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船舶の防火に関する調査研究（**R2**）

（**2005** 年度報告書）

2006 年 **3** 月

財団法人　日本船舶技術研究協会

はしがき

本報告書は、日本財団の平成 17 年度助成事業「船舶関係諸基準に関する調査研究」の一環として、防火プロジェクト（R2）において実施した「船舶の防火に関する調査研究」の成果をとりまとめたものである。

なお、本調査研究は、平成 16 年度末に解散した（社）日本造船研究協会が実施した「船舶の防火に関する調査研究」に引き続き、本会が実施したものである。

防火プロジェクト（R2）ステアリング・グループ　委員名簿（順不同、敬称略）

ﾌﾟﾛｼﾞｪｸﾄ･ﾏﾈｰｼﾞｬｰ		村田　康一（日本海事協会）
委　員		吉田 公一 （海上技術安全研究所）
		太田 進　 （海上技術安全研究所）
		兼清 忠　 （日本海事協会）
		久野 勝秀 （日本舶用品検定協会）
		高野 優一 （日本船主協会）
		平岡 達弘 （日本船舶品質管理協会　製品安全評価センター）
		富沢 茂　 （日本中小造船工業会）
		村上 直　 （日本舶用工業会）
		神山 公雄 （日本旅客船協会）
		内田 成孝 （全国内航タンカー海運組合）
		井崎 宣昭 （日本内航海運組合総連合会）
		火置 将一 （商船三井客船）
		菅　豪　 （郵船エンジニアリング）
		阪口 克典 （アイ・エイチ・アイ マリンユナイテッド）
		吉川 雅洋 （ユニバーサル造船）
		原田 秀利 （三菱重工業）
		倉持 貴好 （住友重機械マリンエンジニアリング）
		濱　匡　 （カシワテック）
		吉川 昭光 （ヤマトプロテック）
		菊池 幸弘 （能美防災）
		高松 正徳 （関東運輸局）
	関係官庁	児玉 敦文 （国土交通省海事局安全基準課）
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		前中 浩　 （日本船舶技術研究協会）
		長谷川 幸生（日本船舶技術研究協会）
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1.　はじめに

本年度は、IMO における防火に係わる問題として、我が国から IMO に提案した FTP コードの総合見直しを含め、消火装置等の火災安全システムの性能試験、旅客船の安全、新及び既存旅客船に関する避難解析、承認基準の調和に関する検討、IACS 統一解釈等の審議が行われた。

本部会としては、上記のような IMO の動きに合わせた対応として、特に、FTP コードの総合見直しに対する我が国の検討方針を検討し、見直しのための資料及び FTP コード改正案等に関する提案文書を作成し、FP50 へ提出した。一方、消火装置等の火災安全システムの性能試験及び承認基準の調和に関し、我が国から提案した、発泡器を保護区域に有する高膨張泡消火装置の承認基準案等の IMO/FP/CG での審議について検討を行い、CG 及び FP 対応を行った。また、IACS 統一解釈等の検討も併せて行い、FP50 対応に関する審議を行い、その対応につき、国土交通省へ意見を具申した。

また、仏籍ケミカルタンカーChassiron 号の事故を契機として欧州で行われている Inter-Industry Working Group（IIWG）での審議結果の報告及び今後の検討方針についても審議が行われた。

2.　部会活動の概要

2.1.　概要

本年度、本部会は 4 回の会議を開催し、IMO/CG への対応を検討するとともに、MSC80 及び FP50 の関連文書の問題点及び各国の意見、提案について検討を行い、国土交通省海事局に本部会の意見を具申した。

また、我が国から新規作業項目として MSC80 へ提案した「FTP コードの総合見直し」に関する審議のため、関係者による 4 回のワーキング・グループ会議を行い、検討方針、検討課題等の決定及び FTP コード改正案の作成を行い、それを基に FP50 への提案文書を作成した。併せて、関連試験を行い、それを基にした提案文書を FP50 への INF.ペーパーとして作成した。

さらに、FP50 での審議結果を基に、次年度の作業方針についても審議を行った。

2.2.　会議議事概要

主な審議内容は下記の通り。

2.2.1　ステアリング・グループ会議

2.2.1.1　第 1 回会議（非公式）（2005 年 6 月 3 日）

（1）MSC80 の報告

5 月に開催された MSC80 の審議結果の報告が行われ、今年度 R2 で検討する必要のある項目について審議が行われた。

（2）IMO/ Passenger Ship Safety の CG 対応

CG の経緯報告が行われた。

（3）IMO/FP/CG 対応

CG で行われている審議内容の報告と対応の検討を行った。

（4）平成 17 年度 R2 事業計画について

「FTP コードの総合見直し」と「2005 年度 R2 事業計画」についての説明及び内容の検討を行った。

FTP コードの総合見直しに関しては、WG で検討を行うことが合意され、事業計画は計画通り承認された。

2.2.1.2　第 2 回会議（2005 年 9 月 6 日）

（1）IMO/FP/CG 対応

FP50 対応として、「火災安全システムの性能基準及び承認基準」、「旅客船の安全について」及び「新及び既存旅客船の避難解析に関する勧告について」の CG での審議経過の報告及び対応について審議が行われた。

（2）FP50 対応

CG 対応以外の議題（IACS の統一解釈、火災事故記録の解析等）に関する検討が行われた。

（3）FTP コードの総合見直し

WG での検討結果の報告と審議が行われた。

（4）その他

資料「Gas measurement system for the FTP Code Part2」等について検討が行われた。

2.2.1.3　第 3 回会議（2005 年 12 月 13 日）

（1）FP50 対応

FP50 の提案文書に対する対処方針案について検討した。

（2）ケミカルタンカー等への IGS 設置について

仏籍ケミカルタンカーChassiron 号の事故を契機として欧州で行われている Inter-Industry Working Group（IIWG）での審議結果の報告が行われ、今後の検討方針が審議された。

2.2.1.4　第 4 回会議（2006 年 1 月 24 日）

（1）FP50 報告

FP50 の審議結果についての報告を行った。

（2）FP51 対応

FP50 での審議結果を基に、次年度行うべき FP51 対応について検討が行われた。

（3）報告書案

本年度の報告書目次案及び一部内容について検討し、了承された。

2.2.2　ワーキング・グループ会議

2.2.2.1　第 1 回会議（2005 年 6 月 27 日）

FTP コード見直しの検討方針、FTP コード改正案、今後の検討課題とすべき項目の提案等の審議が行われた。

2.2.2.2　第 2 回会議（2005 年 7 月 28 日）

FTP コード総合見直しに関する FP50 への提案文書に関する審議が行われた。

2.2.2.3　第 3 回会議（2005 年 8 月 22 日)

FTP コード総合見直しに関する FP50 への提案文書に関する詳細審議が行われた。

2.2.2.4　第 4 回会議（2005 年 11 月 7 日）

（1）SOLAS 規則 II-2/19 の改正提案に関する MSC81 への提案文書に関する審議が行われた。

（2）FP50 対応に関する審議が行われ、各議題の取り纏め担当者を決定した。

（3）「FTP コード総合見直し」に関する今後の作業スケジュールについて検討が行われた。

3.　防火に関するIMOの動向

3.1　MSC80 における防火に関する事項

3.1.1　強制要件の改正の検討及び採択（議題 3 関連）

以下に示す強制要件について MSC は、我が国の吉田公一氏（独立行政法人海上技術安全研究所）を議長とするドラフティング・グループ（DG）を設置し、そこでの検討を経て作成された改正案を採択した。

3.1.1.1　旧 SOLAS/II-2 章第 15 規則の改正と MSC/Circ

MSC63 が採択した旧 SOLAS/II-2 章第 15 規則の修正についての FP からの要請については、DG が一部修正を加えたものを MSC は承認した。この SOLAS 改正は次回 MSC81 にて採択される予定である。また、この修正が必要であることを通知する MSC/Circ を早急に回章することに合意した。

3.1.2　FP からの報告（議題 12 関連）

3.1.2.1　同等火災安全設備の証書への記載

ノルウェーは MSC80/12/1 により、同等火災安全設備を承認した場合にはそれを適当な証書に記載する旨の規定が MSC/Circ.1002 にある一方、証書にはそれを記載する場所が無いことを指摘し、MSC/Circ.1002 からそのような規定を削除することを提案した。プレナリーはこれに合意し、MSC/Circ.1002 から当該規定を削除する修正 MSC/Circ を出すこととなった。

これに関連して、SOLAS の他の章においても同等設備の規定を作成することが long term の作業として旅客船の安全性において検討されていることに鑑み、SOLAS に規定されている設備の設置が承認された同等安全設備によって置き替えられる場合の証書の書き振りについて FSI に検討を指示した。本件は、船技協の対応委員会（R2）にて検討を進める必要がある。

3.1.2.2　SOLAS/II-2/19.2.4.2.5 の解釈

IACS が MSC80/12/2 によって提示した同規則に関する解釈（タンカーの居住区構造であって貨物区域に面する部分を A60 防火構造とする件）については、FP50 へ審議を指示した。また、その審議の帰結として SOLAS 同規則の改正が必要な場合には、委員会ガイドラインに従って Justification を添えて MSC81 へ提出するよう指示した。

3.1.2.3　SOLAS/II-2 章 旧 15.2.10 及び 15.2.11 規則の間違い

同規則の修正について FP49 は rectification を示唆したが、MSC80 は将来の改正で対処する方向を選んだ。また、そのような修正が必要であり将来改正されることを事前に示す MSC/Circular を承認した（これらは議題 3 のもとに DG にて作成された）。

3.1.2.4　その他の FP49 小委員会の報告（MSC80/12）

その他の FP49 からの報告事項は、特段の変更なく承認された。

3.1.3　作業計画（議題 21 関連）

3.1.3.1　新規作業計画；火災再試験方法コードの見直し

SOLAS/II-2 章の下で強制要件となっている火災試験方法コード（FTP Code）を見直すべき旨のわが国提案は、伊、英、蘭、フィンランドら多くの支持を受け、FP 小委員会の作業に取り入れること、及び FP50 の議題に含めることに MSC は合意した。また我が国に対し、FP50 における検討を推進するため、同コード改正案を 13 週前文書として提出するように要望した。従って、この要望を受けて FP50 に同コード改正案を提出する必要がある。

3.1.3.2　FP 小委員会の作業計画及び仮議題（MSC80/21、Add.1、Add.2、WP.14）

2006 年に限り、救命設備関係の作業を DE から FP へ移管した。

また、新作業項目として「FTP コードの見直し（2008 年完了）」を追加し、FP50 の仮議題を承認した。

3.1.4　その他の議題（議題 23 関連）

3.1.4.1　SOLAS II-2/19 に規定される個品危険物への適用（MSC80/23/3）

我が国から、標記規則の 19.3 表において副次危険性や複数の危険性を有する危険物のクラスの分類方法に問題があり、また、防爆型の機械式通風装置の要件の適用にも同様の問題があることを指摘したところ、SOLAS/II-2/19 規則、同様の HSC Code 規則及び関連コードの改正について正式な新作業項目提案を MSC81 に提出するよう、MSC は我が国に要請した。なお、伊は HSC Code にも SOLAS/II-2/19.3 表と同じ表があるため、これも見直しの必要があることを示唆した。従って、MSC81 に向けて適切な新作業を提案する必要がある。

3.2　FP50 への対応と同会合における審議

3.2.1　FP50 における審議

2006 年 1 月 9 日から 13 日まで、IMO 本部で行われた FP50 の主な審議内容は下記の通り。

なお、会議は、、58 ヶ国、1 アソシエイト、10 団体が参加し、議長はクビシーノ氏（アルゼンチン）、副議長はアバテ氏（伊）により行われた。本部会に関する主な審議結果は下記の通り。

3.2.1.1　他の IMO の機関の決定（議題 2 関連）

各機関の本会合の各議題に関わる決定事項については、特段問題となる審議はなかった。なお、FP50 の提案文書提出期限に間に合わなかったが、仏から訓練当直基準小委員会（STW）に提出したケミカルタンカーの爆発事故に関する Industry WG の報告（STW37/11）を議題 12 に提案文書として追加したいとの申し出があり、受け入れられた。

3.2.1.2　旅客船の安全性（議題 3 関連）

（1）プレナリーでの審議（WG 設置前）

事務局が MSC80 の結果を報告した後、コレスポンデンス・グループ（CG）のレポートをコーディネーターを勤めた独が報告した。これらに基づき、“On board safety centre”、“Safe area”等項目ごとに議論した。我が国は、船上安全センターは船内に新たな設置場所を必要とするため新船適用に限定すべきであること、設置要件が一部重複している船上安全センターと既に設置の義務付けがある『継続的に人員が配置されている中央制御場所』との関係の明確化が必要なこと、“safe return to port”は旅客船が自ら推進しない場合も検討対象となっていること、提案されている SOLAS 第 II-2 章の第 21 規則（“safe return to port”等を規定）案に適当な目的が記載されるべきであること等を指摘した。結果、プレナリー（本会議）は、創設する規則は新造船舶に適用し、現存船へは適用しないことに合意し、また我が方の他各国からの指摘も踏まえ、作業部会（WG）を設置して以下の検討項目を指示した。

（イ）船上安全センターに関する SOLAS 第 II-2 章の改正案の最終化

（ロ）固定火災探知警報装置に関する SOLAS 第 II-2 章及び FSS コードの改正案の最終化

（ハ）適当な適用規定を含む、“safe return to port”、“safe areas”、必要な設備に関する SOLAS 第 II-2 章の改定案の最終化

（ニ）“time for orderly evacuation and abandonment”に関する SOLAS 第 II-2 章の改正案の検討

（ホ）その他、旅客船における火災の防止に関する SOLAS 第 II-2 章の改正案の検討

（2）WG での審議

（イ）“On board safety centre”に関する SOLAS 第 II-2 章の改正案の最終化

当該規則は新船へ適用するという本会議の合意を受けて、その旨を SOLAS 内の他の規定例を参考に「適用」項目に記載することとなった。

改正案に記載する“500 総トン”について、WG は適用船の検討を、トン数、乗客数等の面から行った。何らかの適当なデータに基づく設定が必要との意見も出たが、国際航海を前提とする船舶への要件であり、かつ、新船適用とするため、本要件をすべての SOLAS 条約適用の旅客船へ適用することとしても当該旅客船に重大な設計上の問題を生じさせることは無いとの結論に達し、船舶の大きさによる適用の制限は設けないこととなった。

制御／操作／モニターされるべき安全設備について、本要件は新たな設備の設置を要求するものではないこと、また、Ro-Ro 船に限定されている設備もリストの中に含む形にするため“適当に”という用語を規定中に用いること等を確認し後、重複していると思われる項目の削除、“On board safety centre”から制御／操作／モニターされる必要がないと考えられるものの削除等の見直しを行った。また、“継続的に人員が配置されている中央制御場所”とこの新たな要件である“船上安全センター”との関係について、“On board safety centre”が“継続的に人員が配置される中央制御場所”の要件を満たす場合には、“On board safety centre”は“継続的に人員が配置される中央制御場所”を兼ねることが出来ることを確認した（ただし、本件にてついては WG の報告書へは記載されなかったため、今後、再度、検討される可能性がある。）。

これらを踏まえ、改正案の最終化を行った（SOLAS 第 II-2 章　第 3 規則改正案、新第 22 規則案）。

（ロ）固定火災探知警報装置に関する SOLAS 第 II-2 章及び FSS コードの改正案の最終化

旅客船の固定式火災探知警報装置を個別に識別可能とすること、居室の設置場所において探知器の警報音が発生することについて、CG レポートへの若干の編集上の修正を行い、改正案を最終化した（SOLAS 第 II-2 章　第 7 規則改正案、新第 21 規則案、FSS コード第 9 章改正案）。

（ハ）“safe return to port”、“Safe area”、必要な設備に関する SOLAS 第 II-2 章の改定案の最終化

現状の案に対し、適用、目的を追加することとなった。具体的には、適用について、この小委員会では船舶が自力により“safe return to port”する場合のみを対象とする（曳航される場合は考慮しない（SLF における検討との位置付け））こと、長距離の国際航海の船舶が対象であること、当該旅客船が火災発生時に生き残れること等であることを確認し、この前提に基づき、“短国際航海（short international voyage）を除く国際航海で、かつ、主垂直区域（MVZ）を 4 区画以上（more than three）有する旅客船”に本改正案を適用することとなった。

また、目的は、これまでの議論を踏まえ、“The purpose of this regulation is to establish the condition at, and the arrangement for, the ship’s safe return to port after a causality that does not exceed the causality threshold stipulated in the context of a fire.”ということで合意した。

“safe return to port”のために必要な設備として推進機関を掲げているが、1 推進機関のみを有する旅客船においては火災発生時にこの要件を達成することが困難と考えられたため、その趣旨の明確化を図ったところ、区分された 2 推進機関以上を有する旅客船を前提としていることを確認した。その他、必要な設備のリストについては、重複していると考えられるものの削除等を行った（ただし、本件については、報告書へは記載されなかったため、今後、再度検討される可能性がある。）。

“Safe area”について、SLF により作成された定義との一体化を図った。また、“Safe area”に必要な設備について、定義と重複するため“rest facilities”を削除した。

これらを踏まえ、改正案を最終化した（SOLAS 第 II-2 章　第 3 規則改正案、第 8 規則 2 の改正案、新第 21 規則案）。

（ニ）“time for orderly evacuation and abandonment”に関する SOLAS 第 II-2 章の改正案の検討

どのような状況において退船を必要とすることとなるかをシナリオベースで明確化することについて、これまでの CG での検討に引き続き議論したが、現在の技術では直ちに結論を出すのは困難であるとの認識に達した。このため、専門家判断により、火災の閾値を超えた場合にも使用可能となる設備の規定を設けるべきか、将来の課題として新たなタスクを設定し検討を継続することを小委員会に提案することにするか等について議論した。結果、安全に脱出可能を行う場合に必要な設備の設定を行い、また、新作業計画案も提案することとなった。

具体的には、1 つの主垂直区域が完全に使用不可能となった場合においても安全に脱出可能となることを支援する設備のリストを作成した。また、新たな作業計画の案として“火災リスク分析の適用のためのクライテリアの開発”を小委員会に提案することとなった。

これらを踏まえ、改正案を作成した（SOLAS 第 II-2 章　新第 21 規則案）。

（ホ）旅客船における火災の防止に関する SOLAS 第 II-2 章の改正案の検討

旅客船に関する火災防止規定の見直しを行い、具体的には、以下の項目の改正案を作成した。

（a）4 層以上の吹き抜け公室を有するアトリウムを考慮した防火の見直し（SOLAS 第 II-2 章　第 9 規則改正案）

（b）売店（sales shops）の火災危険範疇の見直し（SOLAS 第 II-2 章　第 9 規則改正案）

（c）公共室から階段囲壁への直接連絡の見直し（SOLAS 第 II-2 章　第 13 規則改正案）
（d）主洗濯区域からの排気ダクトの取り扱い（SOLAS 第 II-2 章　第 9 規則改正案）
（e）オープンデッキに設置される調理用設備としてのレンジの取り扱い（SOLAS 第 II-2 章　第 9 規則改正案、第 10 規則改正案）

（3）プレナリーでの審議（WG 後）

WG にも出席していたが、独、ノルウェー、米、英らは改正案に対する多くの修正意見を提出し、また短国際航海船への SOLAS/II-2/21 基礎の適用除外について態度留保も表明した。我が国は、適用に関して、新第 22 章規則案の適用においても新第 22 規則案のように短国際航海に限定すべきこと、各小委員会からの報告を総合的に MSC において検討し、必要に応じ、再度、小委員会において検討をすべきことを指摘した。

これらのコメントを付し、船上安全センターに関する SOLAS 第 II-2 章の改正案、固定火災探知警報装置に関する SOLAS 第 II-2 章及び FSS コードの改正案、“safe return to port”、“safe areas”、必要な設備に関する SOLAS 第 II-2 章の改定案、“time for orderly evacuation and abandonment”に関する SOLAS 第 II-2 章の改正案、旅客船における火災の防止に関する SOLAS 第 II-2 章の改正案等を、MSC81 に提出することに本会議は合意した。

なお、本議題（旅客船の安全性）は以上の結果を MSC81 へ報告し、今回で防火小委員会での審議は終了することとなる。他の小委員会（復原性・満載喫水線・漁船安全小委員会（SLF）、設計設備小委員会（DE）、COMSAR 等）もそれぞれの専門性の観点から同時並行で旅客船の安全性の審議を進めており、これら小委員会がそれぞれ提出する改正案等の間の整合性に十分注意を要すると考えられるので、本件における MSC への対応については、この点に留意する必要がある。

3.2.1.3　火災安全設備のための性能試験及び承認基準（議題 4 関連）

（1）プレナリーでの審議（WG 設置前）

コーディネーターである米が統一解釈に関する CG の成果を報告した（FP50/4）。議長より WG での付帯事項の確認及び IACS が提案した統一解釈（UI）の SC198 と SC200（FP50/11/5）は本議題に関連するため、これも合わせて WG が検討するよう指示があった。なお、固定式加圧水噴霧消火装置の基準案に関しては、我が国は、非強制の MSC/Circ.1165 を強制コードである FSS コードで強制化することは問題があるため、字句の修正があることを指摘した。また、固定式 CO_2 消火装置の保守に関する指針案に関しては、我が国及び ICS が保守間隔は IMO 決議 A.948 に合わせて行うべきとの指摘したところ、イランから支持があった。なお、CO_2 消火装置の使用禁止に関する事項に関しては、英は、消火用の CO_2 は大気中の CO_2 を圧縮したものであって、放出しても大気へ影響はないこと、従って環境影響は使用禁止の理由にはならないことが表明し、ICS がこれを支持した。

独提案（FP50/4/1）に関しては、中及び英より支持があったが、我が国が、CO_2 の放出時間は、船種及び貨物倉の積載状等により変える必要があるため一つの基準を決めることは難しいと指摘したところ、ICS が我が方を支持した。議長は、我が国の指摘を基に WG で検討を行うよう指示した。

自動スプリンクラー装置の同等手段として持ち運び消火器を設置する旨の SLS14Circ に関す

る独の問題提起 FP50/4/2 に関し、我が国は持ち運び消火器は自動起動のスプリンクラーと同等とは考えられないため、当該 SLS14Circ の内容は支持できないと発言したところ、技術的には多くの国が支持した。一方、当該 SLS14Circ はポーランドから IMO への情報を IMO が回章したものであって、内容の是非を判定することは FP には課されていないという指摘があった。審議の結果、関係国である独とポーランドで相互に解決すべきとの結論となった。

中（FP50/4/3）、フィンランド及びスウェーデン（FP50/4/4）提案は特段の審議は行われず、WG にて検討することとなった。

（2）WG での審議

（イ）コレスポンディンスグループ（CG）の報告（FP50/4）（米）

（a）固定式 CO_2 消火装置の検査及び保守に関する指針案（FP50/4 Annex 1）

プレナリーの決定に従い、検査間隔に関しては、旅客船は少なくとも 2 年毎、貨物船は中間検査及び定期検査毎とし、[ ] を削除することで合意した。また、添付の Service chart は参考であることを明確にするよう語句を修正し、合わせて検査項目を現状に合うよう修正した。更に、起動装置の保守に関しては、1994 年 10 月 1 日以前の船舶は起動のための 2 つの独立した制御装置が要求されていないことを考慮した記述に修正した。本件はプレナリーで検討することに合意した。なお、改正案では、CO_2 ボトルの内容物の確認、CO_2 ラインのエアブロー等は責任のある乗組員が行えることになっているが、一部の国はこれらも訓練された専門家が行うべきとの見解を表明した。しかし本件を検討することは WG の付託事項にないため、小委員会に判断を委ねることとした。

（b）MSC/Circ.848 の改正提案（FP50/4 Annex 2）

WG は、CG で作成された案を基に作成された改正案に合意した。なお、許容毒性基準に関しては、多くの国が FP48 の合意基準を支持したため、関連箇所を FP48/WP.4/Rev.1 のものに置き替えた。

（c）IMO 決議 A.800（19）の改正（FP50/4 Annex 3）

CG での検討結果及び FP50/4/4 を基に検討を行い、改正案を作成した。本件に関し、Well ventilated fire test hall を明確にするため、6.1.3 として“Verification of ventilation conditions”を新たに作成した。更に、当該装置の動力、制御装置が故障した場合の自動起動能力の減少に関し検討を行い、50%を超える減少を起こさないことを要求することに合意した。また、アトリウムのノズルに関しては、設置高さが高いため、天井にはノズルを設置しても効果がないことから要求しないことに合意した。我が国は、試験室の温度基準の変更（20±5℃）の理由（温度の幅が少ないほうが再現性がある。）と Standing water の程度（Dry である必要なし。）について確認した。

（d）高膨張泡消火装置の承認指針案（FP50/4 Annex 4）

WG は、CG に送られたスウェーデン、ノルウェー、米のコメント及び我が国の回答について個別に検討したが、合意に至らず、FP51 での合意に向け、再度 CG で検討することになった。なお、スウェーデンが提案していた小区画での火災試験は、MSC/Circ.670 に代わり、本装置用の泡原液試験基準として検討することとなった。部品の検査基準としてスウェーデンが提案していた EN13565-1 適用に関しては、関連内容をスウェーデンが抜き出し CG で検討することとなった。本件に対するコメント及び対応は別添 3.1 を参照されたい。

（e）FSS コード 7 章改正（FP50/4 Annex 5）

WG は、CG で作成された 2 つの案のうち Water Mist Nozzle の承認基準（MSC/Circ.1165）を使用すること（Option 1）に合意した。

（f）FSS コード 4 章改正（FP50/4 Annex 6）

WG は特段の意見もなく、CG が作成した案に合意した。

（g）固定式エアロゾール消火装置の承認に関する指針（MSC/Circ.1007）の改正提案（FP50/4 Annex 7）

Circular の条項を SOLAS 2000 年改正に合わせたものにする作業の中で、必要エアロゾール濃度の確立のための標準手法の決定、発生器の設置場所の要件等、改善する必要がある要件が多くあったため、再度 CG で検討することになった。

（h）固定式水系局所消火装置の承認に関する指針（MSC/Circ.913）の改正提案（FP50/4 Annex 8）

自動起動用の火災探知装置として炎式とその他の探知器を使用すること、及び DG のように 2 台以上ある機関を保護する場合は少なくとも 2 つ以上の保護場所とする必要があること（IACS/UI SC198）に WG は合意した。

（i）Ro-Ro 区域と特殊分類区域用固定式加圧水噴霧消火装置と固定式水ミスト消火装置

フィンランド、ノルウェー、スウェーデンが行った本件に関するプレゼンテーションを基に、各国の意見交換が行われ、詳細な検討は CG で行うことに合意した。

（ロ）人が立ち入る区画の CO_2 消火装置の使用

時間の都合上、審議は行われなかった。

（ハ）関連提案（FP50/4/1（独）、FP50/4/3（中）、FP50/4/4（フィンランド及びスウェーデン））

FP50/4/4 に関しては、関連改正案検討時に合わせて審議した。火災試験室や試験準備の要件等の必要と思われる要件を決議 A.800（19）の改正案に取り入れたが、一部の提案は更なる検討が必要と WG は認識し、CG で検討することとなった。その他の提案文書は、時間の都合上、特段の審議は行われず、CG で検討することとなった。

（ニ）作業計画

今次会合までの作業の進捗を考慮し、新たな作業計画を作成した。

（ホ）CG の設立

WG は今回の検討結果を考慮し、以下の付託事項とする CG の必要性を確認した。

（a）固定式エアロゾール消火装置の承認のための指針の改正案の検討

（b）高膨張泡消火装置の承認のための指針案の検討

（c）車両区域、Ro-Ro 区域及び特殊分類区域用固定式水ミスト及び固定式加圧水噴霧消火装置に関する関連改正案の作成

（d）FP50/4/1 を考慮した中期検討課題（貨物区域の消火装置、火災探知装置等）の検討の開始

（e）報告書の FP51 への提出

（3）プレナリーでの審議（WG 後）

（イ）今回合意された下記の改正案のうち、FSS コードに関する改正案は承認ため MSC81 に送付し、その他の技術基準に関する改正案は、FP51 の最終報告書にまとめ、将来、承認のための総合的な MSC に含めることに本会議は合意した。

・the proposed amendments to chapters 4, 6 and 7 of the FSS Code

・the amendments to the Revised Guidelines for approval of sprinkler systems equivalent to that referred to in SOLAS regulation II-2/12 (resolution A.800(19))

・the proposed amendments to the Revised Guidelines for the approval of equivalent fixed gas fire-extinguishing systems, as referred to in SOLAS 74, for machinery spaces and cargo pump-rooms (MSC/Circ.848)

・the draft guidelines for maintenance and inspections of fixed CO2 systems

・the proposed amendments to the Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces (MSC/Circ.913)

（ロ）MSC/Circ.848 の改正提案（FP50/WP.2 Annex 3）

特段の反対もなく合意したが、英より、今回合意した許容毒性基準は、固定式エアロゾール消火装置の改正案検討時にも調和して検討することを CG の付託事項に追加するよう提案があり、本会議はこれに合意した。

（ハ）固定式 CO_2 消火装置の検査及び保守に関する指針案（FP50/WP.2 Annex 4）

ノルウェーは、CO_2 ラインのエアブロー等の装置の保守は訓練された専門家が行うべきと再度指摘したが、英の提案した日常の保守は訓練された乗組員でもよいとの見解が大方の支持を得た。装置の起動のための 2 つの独立した制御装置に関する要件の 1994 年以前設置の装置への遡及適用に関しては意見が分かれたため、米が CG で検討することを提案し、多数がこれを支持したため CG の付託事項に追加することとなった。本件に関し、我が国は、Industry の負担も考慮して検討する必要があることを指摘した。

（ニ）その他の改正案（FP49/WP.2 Annex 1、2 及び 5）及び作業計画（FP50/WP.2 Annex 6）

その他の改正案及び作業計画は関しては特段の反対もなく、本会議はこれらを承認した。デンマークは、Class III の機関室用水ミスト消火装置の検討を早急に開始するよう提案し、特段の反対意見がなかったため、CG に新たに付託事項として追加することとなった。

（ホ）CG の設立

上記の追加の付託事項を追加し、米をコーディネーターとする CG を再設置し、検討を進めることに合意した。

3.2.1.4　新造旅客船及び現存旅客船の避難解析に関する報告（議題 5 関連）

我が国がコーディネーターとして CG の結果を報告（FP50/5/1）した。独が提案（FP50/5）を説明した。プレナリーは初日に、本件についてドラフティング・グループ（DG）を設置するか否かが審議し、複数の国がこのための専門家を参加させている旨指摘し、DG を設置することとなった。また、提案文書の審議においては、内容を逐一プレナリーで審議するか、DG に検討を委ねるか等の審議の方法について議論され、結局、WG では無い DG ではあるものの、詳細な審議を委ねることとなり、我が国太田氏を議長とする DG を設置した。

DG は、詳細解析（Advanced Analysis）から安全余裕（600 秒）を削除し、代わりに詳細解析と簡易解析（Simplified Analysis）の両方に安全率を導入すること等に合意し、暫定避難解析指針（MSC/Circ.1033）の改正案を作成した。一方、避難開始時間（Response Time）の分布については、実験結果（実験は実施済み）に基づき決定すべき、即ち、今次会合で結論すべきではないとの意見が

DG 内で支持された。DG は CG への付託事項案を作成した。

プレナリーは審議の結果、DG の報告の通り CG を設置し、改正避難解析指針案を作成するすることを指示することに合意し、我が国太田氏がコーディネーターを引き受けた。

3.2.1.5　ガス燃料船の要件の策定（議題 6 関連）

ノルウェーは、本件に関するばら積み液体及びガス小委員会（BLG）の CG が総括的な指針案作成の報告を昨年末に提出した（BLG/10/6）ことを報告し、防火小委員会（FP）としては BLG10 の動向を見て次回 FP51 で詳細審議することを提案した。ギリシャ、英、韓がこれを支持した。プレナリーでは、この提案に従って、本件を FP51 で審議すること、事務局に BLG10 の結果を FP51 へ報告するよう要請すること、各メンバーは BLG10 の審議結果を考慮して FP51 へ提案・意見を提出するよう要請することに合意した。

3.2.1.6　機関室の貨物ポンプ室の防火対策（議題 7 関連）

機関室の火災防止、特に発火防止の指針を作成すべきという韓からの新作業提案は MSC80 が承認し、FP50 から作業を開始することとなっている。

韓は、FP49 に提出した文書（FP49/16、FP49/16/4、FP49/INF6）に基づいて提案した作業内容を説明し、この作業を推進するために CG を設置することを提案した。独、英、ノルウェーがこの提案に賛成した。プレナリーは CG 設置に合意した。

我が方は、CG 設置に賛成するとともに、CG の作業は、（1）まずそのような指針の作成が可能か、妥当か検討し、（2）その答えが「是」であれば、指針案を検討して FP51 へ報告することを提案した。日、韓及び事務局の DG で CG の作業項目案を作成した。プレナリーはこれを承認した。日本は当 CG への参加を表明した。

3.2.1.7　SPS コードの見直し（議題 8 関連）

事務局文書 FP50/8 を審議した。独は、改正 SPS コード案の 1.2 及び 1.3 が引用している SOLAS 条約が 1983 年改正までに止まっているため、これを最新の SOLAS にするよう提案し、プレナリーはこの提案に合意した。この合意に上に立って、プレナリーは FP50/8 の ANNEX に合意した。米は、SPS コードの適用が不適切に広がっている（商業ベースの訓練船は、ほとんど旅客船に近い）ことに懸念を表明した。

3.2.1.8　防火戸の性能基準に関する決議 A.754（18）の改正（議題 9 関連）

「A 級防火扉の扉下部最大隙間には現行の 6mm を適用し、その他の防火扉には 25mm でも可とする」日本提案の審議の前に、本件については「FP49 が修正案検討し、FP49/WP7 に報告していること、またターゲットデートは、2006 年であること」を、議長が説明した。

審議においては、我が国提案について、仏は、Door 下部の隙間については A-class Door の実船での施工ではドア枠とドアの間に床材を施工することがあり、6mm では小さ過ぎると指摘した。中及び英は、B-class Door の 25mm の隙間は大き過ぎるので日本提案に反対を表明した。また英は、Gas-tight door はケミカルガスタンカーに使用するもので、防火目的でない旨説明した。

米も日本提案に反対を表明して仏案を支持し、FP49/WP7 の改定案（A 級及び B 級については、扉下部最大隙間 12mm（12mm の隙間ゲージを使用し、許容値は 150mm 移動まで）とし、コットン試験

を要求する。）を基に、CG で協議することを提案した。
　これらを受け、仏、アルゼンチン、デンマークも同様に本件を CG で検討することを支持した結果、本議題は、FTP コードの総合見直しの中で検討することに本会議は合意し、さらに CG にて引き続き検討することに合意した。従って、本件は FP の議題から削除することとなった。

3.2.1.9　FTP コードの総合的見直し（議題 10 関連）
　本件の審議において、各国提案の説明の前に、「FP49 において、シール材及び樹脂材についての試験方法についての仏提案（FP49/6）については、FTP コードの総合見直しの新作業提案が MSC に提案されており、その新作業提案が承認された場合は当該仏提案を FTP コードの総合見直しの中で検討すること。」と合意されている旨議長が説明し、本件仏提案は、FTP コード見直しの中で審議することになった。
　続いて、我が方は FTP コードの総合的見直しの提案（FP50/10/1 から FP50/10/4、及び FP50/INF.5）を説明し、本件に関する CG の設置を提案した。引き続き、ノルウェー、フランス、米が各々の提案文書を説明した。
　スウェーデン、中、英，露、デンマーク、米、独、仏、韓、及びフィンランドが、我が国の提案及び米提案（日本を支持し、また火災試験規格そのものを FTP コードに取込み、単一文書として判りやすくすること、及び Part 5 と Part 6 を合体する提案）に賛成し、CG への参加を表明した。スウェーデンは、ISO834-1 の試験炉の制御、特に炉内温度制御のため Plate thermometer を FTP コードの Part 3 に取り入れることを提案した。
　独は、FTP コードが引用している ISO 規格については、その取入れを慎重に検討することも重要であると述べた。デンマークは、できるだけ最新の ISO 規格を取り入れるべきであると述べた。
　我が方はこれらのコメントを受けて、FTP コードが引用している ISO 規格を作成・改正している ISO/TC92（火災安全）と親密な連携を取る必要があることを指摘し、プレナリーはこれに合意した。
　露は、本件について FP51 から WG を設置すべきである旨主張した。この件は、FP の将来作業項目の議題において検討することとなった。
　ノルウェーの「総会決議 A.753：プラスチックパイプの使用に関する指針を改正して、フレキシブル・パイプも対象とする」旨の提案に関して、英は、当該指針は固形（rigid）のパイプが鋼及び金属製パイプと同等であることを認める指針であるとして、反対した。本件は、A.753（18）も FTP コードに入れ込むべきかという検討を含め、FTP コード見直しの CG で検討することにプレナリーは合意した。
　これを受け、議長が
　（1）FTP コードの総合的見直しについて我が国の提案に基づいて進めること、
　（2）FTP コードの総合的見直しに関する CG の設立、
　（3）FP51 において FTP コードの総合的見直し WG 設置すること
を提案し、プレナリーはこれに合意した。FTP コードの総合的見直しに関する CG のコーディネーターは日本が引き受けることで合意し、以下の付託事項（TOR）を承認した。
　＜TOR＞
（1）FP50 議題 10 に提出された文書及び各国からのコメントを考慮して、関連する試験規格を取り入れて FTP コード単体で使用できて使いやすくする方向で、New FTP コード案を作成すること。

（2）関連する ISO 規格について、ISO/TC92 と連携し、スウェーデン及び独の意見を苦慮して、FTP コードへの取り込みを検討すること。
（3）FP50/10（ノルウェー）に関して、表明された意見をも考慮し、FTP コードへの取り込みを検討すること。
（4）防火戸の下端スペース（議題 9 における議論を基に）を検討し、FTP コードへの導入を検討すること。
（5）仏提案のシール材の取り扱い（FP48/15、FP49/6）及びその FTP コードへの取り込みを検討すること。
（6）結果を FP51 へ報告すること。

3.2.1.10　IACS 統一解釈の検討（議題 11 関連）

本会議は、IACS の提案文書ごとに審議した。

（1）タンカーの貨物区域に面する窓の要件（FP50/11）

タンカーの前面壁に設置される A-60 の窓の試験火災適用に関する IACS/UI については、米、露等が支持し、特段の反対がないため、本会議は当 UI に合意した。また、タンカーの前面壁への防熱の適用に関しては、関連規則間に矛盾があることを認識し、2000 年以前の SOLAS II-2 章に関する統一解釈 MSC/Circ.847 を踏襲すること、及びそのための新解釈 MSC/Circ 案を、DG を設置して作成することに合意した。現 II-2 章については規則改正が必要なため、DG にて規則改正のための新規作業項目の Justification 及び関連の MSC/Circ 案を作成することとなった。

（2）SOLAS 規題 II-2 章 9 規則 2.4 及び 3.1 の明確化（FP50/11/1）

本件に関する IACS の見解は多くの支持を得たため、DG で UI 案を作成することとなった。

（3）塗料庫の隔離（FP50/11/2）

IACS/UI は ICS、INTERTANCO に支持されたが、英が、本件は、技術的な Justification がない旨指摘し、多くの支持を得た。また、議長は、本件は規則改正に当たると解し、IACS に必要があれば関心のある主管庁とともに、MSC へ規則改正提案するよう指示した。

（4）固定式非常用消火ポンプの要件（FP50/11/3）

我が国は、IACS の見解に同意すると共に提案文書への謝辞を述べたところ、韓の支持を得た。豪も基本的には IACS の見解を支持するが、岸壁（貨物及びバラスト水のない状態）でも当該ポンプが使用可能である必要があるとの見解を示し、英はこれを支持した。この他は、特段の意見もなかったため、議長から、本件の完了を次回（FP51）に延期し、関心のある主管庁は、意見を提出するよう要請する旨提案があり、本会議はこれに合意した。本件は、船舶の設計、建造に影響が大きいと思料するところであり、適宜必要な対応をお願い申し上げる。

（5）危険物を積載する船舶に関する電気設備に関する解釈（FP50/11/4）

ICS は、本提案 UI は以前の UI より簡単になったがこのため適用に間違えが起きないかとの懸念を表明した。しかし IACS は、詳細は引用規格である IEC に記載されているので問題ないと回答したため、本会議はこの UI に合意した。

（6）IACS/UI SC16、197、198、200（FP50/11/5）

IACS/UI SC16 に関し我が国は、Oil Fuel Transfer Pump は規則 II-2/4.2.2.1 を適用する必要がある旨発言したが、米は Unit と System は内容が違うと述べ、英は Oil Fuel Transfer Pump は、低温、低圧の油を輸送するため規則 II-2/4.2.2.1 は適用する必要がない旨指摘した。従って本会議は、

SC197 と共に IACS/UI をそのまま合意した。なお議長は、SC198 及び 200 は第 4 議題と関連が深いため、関連の WG で審議するよう指示した。

（7）MSC/Circ.1120 の SOLAS 規題 II-2 章/規則 5.3 及び 6.2 の解釈の適用に関する明確化（FP50/11/6）

ベルギーよりは、control room には機関制御室も含めるべきと発言したが、我が国は、関連 UI が作成されたときの原則と違うため、IACS/UI は支持できると指摘したところ、多くの支持を得た。一方、デンマーク及びポーランドが表中に誤りがあることを指摘したため、IACS に対して FP51 までに表を見直すことを要請した。

（8）その他の統一解釈（FP49 の報告書へのコメント）（MSC80/12/2）

IACS 提案は我が国、英、米が支持したため、DG において関連 MSC/Circ.案を作成することとなった。

DG で作成された関連 MSC/Circ.案は特段の意見もなく合意され、承認のため MSC81 に送付されることとなった。なお、我が国は、第 4 議題の中で検して関連改正案に取り入れた IACS/UI（SC198 及び SC200）も、関連技術基準の発効までに時間があることから、本 Circular に追加することを提案し、大方の支持を得たため、これらも解釈に関する本 Circular に含めることとなった。

3.2.1.11　火災事故記録の解析（議題 12 関連）

ICS （International Chamber of Shipping）は、産業間作業部会（IIWG：Inter-Industry Working Group）がケミカルタンカーChassiron 号の爆発事故調査解析報告を MSC81 へ提出する予定であることを報告した。仏は、当該事故の重要性を MSC79 へ報告した（MSC79/22/8）ところ、MSC は IIWG に事故を解析して FP、STW、BLG へ報告することを要請したが、IIWG の報告が FP をはじめこれらの小委員会へ出されていないことに遺憾の意を表明した。なお、STW37 へは、ICS が述べたことを STW37/16 として IIWG が提出している。

FP50/12 の FSI からの火災海難報告に関しては、運行上の火災安全及び電気設備の火災安全の対処はすでにできており、追加の措置は不要である旨プレナリーは合意した。当事故は 2001 年に起こったもので、FP での審議までに 5 年の時間が経過している（連絡が遅い）ことにバハマが遺憾の意を表明した。

3.2.1.12　新作業計画及び FP51 の仮議題（議題 18 関連）

（1）議題案

事務局が示した以下の議題案をもとに、本会議は下記の通り MSC81 へ提案すること合意した。

議題 1　議題の採択
議題 2　他の IMO 機関の決定
議題 3　火災安全設備のための性能試験及び承認基準
議題 4　FTP コードの総合的見直し
議題 5　新造旅客船及び現存旅客船の避難解析に関する報告
議題 6　SPS コードの見直し
議題 7　ガス燃料船の要件の策定
議題 8　機関室の貨物ポンプ室の防火対策
議題 9　IACS 統一解釈の検討

議題 10　火災事故記録の解析

議題 11　superstructure と deckhouse の境界外側の保護

議題 12　作業計画及び FP51 の仮議題

議題 13　2008 年の議長及び副議長の選出

議題 14　その他

議題 17 海上安全委員会への報告

（2）作業グループ、コレスポンデンス・グループ

（イ）作業グループ

WG1：　新造旅客船及び現存旅客船の避難解析に関する報告

WG2：　火災安全設備のための性能試験及び承認基準

WG3：　FTP コードの総合的見直し

（ロ）コレスポンデンス・グループ

CG1：　新造旅客船及び現存旅客船の避難解析に関する報告

CG2：　火災安全設備のための性能試験及び承認基準

CG3：　FTP コードの総合的見直し

CG4：　機関室の貨物ポンプ室の防火対策

3.2.1.13　その他の議題（議題 20 関連）

（1）コンテナ船貨物区域への消火器の設置（FP50/20）

IACS の提案は多くが支持し（日、韓、露、英、ノルウェー、独等）、本会議は IACS の見解に合意した。

（2）デッキ上の閉囲されたパイプトランク（FP50/20/1）

タンカーのデッキ上の閉囲されたパイプトランクに消火設備を要求するスウェーデン提案について、常時開いている開口を設ければ消火設備は不要（韓）、他のデッキ下のパイプトランクと同じ扱い（英）等、いくつかの意見が出たが結論に達せず、FP51 にてさらに検討することで合意した。

3.2.2　FP51 以降の課題

FP50 での審議結果を受け、本部会にて FP51 以降の対応案を検討し、現状における FP51 対応として別添 3.2 の通り作業内容及び担当に合意した。

別添 3.1

Report of the discussion on the GUIDELINES
FOR HIGH EXPANSION FOAM USING INSIDE AIR at FP50

Requirement	Comments	Discussion(FP50)	CG 対応
DRAFT GUIDELINES FOR THE APPROVAL OF INSIDE AIR FOAM SYSTEMS **1 General** SOLAS provides for and accepts the use of high expansion foam systems inside machinery spaces. The fixed high expansion foam fire-extinguishing system providing foam generators inside the protected space should demonstrate by a test to have the capability of extinguishing a variety of fires, which may occur in a ship's engine room.			
2 Definitions 2.1 Foam solution: a solution of foam concentrate and water. 2.2 Foam concentrate: the liquid which, when mixed with water in the appropriate concentration forms a foam solution. 2.3 Foam generator: a discharge devices consisting of a nozzle or set of nozzles and a casing. The casing is typically made of perforated steel / stainless steel plates shaped into a box that enclose the nozzle(s).	Foam generator の定義を、将来	基本的に合意	コーディネー

2.4 Inside Air Foam System: a fixed high expansion foam fire extinguishing system with foam generators located inside the protected space. 2.5 Nominal flow rate: the foam solution flow rate expressed in L/min. 2.6 Nominal application rate: the flow rate per area, i.e. expressed in $L/min/m^2$. 2.7 Nominal foam expansion ratio: the ratio of the volume of foam to the volume of foam solution from which it was made. 2.8 Nominal foam production: the volume of foam produced per time unit, i.e. nominal flow rate times nominal foam expansion ratio, expressed in m^3/min 2.9 Nominal filling rate: the ratio of nominal foam production to the area, i.e. expressed in m/min. 2.10 Nominal filling time is the ratio of the height of the protected space to the nominal filling rate, i.e. expressed in minutes.	の新たな開発を考慮し一般的になるよう書き換える。（WG）		タの案を検討。
3 Principal requirements for the system 3.1 Principal performance: .1 The system should be capable of manual release. Automatic release of			

the system should not be permitted, except as permitted by the Administration.			
.2 The system should be capable of fire extinction, and tested in accordance with Appendix 2 to this guideline.			
.3 The expansion ratio and drainage time of the foam concentrate should be approved by the Administration in accordance with MSC/Circ.670. However, the fire tests specified in paragraph 3.8 of the Annex to MSC/Circ. 670 need not be applied. [The foam concentrate should be approved in accordance with (small scale foam quality test to be developed)]	**Sweden**（CG） Need to have small scale tests specific to inside air applications. The tests should include repeatable exposure to heat and smoke **Japan**　（CG） Japan considers the small scale foam quality test is not necessary, since the fire test using the 500 m3 enclosure sufficiently assesses the foam quality. Small scales test seems to require duplicate fire tests. For member's reference, vessels gross tonnage having 500 m3 ER is around 2000 tons.	泡原液の承認試験用基準としてMSC/Circ.670の改正案をスウェーデンが作成する。	改正案の内容のチェック。
.4 The foam generators should be successfully tested in accordance with Appendix 1 to this guideline.			

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3.2 Requirements for the system .1 ~~Electrical power for the system should be supplied from emergency power~~. The system should be supplied by both main and emergency sources of power and should be provided with an automatic change-over switch. The emergency power supply should be provided from outside the protected machinery space	**Germany** （CG） Harmonize with MSC/Circ. 668 **Japan** （CG） Where the system is applied to Machinery spaces of Category A, main source supply is not necessary because main source should be cut off in case of fire in the machinery spaces. Therefore, Japan proposes to retain the original text as it is.	基本的に合意された。	CG 案を確認する。
.2 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, clogging and corrosion normally encountered in machinery spaces or cargo pump room in ships, and manufactured and tested to the satisfaction of the Administration in accordance with the requirements given in Appendix 1 to these Guidelines . Components inside the protected spaces should be designed to withstand the elevated temperatures, which could occur during a fire.	（WG） Comportment の火災試験を EN とするよう提案あり。	CG にて検討。	EN の内容を確認し、対応する。
Deleted			
.4 ~~Foam generators and~~ System piping, components and pipe fittings in contact with the foam concentrate should be constructed of corrosion resistant materials such as stainless steel, ~~CuNi alloy~~ or equivalent. Other system piping and	**Norway**（CG） Add req. for corrosion resistant	材料として CuNi 合金も使	日本での現状を調査し、対応

foam generators should be galvanized steel or equivalent. [If the system components (such as foam proportioner, foam concentrate pump, etc.) should be constructed of copper or copper alloy by practical reason, an effective means of protection such as a steel cover or A-60 insulation should be provided, unless the components are not located in a high fire risk area]	**Japan**（CG） Japan proposes to add “and water constantly” after concentrate, because the corrosion should be considered only in such cases. **Korea**（CG） Foam generators would not be in contact with foam concentrate. Also propose deleting CuNi alloy due to low melting point.	用可との意見あり。（CG で検討。） ノズルは Brass との発言もあり。	する。
.4 bis Means to test the foam and water pumps as well as means to realistically test at least one foam generator should be provided. All sections of piping should be provided with connections for flushing, draining and purging with air.		Upper deck に Foam generator を設置し、実際に発泡試験する。	
.5 The expansion ratio of the foam should not exceed 1,000 to 1. The quantity of foam concentrate available should be sufficient to produce foam for the minimum operation time specified by the manufacturer, but not less than 30 minutes.			
.6 Means should be provided for the crew to safely check the quantity of foam concentrate and take periodic control samples for foam quality.			

