that the dangerous goods are integral parts of the complete life-saving appliance, there is no need to apply the provisions on segregation of substances in chapter 7.2.
SG72	See 7.2.6.3.2.
SG73	*Reserved*
SG 74	Segregation as for 1.4G.
SG 75	Stow "separated from" strong acids.

"

Annex
Segregation flow chart

In the boxes, replace the words "column 16" with "column 16b",

Chapter 7.3 – Consigning operations concerning the packing and use of cargo transport units (CTUs) and related provisions

7.3.2 General provisions for cargo transport units

7.3.2.2 In the paragraph delete reference to footnote "* See IMO publication, sales number IB282E"

7.3.3 Packing of cargo transport units

7.3.3.1 The existing paragraph "7.3.3.1" is renumbered as "7.3.3.2".

7.3.3.1 Insert a new "7.3.3.1" with the following:

> "7.3.3.1 Prior to the use of a cargo transport unit it shall be checked to ensure that it is apparently fit for its intended purpose*."

and add the corresponding footnote as follows:

> "* For safety approval plates and maintenance and examination of containers see the International Convention for Safe Containers, 1972, as amended annex I regulations 1 and 2 (see 1.1.2.3)."

7.3.3.2 The existing "7.3.3.2" is renumbered as "7.3.3.3", and at the end, the following new sentence is added:

> "Whenever the handling provision "keep as dry as reasonably practicable" (H1) is assigned in column (16a) of the dangerous goods list, the cargo transport unit including any contained goods, securing or packing materials shall be kept as dry as reasonably practicable."

7.3.4.2 Segregation in relation to foodstuffs

7.3.4.2.1 In the paragraph, replace the words "column 16" with "column 16b".

7.3.4.2.2 In subparagraph ".4", replace the words "column 16" with "column 16b".

7.3.7 Cargo transport units under temperature control

7.3.7.2 General provisions

7.3.7.2.4 Replace existing paragraph with the following:

> "7.3.7.2.4 Prior to the use of cargo transport unit, the refrigeration system shall be subjected to a thorough inspection and a test to ensure that all parts are functioning properly.
>
> 7.3.7.2.4.1 Refrigerant gas shall only be replaced in accordance with the manufacturer's operating instructions for the refrigeration system. Prior to filling replacement refrigerant gas, a certificate of analysis from the supplier shall be obtained and checked to confirm that the

gas meets refrigeration system specifications. In addition, if concerns about the integrity of the supplier and/or the refrigerant gas supply chain give rise to suspicion to contamination of the gas, the replacement refrigerant gas shall be checked for possible contamination prior to use. If the refrigerant gas is found to be contaminated it shall not be used, the cylinder shall be plainly marked "CONTAMINATED", the cylinder shall be sealed and sent for recycling or disposal and notification shall be given to the refrigerant gas supplier and authorized distributor and competent authority(ies) of the countries to which the supplier and distributor reside, as appropriate. The date of last refrigerant replacement shall be included in the maintenance record of the refrigeration system.

Note: Contamination can be checked by using flame halide lamp tests, gas sniffer tube tests or gas chromatography. Replacement refrigerant gas cylinders may be marked with the test result and the date of testing."

Chapter 7.4 – Stowage and segregation on containerships

7.4.2 Stowage requirements

7.4.2.4 Ventilation provisions

7.4.2.4.1 In the paragraph, replace the words "column 16" with "column 16a".

Chapter 7.6 – Stowage and segregation on general cargo ships

7.6.2 Stowage and handling provisions

7.6.2.3 Ventilation provisions

7.6.2.3.1 In the paragraph, replace the words "column 16" with "column 16a".

7.6.3 Segregation provisions

7.6.3.1 Segregation from foodstuffs

7.6.3.1.2 In the paragraph, replace the words "column 16" with "column 16b".

Chapter 7.7 – Shipborne barges on barge-carrying ships

7.7.3 Barge loading

7.7.3.6 In the paragraph, replace the words "column 16" with "column 16b".

7.7.3.7 In subparagraph ".4", replace the words "column 16" with "column 16b".

7.7.4 Stowage of shipborne barges

7.7.4.1 In the paragraph, replace the words "column 16" with "column 16a".

ANNEX 9

RESOLUTION MSC.373(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFARERS (STCW), 1978

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article XII of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978 (hereinafter referred to as "the Convention"), concerning the procedures for amending the Convention,

RECALLING FURTHER that the Assembly, by resolution A.1070(28), adopted the IMO Instruments Implementation Code (III Code),

NOTING proposed amendments to the Convention to make the use of the III Code mandatory,

HAVING CONSIDERED, at its ninety-third session, amendments to the Convention proposed and circulated in accordance with article XII(1)(a)(i) of the Convention,

1 ADOPTS, in accordance with article XII(1)(a)(iv) of the Convention, amendments to the Convention, the text of which is set out in the annex to the present resolution;

2 DETERMINES that, pursuant to new regulation I/16, whenever the word "should" is used in the III Code (Annex to resolution A.1070(28)), it is to be read as being "shall", except for paragraphs 29, 30, 31 and 32;

3 DETERMINES ALSO, in accordance with article XII(1)(a)(vii)(2) of the Convention, that the amendments to the Convention shall be deemed to have been accepted on 1 July 2015, unless, prior to that date more than one third of Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant shipping of ships of 100 gross register tonnes or more, have notified their objections to the amendments;

4 INVITES Parties to note that, in accordance with article XII(1)(a)(viii) of the Convention, that the amendments to the Convention, shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

5 REQUESTS the Secretary-General, in conformity with article XII(1)(a)(v) to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the Convention;

6 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Parties to the Convention.

ANNEX

AMENDMENTS TO THE INTERNATIONAL CONVENTION ON STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFARERS (STCW), 1978, AS AMENDED

CHAPTER I

GENERAL PROVISIONS

1 The following new definitions are added at the end of regulation I/1.36:

"37 *Audit* means a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.

38 *Audit Scheme* means the IMO Member State Audit Scheme established by the Organization and taking into account the guidelines developed by the Organization*.

39 *Code for Implementation* means the IMO Instruments Implementation Code (III Code) adopted by the Organization by resolution A.1070(28).

40 *Audit Standard* means the Code for Implementation.

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* Refer to the *Framework and Procedures for the IMO Member State Audit Scheme*, adopted by the Organization by resolution A.1067(28)."

2 A new regulation I/16 is added after the existing regulation I/15:

"**Regulation I/16**

Verification of compliance

1 Parties shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in the present Convention.

2 Every Party shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of the present Convention.

3 The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization*.

4 Every Party shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines developed by the Organization*.

5 Audit of all Parties shall be:

.1 based on an overall schedule developed by the Secretary-General of the Organization, taking into account the guidelines developed by the Organization; and

.2 conducted at periodic intervals, taking into account the guidelines developed by the Organization*.

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* Refer to the *Framework and Procedures for the IMO Member State Audit Scheme*, adopted by the Organization by resolution A.1067(28)."

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ANNEX 10

RESOLUTION MSC.374(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE SEAFARERS' TRAINING, CERTIFICATION AND WATCHKEEPING (STCW) CODE

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article XII and regulation I/1.2.3 of the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW), 1978, hereinafter referred to as "the Convention", concerning the procedures for amending part A of the Seafarers' Training, Certification and Watchkeeping (STCW) Code,

HAVING CONSIDERED, at its ninety-third session, amendments to part A of the STCW Code, proposed and circulated in accordance with article XII(1)(a)(i) of the Convention,

1 ADOPTS, in accordance with article XII(1)(a)(iv) of the Convention, amendments to the STCW Code, the text of which is set out in the annex to the present resolution;

2 DETERMINES, in accordance with article XII(1)(a)(vii)(2) of the Convention, that the said amendments to the STCW Code shall be deemed to have been accepted on 1 July 2015 unless, prior to that date, more than one third of Parties or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant shipping of ships of 100 gross tonnage or more, have notified their objections to the amendments;

3 INVITES Parties to the Convention to note that, in accordance with article XII(1)(a)(ix) of the Convention, the annexed amendments to the STCW Code shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

4 REQUESTS the Secretary-General, in conformity with article XII(1)(a)(v) of the Convention, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the Convention;

5 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Parties to the Convention.

ANNEX

AMENDMENTS TO PART A OF THE SEAFARERS' TRAINING, CERTIFICATION AND WATCHKEEPING (STCW) CODE

CHAPTER I – GENERAL PROVISIONS

1 A new section A-I/16 is added after the existing section A-I/15 that reads as follows:

"Section A-I/16

Verification of compliance

1 For the purpose of regulation I/16 the areas that shall be subject to audit are indicated in the table below:

AREAS SUBJECT TO BE AUDITED		
REFERENCE	**AREA**	**REMARKS AND SUMMARY DESCRIPTION**
INITIAL COMMUNICATION OF INFORMATION		
Article IV, regulation I/7, and section A-I/7, paragraph 2	Initial communication of information	Has the Party communicated information pursuant to article IV and regulation I/7? If yes, has the Maritime Safety Committee confirmed that the information provided demonstrates that "full and complete effect" is given to the provisions of the STCW Convention?
SUBSEQUENT REPORTS		
Article IX and section A-I/7, paragraph 3.1	Equivalents	Has the Administration retained/adopted any equivalent educational and training arrangements since communicating information pursuant to regulation I/7? If yes, have the details of such arrangements been reported to the Secretary-General?
Regulation I/10 and section A-I/7, paragraph 3.2	Recognition of certificates	Does the Administration recognize certificates issued by other Party in accordance with regulation I/10? If yes, has the Party submitted reports on the measures taken to ensure compliance with regulation I/10?
Regulation VII/1, section A-I/7, paragraph 3.3	Alternative certification	Does the Party authorize employment of seafarers holding alternative certificates issued under regulation VII/1 on ships entitled to fly its flag? If yes, has a copy of the type of minimum safe manning document issued to such ships been provided to the Secretary-General?

AREAS SUBJECT TO BE AUDITED		
REFERENCE	**AREA**	**REMARKS AND SUMMARY DESCRIPTION**
Regulation I/8.3 and section A-I/7, paragraph 4	Communication of information concerning the periodic independent evaluation	Has the Party communicated its report of independent evaluation pursuant to regulation I/8?
Regulation I/7.4, and section A-I/7 paragraphs 5 and 6	Communication of information concerning STCW amendments	Has the Party communicated a report concerning implementation of subsequent mandatory amendments to the STCW Convention and Code?
Regulation I/13, paragraphs 4 and 5	Conduct of trials	Has the Administration authorized ships entitle to fly its flag to participate in trials? If yes, have the details of such trials been reported to the Secretary-General (paragraph 4)?, and Have the details of results of the trials been reported to the Secretary-General (paragraph 5)?
Article VIII	Dispensations	Has the Administration issued any dispensation? If yes, are reports related to dispensations issued during each year sent to the Secretary-General?

CONTROL

Article X and regulation I/4	Port State control	Has the Party exercised port State control? If yes, have control measures as required under article X been established?

FITNESS FOR DUTY AND WATCHKEEPING ARRANGEMENTS

Regulation VIII/1, paragraph 1 and section A-VIII/1	Fatigue prevention	Has the Administration established measures to enforce the STCW Convention and Code requirements in respect of fatigue prevention?
Regulation VIII/ 1, paragraph 2 and section A-VIII/1, paragraph 10	Prevention of drug and alcohol abuse	Has the Administration established measures to enforce STCW Convention and Code requirements for the purpose of preventing drug and alcohol abuse?
Regulation VIII/2	Watchkeeping arrangements and principles to be observed	Has the Administration directed the attention of companies, masters, chief engineer officers and all watchkeeping personnel to the requirements, principles and guidance set out in the STCW Code to ensure that safe continuous watches appropriate to prevailing circumstances and conditions are maintained in all seagoing ships at all times?

2 The following new text is inserted at the end of the existing notes 6 and 7 of table A-I/9 as follows:

> "Other equivalent confirmatory test methods currently recognized by the Administration may continue to be used."

***

ANNEX 11

RESOLUTION MSC.375(93)
(adopted on 22 May 2014)

AMENDMENTS TO THE PROTOCOL OF 1988 RELATING TO THE INTERNATIONAL CONVENTION ON LOAD LINES, 1966, AS AMENDED

THE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING ALSO article VI of the Protocol of 1988 relating to the International Convention on Load Lines, 1966 (hereinafter referred to as the "1988 Load Lines Protocol") concerning amendment procedures,

RECALLING FUTHER that the Assembly, by resolution A.1070(28), adopted the IMO Instruments implementation Code (III Code),

NOTING proposed amendments to the 1988 Load Lines Protocol to make the III Code mandatory,

HAVING CONSIDERED, at its ninety-third session, amendments to the 1988 Load Lines Protocol proposed and circulated in accordance with paragraph 2(a) of article VI thereof,

1 ADOPTS, in accordance with paragraph 2(d) of article VI of the 1988 Load Lines Protocol, amendments to the 1988 Load Lines Protocol, the text of which is set out in the annex to the present resolution;

2 DETERMINES that, pursuant to new regulation 53 of Annex IV, whenever the word "should" is used in the III Code (annex to resolution A.1070(28)), it is to be read as being "shall", except for paragraphs 29, 30, 31 and 32;

3 DETERMINES ALSO, in accordance with paragraph 2(f)(ii)(bb) of article VI of the 1988 Load Lines Protocol, that the said amendments shall be deemed to have been accepted on 1 July 2015, unless, prior to that date, more than one third of the Parties to the 1988 Load Lines Protocol or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of all the merchant fleets of all Parties, have notified their objections to the amendments;

4 INVITES the Parties concerned to note that, in accordance with paragraph 2(g)(ii) of article VI of the 1988 Load Lines Protocol, the amendments shall enter into force on 1 January 2016 upon their acceptance in accordance with paragraph 2 above;

5 REQUESTS the Secretary-General, in conformity with paragraph 2(e) of article VI of the 1988 Load Lines Protocol, to transmit certified copies of the present resolution and the text of the amendments contained in the annex to all Parties to the 1988 Load Lines Protocol;

6 ALSO REQUESTS the Secretary-General to transmit copies of this resolution and its annex to Members of the Organization, which are not Parties to the 1988 Load Lines Protocol.

ANNEX

AMENDMENTS TO ANNEX B TO THE PROTOCOL OF 1988 RELATING TO THE INTERNATIONAL CONVENTION ON LOAD LINES, 1966, AS AMENDED

ANNEX B

ANNEXES TO THE CONVENTION AS MODIFIED BY THE PROTOCOL OF 1988 RELATING THERETO

Annex I

Regulations for determining load lines

Chapter I
General

Regulation 3
Definitions of terms used in the annexes

1 The following new definitions are added after definition (16):

"(17) *Audit* means a systematic, independent and documented process for obtaining audit evidence and evaluating it objectively to determine the extent to which audit criteria are fulfilled.

(18) *Audit Scheme* means the IMO Member State Audit Scheme established by the Organization and taking into account the guidelines developed by the Organization*.

(19) *Code for Implementation* means the IMO Instruments Implementation Code (III Code) adopted by the Organization by resolution A.1070(28).

(20) *Audit Standard* means the Code for Implementation.

* Refer to the Framework and Procedures for the IMO Member State Audit Scheme, adopted by the Organization by resolution A.1067(28)."

ANNEX B

ANNEXES TO THE CONVENTION AS MODIFIED BY THE PROTOCOL OF 1988 RELATING THERETO

2 A new annex IV is added after annex III, to read as follows:

"**Annex IV**

Verification of compliance

Regulation 53
Application

Contracting Governments shall use the provisions of the Code for Implementation in the execution of their obligations and responsibilities contained in the present Convention.

Regulation 54
Verification of compliance

(1) Every Contracting Government shall be subject to periodic audits by the Organization in accordance with the audit standard to verify compliance with and implementation of the present Convention.

(2) The Secretary-General of the Organization shall have responsibility for administering the Audit Scheme, based on the guidelines developed by the Organization*.