.7 Operating instructions for the system should be displayed at each operating position.			
.8 Spare parts should be provided in accordance with the manufacturer's instruction.			
.9 Filling rate for the system should be followed the results of the test to be conducted in accordance with Appendix 2. Where the volume of the machinery space in question is more than that of the class 3 test enclosure, the test data of filling rate conducted in the class 3 test enclosure can be used for approval. [The design filling rate for the system should be based on the nominal filling rate calculated on the basis of the nominal foam expansion ratio and the nominal application rate used during the approval tests in accordance with Appendix 2. The nominal foam expansion ratio should be determined according to EN 13565-1] [The design filling rate for the system should be adequate to completely fill the largest protected space in [2][10] minutes or less.]	**<u>Sweden</u>**（CG） The design filling rate should be based on the rate used in the approval tests. Also the maximum fill time should be 10 minutes **<u>USA</u>**（CG） We propose that a instead of a filling rate, a maximum filling time of 2 minutes should be specified for all applications **<u>Poland</u>**（CG） Agree with USA **<u>Japan</u>**（CG） Japan considers that filling up time should be determined, taking the character / performance of each fixed fire	基本的に 2 分間は過大な要求であることが認識された。	10 分間で問題ないか検討し、対応する。

	fighting system into account. CO2 system should be filled up the space for short time taking into account the leakage from dampers, etc. On the other hand, high expansion foam and water systems are not necessary to fill up for shorter time, taking into account the cooling effect by water and fire extinguishing scenario and that machinery spaces are protected by A-60 insulation. Therefore, Japan considers that filling rate not less than 1 m/min is enough requirement to the system. Therefore Japan proposes to retain the original text as it is.		
.10 If an internal combustion engine is used as a prime mover for the sea water pump for the system, the fuel oil tank to the prime mover should contain sufficient fuel to enable the pump to run on full load for at least 3 hours and sufficient reserves of fuel should be available outside the machinery space of category A to enable the pump to be run on full load for an additional 15 hours. If the fuel tank serves other internal combustion engines simultaneously, the total fuel tank capacity should be adequate for all connected engines.			

.11 ~~Means should be provided for automatically giving audible and visual warning of the release of the system. The alarms should operate for the length of time needed to evacuate the space, but in no case less than 20 seconds.~~	**Norway**（CG） Propose to delete **Japan**（CG） Japan proposes to retain this requirement as it is, taking a risk to the crew by foam including combustion gases into account. **Poland**（CG） Agree with Japan	基本的に合意された。	CG 案を確認する。
.12 The arrangement of foam generators and piping in the protected space should not interfere with access to the installed machinery for routine maintenance activities.			
.13 The system source of power supply, foam concentrate supply and means of controlling the system should be readily accessible and simple to operate, and should be arranged at positions outside the protected space not likely to be cut off by a fire in the protected space.		通風を遮断する要件は必要か。(排煙の必要性は)	国内で検討し、対応する。
.14 Arrangements of foam generators should in general be designed based on the approval test results. The number of generators may be different, but the minimum filling rate determined during approval testing should be provided by the system	（UK）(CG) 泡に埋まった Generator の取扱い。（埋まった後は、計算に入れるべきではない。）	CG で検討。	国内で調査し、対応する。

.15 Foam generators should be uniformly distributed under the uppermost ceiling in the protected spaces including the engine casing. Extra foam generators may be required in obstructed locations. The foam generators should be arranged with at least 1 m free space in front of the foam outlets, unless tested with less clearance.	UK（WG） 爆発でノズルが損傷する可能性あり。2 系統以上にすべき。 Water mist 装置は管装置が robust になっているため対応は不要。	ノルウェー、日本；不要	両装置の実際と爆発事故を調査し、対応する。
.7 The piping system should be sized in accordance with a hydraulic calculation technique* to ensure availability of flows and pressures required for correct performance of the system.			
.8 The control system of ventilation fans**, discharge alarm and oil pumps** should be available at the position(s) where this extinguishing system is controlled.			
APPENDIX 1 **COMPONENT MANUFACTURING STANDARDS FOR INSIDE AIR FOAM SYSTEMS** Foam ~~generators~~ nozzles installed in the protected space should be tested in accordance with the following items stipulated in Appendix A to MSC/Circ.668 and generators should be tested in accordance with the following items 1 and 6: .1 Dimension .2 Flow constant: The value of the flow constant K should be determined by measuring the flow at the maximum operational pressure, minimum operational pressure and the middle operational pressure.	**Norway**（CG） This section should only apply to foam nozzles and should be based on revised MSC/Circ. 913, whereas a suitable set of design requirements may be defined for the casing. **Japan**（CG） Japan proposes that the tests specified in paragraphs .3 and .4 should be applied to the nozzles	EN 規格の内、必要と思われる項目をスウェーデンが抽出し、CG で検討。 Generator の設置高さは、試験を行ったものに制限すべきとの意見あり。	スウェーデンの作成した資料を検討する。 国内で検討し、対応する。

.3 Stress corrosion .4 Sulphur dioxide corrosion: Visual inspection only may be carried out .5 Salt spray corrosion: The test may be carried out at NaCl concentration of 5%. Paragraph 3.14.2 in Appendix A to MSC/Circ.668 need not to apply. .6 Resistance to heat: Where the components are made of steel, this test need not be applied. .7 Impact test: Only, the nozzles ~~may~~ need to be tested. .8 Clogging test: Where the diameter of the opening of the nozzle exceeds [1.5 mm], this test need not apply. [Foam generators should be tested in accordance with the following items stipulated in EN 13565-1 : • Clause 4: General construction requirements (4.1-connections, 4.5-corrosion resistance of metal parts, 4.8-heat and fire resistance) • Clause 5: Discharge coefficients • Clause 6: Quality of foam (6.2-High-expansion components) • Clause 9: Components for medium and high-expansion foam systems Foam generators should also be able to withstand the effects of vibration without deterioration of their performance characteristics when tested in accordance with (para 4.16 of App A to MSC/Circ. 668) After the vibration test according to (para 4.16 of App A to MSC/Circ. 668) the generators should show no visible deterioration and should meet the requirements of (clauses 5 & 9 of EN13565-1)	only, taking into account of necessity of application of these tests to casings and that it is impossible to carry out these tests for large objects such as the casings. Additional tests according to EN 13565-1 are not familiar worldwide and the tests mentioned in original ones are enough to assess the components. Therefore, Japan proposes to delete " and should meet the requirements of clauses 5 & 9 of EN 13656-1" **<u>Sweden</u>**（CG） Water mist nozzle component tests are not appropriate. Recommend using EN 13565-1 plus an added vibration test taken from 668	試験時の給水圧力は Normal を使用すべきとの意見あり。(Water mist 装置は Min. 圧力を使用している。) (議場外) スウェーデンは Generator の振動試験が必要との意見あり。	

APPENDIX 2 **TEST METHOD FOR HIGH EXPANSION FOAM FIRE-FIGHTING SYSTEM** **1 Scope** The test method is intended for evaluating the extinguishing performance of inside-air high-expansion foam fire-fighting systems. System design should be based on the conditions used during the specified fire tests **2 Sampling** The components to be tested should be supplied by the manufacturer together with design and installation criteria, operational instructions, drawings and technical data sufficient for the identification of the components.			
3 Fire tests 3.1 Test principles This test procedure enables the determination of design criteria and the effectiveness of high expansion foam fire-extinguishing system against spray and pool fires, which are obstructed by a simulated engine. 3.2 Test description 3.2.1 Test enclosure 3.2.1.1 The fire extinguishing tests of the system should be carried out using the			

following test compartments. .1 Test compartment 1 The test should be performed in a 100 m^2 room with 5 m ceiling height and ventilation through a 2 m x 2 m door opening according to figure X (figure 2 in MSC Circ 668). The engine mock-up should be designed according to figure Y (figure 2-3 in MSC Circ 668). The door opening to the test compartment may be covered during the test at the same rate as the foam layer is building up in the compartment to avoid foam leakage through the door opening. .2 Test compartment 2 The test should be performed in a test compartment having a volume of between 1200 to 3000 m^3 and a height exceeding 7,5 m. The ventilation of the test compartment should be as in Test compartment 1 but with four additional 1 m^2 square ventilation openings located at each corner of the ceiling. The foam generators should not be positioned near the ceiling openings. .3 Test compartment 3 The same arrangement should be used as for test compartment 2 but without any ceiling in order to avoid any restrictions in air supply. The height of the walls must be high enough to avoid foam overflow which will depend on the performance of the system. 3.2.1.2 Any test enclosure should be provided with natural or forced ventilation	**Sweden**（CG） Propose three different fire scenarios to account for varying shipboard ventilation and configuration parameters **Japan**（CG） Japan considers that two fire scenarios using small (500 m3) and large (3000-4000 m3) test enclosures are enough to assess the performance of the system, taking volume and ventilation condition of the machinery space, duration and cost of approval test into account Furthermore, Japan considers that the test using the small test compartment should be conducted to assess the affect by smoke produced by the test fire and the test using the large compartment should be conducted for confirmation of the system performance. **Sweden**（CG）	スウェーデンは試験室を 500m^3 と 1,200m^3 の 2 つにすることに合意。	CG 案を検討。

to ensure that the oxygen concentration at the fire location should be a minimum of 20% (by vol.) at the start of the test. The ventilation should be arranged so that fresh air from the ventilation should not been taken into the foam generators directly.	Delete the entire paragraph. Covered by the vent conditions in the 3 new fire test scenarios		
3.2.2 Simulated engine The fire test should be performed in a test apparatus consisting of: .1 A simulated engine of size (width x length x height) 1 m x 3 m x 3 m constructed of sheet steel with a nominal thickness of 5 mm. The simulated engine is fitted with two steel tubes of 0.3 m in diameter and 3 m in length, which simulate exhaust manifolds and a grating. At the top of the simulated engine a 3 m2 tray is arranged. See figure 1. .2 A floor plate system of 4 m x 6 m and 0.5 m in height surrounding the simulated engine with a tray (4 m2 in area), underneath. See figure 1.			
3.2.3 Test Program The fire test should be carried out using following fire scenarios. .1 Combination of the following fire programs (Test fuel: Commercial fuel oil or light diesel oil): (1) Low-pressure spray on top of the simulated engine centered with nozzle angled upward at a 45-degree angle to strike a 12 – 15 mm diameter rod 1 m away.			

(2) Fire in trays under (4m2) and on top (3m2) of the simulated engine. .2 High-pressure horizontal spray fire on top of the simulated engine. (Test fuel: Commercial fuel oil or light diesel oil); .3 Low pressure concealed horizontal spray fire on the side of the simulated engine with oil spray nozzle positioned 0.1 m in from the end of the simulated engine and 0.1 m2 tray positioned 1.4 m in from the engine end at the inside of floor plate. (Test fuel: Commercial fuel oil or light diesel oil); and .4 Flowing fire 0.25 kg/sec from top of mock-up (Test fuel: Heptane)			

Fire type	**Low pressure**	**High pressure**
Spray nozzle	Wide spray angle (120° to 125°) full cone type	Standard angle (at 6 bar) full cone type
Nominal oil pressure	8 bar	150 bar
Oil flow	0.16 ± 0.01 kg/s	0.050 ±0.002 kg/s
Oil temperature	20 ± 5°C	20 ± 5°C
Nominal heat release rate	5.8 ± 0.6 MW	1.8 ± 0.2 MW

3.2.4 Installation requirements for tests .1 Foam generators should not be installed above the simulated engine in such a way that the foam flow directly hits the test fires. .2 Foam generators should be installed at the uppermost level of the space. The distance between the generators and test ceiling and floor should be recorded and reflected in the manufacturer’s design manual.			

.3 The number and spacing of foam generators should be in accordance with the manufacturer's system design and installation manual.			
4 Test procedure 4.1 Preparation .1 The tray(s) used in the tests should be filled with at least 50 mm fuel on a water base. Freeboard should be 150±10 mm, except for the 3 m^2 tray on top of the simulated engine where the free board should be 50±10 mm. .2 ~~Sea water or simulated sea water specified in paragraph 3.6.3 of MSC/Circ.670 should be used for the fire test, except the case where it is shown that fresh water gives the same level of performance as sea water.~~ Sea water or simulated sea water specified in paragraph 3.6.3 of MSC/Circ. 670 should be used for the fire tests. However, fresh water may be used for practical reasons if it is shown that sea water provides the same level of performance. This should be done either by repeating the fresh water test with the longest time to extinguishment to ensure that the minimum performance requirements is still fulfilled or to use the small scale test method for foam concentrates intended for inside air systems, see Paragraph 3.1.3. If the system is tested in more than one test compartment, the sea water test should be performed in test compartment 2 or 3.	**<u>Sweden</u>**（CG） Propose alternate text **<u>Japan</u>**（CG） Since paragraph 3.6.3 is widely used as simulated sea water for foam concentration and such sea water has been demonstrated to produce foam having the same level of performance as foam produced by sea water, additional tests using sea water are not necessary. Therefore, Japan proposes to retain the original text as it is.	スウェーデンから Large scale 試験の一番厳しいものに対し海水で試験を行うことが提案された。（CG で検討）	国内で検討し、対応する。
4.2 Measurements The following should be measured during the test.	ポーランド（WG） Bilge fire 消火のため追加の	火災試験シナリオにプール火災	

.1 oil flow and pressure in the oil system; .2 foam concentrate flow and pressure and water flow and pressure in the extinguishing system; .3 oxygen concentration in the test compartment. The sampling point should be located 4.5 m from the centre of the engine mock-up on the exhaust pipe side and 2.5 m from floor level (The measurement may be terminated when the foam fills up to the oxygen sampling point); and .4 temperatures at the fire locations. Thermocouples should be located 1 m in front of the spray nozzles and 0.5 m above the tray fuel surface to provide additional information about time to extinguishment.	Generator を追加することを提案。 試験室内の温度は 20±5℃とする。 Generator のところで温度計測を行う。	の消火も含まれるため不要となった。 CG で検討。	国内で検討し、対応する。
4.3 Preburn After ignition of all fuel sources, a 2 min pre-burn time ~~for the tray fires and 10 to 15 sec for the spray and heptane fires~~ is required before the extinguishing agent is discharged.	**Sweden**（CG） We propose a 2 min preburn for all test fires **USA**（CG） Agree with Sweden **Poland**（CG） Agree with Sweden. We also propose a 20% design safety factor when calculating the required quantity of foam. **Japan**（CG） Since spray nozzles for spray fire	ポーランドは 20%の余裕を提案。	CG で対応。

	are located with certain height, which is not less than 3m, spray fire is continuously burned until foam is filled up to the position of the spray fire (i.e. pre-burn time is normally not less than 1.5 min.) Therefore, Japan considers that pre-burn time of 10-15 sec. Is enough duration to confirm continuous burning of spray fire. Therefore, original text should be retained as it is.		
4.4 Duration of test ~~Extinguishing agent should be discharged for 50% of the discharge time recommended by the~~ ~~manufacturer or 15 min whichever is less. The oil spray, if used, should be shut of 15 sec after~~ ~~the end of agent discharge.~~ The oil spray, if used should be shut off 30 seconds after the fire has been judged extinguished. The overall time to extinction may not exceed [15][5] minutes (or 50% of the recommended discharge time).	**<u>Sweden</u>**（CG） Propose alternate text **<u>USA</u>**（CG） Propose 5 minutes as the maximum time to extinction **<u>Japan</u>**（CG） The original text should be retained due to the reasons mentioned in item No. 16.	基本的に合意された。	CG 案で確認する。
4.5 Observations before the fire test Temperature of the test room, fuel and the simulated engine should be measured and recorded.			

4.6 Observations during the fire test The following observations should be recorded. .1 start of ignition procedure; .2 start of the test (ignition)); .3 time when the system is activated; .4 time when the fire is extinguished; .5 time when the system is shut off; .6 time when the fire is re-ignited, if any; .7 time when the oil flow for the spray fire is shut off; and .8 time when the test is finished.			
4.7 Observations after fire test The following should be recorded. .1 damage to any system components; .2 level of fuel in the tray(s) to make sure that no limitation of fuel occurred during the test; and .3 temperatures of test room, fuel and the simulated engine.			
5 Classification criteria At the end of discharge of foam and fuel at each test, there should be no re-ignition or fire spread.			
6 Test report The test report should include the following items. .1 Name and address of the test laboratory;			

.2 Date and identification number of the test report; .3 Name and address of client, manufacturer and/or supplier of the system; .4 Purpose of the test; .5 Name or other identification marks of the product;. .6 Description of the test product; .7 Date of the test; .8 Test methods; .9 Drawing of each test configuration .10 Identification of the test equipment and instruments used (including type and manufacturer of the foam concentration); .11 Conclusions; .12 Deviations from the test method, if any; .13 Test results including observation and measurement before, during and after the test; and .14 Date and signature.			
7 Application of Test Results Systems that have been successfully tested to the provisions of paragraph 3 may be installed in different size spaces according to the following: .1 the extinguishing system configuration used for the test compartment 1 tests may be applied to systems for the protection of shipboard spaces of equal or less volume and with restricted airflow; .2 the extinguishing system configuration used for the test compartment 2 tests may be applied to systems for the protection of shipboard	**Sweden**（CG） Guidance is needed on application of test results to different size compartments **Japan**（CG） This sentence should be deleted, since it is impossible to apply to ships, because it is impossible to define the restricted airflow in	スウェーデンは試験室を 2 つにしたことにより、この間の Filling rate は補間法で決定することを提案。	合意できる。

spaces with volumes and ventilation conditions between test compartment 1 and 3 using linear interpolation; and .3 the extinguishing system configuration used for the test compartment 3 tests may be applied to systems for the protection of shipboard spaces of equal or greater volumes and no restriction in ventilation	the machinery spaces.		

別添 3.2

FP51 に向けた今後の検討課題

平成 18 年 1 月 24 日　NK　村田

1．　CG 対応

（1） 火災安全システムの性能基準及び承認基準（CG 対応）

項目	作業内容	検討主体	備考
下記項目に関する関連改正案の作成 ・高膨張泡消火装置 ・車両区域の固定式加圧水噴霧及び水ミスト消火装置の関連指針改正に関する検討等	・CG レポート及び関連提案文書の検討及び必要があれば提案文書案作成 ・国内で行った実験結果の再検討及び必要があれば提案文書の作成	HK、製安セ、メーカー、NK	必要があれば、詳細は非公式小グループにおいて検討
中期検討課題（火災探知装置、貨物倉用固定式消火装置等）に関する検討	関連装置の問題点の抽出及び独提案（FP50/4/1）の検討。必要があれば提案文書案作成	HK、製安セ、メーカー、船協、造工、海技研、NK	同上
固定式 CO2 消火装置の起動の二重化の遡及適用	安全性、有効性及び費用対効果の検討	同上	同上

（2）FTP コードの総合見直し（CG 対応）

項目	作業内容	検討主体（取りまとめ）	備考
FTP コードの見直し	仏提案改正案の検討 FP50 審議結果（FP50/WP.6-Add-1）を基にした検討 FTP コード改正案及び提案文書の作成	製安セ、NK、海技研	必要があれば詳細は非公式小グループにおいて検討

(3) 新及び既存旅客船の避難解析に関する勧告（CG 対応）

項目	作業内容	検討主体（取りまとめ）	備考
・ 調査を基にした避難開始時間の分布の検討 ・ MSC/Circ.1033 の改正案の作成	FP50 での審議内容及び関連提案文書の検討	海技研、海事局、造工	コーディネーター（太田氏）

(4) 機関室及び貨物ポンプ室の防火対策（CG 対応）

項目	作業内容	検討主体（取りまとめ）	備考
機関室及び貨物ポンプ室の防火対策	韓国提案の検討	造工、NK	

2．　　その他

項目	作業内容	検討主体	備考（協力）
ガス燃料船に関する要件の策定	関連提案文書の検討	造工、舶用工、NK	海技研
IACS の統一解釈（非常用消火ポンプ）	FP50 での審議結果の検討及び我が国提案（FP49/13）の再検討並びに提案文書作成	造工、中小型造工、NK	
火災事故記録の解析（20000DW 未満のタンカー等への IGS 設置について）	IIWG の検討結果に関する MSC81 への提案文書の検討及び IGS 設置に関する Feasibility、費用対効果等の調査検討。Operational matter に関する調査検討	海事局、船主協会、NK	造工、船協、製安セ

4.　IMO への提案文書の概要

本部会で検討し、IMO に提出した文書は下記の通りである。

4.1.　MSC80（前年度）

4.1.1　FTP Code 総合見直し

同 Code は、1998 年 7 月 1 日から発効したが、その後、IMO 統一解釈や改正が承認されたこと、HSC コードと共に FTP コードの Part 10、Part 11 が制定されたこと、同 Code が試験方法として引用している ISO 規格の改正、また造船に関与する技術の進歩等から、制定以来 8 年間が経過した現在、同 Code を総合的に見直しの必要性が生じている。前年度、FP49 及び MSC80 の開催に先駆け、MSC に対して「FTP コードの総合見直し作業」を、FP の New work items として提案し、承認された。（MSC80/21/5）

4.1.2　SOLAS 規則 II-2/19

提案文書本文では、個品危険物の要件の適用を規定する SOLAS 条約第 II-2 章第 19 規則の 19.3 表に問題がある旨（付録参照）を指摘し、副次危険性や複数の危険性を有する危険物のクラスの分類方法をも考慮して、要件の適用について、関係する小委員会で検討する必要がある旨の指摘を行っている。また、SOLAS 条約第 II-2 章の 19.3 表を修正する際には、併せて MSC/Circ.1027（危険物運送船適合証書の書式に関する指針）及び MSC/Circ.1148（MSC/Circ.1027 の補足）をも修正する必要がある旨も合わせて指摘している。

付録では、発火源の排除の要件（暴露甲板上にも適用）が、Class 2.3（高圧毒性ガス）であって副次危険性が Class 2.1（高圧引火性ガス）の危険物及び Class 4.3（水反応性引火性物質）であって引火点 23 度未満の危険物（副次危険性が Class 3 であって容器等級が I または II の物質であれば、引火点が 23 度未満の可能性がある。）が適用されていないこと、また、防爆型の機械式通風装置の要件の適用にも同様の問題があること等を指摘し、19.3 表の修正案、上記 MSC/Circulars の修正案を示している。（MSC80/23/3）

4.2　FP50

「FTP コードの総合見直し作業」を、FP の New work items とする提案は、FP50 から 3 年の新作業項目として、MSC80 において承認され、それに伴い日本からは「FTP コードの総合見直しについての具体的な提案」を提出することとなった。（FP50　議題 10 関連）

また、FP48 より検討されている防火戸下部の隙間に対する基準の緩和、試験方法の変更についての仏提案についての日本としての意見を提出した。（FP50　議題 9 関連）

FP50 への提案文書は下記の通りである。

＜　提案文書　＞

FP50/10/1　　FTP コードの改正提案本文

発行された FTP コードの Amendment, Unified Interpretation、改正された ISO 試験規格、

及び改正案と判断され FTP コードの解釈案の審議で議論されなかった提案等、並びに日本コメントを含む、総括的な FTP コードの総合見直し作業提案である。

FP50/10/1 Add.1　FP50/10/1 の補足提案

上記の FTP コードの総合見直し作業提案において、「FTP コードの改正に対する日本の改正提案」をまとめた文書である。FTP コード発効以来、日本での試験の実績等から考えられる改良点をまとめている。

FP50/10/2　New FTP コード（案）

発行された FTP コードの Amendment, Unified Interpretation において承認された FTP コードの改正事項を、現行の FTP コードに加えて、「New FTP code（案）」のたたき台とした。（本文書には、FP50/10/1 にて、日本が提案している FTP コードの改正提案は含まれていない。）

FP50/10/3　FTP コード Part 3 – IMO A. 754 改正案

発行された FTP コードの Amendment, Unified Interpretation において承認された FTP コードの改正事項（FTP コード Part 3 関連）を、現行の FTP コード Part 3 の試験方法である IMO. A.754（18）に加えて、「New FTP コード Part 3（案）」のたたき台とした。（本文書には、FP50/10/1 にて、日本が提案している FTP コードの改正提案は含まれていない。）

FP50/10/4　FTP コード Part 5 – IMO A.653 改正案

発行された FTP コードの Amendment, Unified Interpretation において承認された FTP コードの改正事項（FTP コード Part 5 関連）を、現行の FTP コード Part 5 の試験方法である IMO A.653（16）に加えて、「New FTP コード Part 5（案）」のたたき台とした。（本文書には、FP50/10/1 にて、日本が提案している FTP コードの改正提案は含まれていない。）

FP50/INF.5　FTP コード Part2 - FTIR ガス分析方法の試験についての紹介

FTP コード Part2 煙と毒性試験におけるガス分析方法について、現在 ISO で開発中の FTIR によるガス分析方法の ISO 規格（案）の紹介と、日本が ISO 規格（案）に基づき FTIR ガス分析試験を実施していることを紹介するとともに、日本は FP51 にはその結果を報告することを、情報として、小委員会に報告している。

FP50/9　防火扉の下部隙間に対する日本提案（議題 9 関連）

FTP コード Part 3 の防火戸の試験において、防火戸下部の隙間については φ6 mm の Gap ゲージを使用せず、コットン試験で代用する。また、防火戸下部の隙間の上限値を 15mm 以下とする（仏案）に対して、日本の意見（立場）を明確にするため、以下の提案している。

1）防火戸下部の隙間に φ6 mm の Gap gauge を使用しないとする仏提案は、A 級の防火戸を除くこととする。（A 級の防火戸については、φ6 mm Gap gauge で評価する。）

2）A 級以外の防火戸（B 級、F 級防火戸等）については、「防火戸下部の隙間の上限値」は、25mm の Gap gauge が入らないこととする。

4.3　MSC81

提案文書本文では､個品危険物の要件の適用を規定する SOLAS 条約第 II-2 章第 19 規則の 19.3 表に問題がある旨（付録参照）を指摘し、副次危険性や複数の危険性を有する危険物のクラスの分類方法をも考慮して、要件の適用について、関係する小委員会で検討する必要があるとの意見を述べる。また、SOLAS 条約第 II-2 章の 19.3 表を修正する際には、併せて HSC コード 2000 年改正の表 7.17-3 及び MSC/Circ.1027 並びに MSC/Circ.1148（MSC/Circ.1027 の補足）をも修正する必要がある旨を指摘する。

更に、Class 6.1 及び 8 の引火点 23 度以上、60 度未満の液体貨物において、発火源の排除と防爆型機械通風装置の要件間の適用に不整合があることを指摘し、併せて検討を行うことを要請している。

また、DSC10 において、IMDG コードの引火点が 61 度から 60 度に変更されたため、当該変更を関連要件においても考慮する必要があることを指摘している。

付録では、上記の Class 6.1 及び 8 の引火点 23 度以上、60 度未満の液体貨物における不整合を考慮した表 19.3 の修正案及び MSC/Circulars の修正案を示している。（MSC81/23/5）

5.　FTPコード総合見直しについて

5.1　R2　WG での審議

5.1.1　背景及び必要性

火災試験方法コード（FTP Code）の総合見直しに関する調査研究

SOLAS 条約 II-2 章の 1996 改正（MSC 決議 57（67）：1996 年 12 月採択）は、同章に規定する船舶防火材料の承認のための火災試験方法コード（FTP コード：International Code for Application of Fire Test procedures）（MSC 決議 61（67））を強制要件として導入した。これらの改正及び Code は、1998 年 7 月 1 日に発効したが､その後の技術の進展並びに同章規則及び同 Code の適用の実績と経験に基づき、FTP Code に係る多くの IMO 統一解釈が IMO の防火小委員会（FP）にて合意され、MSC にて勧告（MSC/Circular）として承認されている。

一方、FTP コードは、試験方法として ISO 規格を引用しているが、これらの ISO 規格はその後の技術の進展により定期的に改正され、また、FTP コードの運用の実績からは、船舶の火災安全性を確保する上で、同コードを改善すべき点が見出されて来ている。さらに、新技術の進展により、同コードが想定した以外の船舶防火材料及びシステムが出現し、船舶の火災安全性を確保する上で適正な対応が必須となって来ている。

同コード制定以来 8 年間が経過した現在、上記の状況を踏まえ、同コードを総合的に見直す必要が生じており、この見直し作業を我が国が行うことは、造船・海運国としての我が国の地位の確保の一貫として、国際的に牽引して推進する必要がある。

R2 における FTP コードに関する調査研究の目的は、以上の背景及び必要性を踏まえ、IMO の FTP コードを総合的に見直し、同コードの総合改正案を作成し、IMO に提案して改正を実現することにある。

本作業は、（社）日本造船研究協会の平成 16 年度の RR 事業から検討されており、昨年は MSC80（2005 年 5 月）に火災試験方法コード改正作業を新作業項目として提案し､承認された。（MSC80/21/5 参照）

5.1.2　WG での検討内容について

上記内容を進めるため R2 船舶の防火に関する調査研究のステアリング・グループ内に、「FTP コードの総合見直しに関する Working Group」が設立され、改正内容の IMO への提出案について検討された。WG 会合は、公式、非公式を含め 4 回の会議が行われた。

（この WG は、火災試験方法コードの試験及び承認の立場にあり、FTP コードに精通するメンバーにより構成された。）

検討内容は、以下の項目に基づいて、検討がすすめられた。

（1）FTP コードの改定及び統一解釈案取り入れの検討

火災試験方法コードに関する現在までの IMO の統一解釈及び IACS の統一解釈を、船舶の火災安全性の維持と向上の面から調査し、同コードに強制要件として取り入れるものと、勧告（解釈）として残すものを判別する。（FTP コードの運用実施以降に発行された Amendment、Interpretation について検討する。）

発行された Amendment	MSC.101(73): Part 10、Part 11(for HSC)の追加
	MSC.173(79): 床表面材の Part 2 基準値（SO_2）の緩和
発行された Interpretation	MSC/Circ.916、964、1004、1008、1036、1120

（2）引用 ISO 規格改正の取り入れの検討

火災試験方法コードが引用している ISO 規格の改正状況を調査し、船舶の火災安全性の維持と向上の面からそれらの同コードへの導入の是非を判別する。必要な場合には、ISO に対して当該 ISO 規格の改正を提案する。（FTP コードの運用実施以降に発行された ISO 規格について調査、検討する。）

（3）統一解釈案として検討されなかった提案の再検討

FP における FTP コードの統一解釈案の検討においては、様々な提案が FP に提案されたが、その一部は解釈案ではなく改正案と見做され、具体的な検討が成されずに保留されたままとなっている。火災試験方法コード改正作業では、これらも再度検討し、FTP コードの改正が必要か否かを判断する。（FTP コードの運用実施以降の、FP での提案及び議論内容を調査し、再度検討が必要と思われる提案を検討する。）

（4）運用実績からの改正・修正の検討

火災試験方法コードの現在までの運用の実績から、同コードの改正・修正すべき内容を検討する。

（国内における FTP コードの試験及び運用実績から、今後見直すべき項目を検討する。）

（5）技術的進展の導入を図るための改正の検討

新技術の進展により、同コードが想定した以外の船舶防火材料及びシステムが出現し、船舶の火災安全性を確保する上で適正な対応が必須となって来ていることを踏まえ、新技術の導入方法及びその取り扱い方法を検討し、同コードに盛り込む案（同コード内に新たなパートを設置して規定する等）を作成する。（新技術の開発等により、今後見直すべき項目を検討する。）

（6）Part 10、Part 11 の導入

2000 年 HSC コードの発効に合わせて、火災試験方法コード（FTP コード）の Part 10、Part 11 が追加された。しかし、本規格は基本的な要件のみを決めており、試験の詳細は非常にわかりにくい。FTP コードの改正においては、この点も見直しが必要だと考えられる。（HSC コードとして製品承認における問題点、Part 10、Part 11 の試験方法としての問題点等、実際の運用において解りにくい点を整理、検討する。）

また、FP49 では合意に至らなかったが、仏国提案の防火扉の下部隙間に対する改正提案について、日本としての対応方針を検討し、日本提案として IMO 提出文書を作成した。

5.2　要件の整理

上記作業内容を考慮し、火災試験方法コード改正提案の検討項目をまとめた。

具体的な検討内容としては、以下に示す、Annex 1－Annex 3（Annex 3-Appendix 1 & Apendix 2 を含む）を参照。

本内容に準じて IMO FP50 提案文書が作成され、以下の文書が IMO に提案された。

提案文書	文書内容
FP50/10/1	FTP コードの改正提案本文（発行された FTP コードの Amendment、Unified Interpretation、改正された ISO 試験規格、及び改正案と判断され FTP コードの解釈案の審議で議論されなかった提案等、並びに日本コメントを含む）
FP50/10/1 Add.1	FP50/10/1 の補足提案（FTP コードの改正に対する日本の改正提案を含む）
FP50/10/2	New FTP コード（案） （発行された FTP コードの Amendment、Unified Interpretation を含む）
FP50/10/3	FTP コード Part 3 – IMO A. 754 改正案 （発行された FTP コードの Amendment、Unified Interpretation を含む）
FP50/10/4	FTP コード Part 5 – IMO A. 653 改正案 （発行された FTP コードの Amendment、Unified Interpretation を含む）
FP50/INF.5	FTP コード Part 2 煙と毒性試験における FTIR ガス分析方法において、ISO 規格案の紹介と、日本が ISO 規格案に基づき FTIR ガス分析試験を実施していること、及び FP51 にはその結果を報告することを、INF.として報告。
FP50/9	議題 9 関連　防火扉の下部隙間に対する日本提案

<< ANNEX 1 >>

1. Amendments of FTP code (Issued)

Relevant document	Para.	Description of the amendment	No of MSC	Action	Comments
FTP code	9	(Add new text) List of references	MSC.101(73)	Add text to the code.	
Part 10 -Fire-resistant materials for HSC	Annex1 Part10	(Add new text; FTP code Part10) 1. Application 2. Fire test procedure : MSC.40(64) as amended by MSC.90(71)	MSC.101(73)	Add text to the code.	
Part 11- Fire-resistant divisions for HSC	Annex1 Part 11	(Add new text: FTP code Part11) 1. Application 2. Fire test procedure: MSC.45(65). 3.Additional requirements	MSC.101(73)	Add text to the code.	
FTP code Annex2	3,4,	(Add new text under “Product which may be installed without testing and/or approval”) 3,4,	MSC.101(73)	Add text to the code.	
Part 2- Smoke and toxicity test	2.6.2	In the table of limits, the following text is added after the entry “SO2 120 ppm”; “(200 ppm for floor coverings)”	MSC.173(79)	Add text to the code.	

2. Unified interpretations for FTP code (Issued)

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
FTP code Approval	5.1.6.5	For cases where an unsuccessful test had been conducted prior to the final approval test, the fire test report should include a description of the modifications made to the test specimen that resulted in the successful test.	1004 (1120)	Keep as interpretation	If the manufacturer would be tested by the several test laboratories when the test was failed, it is difficult that the test laboratory to trace all history of the failure results. So, it should be keep as the interpretation. 試験所間をまたがる試験結果はトレースできない点について問題がある。FTP コードに取り込みにおいては、interpretation として残すべきである。

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
FTP code Approval	5.2.4	Type approval certificates for windows should state which side of the window was exposed to the heating condition during the test.	1036 (1120)	Add text to the code, but A754 should be modified	This interpretation might be conflicted with Res.A754 Appendix AI_2.2. So, A754 Appendix AI_2.2 should be modified. 1) delete the following sentence; "not necessarily being the worst way round." 2) add the following sentence after "the unexposed face of the structural core"; ", such as the window on front bulkhead of the tanker" 3) So the text should be modified as below; "The bulkhead which includes the window should be insulated to class A-60 on the stiffened face, which should be the face exposed to the heating conditions of the test. This is considered to be most typical of the use of windows on board ships~~, not necessarily being the worst way round~~.(deleted) There may be special applications of windows where the Administration considers it appropriate to test the window with the insulation of the bulkhead to the unexposed face of the structural core<u>, such as the window on front bulkhead of the tanker,(added)</u> or within bulkheads other than class A-60." Res.A754 の Appendix AI_2.2 に「窓の試験は、隔壁加熱面に防熱を施すこと」が記されている。FTP コードに取り込む場合矛盾が生じる。あくまでも「主管庁がみなした特別な適用」であることを明確とするか、Res.A754 の Appendix AI_2.2 の記載内容の変更、削除が必要。
FTP code Approval	5.2.4	The certificate should include a reference to optional test(s) such as hose stream test and/or thermo radiation test.	1036 (1120)	Keep as interpretation	"A754 Appendix AI_5 Hose stream test" and "FTP code Annex1 Part3 Appendix thermo radiation test" is the optional test for the window type approval. But it is not clear that which case of the window should be required those optional tests. So, it should be clear the specific reason that those optional test should be required at the code. If it is difficult to make the those reasons clearly, this text should be keep as the interpretation, or it might be the cause of misunderstanding that those optional test would be mandatory requirement. FTP コードに取り込む場合、付加試験が要求されるべき設計仕

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
					様か否かを明確にすべきである。（船上の取り付け箇所により、放水試験、熱輻射の通過制限を要求されない箇所もあると思われる。）また、コードに取入れることで、強制要項と誤解されやすい。interpretation として残すべきである。
Part 1-Non-combustibility test	2.1	The test exposure need not exceed a 30 minute duration.	964 (1120)	Add text to the code	
Part 1-Non-combustibility test	2.1	For the purposes of this Part, ISO 1182:2002 may be used in lieu of ISO 1182:1990.	1120	Add text to the code	“may” should be changed “shall”.
Part 2-Smoke and toxicity test	2.6.2	Not only the FTIR (Fourier Transform Infrared Spectrometer) method but also other methods such as GC/MS (Gas Chromatography/Mass Spectrometer) which can produce traceable results can be used for the gas analysis.	916 (1120)	Add text to the code	Although gas measuring method by using FTIR, and GC/MS were provided by MSC/Circ.916, Japan consider that not only the gas measuring apparatus but also the gas sampling method are very important factor of the measuring. Because the test result of FTIR and indication tube, which applied by same sampling method, were just about same through our experience. FTIR test method is under developing in ISO now. After this test method would be established, gas measuring method of Part2 should be carried out in accordance with ISO standard. It would be also provided those sampling method. * See the comment of FP50_INFX submitted by Japan for detail. FTIR によるガス測定方法が ISO にて開発中である。本測定方法の ISO 規格が確定したら FTP コード Part 2 に取り込むことを提案する。
Part 3-Test for Fire door	2.1	"B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested.	916 (1120)	Add text to the code	“B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A. 754(18)” is obscure meaning. So, definition of the “B class steel bulkheads” should be clear. Japan consider that 3.2 mm thickness steel plate, instead of 4.5 mm on A class bulkhead, apply the bulkhead core for B-class fire door test * See the comment of Annex3 for details MSC/Circ.916 の FTP コードへの取り込みにおいて、「B class steel bulkheads の定義」をはっきりさせるべきである。

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
Resolution A.754(18) Annex	2.6.2.2	"B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested.	916 (1120)	Add text to A.754(18)	Same as above.
Part 3-Test for "A","B", and "F" class divisions	2.2.1	The minimum bulkhead panel height should be a standard height of the manufactured panel with a dimension of 2.400 mm.	964 (1120)	Add text to the code	
Part 3-Test for "A","B", and "F" class divisions	3.1	The calcium silicate board described as a dummy specimen specified in paragraph 3.3 of resolution A.653(16) should be used as a standard substrate for adhesives.	916 (1120)	Add text to the code	Same text should be add to Annex1 Part5 and Res. A.653(16) . 同じ記述を、Annex1 Part 5 及び A.653(16)にも追記する。
Part 3-Test for "A","B", and "F" class divisions	4.1	Sealing materials used in penetration systems for "A" class divisions are not required to meet non-combustibility criteria provided that all other applicable requirements of FTP Code, part 3, are met.	1120	Add text to the code	Same texts should be added to Res.A754 Appendix AIII Pipe and duct penetoretions_2.2, and Appendix AIV Cable Transit_2.2. 同じ記述を、A754 Appendix AIII 2.2, and Appendix AIV 2.2.にも追記する。
Resolution A.754(18) Annex	1.2	The thickness of insulation on the stiffeners need not be same as that of the steel plate.	916 (1120)	Add text to A.754(18)	
Resolution A.754(18) Annex	1.6	Doors, windows and other division penetrations intended to be installed in fire divisions made of material other than steel should correspond to prototype(s) tested on a division made of such material, unless the Administration is satisfied that the construction, as approved, does not impair the fire resistance of the division regardless of the division construction.	1004 (1120)	Add text to A.754(18)	
Resolution A.754(18) Annex	1.7	"B" class constructions should be tested without finishes. For constructions where this is not possible, finishes should be included in the	916 (1120)	Add text to A.754(18)	

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
		non-combustibility test of the construction.			
Resolution A.754(18) Annex	2.8.2	Where testing is conducted on a perforated ceiling system, equally constructed non-perforated ceilings and ceilings with a lesser degree of perforations (in terms of size, shape, and perforations per unit area) may be approved without further testing.	1120	Add text to A.754(18) Modify is necessary.	Res.A754 2.8.2 described as below; "If the ceiling may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the ceiling itself, without the incorporation of these units, to establish the basic performance. A separate test(s) may be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the ceiling." This interpretation might be discrepancy with above sentence. So modification of the above sentence of A754 should be necessary. New sentence proposed; A754 には、「リセスの試験では、リセスなしの試験と、リセス付きの試験の両方で評価すること」となっているが、この解釈では、「リセス付きのみ実施すれば、リセスなしの試験は免除できる。」と解釈できる。A754 の修正が必要。
Resolution A.754(18) Annex	9 (9.2)	There exist no expectations that "A" and "B" class fire doors remain functional, in the ability to be opened/closed, during or after the specified test duration.	1120	Add text to A.754(18) Annex 9.2	
Resolution A.754(18) Appendix A.I Windows	2.1	The test should be conducted on a window of the maximum size (in terms of both the height and the width) and the type of the glass pane and/or the minimum thickness of the glass pane or panes and gaps, if appropriate, for which approval is sought. Test results obtained on this configuration should, by analogy, allow approval of windows of the same type, with lesser dimensions in terms of height and width and with the same or greater thickness.	1036 (1120)	Add text to A.754(18) Appendix A.I 2.1	
Resolution A.754(18) Appendix A.I Windows	5.3	The window should be considered to have failed the hose-stream test if an opening develops that allows an observable projection of water from the stream beyond the unexposed surface during the hose stream test. Gap	1120	Add text to A.754(18) Appendix A.I 5.3	

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
		gauges need not be applied during or after the hose stream test.			
Resolution A.754(18) Appendix A.II Fire dampers	2.2.4	The distance between the fire damper and the structural core specified in paragraph 2.2.4 means the distance between the fire damper centre and the structural core.	964 (1120)	Add text to A.754(18)	Modify the drawing of A.754(18) Appendix A.II. “Length of the coaming” and “the distance between the fire damper and the structural core” should be show on the drawing, A.754(18) Appendix A.II Figure A1. A754 の記載内容、図の修正 コーミングの長さ（全長 900mm 以上、片側 450mm 以上）、及びダンパーの位置は隔壁から 225mm 以上を、図面に明記すべきである。
Resolution A.754(18) Appendix A.II Fire dampers	4	If evaluation of insulation is required, it should prevent a temperature rise at any point on the surface not exceeding 180°C above the initial temperature. The average temperature rise is not relevant.	964 (1120)	Add text to A.754(18)	
Resolution A.754(18) Appendix A.III Pipe and duct penetrations	4.1	Penetrations and transits should meet both integrity and insulation criteria.	916 (1120)	Add text to A.754(18)	
Resolution A.754(18) Append. A.IV Cable transits	4.1	Penetrations and transits should meet both integrity and insulation criteria**.**	916 (1120)	Add text to A.754(18)	Res.A754 Append. A.IV4.1 described as below; “The performance of cable transits may be related to their ability to satisfy both the requirements for insulation and integrity or may be related only to the requirements for integrity, depending on the requirements of the Administration.” This interpretation might be discrepancy with this interpretation. So modification of the above sentence of A754 should be necessary. Following sentence should be deleted. “or may be related only to the requirements for integrity, depending on the requirements of the Administration.” A754 Append. A.IV4.1 には、「電線貫通部の性能は、防熱と保全性の両方の基準にて判定する、または主管庁の要求により、保

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
					全性のみの基準にて判定してもよい。」と記されており、本解釈案と矛盾する。以下の文を削除する。「または主管庁の要求により、保全性のみの基準にて判定してもよい。（削除）」

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
Part 5 - Test for surface flammability	1	Where a product is approved based on a test of a specimen applied on a non-combustible substrate, that product should be approved for application to any non-combustible substrate with similar or higher density (similar density may be defined as a density ≥ 0.75 x the density used during testing) or with a greater thickness if the density is more than 400 kg/m^3. Where a product is approved on the basis of a test result obtained after application on a metallic substrate (e.g. thin film of paints or plastic films on steel plates), such a product should be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness ≥ 0.75 x the thickness of metallic substrate used during testing).	1004 (1120)	Add text to the code	Although MSC/Circ.1004 is the guideline for the type approval of the surface materials, there are some unidentified points for the surface materials. 1. When the no substrate applied for the surface flammability test, product should be approved to both of metallic and non-combustible substrate. 2. For the floor coverings, interpretation of MSC/Circ.1004 is meaningless, because the floor covering could be accepted to carry out single layer test, which meaning that the influence of the substrate could be neglected. 3. For the bulkhead and ceilings, it is not accepted to carry out single layer test, so the test should be based on interpretation of MSC/Circ.1004 strictly. To clarify those unidentified points of approval, Japan made the guideline of the specimen substrate and its type approval, which set at appendix 1 of Annex3, and propose it should be add to the code. FTP コードに取り込み時の疑問点（不明点）が有る。 1）基材を使用しないで実施した試験の場合は、鋼材や、不燃性ボードにも適用できるのか。 2）床材の場合は、床材の各々の層が Part 5 の要件を満たしていなければならない。すなわち、基材の影響を無視できるので、各層が規格ぎりぎりの値で合格していても、複合での使用を容認しているため、試験体基材と施工時の制限条件は、床材には適用されない。 3）表面材（壁、天井）には、厳密に適用すべきであり、壁や天井での承認品の複合使用には、試験も複合試験が必要と考える。 ＜改善事項＞ 上記、不明点を明確にするために、我が国は、「表面材料試験の試験体基材と、その型式承認についてのガイドライン」を作成した。メンバー各国に、本ガイドラインの適用についての検討を要請する。

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
Resolution A.653(16) Annex	7	Same as above	1004 (1120)	Add text to A.653(16) Annex	Same as above
Resolution A.653(16) Annex	7.3	Vapour barriers used in conjunction with insulation should be tested without any other components of “A” or “B” class constructions that will shield the barrier being tested from the radiant panel.	1120	Add text to A.653(16) Annex, and FTP code Annex1 Part5	Evaluation test for the Vapour barriers should be carried out by Part5 surface flammability test without any other components of “A” or “B” class constructions. But the vapour barriers itself is very thin product, and it is impossible for testing without the specimen backing. Japan thinks that it would be problem of this test method. Therefore Japan propose that the evaluation test for the Vapour barriers with backing layers should be tested for non-combustibility test instead of surface flammability test. When there is several density of the insulation which would be base of Vapour barrier, both of maximum and minimum density of insulation material with Vapour barrier should be tested. * See the comment of Annex3 for details Vapour barriers の評価を不燃性基材なしで Part5 の表面燃焼性試験で実施することとなったが、Vapour barriers は薄い材料であり、基材無しでの Part 5 の試験は無理と思われる。 日本は、「Vapour barriers＋ロックウール」の組合せで、不燃性試験で評価することを提案する。（密度は、Min.＆Max.の両方を実施する。）
Resolution A.653(16) Annex	8.3.1	In the first line of the first sentence, the word “or” should read “of”'.	1004 (1120)	Correct text A.653(16) Annex,	
Resolution A.653(16) Annex	10	The sentence should be understood to mean: “Materials giving average values for all of the surface flammability criteria as listed in the following table ... (etc).	1036 (1120)	Correct text A.653(16) Annex,	
Resolution A.653(16) Annex	10	Q_{sb} means an average of three values of average heat for sustained burning, as defined in paragraph 9.3.	1004 (1120)	Add text to A.653(16) Annex	Q_{sb}, average heat for sustained burning, will be calculated by the 150 mm, the first position, to the final station or 400mm which value is lower. When the frame front does not reach 180mm position, the value of Q_{sb} can not calculated in accordance with A653 Para. 3.8. In

Relevant document	Para.	Description of the interpretation	MSC/Circ	Action	Comments
					this case, the calculation method of Q_{sb} is not clear. It should be improved. 試験時の燃焼距離が 180mm を超えない場合は、Qsb は確定した値を持たない。その場合の平均値の計算方法は、不明である。（要検討）
Part 6 - Test for primary deck coverings	2.1	For the purpose of this part, the total heat release value (Q_t) for floor coverings given in section 10 of the annex to resolution A.653(16) is replaced by ≤ 2.0 MJ.	1120	Revise the table of A.653(16) Annex	Qt value in the table of "Surface flammability criteria" described in A653 Para.10 should be changed from 1.5 to 2.0MJ. （A653 の 10 項の床張り材､一次甲板床張り材の Qt の基準値は､2.0MJ 以下に変更する必要が有る。）
Part 6 - Test for primary deck coverings	2.2	Fire test procedure The test may be terminated after 40 min.	1004 (1120)	Revise text of FTP code	

3. Proposal that did not discussed as it was an amendment rather than interpretation.

Following subjects did not discussed at FTP code interpretations, as the group considered being an amendment. If it would be necessary to discus those subjects again.

Code	Ref.	Description of reference documents	Judgement of FP	Action to be taken
Part 5 - Test for surface flammability	FP 49/6 （France） FP48/15 FP 46/5/3	Preparation of specimens for Sealants and Mastics シール材及び樹脂材の試験方法の改正 A.653(16)	(FP49 Report) this item could be merged with the item on the comprehensive review of the FTP Code. 審議事項（継続審議）FP50 では、総合見直しの中で検討することとなっている。	To be continued on the comprehensive review of FTP code.
Part3- Fire door	FP 49/7 （France） FP48/14	Consideration of the Bottom clearance of the fire door 防火扉の性能要件に関する A.754(18) の改正	(FP49 Report) further consideration was needed to resolve the matter and invited Members and international organizations to submit comments and proposals to FP 50. FP50 議題９での審議事項（継続審議）	FP50 Agenda 9(To be continued.)

Code	Ref.	Description of reference documents	Judgement of FP	Action to be taken
Part3 – Enlarged fire door	FP 48/4, paragraph 11 and annex 5	The development of performance standards for large fire doors 大型防火戸の評価方法の確立	(FP48 WG) The group concurred with the view that enlarged fire doors are used on all types of ships and not only on large passenger ships and that enlarged fire doors as a matter of principle should be considered in relation to all ships. The group therefore encouraged Members to submit such a new work programme item proposal with supporting documentation to the Committee. FTP code の CG で検討が必要と考えられる。（継続審議事項）	Further discussion should be necessary?
	FP48/3/4 (US)	3) Proposed interpretation on combustible insulation for piping systems within machinery spaces. 機関区域の配管への可燃性材料の断熱材の使用について	Not discussed (FP48WG) The proposed interpretation on combustible insulation for piping systems within machinery spaces, the group considered this to be an amendment. Not discussed	Further discussion should be necessary?
Part3 – Fire door	FP48/3/4（US）	7) Substitution of stainless steel for steel without additional testing ステンレス材料の鋼への無試験代用	Not agreed (FP48 WG) The proposed interpretation on substitution of stainless steel, the group discussed the matter, but no firm conclusion was reached. FP48 では議論が進まなかった。このようなケースに対する試験のあり方について今後検討が必要と考えられる。	It might be need to discuss more about this issue, if it would be necessary,
Part3 – bulkhead	FP47/3/3（Russia）	Testing of “A-0” corrugated bulkhead 波型隔壁の A 級隔壁防火試験に関する解釈案	Not discussed (FP47 Report) proposing amendments to resolution A.754(18) with regard to “A” class bulkhead tests, and concluded that the document does not give sufficient information or comparison data to support the proposed amendment. このようなケースに対する試験のあり方について今後検討が必要と考えられる。 （新技術に関する内容として検討すべき）	Further discussion should be necessary? （新技術の内容として検討すべきか？）

Code	Ref.	Description of reference documents	Judgement of FP	Action to be taken
Part3 – bulkhead	FP47/3/5 （Italy） Annex 1	Test for Division – para7.5.1.6 and 9.3 of Annex アルミニウム隔壁（甲板）の試験方法に関する解釈案	Not discussed (FP47 Report) the proposed interpretation to paragraphs 7.5.1.6 and 9.3 of the Annex to resolution A.754(18) represented an amendment rather than an interpretation and was therefore not supported. However, the Sub-Committee also agreed that thermocouples placed over aluminium deck stiffeners can yield higher temperatures than those placed on aluminium plate and that this issue should be taken into consideration for any future discussion on amendments to resolution A.754(18); 判定基準の改定であり、議論が必要と言える。	Further discussion should be necessary? （新技術の内容として検討すべきか？）
Part3 – bulkhead	FP47/3/5 （Italy） Annex 2	paragraphs 1.2 and 2.1 of the Annex to resolution A.754(18)	(FP47 Report) the group agreed in principle with the proposed interpretation to paragraphs 1.2 and 1.6 of the annex to resolution A.754(18) but noted that there was not sufficient information on test results regarding primary deck coverings for final approval;	Further discussion should be necessary?
Part3 – bulkhead	FP47/3/5 （Italy） Annex 3	Testing criteria of A-class corrugated bulkhead paragraphs 1.2 and 2.1 of the Annex to A.754(18) 波型の構造体をスティフナーの代わりに使用した A 級防火隔壁の判定方法	(FP47 Report) the group did not support the proposed interpretation to paragraphs 1.2 and 2.1 of the Annex to resolution A.754(18) since it considered this to be an amendment to the resolution rather than an interpretation Not discussed	Further discussion should be necessary? （新技術の内容として検討すべきか？）
Part3	FP 46/5 (US)	Optional test of Windows (Fire testing of watertight door) Watertight door の試験（放水試験、熱輻射測定）	(FP46 WG) It to be amendments and did not include them in the interpretations. Not discussed 今後も引続き審議されるべき項目か？	Further discussion should be necessary?

Code	Ref.	Description of reference documents	Judgement of FP	Action to be taken
Part3	FP44/6/3 (china)	Para.4: B-class steel bulkhead described on MSC/Circ.916. The thickness of steel sheet is proposed to be 0.6 ± 0.1 mm and that of mineral wool to be 50 ± 5 mm. MSC/Circ.916 に示す鋼製の B 級隔壁を明確にすべき（鋼板 0.6mm、防熱 50mm）	(FP45 WG) the group agreed that this was sufficiently covered by the interpretation to paragraph 2.1 of part 3 of the FTP Codes set out in circular MSC/Circ.916. FP44 では、日本は「特に必要なし」との判断。しかし、鋼製の B 級隔壁とは何かは不明である。日本国内は、試験時の鋼製の B 級隔壁とは「鋼板 3.2mm、B15 は防熱材 30mm、B0 は防熱材なし（NK 案）」と判断し適用している。（国内でも特に文書化されていない。鋼製の B 級隔壁の定義も不明確のため、議論すべきと考える。） MSC/Circ.916 の FTP コードへの取り込みにおいて、「B class steel bulkheads の定義」をはっきりさせるべきである。	Definition of the B-class steel bulkhead should be clear?
Part3	FP44/6/3 (china)	Para.5: Test for A,B&F class division Part 3-A 級隔壁+B 級内張り、A 級甲板＋B 級天井の試験について	(FP44 WG) document represented proposals for amendments to the Fire Test Procedure Code and relevant fire test procedures and took no further action in respect to these proposals. Not discussed. 今後審議されるべき項目か？	Further discussion should be necessary? （新技術の内容として検討すべきか？）
Part3 – Ventilation system	FP49/INF.2（UK）	Test for ventilation duct 排気ダクトの試験方法について（試験例の紹介）	Information only	Further discussion should be necessary? （新技術の内容として検討すべきか？）

<< ANNEX 2 >>

4. ISO standards that were referred in FTP code were updated.

Relevant document	**ISO No**	**Description of the ISO STD**	**Action**	**Remarks**	**Comments**
Part 1- Non-combustibility test	1182	Original - ISO1182:1990 Updated - ISO1182:2002	Modify FTP code	Agreed to add UI	
Part 2- Smoke and toxicity test	5659-2	Original - ISO5659-2:1994 (Not revised) ISO/CD21489:Fire tests -Method of measurement of gases using Fourier transform infrared spectroscopy (FTIR) in cumulative smoke test FTIR test method: under developing now.	要検討		Although gas-measuring method by using FTIR, and GC/MS were provided by MSC/Circ.916, Japan consider that not only the gas measuring apparatus but also the gas sampling method are very important factor of the measuring. Because, through our experience, the test result of FTIR and indication tube, which applied by same sampling method, were just about same. FTIR test method including those sampling method is under developing in ISO now. After this test method would be established, gas measuring method of Part2 should be carried out in accordance with ISO standard. MSC/Circ.916 の発効により、Part 2 のガス測定には、FTIR や GC/MS を使用することとされた。しかし、日本での試験では、サンプリング方法が同じ場合、FTIR もガス検知管もほぼ同等の試験結果を出しており、試験装置だけでなくガスのサンプリング方法は、試験の重要な要素である。 サンプリング方法も含めた FTIR によるガス測定方法が現在 ISO にて開発中である。本測定方法の ISO 規格が確定後 FTP コード Part 2 に取り込むことを提案する。
Part 5 - Test for surface flammability	5658-2	Reference: ISO5658-2:1996 (Not revised yet) (Similar test of Res. A.653(16)) ISO/CD5658-2: Reaction to fire tests – Spread of flame – Part2: Lateral spread on building products in vertical configuration	要検討	A653 should be modified ISO5658-2 規格が改定されたら、IMO Res. A.653(16) の見直しを検討する。	ISO5658-2 is under revising in ISO now. Modification points are; 1) Pilot flame: changed from Acetylene gas to Propane gas 2) Delete remote pilot flame test, use only impinge flame test. Test apparatus of ISO5658-2 at testing laboratory for FTP code are usually share with the test apparatus of A653. (FTP code Part5). This modification of ISO5658 might be destroyed those compatibility. So, test of A653 should be changed as same as ISO5659-2. Additional reason for the change; At the original test of A653, in the case of that the result of impinge flame condition might be applied for the judgement and it failed, although the result of remote flame

Relevant document	ISO No	Description of the ISO STD	Action	Remarks	Comments
					condition was not burned, it might not be satisfaction of the test result. Above modification would be more clear or reasonable test result for the flammability characteristic. ISO5658-2 が現在改正作業中である。（ISO/CD5658-2） 改正点、1) アセチレンガスからプロパンガスに変更、2) 非接触着火炎の試験を省き、接触炎のみで試験する。 火災試験所の ISO5658-2 の試験は、A653 の試験装置と共用しているため、ISO 規格の改正は共通性が崩れる。A653 も同時に改正することが望ましい。 （今までの試験では、非接触着火炎の試験で着火しなかった試験体が、接触着火炎の試験で、不合格の値となるケースも有り、合否の判定の不明瞭さが有ったが、ISO5658-2 同様に、接触着火炎のみの試験にすることで、その問題が解決する。）
Part 5 - 3.1 gross calorific value	1716	Original - ISO1716:1973 Updated - ISO1716:2002	FTP code の改正	Agreed to add UI	
Part10 – Test for high-speed craft	5660-1	Original - ISO5660-1:1993 Updated - ISO5660-1:2002	MSC40(64) MSC90(71)		
Part10 – Test for high-speed craft	9705	ISO 9705:1993			

<< ANNEX 3 >>

5. Several reviews and revisions of the FTP code would be necessary through the experience of the application of FTP code

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part1	Vapour barriers	Evaluation test method for the Vapour barriers, usually made by aluminium sheet or glass cloth sheet, used in conjunction with insulation was noted as MSC/Circ. 1120 that it should be tested by Part5 surface flammability test without any other components of “A” or “B” class constructions. But the vapour barriers itself is very thin product, and it is impossible for testing without the specimen backing. Japan thinks that it would be problem of this test method. Therefore, Japan used to carry out by Part1 non-combustibility test for evaluation of the Vapour barriers, and then it is satisfied ‘the products which may be installed without testing and/or approval described Annex2 5.1. Proposal: Evaluation test method for the Vapour barriers should be used for non-combustibility test instead of surface flammability test. To clarify the test methods of the Vapour barriers by using Part1, those application should be noted on the code. When the evaluation of the Vapour barriers by using Part1 non-combustibility test, following method would be applied. 1. Vapour barriers used in conjunction with insulation should be tested with the components of “A” or “B” class constructions. 2. When there is several density of the insulation which would be base of Vapour barrier, both of maximum and minimum density of insulation material with Vapour barrier should be tested. Vapour barriers（ロックウールの上に薄いアルミシートやガラスクロスを貼り付けて使用する）の試験については、MSC/Circ.1120 において、Vapour barriers（フィルム等）を基材（ロックウール等）から切り離し、Part 5 で評価する方法がノートされた。しかし、この場合 Vapour barriers は薄く単体での試験は不可能と思われ、試験体基材が必要となる。(Part 5 による試験の問題点) 日本は、これに対して Part 1 の不燃性材料試験にて評価をしている。Part 1 の試験は Part 5 の要件を満足すると考えられる。日本は、Vapour barriers の試験については、表面燃焼性試験の代わりに、不燃性材料試験への変更を提案する。 Part1 による Vapour barriers の評価方法を明確にするため、試験方法を推奨する。（日本での試験方法：ロックウールの上に薄いアルミシートやガラスクロスを貼り付けて使用する場合（Vapour barriers）は、ロックウール等との複合状態で不燃性材料試験にて評価する。基材となるロックウールの密度が複数の仕様がある場合には、仕様の最大と最小の両方の密度について不燃性試験を実施する。）	Test method for the Vapour barriers should be considered.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part1	Test report for A754 fire test	Following text of “non-combustibility test reports should not be more than 24 months old at the date of the performance of the fire resistance test” is described on A.754(18) 3.1. It doesn't harmonize with five years of type approval period for the non-combustible material, and it might be some confusion is occurred at the conducting of the fire resistant test of Part3. Therefore, it proposes changing hereafter. 1. Type approval product of non-combustible material (within the period of the approval): Test report may not be required. 2. Not type approval product: The non-combustibility test reports should not be more than 24 months old at the date of the performance of the fire resistance test would be required. So, new test should be added after above sentence. New text “non-combustibility test reports may not be required if the type approval product that within the approval period would be used.” A754(18)の Para3.1 に Part 3（標準火災試験）の試験体に使用される不燃性材料については 2 年（24 ヶ月）以内の試験報告書を要求しているが、不燃性材料自体の承認期間の 5 年間と合致せず、Part 3 の試験実施時に混乱を招く。よって、以下変更を提案する。 1. 型式承認品の不燃性材料（承認期限内のもの）：試験報告書は必要としない。（承認時に確認されているので） 2. 型式承認品以外の不燃性材料：現状の通り「24 ヶ月以内の試験報告書を要求する」 よって、A754（18）の Para3.1 の「24 ヶ月以内」を、「承認期間内の型式承認品を除く」を追記する。	Handling of the non-combustibility test reports should be considered.
Part1	torerance of Product density	When testing the Part3, the tolerance of specimen density of the non-combustible material is required within +/-10% value, but the density allowance of the some products itself is more than 10%. So, it might be inadequacy for using those materials to the A-class division. Therefore, non-combustible material that allowance of density is more than 10% are inadequate as the material which is used for the insulation material of the A-class division, and it shall be described on the type approval certificate. (Limitation of the non-combustible material) Part 3 の試験時は不燃性材料の試験体密度の許容値+/-10%を要求しているが、実際の製品自体の密度の許容値が＋10%以上の製品もあり、これらは Part 3 に使用する材料としては不適切と考えられる。従って、“製品許容値が＋/－10%以上の不燃性材料は、A60 の防熱材料としては不適当”と考えられ、型式承認証書には、制限事項としてその旨記載することが望ましい。	Add the comments on the Type approval certificate

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part3	Insulation materials For bulkheads and decks	Recently the trend of the insulation materials for A60 bulkheads and decks became thinner and lighten, it means that the design of it became very close to the margin of the A60 performance. Therefore following restriction would be necessary for reflect the specimen information to the product accurately. Following restriction should be added to the test of Part3, A754. 1. (A754 Para3.2.4 first sentence) The thickness of each material used in the test specimen should be +/-10% of the value stated as the nominal thickness. (New sentence) 2. (A754 Para3.2.5 first sentence) The density of each material used in the test specimen should be +/-10% of the value stated as the nominal density. (it sentence is moved from A754 Para3.1) 3. (Type approval certificates of the bulkheads, ceilings and decks) Information of the insulation materials including its tolerance of the density and thickness should be stipulated on the type approval certificate of the bulkheads, ceilings and decks. Specifically, the tolerance of the density and thickness more than 10% of the nominal value could not be accepted to the insulation material for A60 bulkheads, ceilings and decks. (New sentence to FTP code Para. 5.2.6) A60 仕切り隔壁、甲板の防熱材について 近年 A60 仕切り隔壁に使用されているロックウールは、密度は小さく、厚さは薄くなる傾向にある。すなわち合格基準値ぎりぎりの設計で有るが、合格した試験体仕様が正しく製品仕様に反映されるためには、以下の規定が必要と考える。 Part 3 の試験については、以下の改定が必要。 1) Part 3 試験時の製品厚さは、製品仕様値の+/-10%とすべきである。（改正提案 A754 3.2.4） 2) Part 3 試験時の密度は、製品仕様値の+/-10%とすべきである。(A754 3.1 の記述を、現文のまま A754 3.2.5 に移動) 3) Part 3 隔壁、天井、甲板の型式承認証書には、不燃性材料の製品仕様値を明記する。（厚さ、密度の製品仕様値での許容値は+/-10%以内でなければならない。それ以上の許容値の製品（不燃性材料）の使用は認められない。）（改正提案 FTP コード 5.2.6 に追加する）	Tolerance of the insulation materials should be considered.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part3	Fire door	MSC/Circ.916 specified that "B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested. On the other hand, A.754(18) 2.6.2.2 : “The door leaf and frame should be mounted as appropriate into a “B” or “F” class bulkhead of compatible construction, thereby reflecting an actual end use situation. The bulkhead should have dimensions as prescribed in 2.4.1. The bulkhead should be of a construction approved by the Administration as having at least a similar classification to that required by the door. ” Therefore B0 class fire doors should be tested by B0 class steel bulkhead, and B15 class fire doors should be tested by B15 class steel bulkhead. However “B0 class and B15 class steel bulkheads” is obscure meaning. So, definition of the “B class steel bulkheads” should be clear. Japan interpret that 3.2 mm thickness steel plate, instead of 4.5 mm on A class bulkhead, apply the bulkhead core for B-class fire door test Stiffener should be same as A class bulkhead. MSC/Circ.916 で「B 級防火戸の試験においては、B 級の鋼製隔壁に取付けて試験した場合は、試験された B 級防火戸は他の隔壁に使用できるが、それ以外の隔壁で試験した場合は、取り付け可能な隔壁は試験時の隔壁に限定される。」との解釈がなされた。 一方、A.754（18）2.6.2.2 には、「扉及び戸枠は、実際の使用状況を反映する様な B 級または F 級の隔壁に取付ける。（2.4.1 に規定された寸法）隔壁は、少なくとも防火戸の要求する等級と同じものとし、主管庁によって承認された隔壁とする。」と記されている。 すなわち、B0 級防火戸の試験には B0 級隔壁を使用して、B15 級防火戸の試験には B15 級隔壁を使用して試験を実施することとなる。この場合、B0 級及び B15 級の鋼製隔壁とは、どのような隔壁を例示すれば良いのか不明である。 日本では（主管庁判断として）、「B 級鋼製隔壁は、厚さ 3.2mm の鋼板（参考：A 級隔壁は厚さ 4.5mm）と 65mm のスティフナーの構成とする。B0 級鋼製隔壁の場合は防熱材を使用しないこととし、B15 級鋼製隔壁の場合は、厚さ 25mm の防熱材を使用する。」 MSC/Circ.916 の FTP コードへの取り込みにおいて、「B class steel bulkheads の定義」をはっきりさせるべきである。	Definition of "B" class doors should be considered.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
A.754 Appendix A.IV Cable Transit	Insulation material for Cable Transit	Insulation material for Cable Transit When the fire resistant test for Cable Transit, temperature of following points would be measured. 1. two positions on the surface of the outer perimeter of the frame, box or coaming 2. two positions at the end of the transit, on the face of the sealant system or material 3. the surface of each type of cable included in the cable transit Generally the insulation material of the coamings would be used a same materials for the bulkheads or decks. It would be supposed that the deferent insulation material would be applied for the ships than the material that applied for the test. Japan believes that the coaming is a part of the bulkhead or deck, because the same insulation material would be applied on it. Therefore Japan believes that the restriction of the insulation material is not suitable, but also the temperature measuring of the coaming surface is unnecessary. Following change would be required. 1. The temperature measuring of the coming surface is unnecessary. (It would be deleted.) 2. When the insulation would be applied on the surface of the cable transit, such as drawing of A.2 on A754(18) Appendix A.IV, the insulation material is a part of cable transit system, then the restriction of the insulation material is necessary. 電線貫通部の試験に使用する断熱材 電線貫通部の試験においては、コーミング外側表面温度、電線貫通部詰め物表面温度、貫通ケーブルの表面温度を測定する。通常コーミング外側の断熱材は、隔壁または甲板の防熱に使用される断熱材をコーミング周りに施工し防熱するので、船舶の設計により使用材料は異なる。すなわち、実船において試験実施時の断熱材を使用するとは限らない。我が国は、コーミングは、隔壁、及び甲板と同じ防熱材が施されるため、壁、及び甲板の一部と判断すべきである。使用する断熱材の制限は適当ではなく、測定も不要と考える。 よって、以下の変更を提案する。 1）コーミング外側表面温度測定は不要である。（廃止する。） 2）但し、A754（18）Appendix A.IV の図 A2 に示す防熱材表面を測定する場合は、その防熱材は電線貫通部詰め物とペアで使われる材料として、限定使用とすべきである。	Temperature measuring of the coaming surface should be considered.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part3	Window Temperature measurment position	Temperature measuring points and it criteria of the windows. Although the following text was described on A.754(18) Appendix AI 3, the criteria of the thermocouples that were fitted to the window frame is not clear. On the other hand, A.754(18) Appendix AI 4.1 provided that only those thermocouples fixed to the face of the window pane(s) should be used for the calculation of the average temperature rise on the unexposed face. So, additional thermocouples fitted to the window frame are only the reference measuring. It should be necessary to specify that additional thermocouples fitted to the window frame are only the reference measuring, not used for the criteria. A.754(18) Appendix AI 3: thermocouples should be fixed to the window pane as specified for the leaf of a door. In addition, thermocouples should be provided to the window frame, one at mid-length of each perimeter edge. A.754(18) Appendix AI 4.1: For the calculation of the average temperature rise on the unexposed face, only those thermocouples fixed to the face of the window pane(s) should be used. Therefore to clarify the criteria of the windows, following texts should be added on Appendix AI Para.5.3. 1. For the calculation of the average temperature rise on the unexposed face, only those thermocouples fixed to the face of the window pane(s) should be used. 2. For the judgment of the maximum temperature rise on the unexposed face, all of the thermocouples fixed to the face of the window pane(s) and the window frame should be used. 防火窓の温度測定点と判定基準 窓の試験（Appendix AI）Para3 には「窓表面に 5 点、窓枠に 4 点の熱電対を取付けること」が規定されているが、窓枠の 4 点の熱電対が判定基準として使用されるか否かが明確でない。Para4.1 の判定基準に、平均温度上昇の計算は、窓表面 5 点の熱電対で判定するとされている。 よって、判定基準を明確にすべきである。 Para5.3 の判定基準に以下を追加する。：1）平均温度上昇の計算は、窓表面 5 点の熱電対で判定する。2）窓枠に付けた 4 点の熱電対は最高温度上昇の判定にのみ使用する。	Add the criteria on Appendix AI Para.5.3
Part3	Window Heat radiation measurment	Although the heat radiation measurement for the windows was specified in FTP code Annex1 Part3 Appendix 1, the criteria of the heat flux through windows are too larger value to prevent the spread of fire and to enable escape routes to pass near the windows. It is supposed that it would be meet the criteria of the heat flux from windows if the average temperature rise on the window unexposed face could be satisfy the criteria of it. So the heat radiation measurement for windows is meaningless. Therefore Japan proposes that delete the heat radiation measurement described in Appendix 1. 防火窓の試験では、窓からの輻射を測定すること（オプション試験）とされているが、ルールに規定されている「熱放射の基準値」は、あまりに大きく、その熱放射の中で乗客が避難することは困難ではないか？規格値の見直しは必要か？現状の規格値ではどんな製品でも合格する値になっているように思われ、測定する意味ないと判断する。 よって、窓からの輻射測定試験（オプション試験）は、ルールから削除する。	Deletion of the heat radiation measurement should be considered.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part5	Selection of the test specimen (Organic contents and specimen Color)	The test specimen used for the test is representative the characteristic of the product. The test specimen shall be selected as the highest danger, and a disadvantageous condition of the product in actual operating condition of the ship. Specimen selection should be concerned with thickness, colour, organic content, substrate of the product, and its combination of a product, etc. The influence of colour and organic contents of the specimen are important factors of the fire resistance tests. The organic content of the specimen is a key of the characteristic of product combustion. Specimen should be selected as the maximum organic content of the product variation. And the colour of the specimen is also a key of it, because the dark colour of specimen that absorbs the radiant heat would be easy to affect its flammability. The test results of the duck colour specimen and the bright colour specimen would be different. Then the dark colour specimen would be selected if the product has some colour variation. To clarify the selection of the representative specimen and its type approval, Japan made the guideline of the specimen substrate and its type approval, and proposes that it should be add to the code. 試験に使用される試験体は、基本的にその試験を代表するもので実施する。この場合の代表する試験体は、試験体の実船での使用条件において最も危険性の高いもの、最も試験的に不利な試験体を選択する必要が有る。これは、製品の厚さ、製品の組合せ、製品が使用される基材、製品の色、製品の有機含有量等を考慮し、代表する試験体を選択する。 試験体の有機含有量は火災試験において重要な要素である。試験体は製品の種類において、最も有機含有量の多いものを選択する。また、色についても、試験における重要な要素である。なぜならば、暗い色（黒に近い色）は熱輻射を受けて着火しやすい。黒系の色と、白系の色の試験体の試験結果は異なる結果となる。従って、試験に使用される代表試験体は、基本的には、黒系の色を選択する。 ＜改善事項＞上記、代表試験体の選択と型式承認について明確にするために、我が国は、「表面材料試験の試験体基材と、その型式承認についてのガイドライン」を作成した。メンバー各国は、本ガイドラインの適用についての検討を要請する。	Draft guideline of Appendix 1 should be considered. （Appendix 1 参照）

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part5	Test substrate And Combination test	Although MSC/Circ.1004 is the guideline for the type approval of the surface materials, there are some unidentified points for the surface materials. 1. When the no substrate applied for the surface flammability test, product should be approved to both of metallic and non-combustible substrate. 2. For the floor coverings, interpretation of MSC/Circ.1004 is meaningless, because the floor covering could be accepted to carry out single layer test, which meaning that the influence of the substrate could be neglected. 3. For the bulkhead and ceilings, it is not accepted to carry out single layer test, so the test should be based on interpretation of MSC/Circ.1004 strictly. To clarify those unidentified points of approval, Japan made the guideline of the specimen substrate and its type approval, and proposes that it should be add to the code. FTP コードに取り込み時の疑問点（不明点）が有る。 1）基材を使用しないで実施した試験の場合は、鋼材や、不燃性ボードにも適用できるの。 2）床材の場合は、床材の各々の層が Part5 の要件を満たしていなければならない。すなわち、基材の影響を無視できるので、各層が規格ぎりぎりの値で合格していても、その複合での使用を容認しているため、試験体基材と施工時の制限条件は、床材には適用されない。 3）表面材（壁、天井）には、厳密に適用すべきであり、壁や天井での承認品の複合使用には、試験も複合試験を必要と考える。 ＜改善事項＞ 上記、不明点を明確にするために、我が国は、「表面材料試験の試験体基材と、その型式承認についてのガイドライン」を作成した。メンバー各国に、本ガイドラインの適用についての検討を要請する。	Draft guideline of Appendix 1 should be considered. （Appendix 1 参照）

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
Part5	Test method & test appuratus	ISO5658-2 is under revising in ISO now. Modification points are; 1) Pilot flame: changed from Acetylene gas to Propane gas. 2) Delete remote pilot flame test, use only impinge flame test. Test apparatus of ISO5658-2 at testing laboratory for FTP code are usually share with the test apparatus of A653. (FTP code Part5). This modification of ISO5658-2 might be destroyed those compatibility. So, test of A653 should be changed as same as ISO5659-2. Additional reason for the change; At the original test of A653, in the case of that the result of impinge flame condition might be applied for the judgement and it failed, although the result of remote flame condition was not burned, it might not be satisfaction of the test result. Above modification would be more clear or reasonable test result for the flammability characteristic. ISO5658-2 が現在改正作業中であり、以下の改正が実施される。（ISO/CD5658-2） 改正点、1) アセチレンガスからプロパンガスに変更、2) 非接触着火炎の試験を省き、接触炎のみで試験する。 火災試験所の ISO5658-2 の試験は、A653 の試験装置と共用しているため、ISO 規格の改正は共通性が崩れる。A653 も同時に改正することが望ましい。 （今までの試験では、非接触着火炎の試験で着火しなかった試験体が、接触着火炎の試験で、不合格の値となるケースも有り、合否の判定の不明瞭さが有ったが、ISO5658-2 同様に、接触着火炎のみの試験にすることで、その問題が解決する。）	Test method should be modified.
Part6	Definition	“A primary deck covering is the first layer of a floor construction which is applied directly on top of the deck plating” is described on FTP code Annex1 Part5 3.2.1. On the other hand, “When the primary deck covering is also the exposed surface, it shall comply with this part” is described on FTP code Annex1 Part5 3.2.2. Therefore the product that is the first layer of a floor construction which is applied directly on top of the deck plating and is also the exposed surface, when no upper layer applied on it, it should be considered as the floor covering of FTP code Annex1 Part5. FTP コード Annex 1 Part 5 3.2.1 には、「一次甲板床張り材は、甲板プレートの上部に直接置かれる床構造の最初の層であって、甲板プレートの保護またはプレートへの接着に必要な全ての一次コート、耐蝕材または接着剤を含む。甲板プレートの上部の床構造の他の層は、床張り材である。」と記載されている。一方、FTP コード Annex 1 Part 5 3.2.2 には、「一次甲板床張り材が暴露表面にある場合は、このパート（Part 5 の床張り材規定を示す）を満足しなければならない。」と記載されている。 すなわち、甲板プレートの上に直接置かれる床構造の最初の層であって、上部に床張り材なく暴露されている場合は、Part 5 に示す床張り材と定義する。	Definition of "Primary deck covering" should be considered. （Appendix 1 参照）

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
A563 (Part7)	Product description on Test report	Information of the specimen which was tested should be reflected to the Type approval of the products. At A.563 Para.8, necessary information that should be included in the test report, but it is not specified about the description of materials. Therefore the details for description of materials should be specified. So, following information should be added to A563 para.8. 1) Material: materials such as wool, nylon, polyester and etc., and its composite ratio. 2) Composition of weave: Such as plain, weave, twilled 3) Density (Number/inch) : The number of grains per inch in both warp and weft 4) Yarn number count : 5) Thickness of the fabric : unit of mm 6) Mass : weigh per unit area (g/mm2) 7) Colour and tone: If the product has a pattern, the representative colour should be described. 8) Fire retardanr treatment 試験を実施した試験体情報が、型式承認申請の製品に正しく反映されなければならない。A.563 Para.8 では、試験成績書には、材料詳細を記載することとされているが、記載すべき内容が明確でない。よって、試験成績書に記載すべき項目（材料詳細）を明確にする必要がある。 生地について記載すべき項目として、以下の内容を追加する。 (1) 素材: 糸を構成する繊維として毛、ナイロン、ポリエステル等の比率 (2) 織り組織：平織り、綾織り、斜文織り等 (3) 密度（本/inch）　縦目と横目各々について：縦と横の一インチあたりの本数を言う。 (4) 糸番手　縦目と横目各々について：糸の太さをあらわし、縦と横がある (5) 厚さ(mm)：単位荷重をかけて測定する厚さ (6) 質量（g/m^2）：平方メートルあたりの質量 (7) 色調 color：試験体の色、柄がある場合は基本の色調を表示する。 (8) 防炎処理方法：	Add to A563 para.8

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
A563 (Part7)	Appendix 2 Cleaning and weathering procedures	According to A563_Appendix2_4.1, IEC test detergent with perforate type 1 that is defined in IEC456 Amend.1_1980 has to apply the accelerated laundering. But this kind detergent is obsolete and it is impossible to have it in Japan, because the sodium tripolyphoshate can not be used in the commercial detergent for prevention of the environmental pollution. So, following changes should be proposed. 1) The test detergent should be changed to use the commercial detergent or the preparation of the test specimen should be carried out according with the instructions/recommended method given by the manufacturer. 2) Type approval should be based on that preparation method of the test specimen. A563_Appendix 2_4.1 に示す洗剤（IEC456-1980 perforate Type 1）は、リン系の洗剤であり、日本国内では入手が困難である。国内でほとんどが無リン系になっているので、IEC456-1980 perborate Type 1 の洗剤は、obsolete であり入手できない。（国内での試験方法としては日本防炎協会の洗濯試験方法を適用している。FTP コードの国内解釈として採用している。） よって、以下の変更を提案する。 1）洗剤は入手（市販）できる洗剤で可とする。または、製造者の推奨する洗濯方法に準ずる。 2）型式承認は、試験時の前処理方法（洗濯試験）を考慮する。	Modify A563_Appendix2

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
A652 (Part8)	Product description on Test report	Information of the specimen which was tested should be reflected to the Type approval of the products. But it is not specified. Therefore the necessary information that should be included in the test report, and details for description of materials should be specified on the test procedure. (Proposal) Following information should be added to A652 para.9. (New Para.) 9. Test report The test report should be including the following information of the products. .1 name of the testing authority .2 name of the manufacturer of the materials .3 date of supply of the materials, and date of test .4 name and identification mark of the materials .5 conditioning of the specimens, and exposure procedure used, if any ; .6 descriptions of materials: following information should be included in that description. .6.1 Fabric 1) Material: materials such as wool, nylon, polyester and etc., and its composite ratio. 2) Composition of weave: Such as plain, weave, twilled 3) Density (Number/inch) : The number of grains per inch in both warp and weft 4) Yarn number count : 5) Thickness of the fabric : unit of mm 6) Mass : weigh per unit area (g/mm^2) 7) Colour and tone: If the product has a pattern, the representative colour should be described. 8) Fire retardant treatment .6.2 Fillings 1) Material : 2) Density : weigh per unit volume (kg/m^3) 3) Fire retardant treatment, if any 試験を実施した試験体情報が、型式承認申請の製品に正しく反映されなければならない。よって、試験成績書に記載すべき項目（材料詳細）を明確にする必要がある。 試験成績書に記載すべき項目として、以下の内容を追加する。 1. 試験機関の名称 2. 材料の製造者名 3. 材料の提出日、及び試験日 4. 材料の識別記号、または名称 5. 試験体の調湿条件、及び暴露試験方法（適用した場合のみ）	Add to A.652 para.9

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
		6. 材料の記述（詳細） 6.1 生地の材料の記述、以下の内容を追加する。 (1) 素材: 糸を構成する繊維として毛、ナイロン、ポリエステル等の比率 (2) 織り組織：平織り、綾織り、斜文織り等 (3) 密度（本/inch)　縦目と横目各々について：縦と横の一インチあたりの本数を言う。 (4) 糸番手　縦目と横目各々について：糸の太さをあらわし、縦と横がある (5) 厚さ(mm)：単位荷重をかけて測定する厚さ (6) 質量（g/mm^2）：平方ミリメートルあたりの質量 (7) 色調：試験体の色、柄がある場合は基本の色調を表示する。 (8) 防炎処理方法： 6.2 詰め物の材料の記述、以下の内容を追加する。 (1) 素材: (2) 密度（kg/m^3）　立方メートルあたりの質量 (3) 防炎処理方法：	

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
A688 (Part9)	Product description on Test report	Information of the specimen which was tested should be reflected to the Type approval of the products. But it is not specified about the description of materials. Therefore the necessary information that should be included in the test report, and details for description of materials should be specified. So, following information should be added to A688 para.5.7. Following information should be included in those descriptions. 5.7.10.1 Fabric 1) Material: materials such as wool, nylon, polyester and etc., and its composite ratio. 2) Composition of weave: Such as plain, weave, twilled 3) Density (Number/inch) : The number of grains per inch in both warp and weft 4) Yarn number count : 5) Thickness of the fabric : unit of mm 6) Mass : weigh per unit area (g/mm^2) 7) Colour and tone: If the product has a pattern, the representative colour should be described. 8) Fire retardant treatment 5.7.10.2 Fillings 1) Material : 2) Density : weigh per unit body (g/mm^3) 3) Fire retardant treatment, if any 試験を実施した試験体情報が、型式承認申請の製品に正しく反映されなければならない。よって、試験成績書には、材料詳細を記載することとされているが、記載すべき内容が明確でない。試験成績書に記載すべき項目（材料詳細）を明確にする必要がある。 5.7.10 材料の記述（詳細） 5.7.10.1 生地の材料の記述、以下の内容を追加する。 (1) 素材: 糸を構成する繊維として毛、ナイロン、ポリエステル等の比率 (2) 織り組織：平織り、綾織り、斜文織り等 (3) 密度（本/inch）　縦目と横目各々について：縦と横の一インチあたりの本数を言う。 (4) 糸番手　縦目と横目各々について：糸の太さをあらわし、縦と横がある (5) 厚さ(mm)：単位荷重をかけて測定する厚さ (6) 質量（g/mm^2）：平方ミリメートルあたりの質量 (7) 色調：試験体の色、柄がある場合は基本の色調を表示する。	Add to A688 para.5.7.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
		(8) 防炎処理方法： 5.7.10.2 詰め物の材料の記述、以下の内容を追加する。 (1) 素材: (2) 密度（kg/m^3） 立方メートルあたりの質量 (3) 防炎処理方法：	
Part9	Cleaning treatments in ISO6330	According to ISO6330_1984_3.4, ECE test detergent that is defined in ISO6330 Annex B has to apply the cleaning treatments. But this kind detergent is obsolete and it is impossible to have it in Japan, because the sodium tripolyphoshate can not be used in the commercial detergent for prevention of the environmental pollution. So, following changes should be proposed. 1) The test detergent should be changed to use the commercial detergent or the preparation of the test specimen should be carried out according with the instructions/recommended method given by the manufacturer. 2) Type approval should be based on those cleaning treatments. ISO6330_1984_3.4 and Annex B に示す洗剤（ECE test detergent）は、リン系の洗剤は、日本国内では入手が困難である。国内でほとんどが無リン系になっているので、この洗剤は obsolete であり入手できない。 よって、以下の変更を提案する。 1）洗剤は入手（市販）できる洗剤で可とする。または、製造者の推奨する洗濯方法に準ずる。 2）型式承認は、試験時の前処理方法（洗濯試験）を考慮する。	Add to A.688.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
FTP Code	Type approval certificates	Type approval certificates should be stated the approval condition or restriction of the products when it applied on actual ships. To clarify the approval condition or restriction of the products, following sentences should be added to the FTP code 5.2.4. 9. Type approval certificates for windows should state which side of the window was exposed to the heating condition during the test. (MSC/Circ.1036) 10. Type approval certificates for windows should include a reference to optional test(s) such as hose stream test and/or thermo radiation test. (MSC/Circ.1036) 11. Type approval certificates for surface materials should state what substrate was applied for the test. The restriction of the base materials, which products would be applied on, should be considered. (MSC/Circ.1004.) 12. Type approval certificates for surface materials should state the specimen information about the colour, organic contents and thickness of the products. The restriction of the products should be considered by those informations. 13. Type approval certificates for "A", "B" and "F" class divisions should state the detail information for the thickness and density of the insulation materials. The restriction of the products should be considered by that information 14. Other restriction matters which Administration should be stated. 型式承認の承認証書には、製品の承認条件及び使用時の制限条項が明示されるべきである。製品の実船への適用できる条件を明確にするために、以下の項目を FTP コード 5.2.4 に追加すべきと考える。 （型式承認証書のサンプル及び記載すべき事項を追加する） 9.窓の型式承認証書においては、試験時の加熱方向を記載する。(MSC/Circ.1036) 10. 窓の型式承認証書においては、付加的試験（放水試験及び/もしくは熱放射測定）の記述をする。(MSC/Circ.1036) 11. 表面材の型式承認証書には、試験実施時の基材情報を明記する。型式承認においては、実船で使用できる基材について、それらを考慮する。(MSC/Circ.1004) 12.表面材の型式承認証書には、試験実施時の色、有機含有量、厚さ等の試験体情報を明記する。型式承認においては、それらを考慮する。 13.仕切り隔壁、天井、甲板の型式承認証書には、断熱材の厚さ、密度に対する詳細情報を明記する。型式承認においては、それらを考慮する。 14.その他、主管庁が必要と判断した制限事項。	Add to the code.

Code	Ref.	Description of the review point and proposal for the comprehensive review of FTP code	Action required
FTP Code	All of test items	Type approval products and the test items which would be required in FTP code should be clearer. Japan considers that the table of the relationship between the type approval products and its required test items would be helpful for the publicity of the FTP code. Refer Appendix 2 . FTP コードの試験対象品目と、要求されるべき試験の関連を表に示し、FTP コードに加え明確化する必要がある。 (FTP コードに、「FTP コードの試験品と試験の関連」に関する表を添付する。（Appendix 2 参照）	Add to the code. Refer Appendix 2 （Appendix 2 参照）

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6. New technology : new fire protection systems and materials have been developed 新技術の開発により、船舶の火災安全性を確保する上で適正な対応

Code	Ref.	Description	今後の対応（案）

7. Further clarifications for unified application of FTP code part 10 and Part 11for high speed craft.　FTP code Part10&Part11 における問題点

Code	Ref.	Description	今後の対応（案）
Part10		家具等の表面材で、具体的な試験方法わかりにくい。	

Appendix-1

表面材料試験の試験体と、その型式承認についてのガイドライン

（本ガイドラインは、表面材料の試験（FTP コード Part 2 & Part 5）の試験体、および試験体基材と、その型式承認についてのガイドラインとして作成する。）

＜　基本的な考え方　＞

1）試験に使用される試験体は、基本的にその試験を代表するもので実施する。この場合の代表する試験体は、試験体の実船での使用条件において最も危険性の高いもの、最も試験的に不利な試験体を選択する必要が有る。これは、製品の厚さ、製品の組合せ、製品が使用される基材、製品の色、製品の有機含有量等を考慮し、代表する試験体を選択する。

2）試験体は、その製品厚さで、実際に使用される基材に実際に施工される要領で取り付けて試験する。（A653 7.2.1 より）

3）複合材料：薄い材料あるいは複合材料が試験体を構成する場合、その裏面の空隙あるいは裏打ち構成が暴露される表面の燃焼性状に大きく影響する場合がある。裏打ち層の影響に注意し、得られる試験結果が実際に使用される製品の燃焼性状を正しく表わすようにしなければならない。（A653_7.3 より）

（すなわち、複合材料については、実際に使用される組合せによる複合試験を要求することと考える。接着剤、表面仕上げ材（Surface Veneer）や表面仕上げ塗料を別々に試験して、組合せ使用を承認することはできない。但し、床張り材については、その限りでない。6 項、Part 5 3.2.2 参照）

4）試験体基材とその承認については、MSC/Circ.1004 の解釈に準じて、Steel 基材での試験と、不燃性ボード基材での試験とは、別の試験と考える。

「MSC/Circ.1004：試験品が鉄板（Metallic substrate）に施工して試験した場合は、試験に使用された基材厚さと同等かそれよりも厚い鉄板に施工する場合に限り承認される。試験品が不燃材料に施工して試験した場合は、試験に使用された基材の密度と同等か、それよりも密度の高い不燃材料に、また密度 400kg/m^3 以上の基材においては、試験に使用された基材厚さと同等か、それよりも厚い不燃材料に施工する場合に限り承認される。」

5）一次甲板床張り材は、甲板プレートの上部に直接置かれる床構造の最初の層であって、甲板プレートの保護またはプレートへの接着に必要な全ての一次コート、耐蝕材または接着剤を含む。甲板プレートの上部の床構造の他の層は、床張り材である。（FTP コード Annex 1 Part 5 3.2.1 より）

6）床材に対する単体試験の許可とその組合せ使用の容認：試験は、床材が多層構造の場合は、全ての層がこの Part 5 の規格に合致していることが要求される。主管庁は、その床張り材の各層について、または層の組み合せについて試験を要求できる。組み合せで実施した場合は、その組み合せのみに承認される。（FTP コード Annex1 Part 5 3.2.2 より）

（すなわち、床材の複合材については、各層の単体試験を認められ、その複合使用も許可される。すなわち、各層の組み替えも容易にできる。）

7）床材については、複合材料（組合せ使用）では有るが、各層の単体試験が認められており、他の層（試験基材）の影響を無視し使用できるため、MSC/Circ.1004 の解釈を適用しない。（適用できない。）

8）一次甲板床張り材と床張り材（定義）

一次甲板床張り材は、甲板プレートの上部に直接置かれる床構造の最初の層であって、甲板プレートの保護またはプレートへの接着に必要な全ての一次コート、耐蝕材または接着剤を含む。甲

板プレートの上部の床構造の他の層は、床張り材である。（FTP コード Annex 1 Part 5 3.2.1 より）
一次甲板床張り材が暴露された表面にある場合には、それはこのパート（Part 5 の床材の要件）を満足しなければならない。（FTP コード Annex 1 Part 5 3.2.2 より）
よって、「甲板プレートの上部に直接置かれる床構造の最初の層（通常一次甲板床張り材）」であっても、その上に他の層がなく直接表面に露出している場合は「表面床張り材」と考えられる。
（日本では、表面に露出する一次甲板床張り材は、「表面床張り材」と考える。）
（表 1 参照）

表 1　一次甲板床張り材と、表面床張り材の判定基準の比較

		床張り材（Part 5）	一次甲板床張り材（Part 6）
関連規格		A.653(16)	A.687(17)
試験体基材		基材は規定していない	鋼板（厚さ 3±0.3 mm）
判定基準	CFE (kW/m^2)	≧7.0	≧7.0
	Qsb (MJ/m^2)	≧0.25	≧0.25
	Qt (MJ)	≦2.0（Part5 で改定）	≦2.0（MSC/Circ.1120）
	Qp (kW)	≦10.0	≦10.0
	燃焼する小滴	10 滴以下（Part 5 で規定）	なきこと

9）試験体の色と、有機含有量
FTP コードには記載されていないが、一般的に表面材の試験では「試験体の色」と「有機含有量」による試験結果への影響は大きい。「有機含有量」は製品の燃焼性に対する主な要素であり、試験体は有機含有量が最大のものを選択する。また、「試験体の色」もまた主要素といえる。熱輻射の影響を受けやすい黒系色の試験体と、熱輻射の影響を受けにくい白系色の試験体とでは、試験結果が異なる。基本的に、熱輻射の影響を受けやすい黒系色を試験体として選択する。
（類似のケースでは、A653_7.4 には、反射性の金属表面は使用される場合には、試験体の状態調節を行う前に、その表面を薄く黒色に塗装することとされている。）

10）FTP コード Part 2 の試験免除規定
一般に、表面材及び一次甲板上張り材であって総発熱量(Qt)が 0.2MJ 以下でかつ最大発熱率(Qp)が 1.0kW を越えないもの(両方の値ともこのコードの附属書 1 のパート 5 または決議 A.653(16)に従って決定される)は、試験しなくとも附属書 1 のパート 2 の要件を満たすと見なされる。（FTP コード Annex 2 2.2 より）
よって、Part 5 の試験結果において、上記条件を満足する場合は、Part 2 の試験が免除される。

＜　承認範囲の考え方　＞
上記（2 項記載）の「試験体及び試験体選択の基本的な考え方」を考慮し、試験結果から承認できる範囲（制限事項）を考える。
（表 2 参照）

表 2「表面材料試験の試験体基材と、その型式承認について（承認範囲と使用制限）」

分類	試験基材	型式承認証書での制限事項
塗料 Paint 及び 表面仕上材 Surface Veneer	鋼板（例：3.0mm）	1）試験した塗装色、及び有機含有量による制限条件 2）試験品と同等（3.0 mm×0.75）もしくは厚い基材厚さの金属表面（鋼板、ステンレス、アルミ等）に使用可能 （ドア、B 級パネル等の鋼板厚さの薄い製品には使用できない） 3）不燃板には使用できない。可燃材料には使用できない。 4）床材として使用する場合、鋼板、不燃板、一次甲板床張り材、床表面材等に使用できる。（床材は、承認品の複合使用を認めているため）
	鋼板（例：0.8mm）	1）試験した塗装色、及び有機含有量による制限条件 2）試験品と同等（0.8 mm×0.75）もしくは厚い基材厚さの金属表面（鋼板、ステンレス、アルミ等）に使用可能 （ドア、B 級パネル等の鋼板厚さの薄い製品にも基材厚さにより使用可能） 3）不燃板には使用できない。可燃材料には使用できない。 4）床材として使用する場合、鋼板、不燃板、一次甲板床張り材、床表面材等に使用できる。（床材は、承認品の複合使用を認めているため）
	密度 400kg/m^3 を超える不燃板 （例：10mm、密度 450kg/m^3）	1）試験した塗装色、及び有機含有量による制限条件 2）試験品と同等以上の厚さの不燃板に使用可能 3）金属表面には使用できない。可燃材料には使用できない。 4）床材として使用する場合、鋼板、不燃板、一次甲板床張り材、床表面材等に使用できる。（床材は、承認品の複合使用を認めているため）
	密度 400kg/m^3 以下の不燃板 （例：10mm、密度 250kg/m^3）	1）試験した塗装色、及び有機含有量による制限条件 2）試験品と同等（試験時密度×0.75)もしくは大きい密度の不燃板に使用可能 3）金属表面には使用できない。 4）床材として使用する場合、鋼板、不燃板、一次甲板床張り材、床表面材等に使用できる。（床材は、承認品の複合使用を認めているため）
表面仕上材 Surface Veneer	試験基材なし （試験体は充分な厚さがある場合）	1）試験した表面色や模様による制限条件 2）試験体自身は、基材の影響を受けないだけの厚さを持つものと考えられ、金属面及び不燃性ボードに使用可能 3）床材として使用する場合、鋼板、不燃板、一次甲板床張り材、床表面材等に使用できる。（床材は、承認品の複合使用を認めているため）
床表面材 Floor covering	鋼板（例：3.0mm）	1）試験した表面色や模様による制限条件 2）床材は、単体試験で、複合使用を認めているため、金属表面でも不燃板にも使用可能（MSC/Circ.1004 の解釈を適用しない）