(3) Every Contracting Government shall have responsibility for facilitating the conduct of the audit and implementation of a programme of actions to address the findings, based on the guidelines developed by the Organization*.

(4) Audit of all Contracting Governments shall be:

(a) based on an overall schedule developed by the Secretary-General of the Organization, taking into account the guidelines developed by the Organization*; and

(b) conducted at periodic intervals, taking into account the guidelines developed by the Organization*.

* Refer to the Framework and Procedures for the IMO Member State Audit Scheme, adopted by the Organization by resolution A.1067(28)."

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MSC.1/Circ.1482
26 June 2014

EARLY IMPLEMENTATION OF THE AMENDMENTS TO SOLAS REGULATION II-1/29

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), adopted, by resolution MSC.365(93), amendments to SOLAS regulation II-1/29, concerning the methods to demonstrate compliance with the requirements relating to the main and auxiliary steering gear.

2 In adopting the aforementioned amendments, the Committee agreed to allow compliance to be demonstrated in accordance with the methods listed under paragraphs 3.2 and 4.2 of the amended regulation before the entry-into-force date of the related amendments.

3 Member Governments, shipyards and shipowners are invited to take account of this circular and bring it to the attention of all parties concerned.

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MSC.1/Circ.1472
29 May 2014

GUIDELINES FOR THE DESIGN, PERFORMANCE, TESTING AND APPROVAL OF MOBILE WATER MONITORS USED FOR THE PROTECTION OF ON-DECK CARGO AREAS OF SHIPS DESIGNED AND CONSTRUCTED TO CARRY FIVE OR MORE TIERS OF CONTAINERS ON OR ABOVE THE WEATHER DECK

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), adopted amendments to SOLAS regulation II-2/10 on additional measures of fire safety for ships designed and constructed to carry five or more tiers of containers on or above the weather deck, prepared by the Sub-Committee on Fire Protection at its fifty-sixth session (7 to 11 January 2013). The amendments, to be applied to new ships constructed on or after 1 January 2016 contain, inter alia, requirements for mobile water monitors used for the protection of on-deck cargo areas.

2 At the same time, the Committee approved the *Guidelines for the design, performance, testing and approval of mobile water monitors used for the protection of on-deck cargo areas of ships designed and constructed to carry five or more tiers of containers on or above the weather deck*, set out in the annex, in order to provide instructions on the design, performance, testing and approval of such mobile water monitors.

3 Member Governments are invited to use the annexed Guidelines when applying the requirements of SOLAS regulation II-2/10 and to bring them to the attention of all parties concerned.

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ANNEX

GUIDELINES FOR THE DESIGN, PERFORMANCE, TESTING AND APPROVAL OF MOBILE WATER MONITORS USED FOR THE PROTECTION OF ON-DECK CARGO AREAS OF SHIPS DESIGNED AND CONSTRUCTED TO CARRY FIVE OR MORE TIERS OF CONTAINERS ON OR ABOVE THE WEATHER DECK

1 Application

These Guidelines apply to mobile water monitors for the protection of on deck container stacks, in accordance with SOLAS regulation II-2/10.7.3.

2 Definitions

Mobile water monitors (hereinafter referred to as monitors) are water discharge devices of portable or wheeled type, consisting of inlet fitting(s), monitor waterway, swivel fittings, discharge nozzle and a shut-off device.

3 Principal requirements

3.1 All monitors should be tested and approved by the Administration based upon these Guidelines.

3.2 Monitors should be constructed of corrosion resistant materials.

3.3 Discharge nozzles should be of a dual-purpose spray/jet type capable of discharging effective water barriers between container stacks in the event of a container fire on deck.

3.4 Monitors should be equipped with a coupling allowing connection to the ship's fire hydrants by fire hoses. The coupling should be sized so as to ensure that the flow and pressure needed for correct performance will be provided.

3.5 The minimum monitor capacity should be 60 m^3/h (1000 *l*/min), at the pressure required by SOLAS regulation II-2/10.7.3.

3.6 Monitors should allow swivelling of the discharge nozzle for adjusting and controlling the throw direction of water in both the horizontal and vertical planes, whilst in continuous operation. The vertical swivel range should be from 0° to 90°. External lubrication fittings should be provided for the swivel joints, if lubrication is required.

3.7 Monitors should be capable of a minimum horizontal throw of 40 m at an inlet pressure of 0.4 N/mm^2, when discharging at a horizontal elevation of 30° to 35°.

3.8 Monitors should be provided with an inlet waterway designed to balance radial thrust forces. The design configuration should minimize nozzle thrust reaction, permitting one-person operation and/or unattended operation, once set up. Heavy duty dual spring-loaded locking pins for quick and secure base set up or other means to ensure a secure/safe fixing to the ship's structure should be provided. A manufacturer's operating manual should be provided which includes information on the safe operation of the monitors.

3.9 Monitors should be provided with a carrying handle or other means for ease of transport. Monitors weighing more than 23 kg should be fitted with wheels.

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MSC.1/Circ.1480
29 May 2014

UNIFIED INTERPRETATION OF SOLAS REGULATION II-2/9.7.1.1

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), with a view to providing more specific guidance on flexible bellows of combustible materials, approved a unified interpretation on SOLAS regulation II-2/9.7.1.1, prepared by the Sub-Committee on Ship Systems and Equipment at its first session (10 to 14 March 2014), as set out in the annex.

2 Member Governments are invited to use the annexed unified interpretation as guidance when applying SOLAS regulation II-2/9.7.1.1 to ships constructed before 1 January 2016 and to bring the unified interpretation to the attention of all parties concerned.

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ANNEX

UNIFIED INTERPRETATION OF SOLAS REGULATION II-2/9.7.1.1

A short length, not exceeding 600 mm, of flexible bellows constructed of combustible material may be used for connecting fans to the ducting in air-conditioning rooms.

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MSC.1/Circ.1479
19 May 2014

UNIFIED INTERPRETATION ON THE APPLICATION OF THE PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR CARGO OIL TANKS OF CRUDE OIL TANKERS (RESOLUTION MSC.288(87))

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), with a view to providing specific guidance on the application of the relevant requirements of the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers*, as adopted by resolution MSC.288(87), approved the Unified interpretation on the application of the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* (resolution MSC.288(87)), prepared by the Sub-Committee on Ship Design and Construction, at its first session (20 to 24 January 2014).

2 Member Governments are invited to use the annexed Unified Interpretations as guidance when applying relevant provisions of the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* and to bring them to the attention of all parties concerned.

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ANNEX

UNIFIED INTERPRETATION ON THE APPLICATION OF THE PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR CARGO OIL TANKS OF CRUDE OIL TANKERS (PSPC-COT) (RESOLUTION MSC.288(87))

Paragraph 2 – Definitions

GOOD: Condition with spot rusting on less than 3% of the area under consideration without visible failure of the coating, or no-perforated blistering. Breakdown at edges or welds should be less than 20% of edges or weld lines in the area under consideration.

Coating Technical File (CTF): A term used for the collection of documents describing issues related to the coating system and its application from the point in time when the first document is provided and for the entire life of the ship including the inspection agreement and all elements of PSPC-COT 3.4.

Paragraph 3.2 – General principles

1 Inspection of surface preparation and coating processes agreement should be signed by shipyard, shipowner and coating manufacturer and should be presented by the shipyard to the Administration for review prior to commencement of any coating work on any stage of a new building and as a minimum should comply with the PSPC-COT.

2 To facilitate the review, the following from the CTF, should be available:

a) Coating specification including selection of areas (spaces) to be coated, selection of coating system, surface preparation and coating process.

b) Statement of Compliance or Type Approval of the coating system.

3 The agreement should be included in the CTF and should at least cover:

a) Inspection process, including scope of inspection, who carries out the inspection, the qualifications of the coating inspector(s) and appointment of one qualified coating inspector (responsible for verifying that the coating is applied in accordance with the PSPC-COT). Where more than one coating inspector will be used then their areas of responsibility should be identified. (For example, multiple construction sites).

b) Language to be used for documentation.

4 Any deviations in the procedure relative to the PSPC-COT noted during the review should be raised with the shipyard, which is responsible for identifying and implementing the corrective actions.

5 Cargo Ship Safety Certificate or Cargo Ship Safety Construction Certificate, as appropriate, should not be issued until all required corrective actions have been closed to the satisfaction of the Administration.

Paragraph 3.4 – Coating Technical File (CTF)

Procedure for Coating Technical File Review

1 The shipyard is responsible for compiling the Coating Technical File (CTF) either in paper or electronic format, or a combination of the two.

2 The CTF is to contain all the information required by paragraph 3.4 of the PSPC and the inspection of surface preparation and the coating processes agreement (see PSPC-COT, paragraph 3.2).

3 The CTF should be reviewed for content in accordance with the PSPC-COT, paragraph 3.4.2.

4 Any deviations found under paragraph 3 should be raised with the shipyard, which is responsible for identifying and implementing the corrective actions.

5 Cargo Ship Safety Certificate or Cargo Ship Safety Construction Certificate, as appropriate, should not be issued until all required corrective actions have been closed to the satisfaction of the Administration.

Paragraph 3.5 – Health and safety

In order to document compliance with paragraph 3.5 of the PSPC-COT relevant documentation from the coating manufacturer concerning health and safety aspects such as Material Safety Data Sheet is recommended to be included in the CTF for information.

Paragraph 4.5 – Special application

Reference is made to the *Guidelines for corrosion protection of permanent means of access* arrangements (MSC.1/Circ.1279), approved by MSC 84 in May 2008.

Paragraph 4, table 1 – Footnotes of standards

Only the footnoted standards referred to in PSPC-COT table 1 are to be applied, i.e. they are mandatory.

Paragraph 4, table 1, section 1.3 – Design of coating system

Procedure for coating system approval

Type Approval Certificate showing compliance with the PSPC-COT 5 should be issued if the results of either method A+C, or B+C are found satisfactory by the Administration.

The Type Approval Certificate should indicate the Product and the Shop Primer tested. The certificate should also indicate other type approved shop primers with which the product may be used which have under gone the cross over test in a laboratory meeting the requirements in Method A, paragraph 1.1 of this Unified Interpretation.

The documents required to be submitted are identified in the following sections, in addition for all type approvals the following documentation is required:

Technical Data Sheet showing all the information required by PSPC-COT, paragraph 3.4.2.2.

Winter type epoxy is required separate prequalification test including shop primer compatibility test according to PSPC-COT, annex 1. Winter and summer type coating are considered different unless Infrared (IR) identification and Specific Gravity (SG) demonstrates that they are the same.

Method A: Laboratory test

1.1 Coating pre-qualification test should be carried out by the test laboratory which is recognized by the Administration.

1.2 Results from satisfactory pre-qualification tests (PSPC-COT, table 1: 1.3) of the coating system should be documented and submitted to the Administration.

1.3.1 Type Approval tests should be carried out for the epoxy based system with the stated shop primer in accordance with the PSPC-COT, annex 1. If the tests are satisfactory, a Type Approval Certificate will be issued to include both the epoxy and the shop primer. The Type Approval Certificate will allow the use of the epoxy either with the named shop primer or on bare prepared steel.

1.3.2 An epoxy based system may be used with shop primers other than the one with which it was originally tested provided that, the other shop primers are approved as part of a system, PSPC-COT, table 1: 2.3 and table 1: 3.2, and have been tested according to the immersion test of PSPC-COT, annex 1, or in accordance with resolution MSC.215(82), which is known as the "Crossover Test". If the test or tests are satisfactory, a Type Approval Certificate will be issued. In this instance the Type Approval Certificate will include the details of the epoxy and a list of all shop primers with which it has been tested that have passed these requirements. The Type Approval Certificate will allow the use of the epoxy with all the named shop primers or on bare prepared steel.

1.3.3 Alternatively the epoxy can be tested without shop primer on bare prepared steel to the requirements of the PSPC-COT, annex 1. If the test or tests are satisfactory, a Type Approval Certificate will be issued. The Type Approval Certificate will just record the epoxy. The certificate will allow the use of the epoxy on bare prepared steel only. If in addition, crossover tests are satisfactorily carried out with shop primers, which are approved as part of a system, the Type Approval Certificate will include the details of shop primers which have satisfactorily passed the crossover test. In this instance the Type Approval Certificate will allow the use of the epoxy based system with all the named shop primers or on bare prepared steel.

1.3.4 The Type Approval Certificate is invalid if the formulation of either the epoxy or the shop primer is changed. It is the responsibility of the coating manufacturer to inform the Administration immediately of any changes to the formulation.

1.3.5 For the coating pre-qualification test, the measured average dry film thickness (DFT) on each prepared test panels should not exceed a nominal DFT (NDFT) of 320 microns plus 20% unless a paint manufacturer specifies a NDFT greater than 320 microns. In the latter case, the average DFT should not exceed the specified NDFT plus 20% and the coating system should be certified to the specified NDFT if the system passes the tests according to annex 1 of PSPC-COT. The measured DFT should meet the "90/10" rule and the maximum DFT should be always below the maximum DFT value specified by the manufacturer.

Method B: 5 years field exposure

1.4 Coating manufacturer's records, which should at least include the information indicated in paragraph 1.4.1, should be examined to confirm coating system has 5 years field exposure, and the current product is the same as that being assessed.

1.4.1 Manufacturer's records

- Original application records
- Original coating specification
- Original Technical Data Sheet
- Current formulation's unique identification (Code or number)
- If the mixing ratio of base and curing agent has changed, a statement from the coating manufacturer confirming that the composition mixed product is the same as the original composition. This should be accompanied by an explanation of the modifications made.
- Current Technical Data Sheet for the current production site
- SG and IR identification of original product
- SG and IR identification of the current product
- If original SG and IR cannot be provided then a statement from the coating manufacturer confirming the readings for the current product are the same as those of the original.

1.5 Either class survey records from an Administration or a joint (coating manufacturer and Administration) survey of cargo tanks of a selected ship is to be carried out for the purpose of verification of compliance with the requirements of paragraphs 1.4 and 1.9. The reporting of the coating condition in both cases should be in accordance with the principles given in section 4 of MSC.1/Circ.1399.

1.6 The selected ship is to have cargo tanks in regular use, of which:

- At least one tank is exposed to minimum temperature of 60°C plus or minus 3°C.

- For field exposure the ship should be trading in varied trade routes and carrying substantial varieties of crude oils including highest temperature and lowest pH limits to ensure a realistic sample: for example, three ships on three different trade areas with different varieties of crude cargoes.

1.7 In the case that the selected ship does not meet the requirements in paragraph 1.6 then the limitations on lowest pH and Highest temperature of crude oils carried should be clearly stated on the Type Approval Certificate.

1.8 In all cases of approval by Method B, the shop primer should be removed prior to application of the approved epoxy based system coating, unless it can be confirmed that the shop primer applied during construction, is identical in formulation to that applied in the selected ship used as a basis of the approval.

1.9 All cargo tanks should be in "GOOD" condition excluding mechanical damages, without touch up or repair in the prior 5 years.

1.9.1 "Good" is defined as: *Condition with spot rusting on less than 3% of the area under consideration without visible failure of the coating, or no perforated blistering. Breakdown at edges or welds should be less than 20% of edges or welds in the area under consideration.*

1.9.2 Examples of how to report coating conditions with respect to areas under consideration should be as those given in the principles contained in section 4 of MSC.1/Circ.1399.

1.10 If the applied NDFT is greater than required by the PSPC, the applied NDFT will be the minimum to be applied during construction. This will be reported prominently on the Type Approval Certificate.

1.11 If the results of the inspection are satisfactory, a Type Approval Certificate should be issued to include both the epoxy based system and the shop primer. The Type Approval Certificate should allow the use of the epoxy based system either with the named shop primer or on bare prepared steel. The Type Approval Certificate should reference the inspection report which will also form part of the Coating Technical File.

1.12 The Type Approval Certificate is invalid if the formulation of either the epoxy based system or the shop primer is changed. It is the responsibility of the coating manufacturer to inform the Administration immediately of any changes to the formulation.

Method C: Coating manufacturer

1.18 The coating/shop primer manufacturer should meet the requirements set out in IACS UR Z17 paragraphs 4 to 7, (except for 4.6) and paragraphs 1.18.1 to 1.18.6 below, which should be verified by the Administration.

1.18.1 Coating manufacturers

(a) Extent of engagement – Production of coating systems in accordance with PSPC-COT and this Unified Interpretation.

(b) These requirements apply to both the main coating manufacturer and the shop primer manufacturer where both coatings form part of the total system.

(c) The coating manufacturer should provide to the Administration the following information;

- A detailed list of the production facilities.
- Names and location of raw material suppliers, which should be clearly stated.
- A detailed list of the test standards and equipment to be used, (scope of approval).
- Details of quality control procedures employed.
- Details of any sub-contracting agreements.
- List of quality manuals, test procedures and instructions, records, etc.
- Copy of any relevant certificates with their issue number and/or date e.g. Quality Management System certification.

(d) Inspection and audit of the manufacturer's facilities will be based on the requirements of the PSPC-COT.

(e) With the exception of early "scale up" from laboratory to full production, adjustment outside the limitations listed in the QC instruction referred to below is not acceptable, unless justified by trials during the coating system's development programme, or subsequent testing. Any such adjustments must be agreed by the formulating technical centre.
If formulation adjustment is envisaged during the production process the maximum allowable limits will be approved by the formulating technical centre and clearly stated in the QC working procedures.

(f) The manufacturer's quality control system will ensure that all current production is the same formulation as that supplied for the Type Approval Certificate. Formulation change is not permissible without testing in accordance with the test procedures in the PSPC-COT and the issue of a Type Approval Certificate by the Administration.

(g) Batch records including all QC test results such as viscosity, specific gravity and airless spray characteristics will be accurately recorded. Details of any additions will also be included.

(h) Whenever possible, raw material supply and lot details for each coating batch will be traceable. Exceptions may be where bulk supply such as solvents and pre-dissolved solid epoxies are stored in tanks, in which case it may only be possible to record the supplier's blend.

(i) Dates, batch numbers and quantities supplied to each coating contract will be clearly recorded.

1.18.2 All raw material supply should be accompanied the supplier's "Certificate of Conformance". The certificate will include all requirements listed in the coating manufacturer's QC system.

1.18.3 In the absence of a raw material supplier's certificate of conformance, the coating manufacturer should verify conformance to all requirements listed in the coating manufacturer's QC system.

1.18.4 Drums should be clearly marked with the details as described on the "Type Approval Certificate".

1.18.5 Product Technical Data Sheets must comply with all the PSPC-COT requirements. The QC system will ensure that all Product Technical Data Sheets are current.

1.18.6 QC procedures of the originating technical centre will verify that all production units comply with the above stipulations and that all raw material supply is approved by the technical centre.

1.19 In the case that a coating manufacturer wishes to have products which are manufactured in different locations under the same name, then IR identification and SG should be used to demonstrate that they are the same coating, or individual approval tests will be required for the paint manufactured in each location.

1.20 The Type Approval Certificate is invalid if the formulation of either the epoxy based system or the shop primer is changed. It is the responsibility of the coating manufacturer to inform class immediately of any changes to the formulation. Failure to inform class of an alteration to the formulation will lead to cancellation of the certificates for that manufacturer's products.

Paragraph 4, table 1, section 1.4 – Job specification

Wet film thickness should be regularly checked during application for quality control by the Builder. PSPC-COT does not state who should check WFT, it is accepted for this to be the Builder. Measurement of DFT should be done as part of the inspection required in PSPC-COT, paragraph 6.

Stripe coats should be applied as a coherent film showing good film formation and no visible defects. The application method employed should insure that all areas that require stripe coating are properly coated by brush or roller. A roller may be used for scallops, ratholes etc. but not for edges and welds.

Paragraph 4, table 1, section 2 – PSP (Primary surface preparation)

Section 2.2:

The conductivity of soluble salts is measured in accordance with standards ISO 8502-6 and ISO 8502-9 or equivalent method as validated according to NACE SP0508-2010, and compared with the conductivity of 50 mg/m^2 NaCl. If the measured conductivity is less than or equal to, then it is acceptable. Minimum readings to be taken are one (1) per plate in the case of manually applied shop primer. In cases where an automatic process for application of shop primer is used, there should be means to demonstrate compliance with PSPC-COT through a Quality Control System, which should include a monthly test.

Section 2.3:

Shop primers not containing zinc or not silicate based are considered to be "alternative systems" and therefore equivalency is to be established in accordance with section 8 of the PSPC-COT with test acceptance criteria for "alternative systems" given in section 3.1 (right columns) of appendixes 1 and 2 to annex 1 of PSPC-COT.

Procedure for review of Quality Control of Automated Shop Primer plants

1 It is recognized that the inspection requirements of PSPC-COT, paragraph 6.2, may be difficult to apply to an automated shop primer plant and a Quality Control approach would be a more practical way of enabling compliance with the requirements of PSPC-COT.

2 As required in PSPC it is the responsibility of the coating inspector to confirm that the quality control procedures are ensuring compliance with PSPC-COT.

3 When reviewing the Quality Control for automated shop primer plants the following procedures should be included.

3.1 Procedures for management of the blasting grit including measurement of salt and contamination.

3.2 Procedures recording the following: steel surface temperature, relative humidity, dewpoint.

3.3 Procedures for controlling or monitoring surface cleanliness, surface profile, oil, grease, dust and other contamination.

3.4 Procedures for recording/measuring soluble salts.

3.5 Procedures for verifying thickness and curing of the shop primer conforms to the values specified in the Technical Specification.

Paragraph 4, table 1, section 3 – SSP (Secondary surface reparation)

Sections 3.2 to 3.4:

Usually, the fillet welding on tank boundary watertight bulkhead is left without coating on block stage (because not yet be leakage tested), in which case it can be categorized as erection joint ("butt") to be power tooled to St 3.

Section 3.6:

The conductivity of soluble salts is measured in accordance with standards ISO 8502-6 and ISO 8502-9, or equivalent method as validated according to NACE SP0508-2010, and compared with the conductivity of 50 mg/m^2 NaCl. If the measured conductivity is less than or equal to, then it is acceptable.

All soluble salts have a detrimental effect on coatings to a greater or lesser degree. The standard ISO 8502-9:1998 does not provide the actual concentration of NaCl. The percentage of NaCl in the total soluble salts will vary from site to site. Minimum readings to be taken are one (1) reading per block/section/unit prior to applying.

Paragraph 4, table 1, section 4 – Miscellaneous

Section 4.3:

All DFT measurements should be measured. Only the final DFT measurements need to be measured and reported for compliance with the PSPC-COT by the qualified coating inspector. The Coating Technical File may contain a summary of the DFT measurements which typically will consist of minimum and maximum DFT measurements, number of measurements taken and percentage above and below required DFT. The final DFT compliance with the 90/10 practice should be calculated and confirmed, see PSPC-COT, paragraph 2.8.

Paragraph 4, table 1, section 5 – Coating system approval

See Interpretation of PSPC-COT table 1: 1 Design of coating system, 1.3 Coating prequalification test.

Paragraph 4, table 1, section 6 – Coating inspection requirements

Procedure for assessment of Coating Inspectors' qualifications

1 Coating inspectors required to carry out inspections in accordance with the PSPC-COT, paragraph 6, should be qualified to NACE Coating Inspector Level 2, FROSIO Inspector Level III, or an equivalent qualification. Equivalent qualifications are described in paragraph 3 below.

2 However, only coating inspectors with at least 2 years relevant coating inspector experience and qualified to NACE Coating Inspector Level 2 or FROSIO Inspector Level III, or with an equivalent qualification, can write and/or authorise procedures, or decide upon corrective actions to overcome non-compliances.

3 Equivalent Qualification

3.1 Equivalent qualification is the successful completion, as determined by course tutor, of an approved course.

3.1.1 The course tutors should be qualified with at least 2 years relevant experience and qualified to NACE Coating Inspector Level 2 or FROSIO Inspector Level III, or with an equivalent qualification.

3.1.2 Approved Course: A course that has a syllabus based on the issues associated with the PSPC including the following:

- Health environment and safety
- Corrosion
- Materials and design
- International standards referenced in PSPC
- Curing mechanisms
- Role of inspector
- Test instruments
- Inspection procedures
- Coating specification
- Application procedures
- Coating failures
- Pre-job conference
- MSDS and product data sheet review
- Coating Technical File
- Surface preparation
- Dehumidification
- Waterjetting
- Coating types and inspection criteria
- Specialized application equipment
- Use of inspection procedures for destructive testing and non-destructive testing instruments
- Inspection instruments and test methods
- Coating inspection techniques
- Cathodic protection
- Practical exercises, case studies.

Examples of approved courses may be internal courses run by the coating manufacturers or shipyards etc.

3.1.3 Such a course should have an acceptable measurement of performance, such as an examination with both theoretical and practical elements. The course and examination should be approved by the Administration.

3.2 Equivalent qualification arising from practical experience: An individual may be qualified without attending a course where it can be shown that the individual:

- has a minimum of 5 years practical work experience as a coating inspector of ballast tanks and/or cargo tanks during new construction within the last 10 years; and

- has successfully completed the examination given in paragraph 3.1.3.

4 Assistants to coating Inspectors

4.1 If the coating inspectors requires assistance from other persons to perform part of the inspections, those persons should perform the inspections under the coating inspector's supervision and should be trained to the coating inspector's satisfaction.

4.2 Such training should be recorded and endorsed either by the inspector, the yard's training organization or inspection equipment manufacturer to confirm competence in using the measuring equipment and confirm knowledge of the measurements required by the PSPC-COT.

4.3 Training records should be available for verification.

Paragraph 4, table 1, section 7 – Coating verification requirements

Procedure for Verification of Application of the PSPC-COT

1 The verification requirements of PSPC-COT, paragraph 7, should be carried out by the Administration.

1.1 Monitoring implementation of the coating inspection requirements, as called for in PSPC-COT, paragraph 7.5 means checking, on a sampling basis, that the inspectors are using the correct equipment, techniques and reporting methods as described in the inspection procedures reviewed by the Administration.

2 Any deviations found under paragraph 1.1 should be raised initially with the coating inspector, who is responsible for identifying and implementing the corrective actions.

3 In the event that corrective actions are not acceptable to the Administration or in the event that corrective actions are not closed out then the shipyard should be informed.

4 Cargo Ship Safety Certificate or Cargo Ship Safety Construction Certificate, as appropriate, should not be issued until all required corrective actions have been closed out to the satisfaction of the Administration.

Annex 1 – Footnotes of standards

Only the footnoted standards referred to in annex 1 are to be applied, i.e. they are mandatory.

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UNIFIED INTERPRETATION ON THE APPLICATION OF THE PERFORMANCE STANDARD FOR ALTERNATIVE MEANS OF CORROSION PROTECTION FOR CARGO OIL TANKS OF CRUDE OIL TANKERS (RESOLUTION MSC.289(87))

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), with a view to providing specific guidance on the application of the relevant requirements of the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers*, as adopted by resolution MSC.289(87), approved the Unified interpretation on the application of the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87), prepared by the Sub-Committee on Ship Design and Construction, at its first session (20 to 24 January 2014).

2 Member Governments are invited to use the annexed Unified Interpretations as guidance when applying relevant provisions of the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* and to bring them to the attention of all parties concerned.

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ANNEX

UNIFIED INTERPRETATION ON THE APPLICATION OF THE PERFORMANCE STANDARD FOR ALTERNATIVE MEANS OF CORROSION PROTECTION FOR CARGO OIL TANKS OF CRUDE OIL TANKERS, AS SET OUT IN THE ANNEX TO THE ANNEX OF RESOLUTION MSC.289(87)

Paragraph 2.1 – General principles

1 Normal and higher strength *Corrosion Resistant Steels* as defined within this Unified Interpretation, is steel whose corrosion resistance performance in the bottom or top of the internal cargo oil tank is tested and approved to satisfy the requirements in resolution MSC.289(87) in addition to other relevant requirements for ship material, structure strength and construction. It is not the intention of this document to suggest that Corrosion Resistant Steels be used for corrosion resistant applications in other areas of a ship.

2 *Corrosion Resistant Steels* are similar to conventional ship construction steels in terms of chemical composition and mechanical properties.

3 The weldability of *Corrosion Resistant Steels* is similar to the weldability of conventional ship construction steels and, therefore, normal shipyard welding requirements in terms of qualification by the approval of welding consumables and welding procedure qualification also apply.

Paragraph 2.2 – Technical File

1 The shipbuilder is to prepare and submit the Technical File to the Administration for verification. If the applicable corrosion protection method varies for different locations, the information required for the Technical File is to include each location and corrosion protection method separately. Once verified, one copy of the Technical File is to be placed on board the ship. The following construction records are to be included in the Technical File:

1.1 The copy of the Type Approval Certificate.

1.2 Other technical data is to include:

(a) Detail of the brand of welding consumables and welding process used.

(b) Repair method. Only to be included when specially recommended by the manufacturer of corrosion resistant steel.

1.3 Application records

(a) Areas of application/location of corrosion resistant steel.

(b) Brand of corrosion resistant steel and thickness.

Note: Items (a) and (b) above may be substituted by the information given in the hull-related approved drawings. However, each brand of corrosion resistant steel used and its location is to be indicated on the approved drawings, the drawings are to be included in the Technical File.

1.4 The test certificates and actual measured values of plate thickness of each corrosion resistant steel, and individual welding conditions need not be included.

2 After the ship enters service, the shipowner or operator is to maintain repair data in the Technical File for review by the Administration. The information required is to include each location and corrosion protection method separately. These records should include:

2.1 Where repairs are made in service to the cargo oil tank in which corrosion resistant steel is used, the following information is to be added to the Technical File:

(a) areas of repair work;

(b) repair method (replacement by corrosion resistant steel or coating);

(c) records of the brand of corrosion resistant steel used, plate thickness and welding consumables (brand name and welding method) if corrosion resistant steel is used; and

(d) records in accordance with the Performance standard for protective coatings for cargo oil tanks of crude oil tankers (resolution MSC.288(87)), if coating is used.

2.2 Repairs that require records to be maintained as mentioned in paragraph 2.1 above include the following:

(a) replacement by corrosion resistant steel;

(b) application of coating on members in which corrosion resistant steel is used (including cases where corrosion resistant steel is replaced with conventional steel and coating); (Note 1) and

(c) repairs of pitted parts.(Note 2)

Note 1: Details of coating on repairs to corrosion resistant steel are to be recorded in the Corrosion Resistant Steel Technical File. In such cases, duplicates of these coating records do not need to be included in the Coating Technical File.

Note 2: The wastage limit of the pitted part or area is to be as deemed appropriate by the classification society and/or Administration. However, the standard value of the permissible wastage amount is to be taken as about 40% of the original thickness. In this case weld repairs are required. Only welding consumables approved for the relevant corrosion resistant steel are to be used. The full depth of the pitting is to be filled up by the weld metal. If non-approved welding consumables are used, an appropriate area around the repaired part is to be coated suitably after the repairs in accordance with the IMO Performance standard for protective coatings for cargo oil tanks of crude oil tankers.

2.3 Plate thickness records during periodical surveys need not be recorded in the Technical File.

Paragraph 3.3 – Special application

1 Where other items of structure, such as appurtenances, are not clearly identified, the application of the PSPC**-COT Alt** to these items is described here.

1.1 Means of access, to be used for ship inspections, which are not integral to the ship structure.

1.1.1 Permanent means of access which are not integral to the ship's structure include:

- ladders
- rails
- independent platforms
- steps

1.1.2 Appropriate corrosion protection measures are to be adopted for permanent means of access mentioned in paragraph 1.1.1 above.

1.1.3 When corrosion resistant steel is used, in principle, a corrosion resistant steel of the same brand as used in the main structure is to be used for the means of access and the attachments.

1.1.4 When conventional steel is used, and is welded to corrosion resistant steel, corrosion protection measures for the attachment and weld are recommended to be in accordance with the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* (resolution MSC.288(87)).