分類	試験基材	型式承認証書での制限事項
	密度 400kg/m^3 以上の不燃性ボード（例：10mm、密度 400kg/m^3）	1）試験した表面色や模様による制限条件 2）床材は、単体試験で、複合使用を認めているため、金属表面でも不燃板にも使用可能（MSC/Circ.1004 の解釈を適用しない）
	試験基材なし（試験体は充分な厚さがある場合）	1）試験した表面色や模様による制限条件 2）床材は、単体試験で、複合使用を認めているため、金属表面でも不燃板にも使用可能（MSC/Circ.1004 の解釈を適用しない）
	実際の使用を想定した複合試験 （基材：鋼板＋一次甲板床張り材＋床表面材の各層）	1）試験した表面色や模様による制限条件 2）実船に即した、主管庁の要求する最も厳しい試験。（この組合せについて承認される。）
一次甲板床張り材 Primary Deck covering	鋼板（例：3.0mm）	1）試験した表面色や模様による制限条件（必要な場合のみ） 2）金属表面には使用できる。

（参考）表面材料試験の試験体の選択、及び作成について

（本資料は、表面材料の試験（FTP コード Part 2 & Part 5）の代表試験体選択、試験体作成時の考え方の参考として作成する。）

1) 試験体は製品性能を代表するものとし、想定される使用方法において最も劣った性能と思われるものを試験体として選択する。
2)試験体は、その製品厚さで、実際に使用される基材に実際に施工される要領で取り付けて試験する。（A653 7.2.1）
3)表面材料の試験（全般）：試験体の、暴露される表面それぞれについて、試験を実施する。（A653_7.1）
4）Part 2 の試験体作成、準備は、Part 5、Part 6 及び A.753(18)に従う。(Part 2_2.2)
5）試験体のサイズ：Part 5　幅：155mm＋0mm/－5mm、長さ：800mm＋0mm/－5mm（A653_5.7.2）
Part 2　幅：75mm＋0mm/－1mm、長さ：75mm＋0mm/－1mm（ISO5659-2_6.2.1）
6）試験体の厚さ：　試験体厚さは最大厚さとする。（最大厚さが試験体最大厚さを越える場合には、裏面を削って試験体最大厚さに減じて試験する。（A653_7.2.1 に順ずる）
試験体最大厚さ Part 5 最大：50mm＋3mm/－0mm.　（A653_7.2.1）
Part 2 最大：25mm（ISO5659-2_6.2.1）
7）塗料、表面仕上材等、多くの色や模様等のバリエーションが存在する製品群についての試験は、以下の点を考慮し、代表試験体を選択する。
7-1）有機含有量：製品最大厚さで施工された場合の有機含有量の最大のものを考慮する。
7-2）試験体の色：試験体の色は、黒色、または濃い暗い色を選択する。（Part 5 表面燃焼性試験では、黒い色の試験体は着火しやすい。Part 2 も同じ仕様とする。）
7-3）有機含有量最大の試験体の色が、最も黒系の色の有機含有量よりも大きい場合は、主管庁、また

は検査機関の判断で試験体を選択する。（白系の試験体と、黒系の試験体の有機含有量が接近している場合（有機含有量の差が[5%]以内）は、試験体は黒系を選択する。白系の試験体の有機含有量が、黒系の試験体の有機含有量より遥かに大きかった場合（有機含有量の差が[5%]以上）は、有機含有量最大の試験体を選択する。）

7-4）試験申請者、または製造者は、試験実施時には、申請する全てのカラー（バリエーション）についての、有機含有量と色の情報を、主管庁、または試験機関に提示する。主管庁、または試験機関は、必要に応じて試験体を指定することができる。

7-5）承認においての注意：白系の色で試験に合格した試験結果ついて型式承認を申請する場合、試験した色、及び同系色の色のみの承認とする。最も試験的に厳しいと思われる黒系の色での試験に合格した試験体について型式承認を申請する場合、全てのカラー（バリエーション）について承認できるものとする。（承認においては、有機含有量も考慮する）

8）試験体基材は、実際に使用される基材を使用するが、MSC/Circ.1004 の解釈に準じて、Steel 基材の試験と、不燃性ボード基材の試験とは、別の試験と考える。

9）試験体基材厚さ：MSC/Circ.1004 の解釈に準じて、基材厚さは、想定される使用方法の最小厚さとする。（試験時の試験体基材の厚さと同等もしくは、厚い基材への使用について承認される。

10）床表面材、及び一次甲板床張り材

FTP コード Annex 1 Part 5 3.2.1 に、「一次甲板床張り材は、甲板プレートの上部に直接置かれる床構造の最初の層であって、甲板プレートの保護またはプレートへの接着に必要な全ての一次コート、耐蝕材または接着剤を含む。甲板プレートの上部の床構造の他の層は、床張り材である。」と記載されている。

一次甲板床張り材（甲板プレートの上部に直接置かれる床構造の最初の層）であっても、その上に他の層がなく直接表面に露出している場合は「表面床張り材」と考える。

11）一次甲板床張り材の試験基材：厚さ 3mm±0.3mm の鋼板を使用する。（A687 3.1）

12）表面床張り材の試験基材：一次甲板床張り材の試験基材と同様に、厚さ 3mm±0.3mm の鋼板を推奨する。（床材については、MSC/Circ.1004 の解釈は意味を成さない。）*1

*1（解説）FTP コード Annex 1 Part 5 3.2.2 に、「試験は、床材が多層構造の場合は、全ての層がこの Part 5 の規格に合致していることを要求される。主管庁は、その床張り材の各層について、または層の組み合わせについて試験を要求できる。組合せで実施した場合は、その組合せのみに承認される。」と記載されている。

すなわち、床材については、床材の多層構造の各層について試験を実施できる。A653 7.1 に示される「試験体は製品厚さで、実際に使用される基材に実際に施工される要領で取り付けて試験する。」という記述は適用しなくても良く、各層が A.653 の床材の判定基準を満足していれば良いと判断される。

この多層構造の各層毎に試験ができる場合は、「試験基材とその承認範囲を規定した MSC/Circ.1004 の解釈」は適用が困難になるので、結果的に床材には適用できないと判断できる。

また、実際は各層の組み合せ（複合状態）で使用されるので、複合状態（実船での使用状態）では A.653 の床材の判定基準を満足できないことが想定される。

（この様に各層別々に試験をした製品を組合せて使用することは、FTP コード Annex 1 Part 5 3.2.2 により、許可されていると判断できる。一方、日本の床材試験は全て複合条件で実施してきおり、FP48 では「床材の複合試験の実施」を提案したが、諸外国の同意は得られず、本件は緩和する方向になった。）

よって、床材の試験においては、そのまま一次甲板床張り材にも適用できるように、厚さ 3mm±0.3mm の鋼板の使用を推奨している。

13）複合材料（表面材）

試験体構成は,5.7.2 に合致しなければならない。しかし、薄い材料あるいは複合材料で試験体を構成する場合、その裏面の空隙あるいは裏打ち構成が暴露される表面の燃焼性状に大きく影響する場合がある。裏打ち層の影響に注意し、得られる試験結果が実際に使用される製品の燃焼性状を正しく表わすようにしなげればならない。（A653_7.3）

14）金属表面

反射性の金属表面は使用される場合には、試験体の状態調節を行う前に、その表面を薄く黒色に塗装する。（A653_7.4）

15）可燃性通気ダクトの試験

可燃性通気ダクトが火炎伝播性の低い材料であることが要求される場合には、A.653(16)に従い、表面燃焼性試験方法、及び内張り及び天井の仕上げ材の判定基準を適用しなければならない。均質な材料についてはダクトの外側の表面について試験を実施する。複合材料では、その両面について試験を実施しなければならない。（Annex 1 Part 5_3.3.1）

16）冷却サービスシステムのための防熱材料

冷凍サービスシステムの防熱材とともに使用される蒸気バリアの表面及び接着剤、並びにパイプ類の防熱材が低火炎伝播性を要求される場合には、A.653(16)に従って内張り及び天井に関する試験及び判定基準を適用しなければならない。試験体の、暴露される表面各々について、試験を実施する。（Annex 1 Part 5_3.4.1）

17）接着剤の試験

試験体基材は A.653 3.3 に示すダミー試験体を使用する。（MSC/Circ.916 の解釈）

18）蒸気バリアの試験

断熱材と結合で使用される Vapour barriers については、A、B 級の構造体を除いた状態で、Part 5 の試験にて評価する。（MSC/Circ.1120 の解釈）

（参考）MSC/Circ.1004：Part 5 の試験について、

Where a product is approved based on a test of a specimen applied on a non-combustible substrate, that product should be approved for application to any non-combustible substrate with similar or higher density (similar density may be defined as a density ≥ 0.75 x the density used during testing) or with a greater thickness if the density is more than 400 kg/m^3. Where a product is approved on the basis of a test result obtained after application on a metallic substrate (e.g. thin film of paints or plastic films on steel plates), such a product should be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness ≥ 0.75 x the thickness of metallic substrate used during testing).

試験品を鉄板（MSC/Circ.1004 では ”Metallic substrate ”と表記）に取り付けて試験した場合は、試験に使用された基材厚さと同等かそれよりも厚い鉄板に施工する場合に限り承認される。試験品を不燃材料に取り付けて試験した場合は、試験に使用された基材の密度と同等か、それよりも密度の高い不燃材料に、また密度 400kg/m^3 以上の基材においては、試験に使用された基材厚さと同等か、それよりも厚い不燃材料に施工する場合に限り承認される。

（参考）MSC/Circ. 916：A754 に記されている隔壁に使用できる可燃性接着剤の試験について、 The calcium silicate board described as a dummy specimen specified in paragraph 3.3 of resolution A.653(16) should be used as a standard substrate for adhesives. A.653(16) Para3.3 のダミー試験体を基材として試験する。
（参考）MSC/Circ. 1120：Vapour barriers Vapour barriers used in conjunction with insulation should be tested without any other components of “A” or “B” class constructions that will shield the barrier being tested from the radiant panel. 断熱材と結合で使用される Vapour barriers については、A、B 級の構造体を除いた状態で、Part 5 の試験にて評価する。

Appendix-2

Fire protection Materials and Required Approval test methods

Test method (FTP code) / Specimen (Products)	Part1 Non combustibility	Part2 Smoke & Toxicity	Part3 A, B & F class Division	Part4 Door Systems	Part5 Surface flammability	Part6 Primary deck coverings	Part7 Curtain Virtically supported textiles	Part8 Upholstered furniture	Part9 Bedding components	Part10 – ISO9705 (MSC.40(64) & MSC.90(71)	Part10 – ISO5660 (MSC.40(64) & MSC.90(71)	Part11 – A754 (for HSC 2000)	ISO 1716 Calorific potential	Remarks
Non-combustibility materials	X													
A class Bulkhead	X		X											A754(17)
B class Bulkhead	X		X											A754(17)
A class Deck	X		X											A754(17)
B class Deck	X		X											A754(17)
B class Lining	X		X											A754(17)
B class Ceilings	X		X											A754(17)
B class Continues ceilings	X		X											A754(17)
A class Fire Door	X		X											A754(17)
B class Fire Door	X		X											A754(17)
A class Windows	X		X											A754(17)
B class Windows	X		X											A754(17)
Fire damper	X		X											A754(17)
Cable transit	X		X											A754(17)
Pipe penetration	X		X											A754(17)
Fire Door Control System				X										
Ventilation Ducts			X											????
Adhesive (bulkhead, deck, door and other division)					X									MSC/Circ.916, A754(17)
Surface Veneers (for bulkhead and ceilings)		X			X								X*1	A653(16), ISO5659-2
Fire retarding Base materials		X			X								X*1	A653(16), ISO5659-2
Paint (for bulkhead and ceilings ,and ship exterior)		X			X									A653(16), ISO5659-2
Floor coverings		X			X								X*1	A653(16), ISO5659-2
Combustible ventilation ducts					X									A653(16),

Test method (FTP code) / Specimen (Products)	Part1 Non combustibility	Part2 Smoke & Toxicity	Part3 A, B & F class Division	Part4 Door Systems	Part5 Surface flammability	Part6 Primary deck coverings	Part7 Curtain Virtically supported textiles	Part8 Upholstered furniture	Part9 Bedding components	Part10 – ISO9705 (MSC.40(64) & MSC.90(71))	Part10 – ISO5660 (MSC.40(64) & MSC.90(71))	Part11 – A754 (for HSC 2000)	ISO 1716 Calorific potential	Remarks
Insulation materials for cold service systems					X									A653(16)
Vapour barriers	(X)				X									MSC/Circ.1120, A653(16)
Primary deck coverings		X				X							X*1	A687(17)
Curtain - Vertically supported textiles							X							A471(12) amended A563(14)
Upholstered furniture								X						A652(16)
Bedding components									X*2					A688(17)
Bulkheads, not fire-resisting division (for HSC)										X				HSC2000 code 7.4.3.1
Ceilings, not fire-resisting division (for HSC)										X				HSC2000 code 7.4.3.1
Linings, not fire-resisting division (for HSC)										X				HSC2000 code 7.4.3.1
Surface material for bulkhead (for HSC)										X				HSC2000 code 7.4.3.1
Case furniture (for HSC)											X			HSC2000 code 7.4.3.3.1
Other furniture (Chairs, sofas and tables) (for HSC)											X			HSC2000 code 7.4.3.3.2
Thermal and acoustic Insulation material (for HSC)											X			HSC2000 code 7.4.3.5
Non-load bearing fire-resisting divisions												X		MSC45(65) para1.6
Load bearing fire-resisting divisions, with metal core												X		MSC45(65) para1.6
Load bearing fire-res. divisions, without metal core												X		MSC45(65) para1.6

*1: In case of the maximum gross calorific value less then 45 MJ/m^2 was required.

*2: Passenger ship (more than 36 persons)

5.3　PTP コード Part 2 煙と毒性試験　(FTIR を使用した毒性分析試験関連)

5.3.1　背景及び必要性

FTP コードの総合見直しに関する調査研究」の中の検証試験として行うものであり、背景、必要性、目的は、上記調査研究と同一である。試験実施においては、その内容と上記調査研究の整合性を確保するものとする。

5.3.2　内容

ISO/TC92/SC1 では現在、FTP コード Part 2 が規定している発煙性試験と FTIR ガス分析計を連結した燃焼ガス分析方法の基準を作成している。その最新の内容及び動向を調査した。その内容に準じて試験を行い、FTP コード Part 2 への取り込みを検討した。

5.3.2.1　ISO 等の現状の基準の調査

2005 年 11 月くらいまで、ISO/CD 21489 (date; 2003-03-6)旧バージョンを元に準備を進めてきた今回最新のバージョンを入手できたので、すべてを日本語化するとともに、旧バージョンとの違いを検討した。（P.96 の別添 5.1 参照）

以前のものに比べ、より詳細になり、かつ明確になっている。このことで、製品安全評価センターの準備した機器にも変更すべき点が出てきた。（例：フィルター直径、長さ、サンプリングライン上の温度測定点点数等。）

5.3.2.2　燃焼毒性試験

①FTP コード Part 2 の発煙性試験装置及び FTIR ガス分析計を整備し、試験の実施に備える。必要に応じ FTIR ガス分析計以外の分析方法も検討する。また、過去の船舶内装材料の使用状況及び発生ガス種を勘案して、試験体を用意する。さらに、（1）の調査結果を勘案して、試験方法を決めた。

　また、実際に試験を実施し、FTP コード Part 2 への取り込みを検討した。

②燃焼により発生するガスは、試験体により決まる。発生可能なガス種すべてにおいて試験を行いたいため、発生するガス種により以下のように試験体を決め手配した。

表 1.　試験体

NO.	名称	主なガス	試験内容	厚さ	基材
1	塗料	CO	サンプリング方法の相違が結果に及ぼす影響	300μm	スチール
2	床の表面材 A	CO	サンプリング方法の相違が結果に及ぼす影響	2mm	スチール
3	床の表面材 B	CO	サンプリングライン気密性の影響	3.3mm	スチール
4	メラミン A	HCN	校正試験	2.0mm	なし
5	メラミン B	HCN	校正試験	1.8mm	なし
6	ウールカーペット	SO_2	SO_2 の検出	12mm	スチール
7	ゴム	SO_2	SO_2 の検出（未試験）	1mm	なし
8	塩ビ板	HCl	コンタミネーション調べ	1mm	なし

5.3.2.3　IMO 関係

①ISO/CD 21489 取り込みによる効果

現在、FTP コード Part 2 の分析方法は、世界で統一されていない。FTP コードの解釈案である MSC/Cir.916 には、

“Not only the FTIR (Fourier Transform Infrared Spectrometer) method but also other methods such as GC/MS (Gas Chromatography/Mass Spectrometer) which can produce traceable results can be used for the gas analysis.”

と記述されており、分析方法については提言があるが、サンプリングについては、そのようなものはなく、世界の試験所で様々な方法がとられている可能性がある。

ISO/CD 21489 は、サンプリングについてもかなり詳細に決められた規格であり、この方法をすべての試験所が採用することにより、試験所間の格差是正につながると考えられる。

②上記については、INF. paper を提出済み(FP 50/INF.5),また、本調査研究の内容は、FP51 の提案文章とする。

5.3.3　装置の保守

5.3.3.1　FTIR 本体は、精密機械でごみに弱い。また、試験室で保管する場合の保管温度、湿度に注意を要する。ガスセル内部には、腐食性ガスが導入されるが、そのガスによる腐食を防ぐ必要がある。

5.3.3.2　対策

現在、ガス分析を行ったあと、大気をガスセルに導入、セル内のガスを置換した後、試験を終了としている。

NOTE 1.　ISO 等の現状の基準の調査関連

ISO/CD 21489・・・FTP コードへの取り込みを検討する規格。スモークチャンバーからガスをサンプリングする方法、それを FTIR で分析する規格。

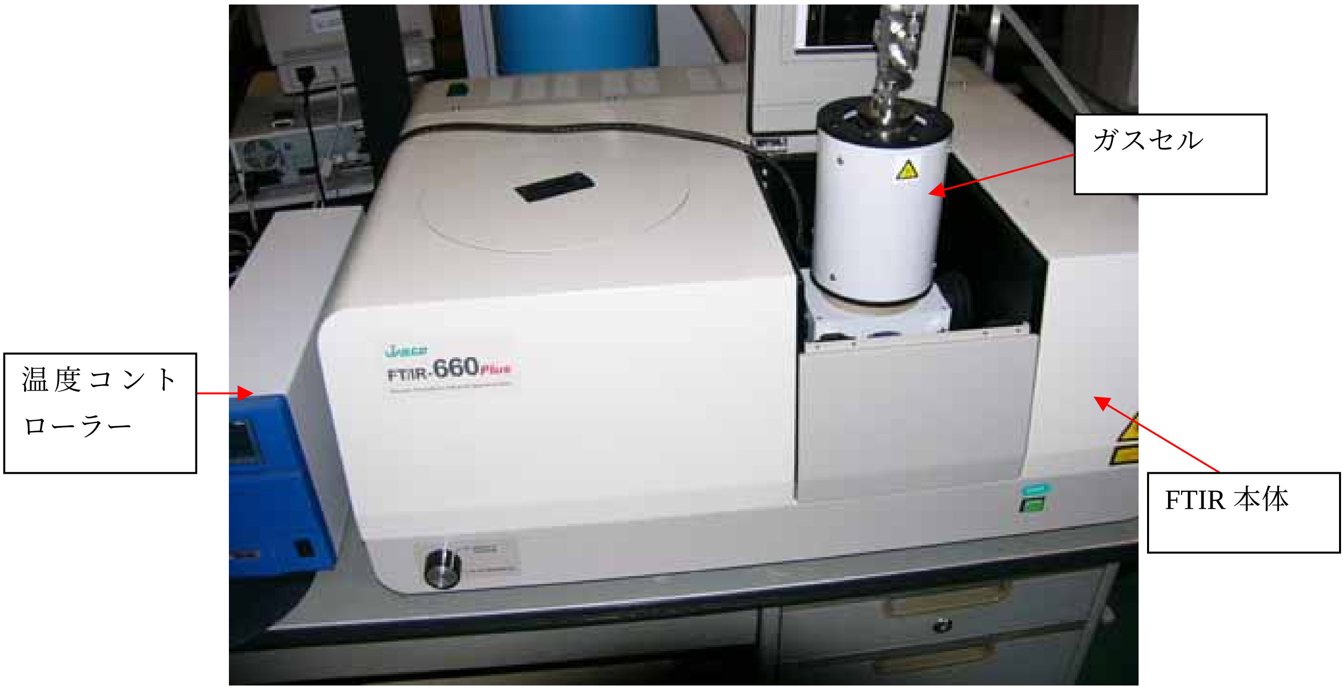
ISO/CD 19702・・・FTIR を用いたガス分析方法、（ガスセルの仕様、装置の推奨仕様等。）
ISO/CD 19701・・・火災で発生するガスの分析方法。
　例　　HCN: 比色定量、イオンクロマトグラフィー、
　　　　HCl: イオン選択性電極、イオンクロマトグラフィー、
　　　　（これらは、サンプリング中、フィルター等にトラップされるガス量の把握に必要。）

5.3.4　燃焼毒性試験のための FTIR の整備

①　装置仕様

表 2.　装置仕様（ISO/CD 19702 の推奨により仕様を決めた。）

ＦTIR	ガスセル	現在測定可能ガス
日本分光　FT/IR-660Plus	光路長　2m	CO、HCN、HCl
検出器　MCT,DLATGS	セル窓材　CaF_2	HBr、HF、NOx
分 解　0.5,　1.0,　2.0,　4.0,　8.0,　$16.0cm^{-1}$	内容量　0.2L	SO_2
	最高温度　200℃	



②　校正

　検量線を作成するために、校正を行った。校正は、通常、ある濃度のガス（検量線が直線なら、3 濃度、直線でない場合 5 濃度程度。）を購入し校正ガスとした。しかし、シアン化水素は、日本で運搬が許されていないため、購入できない。化学反応により発生させたり、メラミンの燃焼によって発生させた。（アメリカでは、ボンベが購入できる。）

5.3.5　試験とその結果

5.3.5.1　最新規準からの逸脱。

5.3.2.1 で述べた理由より、本試験で、未解決に終わった最新試験方法との相違は以下の点である。

①フィルターの大きさ、　規格：直径 20±2mm、長さ 75±5mm の円筒計

今回試験に用いたもの：直径 25mm、長さ 90mm の円筒計でテーパがついている。

②温度測定点、　規格：ハウジングの 3 箇所　今回試験に用いたもの：ハウジングの 1 箇所

5.3.5.2　CO の分析

ISO 5659-2 に準拠した試験を行い、各条件の第 2、第 3 回目からガスをサンプリングし CO を定量分析した。その過程で、サンプリングを含めた分析方法による、分析結果の相違を把握し、調べた。試験方法は、

①サンプリングラインから直接 FTIR のガスセルに取り込み分析。

②サンプリングバッグにガスを採取し、検知管で分析。

③ ②で採取したガスを FTIR で分析した。

その結果、サンプリングバッグで採取したものは、CO 値がやや低い値となった。

表 3.　CO 分析試験その①

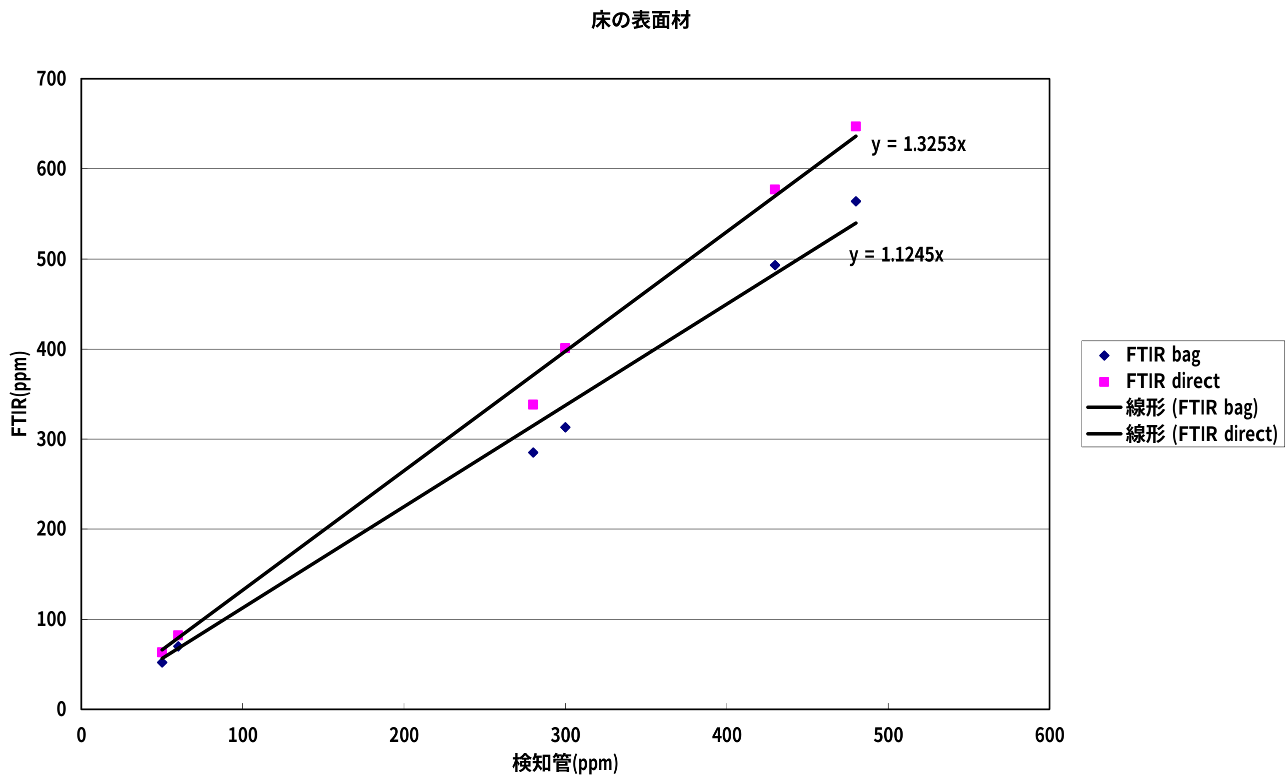
試験体：床の表面材 A　濃 度 ： ppm

条件		検知管	FTIR bag	FTIR direct
50no	1st	480	564	647
	2nd	430	493	577
25no	1st	60	70	82
	2nd	50	52	63
25yes	1st	300	313	401
	2nd	280	285	338

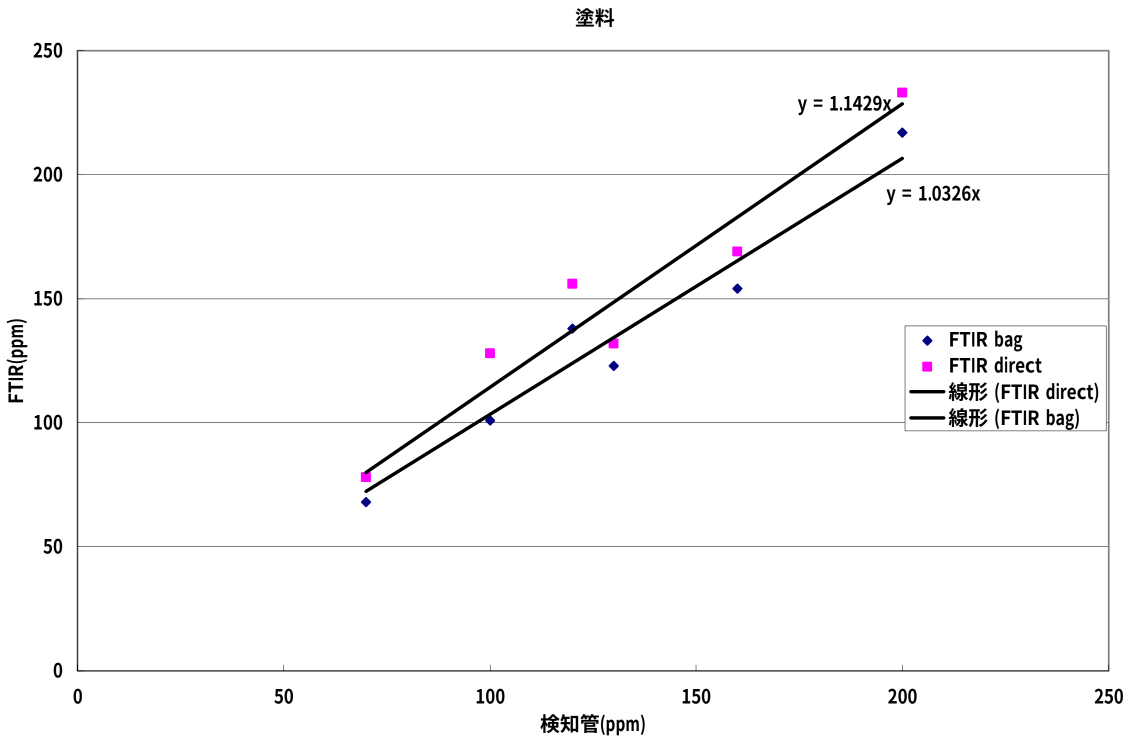
表 4.　CO 分析試験その②

試験体：塗料　濃 度 ： ppm

条件		検知管	FTIR bag	FTIR direct
50no	1st	200	217	233
	2nd	160	154	169
25no	1st	100	101	128
	2nd	70	68	78
25yes	1st	120	138	156
	2nd	130	123	132



グラフ 1.　CO の分析値比較①



グラフ 2.　CO の分析値比較②

5.3.5.3　サンプリングシステムのリークの影響

サンプリングラインを ISO/CD 21489 に準拠したものにして、床の表面材 B を用いて FTP コード Part 2 の試験を行った結果、CO が今までの経験上より低い値となったため、その原因を調べた。

原因は、フィルターのハウジング部分からのリークとハウジング部分の一部溶接割れによるリークであった。リークがあった時の CO 濃度とリークをなくした場合の CO 濃度を表 5 に示す。

表 5.　CO 分析試験その③

試験体：床の表面材 B　濃度：ppm

条件		リークあり（誤）	リークなし（正）
50no	1st	61	263
25no	1st	44	162
25yes	1st	70	179

今回のリークは、かなり大きく、結果に及ぼした影響も大きかった。ISO のルールには、規定がないようであるが、このサンプリングシステムの気密性にある一定の基準があった方がより良いと考える。

現状では、スモークチャンバー上のバルブを閉めた時に、流量計で測定している流量が 6L/min から、ほぼゼロに落ちるのを確認して試験を行っている。

5.3.5.4　HCl の定量とコンタミネーションの影響。

　サンプリングラインを ISO/CD 21489 に準拠したものにして、HCl の定量を試みた。1mm 厚さの塩ビ板は、大量の煙を発生させ HCl の濃度も 1000ppm を超えて計測された。50kW/m^2 の試験後、25kw/m^2 の試験を行いブランク値を調べた。この方法は、大気を吸引しバックグラウンド値として次に、スモークチャンバー中に試験体のない状態で内部の気体を吸引、FTIR で分析するものである。この時、はっきりと HCl の特徴的なピークが検出され値は、25ppm であった。

表 6 には、各条件の HCl 値を示した。

表 6.　HCl 分析試験その①

試験体：塩ビ板　　濃度：ppm

条件		コンタミあり。	ブランク 0（正）
50no	1st	----	1149
25no	1st	1045	1011
25yes	1st	----	878

　スモークチャンバー内部のコンタミネーションが確認できた、この解消のための実験を行ったところ、内部のススの除去（掃除）は、あまり有効でなかったが、壁温度を 55℃程度にして、ポンプで内部を吸引することにより、HCl を除去できることがわかった。

NOTE 2. ISO/CD 21489 関連事項

　NOTE　1 日の試験を始める前スモークチャンバー内の大気をサンプリング分析することによりダミーガス測定をして、いかなるガスも検出されないことを確かめることが推奨される。また、測定結果より疑問のあるガスが検出された場合も同様のダミーガス分析を行うことが推奨される。

5.3.5.2　SO_2 の定量（①目詰まりの影響②サンプリングラインの影響）

　当初、ウールカーペットを用いて、サンプリングラインの違いについて検討する目的で①テフロンのサンプリングラインを常温で用いたものと②サンプリングラインを ISO/CD 21489 に準拠したものにして、ステンレスで 175℃のものとの比較を行った。加熱したラインの方がガスの定量値が低くでたが、この試験前に同一条件で流量が落ちている事実があり、実験結果から考えて、何らかの不具合と考えた。サンプリングラインを分解清掃の結果、流量がもとに戻ったので、残りの試験体で試験を行った結果、（50KW/m^2 フレームなしの条件）サンプリングラインの条件は、CO、SO_2 の定量結果には、影響を与えないように思われる。

表 7.　カーペットの燃焼・毒性試験

試験体：カーペット　　　　濃度：ppm

$50KW/m^2$ フレームなし

ガス	テフロン：常温	SUS:175℃	SUS:175℃
状態	---	目詰まりあり	正常
CO	901	469	1035
SO_2	64	42	62

$25KW/m^2$ フレームなし

ガス	テフロン：常温	SUS:175℃	SUS:175℃
状態		目詰まりあり	正常
CO	187	122	---
SO_2	14	18	---

$25KW/m^2$ フレームあり

ガス	テフロン：常温	SUS:175℃	SUS:175℃
状態		目詰まりあり	正常
CO	252	143	---
SO_2	62	36	---

NOTE 3. ISO/CD 21489 関連事項

引用－6.4　ガス圧力指示

ガス圧力指示計を FTIR のガスセル入り口の近くに設置し、サンプリングラインとガスセルの圧力が一定であり、目詰まりによる圧力低下がないことを示せるようにする。この目的のために、ガスセルに取り付けた圧力計が使用できる。

5.3.5.6　HCN の定量。

シアン化水素は、日本で運搬が許されていないため、購入できない。化学反応により発生させたり、メラミンの燃焼によって発生させた。（表 25 参照。）但し、たかだか 100ppm 程度のものしか得られていないので、今後の課題として残る。ある論文*によると、ホルムアミドを希釈用気体でバブリングした低濃度気化させたものを 490℃に加熱したガラスビーズ層を通せば、HCONH2→HCN＋H2O となって簡単に HCN を発生できるとのことであるが、比較的高濃度（3600ppm）の HCN が発生するので、かなりしっかりした、反応管を準備する等、慎重に実験を進める必要があると思わる。

*Irene O. Y. Lui et all, Journal of Catalysis 195, 352-359 (2000)

5.3.6　実験結果から時期 FP 提案文章内容（案）

実験結果より、サンプリング方法そのものはもとより、サンプリングシステムからのリーク、②コンタミネーション、③目詰まり、が実験結果に影響を及ぼすことがわかった。言葉を変えると、分析システムを、サンプリング方法（機器）、サンプリング手順、分析方法の統合されたものと考えた場合、この分析システムの一部の相違が、分析結果に大きく影響を及ぼすことがわかった。

これら、分析システムを統一することにより、様々な試験所間での較差をなくすことが可能である。（サンプリングシステムだけ、分析方法の統一だけでなくその手順の統一が必要。）

その統一には、ISO/TC92/SC1 で作成している発煙性試験と FTIR ガス分析計を連結した燃焼ガス分析方法の基準が最適であると思われる。

5.3.7　本実験結果より、提案及び推奨

①サンプリングシステムの気密性についての規準または、確認手順を決めることが重要だと思われる。

②試験終了に関して、装置保守のため、ガス分析を行った後、空気または窒素等をガスセルに導入、セル内のガスを置換した後、試験を終了することを推奨する。

③必要に応じ、チャンバーの温度を上げて、ポンプで内部を吸引し、1 時間～数時間保つことにより、コンタミネーションを防ぐことが可能である。

5.3.8　まとめ

本実験を通して、サンプリング装置、手順が、非常に敏感に結果に影響することがわかった。実験を進める上で実際に様々な問題に直面し、一連の問題解決に時間がかかったが、いずれも、同一の試験を行う場合、起こる可能性の高い問題であったため、本研究結果が、毒性ガス分析のための 1 つの指標となると思われる。

表 8　各試験条件による試験結果

（加熱 25（kW/m²）　口火使用せず）

condition: 25（kW/m²） pilot flame: no/~~yes~~

specimen: 床の表面材 A

specimen	No.	1	2	3	Average
thickness(mm)	-	5.4	5.4	5.4	-
mass (g)	before	156.0	157.3	155.0	156.1
	before(with holder)	415.5	416.6	414.2	―
	after(with holder)	411.2	412.1	410.2	―
	after	151.7	152.8	151.0	―
	loss	4.3	4.5	4.0	4.3
smoke	smoke Ds max. ＊	302.2	318.2	291.9	304.1
	Time(sec.)＊＊	969	977	956	967
	Ds10	185.9	187.10	185.5	186.2
	Dc	----	----	----	―
	test duration(min)	20	20	20	―
gases(ppm)	CO(FTIR)	-	82	63	-
	CO(検知管)	-	60	50	-
	CO(Bag_FTIR)	-	70	52	-
	他のガス	-	N.D.	N.D.	-
ignition	Time(sec)	N.I.	N.I.	N.I.	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目の試験では、 ガス濃度は測定 しない。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。	

表 9　各試験条件による試験結果

（加熱 25（kW/m^2）　口火使用）

condition: 25（kW/m^2） pilot flame: ~~no~~/yes

specimen: 床の表面材 A

specimen	No.	1	2	3	Average
thickness(mm)	-	5.2	5.2	5.2	-
mass (g)	before	155.1	155.8	155.6	155.5
	before(with holder)	414.5	414.9	414.7	—
	after(with holder)	408.8	409.9	409.5	—
	after	149.4	150.8	150.4	—
	loss	5.7	5.0	5.2	5.3
smoke	smoke Ds max. ＊	266.2	194.1	189.2	216.5
	Time(sec.)＊＊	490	563	566	540
	Ds10	251.6	192.6	187.3	210.5
	Dc	46.93	28.43	31.92	—
	test duration(min)	20	20	20	—
gases(ppm)	CO(FTIR)	-	401	338	-
	CO(検知管)	-	300	280	-
	CO(Bag_FTIR)	-	313	285	-
	他のガス	-	N.D.	N.D.	-
ignition	Time(sec)	178	287	296	254
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目の試験では、ガス濃度は測定しない。				

表 10　各試験条件による試験結果

(加熱 50（kW/m^2）　口火使用せず)

condition: 50（kW/m^2） pilot flame: no/~~yes~~

specimen: 床の表面材 A

specimen	No.	1	2	3	Average
thickness(mm)	-	5.2	5.6	5.3	-
mass (g)	before	153.5	156.4	154.5	154.8
	before(with holder)	413.3	415.9	413.9	—
	after(with holder)	407.0	408.9	407.5	—
	after	147.2	149.4	148.1	—
	loss	6.3	7.0	6.4	6.6
smoke	smoke Ds max. ＊	420.3	455.6	452.7	442.9
	Time(sec.)＊＊	314	367	331	337
	Ds10	322.4	354.8	374.0	350.4
	Dc	57.93	53.25	59.69	—
	test duration(min)	10	10	10	—
gases(ppm)	CO(FTIR)	-	647	577	-
	CO(検知管)	-	480	430	-
	CO(Bag_FTIR)	-	564	493	-
	他のガス	-	N.D.	N.D.	-
ignition	Time(sec)	130	161	91	127
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目の試験では、ガス濃度は測定しない。				

表 11　各試験条件による試験結果

（加熱 25（kW/m^2）　口火使用せず）

condition: 25（kW/m^2） pilot flame: no/~~yes~~

specimen: 塗料

specimen	No.	1	2	3	Average
thickness(mm)	-	3.6	3.6	3.6	-
mass (g)	before	141.3	140.8	140.1	140.7
	before(with holder)	402.7	401.9	401.3	─
	after(with holder)	401.2	400.6	400.0	─
	after	139.8	139.4	138.8	─
	loss	1.5	1.3	1.4	1.4
smoke	smoke Ds max. ＊	143.9	134.0	134.2	137.4
	Time(sec.)＊＊	865	861	869	865
	Ds10	100.9	90.28	103.8	98.33
	Dc	7.85	8.78	8.51	─
	test duration(min)	20	20	20	─
gases(ppm)	CO(FTIR)	-	128	78	-
	CO(検知管)	-	100	70	-
	CO(Bag_FTIR)	-	101	68	-
	他のガス	-	N.D.	N.D.	-
ignition	Time(sec)	N.I.	N.I.	N.I.	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目の試験では、ガス濃度は測定しない。				

表 12　各試験条件による試験結果

（加熱 25（kW/m^2）　口火使用）

condition: 25（kW/m^2） pilot flame: ~~no~~/yes

specimen: 塗料

specimen	No.	1	2	3	Average
thickness(mm)	-	3.6	3.6	3.6	-
mass (g)	before	140.7	141.4	141.3	141.1
	before(with holder)	401.9	402.4	402.3	—
	after(with holder)	400.5	401.0	400.8	—
	after	139.3	140.0	139.8	—
	loss	1.4	1.4	1.5	1.4
smoke	smoke Ds max. ＊	37.04	34.95	47.52	39.84
	Time(sec.)＊＊	579	529	388	499
	Ds10	36.68	33.69	45.72	38.70
	Dc	5.28	6.17	7.13	—
	test duration(min)	20	20	20	—
gases(ppm)	CO(FTIR)	-	156	132	-
	CO(検知管)	-	120	130	-
	CO(Bag_FTIR)	-	138	123	-
	他のガス	-	N.D.	N.D.	-
ignition	Time(sec)	295	265	322	294
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目の試験では、 ガス濃度は測定 しない。				

表 13　各試験条件による試験結果

(加熱 50（kW/m^2）　口火使用せず)

condition: 50（kW/m^2） pilot flame: no/~~yes~~

specimen: 塗料

specimen	No.	1	2	3	Average
thickness(mm)	-	3.6	3.6	3.6	-
mass (g)	before	141.1	141.5	141.6	141.4
	before(with holder)	402.6	402.9	402.7	―
	after(with holder)	400.6	400.9	401.0	―
	after	139.2	139.5	140.0	―
	loss	1.9	2.0	1.7	1.9
smoke	smoke Ds max. ＊	106.4	78.74	134.8	106.6
	Time(sec.)＊＊	206	199	197	201
	Ds10	76.65	58.15	87.10	73.97
	Dc	18.91	12.29	7.92	―
	test duration(min)	10	10	10	―
gases(ppm)	CO(FTIR)	-	233	169	-
	CO(検知管)	-	200	160	-
	CO(Bag_FTIR)	-	217	154	-
	他のガス	-	N.D.	N.D.	-
ignition	Time(sec)	135	124	160	140
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目の試験では、 ガス濃度は測定 しない。				

表 14　各試験条件による試験結果
（加熱 25（kW/m^2）　口火使用せず）

condition: 25（kW/m^2）　pilot flame: no/~~yes~~

specimen: 床の表面材 B

specimen	No.	1	2	3	Average
thickness(mm)	-	6.5	6.6	6.2	-
mass (g)	before	162.5	161.0	160.4	161.3
	before(with holder)	421.4	419.9	419.2	—
	after(with holder)	418.5	417.1	416.4	—
	after	159.6	158.2	157.6	—
	loss	2.9	2.8	2.8	2.8
smoke	smoke Ds max. ＊	201.3	194.4	196.7	197.5
	Time(sec.)＊＊	1194	1193	1145	1177
	Ds10	61.29	62.10	62.33	61.91
	Dc	----	----	----	—
	test duration(min)	20	20	20	—
gases(ppm)	CO	-	-	44	44
	HCN	-	-	N.D.	N.D.
	HCl	-	-	N.D.	N.D.
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	N.D.	N.D.
ignition	Time(sec)	N.I.	N.I.	N.I.	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。 ガス計測結果誤り	

表 15　各試験条件による試験結果

（加熱 25（kW/m²）　口火使用）

condition: 25（kW/m^2） pilot flame: ~~no~~/yes

specimen: 床の表面材 B

specimen	No.	1	2	3	Average
thickness(mm)	-	6.4	6.4	6.3	-
mass (g)	before	162.8	160.4	161.9	161.7
	before(with holder)	421.4	419.2	420.8	―
	after(with holder)	417.6	415.5	417.3	―
	after	159.0	156.7	158.4	―
	loss	3.8	3.7	3.5	3.7
smoke	smoke Ds max. ＊	142.4	135.7	158.4	145.5
	Time(sec.)＊＊	549	504	603	552
	Ds10	132.9	125.7	157.7	138.8
	Dc	25.3	23.22	23.04	―
	test duration(min)	20	20	20	―
gases(ppm)	CO	-	-	70	70
	HCN	-	-	N.D.	N.D.
	HCl	-	-	N.D.	N.D.
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	N.D.	N.D.
ignition	Time(sec)	369	367	479	405
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。			ガス計測 結果誤り	

表 16　各試験条件による試験結果

(加熱 50（kW/m^2）　口火使用せず)

condition: 50（kW/m^2）　pilot flame: no/~~yes~~

specimen: 床の表面材 B

specimen	No.	1	2	3	Average
thickness(mm)	-	6.6	6.6	6.5	-
mass (g)	before	164.2	163.2	162.1	163.2
	before(with holder)	423.4	422.0	420.8	―
	after(with holder)	418.4	417.8	416.3	―
	after	159.2	159.0	157.6	―
	loss	5.0	4.2	4.5	4.6
smoke	smoke Ds max. ＊	455.0	309.7	306.9	357.2
	Time(sec.)＊＊	547	355	345	416
	Ds10	440.5	243.9	248.1	310.8
	Dc	----	31.13	33.14	―
	test duration(min)	20	10	10	―
gases(ppm)	CO	-	-	61	61
	HCN	-	-	N.D.	N.D.
	HCl	-	-	N.D.	N.D.
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	N.D.	N.D.
ignition	Time(sec)	N.I.	247	214	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。	Dc は、Ds max. の 5% 以下。		ガス計測結果誤り	

表 17　各試験条件による試験結果

(加熱 3 条件での試験：リーク補修後の試験)

specimen: 床の表面材 B

specimen	No.	1	2	3
condition	（kW/m^2）	50	25	25
pilot frame		no	no	yes
thickness(mm)	-	6.3	6.8	6.3
mass (g)	before	161.0	163.0	163.9
	before(with holder)	420.0	421.8	422.7
	after(with holder)	415.3	418.9	418.6
	after	156.3	160.1	159.8
	loss	4.7	2.9	4.1
smoke	smoke Ds max. ＊	287.5	211.3	147.7
	Time(sec.)＊＊	388	1199	612
	Dc	21.94	----	33.14
	test duration(min)	10	10	10
gases(ppm)	CO	263	162	179
	HCN	N.D.	N.D.	N.D.
	HCl	N.D.	N.D.	N.D.
	HBr	N.D.	N.D.	N.D.
	HF	N.D.	N.D.	N.D.
	NOx	N.D.	N.D.	N.D.
	SO2	N.D.	N.D.	N.D.
ignition	Time(sec)	303	N.I.	467
remarks	＊発煙係数の最大値 ＊＊最大値の時間		Dc は、Ds max. の 5% 以下。	

表 18　各試験条件による試験結果

（加熱 25（kW/m^2）　口火使用せず）

condition: 25（kW/m^2）　pilot flame: no/~~yes~~

specimen: 塩ビ板　sampling: 175℃;SUS

specimen	No.	1	2	3	Average
thickness(mm)	-	1.0	1.0	1.0	-
mass (g)	before	7.7	7.6	7.8	7.7
	before(with holder)	266.8	266.4	266.6	—
	after(with holder)	261.5	261.1	261.1	—
	after	2.4	2.3	2.3	—
	loss	5.3	5.3	5.5	5.4
smoke	smoke Ds max. ＊	242.0	264.3	276.6	261.0
	Time(sec.)＊＊	361	323	318	334
	Dc	----	----	----	—
	test duration(min)	20	20	20	—
gases(ppm)	CO	-	-	56	56
	HCN	-	-	N.D.	N.D.
	HCl	-	-	1045	1045
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	N.D.	N.D.
ignition	Time(sec)	N.I.	N.I.	N.I.	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。 HCl 値にコンタミの影響。	

表 19　各試験条件による試験結果

（加熱 25（kW/m²）　口火使用）

condition: 25（kW/m²） pilot flame: ~~no~~/yes

specimen: 塩ビ板 sampling: 175℃;SUS

specimen	No.	1	2	3	Average
thickness(mm)	-	1.0	1.0	1.0	-
mass (g)	before	7.8	7.6	7.6	7.7
	before(with holder)	266.7	266.4	266.4	―
	after(with holder)	261.0	260.7	260.7	―
	after	2.1	1.9	1.9	―
	loss	5.7	5.7	5.7	5.7
smoke	smoke Ds max. ＊	443.1	479.9	479.3	467.4
	Time(sec.)＊＊	217	211	224	217
	Dc	37.2	37.60	42.56	―
	test duration(min)	20	20	20	―
gases(ppm)	CO	-	-	273	273
	HCN	-	-	N.D.	N.D.
	HCl	-	-	878	878
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	N.D.	N.D.
ignition	Time(sec)	369	367	479	405
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。				

表 20　各試験条件による試験結果

(加熱 50（kW/m^2）　口火使用せず)

condition: 50（kW/m^2）　pilot flame: no/~~yes~~

specimen: 塩ビ板　sampling: 175℃;SUS

specimen	No.	1	2	3	Average
thickness(mm)	-	1.0	1.0	1.0	-
mass (g)	before	7.8	7.8	7.8	7.8
	before(with holder)	266.8	266.5	266.6	―
	after(with holder)	259.1	259.3	259.2	―
	after	0.1	0.6	0.4	―
	loss	7.7	7.2	7.4	7.4
smoke	smoke Ds max. ＊	700 以上	700 以上	700 以上	-
	Time(sec.)＊＊	109	91	109	103
	Dc	58.73	81.10	52.24	―
	test duration(min)	10	10	10	―
gases(ppm)	CO	-	-	354	354
	HCN	-	-	N.D.	N.D.
	HCl	-	-	1149	1149
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	N.D.	N.D.
ignition	Time(sec)	69	30	96	65
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。				

表 21　各試験条件による試験結果

（加熱 25（kW/m^2）　口火使用せず）

condition: 25（kW/m^2） pilot flame: no/~~yes~~

specimen: ウールカーペット サンプリング テフロン：常温

specimen	No.	1	2	3	Average
thickness(mm)	-	13.2	13.1	13.2	-
mass (g)	before	147.6	147.5	146.7	147.2
	before(with holder)	403.7	403.7	403.0	―
	after(with holder)	399.6	399.7	398.3	―
	after	143.5	143.5	142.0	―
	loss	4.1	4.0	4.7	4.3
smoke	smoke Ds max. ＊	128.8	138.1	139.5	135.5
	Time(sec.)＊＊	1194	1200	1200	1198
	Ds10	90.70	93.83	83.64	89.39
	Dc	----	----	10.24	―
	test duration(min)	20	20	20	―
gases(ppm)	CO	-	-	187	187
	HCN	-	-	N.D.	N.D.
	HCl	-	-	N.D.	N.D.
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	14	14
ignition	Time(sec)	N.I.	N.I.	N.I.	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。		

表 22　各試験条件による試験結果

（加熱 25（kW/m²）　口火使用）

condition: 25（kW/m²）　pilot flame: ~~no~~/yes

specimen: ウールカーペット　サンプリング テフロン：常温

specimen	No.	1	2	3	Average
thickness(mm)	-	12.9	13.2	13	-
mass (g)	before	145.3	146.7	146.7	146.2
	before(with holder)	401.7	403.1	403.0	―
	after(with holder)	396.7	398.5	398.2	―
	after	140.4	142.2	141.9	―
	loss	4.9	4.6	4.8	4.7
smoke	smoke Ds max. ＊	81.83	65.49	63.26	70.19
	Time(sec.)＊＊	1198	1197	1196	1197
	Ds10	58.96	46.59	39.40	48.32
	Dc	----	----	----	―
	test duration(min)	20	20	20	―
gases(ppm)	CO	-	-	252	252
	HCN	-	-	N.D.	N.D.
	HCl	-	-	N.D.	N.D.
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	62	62
ignition	Time(sec)	8	6	5	6
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。	Dc は、Ds max. の 5% 以下。	

表 23　各試験条件による試験結果

(加熱 50（kW/m^2）　口火使用せず)

condition: 50（kW/m^2）　pilot flame: no/~~yes~~

specimen: ウールカーペット　サンプリング テフロン：常温

specimen	No.	1	2	3	Average
thickness(mm)	-	12.9	13.0	12.8	-
mass (g)	before	148.0	146.8	146.8	147.2
	before(with holder)	404.6	403.2	403.0	―
	after(with holder)	395.2	393.7	393.6	―
	after	138.6	137.4	137.4	―
	loss	9.4	9.5	9.4	9.4
smoke	smoke Ds max. ＊	352.8	406.4	361.4	373.5
	Time(sec.)＊＊	611	567	582	587
	Ds10	350.9	404.5	361.1	372.2
	Dc	36.07	23.22	27.40	―
	test duration(min)	20	20	20	―
gases(ppm)	CO	-	-	901	901
	HCN	-	-	N.D.	N.D.
	HCl	-	-	N.D.	N.D.
	HBr	-	-	N.D.	N.D.
	HF	-	-	N.D.	N.D.
	NOx	-	-	N.D.	N.D.
	SO2	-	-	64	64
ignition	Time(sec)	5	N.I.	17	-
remarks	＊発煙係数の最大値 ＊＊最大値の時間 1 回目及び 2 回目の試験では、ガス濃度は測定しない。				

表 24　各試験条件による試験結果

(加熱 3 条件での試験：目詰まりありとなし)

specimen: ウールカーペット　　サンプリング 175℃:SUS

specimen	No.	1	2	3	3
condition	(kW/m^2)	50	25	25	50
pilot frame		no	no	yes	no
thickness(mm)	-	12.2	12.2	12.1	12.7
mass (g)	before	147.3	147.0	146.3	146.6
	before(with holder)	400.2	399.8	399.3	399.5
	after(with holder)	391.0	395.8	394.9	389.6
	after	138.1	143.0	141.9	136.7
	loss	9.2	4.0	4.4	9.9
smoke	smoke Ds max. ＊	416.8	148.4	68.54	389.6
	Time(sec.)＊＊	567	1199	1199	610
	Dc	34.38	----	----	34.48
	test duration(min)	20	20	20	20
gases(ppm)	CO	469	122	143	1035
	HCN	N.D.	N.D.	N.D.	N.D.
	HCl	N.D.	N.D.	N.D.	N.D.
	HBr	N.D.	N.D.	N.D.	N.D.
	HF	N.D.	N.D.	N.D.	N.D.
	NOx	N.D.	N.D.	N.D.	N.D.
	SO2	42	18	36	62
ignition	Time(sec)	7	N.I.	12	6
remarks	＊発煙係数の最大値 ＊＊最大値の時間		Dc は、Ds max.の 5% 以下。	Dc は、Ds max.の 5% 以下。	

表 25　各試験条件による試験結果

(加熱 50（kW/m^2）　口火使用せず)

condition: 50 （kW/m^2）　pilot flame: no/~~yes~~

specimen: メラミン　サンプリング 175℃:SUS

specimen	No.	1	2	3	4
specimen		メラミン A	メラミン A	メラミン A	メラミン B
thickness(mm)	-	2.0	2.0	2.0	1.8
mass (g)	before	22.5	22.5	22.8	20.4
	before(with holder)	281.2	275.0	278.4	276.1
	after(with holder)	271.7	264.7	268.3	266.1
	after	13.0	12.2	12.7	10.4
	loss	9.5	10.3	10.1	10.0
smoke	smoke Ds max. ＊	125.6	141.4	136.8	122.2
	Time(sec.)＊＊	333	365	360	327
	Dc	7.98	12.94	12.29	13.37
	test duration(min)	10	10	10	10
gases(ppm)	CO	808	643	---	635
	HCN	65	72	---	62
	HCl	N.D.	N.D.	---	N.D.
	HBr	N.D.	N.D.	---	N.D.
	HF	N.D.	N.D.	---	N.D.
	NOx	N.D.	N.D.	---	N.D.
	SO2	N.D.	N.D.	---	N.D.
ignition	Time(sec)	N.I.	N.I.	N.I.	N.I.
remarks	＊発煙係数の最大値 ＊＊最大値の時間				

5.4　FP50 における審議

（議題 9 関連）　防火戸の性能基準に関する決議 A.754（18）の改正

「A 級防火扉の扉下部最大隙間には現行の 6mm を適用し、その他の防火扉には 25mm でも可とする」日本提案の審議の前に、本件については「FP49 が修正案検討し、FP49/WP7 に報告していること、またターゲットデートは、2006 年であること」を、議長が説明した。

審議においては、我が国提案について仏は、Door 下部の隙間については A-class Door の実船での施工ではドア枠とドアの間に床材を施工することがあり、6mm では小さ過ぎると指摘した。中及び英は、B-class Door の 25mm の隙間は大きすぎるので日本提案に反対を表明した。また英は、Gas-tight door はケミカル及びガスタンカーに使用するもので、防火目的でない旨説明した。

米も日本提案に反対を表明して仏案を支持し、FP49/WP7 の改定案（A 級及び B 級については、扉下部最大隙間 12mm（12mm の隙間ゲージを使用し、許容値は 150mm 移動まで）とし、コットン試験を要求する。）を基に、CG で協議することを提案した。

これらを受け、仏、アルゼンチン、デンマークも同様に本件を CG で検討することを支持し、本議題は、FTP コードの総合見直しの中で検討することに小委員会は合意し、さらに CG にて引き続き検討することに合意した。従って、本件は FP の議題から削除することとなった。

（議題 10 関連）FTP コードの総合的見直し

本件の審議において、各国提案の説明の前に、「FP49 において、シール材及び樹脂材についての試験方法についての仏提案（FP49/6）については、FTP コードの総合見直しの新作業提案が MSC に提案されており、その新作業提案が承認された場合は当該仏提案を FTP コードの総合見直しの中で検討すること。」と合意されている旨議長が説明し、本件仏提案は、FTP コード見直しの中で審議することになった。

続いて、我が方は FTP コードの総合的見直しの提案（FP50/10/1 から FP50/10/4、及び FP50/INF.5）を説明し、本件に関する CG の設置を提案した。引き続き、ノルウェー、仏、米が各々の提案文書を説明した。

スウェーデン、中、英，露、デンマーク、米、独、仏、韓、及びフィンランドが、我が国の提案及び米提案（日本を支持し、また火災試験規格そのものを FTP コードに取込み、単一文書として判りやすくすること、及び Part 5 と Part 6 を合体する提案）に賛成し、CG への参加を表明した。スウェーデンは、ISO834-1 の試験炉の制御、特に炉内温度制御のため Plate thermometer を FTP コードの Part 3 に取り入れることを提案した。

独は、FTP コードが引用している ISO 規格については、その取入れを慎重に検討することも重要であると述べた。デンマークは、できるだけ最新の ISO 規格を取り入れるべきであると述べた。

我が国はこれらのコメントを受けて、FTP コードが引用している ISO 規格を作成・改正している ISO/TC92（火災安全）と親密な連携を取る必要があることを指摘し、プレナリーはこれに合意した。

露は、本件について FP51 から WG を設置すべきである旨主張した。この件は、FP の将来作業項目の議題において検討することとなった。

ノルウェーの「総会決議 A.753：プラスチックパイプの使用に関する指針を改正して、フレキシブル・パイプも対象とする」旨の提案に関して、英は、当該指針は固形（rigid）のパイプが鋼及び金属

製パイプと同等であることを認める指針であるとして、反対した。本件は、A.753（18）も FTP コードに入れ込むべきかという検討を含め、FTP コード見直しの CG で検討することにプレナリーは合意した。

これを受け、議長が

（1）FTP コードの総合的見直しについて我が国の提案に基づいて進めること、

（2）FTP コードの総合的見直しに関する CG の設立、

（3）FP51 において FTP コードの総合的見直し WG 設置すること

を提案し、プレナリーはこれに合意した。小委員会は FTP コードの総合的見直しに関する CG のコーディネーターは日本が引き受けること、及び以下の付託事項に合意した。

（1）FP50 議題 10 に提出された文書及び各国からのコメントを考慮して、関連する試験規格を取り入れて FTP コード単体で使用できて使いやすくする方向で、New FTP コード案を作成すること。

（2）関連する ISO 規格について、ISO/TC92 と連携し、スウェーデン及び独の意見を考慮して、FTP コードへの取り込みを検討すること。

（3）FP50/10（ノルウェー）に関して、表明された意見も考慮し、FTP コードへの取り込みを検討すること。

（4）防火戸の下端スペース（議題 9 における議論を基に）を検討し、FTP コードへの導入を検討すること。

（5）仏提案のシール材の取り扱い（FP48/15、FP49/6）及びその FTP コードへの取り込みを検討すること。

（6）結果を FP51 へ報告すること。

5.5　CG の作業計画

FP50 での合意により、FTP コードの総合的見直しに関する CG が設立されることとなり、その CG のコーディネーターを日本が引き受け、FP51 に向け、上記内容について CG 参加各国と我が国から提案した FP50 の提案文書の検討、情報交換、意見調整等を進めることとなった。

CG での検討作業においては、以下の点に留意し検討を行う予定である。

（1）日本提案文書内容についての、各国からのコメントを集め、New FTP コードの方向性を探る。（FP50/10/1, FP50/10/1-ADD-1、FP50/10/2、FP50/10/3、FP50/10/4、FP/INF.5）

（2）FP49 議題 6 関連（FP49/6、FP48/15　仏提案のシール材の取り扱い）についての検討、調節。

（3）FP50 議題 9 関連（FP50/9、防火戸の下端スペースにおける議論）についての検討、調節。

（4）FP50 議題 10 関連（FP50/10、ノルウェー提案のフレキシブル・パイプの採用）についての検討。

（5）FP50 議題 10 関連（FP50/10/6、米提案の Part5 及び Part6 の統合）についての検討。

（6）ISO/TC92（火災安全）との連携により、ISO 規格の FTP コードへの導入を円滑に導く。

（7）新 FTP コードにおいては、試験規格を引用することなく、FTP コード単体で運用が可能な、シンプルな構成と、使いやすさを重視したコードにすることを重視する。

5.6　今後の作業方針

以上の作業の成果を踏まえて、火災試験方法コード改正の今後の作業として、下記の項目を行う予定である。

（1）CG 対応：我が国の意見を CG での検討に反映させるため、必要に応じ、本部会または WG 等において検討を行う。

（2）FP への対応： FP51（2007 年 1 月）に CG での検討結果を踏まえて、FTP コードの改正案を提出する。

（3）今年度実施した実験内容（FTP コード Part 2（煙と毒性試験方法）における毒性分析方法として、ISO 基準案に基づく FTIR によるガス分析方法の確認試験の結果）について、FP51 に報告するとともに、FTP コード Part 2 における毒性分析方法として、ISO/DIS 21489 に準拠した試験方法の採用を提案する。

（4）FP50 の火災試験方法コード改正提案の意見の中で、スウェーデンから提案された、「ISO834-1 の試験炉の制御、特に炉内温度制御のため Plate thermometer を FTP コードの Part 3 に取り入れ」については、R2 の 2006 年度作業においては、ISO834-1 に準じた試験炉の制御（ISO834-1 に使用される Plate thermometer を使っての炉内温度の制御方法）の可否について検討する必要が有り、本件についての検証試験を実施して行く。また、この検証試験結果は、次回 FP51 に、FTP コード Part 3（A、B 及び F 級仕切り隔壁の標準火災試験方法）の改正案として提案することを検討する。

（5）FTP コード Part 5 と Part 6 の統合の検討、また Part 5 の試験方法に ISO 規格（ISO5658-2）の改正内容の導入し新規格を検討する。

今後の作業におけるタイムテーブル

計画線表（2006 年度）

作業内容	4	5	6	7	8	9	10	11	12	1	2	3
CG での検討	←—	——	——	——	——	——	——	——	——	—→		
引用 ISO 規格改正の取り入れの検討	←—	——	——	——	——	——	——	——	——	—→		
運用実績からの改正・修正の検討	←—	——	——	——	——	——	——	——	——	—→		
技術的進展の導入を図るための改正の検討	←—	——	——	——	——	——	——	——	——	—→		
検証試験の実施 コード Part 3 の改正に係る試験		←—	——	——	——	——	——	—→				
火災試験方法コード改正案の作成					←—	——	——	—→				
IMO への対応								**FP51** 文書			**FP51** 会議	

計画線表（2006 年度＆2007 年度）

作業内容	2006 年度				2007 年度			
統一解釈取り入れの検討	←――	―――	―――	→				
引用 ISO 規格改正の取り入れの検討	←――	―――	―――	→				
ISO への提案の検討					←――	―――	――→	
運用実績からの改正・修正の検討	←――	―――	―――	→	←――	―――	――→	
技術的進展の導入を図るための改正の検討	←――	―――	―――	→	←――	―――	―――	→
検証試験の実施	←――	――― Part 5	――― Part 3	→ **FP51**	←――	――― Part 3 Part 7	――― Part 8	→ **FP52**
Part 2　毒性分析試験方法の見直し			←――	――→	←――	―――	―――	→
Part 5 & Part 6　表面燃焼性試験方法の見直し			←――	――→	←―	―――	―――	→
Part3 防火仕切りの耐火性試験方法の見直し			←――	――→	←―	―――	―――	→
火災試験方法コード改正案の作成			←――	――→	←―	―――	―――	→
IMO への対応				FP51				FP52

別添 5.1　ISO/DIS 21489　（日本語仮訳）（5.3 項　補足資料）

火災試験－累積発煙試験における、フーリエ変換赤外分光光度法(FTIR)を用いた種々のガス分析方法

1　適用範囲

この、国際基準は、FTIR を用いた累積的発煙/火災試験におけるガス濃度の測定方法を規定する。ガスサンプリングシステムとガス測定条件には、特別の注意をはらう。

以下の事実に特別の配慮を要す。

－ガスというより例えば、微粒子、煙または蒸気で毒性のある可能性のあるものも火災流出物に含まれる。また、例えばハロゲン化水素のようなガスの中には、サンプリングライン中の湿気（水分）または煙の粒子を除去するためのみに設計されたフィルターによって捕らえられてしまうものもある。

累積的発煙/火災試験におけるフーリエ変換赤外分光光度法(FTIR)を用いたガス分析方法は、火災安全工学上の幾つかの取り組みの中でも、定量的、定性的分析のための情報提供方法として有益である。FTIR を用いたガス分析は、短時間のインターバルで行え、そして時系列データを得ることができる。FTIR を用いたガス濃度測定は、試験の間ずっと一定のインターバルによって行うことができる。

2　引用規格

この文章の適用のために、以下の引用規格が必須である。日付のある引用規格は、その引用された発行日のもののみ適用される。日付のない引用規格は、その規格の最新の版が（いかなる修正も含め。）適用される。

ISO 5659-2; 1999, Plastics-Smoke generation-Part2:Determination of optical density by a single-chamber test

ISO/IEC 13943: 2000, Fire safety- Vocabulary

ISO 19702: Toxicity testing of fire effluents- Analysis of gases and vopours in fire effluents using FTIR technology

3　用語と定義

この規格の目的のために、ISO 13943 及び ISO 19702 に示されている用語と定義を適用する。

4　原理

チャンバーの容積、が知られている発煙試験（ISO5659-2）の累積発煙チャンバーから燃焼流出物をサンプリングする。火災安全工学を用いて、ガス分析結果を火災危険性の分析へ適用するためにこれらの試験の火災条件を設定しなければならない。

ガスサンプリングは、チャンバー内のガス及び火災流出物を質及び量的に代表するものでなければならない。また、いかなるサンプリングシステムの影響（プローブ、パイプ、チューブ及びポンプ）も最小にしなければならない。さらに、ガスサンプリングシステムを通じて燃焼流出物が移動する時間と距離を最小にすることを推奨する。

燃焼流出物のフィルターリングシステムを設け、ガスサンプリングシステムを通して、小さな粒子がガス分析装置に入るのを防ぐ。FTIR をガス分析装置として用いる。

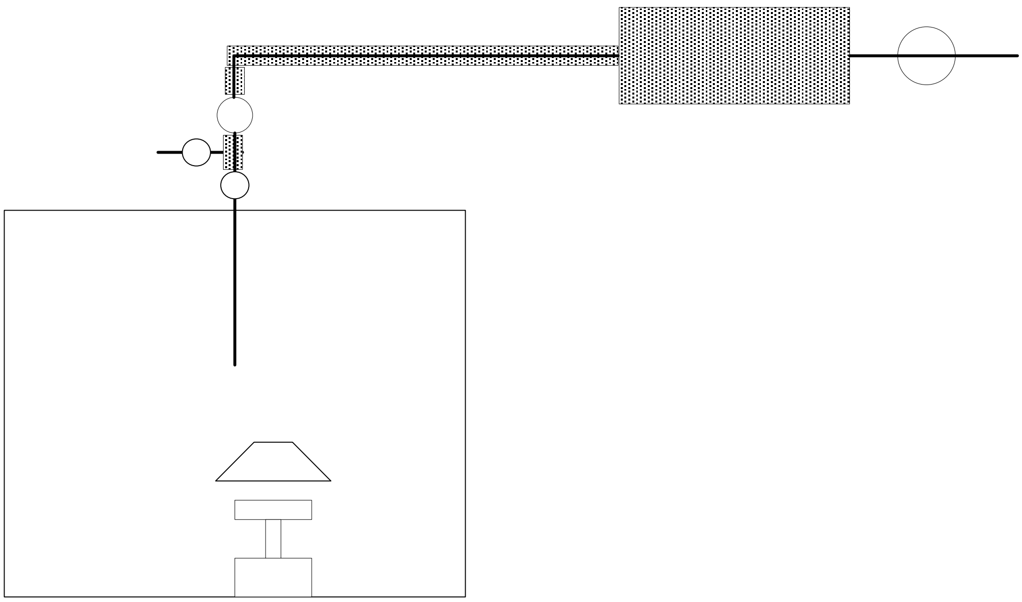
5　試験体の燃焼装置

ISO5659-2 に規定されている試験装置及び付属装置を用いなければならない。

ISO5659-2（例えば、スモークチャンバー、試験体保持部、過熱システム、ガス供給部、光学システム、さらにその他の測定装置）

6　ガスサンプリングシステム

ガスサンプリングシステムは、プローブ、フィルター、ガス流量計、ガス温度モニター、ガス圧モニター及びポンプよりなる。ガス分析装置は、ガスサンプリングラインの最後ポンプの前に位置する。ガスサンプリングシステムの 1 例を図 1 に示す。



1) 試験体と、チャンバー内のヒーター
2) 燃焼流出物のサンプリング　プローブ
3) 加熱されたサンプリングライン
4) 熱したススフィルター
5) FTIR 分析装置の過熱した測定セル
6) ガス循環ポンプ
7) バルブ
8) スモークチャンバー

図 1 — ガスサンプリングシステムの例

6.1　ガスサンプリングラインのプローブ

累積発煙チャンバー中のガスサンプリングに適切なプローブは、直径 4.0±1.0mm で、一方が開放しており、スモークチャンバーの中心に直接伸びているものである。プローブの材質は、錆びないタイプのもので試験の間スモークチャンバー内の温度に影響を受けないものとする。

チャンバーやフィルターユニットから分析装置までガスを通すサンプリングラインは、錆びない材質を用いる。このラインは、175±5℃の温度に一定に保つ。サンプリングラインの内径は、4.0±1.0mmとする。プローブとススのフィルターの距離はできるだけ短くし、どんな場合も 4m を超えてはならない。ベントやジョイントの数は、最小にする。

もし、HF を分析する場合には、ガラスのサンプリングプローブは用いてはならない。

6.2　フィルター

6.2.1　概要

FTIR 及び他の分析計は、火災流出物にしばしば含まれるススや固体の粒子のコンタミネーションから、フィルターユニットにより保護しなければならない。フィルターユニットは、フィルターのエレメントを容易に取り替えられるようなものであるべきである。フィルターユニットは、は、チャンバーとサンプリングラインの間の出来るだけ実用的なところに配置すべきである。

注記　1　　　FTIR 装置のガスセルに汚れたものを用いている試験所がある、このことで、少ない量のススがガスセルにはいるのを許容している。しかし、火災試験が様々な材料及び製品に及ぶ時、この装置は望ましくない。ISO5659-2 のような累積発煙試験手順においてススのでる材料の試験時には、FTIR 装置の圧力調整のためのニードルバルブが 2、3 分以内塞がれる可能性が指摘されている。

注記　2　　　分析すべきガスにより、フィルターを選ぶとき特別な留意が必要である。ガスとフィルター材質の相互作用を調べるべきである。

6.2.2　フィルターの材質

直径 20±2mm、長さ 75±5mm でポアサイズが 2 ミクロンの円筒のフィルターを使用すべきである。もし、平板のメンブランフィルターを用いるならポアサイズが 5 ミクロンで、直径約 47mmのものを用いるべきである。

ガラスまたはガラスファイバーのメンブランフィルターは、多くのガス流出物の時、適当だが、フッ素コーティングした材料の試験には使うべきでない。フィルターのハウジングには、ステンレス鋼でできたものかまたは、錆びないほかの材質のものを用いる。フィルターとハウジングは、フィルターユニットを加熱する温度に影響されてはならない。

注記　1　　　サイズ及びポアサイズの異なるフィルターのうちにも適切なものがある可能性がある。フィルターのポアサイズを 1 から 5 ミクロンの範囲で選択することは、ガスセルに入る前にススを捕まえることとフィルターの目詰まりを回避することの相反する関係により決まる。大量のススが発生する試験では、直径約 47mm 平板フィルターの目詰まりが起こる可能性がある。

注記　2　　　　ガラスウールのフィルターは、サンプリングガスに HF と HBr の両者または一方が含まれる時、不適当である。

6.2.3　フィルターの状態

フィルター及びサンプリングラインの温度は、175±5℃に保つ、この温度はフィルターのハウジングと、サンプリングラインの適当な外部位置で測定する。

6.2.4 フィルター補正

ガスの中には（HCl や HBr のように）フィルターに吸着する可能性があるものがあり、試験後にこの保持された量を決定する必要があるだろう。この補正は、これらガス種の総収量に適用されるかもしれない。（ISO 19702 参照。）フィルターに捕集されたガス種の量は試験の間すべてのガス測定時に把握できないため、この補正は、濃度/時間曲線に適用できない。

注記　附属書 A に分析方法の詳細を示す。

6.3　ガス温度指示

ガス温度指示計は、少なくともススフィルターの入り口及び出口とその中間に置きガス温度を175±5℃に保っていることを示すようにガス温度指示をサンプリングライン中に設置する。

6.4　ガス圧力指示

ガス圧力指示計を FTIR のガスセル入り口の近くに設置し、サンプリングラインとガスセルの圧力が一定であり目詰まりによる圧力低下がないことを示せるようにする。この目的のために、ガスセルに取り付けた圧力計が使用できる。

6.5　ポンプ

ポンプは、FTIR の出口につなげる（図 1 参照）。ポンプは、その容量が、ガスセルとサンプリングラインの容量を足したものを 1 分間で吸引できる値の 2 倍のものとする。また、サンプリングライン及びフィルターの目詰まりを防ぎ、熱せられたガスのサンプリング流量を一定にし、必要なガス量を分析計に供給するに十分な流量を得ることのできるものとする。ポンプは、175±5℃の温度に対する耐熱性がなければならない。

7　ガス分析技術

ISO19702 に記述されている FTIR システムを用いる。累積発煙試験の間のガス分析は、煙濃度が最大になった時に行う（8 項参照）

8　校正

測定ガスの校正は、ISO19702 に従って行う。

9 試験手順

9.1　試験前操作

それぞれの試験前

a)　ガスセルをクリーンな大気で満たした時、大気以外のガスが確認されないようにする。
b)　試験前にフィルターエレメントを取り替える。
c)　プローブの入り口をきれいにする。また必要なら新しい一次チューブフィルターをつける。
d)　フィルターユニットとサンプリングラインの温度を上昇し 175±5℃に保つ。
e)　ポンプを動かし、ガスサンプリングライン中の流量、圧力が 10 分間で±3%以内また温度は 175±5℃以内であることを確認する。

注記　1 日の試験を始める前スモークチャンバー内の大気をサンプリング分析することによりダミーガス測定をして、いかなるガスも検出されないことを確かめることが推奨される。また、測定結果より疑問のあるガスが検出された場合も同様のダミーガス分析を行うことが推奨される。また、スモークチャンバーを揮発性溶液でクリーンにした後、このようなスクリーニング測定を行うことが推奨される。

9.2　試験の間の操作

9.2.1　試験の最初にポンプを稼動させる。サンプリングラインのバルブは、スモークチャンバーの外気が、ガスセルへ導入できるような位置に設置する。

9.2.2　測定している煙の濃度が最大レベルに達したら、サンプリングラインのバルブバルブを開いてガスサンプリングを開始する。

注記　1　ISO 5659-2 の試験による煙は、スモークチャンバーに蓄積されていくので、通常は、試験の初めには煙の濃度が増加し、最大値を示してから、煙濃度が減少する。

注記　2　ある間隔をあけてガス分析を行う場合、ガスサンプリング及びガス分析は試験の初めすぐに開始するべきかもしれない。

もし、スモークチャンバーの圧力が試験体の燃焼のいかなる現象によってでも ISO 5659-2 の規定の最小値より落ちたら、ISO 5659-2 に従って、スモークチャンバーの入り口バルブが自動的に開く。この現象が起きたら、報告する。

もし、スモークチャンバーの圧力が試験体の燃焼のいかなる現象によってでも ISO 5659-2 の規定の最大値より上がったら、ISO 5659-2 に従って、スモークチャンバーの出口バルブが自動的に開く。この現象が起きたら、報告する。

10　ガス分析

ガス分析は、ISO 19702 に従って行わなければならない。

注記　試験が SOLAS の要件により行われている場合、分析すべきガスは IMO の FTP コードに規定されている。

11　精度

累積発煙試験のガス分析精度の知見は得られていない。

注記　1　　ISO 5660-1 による、発熱速度測定に関する FTIR のガス分析精度は、ISO 19702 に示されている。そのデータは、FTIR によるガス分析精度を示している。

注記　2　　材料の燃焼/くすぶり挙動の煙測定精度については、ISO 5659-2 に示されている。

注記　3　　ラウンドロビン試験が進められている。また、精度データは、そのラウンドロビン試験で得られ、この規準に加えられる。

12　試験成績書

各試験体に対して試験成績書は、以下の情報を含まなければならない。

1. 試験所の名称及び住所
2. 依頼者の名称及び住所
3. 材料の製造者の名称と住所
4. 試験日
5. 商品名、識別記号、構造、厚さ、密度及び試験するのに適した面を含む製品に関するすべての情報
6. 使用した基材の記述、また基材への固定方法
7. 以下の情報を含む試験データ
   - A)　試験体を輻射源に暴露してから煙濃度が最大になったと決定された時間までの時間経過；
   - B)　試験体を輻射源に暴露してからガス分析までの時間経過；
   - C)　ガス濃度の計測結果
   - D)　もし、インターバルをおいて測定をおこなったならそのインターバル
   - E)　以下の情報を含む測定装置に関するデータ
     - 1）ガスセル及びサンプリングラインの容積
     - 2）ポンプの能力

8. この基準の参照

9. この試験と接続して行われた煙測定の試験報告書の参照

附属書 A
（参考）

ガス保持を評価するためのフィルター材及びサンプリングラインの分析

酸性ガスは、フィルターによって保持されたススに吸着されている可能性がある。ある特定の酸性ガスの総量を測定しなければならない時、フィルターに保持されている量を FTIR により分析された HCl の総量に加えなければならない。

A.1　フィルターの洗浄手順

－円形フィルター
- －各試験後、フィルターを外し、最小量の水の中に入れる。（分析する量）；
- －溶液（水とフィルター）を 10 分間超音波洗浄にかける；
- －分析前に溶液の体積を測っておく。（ISO CD 19701 にその情報がある滴定またはイオンクロマトグラフィーで分析する。）

－円筒形のフィルター
- －2 つの方法が提案される。一つ目は、円形フィルターについて述べたものと同じである。
- －2 つ目は、フィルターを Soxlhet*中の暖かい水で 20 分間洗う。分析前に溶液の体積を測っておき、滴定またはイオンクロマトグラフィーで分析する。

注記　（Soxlhet を用いた）同じ手順を新しいフィルターを洗う場合にも用いることができる。フィルターは、使用前に乾燥させておく。（オーブン 250℃が適当。）

*ソクスレー抽出器（Soxhlet’extractor）を意味していると思われる。（訳者注）

A.2　移送ラインとプローブの洗浄

移送ラインとプローブの洗浄を水ですすぐ（分析する量）。すすぐ前には、そのシステムの温度は、70℃くらいにしておき､水の蒸発を防ぐ｡サンプリングシステムの各部分について洗浄液をメスフラスコに集め、分析前に溶液の体積を測っておく。そして適切な方法で分析する。

A.3　総濃度の調整

燃焼中に得られたガスの総量が測定された時、フィルターに吸着されたガスの計算値を FTIR で分析されたガスの総量(濃度、時間曲線下の面積)そして洗浄液中の分析された捕集ガスの総量に加える。

注記　計算する前に、2 種の濃度につき同じユニットで結果を検証してかなければならないかもしれない。

6.　まとめ

今年開催された IMO/FP50 での審議の結果、下記の対応が必要と考えられる。

（1）　我が国が新規作業項目として提案した「FTP コードの総合見直し」に対する作業が開始され、我が国をコーディネーターとする CG の設置が承認された。本件に関する CG 及び FP51 対応として、関連の検討及び必要な試験を行い、その結果を CG での審議に反映させ、FP51 への提案文書を作成する必要がある。

（2）　火災安全システムに関する性能試験及び承認基準においては、FP50 の WG において我が国提案の固定式高膨張泡消火装置に関する承認試験基準案の検討が行われ、次回 FP 会合での完成を目標に関連 CG で検討が行われることとなった。また、FP51 では中期検討課題（貨物倉の固定式消火装置、火災探知装置等）の審議も始まるため、これらに対応すべく、国内での検討を開始する必要がある。

（3）　大型旅客船の安全に関しては、今回で FP 小委員会での審議は終了し、各小委員会の審議結果が MSC81 で検討される予定である。このため、MSC81 での審議結果を基に今後の作業方針が決定される予定のため、MSC81 での審議を監視し、その結果に合わせ対応することが必要である。

（4）　FP49 から検討が開始された非常用消火ポンプのサクション位置に関する IACS の統一解釈に関しては、IACS 提案文書の見解(FP50/11/3 参照。) は一応合意されたが、更なる検討が必要との判断により FP51 でも検討が行われることとなった。本件は、国内でさらに検討を重ね対応する必要がある。

（5）　FP50 では、韓国の提案した「機関室及び貨物ポンプ室の防火対策」の CG の設置も承認さ、今後、CG において検討が開始されるため、当該 CG での審議を基に国内で対応をとる必要がある。

（6）　ノルウェーの提案した「ガス燃料船に関する要件の策定」に対する対応も、船舶設計にかかわる事項のため、BLG での検討結果を基に、必要であれば我が国の意見を審議及び検討結果に反映させる必要があると考えられる。

（7）　火災事故記録の解析に関し、仏で起こったケミカルタンカー船の事故に関する対応については、IMO での審議結果によれば、その影響が大きいため、今後、IMO（MSC81 等）での審議を監視するとともに、その結果を基に検討を行う等の対応を行う必要があると考えられる。

また、我が国から MSC81 に新作業項目として提案した、SOLAS 規則 II/19 の改正に関しても、MSC81 での審議結果を基に、関連国内委員会とも連携を取り、対応する必要がある。

7.　添付資料リスト

添付資料 7.1　FP50 議題及び関連文書一覧

添付資料7.2　FP50/9　AMENDMENTS TO RESOLUTION A.754(18) RELATING TO PERFORMANCE CRITERIA FOR FIRE DOORS

添付資料 7.3　FP50/10/1　COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE　－　Proposals for the comprehensive review of the International Code for Application of Fire Test Procedures and relevant fire test procedures

添付資料 7.4　FP50/10/1 Add.1　COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE　－　Proposals for the comprehensive review of the International Code for Application of Fire Test Procedures and relevant fire test procedures

添付資料 7.5　FP50/10/2　COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE　－　Draft of the new fire test procedures code

添付資料 7.6　FP50/10/3　COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE　－　Related revision to resolution A.754(18) Recommendation on fire resistance tests for .A., .B. and .F. class divisions

添付資料 7.7　FP50/10/4　COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE　－　Related revision to resolution A.653(16) Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials

添付資料 7.8　FP/INF.5　COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE　－　Gas measurement system for part 2 of the FTP Code

添付資料 7.9　MSC81/23/5　WORK PROGRAMME　－　Sub-Committee on Fire Protection and Sub-Committee on Dangerous Goods, Solid Cargoes and Containers　－　Application of requirements for dangerous goods in packaged form

添付資料 7.10	MSC/Circ.1165	REVISED GUIDELINES FOR THE APPROVAL OF EQUIVALENT WATER-BASED FIRE-EXTINGUISHING SYSTEMS FOR MACHINERY SPACES AND CARGO PUMP-ROOMS
添付資料 7.11	MSC/Circ.1169	UNIFIED INTERPRETATIONS OF SOLAS CHAPTER II-2
添付資料 7.12	MSC/Circ.1170	APPLICATION OF SOLAS REGULATION II-2/15 FOR LUBRICATING OIL AND OTHER FLAMMABLE OIL ARRANGEMENTS FOR SHIPS BUILT BEFORE 1 JULY 1998

添付資料 7.1

FP50 議題及び関連文書一覧

Doc. No.	Title	Submitted by
1 Adoption of the agenda		
FP50/1	PROVISIONAL AGENDA	Secretariat
FP50/1/1	Annotations to the provisional agenda	Secretariat
2 Decisions of other IMO bodies		
FP50/2	Outcome of COMSAR 9, DE 48, FSI 13, BLG 9 and MSC 80	Secretariat
FP50/2/1	Outcome of C 94, NAV 51, MEPC 53, SLF 48 and DSC 10	Secretariat
3 Passenger ship safety		
FP50/3	Outcome of MSC 80	Secretariat
FP50/3/1	Report of the correspondence group	Germany
FP50/3/2	Comments on document FP 50/3/1	Australia
FP50/INF.2	Measures to contain and extinguish electrical-origin fires within medium and high voltage switchboard rooms	Canada
4 Performance testing and approval standards for fire safety systems		
FP50/4	Report of the correspondence group	U.S.
FP50/4/1	Proposed amendments to the FSS Code	Germany
FP50/4/2	Installation requirement for sprinkler systems	Germany
FP50/4/3	Clarification of test scenario in MSC/Circ.1165	China
FP50/4/4	Comments on document FP 50/4	Finland and Sweden
5 Recommendation on evacuation analysis for new and existing passenger ships		
FP50/5	Proposed revisions to MSC/Circ.1033	Germany
FP50/5/1	Report of the correspondence group	Japan

6 Development of provisions for gas-fuelled ships		
FP50/6	Fire protection, fire detection and fire extinction	Norway
FP50/6/1	Comments on document FP 50/6	Germany
7 Measures to prevent fires in engine-rooms and cargo pump-rooms		
	<No Document>	
8 Review of the SPS Code		
FP50/8	Excerpts of the fire protection-related provisions of the SPS Code	Secretariat
9 Amendments to resolution A.754(18) relating to performance criteria for fire doors		
FP50/9	Comments on document FP 49/7	Japan
10 Comprehensive review of the Fire Test Procedures Code		
FP50/10	Fire test procedures for non-metallic pipes in fire water systems - Synthetic rubber pipes	Norway
FP50/10/1	Proposals for the comprehensive review of the International Code for Application of Fire Test Procedures and relevant fire test procedures	Japan
FP50/10/1/Add.1	Proposals for the comprehensive review of the International Code for Application of Fire Test Procedures and relevant fire test procedures	Japan
FP50/10/2	Draft of the new fire test procedures code	Japan
FP50/10/3	Related revision to resolution A.754(18) Recommendation on fire resistance tests for .A., .B. and .F. class divisions	Japan
FP50/10/4	Related revision to resolution A.653(16) Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials	Japan
FP50/10/5	COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE	France
FP50/10/6	Comments on documents FP 50/10/1, FP 50/10/1/Add.1, FP 50/10/2, FP 50/10/3 and FP 50/10/4	U.S.
FP50/INF.5	Gas measurement system for part 2 of the FTP Code	Japan
11 Consideration of IACS unified interpretations		
FP50/11	Windows and sidescuttles located within the limits of the cargo area as per SOLAS II-2/4.5.2	IACS
FP50/11/1	Clarification to SOLAS regulations II-2/9.2.4 and 9.3.1	IACS

FP50/11/2	Unified Interpretation to SOLAS regulations II-2/4.5.1.2 and 4.5.1.3 and IBC Code regulation 3.2.1	IACS
FP50/11/3	Clarification to the International Code for Fire Safety Systems, chapter 12, paragraph 2.2.1.3	IACS
FP50/11/4	SOLAS regulation II-2/19.3.2 – Sources of ignition	IACS
FP50/11/5	IACS Unified Interpretations SC 16, 197, 198 and 200	IACS
FP50/11/6	Clarification on the application of interpretations to SOLAS regulations II-2/5.3 and II-2/6.2 as contained in MSC/Circ.1120	IACS
12 Analysis of fire casualty records		
FP50/12	Casualty analysis information on the Spirit of Tasmania	Secfretariat
13 Measures to prevent accidents with lifeboats		
FP50/13	Outcome of focused inspection campaign on lifeboats	Australia
FP50/13/1	Draft amendment to SOLAS regulation III/19.3.3.4	Sweden
FP50/13/2	Report of the Correspondence Group - Part 1 Draft Guidelines for the development of operation and maintenance manuals for lifeboats	U.S. and Japan
FP50/13/3	Report of the Correspondence Group - Part 3 Amendments to MSC circulars related to measures to prevent accidents with lifeboats	U.S. and Japan
FP50/13/4	Comments on document FP 50/13/1	ICS
FP50/INF.4	Evaluation of release mechanisms in davit launched lifeboats	Canada
FP50/INF.6	Research being conducted on the development of lifeboat design	U.K.
14 Compatibility of life-saving appliances		
FP50/14	Proposal to amend life-saving appliances code related to survival craft testing	Canada
FP50/14/1	A proposed method for determining the design load of a lifeboat from statistical population data	U.K.
FP50/INF.3	Anthropometric comparisons from recent research reports	Canada
15 Inconsistencies in IMO instruments regarding requirements for life-saving appliances		
FP50/15	Outcome of DE 48 and MSC 80	Secretariat
FP50/15/1	Report of the Correspondence Group - Part 2	U.S. and Japan

	Amendments to SOLAS chapter III, the LSA Code, and the Revised recommendation on testing (resolution MSC.81(70), as amended)	
16 Test standards for extended service intervals of inflatable liferafts		
FP50/16	Proposed amendments to SOLAS chapter III, the LSA Code and resolution A.761(18)	Denmark
17 Amendments to resolution A.761(18)		
FP50/17	Proposed amendments to resolution A.761(18)	Denmark
18 Work programme and agenda for FP 51		
	<No Document>	
19 Election of Chairman and Vice-Chairman for 2007		
	<No Document>	
20 Any other business		
FP50/20		
FP50/20/1	Unified interpretation of SOLAS regulations II-2/10.8.1, II-2/10.9 and the FSS Code, chapter 14, paragraph 2.1.1	Sweden
21 Report to the Maritime Safety Committee		
FP50/21	REPORT TO THE MARITIME SAFETY COMMITTEE	Secretariat

SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 9

FP 50/9
7 November 2005
Original: ENGLISH

AMENDMENTS TO RESOLUTION A.754(18) RELATING TO PERFORMANCE CRITERIA FOR FIRE DOORS

Comments on document FP 49/7

Submitted by Japan

SUMMARY	
Executive summary:	This document presents comments from Japan to the proposals submitted by France for amendments of resolution A.754(18) referred to in part 3 of the FTP Code relating to performance criteria for fire doors
Action to be taken:	Paragraph 9
Related documents:	FTP Code, resolution A.754(18), MSC 77/23/3, FP 48/14 and FP 49/7

Background

1 At the forty-eighth session of the Sub-Committee, France submitted a document (FP48/14) proposing amendments to sill integrity criteria of fire doors in resolution A.754(18) - Recommendation on Fire Resistance Tests for “A”, “B”, and “F” Class Divisions. The Sub-Committee agreed on the necessity of further discussion at FP 49.

2 At the forty-ninth session of the Sub-Committee, the discussion was made based on document FP 49/7, proposing that the cotton-wool pad test should be applied instead of the 6 mm gauge test and an additional provision on this matter should be included in subparagraph 6.2 of resolution A.754(18) specifying a maximum gap of 15 mm at the door-sill level, but that had been left unconcluded.

3 Taking the above into consideration, Japan would like to propose criteria for fire doors based on its experience in the past.

Integrity criteria of fire door

4 Through the experiences of fire resistance tests according to resolution A.754(18), Japan has also faced the same problem described in FP 48/14, paragraph 4, and shares the view of the proposal submitted by France.

5 Taking into consideration the required performance of "A" class fire door, Japan considers that the French proposal is not suitable and applicable to "A" class fire doors because spaces such as machinery space category A, CO_2 room and galley are required "A" class fire division or gas-tight at their boundaries to control penetration of flammable gases, smoke and CO_2. Therefore, Japan considers that the French proposal relating to the performance criteria for fire doors should not be applied to "A" class fire doors.

6 Fire doors other than "A" class are normally applied to the boundaries in accommodation space or similar areas and the bottom of the doorframes are designed to be flat to fit standard design. Those door types do not require such high integrity criteria for the doorsill. Therefore, Japan considers that the French proposal relating to the performance criteria for fire door is useful to fire doors other than "A" class.

Sill clearance of "B" class door

7 Although, France proposed that the clearance of the doorsill should be less than 15 mm in document FP 49/7, Japan considers that this proposal should not be applied to "A" class fire doors, however, it could be applied to "B" class doors only because such doors do not need to be gas-tight. Japan also considers that the clearance of "B" class doorsill of no more than 25 mm is acceptable, because "B" class doors may be permitted to have ventilation openings up to 0.05 m^2 as total net, according to SOLAS regulation II-2/4.1.2.1, in the lower portion. It means that the clearance of "B" class doors could be considered as one of the ventilation openings and the sill clearance of the "B" class door can be acceptable when it is less than 50 mm when the width of the door is 1,000 mm or less. Therefore, the proposal that the clearance of "B" class doorsill should not be more than 25 mm is considered reasonable.

Proposal

8 Taking the above into consideration, Japan proposes that the fire integrity criteria of fire doors as defined in resolution A.754(18) should be amended as set out in the annex, which is based on the French proposal.

Action requested of the Sub-Committee

9 The Sub-Committee is invited to consider the proposal described in paragraph 7 and to take action as appropriate.

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ANNEX

PROPOSAL FOR REVISION OF THE FTP CODE REGARDING THE FIRE INTEGRITY CRITERIA OF SHIP DOORS (RESOLUTION A.754(18) "RECOMMENDATION REGARDING FIRE RESISTANCE TESTS FOR "A", "B"AND "F" CLASS DIVISIONS")

New text is underlined.

1 A new sentence is added in the end of paragraph 6.2, as follows:

"**6.2 Door clearances**

Following mounting of the door and immediately prior to the test, the laboratory should measure the actual clearances between the door leaf and the door frame, and additionally for a double leaf door between the adjacent door leaves. The clearances should be measured for each door leaf at two positions along the top and bottom edges and at three positions along each vertical edge.

It should be verified that the actual clearance between the leaf of fire doors other than "A" class and the frame is less than **25** mm."

2 A new sentence is added in the end of paragraph 8.4.4, as follows:

"**8.4.4** Gap gauges

8.4.4.1 Tests with gap gauges are used to indicate whether cracks and openings in the test specimen are of such dimensions that they could lead to the passage of hot gases sufficient to cause ignition of combustible materials.

8.4.4.2 The gap gauges should be used at intervals which will be determined by the apparent rate of specimen deterioration. Two gap gauges should be employed in turn, and without undue force, to determine:

- whether the 6 mm gap gauge can be passed through the specimen such that the gauge projects into the furnace, and can be moved a distance of 150 mm along the gap, or

- whether the 25 mm gap gauge can be passed through the specimen such that the gauge projects to the surface.

Any small interruption to the passage of the gauge that would have little or no effect upon the transmission of hot gases through the opening should not be taken into account, e.g. small fastening across a construction joint that has opened up due to distortion.

In case of fire test for fire doors other than "A" class doors, the cotton-wool pad test in accordance with the provisions specified in paragraph 8.4.3 can be applied instead of the test using 6 mm gauge."

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INTERNATIONAL MARITIME ORGANIZATION

IMO

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SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 10

FP 50/10/1
25 October 2005
Original: ENGLISH

COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE

Proposals for the comprehensive review of the International Code for Application of Fire Test Procedures and relevant fire test procedures

Submitted by Japan

SUMMARY

Executive summary:	This document provides some proposals for the comprehensive review of the International Code for Application of Fire Test Procedures (FTP Code) and related fire test procedures, based on the considerations made by Japan
Action to be taken:	Paragraph 15
Related documents:	MSC 80/21/5, MSC 80/24 and FP 50/10/1/Add.1

Introduction

1 Japan proposed a new work programme "Comprehensive Review of Fire Test Procedures Code" to MSC 80 as a work item of the Sub-Committee (MSC 80/21/5). The Committee agreed to include the work item in the Sub-Committee's work programme and the provisional agenda for FP 50 as high priority item, with a target completion date of 2008 (MSC 80/24, paragraph 21.11). According to this decision, Japan submits some proposals for comprehensive review of the FTP Code. Additional proposals are also submitted to the Sub-Committee in separate documents.