1.1.5 Other corrosion protection measures are to be left to the discretion of the Administration.

1.1.6 Where other corrosion protection measures other than those stated above, for example cathodic protection are used, the performance of the corrosion resistant steel of the surrounding structure is not to be impaired.

1.2 Access arrangements integral to the ship's structure

1.2.1 The phrase "Access arrangements that are integral to the ship structure" in paragraph 3.2.2 of the annex to the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87)) means access arrangements integral to the ship structure such as the items mentioned below, for access in the cargo oil tanks of crude oil tankers.

- Stiffeners and girders with increased depth for walkways

1.2.2 Appropriate corrosion protection measures are to be adopted for access arrangement given in paragraph 1.2.1. If coating is applied, the provisions of the Performance standard for protective coatings for cargo oil tanks (resolution MSC.288(87)) are to be followed. If corrosion resistant steel is used on the above arrangements, in principle, corrosion resistant steel of the same brand/type as that used in the cargo oil tanks of crude oil tankers, is to be used.

1.3 Supporting members, etc.

1.3.1 It is recommended that pipes and supporting members for measuring equipment or outfitting items that are not strength members of the hull be protected either by coating or by use of corrosion resistant steel in accordance with the provisions of paragraph 1.1.4.

1.4 Work attachments

1.4.1 In the case of attachments (conventional steel) used only during construction work such as hanging pieces, if welding consumables which are not indicated on the Type Approval Certificate of the corrosion resistant steel are used, it is recommended that the welded part is coated in accordance with figure 3.3.1.

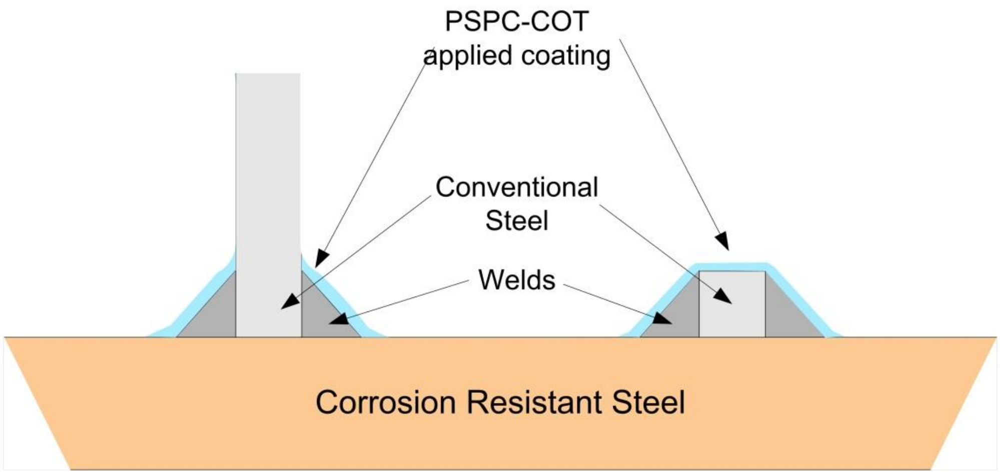

Figure 3.3.1 Range of coating when work attachments are welded to corrosion resistant steel

Paragraph 3.2 – Area of application

1 Structural members in the COT that require protection measures against corrosion are specified in the Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers (resolution MSC.289(87).

2 Different methods of corrosion protection (coating and corrosion resistant steel) may be adopted for (a) and (b) above. Moreover, a combination of different corrosion protection methods may be used for each of the structural members within the areas identified by (a) and (b).

3 Acceptable combinations of corrosion protection methods are shown in table 1.

Table 1 – Acceptable combinations of corrosion protection methods

Member		Lower surface of strength deck (a)	Upper surface of inner bottom plating (b)
Corrosion protection method	Case 1	Corrosion resistant steel – Brand A*	Corrosion resistant steel – Brand B*
	Case 2	Coating	Corrosion resistant steel – Brand B*
	Case 3	Corrosion resistant steel – Brand A*	Coating
	Case 4	Corrosion resistant steel – Brand C*	Corrosion resistant steel – Brand C*
*Corrosion Resistant Steel and coating may be used on the same member.			

4 If different corrosion protection methods (coating and corrosion resistant steel) are selected for either (a) or (b), the selected procedure for each member is to comply with the relevant performance standards.

5 Where corrosion resistant steel is used it is to be type approved by the Administration.

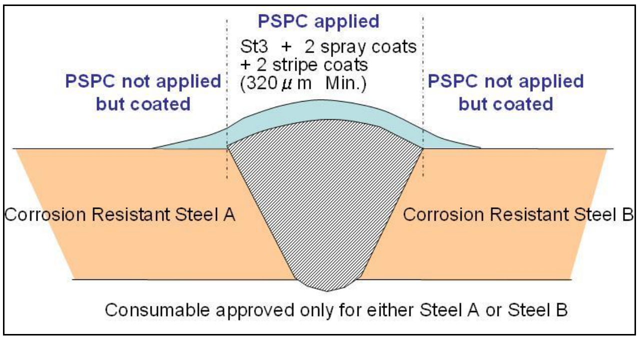

Figure 3.4.1

6 Where different brands of corrosion resistant steels are used in the same structural member, see figure 3.4.1, the weld joining the two different steels is to be coated. Coating is to be in accordance with the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* (resolution MSC.288(87)). However, coating of the weld is not required if the welding consumable used to produce the weld has been subject to the necessary corrosion tests. In such a case, a type approval certificate is required for the both steel brands in association with the welding consumable used.

7 When corrosion resistant steel and conventional steel are used together in an area where corrosion protection is necessary, see figure 3.4.2, the conventional steel and the weld is to be coated in accordance with the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* (resolution MSC.288(87)),

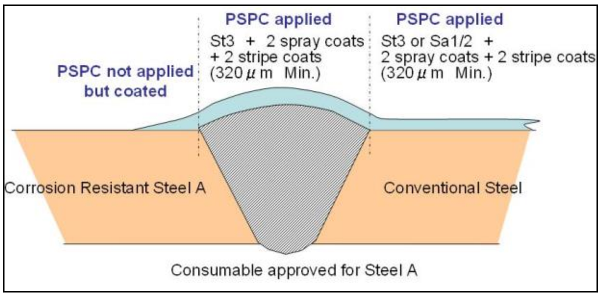

Figure 3.4.2

8 Where the welding consumable used is different from that indicated on the Type Approval Certificate of corrosion resistant steel, the weld is to be coated in accordance with the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* (resolution MSC.288(87)), see figure 3.4.3.

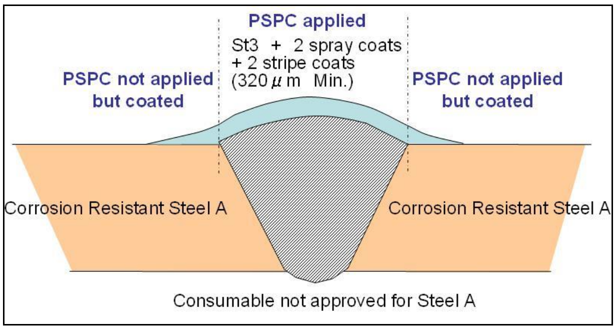

Figure 3.4.3

Paragraph 4 – Approval

1 Approval procedure

1.1 The steel must be approved and graded accordingly.

1.2 The approval procedure for corrosion testing of corrosion resistant steel is described in the annex to the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87)).

1.3 The Administration's approval is not needed for the testing laboratory where a surveyor of the Administration is present at specified stages to witness the approval tests.

1.4 In the case where the Administration is not present at specified stages to witness the approval tests, the testing laboratory is to be approved.

1.5 Where the scope of approval changes, for example for additions to the applicable welding consumables, the effects of these changes are to be subjected to corrosion resistance tests for the welded joints specified in the annex to the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87)).

2 Type Approval Certificate

2.1 The Type Approval Certificate for approved corrosion resistant steel is to include the following items:

(a) brand name, manufacturer and certificate number;

(b) steel grade and area of application designation;

(c) chemical composition range (including additive and/or controlling element percentages to improve corrosion resistance);

(d) maximum thickness;

(e) steelmaking process;

(f) casting process;

(g) delivery condition;

(h) brand of welding consumables and welding method; and

(i) period of validity of approval.

2.2 The Type Approval Certificate is valid for a maximum period of 5 years from the date of approval. When the renewal of approval is carried out, the period of validity will be a maximum period of 5 years from the next day after the expiry date of the previous validity.

Paragraph 5 – Inspection and verification requirements

1 General requirements

1.1 The general requirements are as follows:

(a) Corrosion resistant steel type approved by the Administration is to be used.

(b) Welding consumables used are to be the Brand specified on the type approval certificate.

(c) Welding work is to be implemented according to the approved welding procedure.

(d) The correct use of corrosion resistant steel is verified by engineering review and survey.

(e) The shipbuilder is to prepare a Technical File after the construction work has been completed, and submit it to the Administration for verification.

(f) The Technical File is to be maintained on board the ship.

1.2 If any of the items in 1.1(a) to 1.1(f) above are not complied with, the Administration notifies the shipbuilder immediately who confirms the corrective action to be followed and its completion. A SOLAS Safety Construction Certificate should not be issued until all required corrective actions have been closed to the satisfaction of the Administration.

2 Procedure applicable to new ships

2.1. Product inspection is to be carried out as part of material certification. The control range of the chemical composition is determined as follows:

2.1.1 The manufacturer is to supply data relating to the control of applicable chemical elements that the manufacturer has intentionally added or is controlling to improve corrosion resistance. Upper and lower limits for all such elements and any relationship between these elements are to be disclosed. The manufacturer is to obtain the Administration's approval for these additions and the relationships.

2.1.2 The effect of variation of each element is to be assessed by using sufficient corrosion tests to determine the effects of variation with variations of other elements used to enhance corrosion resistance.

2.1.3 The corrosion resistance test is to be conducted in accordance with the appendix to annex 3 to the *Performance standard for the alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87)).

2.2 Survey during the construction stage

2.2.1 The Administration's surveyor is to verify that corrosion resistant steel has been used correctly at the appropriate locations.

2.2.2 The verification in 2.2.1 is to be implemented periodically, and the frequency is to be determined on assessment of quality control feedback of each shipyard. However, if some deficiency is found, the shipyard is to formulate the necessary remedial action with regard to both the deficient location and counter measures to be taken to improve inspection methods.

3 Procedure applicable to ships in service

3.1 If the repair method is described in the Technical File, repairs are to be carried out in accordance with the said method.

3.2 If corrosion resistant steel or coated member is to be replaced, the same corrosion protection method to the one used during construction is recommended.

3.3 If corrosion resistant steel is to be used during repairs, use of the corrosion resistant steel of the same brand as that used during construction is recommended.

3.4 If conventional steel is used in a corrosion resistant steel member that is to be replaced, coating is to be applied to the conventional steel. In this case, it is required that the coating complies with paragraph 3.4.3 of the *Performance standard for protective coatings for crude oil tanks of crude oil tankers* (resolution MSC.288(87)), see figure 3.4.2.

3.5 The application of welding consumables to be used is to be confirmed through the latest Type Approval Certificate of the relevant corrosion resistant steel to ensure conformity (brands of the welding consumables are indicated on the Type Approval Certificate).

3.6 If the welding consumables specified in the Type Approval Certificate for the corrosion resistant steel cannot be used, the weld is to be coated, see figure 3.4.3. In this case, it is required that the coating complies with paragraph 3.4.3 of the *Performance standard for protective coatings for cargo oil tanks of crude oil tankers* (resolution MSC.288(87)).

4 Welding Considerations

4.1 Welding workmanship standards accepted for conventional steel may be used.

4.2 An approved welding procedure is to be used for welding work as appropriate to the grades (excluding subscripts related to corrosion resistance), welding consumables, welding position and plate thickness, etc. of the corrosion resistant steel to be used.

Appendix – Test procedures for qualification of corrosion resistant steel for cargo tanks in crude oil tankers

1 Test on simulated upper deck conditions

1.1 Test condition

(a) The chemical composition of the conventional shipbuilding steel used for test purposes (table 1 in the annex to the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87))) is to be based on ladle analysis given in the mill certificate. Steel complying with a national standard that meets the requirements of table 1 is also acceptable.

(b) All the base material specimens should be located in one tank. Figure 2 in the annex to the *Performance Standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87)) only shows locations of 20 specimens. The tank can be designed to hold 25 or more specimens; alternatively specimens can be added and removed as necessary so that the appropriate time periods are achieved within the total timescale of 98 days.

(c) Since certain factors such as control and measurement of temperature and size of chamber may affect the corrosion rate achieved, it should be confirmed that the corrosion rate of conventional steel in the conditions and equipment of the test, satisfies the rate criteria, before carrying out corrosion test for evaluation of corrosion resistant steel.

(d) To remove specimens, the chamber is to be purged with 100% nitrogen gas while the specimens are in the high temperature region until the specimens are dry.

(e) The cycling pattern of specimen temperature and temperature of distilled water should be controlled such that each cycle is as identical as possible throughout the whole corrosion test period. These temperatures must be recorded. See figure App 1.

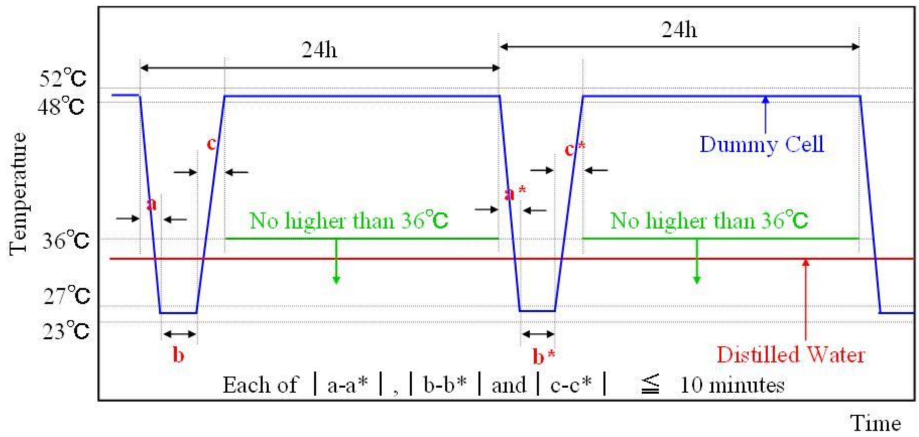

Figure App 1 – Schematic view of temperature controlling accuracy of specimens and distilled water during corrosion test

(f) The transition time, a, a*, c and c* in figure App 1 is the time from when the cooling and heating commences until the lower or upper temperature is reached, see figure App 2. The transition of each cycle is to be as identical as possible throughout the whole corrosion test period.

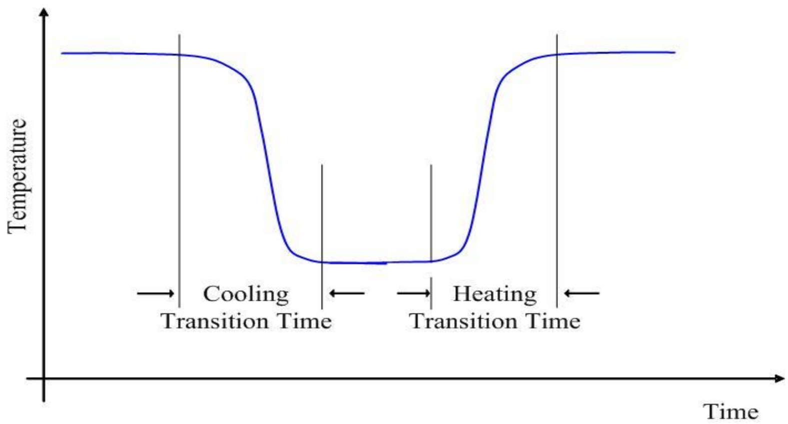

Figure App 2 – Transition time definition

(g) The temperature of both the specimens and the water is to be continuously recorded throughout the test.

(h) Welded specimens may be tested with the parent material tests or tested separately against 5 conventional steel specimens.