Background of the proposal

2 The Maritime Safety Committee, at the sixty-seventh session, held in December 1996, adopted resolution MSC.57(67) "Adoption of amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974" and the resolution MSC.61(67) "Adoption of the International Code for Application of Fire Test Procedures (FTP Code)". The FTP Code became a mandatory instrument under SOLAS chapter II-2 when the SOLAS amendments entered into force on 1 July 1998.

Amendments and interpretations to the FTP Code

3 After adoption of the FTP Code, based on the evolution of the shipbuilding and related technologies and the actual results of the application of the FTP Code, various possible interpretations have been raised among the maritime Administrations and some of them were put into consideration of the Sub-Committee. Having recognized the results of the consideration and conclusions of the Sub-Committee, some amendments were adopted and some interpretations were approved by the Committee. Therefore, many interpretations and amendments for the FTP Code exist now. In particular, because such interpretations were issued in many separate MSC circulars, it is difficult to follow these interpretations.

Adopted amendments to the FTP Code

4 Adopted amendments to the FTP Code should be incorporated into the next version of the FTP Code.

Approved unified interpretations to the FTP Code

5 Japan considers that it should be necessary and beneficial to consider whether the approved unified interpretations to the FTP Code should be included into the new version of the FTP Code as mandatory provisions and whether further improvement of the FTP Code is necessary to enhance the uniform application of the Code.

Proposals not agreed at the Sub-Committee

6 There were proposals of interpretations of the FTP Code, which were also discussed in the previous sessions of the Sub-Committee but were not agreed, because the Sub-Committee decided such proposals had a nature of amendment rather than interpretation. Now it would be possible to reconsider these proposals under the scope of the comprehensive review of the FTP Code.

Summary of the reviewing points and comments of Japan

7 In order to clarify the reviewing points on the FTP Code, Japan prepared lists of summary of adopted amendments and approved interpretations, as well as, proposed interpretations that were not agreed, in annex 1 to this document. The lists also contain Japanese comments, which may facilitate the consideration of the Sub-Committee.

ISO fire test standards

8 After the adoption of the FTP Code in 1996, ISO fire test standards, which are referred to in the FTP Code, were revised, based on the evolution of the fire safety technology, in order to facilitate to conduct the fire tests more uniformly and correctly. Therefore, references to these ISO fire test standards in the FTP Code should be reviewed and revised if necessary. Annex 2 contains a list of the latest ISO fire test standards, some of which have been revised by relevant ISO groups.

Experiences of the application of the FTP Code

9 It seems that several reviews and revisions of the FTP Code would be necessary based on the experiences obtained through the application of the FTP Code, in order to enhance the unified application of the fire tests procedures worldwide. Since Japan has extensive experiences on application of the FTP Code and found difficulties and problems on the application through the experiences, Japan has reviewed the problems and provided possible solutions to such problems. Annex 3 to this document contains a list of such discussion points together with comments and Japanese proposals. Appendices 1 and 2 to document FP 50/10/1/Add.1 provide supplemental ideas to the proposals in the annex to the document FP 50/10/1/Add.1.

New technologies

10 In addition, new fire protection systems and materials have been developed and are being developed based on the evolution of the shipbuilding and related technologies. However, those were not expected or assumed at the stage of the development of the FTP Code. Therefore, an appropriate action should be taken to accommodate such development of fire protection technologies to enhance the fire safety of ships.

High-speed craft

11 Part 10 and part 11 have been added to the FTP Code by resolution MSC.101(73) in relation to the 2000 HSC Code. These parts have basic requirements, which may need further clarifications for unified application of these parts to constructions and materials of high-speed crafts.

12 However, as Japan has no sufficient experiences concerning high-speed craft, no precise comments have been made for those items so far. Therefore, it is anticipated that the Member Governments or organizations, which may have experiences of application of the FTP Code for high-speed craft, would be requested to submit any idea or proposals of reviewing the FTP Code in relation to high-speed crafts.

Development of the draft code and revised test procedures

13 For convenience of the discussions on the comprehensive review of the FTP Code, Japan prepared a draft of the New FTP Code and proposals of revision of part 3 and part 5, which both includes possible incorporation of adopted amendments and approved interpretations. As a consequence of the revision to part 3 and part 5 of the FTP Code, it is necessary to revise the related test procedures prescribed in IMO Assembly resolutions A.653(16) and A.754(18). Such proposals will be submitted by separate papers to this session of the Sub-Committee, as follows:

.1 FP 50/10/2 draft new FTP code 200X;

.2 FP 50/10/3 in consequence of revision to part 3 of the FTP Code, possible revision to the test procedures in IMO resolution A.754(18) “Recommendation on fire resistant test for “A”, “B” and “F” class divisions”; and

.3 FP 50/10/4 in consequence of revision to part 5 of the FTP Code, possible revision to the test procedures in IMO resolution A.653(16) “Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials”.

Establishment of a correspondence group

14 Considering the allocated target completion date of 2008, the Sub-Committee should make progress on the review work until 2007. Japan proposes to establish a correspondence group on this agenda item in order to make progress of the work until the fifty-first session of the Sub-Committee.

Action requested of the Sub-Committee

15 The Sub-Committee is invited to note the information in paragraph 13 and consider the following:

.1 the opinions expressed in paragraphs 3 to 12 above;

.2 the discussion points listed in annexes 1 and 2 to this document and the annex to document FP 50/10/1/Add.1;

.3 establishment of a correspondence group for the comprehensive review of the FTP Code (paragraph 14); and

.4 take action as appropriate.

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ANNEX 1

SUMMARY OF THE REVIEWING POINTS ON THE FTP CODE AND COMMENTS OF JAPAN

1 Adopted amendments to FTP Code

Relevant document	Paragraph or Annex	Description of the amendment	MSC/Res.	Action
FTP Code	9	(Add new text) List of references	MSC.101(73)	Add text to the Code.
Part 10 - Fire resistant materials for HSC	Annex 1, part 10	(Add new text; FTP Code, part10) 1. Application 2. Fire test procedure: resolution MSC.40(64), as amended by MSC.90(71)	MSC.101(73)	Add text to the Code.
Part 11 - Fire resistant divisions for HSC	Annex 1, part 11	(Add new text: FTP Code, part 11) 1. Application 2. Fire test procedure: resolution MSC.45(65) 3. Additional requirements	MSC.101(73)	Add text to the Code.
FTP Code, annex 2	3, 4	(Add new text under "Product which may be installed without testing and/or approval") 3, 4	MSC.101(73)	Add text to the Code.
Part 2 - Smoke and toxicity test	2.6.2	In the table of limits, the following text is added after the entry "SO_2 120 ppm"; "(200 ppm for floor coverings)"	MSC.173(79)	Add text to the Code.

2 Approved unified interpretations for FTP Code and related fire test procedures

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
FTP Code Approval	5.1.6.5	For cases where an unsuccessful test had been conducted prior to the final approval test, the fire test report should include a description of the modifications made to the test specimen that resulted in the successful test.	1004 (1120)	Keep as interpretation	It is difficult for a laboratory to trace all the history of the failure results from other laboratories. So, it should be kept as the interpretation, if necessary.
FTP Code Approval	5.2.4	Type approval certificates for windows should state which side of the window was exposed to the heating condition during the test.	1036 (1120)	Add text to the code, but resolution A.754 should be modified	This interpretation might be in conflict with resolution A.754, appendix AI 2.2. So, resolution A.754, appendix AI 2.2 may need to be modified. 1) delete the following sentence: "not necessarily being the worst way round." 2) add the following sentence after "the unexposed face of the structural core": ", such as the window on front bulkhead of the tanker" 3) So the text should be modified as below: "The bulkhead which includes the window should be insulated to class A-60 on the stiffened face, which should be the face exposed to the heating conditions of the test. This is considered to be most typical of the use of windows on board ships~~, not necessarily being the worst way round~~. There may be special applications of windows where the Administration considers it appropriate to test the window with the insulation of the bulkhead to the unexposed face of the structural core<u>,</u> <u>such as the window on front bulkhead of the tanker,</u> or within bulkheads other than class A-60."

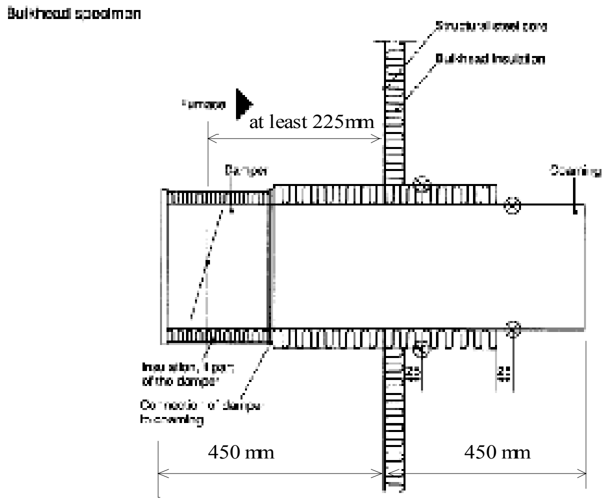
Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
FTP Code Approval	5.2.4	The certificate should include a reference to optional test(s) such as hose stream test and/or thermo radiation test.	1036 (1120)	Keep as interpretation	"Resolution A.754, appendix AI 5, Hose stream test" and "FTP Code, annex 1, part 3, appendix thermo radiation test" are the optional tests for the type approval of windows. But it is not clear in which case those optional tests should be required. So, specific reason for the necessity of those optional tests should be clearly explained. If it is difficult to make those reasons clear, this text should be kept as an interpretation. It is necessary to avoid the misunderstanding that those optional tests would be a mandatory requirement.
Part 1 - Non-combustibility test	2.1	The test exposure need not exceed a 30 minutes duration.	964 (1120)	Add text to the Code	
Part 1 - Non-combustibility test	2.1	For the purposes of this part, ISO 1182:2002 may be used *in lieu* of ISO 1182:1990.	1120	Add text to the Code	"may" should be changed to "shall".
Part 2 - Smoke and toxicity test	2.6.2	Not only the FTIR (Fourier Transform Infrared Spectrometer) method but also other methods such as GC/MS (Gas Chromatography/Mass Spectrometer), which can produce traceable results, can be used for the gas analysis.	916 (1120)	Add text to the Code	Although gas-measuring methods by using FTIR, and GC/MS, were provided by MSC/Circ.916, Japan considers that not only the gas-measuring apparatus but also the gas-sampling methods are very important factor of the measuring. Because the test result of FTIR and indication tube, which applied by same sampling method, were just about the same through our experience. FTIR test method is under development in ISO presently. After this test method is established, gas-measuring method of part 2 should be carried out in accordance with ISO standard. It would be also provided those sampling method. * See the comment of FP 50/INF.5 submitted by Japan for detail.

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
Part 3 - Test for fire door	2.1	"B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested.	916 (1120)	Add text to the Code	"B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A. 754(18)" is obscure meaning. So, definition of the "B class steel bulkheads" should be clarified. Japan considers that 3.2 mm thickness steel plate, instead of 4.5 mm on A class bulkhead, shall be the bulkhead core for B-class fire door test * See the comment to annex 3 for detail.
A.754(18), Annex	2.6.2.2	"B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested.	916 (1120)	Add text to resolution A.754(18)	Same as above.
Part 3 - Test for "A", "B", and "F" class divisions	2.2.1	The minimum bulkhead panel height should be a standard height of the manufactured panel with a dimension of 2.4 mm.	964 (1120)	Add text to the Code	
Part 3 - Test for "A", "B", and "F" class divisions	3.1	The calcium silicate board described as a dummy specimen specified in paragraph 3.3 of resolution A.653(16) should be used as a standard substrate for adhesives.	916 (1120)	Add text to the Code	Same text should be added to annex 1, part 5 and resolution A.653(16).
Part 3 - Test for "A", "B", and	4.1	Sealing materials used in penetration systems for "A" class	1120	Add text to the Code	Same text should be added to resolution A.754, appendix AIII, Pipe and duct penetrations 2.2, and appendix AIV, Cable

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
"F" class divisions		divisions are not required to meet non-combustibility criteria provided that all other applicable requirements of FTP Code, part 3, are met.			Transit 2.2.
A.754(18), Annex	1.2	The thickness of insulation on the stiffeners need not be same as that of the steel plate.	916 (1120)	Add text to resolution A.754(18)	
A.754(18), Annex	1.6	Doors, windows and other division penetrations intended to be installed in fire divisions made of material other than steel should correspond to prototype(s) tested on a division made of such material, unless the Administration is satisfied that the construction, as approved, does not impair the fire resistance of the division regardless of the division construction.	1004 (1120)	Add text to resolution A.754(18)	
A.754(18), Annex	1.7	"B" class constructions should be tested without finishes. For constructions where this is not possible, finishes should be included in the non-combustibility test of the construction.	916 (1120)	Add text to resolution A.754(18)	

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
A.754(18), Annex	2.8.2	Where testing is conducted on a perforated ceiling system, equally constructed non-perforated ceilings and ceilings with a smaller degree of perforations (in terms of size, shape, and perforations per unit area) may be approved without further testing.	1120	Add text to resolution A.754(18) Modification is necessary.	Resolution A.754(18), paragraph 2.8.2 described as below: "If the ceiling may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the ceiling itself, without the incorporation of these units, to establish the basic performance. A separate test(s) may be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the ceiling." This interpretation might be conflicted with above sentence. So, modification of the above sentence of resolution A.754(18) should be necessary. A new paragraph is proposed. Resolution A.754(18), paragraph 2.8.2 should be changed as below: <u>"If the ceiling may incorporate electrical fittings, e.g., light fittings and/or ventilation units, test(s) can be performed on a specimen(s) with the units incorporated. Where testing is conducted on a perforated ceiling system, equally constructed non-perforated ceilings and ceilings with a lesser degree of perforations (in terms of size, shape, and perforations per unit area) may be approved without further testing."</u>
A.754(18), Annex	9 (9.2)	There exist no expectations that "A" and "B" class fire doors remain functional, in the ability to be opened/closed, during or after the specified test duration.	1120	Add text to resolution A.754(18), Annex 9.2	

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
A.754(18), appendix A.I Windows	2.1	The test should be conducted on a window of the maximum size (in terms of both the height and the width) and the type of the glass pane and/or the minimum thickness of the glass pane or panes and gaps, if appropriate, for which approval is sought. Test results obtained on this configuration should, by analogy, allow approval of windows of the same type, with smaller dimensions in terms of height and width and with the same or greater thickness.	1036 (1120)	Add text to resolution A.754(18), appendix A.I 2.1	
A.754(18), appendix A.I Windows	5.3	The window should be considered to have failed the hose-stream test if an opening develops that allows an observable projection of water from the stream beyond the unexposed surface during the hose stream test. Gap gauges need not be applied during or after the hose stream test.	1120	Add text to resolution A.754(18), appendix A.I 5.3	
A.754(18), appendix A.II Fire dampers	2.2.4	The distance between the fire damper and the structural core specified in paragraph 2.2.4 means the distance between the fire damper centre and the structural core.	964 (1120)	Add text to resolution A.754(18)	Modify the drawing of resolution A.754(18), appendix A.II. "Length of the coaming, total 900 mm" and "the distance between the fire damper and the structural core" should be shown in the drawing, resolution A.754(18), appendix A.II, figure A1.

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
					
A.754(18), appendix A.II Fire dampers	4	If evaluation of insulation is required, it should prevent a temperature rise at any point on the surface not exceeding 180°C above the initial temperature. The average temperature rise is not relevant.	964 (1120)	Add text to resolution A.754(18)	
A.754(18), appendix A.III Pipe and duct penetrations	4.1	Penetrations and transits should meet both integrity and insulation criteria.	916 (1120)	Add text to resolution A.754(18)	

Relevant document	**Paragraph**	**Description of the interpretation**	**MSC/ Circ.**	**Action**	**Japan comments or proposals**
A.754(18) appendix A.IV Cable transits	4.1	Penetrations and transits should meet both integrity and insulation criteria.	916 (1120)	Add text to resolution A.754(18)	Resolution A.754(18), appendix A.IV4.1 described as below: “The performance of cable transits may be related to their ability to satisfy both the requirements for insulation and integrity or may be related only to the requirements for integrity, depending on the requirements of the Administration.” This requirement might be inconsistent with MSC/Circ.916. So, modification of the above sentence of resolution A.754(18) should be necessary. Following sentence should be deleted: “~~or may be related only to the requirements for integrity, depending on the requirements of the Administration~~.”

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
Part 5 - Test for surface flammability	1	Where a product is approved based on a test of a specimen applied on a non-combustible substrate, that product should be approved for application to any non-combustible substrate with similar or higher density (similar density may be defined as a density ≥ 0.75 x the density used during testing) or with a greater thickness if the density is more than 400 kg/m^3. Where a product is approved on the basis of a test result obtained after application on a metallic substrate (e.g. thin film of paints or plastic films on steel plates), such a product should be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness ≥ 0.75 x the thickness of metallic substrate used during testing).	1004 (1120)	Add text to the Code	Although MSC/Circ.1004 is the guideline for the type approval of the surface materials, there are some unidentified points for the application of surface materials in ships. Interpretation for actual use in ships: 1) When no substrate applied for the surface flammability test, the product should be approved to both of metallic and non-combustible substrate. 2) If the floor covering has a multilayer construction, the tests can be conducted for each layer (single layer test), by the understanding of annex 1, part 5 3.2.2. The description in FTP Code, annex 1 part 5, 3.2.2 says: "Where a floor covering is required to be low flame-spread, all layers shall comply with part 5. <u>If the floor covering has a multilayer construction, the Administration may require the tests to be conducted for each layer or for combinations of some layers of the floor coverings. Each layer separately, or a combination of layers (i.e. the test and approval are applicable only to this combination), of the floor covering shall comply with this part."</u> Therefore, for the floor coverings, interpretation of MSC/Circ.1004 is meaningless, because the floor covering could be accepted by a single layer test, which means that the influence of the substrate could be neglected. To clarify the above interpretation, Japan prepared the "Guidelines for the specimen and the type approval of those products", as set out at appendix 1 of annex 3 to this document, and propose that it should be added to the Code.

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
A.653(16), Annex	7	Same as above	1004 (1120)	Add text to resolution A.653(16), Annex	Same as above
A.653(16), Annex	7.3	Vapour barriers used in conjunction with insulation should be tested without any other components of "A" or "B" class constructions that will shield the barrier being tested from the radiant panel.	1120	Add text to resolution A.653(16), Annex, and FTP Code, annex 1, part 5	Evaluation test for the vapour barriers should be carried out by part 5 surface flammability test without any other components of "A" or "B" class constructions. But the vapour barrier itself is a very thin product, and it is impossible to conduct such test without the specimen backing. Japan considers that this test method has a problem. Therefore, Japan proposes that the vapour barriers with backing layers should be tested by non-combustibility test instead of surface flammability test. When there are several densities of the insulation, which would be base of vapour barriers, both of maximum and minimum densities of insulation material with Vapour barriers should be tested. * See the comment of annex 3 for details
A.653(16), Annex	8.3.1	In the first line of the first sentence, the word "or" should read "of".	1004 (1120)	Correct text resolution A.653(16), Annex	
A.653(16), Annex	10	The sentence should be understood to mean: "Materials giving average values for all of the surface flammability criteria as listed in the following table ... (etc.).	1036 (1120)	Correct text resolution A.653(16), Annex	

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
A.653(16), Annex	10	Q_{sb} means an average of three values of average heat for sustained burning, as defined in paragraph 9.3.	1004 (1120)	Add text to A.653(16), Annex	The description in resolution A.653(16), paragraph 9.3 (Average heat for sustained burning Q_{sb}) says: "An average of the value for the characteristic defined in 3.8 (Heat for sustained burning) measured at different stations, the first at 150 mm and then at subsequent stations at 50 mm intervals through the final station or 400 mm station, whichever value is the lower." And the description in resolution A.653(16), paragraph 3.8 (Heat for sustained burning) says: "The product of time from initial specimen exposure until arrival of the flame front and the incident flux level at that same location as measured with a dummy specimen during calibration. <u>The longest time used in this calculation should correspond to flame arrival at a station at least 30 mm prior to the position of furthest flame propagation on the centreline of the specimen.</u>" So, when the frame front does not reach 180 mm position, the value of Q_{sb} cannot be calculated in accordance with resolution A.653(16), paragraph. 3.8. In this case, the calculation method of Q_{sb} is not clear. It should be improved.
Part 6 - Test for primary deck coverings	2.1	For the purpose of this part, the total heat release value (Q_t) for floor coverings given in section 10 of the Annex to resolution A.653(16) is replaced by ≤ 2.0 MJ.	1120	Revise the table of resolution A.653(16), Annex	Qt value in the table of "Surface flammability criteria" described in resolution A.653(16), paragraph10, should be changed from 1.5 to 2.0MJ.

Relevant document	Paragraph	Description of the interpretation	MSC/ Circ.	Action	Japan comments or proposals
Part 6 - Test for primary deck coverings	2.2	Fire test procedure The test may be terminated after 40 minutes.	1004 (1120)	Revise text of FTP Code	

3 Proposals that were not agreed

Following subjects were not agreed as interpretation of FTP Code (due to the nature of amendment). If it may be necessary to discuss those subjects again.

Code	Ref.	Description of proposal	Discussion at FP	Action to be taken
Part 5 - Test for surface flammability	FP 49/6	Preparation of specimens for Sealants and Mastics.	(FP 49/17) This item could be merged with the item on the comprehensive review of the FTP Code.	To be continued on the comprehensive review of FTP Code.
Part 3 - Fire door	FP 49/7	Consideration of the Bottom clearance of the fire door.	(FP 49/17) Further consideration was needed to resolve the matter and invited Members and international organizations to submit comments and proposals to FP 50.	FP 50 Agenda 9 (To be continued.)
Combustible insulation for piping systems	FP 48/3/4	3) Combustible insulation for piping systems within machinery spaces.	(FP 48/WP.4) About the proposed interpretation on combustible insulation for piping systems within machinery spaces, the group considered this to be an amendment. Not discussed.	Further discussion should be necessary
Part 3 - Fire door	FP 48/3/4	7) Substitution of stainless steel for steel without additional testing.	(FP 48/WP.4) The group discussed the proposed interpretation on substitution of stainless steel, but no firm conclusion was reached.	Further discussion on this issue would be necessary.

Code	Ref.	Description of proposal	Discussion at FP	Action to be taken
Part 3 - Enlarged fire door	FP 48/4, paragraph 11 and annex 5	The development of performance standards for large fire doors.	(FP 48/WP.4) The group concurred the view that enlarged fire doors are used on all types of ships and not only on large passenger ships and that enlarged fire doors as a matter of principle should be considered in relation to all ships. The group therefore encouraged Member Governments to submit a proposed new work programme item for FP 51 with supporting documentation to the Committee.	Further discussion should be necessary
Part 3 - Bulkhead	FP 47/3/3	Testing of "A-0" corrugated bulkhead.	(FP 47/16) The group considered the proposed amendments to resolution A.754(18) with regard to "A" class bulkhead tests, and concluded that the document does not give sufficient information or comparison data to support the proposed amendment.	Further discussion should be necessary
Part3 - bulkhead	FP47/3/5, annex 1	Fire test on Aluminium Alloy structures, paragraphs 7.5.1.6 and 9.3 of annex.	(FP 47/16) The proposed interpretation to paragraphs 7.5.1.6 and 9.3 of the Annex to resolution A.754(18) was thought to be an amendment rather than an interpretation and was therefore not supported. However, the Sub-Committee also agreed that thermocouples placed over aluminium deck stiffeners can yield higher temperatures than those placed on aluminium plate and that this issue should be taken into consideration for any future discussion on amendments to resolution A754(18).	Further discussion should be necessary
Part 3 - Bulkhead	FP 47/3/5, annex 2	Test of Aluminium Alloy decks together with primary deck coverings. Paragraphs 1.2 and 2.1 of the Annex to resolution A.754(18).	(FP 47/16) The group agreed in principle with the proposed interpretation to paragraphs 1.2 and 1.6 of the Annex to resolution A.754(18) but noted that there was no sufficient information on test results regarding primary deck coverings for final approval.	Further discussion should be necessary

Code	Ref.	Description of proposal	Discussion at FP	Action to be taken
Part 3 - Bulkhead	FP 47/3/5, annex 3	Testing criteria of A-class corrugated bulkhead Paragraphs 1.2 and 2.1 of the Annex to A.754(18)	(FP 47/16) The group did not support the proposed interpretation to paragraphs 1.2 and 2.1 of the Annex to resolution A.754(18) since it considered this to be an amendment to the resolution rather than an interpretation Not discussed.	Further discussion should be necessary
Part 3 - Watertight door	FP 46/5, annex 2	Optional test of Windows	(FP 46/WP.9) It would be amendments and did not include them in the interpretations. Not discussed.	Further discussion should be necessary
Part 3 - B-class steel bulkhead	FP 44/6/3, paragraph 4	Para.4: B-class steel bulkhead described on MSC/Circ.916 The thickness of steel sheet is proposed to be 0.6 ± 0.1 mm and that of mineral wool to be 50 ± 5 mm.	(FP 45/WP.5) The group agreed that this was sufficiently covered by the interpretation to paragraph 2.1 of part 3 of the FTP Code set out in circular MSC/Circ.916.	Definition of the B-class steel bulkhead should be clear
Part 3 - Fire resistant test	FP 44/6/3, paragraph 5	Test for A, B & F class divisions	(FP 44/WP.5) The group considered that the document represented proposals for amendments to the Fire Test Procedure Code and relevant fire test procedures and took no further action in respect to these proposals. Not discussed.	Further discussion should be necessary
Part 3 - Ventilation system	FP 49/INF.2	Test for ventilation duct (Information)	Information only.	Further discussion should be necessary

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ANNEX 2

UPDATED ISO STANDARDS REFERRED TO IN THE FTP CODE WITH COMMENTS OF JAPAN

Relevant document	ISO No	Description of the ISO STD	Action	Comments
Part 1 - Non-combustibility test	1182	Original – ISO 1182: 1990 Updated – ISO 1182: 2002	Modify FTP Code	Agreed to add to UI
Part 2 - Smoke and toxicity test	5659-2	Original – ISO 5659-2: 1994 DIS: ISO/DIS 5659-2 (Not revised) < Related standard > ISO/CD21489: Fire tests: Method of measurement of gases using Fourier transform infrared spectroscopy (FTIR) in cumulative smoke test FTIR test method: under developing now.	Gas-measuring method should be modified	Although gas-measuring methods, by using FTIR and GC/MS, were provided by MSC/Circ.916, Japan considers that not only the gas measuring apparatus but also the gas sampling methods are very important factor of the measuring. Because, through our experience, both test result of FTIR and indication tube, which would be applied by same sampling method, were just about the same. FTIR test method, including those sampling method, is under development in ISO now. After this test method is established, gas-measuring method of part 2 should be carried out in accordance with ISO standard. * See the comment in FP 50/INF.5 submitted by Japan for detail.
Part 5 - Test for surface flammability	5658-2	Reference: ISO 5658-2: 1996 DIS: ISO/DIS 5658-2 (Not revised) (Similar test of resolution A.653(16)) “Reaction to fire tests – Spread of flame – Part 2: Lateral spread on building products in vertical configuration”	A.653 should be modified	ISO 5658-2 is under revision in ISO presently. Modification items are: 1) Pilot flame: changed from Acetylene gas to Propane gas 2) Delete remote pilot flame test, use only impinge flame test. Test apparatus of ISO 5658-2 at testing laboratory for FTP Code are usually shared with the test apparatus of resolution A.653(16) (FTP Code, part 5). This modification of ISO 5658 might destroy this compatibility. So, test of resolution A.653(16) should be changed as same as ISO 5658-2. Additional reason for the change: at the original test of resolution A.653(16), in case that the result of impinging pilot flame condition might be applied for the judgement and it failed, although two of three specimen of remote flame condition were not burned, it might not be satisfied with the test result. Above modification should be more clear or reasonable for the evaluation of flammability characteristic.

Relevant document	ISO No	Description of the ISO STD	Action	Comments
Part 5 - 3.1 Gross calorific value	1716	Original – ISO 1716: 1973 Updated – ISO 1716: 2002	Modify FTP Code	Agreed to add to UI
Part 9 - Test	6330	Original – ISO 6330: 1984 Updated – ISO 6330: 2000	Resolution A.688(17)	Modification of resolution A.688(17) is necessary
Part 10 - Test for high-speed craft	5660-1	Original – ISO 5660-1: 1993 Updated – ISO 5660-1: 2002	MSC.40(64) MSC.90(71)	Modification of MSC.40(64) and MSC.90(71) is necessary

SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 10

FP 50/10/1/Add.1
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Original: ENGLISH

COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE

Proposals for the comprehensive review of the International Code for Application of Fire Test Procedures and relevant fire test procedures

Submitted by Japan

SUMMARY

Executive summary:	This document provides proposals for the comprehensive review of the International Code for Application of Fire Test Procedures (FTP Code) and related fire test procedures, based on the considerations made by Japan
Action to be taken:	Paragraph 2
Related documents:	MSC 80/21/5, MSC 80/24 and FP 50/10/1

1 Attached are proposals for the comprehensive review of the International Code for Application of Fire Test Procedures (FTP Code) to be considered in conjunction with document FP 50/10/1 (Japan).

Action requested of the Sub-Committee

2 The Sub-Committee is invited to consider the attached proposals in conjunction with document FP 50/10/1 and take action as deemed appropriate.

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ANNEX

JAPANESE PROPOSALS FOR THE COMPREHENSIVE REVIEW OF FTP CODE BASED ON EXPERIENCE OBTAINED THROUGH THE APPLICATION

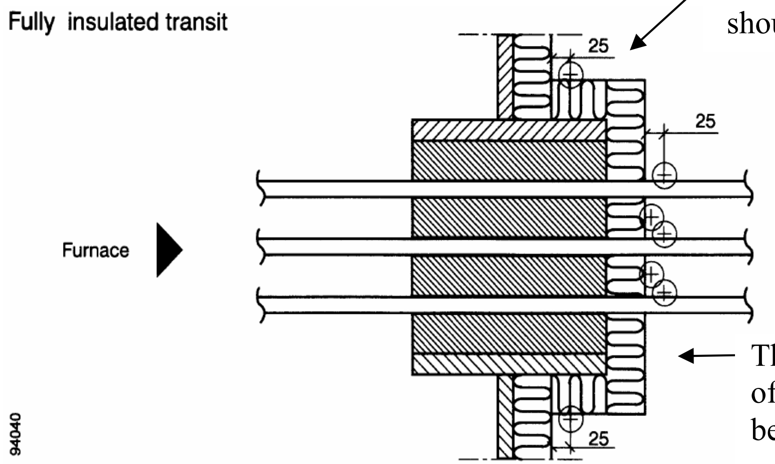
Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Part 1	Non-combustibility test	Density of the materials Although the density of the materials used in the fire resistant test of fire division, FTP Code, part 3, should be within +/- 10% of the value stated as the nominal density, it is not provided in the test procedure of ISO 1182-2002. Proposal Japan believes that the density of the material used in the test should be provided, and the following text should be added to the FTP Code, annex 1, part 1: "The density of each materials used in the test should be +/- 10% of the value stated as the nominal density."

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Part 1	Vapour barriers	Test method for the Vapour barriers should be considered Evaluation for the Vapour barriers, usually made by aluminium sheet or glass cloth sheet, used in conjunction with insulation was noted as MSC/Circ.1120 that it should be tested by part 5 without any other components of "A" or "B" class constructions. However, the vapour barriers themselves are very thin product, and it is impossible for testing without the specimen backing. Japan considers that it would be a problem of this test method. Therefore, Japan used part 1, non-combustibility test, for evaluation of the vapour barriers, so it has satisfied the requirement of the non-combustible material, it means that it complies with part 5 of annex 1. The description in the FTP Code, annex 2, paragraph 5.1 says: "Non-combustible materials are considered to comply with the requirements of part 5 of annex 1. However, due consideration shall be given to the method of application and fixing (e.g. glue)." Proposal Evaluation for the vapour barriers should be non-combustibility test in part 1 (in other words, such vapour barrier shall be a non-combustible according to FTP Code, part 1) instead of surface flammability test. To clarify the test methods of the vapour barriers by using part 1, those applications should be noted on the code. "When the evaluation of the vapour barriers by using part 1 non-combustibility test, following method would be applied: 1. vapour barriers used in conjunction with insulation should be tested with the components of "A" or "B" class constructions; and 2. when there are several densities of the insulation, which would be base of vapour barrier, both of maximum and minimum density of insulation material with vapour barrier should be tested. " Delete: "3.4 ~~Insulation materials for cold service systems~~" of the FTP Code, part 5 of annex 1.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Part 1	Test report for resolution A.754(18) – fire test	Handling of the non-combustibility test reports should be considered. The description in resolution A.754(18), paragraph 3.1 says: "Where materials used in the construction of the specimen are required to be non-combustible, i.e. for "A" class and "B" class, evidence in the form of test reports in accordance with the test method for qualifying marine construction materials as non-combustible, developed by the Organization, and from a testing laboratory recognized by the Administration and independent of the manufacturer of the material should be provided. <u>These test reports should not be more than 24 months old at the date of the performance of the fire resistance test.</u> If such reports cannot be provided then tests as prescribed in 3.2.3 below should be conducted." According to the above sentence, non-combustibility test reports should not be more than 24 months old at the date of the performance of the fire resistance test. But, it doesn't harmonize with five years of type approval period for the non-combustible material, and some confusion might occur at the conducting of the fire resistant test of part 3. Proposal Therefore, Japan proposes changes as follows: Non-combustible materials used in the construction of "A" or "B" class divisions shall: 1. have a type approval certificate for non-combustible material valid at the performance of the fire resistance test; or 2. have a non-combustibility test report which should not be more than 24 months old at the date of the performance of the fire resistance. So, new text should be added to the end of above sentence. The new text is as follows: "These test reports should not be more than 24 months old at the date of the performance of the fire resistance test. If such reports cannot be provided then tests as prescribed in 3.2.3 below, should be conducted. <u>When the material has a type approval certificate for non-combustible material valid at the performance of the fire resistance test, non-combustibility test reports may not be required.</u>"

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Part 3	Insulation materials for bulkheads and decks	Tolerance of the insulation materials should be considered. Recently the insulation materials for A 60 bulkheads and decks became thinner and lighter. It means that the design of it became very close to the margin of the A 60 performance. Therefore, following restriction would be necessary for reflecting the specimen information to the product accurately. Proposal The following restriction should be added to the test of part 3 to resolution A.754(18): 1. (resolution A.754(18), paragraph 3.2.4, first sentence) The thickness of each material used in the test specimen should be +/-10% of the value stated as the nominal thickness. 2. (resolution A.754(18), paragraph 3.2.5, first sentence) The density of each material used in the test specimen should be +/-10% of the value stated as the nominal density. (This sentence is moved from resolution A.754(18), paragraph 3.1). 3. (Type approval certificate of fire divisions) Information of the insulation materials including its density and thickness should be stipulated on the type approval certificate of fire divisions. Specifically, the density and thickness less than minus 10% of the specific value could not be accepted to apply to the insulation material for A-60 fire divisions. (New sentence to FTP Code, paragraph 5.2.6)

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Part 3	Fire door	Definition of "B" class doors should be considered. 1) The description in resolution A.754(18), paragraph 2.6.2.2 says: "The door leaf and frame should be mounted as appropriate in a "B" or "F" class bulkhead of compatible construction, thereby reflecting an actual end use situation. The bulkhead should have dimensions as prescribed in paragraph 2.4.1. The bulkhead should be of a construction approved by the Administration as having at least a similar classification to that required by the door. " 2) On the other hand, MSC/Circ.916 specified that "B" class doors should be fire tested in "B" class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction with which the door was tested. Proposal Therefore, Japan believe that B-0 class fire doors should be tested by B-0 class steel bulkhead, and B-15 class fire doors should be tested by B-15 class steel bulkhead. However, "B-0 class and B-15 class steel bulkheads" is an obscure meaning. So, definition of the "B class steel bulkheads" should be clarified. Japan interprets that 3.2 mm thickness steel plate, instead of 4.5 mm on A-class bulkhead, is applied to the bulkhead core for B-class fire door test. Stiffener should be the same as A-class bulkhead.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.754(18), appendix A.IV Cable Transit	Insulation material for Cable Transit	Temperature measuring of the coaming surface of Cable Transit should be considered. When the fire resistant test for Cable Transit is conducted, the temperature of the following points would be measured. 1. two positions on the surface of the outer perimeter of the frame, box or coaming; 2. two positions at the end of the transit, on the face of the sealant system or material; and 3. the surface of each type of cable installed in the cable transit Generally in ships, the insulation material of the coaming would be the same material used for the bulkheads or decks. It would suppose that the different insulation material would be applied for the ships than the material that was applied for the test. Japan considers that the coaming and its insulation is a part of the bulkhead or deck. Therefore, Japan believes that the restriction of the insulation material for coaming of cable transit is not suitable, and also the temperature measuring of the coaming surface is unnecessary. Proposal The following change would be required: 1. The temperature measurement of the coaming surface is unnecessary. (It would be deleted.) 2. When the cable transit is a fully insulated transit described on figure A.2 of resolution A.754(18), appendix A.IV, such that the insulation would be applied on the surface of the cable transit, the insulation material is a part of cable transit system, and then the restriction of the insulation material is necessary (drawing as below). This measurement should be deleted.  The restriction for the application of this insulation material should be necessary.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.754(18) (Part 3)	Window Temperature measurement position	Temperature measuring points and their criteria for the windows The description in resolution A.754(18), appendix AI, paragraph 3 says: "Thermocouples should be fixed to the window pane as specified for the leaf of a door. In addition, thermocouples should be provided to the window frame, one at mid-length of each perimeter edge." And the description in resolution A.754(18), appendix AI, paragraph 4.1 says: "For the calculation of the average temperature rise on the unexposed face, only those thermocouples fixed to the face of the window pane(s) should be used." According to the above descriptions, the criteria of additional thermocouples fitted to the window frame are not clear. It should be necessary to specify that the criteria of additional thermocouples fitted to the window frame. Proposal Therefore, to clarify the criteria of the windows, the following texts should be added to appendix AI, paragraph 5.3: 1 for the calculation of the average temperature rise on the unexposed face, only those thermocouples fixed to the face of the window pane(s) should be used; and 2. for the judgement of the maximum temperature rise on the unexposed face, all of the thermocouples fixed to the face of the window pane(s) and the window frame should be used.
Part 3	Window Heat radiation measurement	Deletion of the heat radiation measurement should be considered Although the heat radiation measurement for the windows was specified in FTP Code, annex 1, part 3, appendix 1, the criteria of the heat flux through windows are too large value to prevent the spread of fire and to enable people to pass escape routes near the windows. It is supposed that a window would meet the criteria of the heat flux from windows if the average temperature raises on the window unexposed face satisfies the criteria of temperature rise. So the heat radiation measurement for windows is meaningless and unnecessary. Proposal Therefore, Japan proposes to delete the heat radiation measurement described in appendix 1.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Part 5	Selection of the test specimen (Organic contents and specimen Colour)	The test specimen used for the test shall represent the characteristic of the product. The test specimen shall be selected as the highest danger, and a disadvantageous condition of the product in actual operating condition of the ship. Specimen selection should be concerned with thickness, colour, organic content, substrate of the product, and its combination of a product, etc. The influence of colour and organic contents of the specimen are important factors of the fire resistance tests. The organic content of the specimen is a key of the characteristic of product combustion. Specimen should be selected as the maximum organic content within the product variation. And the colour of the specimen is also a key of it, because the dark colour of specimen that absorbs the radiant heat would be easy to affect its flammability. The test results of the dark colour specimen and the bright colour specimen would be different. Therefore, the dark colour specimen would be selected if the product has some colour variation. Proposal/Draft guideline of appendix 1 should be considered. To clarify the selection of the representative specimen and its type approval, Japan prepared the guideline of the specimen substrate and its type approval as contained in appendix 1 to this annex, and proposes that it should be added to the code.
Part 5	Test substrate and combination test	Although MSC/Circ.1004 is the guideline for the type approval of the surface materials, there are some unidentified points for the surface materials. Japanese interpretation: 1. when the no substrate applied for the surface flammability test, product should be approved to both of metallic and non-combustible substrate; 2. for the floor coverings, interpretation of MSC/Circ.1004 is meaningless, because the floor covering could be accepted to be carried out in single layer test, which means that the influence of the substrate could be neglected; and 3. for the bulkhead and ceilings, it is not accepted to carry out single layer test, so the test should be strictly based on interpretation of MSC/Circ.1004. Proposal/Draft guideline of appendix 1 should be considered. To clarify those unidentified points of approval, Japan prepared the guideline of the specimen substrate and its type approval, and proposes that it should be added to the code.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.653(16) (Part 5)	Test method & test apparatus	ISO 5658-2 is under revision in ISO presently. Modification points are: 1) Pilot flame fuel: changed from acetylene gas to propane gas; and 2) Delete remote pilot flame test, use only impinge flame test. Test apparatus of ISO 5658-2 at testing laboratory for the FTP Code are usually shared with the test apparatus of resolution A.653(16) (FTP Code, part 5). This modification of ISO 5658-2 might destroy those compatibility. Proposal The test of resolution A.653(16) should be changed, as well as ISO 5658-2. The reason to change the fuel from acetylene to propane is that there is a strong limitation of use of acetylene and many test laboratories cannot use acetylene. The propane pilot flame is not so hard, and it is somehow difficult to control the distance between specimen surface and the flame. Therefore, impinging pilot frame, which is easily controlled, should be used. This situation is the same for resolution A.653(16). Additional reason for the change: At the original test of resolution A.653(16), in case that the result of impinge flame condition might be applied for the judgement and it failed, although the result of remote flame condition was not burned, it might not be to the satisfaction of the test result. Above modification would be more clear or reasonable for the flammability characteristic.
Part 6	Definition	Proposal / Definition of "Primary deck covering" should be considered "A primary deck covering is the first layer of a floor construction which is applied directly on top of the deck plating" is described on the FTP Code, annex 1, part 5, paragraph 3.2.1. On the other hand, "when the primary deck covering is also the exposed surface, it shall comply with this part" is described on the FTP Code, annex 1, part 5, paragraph 3.2.2. Therefore the product that is the first layer of a floor construction which is applied directly on top of the deck plating and is also the exposed surface, when no upper layer applied on it, it should be considered as the floor covering of the FTP Code, annex 1, part 5.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.563(16) (Part 7)	Product description on Test report	Information of the specimen which was tested should be reflected to the type approval of the products. At resolution A.563(16), paragraph 8, necessary information that should be included in the test report, but it is not specified about the description of materials. Therefore, the details for description of materials should be specified. Proposal The following information should be added to resolution A.563(16), paragraph 8: 1) Material: materials such as wool, nylon, polyester, etc., and its composite ratio. 2) Composition of weave: such as plain, weave, twilled 3) Density (Number/inch): the number of grains per inch in both warp and weft 4) Yarn number count: 5) Thickness of the fabric: unit of mm 6) Mass: weigh per unit area (g/mm^2) 7) Colour and tone: if the product has a pattern, the representative colour should be described. 8) Fire retardant treatment
Res. A.563(16) (Part 7)	Appendix 2 Cleaning and weathering procedures	According to resolution A.563(16), appendix 2, paragraph 4.1, IEC test detergent with perborate type 1 that is defined in IEC 456, amendment 1 1980, has to be applied to the accelerated laundering. However, this kind of detergent is obsolete and it is impossible to have it in Japan, because the sodium tripolyphosphate cannot be used in the commercial detergent for prevention of the environmental pollution. It is recommended to check the most recent version of IEC 456 (now IEC 60456). Proposal The following changes are proposed to resolution A.563(16), appendix 2: 1) The test detergent should be changed to use the commercial detergent or the preparation of the test specimen should be carried out according to the instructions/recommended method given by the manufacturer. 2) Type approval should be based on that preparation method of the test specimen.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.652(16) (Part 8)	Product description on test report	Information of the specimen, which was tested, should be reflected to the Type approval of the products. However, it is not specified. Therefore, the necessary information should be included in the test report, and details for description of materials should be specified on the test procedure. Proposal The following information should be added to resolution A.652(16) as new paragraph 9: "9 Test report The test report should include the following information about the products: .1 name of the testing authority; .2 name of the manufacturer of the materials; .3 date of supply of the materials, and date of test; .4 name and identification mark of the materials; .5 conditioning of the specimens, and exposure procedure used, if any; .6 descriptions of materials: the following information should be included in those descriptions: .6.1 fabric .1 material: materials such as wool, nylon, polyester, etc., and its composite ratio; .2 composition of weave: such as plain, weave, twilled; .3 density (number/inch): the number of grains per inch in both warp and weft; .4 yarn number count; .5 thickness of the fabric: unit of mm; .6 mass: weigh per unit area (g/mm^2); .7 colour and tone: if the product has a pattern, the representative colour should be described; and .8 fire retardant treatment; .6.2 Fillings .1 material; .2 density: weigh per unit volume (kg/m^3); and .3 fire retardant treatment, if any."

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.688(17) (Part 9)	Product description on Test report	Information of the specimen, which was tested, should be reflected to the type approval of the products. However, it is not specified on the description of materials. Therefore, the necessary information should be included in the test report, and details for description of materials should be specified. Proposal The following information should be added to resolution A.688(17), paragraph 5.7: "5.7.10.1 Fabric .1 material: materials such as wool, nylon, polyester, etc., and its composite ratio; .2 composition of weave: such as plain, weave, twilled; .3 density (number/inch): the number of grains per inch in both warp and weft; .4 yarn number count; .5 thickness of the fabric: unit of mm; .6 mass: weigh per unit area (g/mm^2); .7 colour and tone: if the product has a pattern, the representative colour should be described; and .8 fire retardant treatment. 5.7.10.2 Fillings .1 material; .2 density: weigh per unit body (g/mm^3); .3 fire retardant treatment, if any."

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
Res. A.688(17) (Part 9)	Cleaning treatments in ISO6330	According to ISO 6330 1984, paragraph 3.4, ECE test detergent that is defined in ISO 6330, annex B, has to apply the cleaning treatments. However, this kind of detergent is obsolete and it is impossible to have it in Japan, because the sodium tripolyphoshate cannot be used in commercial detergent for prevention of the environmental pollution. Proposal The following changes are proposed to resolution A.688(17): 1) The test detergent should be changed to use the commercial detergent or the preparation of the test specimen should be carried out according to the instructions/recommended method given by the manufacturer. 2) Type approval should be based on those cleaning treatments.
FTP Code	Type approval certificates	Proposal Type approval certificates should state the approval condition or restriction of the products when it applies to actual ships. To clarify the approval condition or restriction of the products, following sentences should be added to the FTP Code, paragraph 5.2.4. 9.Type approval certificates for windows should state which side of the window was exposed to the heating condition during the test. (MSC/Circ.1036). 10.Type approval certificates for windows should include a reference to optional test(s) such as hose stream test and/or thermo radiation test. (MSC/Circ.1036). 11. Type approval certificates for surface materials should state what substrate was applied for the test. The restriction of the base materials, which products would be applied on, should be considered. (MSC/Circ.1004.) 12. Type approval certificates for surface materials should state the specimen information about the colour, organic contents and thickness of the products. The restriction of the products should be considered by that information. 13. Type approval certificates for "A", "B" and "F" class divisions should state the detailed information for the thickness and density of the insulation materials, how to fix the materials to the division, and how to insulate the stiffeners in ships. The restriction of the products should be considered by that information. 14. Other restriction matters, which concern the Administration, should be stated.

Code	Reference	Japanese proposal for the comprehensive review of the FTP Code
FTP Code	All test items	Proposal Type approval products and the test items, which would be required in the FTP Code, should be clear. Japan considers that the table of the relationship between the type approval products and its required test items would be a helpful content of the FTP Code, reference appendix 2.

APPENDIX 1

GUIDELINES FOR THE SPECIMEN OF THE FTP CODE, PARTS 2, 5 AND 6 AND THE TYPE APPROVAL OF THOSE PRODUCTS (RANGE OF APPROVAL AND RESTRICTION IN USE)

1 Scope

This document provides the guidelines for the selection and preparation of specimen for surface materials for the FTP Code, parts 2, 5 and 6, including selection of substrates or backing materials. This document also provides the guidelines for the conditions of type approval for such surface materials.

2 Basic principles for selection of the test specimen

2.1 Basic principle

The test specimen to be used for the test shall be selected as the representative of the characteristic of the product in actual operating condition of the ships. It means that the product, which would be expected to have the worst result, should be selected. For the specimen selection it should be taken into account thickness, colour, organic content, substrate of the product, and its combination of products.

2.2 Specimen thickness

The description in resolution A.653(16), paragraph 7.2.1 says that "materials and composites of normal thickness 50 mm or less should be tested <u>using their full thickness, attaching them, by means of an adhesive if appropriate, to the substrate to which they will be attached in practice.</u> For materials and composites of normal thickness greater than 50 mm, the required specimens should be obtained by cutting away the unexposed face to reduce the thickness to 50 +3/-0 mm".

Interpretation: Therefore the test specimen should be reflecting actual application on ships.

2.3 Composites

The description in resolution A.653(16), paragraph 7.3 says: "Assembly should be as specified in 7.2 (Dimensions). However, <u>where thin materials or composites are used in the fabrication of an assembly, the presence of an air gap and/or the nature of any underlying construction may significantly affect the flammability characteristics of the exposed surface. The influence of the underlying layers should be recognized and care taken to ensure that the test result obtained on any assembly is relevant to its use in practice."</u>

Interpretation: if the product that has a multilayer construction would be applied to the bulkheads and ceilings, the surface flammability test of combination of layers should be required to confirm the influence of these underlying constructions. If the product that has a multilayer construction is to be applied to the floor coverings, the test of combination of layers would not be required in reference to FTP Code, annex 1, part 5, paragraph 3.2.2. (See 2.6 for the description of FTP Code, annex 1, part 5, paragraph 3.2.2.)