(i) Base material is to be prepared such that the surface to be tested is to be taken from a position within 2 mm of one rolled surface. This surface is to be ground to bare steel and polished to 600 grit finish.

(j) For welded samples, a test assembly is to be made from the same steel cast as the base material test in (i) but may be from a plate of different thickness. The assembly is to be welded using the process and consumable to be approved for use with the base material. The surface to be tested is to be selected such that the width of weld metal, excluding heat affected zone, is to be between 10 and 20 mm. This surface is to be ground to bare steel and polished to 600 grit finish.

(k) Specimens are to be weighed to an accuracy of ± 1 mg.

(l) Where the calculated corrosion loss of conventional steel is less than 0.05 mm/year, the concentration of H_2S may be increased in the simulated cargo oil tank gas. All tests will be carried out at this increased level.

(m) At least 3 values of individual weight loss of conventional steel should be in the range of maximum X and minimum Y measured in grams.

$X = (0.11 \times S \times D)/10$

$Y = (0.05 \times S \times D)/10$

Where

S = surface area (cm^2)

D = density (g/cm^3)

2 Test on simulated inner bottom conditions

2.1 Test condition

(a) The conventional steel used should also meet the requirements of table 1 in the annex to the *Performance standard for alternative means of corrosion protection for cargo oil tanks of crude oil tankers* (resolution MSC.289(87)) and interpretations 1.1 (a) above.

(b) Base material is to be prepared such that one surface is to be taken from a position within 2 mm of one rolled surface. All surfaces are to be ground to bare steel and polished to 600 grit finish.

(c) For welded samples, a test assembly is to be made from the same steel cast as the base material test in (e) but may be from a plate of different thickness. The assembly is to be welded using the process and consumable to be approved for use with the base material. The surface to be tested is to be selected such that the width of weld metal, excluding heat affected zone, is to be between 10 and 20 mm. This surface is to be ground to bare steel and polished to 600 grit finish.

(d) Specimens are to be weighed to an accuracy of ± 1 mg.

(e) One specimen that has a corrosion rate deviating from the average corrosion rate by more than +25% may be eliminated from the results, provided that the cause of the accelerated corrosion is demonstrated to be due to localized corrosion around the hanging hole and/or stamp (e.g. crevice corrosion, pitting corrosion, etc.).

3 Interpretation of weld discontinuity

3.1 Preparation of samples after corrosion test

(a) All five samples are to be prepared as follows.

(b) Two full thickness specimens approximately 20 mm long x 5 mm wide are to be sectioned with their principle axis perpendicular to the weld fusion line. Each specimen is to be located such that the weld fusion line is located approximately at its mid length. See figure App 3.

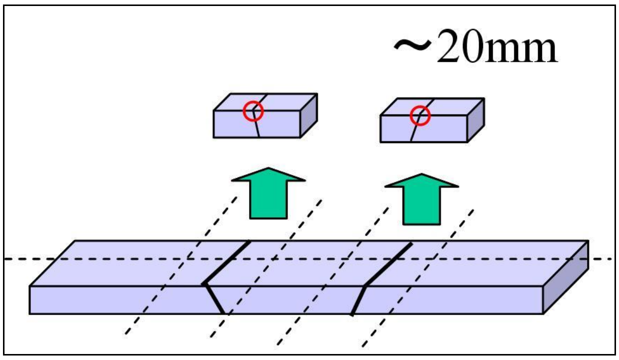

Figure App 3 – Sectioning plan

(c) The specimens are to be mounted in resin to allow polishing of the cross section. The specimens are to be etched in Nital after polishing to reveal the fusion boundary.

(d) A photomicrograph is to be taken at a magnification of approximately 100 X.

3.2 Evaluation of depth step

(a) On the photomicrograph, construct a line A–B, perpendicular to the corrosion surface through the point where fusion line and the surface cross. See figure App 4.

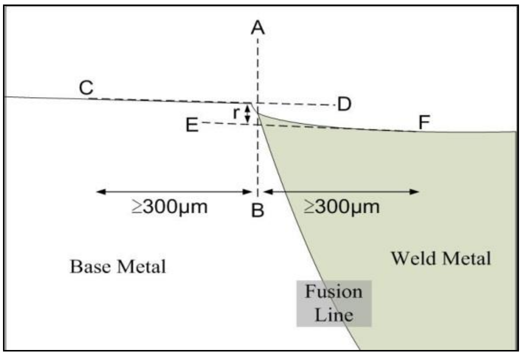

Figure App 4 – Determination of corrosion depth on photomicrograph

(b) Construct two parallel lines C-D and E-F one representing the higher level, the other the lower level. Each line is to be constructed over a distance of ≥ 300 µm from line A-B on the base metal and weld metal side, respectively.

(c) Measure the distance r mm between the intersection point at line A-B and each average surface line on the photomicrograph.

(d) If the intersection point at line A-B and average surface line of welded metal part is above that of base metal part, then the existence of step should be neglected for this sample.

(e) Calculate the depth of discontinuous step R in µm from the actual photomicrograph magnification M as follows:

$$R(\mu m) = \frac{r(mm) \times 1000}{M}$$

3.3 Evaluation of step angle

(a) Evaluation for angle of step is unnecessary if the depth of step calculated on both samples see paragraph 3.2, are not greater than 30 µm or if either step exceeds 50 µm for a single specimen. Otherwise the angle of step is to be calculated as follows.

(b) Produce a photomicrograph at a magnification of approximately 250 X, see figure App 5.

(c) Draw an average surface line C-D for base metal part and E-F for weld metal part.

(d) Find the closest intersection point with the step of the base metal surface profile and the constructed line C-D and the closest intersection point with the step for weld metal constructed line E-F respectively, and connect those two intersection points.

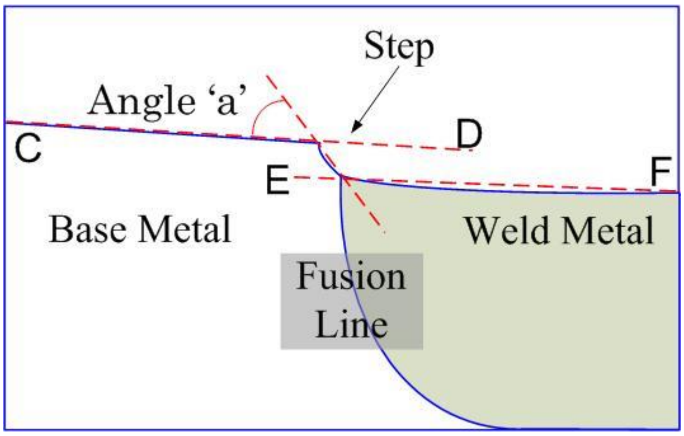

Figure App 5 – Calculation of step angle

(e) Measure the angle "a" in degrees given by the line C-D and the connected line described in paragraph d, see figure App 2.

3.4 Acceptance criteria

(a) If the depth of both steps are less than or equal to 30 µm then the measurement of angle is unnecessary, and the sample is considered to be acceptable.

(b) If the depth of steps on both photomicrographs are less than or equal to 50 µm and in addition if both the measured angles are less than or equal to 15 degrees, then the sample is considered to be acceptable.

(c) If either of the conditions described in paragraphs a or b above are not in compliance, the sample is considered to contain a "*discontinuous surface*" and fails the test.

(d) Welds should be evaluated as "*without discontinuous surface*" when all 5 corrosion test samples are considered acceptable.

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MSC.1/Circ.1260/Rev.1
23 May 2014

UNIFIED INTERPRETATIONS OF COLREG 1972, AS AMENDED

1 The Maritime Safety Committee, at its eighty-fourth session (7 to 16 May 2008), with a view to providing more specific guidance for certain rules, which are open to different interpretations contained in IMO instruments, approved the unified interpretations of COLREG 1972, as amended, prepared by the Sub-Committee on Safety of Navigation.

2 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), reviewed and approved a revised unified interpretation of annex I, section 9(b) – Horizontal sectors of COLREG 1972, as amended, prepared by the Sub-Committee on Safety of Navigation at its fifty-ninth session (2 to 6 September 2013), as set out in the annex.

3 Member Governments are invited to use the annexed unified interpretations with respect to Rule 27(b)(i) and annex I, section 3(b) as guidance when applying relevant provisions of COLREGs to vessels constructed on or after 1 January 2009, whilst the revised unified interpretation with respect to annex I, section 9(b) be used as guidance to vessels constructed on or after 1 July 2015 and to bring the unified interpretations to the attention of all parties concerned.

4 This circular revokes MSC.1/Circ.1260 and MSC.1/Circ.1260/Corr.1.

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ANNEX

UNIFIED INTERPRETATIONS OF COLREG 1972, AS AMENDED

Rule 27(b)(i) – Vessels not under command or restricted in their ability to manoeuvre

"Not under command" (NUC) all-round red lights (Rule 27(a)(i)) may be used as part of the "Restricted Ability to Manoeuvre" (RAM) lights provided the vertical and horizontal distances required by COLREG 1972 are complied with and the electrical system is arranged so that the all-round white light (RAM) may be switched on independently from the two all-round red lights (NUC).

Annex I, section 3(b) – Horizontal positioning and spacing of lights

The term "near the side" is interpreted as being a distance of not more than 10 per cent of the breadth of the vessel inboard from the side, up to a maximum of 1 metre. Where the application of above requirement is impractical (e.g. small ships with superstructure of reduced width), exemption may be given on the basis of the flag State Administration's acceptance.

Annex I, section 9(b) – Horizontal sectors

1 In order to comply with the one (1) mile requirement in 9(b)(ii), the screening of each all-round light shall be as follows:

$$\theta 2 \leq 360 - \theta 1$$

where
$\theta 1$: Screened angle of one all-round light
$\theta 2$: Screened angle of the other all-round light

2 Screenings details and the arrangement of obstacles are to be considered when carrying out the drawing approval process.

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TM.5/Circ.6
19 May 2014

UNIFIED INTERPRETATIONS RELATING TO THE INTERNATIONAL CONVENTION ON TONNAGE MEASUREMENT OF SHIPS, 1969

1 The Maritime Safety Committee, at its sixty-third session (16 to 25 May 1994), agreed to a consolidated set of interpretations of the provisions of the International Convention on Tonnage Measurement of Ships, 1969 (TM.5/Circ.5).

2 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), having considered a proposal by the Sub-Committee on Ship Design and Construction, at its first session, approved the Unified interpretations relating to the International Convention on Tonnage Measurement of Ships, 1969 (the 1969 Tonnage Convention), as set out in the annex.

3 Member Governments are invited to use these Unified interpretations when applying the provisions of the 1969 Tonnage Convention.

4 This circular supersedes circular TM.5/Circ.5.

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ANNEX

UNIFIED INTERPRETATIONS RELATING TO THE INTERNATIONAL CONVENTION ON TONNAGE MEASUREMENT OF SHIPS, 1969

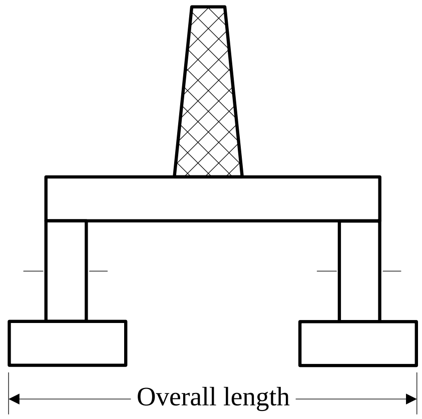
Articles

Article 2 Definitions

Article 2(8) Length

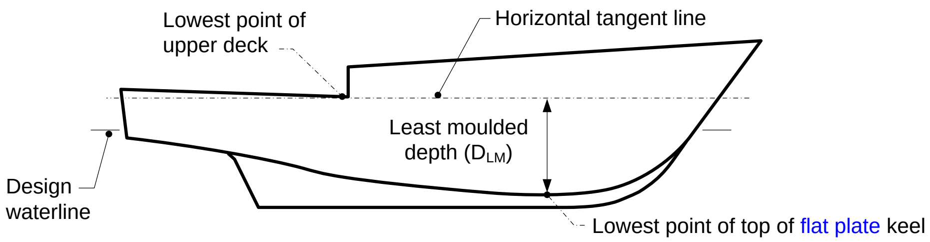
A.2(8)-1 When a ship does not have a rudder stock, the length should be taken as 96% of the total length on a waterline at 85% of the least moulded depth measured as defined in regulation 2(2).

A.2(8)-2 The 96% overall length should be used for ships that do not have a clearly defined stem or stern, such as column-stabilized units, submersibles, floating docks, and similar ships.



Column-stabilized units

A.2(8)-3 In the definition of "length" in article 2(8), the term "least moulded depth" is the vertical distance measured from the top of the flat plate keel (or equivalent lower terminus as described in regulation 2(2)) at the lowest point along the keel's length to the horizontal line that is tangent to the underside of the upper deck at the ship's side (or equivalent upper terminus as described in regulation 2(2)) at the lowest point along the upper deck's length. For the purpose of this definition, the ship is considered to be trimmed on a waterline parallel to the design waterline.



A.2(8)-4 Where more than one rudder is fitted, the aftermost rudder stock is the rudder stock to be considered when determining the length.

Article 3 Application

Article 3(2)(d) Tonnage applicability to "existing" ships

A.3(2)(d)-1 "The term "alterations or modifications which the Administration deems to be a substantial variation in their existing gross tonnage" should be interpreted to mean "an increase or decrease of more than 1% in the gross tonnage calculated in accordance with the 1969 Tonnage Convention.""

Article 9 Form of certificate

Article 9(2) Model in annex II

A.9(2)-1 The "Date" shown on the front of the International Tonnage Certificate (1969) refers to the year when the keel was laid or the ship was at a similar stage of construction (article 2(6)) or the ship underwent alterations or modifications as defined in article 3(2)(b) but when the year of construction or alteration or modification is 1982 or 1994, the month and day should also be described.

A.9(2)-2 Information inserted in the "location" columns on the reverse of the International Tonnage Certificate (1969) should not be detailed.

A.9(2)-3 The phrase "Date and place of original measurement" should refer to the issue of the original International Tonnage Certificate (1969) and should have no reference to measurement under pre-existing national systems.

A.9(2)-4 The phrase "Date and place of last previous remeasurement" should refer to the date and place of issue of the last International Tonnage Certificate (1969).

Article 10 Cancellation of certificate

Article 10(2) Cancellation upon flag transfer

A.10(2)-1 Ships holding an International Tonnage Certificate (1969), which do not comply with agreed interpretations of the provisions of the Convention, should be remeasured. The new characteristics should be determined and applied without delay.

Article 12 Inspection

A.12-1 A copy of the tonnage calculations may be provided together with the International Tonnage Certificate (1969) to the ship's master. Although not a requirement, nothing in the Convention would prevent Administrations from providing these calculations to ships flying their flag.

Regulations

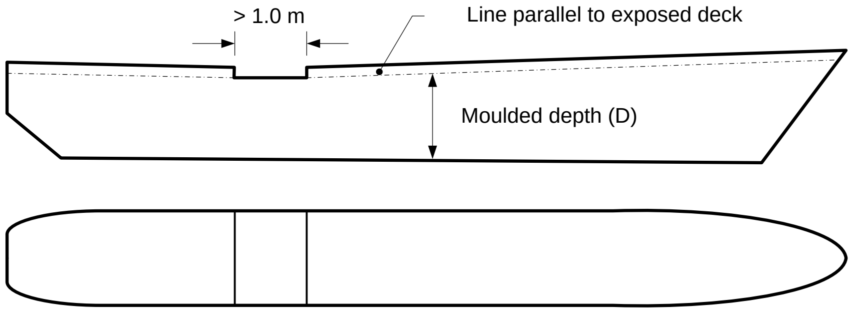
Regulation 1(3) General

R.1(3)-1 In applying these novel craft provisions, the resulting gross and net tonnages should be reflective of the ship's overall size and useful capacity, respectively. A novel type of craft should be understood as one which is novel in its design and should not include existing traditional types of ships of usual shape or those types already covered by the Unified interpretations.