2.4 Specimen and its approval range

The description in MSC/Circ.1004 says: "Where a product is approved based on a test of a specimen applied on a non-combustible substrate, that product should be approved for application to any non-combustible substrate with similar or higher density (similar density may be defined as a density ≥ 0.75 x the density used during testing) or with a greater thickness if the density is more than 400 kg/m^3. Where a product is approved on the basis of a test result obtained after application on a metallic substrate (e.g. thin film of paints or plastic films on steel plates), such a product should be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness ≥ 0.75 x the thickness of metallic substrate used during testing)."

Interpretation: therefore, the test with metallic substrate is different from the test with non-combustible substrate.

2.5 Primary deck covering

The description in FTP Code, annex 1, part 5, paragraph 3.2.1 says: "<u>A primary deck covering is the first layer of a floor construction which is applied directly on top of the deck plating</u> and is inclusive of any primary coat, anti-corrosive compound or adhesive which is necessary to provide protection or adhesion to the deck plating. <u>Other layers in the floor construction above the deck plating are floor coverings."</u>

2.6 Test for floor covering

The description in FTP Code, annex 1, part 5, paragraph 3.2.2 says: "<u>Where a floor covering is required to be low flame-spread, all layers shall comply with part 5. If the floor covering has a multilayer construction, the Administration may require the tests to be conducted for each layer or for combinations of some layers of the floor coverings. Each layer separately, or a combination of layers (i.e. the test and approval are applicable only to this combination) of the floor covering shall comply with this part.</u> When a primary deck covering is required to be not readily ignitable and is placed below a floor covering, the primary deck covering shall comply with part 6. <u>When the primary deck covering is also the exposed surface, it shall comply with this part.</u> Primer or similar thin film of paint on deck plating need not comply with the above requirements of part 6."

Interpretation: therefore, multilayered floor covering such that each layer complying part 5 of "criteria of floor covering" is accepted without carrying out the test of composite condition. This makes it possible to interchange the layers as long as each material used complies with part 5. On the other hand, it is not accepted to carry out single layer test, where the bulkhead or ceiling has a multilayer construction, so the test should be based on the composite condition (paragraph 2.3).

2.7 Invalid MSC/Circ.1004 interpretation for floor covering

According to the test method for floor covering described in 2.6, multilayer application that is the combination of approved floor coverings is accepted. It means that the influence of the other layers or underlying layers could be neglected; therefore the interpretation of MSC/Circ.1004 for floor covering is not valid in this case. See 2.4 for the description of MSC/Circ.1004.

2.8 Definition of "Floor covering" and "Primary deck coverings"

The description in FTP Code, annex 1, part 5, paragraph 3.2.1 says: "A primary deck covering is the first layer of a floor construction which is applied directly on top of the deck plating." On the other hand, the description in FTP Code, annex 1, part 5, paragraph 3.2.2 says: "When the primary deck covering is also the exposed surface, it shall comply with this part."

Interpretation: therefore, the primary deck covering without any floor covering (i.e. it is also exposed surface) is itself called a floor covering as well.

Table 1 shows the comparison of the test method and criteria for Floor covering and primary deck coverings.

Table 1
Comparison of the test method and criteria for "Floor covering" and "Primary deck coverings"

		Floor covering (part 5)	**Primary deck coverings (part 6)**
Reference standard		Resolution A.653(16)	Resolution A.687(16)
Substrate of the test specimen		Not specified	Steel plate 3 +/- 0.3 mm
Criteria	CFE (kW/m^2)	□7.0	□7.0
	Qsb (MJ/m^2)	□0.25	□0.25
	Qt (MJ)	□2.0 (annex1 Part5)	□2.0 (MSC/Circ.1120)
	Qp (kW)	□10.0	□10.0
	Burning droplet	Not more than 10 burning drops (annex 1, part 5)	Not produce

2.9 Colour variation and organic contents of the specimen

Usually the influence of colour and organic contents of the specimen give the significant effect to the result of fire test. The organic content of the specimen is a key factor of the combustion characteristic of product. Specimen should be selected to have the maximum organic content within the product variation. The colour of the specimen is also a key of it, because the dark colour of specimen that absorbs the radiant heat would extensively affect its flammability. Therefore, the test results of the dark colour specimen and the bright colour specimen would be different. In general, the maximum organic content and the dark colour specimen within the product variation should be selected if the product has colour variation.

As similar case of the dark colour specimen absorbs the radiant heat, the description in resolution A.653(16), paragraph 7.4, says: "Metallic facings: if a bright metallic faced specimen is to be tested, it should be painted with a thin coat of flat black paint prior to conditioning for test."

2.10 Exemption of the test of part 2

The description in FTP Code, annex 2, paragraph 2.2 says: "In general, surface materials and primary deck coverings with both the total heat release (Q_t) of not more than 0.2 MJ and the peak heat release rate (Q_p) of not more than 1.0 kW (both values determined in accordance with part 5 of annex 1 or in accordance with resolution A.653(16)) are considered to comply with the requirements of part 2 of annex 1 without further testing."

3 Range of type Approval of surface materials

According to the basic principles for selection of the test specimen described section 2, the range of type approval would be considered according to its specimen selection including its substrate or backing material.

Table 2 shows the relationships of the specimen substrate and the range of type approval of surface materials.

Table 2
Specimen substrate and the type approval of surface materials
(Range of approval and restriction in use)

In the following table:

First line: product will be tested.

Second line: substrate, which was used for the test as a backing material of the test specimen.

Third line: range of approval and restriction in use.

Products	Test substrate	Limitation of product application for ships
Paints and Surface Veneer	Thick steel (e.g. 3 mm)	1. Products can be applied to any metallic base of similar or thicker substrates (metallic bases such as Steel, Stainless steel or Aluminium alloy with more than 75% thickness of metallic substrate used during testing). In this case, it is not accepted to paint the surfaces made by thin steel, such as the door panel or the B-class panel that are made by thin steel. 2. It is not approved to apply to the non-combustible materials. 3. Limitation by the specimen colour and organic contents that was tested. 4. When the products would be applied to the floor covering or primary deck covering that have been approved, no limitation of the base materials would be required.

Products	Test substrate	Limitation of product application for ships
	Thin steel (e.g. 0.8 mm)	1. Products can be applied to any metallic base of similar (more than 75% thickness of metallic substrate used during testing) or thicker substrates (metallic bases such as Steel, Stainless steel or Aluminium alloy). It is accepted to paint the surfaces made by thin-steel such as the door panel or the B-class panel in this case. 2. It is not approved to apply to the non-combustible materials. 3. Limitation by the specimen colour and organic contents that was tested. 4. When the products would be applied to the floor covering or primary deck covering that have been approved, no limitation of the base materials would be required.
	Non-combustible substrate, density more than 400 kg/m^3 (e.g. thickness10 mm, density 450 kg/m^3)	1. Products can be applied to any non-combustible substrate with a greater thickness. (Non-combustible substrate thicker than the one used during testing.) 2. It is not approved to apply to the metallic substrate. 3. Limitation by the specimen colour and organic contents that was tested. 4. When the products would be applied to the floor covering or primary deck covering that have been approved, no limitation of the base materials would be required.
	Non-combustible substrate, density not exceeds 400 kg/m^3 (e.g. thickness10 mm, density 250 kg/m^3)	1. Products could be applied to any non-combustible substrate with similar or higher density (non-combustible substrate more than 0.75 x the density used during testing, thickness is not specified.) 2. It is not approved to apply to the metallic substrate. 3. Limitation by the specimen colour and organic contents that was tested. 4. When the products would be applied to the floor covering or primary deck covering that have been approved, no limitation of the base materials would be required.
Surface Veneer	No substrate used at the test (Product has enough thickness for testing without substrate)	1.Products may be applied to any metallic base and non-combustible base if the product would not need any adhesive or combustible material layer. 2. Limitation by the specimen colour and organic contents that was tested. 3. When the products would be applied to the bulkheads or ceilings by using with adhesive, combination test with adhesive should be required.

Products	Test substrate	Limitation of product application for ships
Floor covering	Thick steel (e.g. 3 mm)	1. Limitation by the specimen colour and organic contents that was tested. 2. When the products would be applied to the floor covering, no limitation of the base materials would be required if the base material has been approved. (It is not valid the interpretation of MSC/Circ.1004.)
	Non-combustible substrate, density more than 400 kg/m^3.	1. Limitation by the specimen colour and organic contents that was tested. 2. When the products would be applied to the floor covering, no limitation of the base materials would be required if the base material has been approved. (It is not valid the interpretation of MSC/Circ.1004.)
	No substrate used at the test (Product has enough thickness for testing without substrate)	1. Limitation by the specimen colour and organic contents that was tested. 2. When the products would be applied to the floor covering, no limitation of the base materials would be required if the base material has been approved. (It is not valid the interpretation of MSC/Circ.1004.)
	Combination test (Combination of layers)	1. Limitation by the specimen colour and organic contents that was tested. 2. The products may only apply to this combination. (If the floor covering has a multilayer construction, the Administration may require the tests to be conducted for each layer or for combinations of some layers of the floor coverings.)
Primary deck covering	Steel plate (Thickness 3mm)	1. Limitation by the specimen colour and organic contents that was tested. 2. Products could be applied to the deck plating or steel deck.

4 Preparation of test specimen for the FTP Code, parts 2, 5 and 6

According to the relationships of the specimen substrate and the range of type approval of surface materials described in section 3, the choice of specimen including substrate should be considered carefully. This section specifies how to make the test specimen for the FTP Code, parts 2, 5 and 6.

4.1 Test specimen

The test specimen shall be selected as the representative of the product. It means that the product, which would be expected to have the worst result, should be selected.

4.2 Application in ships

Specimen should be tested using their full thickness, attaching them to the substrate to which they will be attached in ships. (Refer to resolution A.653(16), paragraph 7.2)

4.3 Exposed surface at the test

Each different exposed surface of the product should be tested. (Refer to resolution A.653(16), paragraph 7.1)

4.4 Part 2: test specimen

Preparation of test specimen, for smoke and toxicity test, shall be in accordance with the practice outlined in resolutions A.653(16), A.687(17) and A.753(18). (Refer to part 2, paragraph 2.2). Therefore, Specimen for the smoke and toxicity test FTP Code, part 2, should be tested with same specimen of parts 5 and 6.

4.5 Specimen size:

Part 5, Width: 155mm +0mm/-5mm, Length: 800mm +0mm/-5 mm (resolution A.653(16), paragraph 5.7.2)

Part 2, Width: 75mm +0mm/-1mm, Length: 75mm+0mm/-1 mm (ISO 5659-2, paragraph 6.2.1)

4.6 Specimen thickness:

Specimen should be tested using their full thickness. (resolution A.653(16), paragraph 7.2.1, ISO 5659-2, paragraph 6.2.2)

Part 5: Maximum 50mm +3mm/-0mm, (resolution A.653(16), paragraph 7.2.1)

Part 2: Maximum 25mm +1mm/-1mm, (ISO 5659-2, paragraph 6.2.3)

If the product thickness is greater than above, the specimens should be obtained by cutting away the unexposed face to reduce to the above maximum thickness.

4.7 Colour variation of the paints or surface materials

If the product has some colour variation, specimen should be carefully selected as the representative of the products, in accordance with following points:

4.7.1 Organic contents

Carefully select the product with maximum organic content when applied by maximum thickness shown in 4.5 considered the maximum organic content of the product, when the product would be applied by this maximum thickness.

4.7.2 Colour of the specimen

Black or dark colour should be selected.

4.7.3 Order of priority about specimen colour and organic contents

When the product of darkest colour is different from the product with maximum organic content, the Administration or the testing laboratory may decide the specimen, (if the amount of organic contents between black or dark colour specimen and white or bright colour specimen are similar [difference within 5%], black or dark colour specimen should be chosen. Otherwise, specimen of the maximum organic content should be selected.)

4.7.4 Information of the colour variation and its organic content

Applicants or manufacturers who request the type approval should submit the information of the colour variation and its organic content to the Administration or testing laboratories. The Administration or testing laboratories may order/advise to the applicant for the selection of the test specimens when necessary.

4.7.5 Attention at the type approval issued

When approving, if the specimen tested can be considered as the representative specimen (i.e. dark colour with maximum organic content), all the colour variations of the product may also be approved. If the particular condition of the product was tested, type approval is only available to the same or similar conditioned product as tested.

4.8 Substrate

Substrate of the specimen should be selected as they are attached in actual ships (resolution A.653(16), paragraph 7.2). According to the interpretation of MSC/Circ.1004, the test with metallic substrate is thought to be different from the test with non-combustible substrate.

4.9 Thickness of the substrate

According to the interpretation of MSC/Circ.1004, the minimum thickness of the substrate that would be used in actual application should be selected as the test specimen, because the product should be approved for application to similar or higher thickness of the substrate that was tested.

4.10 Definition of "Floor coverings" and "Primary deck coverings"

The product that is the first layer of a floor construction which is applied directly on top of the deck plating is defined as "primary deck coverings", and if it is also the exposed surface, with no upper layer applied on it, it should be considered or defined as the floor covering of FTP Code, annex 1, part 5.

4.11 Substrate of Primary deck coverings

The description in resolution A.687(17), paragraph 3.1 says: "The deck covering should be applied to a steel plate having the thickness of 3 +/- 0.3 mm. The specimens should have a nominal thickness and the components and construction of the deck covering should be same as those used in practice."

4.12 Substrate of floor coverings

Same material of the substrate of primary deck coverings, steel plate thickness of 3 +/- 0.3 mm, would be recommended. (Unified interpretation of MSC/Circ.1004 is meaningless for the floor coverings.)

4.13 Composite materials (for bulkhead and ceilings)

The description in resolution A.653(16), paragraph 7.3 says: "Assembly should be as specified in 7.2 (Dimensions). However, where thin materials or composites are used in the fabrication of an assembly, the presence of an air gap and/or the nature of any underlying construction may significantly affect the flammability characteristics of the exposed surface. The influence of the underlying layers should be recognized and care taken to ensure that the test result obtained on any assembly is relevant to its use in practice."

Interpretation: when the product that has a multilayer construction would be applied to the bulkheads and ceilings, the surface flammability test of combination of each layer should be required to confirm the influence of these underlying constructions.

4.14 Metallic facings

The description in resolution A.653(16), paragraph 7.4 says: "If a bright metallic faced specimen is to be tested, it should be painted with a thin coat of flat black paint prior to conditioning for test."

4.15 Combustible ventilation ducts

The description in FTP Code, annex 1, part 5, paragraph 3.3.1 says: "Where combustible ventilation ducts are required to be of material which has low flame-spread characteristics, the surface flammability test procedure and criteria for lining and ceiling finishes according to resolution A.653(16) shall be applied for such ducts. In case homogeneous materials are used for the ducts, the test shall apply to outside surface of the duct, whilst both sides of the ducts of composite materials shall be tested."

4.16 Insulation materials for cold service systems

The description in FTP Code, annex 1, part 5, paragraph 3.4.1 says: "Where the exposed surfaces of Vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings, for cold service systems are required to have low flame-spread characteristics, the surface flammability test procedure and criteria for linings and ceilings according to resolution A.653(16) shall be applied for such exposed surfaces."

4.17 Test of Adhesives described in resolution A.754(18)

The description in MSC/Circ.916 says: "The calcium silicate board described as a dummy specimen specified in paragraph 3.3 of resolution A.653(16) should be used as a standard substrate for adhesives."

4.18 Test of vapour barriers

The description in MSC/Circ.1120 says: "Vapour barriers used in conjunction with insulation should be tested without any other components of "A" or "B" class constructions that will shield the barrier being tested from the radiant panel."

APPENDIX 2

FIRE PROTECTION MATERIALS AND REQUIRED APPROVAL TEST METHODS

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke & toxicity	Part 3 A, B & F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 6 Primary deck coverings	Part 7 Curtain Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) & MSC.90(71))	Part 10 – ISO5660 (MSC.40(64) & MSC.90(71))	Part 11 – A754 (for HSC 2000)	ISO 1716 Calorific potential	Remarks
Non-combustibility materials	X													
A-class bulkhead	X		X											Resolution A.754(17)
B-class bulkhead	X		X											Resolution A.754(17)
A-class deck	X		X											Resolution A.754(17)
B-class deck	X		X											Resolution A.754(17)
B-class lining	X		X											Resolution A.754(17)
B-class ceilings	X		X											Resolution A.754(17)
B-class continues ceilings	X		X											Resolution A.754(17)
A-class fire door	X		X											Resolution A.754(17)
B-class fire door	X		X											Resolution A.754(17)
A-class windows	X		X											Resolution A.754(17)
B-class windows	X		X											Resolution A.754(17)
Fire damper	X		X											Resolution A.754(17)
Cable transit	X		X											Resolution A.754(17)
Pipe penetration	X		X											Resolution A.754(17)
Fire door control system				X										
Ventilation ducts			X											????
Adhesive (bulkhead, deck, door and other division)					X									MSC/Circ.916, Resolution A.754(17)

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke & toxicity	Part 3 A, B & F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 6 Primary deck coverings	Part 7 Curtain Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) & MSC.90(71))	Part 10 – ISO5660 (MSC.40(64) & MSC.90(71))	Part 11 – A754 (for HSC 2000)	ISO 1716 Calorific potential	Remarks
Surface veneers (for bulkhead and ceilings)		X			X								X*1	A.653(16), ISO 5659-2
Fire retarding Base materials		X			X								X*1	A.653(16), ISO5 659-2
Paint (for bulkhead and ceilings, and ship exterior)		X			X									A.653(16), ISO 5659-2
Floor coverings		X			X								X*1	A.653(16), ISO 5659-2
Combustible ventilation ducts					X									Resolution A.653(16)
Insulation materials for cold service systems					X									Resolution A.653(16)
Vapour barriers	(X)				X									MSC/Circ.1120, Resolution A.653(16)
Primary deck coverings		X				X							X*1	Resolution A.687(17)
Curtain - Vertically supported textiles							X							A.471(12), A.563(14)
Upholstered furniture								X						Resolution A.652(16)
Bedding components									X*2					Resolution A.688(17)
Bulkheads, not fire-resisting division (for HSC)										X				HSC 2000 Code, 7.4.3.1
Ceilings, not fire-resisting division (for HSC)										X				HSC 2000 Code, 7.4.3.1
Linings, not fire-resisting division (for HSC)										X				HSC 2000 Code, 7.4.3.1
Surface material for bulkhead (for HSC)										X				HSC 2000 Code, 7.4.3.1
Case furniture (for HSC)											X			HSC 2000 Code, 7.4.3.3.1
Other furniture (chairs, sofas and tables) (for HSC)											X			HSC 2000 Code, 7.4.3.3.2
Thermal and acoustic insulation material (for HSC)											X			HSC 2000 Code, 7.4.3.5
Non-load bearing fire-resisting divisions												X		MSC.45(65), 1.6
Load bearing fire-resisting divisions, with metal core												X		MSC.45(65), 1.6

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke & toxicity	Part 3 A, B & F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 6 Primary deck coverings	Part 7 Curtain Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) & MSC.90(71))	Part 10 – ISO5660 (MSC.40(64) & MSC.90(71))	Part 11 – A754 (for HSC 2000)	ISO 1716 Calorific potential	Remarks
Load bearing fire-resistant divisions, without metal core												X		MSC.45(65), 1.6

*1: In case of the maximum gross calorific value, less than 45 MJ/m^2 was required.

*2: Passenger ship (more than 36 persons).

SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 10

FP 50/10/2
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COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE

Draft of the new fire test procedures code

Submitted by Japan

SUMMARY

Executive summary:	This document presents the draft of the new fire test procedures code (FTP Code 200X) for consideration of the Sub-Committee
Action to be taken:	Paragraph 4
Related documents:	MSC 80/21/5, MSC 80/24 and FP 50/10/1

Background

1 Japan proposed a new work programme entitled "Comprehensive Review of Fire Test Procedures Code" to the Maritime Safety Committee at its eightieth session, as a work item of the Sub-Committee (MSC 80/21/5). The Committee agreed to include the work item in the Sub-Committee's work programme and the provisional agenda for FP 50 as high priority item with a target completion date of 2008 (as reported in paragraph 21.11 of MSC 80/24).

2 Japan has submitted a document (FP 50/10/1) which contains proposals for the comprehensive review of the FTP Code.

Draft of the new fire test procedures code

3 In order to facilitate the Sub-Committee's consideration on comprehensive review of the FTP Code, Japan has prepared a draft of New Fire Test Procedure Code (FTP code 200X), which includes modifications from the existing FTP Code base on the adopted amendments and approved interpretations to the existing FTP Code, as set out in the annex to this document.

Action requested of the Sub-Committee

4 The Sub-Committee is invited to consider the draft of the new FTP Code as set out in the annex to this document and take action as appropriate.

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ANNEX 1

DRAFT INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES
（FTP CODE 200X）

Contents

DRAFT

INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES (FTP Code 200X)

1 SCOPE

1.1 This Code is intended for use by the Administration and the competent authority of the flag State when approving products for installation in ships flying the flag of the flag State in accordance with the fire safety requirements of the 1974 SOLAS Convention, as amended.

1.2 This Code shall be used by the testing laboratories when testing and evaluating products under this Code.

2 APPLICATION

2.1 This Code is applicable for the products which are required to be tested, evaluated and approved in accordance with the Fire Test Procedures Code as referenced in the Convention.

2.2 Where reference to the Code is indicated in the Convention by the terminology "... in accordance with the Fire Test Procedures Code" the subject product shall be tested in accordance with the applicable fire test procedure or procedures as referred to in paragraph 4.1.

2.3 Where reference is only made to a product's fire performance in the Convention using such terminology as "... and their exposed surfaces shall have low flame spread characteristics", the subject product shall be tested in accordance with the applicable fire test procedure or procedures as referred to in paragraph 4.1.

3 DEFINITIONS

3.1 *Fire Test Procedures Code* means the International Code for Application of Fire Test Procedures as defined in chapter II-2 of the 1974 SOLAS Convention, as amended.

3.2 *Test expiry date* means the last date on which the given test procedure may be used to test and subsequently approve any product under the Convention.

3.3 *Approval expiry date* means the last date on which the subsequent approval is valid as proof of meeting the fire safety requirements of the Convention.

3.4 *Administration* means the Government of the State whose flag the ship is entitled to fly.

3.5 *Competent authority* means an organization authorized by the Administration to perform functions required by this Code.

3.6 *Laboratory recognized by the Administration* means a testing laboratory which is acceptable to the Administration concerned. Other testing laboratories may be recognized on a case-by-case basis for specific approvals as agreed upon by the Administration concerned.

3.7 *Convention* means the 1974 SOLAS Convention, as amended.

3.8 *Standard fire test* means a test in which specimens are exposed in a test furnace to temperatures corresponding approximately to the standard time-temperature curve.

3.9 *The standard time-temperature curve* means the time-temperature curve defined by the formula:

$$T = 345 \log_{10}(8t + 1) + 20$$

where:

T is the average furnace temperature (^{o}C)
t is the time (minutes).

4 TESTING

4.1 Fire test procedures

4.1.1 Annex 1 of this Code presents the required test procedures which shall be used in testing products as a basis for approval (including renewal of approval), except as provided in section 8.

4.1.2 The test procedures identify the test methods and the acceptance and classification criteria.

4.2 Testing laboratories

4.2.1 The tests shall be carried out in testing laboratories recognized by the Administrations concerned.*

4.2.2 When recognizing a laboratory, the Administration shall consider the following criteria:

.1 that the laboratory is engaged, as a regular part of its business, in performing inspections and tests that are the same as, or similar to, the tests as described in the applicable part;

.2 that the laboratory has access to the apparatus, facilities, personnel, and calibrated instruments necessary to perform these tests and inspections; and

.3 that the laboratory is not owned or controlled by a manufacturer, vendor or supplier of the product being tested.

4.2.3 The testing laboratory shall use a quality control system audited by the competent authority.

4.3 Test reports

4.3.1 The test procedures state the required contents of the test reports.

4.3.2 In general, a test report is the property of the sponsor of the test.

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* Refer to the list of testing laboratories recognized by the Administration which is issued and updated in a series of FP circulars.

5 APPROVAL

5.1 General

5.1.1 The Administration shall approve products in accordance with their established approval procedures by using the type approval procedure (see paragraph 5.2) or the case-by-case approval (see paragraph 5.3).

5.1.2 The Administration may authorize competent authorities to issue approvals on their behalf.

5.1.3 An applicant who seeks approval shall have the legal right to use the test reports on which the application is based (see paragraph 4.3.2).

5.1.4 The Administration may require that the approved products are provided with special approval markings.

5.1.5 The approval shall be valid when the product is installed on board a ship. If a product is approved when manufactured, but the approval expires before the product is installed on the ship, the product may be installed as approved material, provided that the criteria have not changed since the expiry date of the approval certificate.

5.1.6 The application for approval shall be sought from the Administration or competent authority. The application shall contain at least the following:

.1 the name and address of the applicant and of the manufacturer;

.2 the name or trade name of the product;

.3 the specific qualities for which approval is sought;

.4 drawings or descriptions of the assembly and materials of the product as well as instructions, where applicable, for its installation and use; and

.5 a report on the fire test(s).

For cases where an unsuccessful test had been conducted prior to the final approval test, the fire test report should include a description of the modifications made to the test specimen that resulted in the successful test. (MSC/Circ.1004)

5.1.7 Any significant alteration to a product shall make the relevant approval to cease to be valid. To obtain a new approval, the product shall be retested.

5.2 Type approval

5.2.1 The type approval certificates shall be issued and renewed on basis of the test reports of the applicable fire tests (see section 4).

5.2.2 The Administration shall require that the manufacturers have a quality control system audited by a competent authority to ensure continuous compliance with the type approval conditions. Alternatively, the Administration may use final product verification procedures where the compliance with the type approval certificate is verified by a competent authority before the product is installed on board ships.

5.2.3 The type approval certificates shall be valid no more than 5 years from the date of issue.

5.2.4 Type approval certificates shall include at least the following:

.1 identification (name or trade name and description) of the product;

.2 classification and any restrictions in the use of the product;

.3 name and address of the manufacturer and applicant;

.4 test method(s) used in test(s);

.5 identification of the test report(s) and applicable statements (including date of issue, possible file number and the name and address of the testing laboratory);

.6 date of issue and possible number of the type approval certificate;

.7 expiration date of the certificate; ~~and~~

.8 name of the issuing body (competent authority) and, if applicable, authorization.

.9 type approval certificates for windows should state which side of the window was exposed to the heating condition during the test (MSC/Circ.1036); and

.10 the certificate should include a reference to optional test(s) such as hose stream test and/or thermo radiation test (MSC/Circ.1036).

5.2.5 In general, the type approved products may be installed for their intended use on board ships flying the flag of the approving Administration.

5.3 Case-by-case approval

5.3.1 The case-by-case approval means approval where a product is approved for installation on board a specific ship without using a type approval certificate.

5.3.2 The Administration may approve products using the applicable test procedures for specific ship applications without issuing a type approval certificate. The case-by-case approval is only valid for the specific ship.

6 PRODUCTS WHICH MAY BE INSTALLED WITHOUT TESTING AND/OR APPROVAL

Annex 2 of this Code specifies the groups of products, which (if any) are considered to comply with the specific fire safety regulations of the Convention and which may be installed without testing and/or approval.

7 USE OF EQUIVALENTS AND MODERN TECHNOLOGY

7.1 To allow modern technology and development of products, the Administration may approve products to be installed on board ships based on tests and verifications not specifically mentioned in this Code but considered by the Administration to be equivalent with the applicable fire safety requirements of the Convention.

7.2 The Administration shall inform the Organization of approvals referenced to in paragraph 7.1 in accordance with regulation I/5 of the Convention and follow the documentation procedures as outlined below:

.1 in the case of new and unconventional products, a written analysis as to why the existing test method(s) cannot be used to test this specific product;

.2 a written analysis showing how the proposed alternative test procedure will prove performance as required by the Convention; and

.3 a written analysis comparing the proposed alternative test procedure to the required procedure in the Code.

8 PERIOD OF GRACE FOR OTHER TEST PROCEDURES

8.1 The newest test procedures adopted by the Organization are considered being the most suitable for demonstrating that the products concerned comply with the applicable fire safety requirements of the Convention.

8.2 Notwithstanding what is said elsewhere in this Code, the Administration may use established test procedures and acceptance criteria, other than those in annex 1 to this Code, when approving products to comply with the fire safety requirements of the Convention to allow a practicable period of grace for the testing laboratories to obtain testing equipment, for the industry to re-test their products and for the Administrations to provide the necessary new certification. For such other test procedures and acceptance criteria the test expiry dates and the approval expiry dates are given in annex 3 to this Code.

9 LIST OF REFERENCES

The following IMO Assembly resolutions and ISO standards are referred to in parts 1 to 9 of annex 1 to the Code:

.1 resolution A.471(XII) - "Recommendation on test method for determining the resistance to flame of vertically supported textiles and films";

.2 resolution A.563(14) - "Amendments to the Recommendation on test method for determining the resistance to flame of vertically supported textiles and films (resolution A.471(XII))";

.3 resolution A.652(16) - "Recommendation on fire test procedures for upholstered furniture";

.4 resolution A.653(16) - "Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials";

.5 resolution A.687(17) - "Fire test procedures for ignitability of primary deck coverings";

.6 resolution A.688(17) - "Fire test procedures for ignitability of bedding components";

.7 resolution A.753(18) - "Guidelines for the application of plastic pipes on ships";

.8 resolution A.754(18) - "Recommendation on fire resistance tests for "A", "B" and "F" class divisions";

.9 ISO 1182:1990 - "Fire test - Building materials - Non-combustibility test";

.10 ISO 1716:1973 - "Building materials - Determination of calorific potential"; ~~and~~

.11 ISO 5659:1994 - "Plastics - Smoke generation, Part 2 Determination of optical density by a single chamber test";

.12 resolution MSC.40(64), as amended by resolution MSC.90(71) – "Standard for qualifying marine materials for high-speed craft as fire-restricting materials"; and

.13 resolution MSC.45(65) – "Test procedures for fire-resisting divisions of high-speed craft".

ANNEX 1

FIRE TEST PROCEDURES

PREAMBLE

1 This annex contains the fire test procedures which shall be used for verifying that the products comply with the applicable requirements. For other test procedures provisions in paragraph 8.2 of, and annex 3 to, the Code shall apply.

2 Reference to the test procedures of this annex shall be made (e.g., in the test report and in the type approval certificate) by referring to the applicable part number or numbers as follows:

> **Example:** Where a primary deck covering has been tested in accordance with parts 2 and 6 of annex 1, the reference shall be "IMO FTPC Parts 2 and 6".

3 Some products or their components are required to be tested in accordance with more than one test procedure. For this purpose, references to other parts are given in some parts of this annex. Such references are here for information only, and the applicable guidance shall be sought in the relevant requirements of the Convention.

4 For products which may be installed without testing and/or approval, annex 2 to the Code is referred.

Part 1 - Non-combustibility test

1 APPLICATION

1.1 Where a material is required to be non-combustible, it shall be determined in accordance with this part.

1.2 If a material passes the test as specified in section 2, it shall be considered as "non-combustible" even if it consists of a mixture of inorganic and organic substances.

2 FIRE TEST PROCEDURE

2.1 The non-combustibility shall be verified in accordance with the test procedure in the standard ISO 1182:~~1990~~ 2002 except that instead of Annex A "Criteria for evaluation" of this standard all the following criteria shall be satisfied:
(For the purposes of this Part, ISO 1182:2002 may be used *in lieu* of ISO 1182:1990 (MSC/Circ.1120).)

.1 the average furnace thermocouple temperature rise as calculated in 8.1.2 of ISO 1182 does not exceed 30°C;

.2 the average surface thermocouple temperature rise as calculated in 8.1.2 of ISO 1182 does not exceed 30°C;

.3 the mean duration of sustained flaming as calculated in 8.2.2 of ISO 1182 does not exceed 10 s; ~~and~~

.4 the average mass loss as calculated in 8.3 of ISO 1182 does not exceed 50%; and

.5 the test exposure need not exceed a 30 minute duration (MSC/Circ.964).

2.2 The test report shall include the following information:

.1 name of testing body;

.2 name of manufacturer of the material;

.3 date of supply of the materials and of tests;

.4 name or identification of the material;

.5 description of the material;

.6 density of the material;

.7 description of the specimens;

.8 test method;

.9 test results including all observations;

.10 designation of the material according to the test criteria specified in paragraph 2.1 above.

Part 2 - Smoke and toxicity test

1 APPLICATION

Where a material is required not to be capable of producing excessive quantities of smoke and toxic products or not to give rise to toxic hazards at elevated temperatures, the material shall comply with this part.

2 FIRE TEST PROCEDURE

2.1 **General**

Smoke generation tests shall be conducted in accordance with standard ISO 5659:1994, Part 2 and additional test procedures as described in this part of the Code. To carry out the tests in accordance with this standard, modifications of the arrangements and procedures to the ISO standard shall be made, if necessary.

2.2 **Test specimen**

Preparation of test specimen shall be in accordance with the practice outlined in resolutions A.653(16), A.687(17) and A.753(18). In the case of cables, only specimens of those with maximum insulation thickness need be tested.

2.3 **Test conditions**

Irradiance to the specimen during the test shall be kept constant. Three specimens shall be tested under each of the following conditions:

.1 irradiance of 25 kW/m^2 in the presence of pilot flame;

.2 irradiance of 25 kW/m^2 in the absence of pilot flame; and

.3 irradiance of 50 kW/m^2 in the absence of pilot flame.

2.4 **Duration of tests**

The test shall be carried out for at least 10 min. If the minimum light transmittance value has not been reached during the 10 min exposure, the test shall be continued for a further 10 min period.

2.5 **Test results**

2.5.1 Specific optical density of smoke (Ds) as defined below shall be recorded during the test period at least every 5 s:

$$Ds = (V/(AL))\log_{10}(I_o/I)$$

where:

V = total volume of the chamber (m^3)

A = exposed area of the specimen (m^2)

L = optical length (m) of smoke measurement

I_o = light intensity before the test

I = light intensity during the test (after absorption by the smoke).

2.5.2 When making toxicity measurements, the sampling of fumes shall be made during the testing of the second or the third specimen at each test condition, from the geometrical centre of the chamber within 3 min of the time when the maximum specific optical density of smoke is reached. The concentration of each toxic gas shall be determined as ppm in the chamber volume.

2.6 **Classification criteria**

2.6.1 Smoke

An average (Dm) of the maximum of Ds of three tests at each test condition shall be calculated.

.1 for materials used as surface of bulkheads, linings or ceilings, the Dm shall not exceed 200 in any test condition;

.2 for materials used as primary deck covering, the Dm shall not exceed 400 in any test condition;

.3 for materials used as floor covering, the Dm shall not exceed 500 in any test condition; and

.4 for plastic pipes and electric cables, the Dm shall not exceed 400 in any test condition.

2.6.2 Toxicity

The gas concentration measured at each test condition shall not exceed the following limits:

CO	1450 ppm	HBr	600 ppm	
HC1	600 ppm	HCN	140 ppm	
HF	600 ppm	SO_2	120 ppm	(200 ppm for floor coverings)
NO_x	350 ppm			[MSC.173(79)]

Not only the FTIR (Fourier Transform Infrared Spectrometer) method but also other methods such as GC/MS (Gas Chromatography/Mass Spectrometer) which can produce traceable results can be used for the gas analysis (MSC/Circ.916).

2.7 **Test report**

A test report shall contain the following information:

.1 type of the material, i.e. surface finish, floor covering, primary deck covering, pipes, etc;

.2 trade name of the material;

.3 description of the material;

.4 construction of the specimen;

.5 name and address of the manufacturer of the material;

.6 Dm at each heating and ignition condition;

.7 concentrations of toxic gases in ppm, if applicable;

.8 judgement according to paragraph 2.6;

.9 name and address of the testing laboratory; and

.10 date of testing

3 ADDITIONAL REQUIREMENTS

3.1 Part 5 of this annex is also applicable to paints, floor coverings, varnishes and other finishes used on exposed interior surfaces.

3.2 Part 6 of this annex is also applicable to the primary deck coverings.

Part 3 – Test for "A", "B" and "F" class divisions

1 APPLICATION

Where products (such as decks, bulkheads, doors, ceilings, linings, windows, fire dampers, pipe penetrations and cable transits) are required to be "A" or "B" or "F" class divisions, they shall comply with this part*.

2 FIRE TEST PROCEDURE

2.1 The products shall be tested and evaluated in accordance with the fire test procedure specified in resolution A.754(18). This contains test procedures also for windows, fire dampers and pipe and duct penetrations in its appendices.

"B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested (MSC/Circ.916).

2.2 Specimen sizes

2.2.1 For the purpose of this Code, the first sentence of paragraphs 2.1.1, 2.4.1 and 2.7.1 of the annex to resolution A.754(18) is replaced by the following:

> "The minimum overall dimensions of test specimen, including the perimeter details at the top, bottom and vertical edges, are 2,440 mm width and 2,500 mm height, except that the minimum overall dimensions of 2,440 mm in height and 4.65 m^2 in the exposed surface of the test specimen may be used in testing up to 31 December 1998. The approval expiry date is 31 December 2003 for approvals based on tests with such smaller test specimen."
>
> "The minimum bulkhead panel height should be a standard height of the manufactured panel with a dimension of 2.400 mm." (MSC/Circ.964)

* Products tested for use in buildings have similar classification markings. However, they do not correspond to the classes in marine use.

2.2.2 For the purpose of this Code, the first sentence of paragraphs 2.2.1, 2.5.1 and 2.8.1 of the annex to resolution A.754(18) is replaced by the following:

> "The minimum overall dimensions of test specimen, including the perimeter details at all the edges, are 2,440 mm width and 3,040 mm length, except that the minimum overall dimensions of 2,440 mm in length and 4.65 m^2 in the exposed surface of the test specimen may be used in testing up to 31 December 1998. The approval expiry date is 31 December 2003 for approvals based on tests with such smaller test specimen."

2.2.3 The specimen sizes shall be given in the test reports

2.3 Where thermal radiation through windows is required to be limited, the window assembly may be tested and evaluated in accordance with appendix 1 of this part.

2.4 Where ceilings or linings are required to be continuous "B" class ceilings or linings they may be tested and evaluated in accordance with appendix 2 of this part.

3 ADDITIONAL REQUIREMENTS

3.1 The integrity of class "B" constructions shall be achieved with non-combustible materials. Adhesives used in the construction of the specimen are not required to be non-combustible; however, for the purpose of this Code, they shall have low flame-spread characteristics. The calcium silicate board described as a dummy specimen specified in paragraph 3.3 of resolution A.653(16) should be used as a standard substrate for adhesives. (MSC/Circ.916)

3.2 Materials placed at "B" class panel joints for avoiding vibration or noise transmission shall be of low flame spread characteristics and fire tested with "B" class divisions along which they are used. However, such materials shall be non-combustible if they are necessary to support the non-combustible "B" class structure or to achieve the required integrity.

3.3 Doors and shutters, which are fitted above the bulkhead deck and which are required to meet both fire protection and watertight requirements, shall comply with the fire protection requirements as required in the Convention, for the divisions where they are installed. The watertight doors fitted below the bulkhead deck are not required to be insulated.

4 OTHER REFERENCES

4.1 The non-combustibility of materials used in "A" and "B" class divisions shall be verified in accordance with part 1. Sealing materials used in penetration systems for “A” class divisions are not required to meet non-combustibility criteria provided that all other applicable requirements of FTP Code, part 3, are met. (MSC/Circ.1120).

4.2 Where combustible veneers are allowed to be provided in "A" and "B" class divisions, the low flame spread characteristics of such veneers, if required, shall be verified in accordance with part 5.

Appendix 1

Thermal radiation test supplement to fire resistance tests for windows in "A", "B" and "F" class divisions

1 SCOPE

1.1 This appendix specifies a procedure for measuring heat flux through windows as a basis for characterizing their ability to limit the heat radiation in order to prevent the spread of fire and to enable escape routes to pass near the windows.

1.2 This procedure is an optional requirement and may be requested by some Administrations for windows in specific areas of a ship.

2 TEST PROCEDURE

2.1 The window should be tested in accordance with resolution A.754(18) using the additional instrumentation as described below.

2.2 The term "window" includes windows, side scuttles and any other glazed opening provided for light transmission or vision purposes in a fire resistant division. The term "fire resistant division" includes bulkheads and doors.

3 ADDITIONAL INSTRUMENTATION

3.1 Additional instrumentation consists of a restricted-view total-heat fluxmeter calibrated with the restricted view to indicate incident heat flux. The fluxmeter should be water-cooled and capable of measuring heat flux 0 to 60 kW/m^2. The fluxmeter should be calibrated at least once a year against a standard device.

3.2 The fluxmeter should be placed perpendicular to the centre of the window being tested, and in a position such that the centre of the fluxmeter's view coincides with the centre of the window[*] (see the figure). The fluxmeter should be located at a distance greater than 0.5 m from the window, such that the view of the fluxmeter just includes part of the frame. However, the fluxmeter should not be located more than 2.5 m from the window. The dimension of the boundary and window frame seen by the fluxmeter, which remains outside the window should not exceed 10% of the total width seen by the fluxmeter on the surface of the sample. It should be calculated on the basis of restricted view angle of the fluxmeter and its distance to the sample surface.

3.3 For windows whose greater dimension is less than 1.57 times the smaller dimension, only one fluxmeter is needed.

[*] A satisfactory method of placing, mounting, and aiming the fluxmeter is as follows: a metal stand constructed of a pipe mounted on a sturdy base serves as an instrument tree to locate the fluxmeter at the required distance from the test specimen. A suitable holder for the fluxmeter is constructed by mounting a gun-sight mount on a lockable ball and socket joint. This joint provides flexibility for aiming the meter. The fluxmeter holder is mounted on the instrument tree at the appropriate height. A laser pointer is placed in the gun-sight mount and the mount is oriented such that the dot is in the centre of the window. The laser pointer is slipped out of the holder and replaced by the fluxmeter.

3.4 For oblong windows whose greater dimension is more than 1.57 times the smaller dimension, additional fluxmeters should be provided. The distance of the fluxmeters from the window should be adjusted such that the fluxmeters' view covers at least 50% of the window. However, the fluxmeters should not be located less than 0.5 m nor more than 2.5 m from the window.

No drawing

Figure

4 CLASSIFICATION CRITERIA

4.1 The peak heat flux (E_w) should be measured for the first 15 min of the test, for the first 30 min of the test, and for the entire duration of the test (i.e. 60 min for class "A" and 30 min for class "B" boundaries).

4.2 The peak heat fluxes (E_w) measured in accordance with paragraph 4.1 should be compared against the reference value (E_c) from the table.

4.3 If (E_w) is less than (E_c), the window is acceptable for installation in a boundary of the corresponding fire resistant classification.

Table 1 - Criteria for heat flux

Fire resistant division classification	Time period from beginning of test to	Heat flux E_c (kW/m^2)
A-0	60 minutes	56.5
A-15	15 minutes 60 minutes	2.34 8.0
A-30	30 minutes 60 minutes	2.34 6.4
A-60	60 minutes	2.34
B-0	30 minutes	36.9
B-15	15 minutes 30 minutes	2.34 4.3

Appendix 2

Continuous "B" class divisions

1 SCOPE

1.1 This appendix specifies the procedure for testing linings and ceilings for verifying that they are "continuous 'B' class linings" and "continuous 'B' class ceilings" and for evaluating full constructions to be "continuous 'B' class constructions".

1.2 This procedure is an optional requirement and may be requested by some Administrations for continuous "B" class divisions.

2 TEST PROCEDURE AND EVALUATION

2.1 The linings, ceilings and constructions should be evaluated in accordance with resolution A.754(18) using the arrangements described below.

2.2 The ceilings should be tested in accordance with paragraph 2.8 of the annex to resolution A.754(18) except that the ceiling should be mounted on the horizontal furnace so that at least 150 mm high "B" class bulkheads are mounted on the furnace and the ceiling is fixed to these partial bulkheads by using the joining method as is intended to be used in practice. Such ceilings and the joining methods should be evaluated as required for ceilings in accordance with resolution A.754(18) and accordingly they should be classified as "continuous 'B' (B-0 or B-15, as applicable) class ceilings".

2.3 A lining which has been evaluated in accordance with resolution A.754(18) to be a "B" (B-0 or B-15, as applicable on basis of the lining test) class lining may be considered forming "continuous 'B' (B-0 or B-15, as applicable) class lining" in conjunction with a "continuous 'B' (B-0 or B-15, as applicable) class ceiling" and with the joining method used in the test (see paragraph 2.2 above) without further testing the lining.

2.4 An enclosed construction installed on an "A" class deck and formed by "continuous 'B' (B-0 or B-15, as applicable) class linings" and "continuous 'B' (B-0 or B-15, as applicable) class ceiling" should be considered forming "continuous 'B' class construction".

Part 4 - Test for fire door control systems

1 APPLICATION

Where a control system of fire doors is required to be able to operate in case of fire, the system shall comply with this part.

2 FIRE TEST PROCEDURE

The fire door control systems shall be tested and evaluated in accordance with the test procedure presented in the appendix to this part.

3 ADDITIONAL REQUIREMENTS

Part 1 of this annex is also applicable to insulation materials used in connection with a fire door control system.

Appendix

Fire test procedure for fire door control systems

1 GENERAL

1.1 Fire door control systems which are intended to be used for fire doors capable of operating in case of fire shall be tested in accordance with the fire test procedure described in this appendix independent of its power supply (pneumatical, hydraulic or electrical).

1.2 The fire tests shall be a prototype test and be carried out with the complete control system in a furnace dimensioned according to resolution A.754(18).

1.3 The construction to be tested shall be, as far as practicable, representative of that to be used on board ships, including the materials and method of assembly.

1.4 The functions of the control system including its closing mechanism shall be tested, i.e. normal functions of and, if required, emergency function, including switchover functions, if this is a basis of the manufacturer's design. The required kind of installation and functions shall be evident from a detailed function description.

2 NATURE OF PROTOTYPE CONTROL SYSTEMS

2.1 The installation of the prototype control system shall fully comply with the manufacturer's installation manual.

2.2 The prototype control system shall include a typical door arrangement connected to the closing mechanism. For the purpose of the test a door model shall be used. In case of sliding doors, the model door shall run in original door tracks with original supporting and guide rollers. The model door shall have the weight of the largest door to be actuated by this control system.

2.3 In case of pneumatic or hydraulic systems, the actuator (cylinder) shall have the maximum length allowed by the furnace.

3 MATERIALS FOR PROTOTYPE CONTROL SYSTEMS

3.1 Specifications

Prior to the test, drawings and the list of materials of the test arrangement shall be submitted to the laboratory by the applicant.

3.2 Control measurements

3.2.1 The testing laboratory shall take reference specimens of all those materials whose characteristics are important to the performance of the prototype control system (excluding steel and equivalent material).

3.2.2 If necessary, non-combustibility tests of insulation material in accordance with part 1 shall be conducted. Adhesives used in the construction of the specimen are not required to be non-combustible, however, they shall have low flame-spread characteristics.

3.2.3 The density of each insulation material shall be determined. The density of mineral wool or any similar compressible material shall be related to the nominal thickness.

3.2.4 The thickness of each insulation material and combination of materials shall be measured by using a suitable gauge or calipers.

4 CONDITIONING OF THE PROTOTYPE CONTROL SYSTEMS

4.1 Conditioning of the prototype control system (except insulation) is not necessary.

4.2 If insulation material is used in the construction, the prototype control system shall not be tested until the insulation has reached an air dry condition. This condition is designed as an equilibrium (constant weight) with an ambient atmosphere of 50% relative humidity at 23^{o}C.

Accelerated conditioning is permissible provided the method does not alter the properties of component materials. High temperature conditioning shall be below temperatures critical for the materials.

5 MOUNTING OF THE PROTOTYPE CONTROL SYSTEMS

5.1 The prototype fire door control system and the insulation, if used for protection of the system or parts of it, shall be mounted at the bulkhead plate as shown in figure 1.

5.2 The structural core shall be mounted at the furnace in accordance with the principles for 'A' class divisions in paragraph 5 of resolution A.754(18).

5.3 The door model shall be arranged within the furnace. The structural core to which the system and the door model are fitted shall have no door opening. However, small openings for the release mechanism of the control systems are allowed.

Figure 1

6 EXAMINATION OF THE PROTOTYPE CONTROL SYSTEMS

6.1 Conformity

The laboratory shall verify the conformity of the prototype control system with the drawings and method of assembly provided by the applicant (see section 2), and any area of discrepancy shall be resolved prior to commencement of the test.

6.2 Operation of the prototype control system

Immediately prior to the test, the laboratory shall check the operability of the system by opening the door model by a distance of at least 300 mm. The door model shall then be closed.

7 INSTRUMENTATION

The furnace and the instrumentation of the furnace shall be in accordance with section 7 of the annex to resolution A.754(18).

8 METHOD OF TEST

8.1 Commencement of test

Not more than 5 min before the commencement of the test, the initial temperatures recorded by all thermocouples shall be checked to ensure consistency and the datum values shall be noted. Similar datum values shall be obtained for deformation, and initial condition of the prototype control system shall be noted.

At the time of the test, the initial average internal temperature shall be 20 $\pm$ 10°C and shall be within 5°C of the initial ambient temperature.

8.2 Furnace control

The furnace control shall be in accordance with paragraph 8.3 of the annex to resolution A.754(18).

8.3 Temperatures, duration of testing and actions during test

8.3.1 The average furnace temperature shall be increased and stabilized at 200 $\pm$ 50°C within 5 min and kept at the level of 200±50°C up to the end of the first 60 min. Then the average furnace temperature shall be increased according to the standard time-temperature curve beginning with the level of 200°C up to 945°C.