Regulation 2 Definition of terms used in the annexes

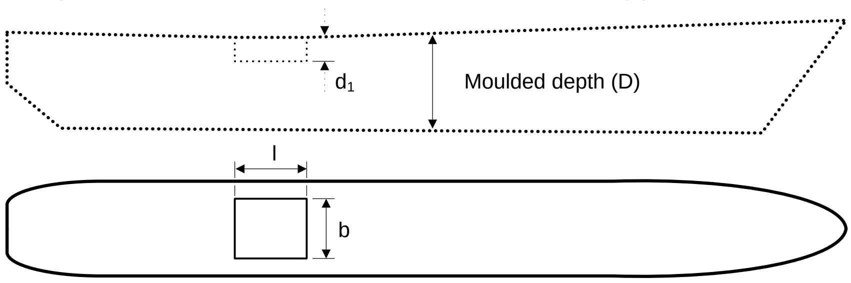
Regulation 2(1) Upper deck

R.2(1)-1 A discontinuity in the upper deck which extends over the full breadth of the ship and is in excess of 1 m in length should be treated as a step as defined in regulation 2(1).

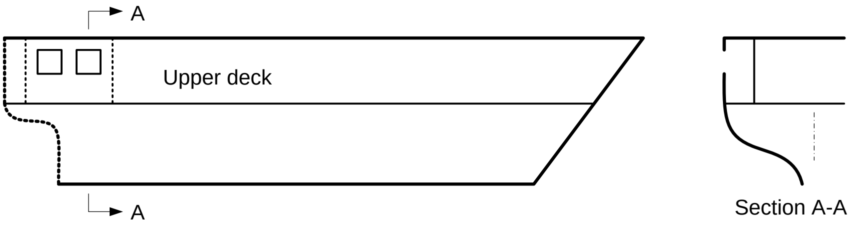


R.2(1)-2 Steps situated outside the "length" (article 2(8)) should not be considered.

R.2(1)-3 A discontinuity in the upper deck which does not extend to the side of the ship should be treated as a recess under the upper deck level.



R.2(1)-4 In a ship having openings in the side of the ship below the uppermost deck, which are not closed but limited inboard by weathertight bulkheads and decks, the deck below such openings should be considered the upper deck.



R.2(1)-5 The Administration may decide on the term "watertight" as a special definition for tonnage purposes is not needed.

Regulation 2(3) Breadth

R.2(3)-1 The term "amidships" should be considered as the midpoint of the length as defined in article 2(8) where the forward terminal of that length coincides with the fore side of the stem.

Regulation 2(4) Enclosed spaces

R.2(4)-1 In regulation 2(4) there is no contradiction between the definition of enclosed spaces as being "bounded by the ship's hull, by fixed or portable partitions ... " and "… nor the absence of a partition or bulkhead, shall preclude a space from being included in the enclosed space".

R.2(4)-2 Space located within the boundaries of "permanent or movable awnings" should be subject to treatment under regulation 2(5).

R.2(4)-3 Tanks, permanently located on the upper deck, provided with removable pipe connections to the cargo system or the vent (de-airing) lines of the ship, should be included in V_c.

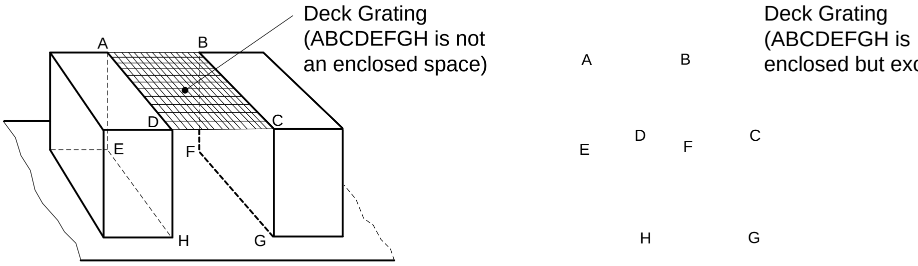
R.2(4)-4 The volume of weathertight steel pontoon covers on hatchway coamings should be included in the calculations of the total volume (V) of the ship. If such covers are open on the underside, their volume should also be included in V_c.

R.2(4)-5 Multipurpose ships which have the facility to trade with cargo hatches open or closed should always be measured with the hatch covers considered to be closed.

R.2(4)-6 Masts, kingposts, cranes, crane and container support structures, which are completely inaccessible and above the upper deck, separated on all their sides from other enclosed spaces should not be included in the total volume of all enclosed spaces. Air trunks having a cross-sectional area not exceeding 1 m^2 may also be excluded under the before-mentioned conditions.

R.2(4)-7 If enclosed spaces comply with the conditions for exclusion specified in regulation 2(5), then they should be excluded from the total volume of all enclosed spaces (V). Such spaces should be treated as "enclosed but excluded spaces" to differentiate from "enclosed and included spaces" (those "enclosed spaces" which do not comply with the conditions for exclusion specified in regulation 2(5)).

R.2(4)-8 Open gratings that are part of the ship's hull, or of any deck, covering, partition or bulkhead, are not considered to bound enclosed space, and are ignored when applying this regulation.

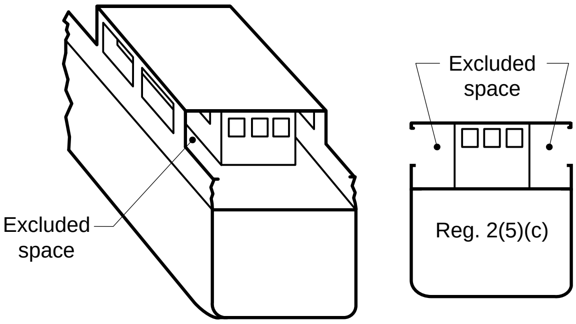


R.2(4)-9 Machinery such as mooring and towing equipment, winches, revolving cranes, cranes with truss structures, and other similar items should not be included in the total volume of all enclosed spaces (V).

R.2(4)-10 Mobile cranes should not be included in the total volume of all enclosed spaces (V). "Mobile" means that the main structure (support) of the crane moves either longitudinally or transversely relative to the ship.

Regulation 2(5) Excluded spaces

R.2(5)-1 The space between the side longitudinal bulkhead of a deckhouse and the bulwark below a deck extending from side to side supported by stanchions or vertical plates connected to the bulwarks, should be treated as an excluded space in accordance with regulation 2(5)(b) and (c). Similarly, open spaces directly below a bridge wing structure should not be treated as enclosed spaces.



R.2(5)-2 In the case of a ro-ro ship, for example, where the space at the end of an erection is fitted with means for securing cargo, the space should be included in V in accordance with the first condition of regulation 2(5).

R.2(5)-3 In applying this regulation:

.1 spaces excluded from the total volume of all enclosed spaces (V) are those spaces which are treated as enclosed ones under regulation 2(4) but also comply with the conditions for exclusion under regulation 2(5);

.2 the volume of those enclosed spaces referred to in regulation 2(5)(a) to (e) shall be excluded from the total volume of all enclosed spaces (V), unless at least one of the following three conditions takes place:

- the space is fitted with any means for securing cargo or stores;
- the openings are fitted with any means of closure;
- the construction provides any possibility of such openings being closed.

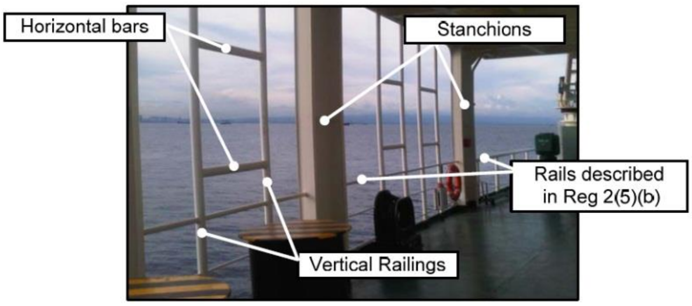
R.2(5)-4 In Appendix 1 to the Convention, labeling in the figures should be interpreted as follows:

.1 "O = excluded space" refers to an enclosed space or part of an enclosed space which corresponds to one of the situations described in regulation 2(5)(a) to (e) and which satisfies the conditions for exclusion from the total volume of all enclosed spaces (V) specified in this regulation;

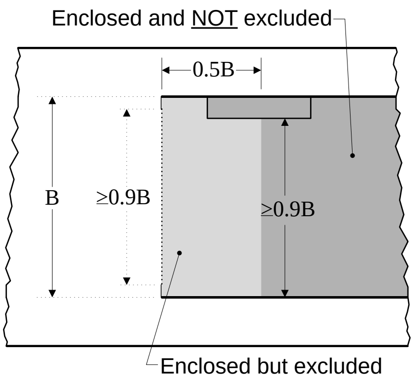
.2 "C = enclosed space" refers to an enclosed space or part of an enclosed space which does not correspond to any of the situations described in regulation 2(5)(a) to (e) and consequently can never be excluded from the total volume of all enclosed spaces (V);

.3 "I = space to be considered as an enclosed space" refers to an enclosed space or part of an enclosed space which corresponds to one of the situations described in regulation 2(5)(a) to (e) but does not satisfy the conditions for exclusion from the total volume of all enclosed spaces (V) specified in this regulation.

R.2(5)-5 In applying regulation 2(5)(b) and (c), stanchions necessary to support an overhead deck and vertical railings are not considered to close or reduce the size of a side opening. Horizontal bars connecting vertical railings should not be treated as rails as described in regulation 2(5)(b).



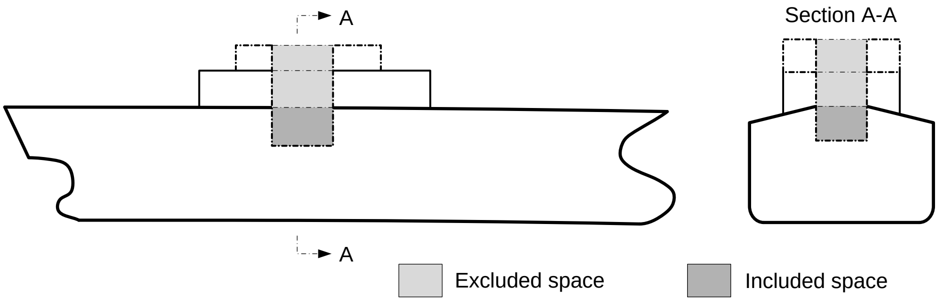
R.2(5)-6 When applying the provisions of regulation 2(5), the phrase "breadth of the deck" means the breadth of the deckhouse structure at the line of the opening of the space, regardless of whether or not the structure extends from side to side. In addition to erections extending from side to side, the requirements for excluded spaces under regulation 2(5) are also applicable to structures that do not extend from side to side of the ship. In such structures B means breadth of a structure that does not extend from side to side, measured in way of the opening (see appendix 1 to the Convention).



R.2(5)-7 Grates covering side or end openings should not be considered as means of closure when applying this regulation.

Regulation 2(5)(d) Space immediately below an uncovered opening

R.2(5)(d)-1 The term "immediately below" means extending from the deck in which the opening occurs to the lower boundary of the opening being considered. Openings which penetrate the upper deck (as defined in regulation 2(1)) are only excluded to the line of the upper deck.



Regulation 2(6) Passenger

R.2(6)-1 N_1 and N_2 should be obtained from the Administration's maritime safety authority.

Regulation 2(7) Cargo spaces

R.2(7)-1 The volumes of the segregated ballast tanks should not be included in V_c provided they are not to be used for cargo.

R.2(7)-2 The volumes of clean ballast tanks in oil tankers should be included in V_c when the ship is fitted with a crude oil washing system which would permit dual purpose cargo/clean ballast tank use of these tanks.

R.2(7)-3 The volumes of dedicated clean ballast tanks should not be included in V_c provided that:

.1 the tanks are not used for cargo;

.2 the ship carries a single IOPP Certificate which indicates it is operating with dedicated clean ballast tanks in accordance with regulation 13A, Annex I, MARPOL 73/78;

.3 the following notation is inserted in the REMARKS column on the International Tonnage Certificate (1969): "This ship carries an IOPP Certificate in conformity with regulation 13A, Annex I, MARPOL. The following tanks are dedicated solely to the carriage of clean ballast water: ________."

R.2(7)-4 The volumes of slop tanks for cargo residues should be included in V_c.

R.2(7)-5 In fishing vessels, the volumes of fish processing spaces for fishmeal, liver oil and canning, tanks for re-cooling fish, wet fish bunkers, stores for salt, spices, oil and tare should be included in V_c. Fishing gear stores should not be included in V_c.

R.2(7)-6 The volume of refrigerating machinery used for refrigerating cargoes and situated within the boundaries of the cargo spaces should be included in V_c.

R.2(7)-7 The volumes of mail rooms, baggage compartments separate from passenger accommodation, and bonded stores for passengers should be included in V_c. The volume of provision rooms for crew or passengers and bonded stores for crew should not be included in V_c.

R.2(7)-8 On combination carriers, where the owners request to have the dual purpose oil/ballast tanks converted to ballast tanks and excluded from V_c, the ballast tanks should be required to be permanently disconnected from the oil cargo system and not used for the carriage of cargo. The ship should then be remeasured in accordance with regulation 5(3). Any ballast tanks not to be included in V_c should be solely allocated to ballast, connected to an independent ballast system, and not used to carry cargo.

R.2(7)-9 When determining the volumes of cargo spaces, no account should be taken of insulation, sparring or ceiling which is fitted within the boundaries of the space concerned. For ships which have permanent independent cargo tanks constructed within the ship, e.g. gas tankers, the volume to be included in V_c should be calculated to the structural boundary of such tanks, irrespective of insulation which may be fitted on the inside or outside of the tank boundary.

R.2(7)-10 The volumes of dual purpose spaces such as those used for both ballast and cargo should be included in V_c.

R.2(7)-11 Spaces allocated to passenger automobiles should be included in V_c.

Regulation 3 Gross tonnage

R.3-1 The K_1 coefficient used in the gross tonnage calculation may be derived from either the table in appendix 2 of the Convention or from the formula in regulation 3 at the discretion of the Administration.

R.3-2 The final tonnage figure determined in accordance with regulation 3 and stated in the tonnage certificate should be given in rounded down figures without decimals.

Regulation 4 Net tonnage

R.4-1 The K_2 coefficient used in the net tonnage calculation may be derived from either the table in appendix 2 of the Convention or from the formula in regulation 4 at the discretion of the Administration.

R.4-2 The final tonnage figure determined in accordance with regulation 4 and stated in the tonnage certificate should be given in rounded down figures without decimals.

Regulation 6 Calculation of volumes

R.6-1 Enclosed spaces above the upper deck, appendages and spaces open to the sea not exceeding 1 m^3 should not be measured.

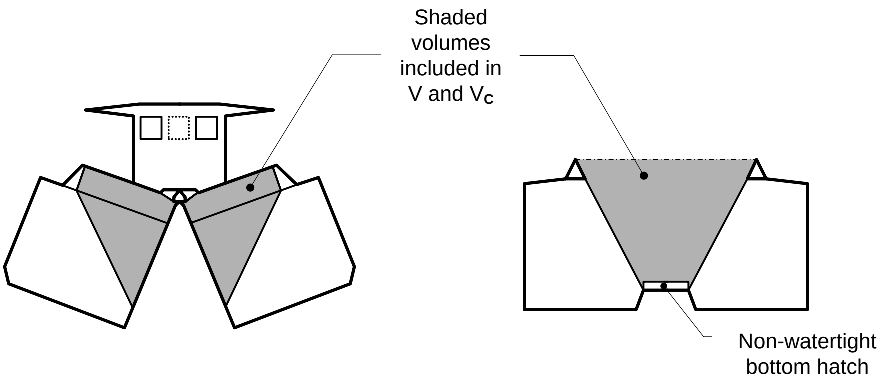
Regulation 6(2) Appendages

R.6(2)-1 Bulbs, fairwaters, propeller shaft bossings or other structures should be treated as appendages.

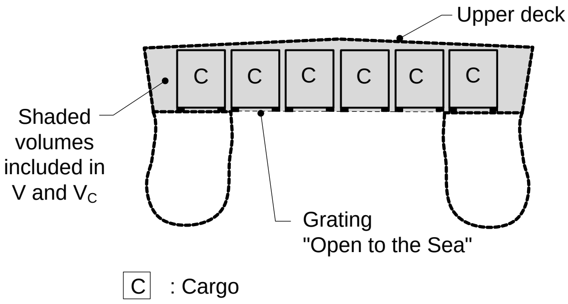
Regulation 6(3) Spaces open to the sea

R.6(3)-1 Hawse pipes, sea-valve recesses, thruster tunnels, stern chutes in fishing vessels, dredging wells in dredgers and other similar spaces fitted in the ship's hull should be dealt with as spaces open to the sea.

R.6(3)-2 Volumes within the hulls of ships, such as split-hull barges and dredgers, should be retained in V and V_c notwithstanding that the space within the hull is temporarily opened to the sea when discharging cargo.



R.6(3)-3 Spaces open to the sea should not be excluded from the total volume of all enclosed spaces (V) if they are used for cargo and/or buoyancy purposes.



Regulation 7 Measurement and calculation

R.7-1 When a tonnage certificate and a copy of the calculations of the tonnages are transmitted to another Government in accordance with article 8(2) or 10(3) of the Convention, they should be accompanied by a form as shown in the annex, showing the main particulars of the tonnage calculations for easy reference. When listing underdeck volumes, the volumes may be combined (e.g. underdeck/extended forecastle, etc.) on the form.

Regulation 7(2) Calculation methods and accuracy

R.7(2)-1 Administrations should decide on the degree of accuracy required for the tonnage calculations.

Novel Craft Interpretations (regulation 1(3))

NvlCr. 1 Livestock carriers

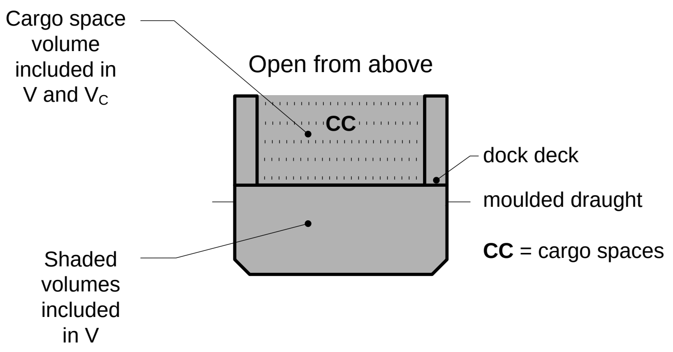
N.1-1 Livestock carriers are most often converted ships. Above the existing upper deck, one or more decks are constructed. Between these decks, the livestock corrals and their associated spaces are arranged, separated by, for example, railings, fences or gangways. The corrals are open to the air.

N.1-2 Stanchions, fences and railings to keep livestock in the corrals are "other means for securing cargo" according to regulation 2(5).

N.1-3 In applying the provisions of the 1969 Tonnage Convention, livestock structures should be included in the gross tonnage.

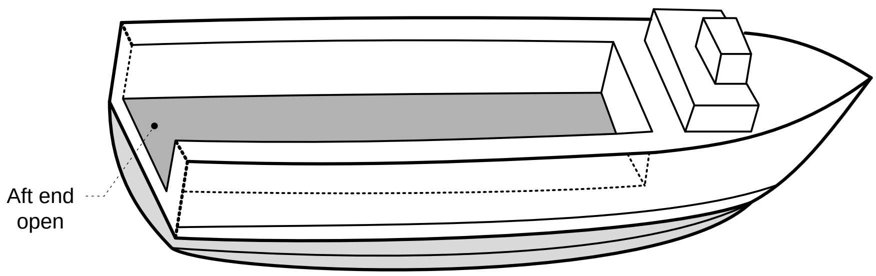
NvICr. 2 Dockships

N.2-1 A dockship may include in its main structural characteristics the absence of hatch covers above the cargo space but may have a dock deck above the moulded draught together with side erections.

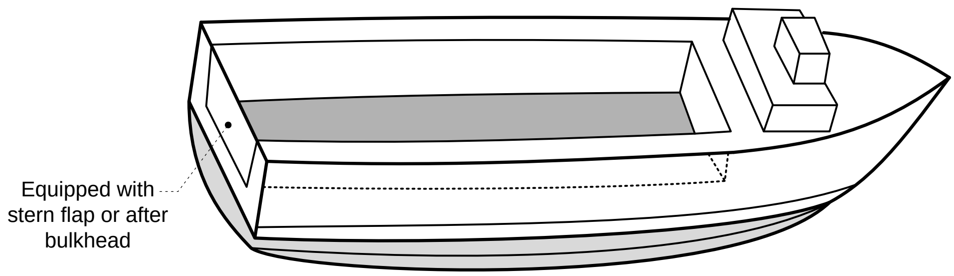


N.2-2 The dockships considered are described as:

.1 a dockship open-ended at the stern,



.2 a dockship fitted with a stern door or a grill stern door (see figure 8 in appendix 1).



N.2-3 The space above the dock deck, bounded on at least three sides by erections and intended for the carriage of cargo should be included.

N.2-4 In this context, an erection is defined as being an enclosed space bounded by bulkheads and a deck above.

NvICr. 3 Open-top containerships

N.3-1 Refer to resolution MSC.234(82) for *Recommendations concerning tonnage measurement of open-top containerships*.

Annex

FORM GIVING PARTICULARS OF UNIFORM TONNAGE CALCULATION

GROSS TONNAGE

Item No.	Name of Space	Location	Length	Moulded volume
	Underdeck Poop Bridge Forecastle Deckhouses Hatches, etc.			
		Total volume		

NET TONNAGE

	No. 1 hold No. 2 hold, etc. No. 1 tween decks, etc. No. 2 tween decks, etc. Hatches, etc.			
		Total volume		

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MSC.1/Circ.1474
23 May 2014

GUIDANCE ON THE BRIDGE NAVIGATIONAL WATCH ALARM SYSTEM (BNWAS) AUTO FUNCTION

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), with a view to providing more specific guidance on the automatic function specified in resolution MSC.128(75) – *Performance standards for a bridge navigational watch alarm system (BNWAS)*, approved the guidance, prepared by the Sub-Committee on Safety of Navigation at its fifty-ninth session (2 to 6 September 2013), as set out in the annex.

2 Member Governments are invited to use the guidance as an *interim* measure until such time as the performance standards can be reviewed and revised and, furthermore, bring this guidance to the attention of all parties concerned.

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ANNEX

GUIDANCE ON THE BRIDGE NAVIGATIONAL WATCH ALARM SYSTEM (BNWAS) AUTO FUNCTION

1 SOLAS regulation V/19.2.2.3 requires the provision of a Bridge Navigational Watch Alarm System (BNWAS), which shall be in operation whenever the ship is under way at sea, whilst SOLAS regulation V/18 requires BNWAS to conform to appropriate performance standards not inferior to those adopted by the Organization (i.e. resolution MSC.128(75)).

2 Resolution MSC.128(75) – *Performance standards for a bridge navigational watch alarm system (BNWAS)*, section 4.1.1.1 states that "*the BNWAS should incorporate the following operational modes:*

- Automatic (Automatically brought into operation whenever the ships heading or track control system is activated and inhibited when this system is not activated)
- Manual ON (In operation constantly)
- Manual OFF (Does not operate under any circumstances)".

3 At the fifty-fifth session of the NAV Sub-Committee, concerns were raised with respect to the use of the Automatic mode and NAV 55 concluded that the Automatic mode of the performance standard was therefore not usable on a ship compliant with the SOLAS Convention. It was considered that it would not be possible to change the performance standards before the date at which the carriage requirements came into force (1 July 2011). In order to conform with the performance standards, therefore, equipment would include the Automatic mode, despite that this operational mode should not be used on ships which are subject to the SOLAS Convention.

4 From the operational point of view, automatic interface with activation of the ship's heading or track control system (HCS/TCS) is a superfluous function because SOLAS regulation V/19.2.2.3 requires the BNWAS to be in operation whenever the ship is under way at sea. This creates an inconsistency between SOLAS regulation V/19.2.2.3 and the "Automatic mode" provisions in the performance standard. In addition, from the technical point of view, it is noted that this issue is also addressed in the "note" to section 3.1.1 of IEC 62616:2010 – Maritime navigation and radiocommunication equipment and systems – Bridge navigational watch alarm system (BNWAS), which states:

> "*NOTE: <u>The Automatic mode is not suitable for use</u> on a ship conforming with regulation SOLAS V/19.2.2.3 which requires the BNWAS to be in operation whenever the ship is underway at sea*".

5 Accordingly, as an *interim* measure and pending a revision of the *Performance standards for a bridge navigational watch alarm system (BNWAS)* – (resolution MSC.128(75)), the automatic operational mode, if it is available, should not be used.

____

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MSC.1/Circ.1477
9 June 2014

GUIDELINES TO FACILITATE THE SELECTION OF PORTABLE ATMOSPHERE TESTING INSTRUMENTS FOR ENCLOSED SPACES AS REQUIRED BY SOLAS REGULATION XI-1/7

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), having considered the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its eighteenth session (16 to 20 September 2013), approved the *Guidelines to facilitate the selection of portable atmosphere testing instruments for enclosed spaces as required by SOLAS regulation XI-1/7*, as set out in the annex.

2 The Guidelines are intended to be read in conjunction with new SOLAS regulation XI-1/7 (Atmosphere testing instruments for enclosed spaces) upon its entry into force and the *Revised recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27)).

3 Member Governments are invited to bring the annexed Guidelines to the attention of all parties concerned.

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ANNEX

GUIDELINES TO FACILITATE THE SELECTION OF PORTABLE ATMOSPHERE TESTING INSTRUMENTS FOR ENCLOSED SPACES AS REQUIRED BY SOLAS REGULATION XI-1/7

Introduction

1 These Guidelines are to facilitate the selection of a portable atmosphere testing instrument for enclosed spaces as required by SOLAS regulation XI-1/7. They are intended to be read in conjunction with this SOLAS regulation and the *Revised recommendations for entering enclosed spaces aboard ships* (resolution A.1050(27)). They are not intended to constitute a performance standard for such equipment.

2 It should be noted that, given a ship's specific characteristics and operations, additional atmospheric hazards in enclosed spaces may be present that may not be detected by the instrument recommended to be selected by these Guidelines, and in such cases, if known, additional appropriate instruments should be carried.

General

3 These Guidelines refer to the instrument that is used to test the atmosphere in an enclosed space before entry and at appropriate intervals thereafter until all work is completed. They do not refer to a personal gas detector that is intended to be carried by an individual whilst inside the enclosed space.

4 The instrument should be capable of remote sampling and detection for all gases that it is designed for, without interference from the atmosphere or other characteristics of the intervening space.

5 Upon activation, the instrument should perform a "self-test" which indicates that the instrument is functioning correctly.

6 Training requirements should be considered when selecting the instrument. Any atmosphere testing should be performed by trained personnel.

Gases and vapours to be measured

7 The instrument should be capable of measuring and displaying concentrations of:

.1 oxygen;

.2 flammable gases or vapours (% of LFL);

.3 carbon monoxide; and

.4 hydrogen sulphide,

8 The instrument should clearly and unambiguously show which gas or vapour it is measuring (noting that the display may be switchable or menu accessible).

9 If the instrument is fitted with an alarm function, it should activate at the appropriate level as determined by the flag State Administration.

Use of the instrument for atmosphere testing of enclosed spaces on board ships

10 The instrument should be suitably protected, having due regard for the environment and temperatures in which it is expected to operate.

11 The instrument should be capable of being easily carried.

12 The instrument should be suitably protected from the ingress of dust and water.

13 The minimum battery life of the instrument (with fresh batteries of recommended type) should be 10 hours.

14 The instrument should be intrinsically safe.

15 The instrument display should be readable in all lighting conditions.

Calibration

16 The manufacturers' instructions should have clearly defined calibration requirements.

17 If the instrument is fitted with an alarm or shutdown function that activates if the manufacture's calibration interval is exceeded, this should not stop the instrument from functioning during actual use and the unit should not restart once the alarm or function has been activated.

Instruction manual

18 The instrument should be provided with a manual that describes its features and alarms and explains how to calibrate, operate and maintain it. The information in this manual should be available in the working language of the ship.

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MSC.1/Circ.1475
9 June 2014

GUIDELINES REGARDING THE VERIFIED GROSS MASS OF A CONTAINER CARRYING CARGO

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), having considered the proposal by the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers, at its eighteenth session (16 to 20 September 2013), approved the *Guidelines regarding the verified gross mass of a container carrying cargo*, as set out in the annex.

2 The Guidelines are intended to establish a common approach for the implementation and enforcement of the SOLAS requirements regarding the verification of the gross mass of packed containers.

3 Member Governments are invited to bring the annexed Guidelines to the attention of all parties concerned.

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ANNEX

GUIDELINES REGARDING THE VERIFIED GROSS MASS OF A CONTAINER CARRYING CARGO

1 Introduction

1.1 To ensure the safety of the ship, the safety of workers both aboard ships and ashore, the safety of cargo and overall safety at sea, the International Convention for the Safety of Life at Sea (SOLAS), as amended, requires in chapter VI, part A, regulation 2 that packed containers' gross mass are verified prior to stowage aboard ship. The shipper is responsible for the verification of the gross mass of a container carrying cargo (hereinafter "a packed container"). The shipper is also responsible for ensuring that the verified gross mass is communicated in the shipping documents sufficiently in advance to be used by the ship's master or his representative and the terminal representative in the preparation of the ship stowage plan. In the absence of the shipper providing the verified gross mass of the packed container, the container should not be loaded on to the ship unless the master or his representative and the terminal representative have obtained the verified gross mass through other means.

1.2 The purpose of these Guidelines is to establish a common approach for the implementation and enforcement of the SOLAS requirements regarding the verification of the gross mass of packed containers. The Guidelines provide recommendations on how to interpret and apply the provisions of the SOLAS requirements. They also identify issues that may arise from the application of these requirements and provide guidance for how such issues should be resolved. Adherence to these Guidelines will facilitate compliance with the SOLAS requirements by shippers of containerized shipments, and they will assist other parties in international containerized supply chains, including shipping companies and port terminal facilities and their employees, in understanding their respective roles in accomplishing the enhancement of the safe handling, stowage and transport of containers.

2 Definitions

2.1 For the purpose of these Guidelines:

2.1.1 *Administration* means the Government of the State whose flag the ship is entitled to fly.

2.1.2 *Calibrated and certified equipment* means a scale, weighbridge, lifting equipment or any other device, capable of determining the actual gross mass of a packed container or of packages and cargo items, pallets, dunnage and other packing and securing material, that meets the accuracy standards and requirements of the State in which the equipment is being used.

2.1.3 *Cargo items* has the same general meaning as the term "cargo" in the International Convention for Safe Containers, 1972, as amended (hereinafter referred to as "the CSC"), and means any goods, wares, merchandise, liquids, gases, solids and articles of every kind whatsoever carried in containers pursuant to a contract of carriage. However, ship's equipment and ship's supplies[1], including ship's spare parts and stores, carried in containers are not regarded as cargo.

[1] Refer to the *Revised recommendations on the safe transport of dangerous cargoes and related activities in port areas* (MSC.1/Circ.1216).

2.1.4 *Container* has the same meaning as the term "container" in the CSC and means an article of transport equipment:

(a) of a permanent character and accordingly strong enough to be suitable for repeated use;

(b) specially designed to facilitate the transport of goods, by one or more modes of transport, without intermediate reloading;

(c) designed to be secured and/or readily handled, having corner fittings for these purposes; and

(d) of a size such that the area enclosed by the four outer bottom corners is either:

(i) at least 14 m^2 (150 sq. ft.); or

(ii) at least 7 m^2 (75 sq. ft.) if it is fitted with top corner fittings.

2.1.5 *Contract of carriage* means a contract in which a shipping company, against the payment of freight, undertakes to carry goods from one place to another. The contract may take the form of, or be evidenced by a document such as sea waybill, a bill of lading, or multi-modal transport document.

2.1.6 *Gross mass* means the combined mass of a container's tare mass and the masses of all packages and cargo items, including pallets, dunnage and other packing material and securing materials packed into the container (see also *"Verified gross mass"*).

2.1.7 *Package* means one or more cargo items that are tied together, packed, wrapped, boxed or parcelled for transportation. Examples of packages include, but are not limited to, parcels, boxes, packets and cartons.

2.1.8 *Packed container* means a container, as previously defined, loaded ("stuffed" or "filled") with liquids, gases, solids, packages and cargo items, including pallets, dunnage, and other packing material and securing materials.

2.1.9 *Packing material* means any material used or for use with packages and cargo items to prevent damage, including, but not limited to, crates, packing blocks, drums, cases, boxes, barrels, and skids. Excluded from the definition is any material within individual sealed packages to protect the cargo item(s) inside the package.

2.1.10 *Securing material* means all dunnage, lashing and other equipment used to block, brace, and secure packed cargo items in a container.

2.1.11 *Ship* means any vessel to which SOLAS chapter VI applies. Excluded from this definition are roll-on/roll-off (ro-ro) ships engaged on short international voyages[2] where the containers are carried on a chassis or trailer and are loaded and unloaded by being driven on and off such a ship.

2 SOLAS regulation III/2 defines "short international voyage" as an international voyage in the course of which a ship is not more than 200 miles from a port or place in which the passengers and crew could be placed in safety, and which does not exceed 600 miles in length between the last port of call in the country in which the voyage begins and the final port of destination.

2.1.12 *Shipper* means a legal entity or person named on the bill of lading or sea waybill or equivalent multimodal transport document (e.g. "through" bill of lading) as shipper and/or who (or in whose name or on whose behalf) a contract of carriage has been concluded with a shipping company.

2.1.13 *Shipping document* means a document used by the shipper to communicate the verified gross mass of the packed container. This document can be part of the shipping instructions to the shipping company or a separate communication (e.g. a declaration including a weight certificate produced by a weigh station).

2.1.14 *Tare mass* means the mass of an empty container that does not contain any packages, cargo items, pallets, dunnage, or any other packing material or securing material.

2.1.15 *Terminal representative* means a person acting on behalf of a legal entity or person engaged in the business of providing wharfage, dock, stowage, warehouse, or other cargo handling services in connection with a ship.

2.1.16 *Verified gross mass* means the total gross mass of a packed container as obtained by one of the methods described in paragraph 5.1 of these Guidelines. (see also *"gross mass").*

3 Scope of applicability

3.1 The SOLAS requirements to verify the gross mass of a packed container apply to all containers to which the CSC applies, and which are to be stowed onto a ship determined by the Administration to be subject to SOLAS chapter VI.

3.2 For example (but not limited to), a packed container on a chassis or trailer to be driven on a ro-ro ship is subject to the SOLAS requirements, if the ship has been determined by the Administration to be subject to SOLAS chapter VI and is not engaged on short international voyages. However, cargo items tendered by a shipper to the master for packing into a container already on board the ship are not subject to these SOLAS requirements.

3.3 The term container includes tank-containers, flat-racks, bulk containers etc. Also included are containers carried on a chassis or a trailer except when such containers are driven on or off a ro-ro ship engaged in short international voyages (see definition of ship). Excluded from the definition is any type of vehicle[3]. Also excluded from the definition are "offshore containers" to which the CSC, according to the *Guidelines for the approval of offshore containers handled in open seas* (MSC/Circ.860) and the *Revised recommendations on harmonized interpretation and implementation of the International Convention for Safe Containers, 1972, as amended* (CSC.1/Circ.138/Rev.1), does not apply.

4 Main principles

4.1 The responsibility for obtaining and documenting the verified gross mass of a packed container lies with the shipper.

4.2 A container packed with packages and cargo items should not be loaded onto a ship to which the SOLAS regulations apply unless the master or his representative and the terminal representative have obtained, in advance of vessel loading, the verified actual gross mass of the container.

[3] Refer to the *Revised recommendations on harmonized interpretation and implementation of the International Convention for Safe Containers, 1972, as amended* (CSC.1/Circ.138/Rev.1).

5 Methods for obtaining the verified gross mass of a packed container

5.1 The SOLAS regulations prescribe two methods by which the shipper may obtain the verified gross mass of a packed container:

5.1.1 Method No.1: Upon the conclusion of packing and sealing a container, the shipper may weigh, or have arranged that a third party weighs, the packed container.

5.1.2 Method No.2: The shipper (*or, by arrangement of the shipper, a third party*), may weigh all packages and cargo items, including the mass of pallets, dunnage and other packing and securing material to be packed in the container, and add the tare mass of the container to the sum of the single masses using a certified method as described in paragraphs 5.1.2.3 and 5.1.2.3.1. Any third party that has performed some or all of the packing of the container should inform the shipper of the mass of the cargo items and packing and securing material that the party has packed into the container in order to facilitate the shipper's verification of the gross mass of the packed container under Method No.2. As required by SOLAS VI/2 and paragraph 5, the shipper should ensure that the verified gross mass of the container is provided sufficiently in advance of vessel loading. How such information is to be communicated between the shipper and any third party should be agreed between the commercial parties involved.

5.1.2.1 Individual, original sealed packages that have the accurate mass of the packages and cargo items (including any other material such as packing material and refrigerants inside the packages) clearly and permanently marked on their surfaces, do not need to be weighed again when they are packed into the container.

5.1.2.2 Certain types of cargo items (e.g. scrap metal, unbagged grain and other cargo in bulk) do not easily lend themselves to individual weighing of the items to be packed in the container. In such cases, usage of Method No.2 would be inappropriate and impractical, and Method No.1 should be used instead.

5.1.2.3 The method used for weighing the container's contents under Method No.2 is subject to certification and approval as determined by the competent authority of the State in which the packing and sealing of the container was completed.[4]

5.1.2.3.1 How the certification is to be done will be up to the State concerned, and could pertain to either the procedure for the weighing or to the party performing the weighing or both.

5.1.3 If a container is packed by multiple parties or contains cargo from multiple parties, the shipper as defined in paragraph 2.1 is responsible for obtaining and documenting the verified gross mass of the packed container. If the shipper chooses Method No.2 to obtain the verified gross mass, the shipper is then subject to all the conditions given in paragraphs 5.1.2, 5.1.2.1, 5.1.2.2, and 5.1.2.3.

6 Documentation

6.1 The SOLAS regulations require the shipper to verify the gross mass of the packed container using Method No.1 or Method No.2 and to communicate the verified gross mass in a shipping document. This document can be part of the shipping instructions to the shipping company or a separate communication (e.g. a declaration including a weight certificate produced by a weigh station utilizing calibrated and certified equipment on the route between the shipper's origin and the port terminal). In either case, the document should clearly highlight that the gross mass provided is the "verified gross mass" as defined in paragraph 2.1.

[4] Reference to the relevant MSC Circular regarding contact information for the competent authority.

6.2 Irrespective of its form, the document declaring the verified gross mass of the packed container should be signed by a person duly authorized by the shipper. The signature may be an electronic signature or may be replaced by the name in capitals of the person authorized to sign it.

6.3 It is a condition for loading onto a ship to which the SOLAS regulations apply that the verified gross mass of a packed container be provided, preferably by electronic means such as Electronic Data Interchange (EDI) or Electronic Data Processing (EDP), to the ship's master or his representative and to the terminal representative sufficiently in advance of ship loading to be used in the preparation and implementation of the ship stowage plan.

6.3.1 Because the contract of carriage is between the shipper and the shipping company, not between the shipper and the port terminal facility, the shipper may meet its obligation under the SOLAS regulations by submitting the verified gross mass to the shipping company. It is then the responsibility of the shipping company to provide information regarding the verified gross mass of the packed container to the terminal representative in advance of ship loading. Similarly, the shipper may also submit the verified gross mass to the port terminal facility representative upon delivery of the container to the port facility in advance of loading.

6.3.1.1 The master or his representative and the terminal representative should enter into arrangements to ensure the prompt sharing of verified container gross mass information provided by shippers. Existing communication systems may be used for the transmission and sharing of such verified container gross mass information.

6.3.1.2 At the time a packed container is delivered to a port terminal facility, the terminal representative should have been informed by the shipping company whether the shipper has provided the verified gross mass of the packed container and what that gross mass is.

6.3.2 There is no SOLAS prescribed time deadline for the shipper's submission of the verified gross mass other than such information is to be received in time to be used by the master and the terminal representative in the ship stowage plan. The finalization of the ship stowage plan will depend on ship type and size, local port loading procedures, trade lane and other operational factors. It is the responsibility of the shipping company with whom the shipper enters into a contract of carriage to inform the shipper, following prior discussions with the port terminal, of any specific time deadline for submitting the information.

7 Equipment

7.1 The scale, weighbridge, lifting equipment or other devices used to verify the gross mass of the container, in accordance with either Method No.1 or Method No.2 discussed above, should meet the applicable accuracy standards and requirements of the State in which the equipment is being used.

8 Intermodal container movements and transhipments

8.1 The verified gross mass of a packed container should be provided to the next party taking custody of the container.

8.1.1 If a packed container is transported by road, rail or a vessel to which the SOLAS regulations do not apply and delivered to a port terminal facility without its verified gross mass, it may not be loaded onto a ship to which the SOLAS regulations apply unless the master or his representative and the terminal representative have obtained the verified gross mass of the container on behalf of the shipper (see also paragraph 13.1).

8.1.2 If a packed container is delivered to a port terminal facility by a ship to which the SOLAS regulations apply for transhipment onto a ship to which the SOLAS regulations also apply, each container being delivered is required by the SOLAS regulations to have had a verified gross mass before loading onto the delivering ship. All packed containers discharged in the transhipment port should therefore already have a verified gross mass and further weighing in the transhipment port facility is not required. The delivering ship should inform the port terminal facility in the transhipment port of the verified gross mass of each delivered packed container. The master of the ship onto which the transhipped, packed containers are to be loaded and the port terminal facility in the transhipment port may rely on the information provided by the delivering vessel. Existing ship-port communication systems may be used for the provision of such information in agreement between the commercial parties involved.

9 Discrepancies in gross mass

9.1 Any discrepancy between a packed container's gross mass declared prior to the verification of its gross mass and its verified gross mass should be resolved by use of the verified gross mass.

9.2 Any discrepancy between a verified gross mass of a packed container obtained prior to the container's delivery to the port terminal facility and a verified gross mass of that container obtained by that port facility's weighing of the container should be resolved by use of the latter verified gross mass obtained by the port terminal facility.

10 Containers exceeding their maximum gross mass

10.1 SOLAS regulation VI/5 requires that a container not be packed to more than the maximum gross mass indicated on the Safety Approval Plate under the International Convention for Safe Containers (CSC), as amended. A container with a gross mass exceeding its maximum permitted gross mass may not be loaded onto a ship.

11 Containers on road vehicles

11.1 If the verified gross mass of a packed container is obtained by weighing the container while it is on a road vehicle, (e.g. chassis or trailer), the tare mass of the road vehicle (and, where applicable, the tractor) should be subtracted to obtain the verified gross mass of the packed container. The subtraction should reflect the tare mass of the road vehicle (and, where applicable, the tractor) as indicated in their registration documents as issued by the competent authority of the State where these assets are registered. The mass of any fuel in the tank of the tractor should also be subtracted.

11.2 If two packed containers on a road vehicle are to be weighed, their gross mass should be determined by weighing each container separately. Simply dividing the total gross mass of the two containers by two after subtracting the mass of the road vehicle and the tractor, where applicable, would not produce an accurate verified gross mass for each container, and should not be allowed.

12 Empty containers

12.1 Shippers of empty containers and operators of empty containers are encouraged to have practices and arrangements in place to ensure that they are empty. The tare weight will visually appear on the container in accordance with the International Organization for Standardization (ISO) standard for container marking and identification[5]) and should be used.

[5] Refer to standard ISO 6346 – Freight containers – Coding, identification and marking.

13 Contingencies for containers received without a verified gross mass

13.1 Notwithstanding that the shipper is responsible for obtaining and documenting the verified gross mass of a packed container, situations may occur where a packed container is delivered to a port terminal facility without the shipper having provided the required verified gross mass of the container. Such a container should not be loaded onto the ship until its verified gross mass has been obtained. In order to allow the continued efficient onward movement of such containers, the master or his representative and the terminal representative may obtain the verified gross mass of the packed container on behalf of the shipper. This may be done by weighing the packed container in the terminal or elsewhere. The verified gross mass so obtained should be used in the preparation of the ship loading plan. Whether and how to do this should be agreed between the commercial parties, including the apportionment of the costs involved.

14 Master's ultimate decision whether to stow a packed container

14.1 Ultimately, and in conformance with the Code of Safe Practice for Cargo Stowage and Securing[6], the ship's master should accept the cargo on board his ship only if he is satisfied that it can be safely transported. Nothing in the SOLAS regulations limit the principle that the master retains ultimate discretion in deciding whether to accept a packed container for loading onto his ship. Availability to both the terminal representative and to the master or his representative of the verified gross mass of a packed container sufficiently in advance to be used in the ship stowage plan is a prerequisite for the container to be loaded onto a ship to which the SOLAS regulations apply. It does, however, not constitute an entitlement for loading.

15 Enforcement

15.1 Like other SOLAS provisions, the enforcement of the SOLAS requirements regarding the verified gross mass of packed containers falls within the competence and is the responsibility of the SOLAS Contracting Governments. Contracting Governments acting as port States should verify compliance with these SOLAS requirements. Any incidence of non-compliance with the SOLAS requirements is enforceable according to national legislation.

15.2 The ultimate effectiveness and enforcement of the SOLAS container gross mass verification requirement is that a packed container, for which the verified gross mass has not been obtained sufficiently in advance to be used in the ship stowage plan, will be denied loading onto a ship to which the SOLAS regulations apply. Any costs associated with the non-loading, storage, demurrage or eventual return of the container to the tendering shipper of the container should be subject to contractual arrangements between the commercial parties.

16 Effective date of the SOLAS requirements regarding verified gross mass of a container carrying cargo

16.1 The SOLAS requirements regarding verified gross mass of a container carrying cargo (SOLAS regulation VI/2) are expected to enter into force in July 2016.

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[6] Refer to the *Code of Safe Practice for Cargo Stowage and Securing* (resolution A.714(17)) and subsequent amendments.

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MSC.1/Circ.1471
29 May 2014

RECOMMENDATION ON SAFETY MEASURES FOR EXISTING VEHICLE CARRIERS CARRYING MOTOR VEHICLES WITH COMPRESSED HYDROGEN OR NATURAL GAS IN THEIR TANKS FOR THEIR OWN PROPULSION AS CARGO

1 The Maritime Safety Committee, at its ninety-third session (14 to 23 May 2014), in adopting the amendments to SOLAS chapter II-2 to include requirements for vehicle carrier carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo, approved *Recommendations on safety measures for existing vehicle carriers carrying motor vehicles with compressed hydrogen or natural gas in their tanks for their own propulsion as cargo*, as set out in the following paragraphs.

2 The carriage of vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion should be to the satisfaction of the Administration, taking into account SOLAS regulation II-2/20-1 and SP 961 and SP 962 of the IMDG Code, as applicable.

3 The shipper should provide a signed certificate or declaration that the vehicle fuel system, as offered for carriage, has been checked for leak-tightness and the vehicle is in proper condition for carriage prior to loading. In addition, the shipper is to mark, label or placard each vehicle, after it has been checked for leak-tightness and that it is in proper condition for carriage. During loading, the crew should check each vehicle for the shipper's markings.

4 Member States are invited to use the recommendations above on a voluntary basis when approving the carriage of motor vehicles with compressed hydrogen or compressed natural gas in their tanks for their own propulsion as cargo on existing vehicle carriers and bring them to the attention of owners, operators and other parties concerned, as appropriate.

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