8.3.2 The opening and closing function of the door control mechanism shall be activated every 5 min from the beginning of the test for the duration of 60 min.

8.3.3 The automatic switchover shall isolate the door control system from the power supply at the average furnace temperature of 300°C and shall be able to keep the door closed at least up to 945°C.

8.4 Measurements and observations on the prototype control system

In case of pneumatic or hydraulic systems, the input pressure which shall be identical with the approved system pressure shall be recorded. Due to a high input pressure, necessary safety precautions shall be taken when the test is carried out.

9 CLASSIFICATION CRITERIA

9.1 During the first 60 min of the test, a prototype fire door control system shall not fail.

9.2 During the period from the end of the first 60 min until the end of the test, the door shall remain closed.

10 TEST REPORT

The test report shall include all important information relevant to the prototype control system and the fire test, including the following specific items:

.1 the name of the testing laboratory and the test date;

.2 the name of the applicant for the test;

.3 the name of the manufacturer of the prototype control system and of the products and components used in the construction, together with identification marks and trade names;

.4 the constructional details of the prototype control system, including description and drawings and principal details of components. All the details requested in section 2 shall be given. The description and the drawings which are included in the test report shall, as far as practicable, be based on information derived from a survey of the prototype control system. When full and detailed drawings are not included in the report, then the applicant's drawing(s) of the prototype control system shall be authenticated by the laboratory and at least one copy of the authenticated drawing(s) shall be retained by the laboratory; in this case reference to the applicant's drawing(s) shall be given in the report together with a statement indicating the method of endorsing the drawings;

.5 all the properties of materials used that have a bearing on the fire performance of the prototype control system together with measurements of thickness and density of the insulation material(s);

.6 a statement that the test has been conducted in accordance with the requirements of this Appendix and if any deviations have been made to the prescribed procedures (including any special requirements of the Administration), a clear statement of the deviations;

.7 the name of the representative of the Administration present at the test. When the test is not witnessed by a representative of the Administration, a note to this effect shall be made in the report in the following form:

> "The ..... (name of the Administration) ... was notified of the intention to conduct the test detailed in this report and did not consider it necessary to send a representative to witness it.";

.8 information concerning the location of the pressure gauges or other devices together with tabulated data obtained during the test;

.9 observations of significant behaviour of the prototype control system during test and photographs, if any; and

.10 a statement that the prototype fire door control system has passed the test and complies with the classification criteria.

Part 5 - Test for surface flammability

1 APPLICATION

Where a product is required to have a surface with low flame-spread characteristics, the product shall comply with this part.

<u>Where a product is approved based on a test of a specimen applied on a non-combustible substrate, that product should be approved for application to any non-combustible substrate with similar or higher density (similar density may be defined as a density ≥ 0.75 x the density used during testing) or with a greater thickness if the density is more than 400 kg/m3. Where a product is approved on the basis of a test result obtained after application on a metallic substrate (e.g., thin film of paints or plastic films on steel plates), such a product should be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness ≥ 0.75 x the thickness of metallic substrate used during testing). (MSC/Circ.1004)</u>

2 FIRE TEST PROCEDURE

2.1 The surface materials shall be tested and evaluated in accordance with the test procedure specified in resolution A.653(16). For the purpose of this part, the total heat release value (Q_t) for floor coverings given in section 10 of the annex to resolution A.653(16) is replaced by ≤ 2.0 MJ. The test may be terminated after 40 min.

2.2 During fire tests for bulkhead, ceiling and deck finish materials and primary deck coverings (see part 6 of this annex for primary deck coverings), there are those specimens which exhibit various phenomena which cause difficulties in classification of the materials. Appendix to this part provides guidance on the uniform interpretation of such results.

3 ADDITIONAL REQUIREMENTS

3.1 Surface materials for bulkheads and ceilings and similar exposed surfaces

In case there is a requirement of maximum gross calorific value (e.g., 45 MJ/m^2) for a product, the method specified in standard ISO 1716: 1973 is recommended for determining the gross calorific value.

3.2 Floor coverings and primary deck coverings

3.2.1 A primary deck covering is the first layer of a floor construction which is applied directly on top of the deck plating and is inclusive of any primary coat, anti-corrosive compound or adhesive which is necessary to provide protection or adhesion to the deck plating. Other layers in the floor construction above the deck plating are floor coverings.

3.2.2 Where a floor covering is required to be low flame-spread, all layers shall comply with part 5. If the floor covering has a multilayer construction, the Administration may require the tests to be conducted for each layer or for combinations of some layers of the floor coverings. Each layer separately, or a combination of layers (i.e. the test and approval are applicable only to this combination), of the floor covering shall comply with this part. When a primary deck covering is required to be not readily ignitable and is placed below a floor covering, the primary deck covering shall comply with part 6. When the primary deck covering is also the exposed surface, it shall comply with this part. Primer or similar thin film of paint on deck plating need not comply with the above requirements of part 6.

3.3 Combustible ventilation ducts

3.3.1 Where combustible ventilation ducts are required to be of material which has low flame-spread characteristics, the surface flammability test procedure and criteria for lining and ceiling finishes according to resolution A.653(16) shall be applied for such ducts. In case homogeneous materials are used for the ducts, the test shall apply to outside surface of the duct, whilst both sides of the ducts of composite materials shall be tested.

3.4 Insulation materials for cold service systems

Where the exposed surfaces of vapour barriers and adhesives used in conjunction with insulation, as well as insulation of pipe fittings, for cold service systems are required to have low flame-spread characteristics, the surface flammability test procedure and criteria for linings and ceilings according to resolution A.653(16) shall be applied for such exposed surfaces.

3.5 Other references

Part 2 of this annex is also applicable to surface materials.

Appendix

Interpretation of results
Evaluating unusual test specimen behaviour
(see paragraph 2.2 of this part)

	Unusual behaviour	**Guidance on classification**
1	Flashing, no steady flame	Report furthest progress of flame and time, and whether or not flash is on centerline. Classify on basis of the data.
2	Explosive spalling, no flashing or flame	Accept material as passing test.
3	Rapid flash over surface, later steady flame progress	Report result for both flame fronts but classify on basis of worst performance for each of the four test parameters in the two burning regimes.
4	Specimen or veneer melts and drips off, no flame	Report behaviour and extent of advance on specimen.
5	Explosive spalling, and flame on exposed part of specimen	Report explosions and classify on basis of flame progress irrespective of whether above or below centerline.
6	Specimen or veneer melts, burns, and drips off	Reject material regardless of criteria. For floor covering, no more than 10 burning drops are acceptable.
7	Pilot flame extinguished	Report occurrence, reject data and repeat test.
8	Heat release signal after test and re-insertion of dummy specimen remains at a higher or lower level than initial stabilizing level	Reject data and stabilize the equipment, then repeat test.
9	Very short ignition delay on carpets or non-rigid specimens	Could be caused by pile extension above holder surface, reducing space to pilot flame. Repeat with shims as required by procedure in paragraph 8.1.1 of the annex to resolution A.653(16).

10	Specimen breaks up, and falls out of holder	Report behaviour, but classify on basis of worst performance with and without specimen restraint in paragraph 8.3.2 of the annex to resolution A.653(16).
11	Substantial jetting combustible pyrolysis gases from specimen, adhesive or bonding agents	Reject material.
12	Small flame remaining along the edge of specimen	Report behaviour and terminate the test 3 min after flaming on exposed surface of specimen ceased.

Part 6 - Test for primary deck coverings

1 APPLICATION

1.1 Where the primary deck coverings are required to be not readily ignitable, they shall comply with this part.

1.2 For determining which layers on the deck shall be tested as floor coverings and which of them shall be tested as primary deck coverings, see paragraph 3.2 of part 5.

2 FIRE TEST PROCEDURE

2.1 The primary deck coverings shall be tested and evaluated in accordance with the fire test procedure specified in resolution A.687(17):

For the purpose of this part, the total heat release value (Qt) for floor coverings given in section 10 of the annex to resolution A.653(16) is replaced by £ 2.0 MJ. (MSC/Circ.1120).

2.2 The test ~~shall~~ may be terminated after 40 min. (MSC/Circ.1004).

3 ADDITIONAL REQUIREMENTS

Part 2 of this annex 1 is also applicable to primary deck coverings.

Part 7 - Test for vertically supported textiles and films

1 APPLICATION

Where draperies, curtains and other supported textile materials are required to have qualities of resistance to the propagation of flame not inferior to those of wool of mass 0.8 kg/m^2, they shall comply with this part.

2 FIRE TEST PROCEDURE

The vertically supported textiles and films shall be tested and evaluated in accordance with the fire test procedure specified in resolution A.471(XII) as amended by resolution A.563(14).

3 ADDITIONAL REQUIREMENTS

The tests shall be made by using specimens of the final product (e.g., with colour treatment). In cases where only the colours change, a new test is not necessary. However, in cases where the basis product or the treatment procedure change, a new test is required.

Part 8 - Test for upholstered furniture

1 APPLICATION

Where upholstered furniture are required to have qualities of resistance to the ignition and propagation of flame, the upholstered furniture shall comply with this part.

2 FIRE TEST PROCEDURE

The upholstered furniture shall be tested and evaluated in accordance with the fire test procedure specified in resolution A.652(16).

3 ADDITIONAL REQUIREMENTS

The tests shall be made by using specimens of the final product (e.g., with colour treatment). In cases where only the colours change, a new test is not necessary. However, in cases where the basis product or the treatment procedure changes, a new test is required.

Part 9 - Test for bedding components

1 APPLICATION

Where bedding components are required to have qualities of resistance to the ignition and propagation of flame, the bedding components shall comply with this part.

2 FIRE TEST PROCEDURE

The bedding components shall be tested and evaluated in accordance with the fire test procedure specified in resolution A.688(17).

3 ADDITIONAL REQUIREMENTS

The tests shall be made by using specimens of the final product (e.g., with colour treatment). In cases where only the colours change, a new test is not necessary. However, in cases where the basis product or the treatment procedure changes, a new test is required.

[MSC101(73)]

Part 10 – Test for fire-restricting materials for high-speed craft

1 APPLICATION

Where materials used in high-speed craft are required to be fire-restricting, they shall comply with this part.

2 FIRE TEST PROCEDURE

Surface materials on bulkheads, wall and ceiling linings including their supporting structure, furniture, and other structural or interior components required to be fire-restricting materials shall be tested and evaluated in accordance with the fire test procedures specified in resolution MSC.40(64), as amended by resolution MSC.90(71).

[MSC101(73)]

Part 11 – Test for fire-resisting divisions of high-speed craft

1 APPLICATION

Where constructions for use in high-speed craft are required to have fire-resisting properties, they shall comply with this part. Such constructions include fire-resisting bulkheads, decks, ceilings, linings and doors.

2 FIRE TEST PROCEDURE

Fire-resisting divisions of high-speed craft shall be tested and evaluated in accordance with the fire test procedures specified in resolution MSC.45(65).

3 ADDITIONAL REQUIREMENTS

3.1 Materials used in fire-resisting divisions shall be non-combustible or fire-restricting as verified in accordance with part 1 or part 10 of this annex, respectively.

3.2 Part 3 of this annex is also applicable to certain constructions such as windows, fire dampers, pipe penetrations and cable transits.

3.3 Part 4 of this annex is also applicable where a control system of fire doors is required to be able to operate in case of fire.

3.4 Where combustible veneers are allowed to be provided in fire-resisting divisions in conjunction with non-combustible substrates, the low flame spread characteristics of such veneers, if required, shall be verified in accordance with part 5 of this annex.

***

ANNEX 2

PRODUCTS WHICH MAY BE INSTALLED WITHOUT TESTING AND/OR APPROVAL

GENERAL

In general, the products and product groups listed in this annex are considered to have the fire safety characteristics specified below and they may be installed without testing according to and without approval on basis of the specific fire test procedures in this Code for the specific safety characteristics of the product.

The paragraphs below are numbered with the same part number in which the corresponding testing requirements are specified in annex 1.

1 NON-COMBUSTIBLE MATERIALS

In general, products made only of glass, concrete, ceramic products, natural stone, masonry units, common metals and metal alloys are considered being non-combustible and they may be installed without testing and approval.

2 MATERIALS NOT GENERATING EXCESSIVE QUANTITIES OF SMOKE NOR TOXIC PRODUCTS IN FIRE

2.1 In general, non-combustible materials are considered to comply with the requirements of part 2 of annex 1 without further testing.

2.2 In general, surface materials and primary deck coverings with both the total heat release (Q_t) of not more than 0.2 MJ and the peak heat release rate (q_p) of not more than 1.0 kW (both values determined in accordance with part 5 of annex 1 or in accordance with resolution A.653(16) are considered to comply with the requirements of part 2 of annex 1 without further testing.

<u>2.3 For high-speed craft, fire-restricting materials are considered to comply with the requirements of part 2 of annex 1 without further testing. [MSC.101(73)]</u>

3 "A", "B" And "F" Class Divisions

3.1 The following products may be installed without testing or approval:

Classification	**Product description**
Class A-0 bulkhead	A steel bulkhead with dimensions not less than the minimum dimensions given below: - thickness of plating: 4 mm - stiffeners 60 x 60 x 5 mm spaced at 600 mm or structural equivalent
Class A-0 deck	A steel deck with dimensions not less than the minimum dimensions given below: - thickness of plating: 4 mm - stiffeners 95x 65 x 7 mm spaced at 600 mm or structural equivalent.

3.2 Notwithstanding the provisions in 3.1 above, the materials which are used in "A", "B" and "F" class divisions and which are required to have certain other specified characteristics (e.g., non-combustibility, low flame-spread characteristics, etc.) shall comply with the appropriate parts of annex 1 or section 8 and annex 3, of this Code.

4 FIRE DOOR CONTROL SYSTEMS

(no entries)

5 LOW FLAME-SPREAD SURFACES

5.1 Non-combustible materials are considered to comply with the requirements of part 5 of annex 1. However, due consideration shall be given to the method of application and fixing (e.g., glue).

5.2 Primary deck coverings classified as not readily ignitable in accordance with part 6 of annex 1 are considered to comply with the requirements of part 5 of annex 1 for floor coverings.

<u>5.3 For high-speed craft, surfaces and materials that are qualified as fire-restricting materials are considered to comply with the requirements of part 5 of annex 1 without further testing. [MSC.101(73)]</u>

6 PRIMARY DECK COVERINGS

Non-combustible materials are considered to comply with the requirements of part 6 of annex 1. However, due consideration shall be given to the method of application and fixing.

7 VERTICALLY SUPPORTED TEXTILES AND FILMS

(no entries)

8 UPHOLSTERED FURNITURE

(no entries)

9 BEDDING COMPONENTS

(no entries)

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SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 10

FP 50/10/3
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COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE

Related revision to resolution A.754(18)
Recommendation on fire resistance tests for “A”, “B” and “F” class divisions

Submitted by Japan

SUMMARY

Executive summary:	This document contains the draft revision to IMO Assembly resolution A.754(18) “Recommendation on fire resistance tests for “A”, “B” and “F” class divisions”, which is the consequence of the draft revision to part 3 of the FTP Code, for consideration of the Sub-Committee on the comprehensive review of the FTP Code
Action to be taken:	Paragraph 5
Related documents:	MSC 80/21/5, MSC 80/24, FP 50/10/1 and FP 50/10/1/Add.1

Background

1 Japan proposed a new work programme entitled “Comprehensive Review of Fire Test Procedures Code” to the Maritime Safety Committee, at its eightieth session, as a new work item for the Sub-Committee (MSC 80/21/5). The Committee agreed to include the new work item in the Sub-Committee’s work programme and the provisional agenda for FP 50 as high priority with a target completion date of 2008 (MSC 80/24, paragraph 21.11).

2 Japan has also submitted documents FP 50/10/1 and FP 50/10/1/Add.1, which contain proposals for the comprehensive review of the FTP Code.

Revision to part 3 of the FTP Code

3 As described in the document FP 50/10/1, part 3 of the FTP Code needs to be revised. As a consequence, the related test procedures in IMO Assembly resolution A.754(18) should also be revised to reflect the revision to part 3. There have also been an extensive number of the IMO unified interpretations to the test procedures in resolution A.754(18), which may also be included into the revised test procedures.

Draft of revised resolution A.754(18)

4 In order to facilitate the Sub-Committee's consideration on comprehensive review of the FTP Code, Japan has prepared a draft of revised resolution A.754(18) "Fire resistance tests for "A", "B" and "F" class divisions", which includes modifications from the existing resolution A.754(18) base on the adopted amendments and approved interpretations to the existing resolution A.754(18), as set out in the annex.

Action requested of the Sub-Committee

5 The Sub-Committee is invited to consider the draft of revised resolution A.754(18) set out in the annex and take action appropriate.

***

ANNEX

RECOMMENDATION ON FIRE RESISTANCE TESTS FOR "A", "B" AND "F" CLASS DIVISIONS*

(supersedes resolutions A.163(ES.IV), A.215(VI) and A.517(13))

1 GENERAL

1.1 Under the provisions of the International Convention for the Safety of Life at Sea, 1974, and subsequent amendments thereto, and the Torremolinos Protocol of 1993 relating to the Torremolinos International Convention for the Safety of Fishing Vessels, 1977, constructions for use in passenger ships, cargo ships, and fishing vessels should have a "fire insulation" to the satisfaction of, and be approved by, the Administration. In this context "fire insulation" is the ability of the construction to insulate/protect an area from the influences of a fire in an adjoining area by having separating performance during fire. Such constructions are "class bulkheads and decks, "A" class doors, "B" class bulkheads, decks, ceilings and linings, "B" class doors, "F" class bulkheads, decks, ceilings and linings, and "F" class doors.

The approval will be given by the Administration based on results of tests carried out on the construction and material in question. Tests should be conducted at a testing laboratory recognized by the Administration. The applicant for the test, i.e., the manufacturer or agent, should if required submit test specimens and information to the testing laboratory as prescribed in this document.

1.2 Approval of constructions will be restricted to the orientation in which they have been tested; therefore bulkheads, linings and doors should be tested vertically mounted and decks and ceilings should be tested horizontally mounted. It is only necessary to test decks with the underside exposed to the heating conditions, and "B" and "F" class ceilings and linings are required only to be tested from the side incorporating the ceiling or the lining.

For "A" class bulkheads and doors for "general application", i.e. for use of the insulation material on either side of the structural core, and also for "B" class bulkheads and doors, approval usually requires that the construction has been tested from each side separately, using two separate specimens, unless the Administration considers that only a single test to one side, that being the side expected to provide a performance inferior to the other side, is appropriate.

In tests for "A" class bulkheads for "general application" it may be possible for approval be granted on the basis of a single test only, provided that the bulkhead has been tested in the most onerous manner, which is considered to be with the insulation on the unexposed face and the stiffeners also on that side.

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* As defined in the International Convention for the Safety of Life at Sea, 1974, chapter II-2, part A, and the Torremolinos Protocol of 1993 relating th the Torremolinos International Convention for the Safety of Fishing Vessels, 1977, chapter V, expect that "F" class divisions are defined only in the latter Convention.

In tests for "A" class bulkheads for "restricted application", i.e. where the fire hazard has been identified as being from the insulated side only, the bulkhead can be tested with the insulation on the exposed face and with the stiffeners also on that side.

If approval of an "A" class bulkhead is being sought involving the use of "double-sided application" of the insulation, the thickness of the insulation being equal on both sides of the structural core, it should be tested with the stiffeners on the unexposed side of the bulkhead, otherwise it should be tested with the side with the thinnest thickness of insulation on the exposed face.

If insulation of an "A" class division is to be provided by membrane protection, i.e. by a "B" class ceiling to a structural steel core or a "B" class lining to a structural steel core, the distance between the membrane, i.e. the ceiling or the lining, and the structural core should be the minimum for which approval is being sought. For "A" class bulkheads, the division is required to be tested both from the structural core side, and from the "B" class lining side. For both ceilings and linings which may form part of such deck or bulkhead constructions, they should satisfy at least B-0 classification.

When the insulation of an "A" class division is provided by membrane protection, the stiffeners of the structural core should be positioned in the cavity between the steel plate of the structural core and the membrane protection. For an "A" class bulkhead the Administration may accept or require the stiffeners to be on the opposite side of the steel plate of the structural core to enable the distance between the membrane protection and the structural core to be reduced to a minimum.

<u>The thickness of insulation on the stiffeners need not be same as that of the steel plate. (MSC/Circ.916)</u>

1.3 The dimensions of the structural cores of the test specimens given in section 2 are intended for structural cores of stiffened flat plates of steel or aluminium alloy. The Administration may require tests to be carried out on specimens having structural cores of materials other than steel or aluminium alloy if such materials are more representative of the construction to be used on board ships.

1.4 "A" class divisions which consist of an uninsulated steel bulkhead or deck of suitable scantlings and without openings can be deemed to satisfy the requirements for class A-0 divisions, i.e. to satisfy the requirements for the passage of smoke and flame, without the need for testing. All other divisions, including class A-0 divisions with a structural core of aluminium, are required to be tested.

1.5 Results obtained on an insulating material used in conjunction with an "A" class division may be applied to constructions incorporating heavier scantlings than those tested and providing the orientation of the construction is the same, i.e. results from bulkhead tests should not be applied to decks and *vice versa*.

1.6 The construction to be tested should be, as far as possible, representative of that to be used on board ships, including the materials and method of assembly.

The designs of the specimens proposed in this resolution are considered to reflect the worst case situations in order to provide maximum usefulness of the classifications to end use applications. However, the Administration may accept or request special test arrangements which provide additional information required for approval, especially of those types of constructions which do not utilize the conventional components of horizontal and vertical divisions, e.g. where cabins may be of a modular type construction involving continuous connections between bulkheads, decks and ceilings.

Doors, windows and other division penetrations intended to be installed in fire divisions made of material other than steel should correspond to prototype(s) tested on a division made of such material, unless the Administration is satisfied that the construction, as approved, does not impair the fire resistance of the division regardless of the division construction. (MSC/Circ.1004)

1.7 Constructions should be tested without paint or other superimposed finish, provided that where they are only produced with a superimposed finish, and subject to the agreement of the Administration, they may be tested as produced. Such constructions may be required to be tested with a superimposed finish if such a finish is considered by the Administration to have a detrimental effect on the performance of the construction in the test.

"B" class constructions should be tested without finishes. For constructions where this is not possible, finishes should be included in the non-combustibility test of the construction. (MSC/Circ.916)

2 NATURE OF TEST SPECIMENS

2.1 "A" class bulkheads

2.1.1 *Dimensions*

The minimum overall dimensions for the test specimen are given in SOLAS regulation ll-2/3.2, but the recommended dimensions of the test specimen, including the perimeter details at the top, bottom and vertical edges, are 2,440 mm width and 2,500 mm height.

The overall dimensions of the structural core should be 20 mm less in both the width and the height than the overall dimensions of the specimen, and the other dimensions of the structural core should be as follows:

– thickness of plating:	steel	4.5 +/- 0.5 mm
	aluminium	6.0 +/- 0.5 mm
– stiffeners spaced at 600 mm:	steel	65 +/- 5 X 65 +/- 5 X 6 +/- 1 mm
	aluminium	100 +/- 5 X 75 +/- 5 X 9 +/- 1 mm

The width of the structural core may be greater than the specified dimensions providing that the additional width is in increments of 600 mm to maintain the stiffener centres and the relationship between the stiffeners and the perimeter detail.

Any joints in the plating should be full welded, at feast from one side.

The construction of a structural steel core having the recommended dimensions is shown in figure 1; the thickness of the plating and dimensions of the stiffeners shown are nominal dimensions. Irrespective of the dimensions of the structural core and the material of manufacture, the details around the perimeter should be as illustrated in figure 3.

2.1.2 *Design*

Where insulation is provided by panels (e.g. a "B" class lining), then the test specimen should be such that at least one of the panels is of full width and this, or these, should be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

The overall dimensions of the panel insulation system, including the perimeter details at all the edges, should be 20 mm greater in each direction than the equivalent dimensions of the structural core.

If the insulation system is a lining which may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the lining itself, without the incorporation of these units, to establish the basic performance. A separate test(s) may be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the lining.

2.1.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the thicknesses of insulation used in way of the plating and the stiffeners, the method of securing the insulation system and details of the components used for this purpose, details of joints, connections, air gaps and all other details.

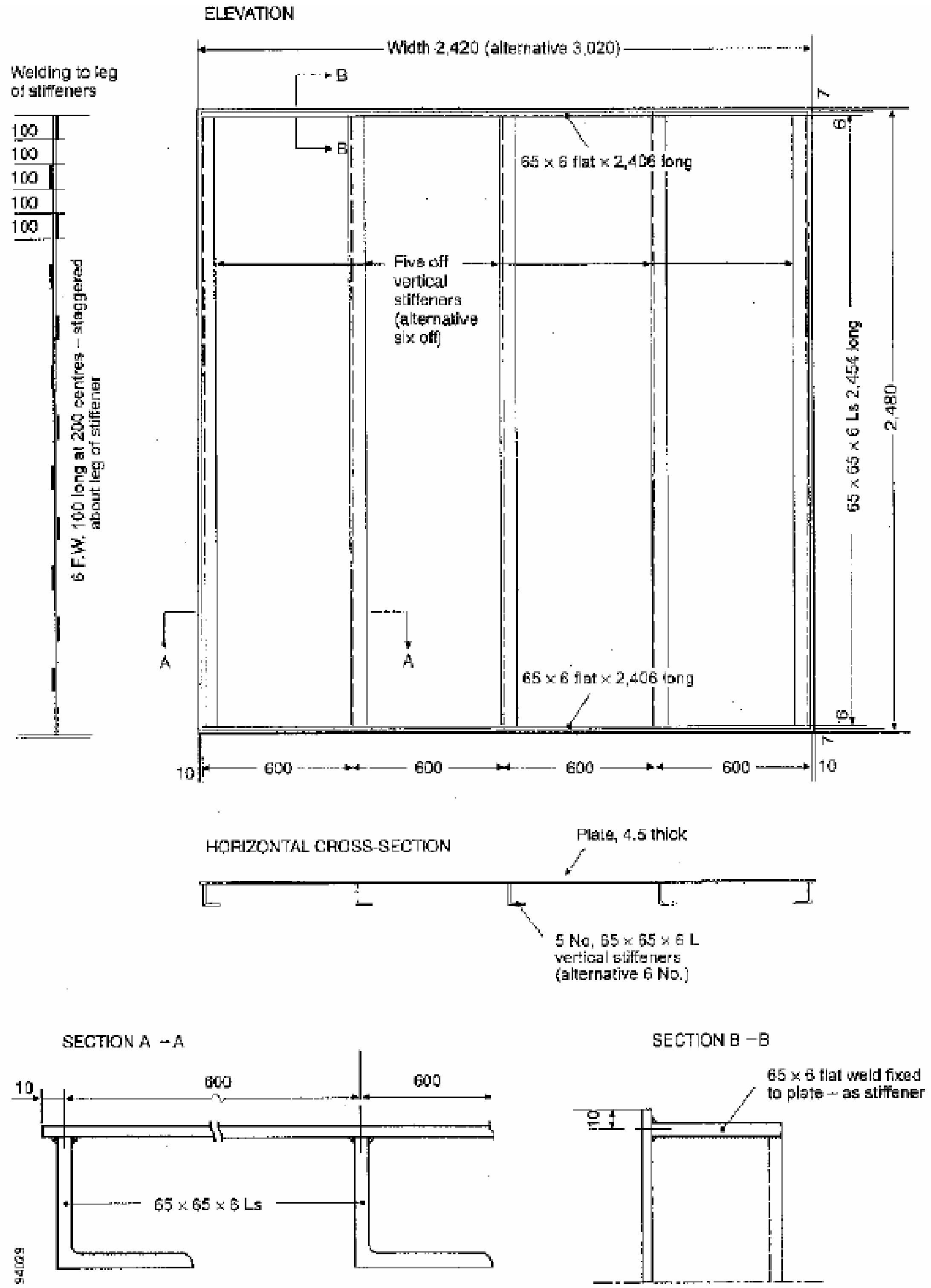


Figure 1 – Structural steel core for "A" class bulkhead and "B" class lining

2.2 "A" class decks

2.2.1 *Dimensions*

The minimum overall dimensions for the test specimen are given in SOLAS regulation II-2/3.2, but the recommended dimensions of the test specimen, including the perimeter details at all edges, are 2,440 mm width and 3,040 mm length.

The overall dimensions of the structural core should be 20 mm less in both the width and length than the overall dimensions of the specimen, and the other dimensions of the structural core should be as follows:

– thickness of plating:	steel	4.5 +/- 0.5 mm
	aluminium	6.0 +/- 0.5 mm
– stiffeners spaced at 600 mm:	steel	100 +/- 5 X 70 +/- 5 X 8 +/- 1 mm
	aluminium	150 +/- 5 X 100 +/- 5 X 9 +/- 1 mm

The width of the structural core may be greater than the specified dimensions providing that the additional width is in increments of 600 mm to maintain the stiffener centres and the relationship between the stiffeners and the perimeter detail.

Any joints in the plating should be full welded, at least from one side.

The construction of a structural steel core having the recommended dimensions is shown in figure 2; the thickness of the plating and dimensions of the stiffeners shown are nominal dimensions. Irrespective of the dimensions of the structural core and the material of manufacture, the details around the perimeter should be as illustrated n figure 3.

2.2.2 *Design*

Where insulation is provided by panels (e.g. a "B" class ceiling), then the test specimen should be designed such that at least one of the panels is of full width and this, or these, should be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame. The overall dimensions of the panel insulation system, including the perimeter details at all the edges, should be 20 mm greater in each direction than the equivalent dimensions of the structural core.

If the ceiling incorporates panels, the specimen should include examples of both the lateral and longitudinal joints between the panels. If the specimen is to simulate a ceiling where the maximum length of the panels is greater than the length of the specimen, then a joint should be positioned at a distance of approximately 600 mm from one of the shorter ends of the test specimen.

If the insulation system is a ceiling which may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the ceiling itself, without the incorporation of these units, to establish the basic performance. A separate test(s) may be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the ceiling.

2.2.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the thicknesses of insulation used in way of the plating and the stiffeners, the method of securing the insulation system and details of the components used for this purpose, details of joints, connections, air gaps and all other details.

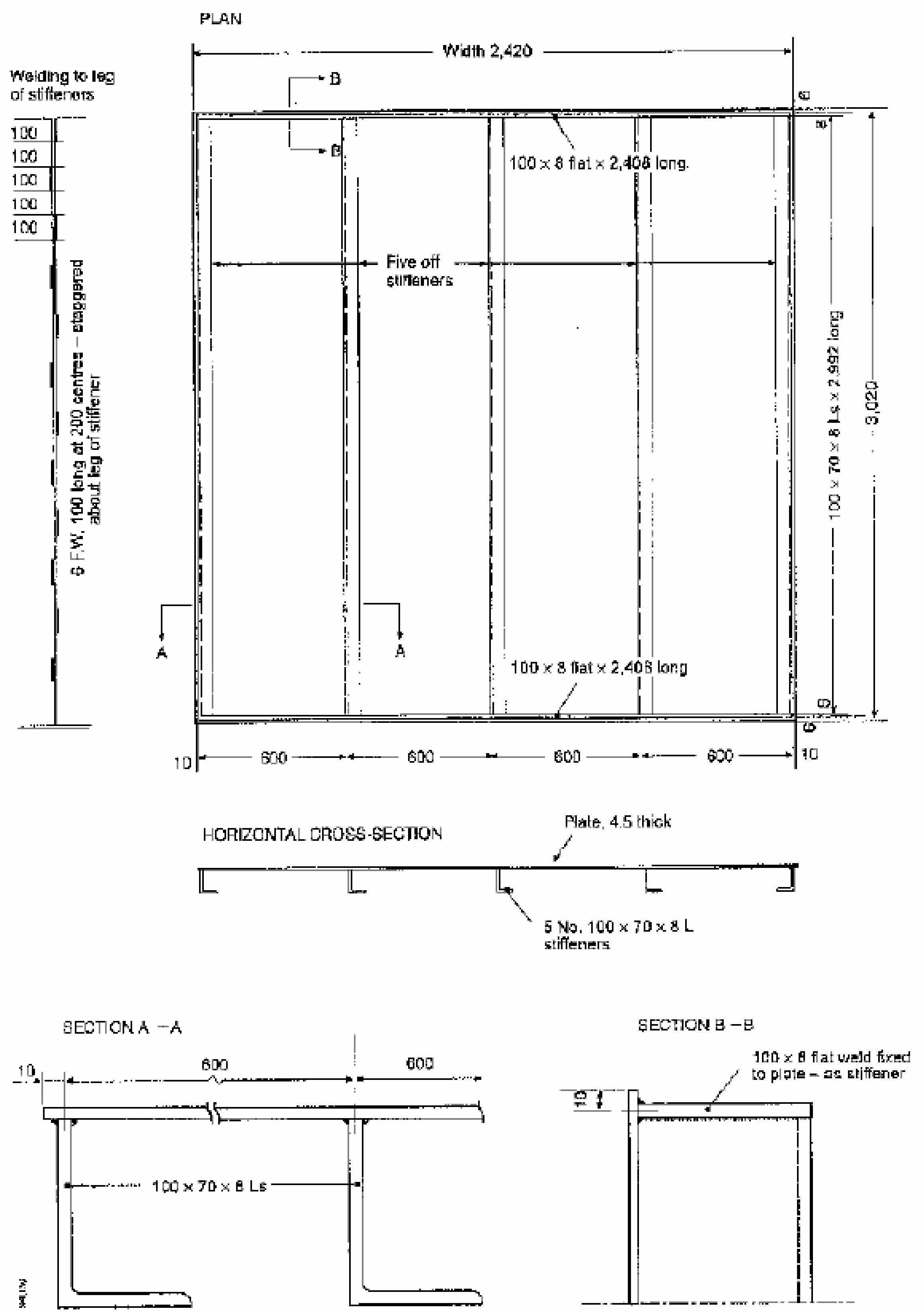
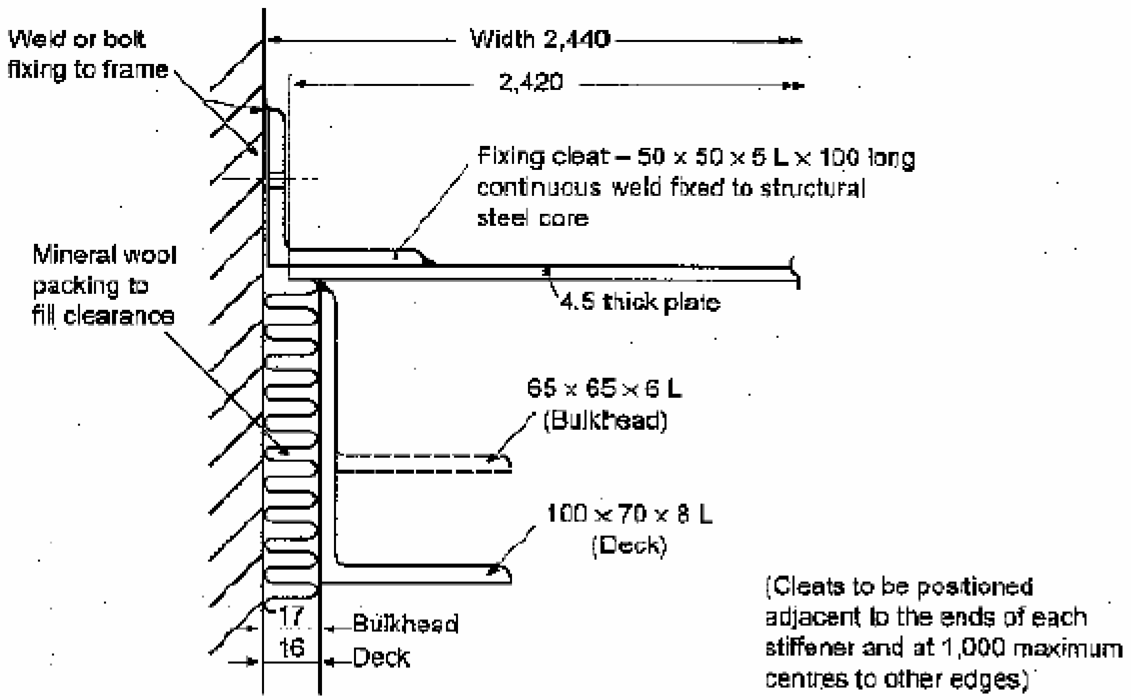


Figure 2 – Structural steel core for "A" class deck and "B" class ceiling

SECTION A – A (see figures 1 and 2)



SECTION B – B (see figures 1 and 2)

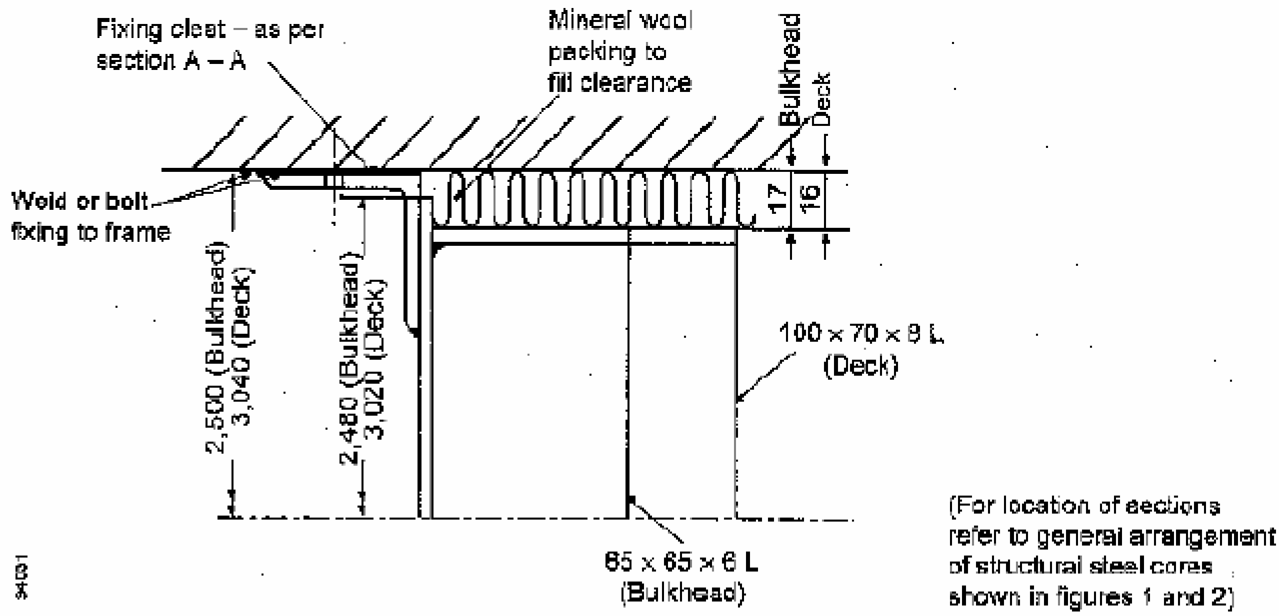


Figure 3 – Connection between restraint frame and structural steel core

2.3 “A” class doors

2.3.1 *Dimensions*

The test specimen should incorporate the maximum size (in terms of both the width and the height) of door leaf or leaves for which approval is to be sought. The maximum size of a door which can be tested will be determined by the requirement to retain certain dimensions of the structural core (see 2.3.2.2).

2.3.2 *Design*

2.3.2.1 The door leaf and frame should be constructed of steel or other equivalent material and insulated as necessary to achieve the desired standard of insulation.

Door furniture such as hinges, locks, latches, shoot bolts, handles, etc. should be constructed of materials having melting points of not less than 950°C.

2.3.2.2 The door leaf and frame should be mounted into a structural core constructed in accordance with 2.1.1.

An opening to accommodate the door assembly should be provided in the structural core; the maximum dimensions of the opening will be determined by a requirement to retain a minimum width of the structural core of 300 mm to each vertical side of the opening and a minimum distance of 100 mm from the top edge of the structural core.

No additional stiffening should be provided to the structural core unless provided as part of the door frame.

The method of fixing the door frame into the opening in the structural core should be as used in practice.

2.3.2.3 The structural core should be mounted such that the stiffeners are on that side which is intended to face away from the heating conditions of the test (i.e. the unexposed face), whilst the insulating system should be on the side intended to be exposed to the heating conditions of the test (i.e. the exposed face).

2.3.2.4 The insulation system should be approved by the Administration to at least the same standard as that which the door is intended to achieve. If the insulation performance of the door is unknown the structural core should be insulated to A-60 standard. The insulation of the structural core should not be extended beyond the outer web of the door frame.

2.3.2.5 The door should be mounted into the structural core such that the side expected to give the inferior performance will be exposed to the heating conditions of the test.

A hinged door should be tested with the door leaf opening away from the heating conditions unless the Administration deems otherwise.

For sliding doors it is not possible to state generally from which side the door should be tested to give the inferior performance. It will, therefore, be necessary to conduct two separate tests, one with the door mounted to the exposed face and one with the door mounted to the unexposed face of the bulkhead. If, for practical reasons, a sliding door cannot be fixed to the stiffened face of the structural core, then, subject to the agreement of the Administration, the stiffeners may be positioned on the exposed face.

2.3.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the following:

– the bulkhead;

– the door leaf and frame construction, including the clearances between the door leaf and the frame;

– the connection of the door frame to the bulkhead;

– the method of securing insulation and details of components used for this purpose (e.g. the type and rate of application of any adhesive);

– fittings such as hinges, shoot bolts, latches, locks, etc.

2.4 "B" and "F" class bulkheads

2.4.1 *Dimensions*

The minimum overall dimensions for the test specimen are given in SOLAS regulation ll-2/3.2, but the recommended dimensions of the test specimen, including the perimeter details at the top, bottom and vertical edges, are 2,440 mm width and 2,500 mm height. When the maximum overall height in practice is to be less than given above, then the test specimen should be of the maximum height to be used in practice.

2.4.2 *Design*

Where the construction incorporates panels, the specimen should be constructed such that at least one of the panels is of full width and this, or these, should be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

If the bulkhead may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the bulkhead itself, without the incorporation of these units, to establish the basic performance. A separate test(s) should be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the bulkhead.

2.4.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the thicknesses of materials used in the insulation system (e.g. of any panels), the method of securing the panels and details of the components used for this purpose, details of joints, connections, air gaps and all other details.

2.5 "B" and "F" class decks

2.5.1 *Dimensions*

The minimum overall dimensions for the test specimen are given in SOLAS regulation ll-2/3.2, but the recommended dimensions of the test specimen, including the perimeter details at all the edges, are 2,440 mm width and 3,040 mm length. When the maximum dimensions in practice are less than given above then the test specimen should be of the maximum size to be used in practice.

2.5.2 *Design*

Where the construction incorporates panels, the specimen should be constructed such that at least one of the panels is of full width and this, or these, should be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

2.5.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that confirm agreement between the actual specimen and the drawings and the laboratory is able to specifications prior to the test. The drawings should include dimensions and details of the thicknesses of materials used in the insulation system (e.g. of any panels), the method of securing the insulation system and details of the components used for this purpose, details of joints, connections, air gaps and all other details.

2.6 "B" and "F" class doors

2.6.1 *Dimensions*

The test specimen should incorporate the maximum size (in terms of both the width and the height) of door leaf or leaves for which approval is to be sought. The maximum size of a door which can be tested will be determined by the requirement to retain certain dimensions of the bulkhead (see 2.6.2.3).

2.6.2 *Design*

2.6.2.1 Door furniture such as hinges, locks, latches, shoot bolts, handles, etc. should be constructed of materials having melting points of not less than 850°C unless it can be shown by the fire test that materials having melting points below 850°C do not adversely affect the performance of the door.

2.6.2.2 The door leaf and frame should be mounted as appropriate into a "B" or "F" class bulkhead of compatible construction, thereby reflecting an actual end use situation. The bulkhead should have dimensions as prescribed in 2.4.1.

The bulkhead should be of a construction approved by the Administration as having at least a similar classification to that required by the door.

The method of fixing the door frame to the bulkhead should be as used in practice.

"B" class doors should be fire tested in B class steel bulkheads of dimensions as stated in paragraph 2.4.1 of resolution A.754(18), otherwise approval should be limited to the type of construction in which the door was tested. (MSC/Circ.916)

2.6.2.3 The door should be positioned such that there is a minimum width of the bulkhead of 300 mm to each vertical side of the door and a minimum distance of 100 mm from the top edge of the bulkhead.

2.6.2.4 The door should be mounted into the bulkhead such that the side expected to give the inferior performance will be exposed to the heating conditions of the test.

A hinged door should be tested with the door leaf opening away from the heating conditions unless the Administration deems otherwise.

For sliding doors it is not possible to state generally from which side the door should be tested to give the inferior performance. It will, therefore, be necessary to conduct two separate tests, one with the door mounted to the exposed face and one with the door mounted to the unexposed face of the bulkhead.

2.6.2.5 For a door which incorporates a ventilation opening within its construction, the ventilation grille(s) should be open at the commencement of the test. Temperature measurements on such a door should not be made over the face of the grille(s).

2.6.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, Such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the following:

– the bulkhead;

– the door leaf and frame construction, including the clearances between the door leaf and the frame;

– the connection of the door frame to the bulkhead;

– the method of securing insulation and details of components used for this purpose (e.g. the type and rate of application of any adhesive);

– fittings such as hinges, shoot bolts, latches, locks, handles, ventilation louvres, escape panels, etc.

2.7 "B" and "F" class linings

2.7.1 *Dimensions*

The minimum overall dimensions for the test specimen are given in SOLAS regulation lI-2/3.2, but the recommended dimensions of the test specimen, including the perimeter details at the top, bottom and vertical edges, are 2,440 mm width and 2,500 mm height. Irrespective of the overall dimensions, the width and the height of the lining should each be 20 mm greater than the equivalent dimensions of the structural core.

2.7.2 *Design*

The lining should be positioned alongside a structural core constructed in accordance with 2.1.1. The design of the lining should be such that it facilitates its assembly with the limited access provided by the proximity of the structural core, i.e. it should be mounted with the structural core in place.

During a test on an "A" class bulkhead which utilizes membrane protection along its exposed side, e.g. a "B" class lining, it is possible also to evaluate the performance of the lining with a view to classification providing that the necessary thermocouples are attached to the lining and providing that the necessary integrity measurements are made.

The specimen should be constructed such that at least one of the panels is of full width and this, or these, should be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

If the lining may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the lining itself, without the incorporation of these units, to establish the basic performance. A separate test(s) may be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the lining.

2.7.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the thicknesses of materials used in the insulation system(e.g. of any panels), the method of securing the insulation system and details of the components used for this purpose, details of joints, connections, air gaps and all other details.

2.8 "B" and "F" class ceilings

2.8.1 *Dimensions*

The minimum overall dimensions for the test specimen are given in SOLAS regulation ll-2/3.2, but the recommended dimensions of the test specimen, including the perimeter details at all edges, are 2,440 mm width and 3,040 mm length. Irrespective of the overall dimensions, the width and the length of the ceiling should each be 20 mm greater than the equivalent dimensions of the structural core.

2.8.2 *Design*

The ceiling should be positioned below a structural core constructed in accordance with 2.2.1. The design of the ceiling should be such that it facilitates its assembly with the limited access provided by the proximity of the structural core, i.e. it should be mounted with the structural core in place.

During a test on an "A" class deck which utilizes membrane protection along its underside, e.g. a "B" class ceiling, it is possible also to evaluate the performance of the ceiling with a view to classification providing that the necessary thermocouples are attached to the ceiling and providing that the necessary integrity measurements are made.

If the ceiling incorporates panels, the specimen should include examples of both the lateral and longitudinal joints between the panels. If the specimen is to simulate a ceiling where the maximum length of the panels is greater than the length of the specimen, then a joint should be positioned at a distance of approximately 600 mm from one of the shorter ends of the test specimen.

The specimen should be constructed such that at least one of the panels is of full width and this, or these, should be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

If the ceiling may incorporate electrical fittings, e.g. light fittings and/or ventilation units, it is necessary that initially a test is performed on a specimen of the ceiling itself, without the incorporation of these units, to establish the basic performance. A separate test(s) may be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the ceiling.

Where testing is conducted on a perforated ceiling system, equally constructed non perforated ceilings and ceilings with a lesser degree of perforations (in terms of size, shape, and perforations per unit area) may be approved without further testing. (MSC/Circ.1120)

2.8.3 *Description*

The applicant should provide full constructional details of the test specimen in the form of drawings (including a detailed schedule of components) and method of assembly, such that the laboratory is able to confirm agreement between the actual specimen and the drawings and specifications prior to the test. The drawings should include dimensions and details of the thicknesses of materials used in the insulation system(e.g. of any panels), the method of securing the insulation system and details of the components used for this purpose, details of joints, connections, air gaps and all other details.

3 MATERIALS FOR TEST SPECIMENS

3.1 Specifications

Prior to the test, the following information should be submitted to the laboratory by the applicant for each of the materials used in the construction:

- the identification mark and trade name;
- principal details of composition;
- nominal thickness;
- nominal density (for flexible materials this should be related to the nominal thickness);
- nominal equilibrium moisture content (at relative humidity of 50% and a temperature of 23°C);
- specific heat at ambient temperature,.
- thermal conductivity at ambient temperature.

The density of each material used in the test specimen should be within +/- 10% of the value stated as the nominal density.

Where materials used in the construction of the specimen are required to be non-combustible, i.e. for "A" class and "B" class, evidence in the form of test reports in accordance with the test method for qualifying marine construction materials as non-combustible, developed by the Organization, and from a testing laboratory recognized by the Administration and independent of the manufacturer of the material should be provided. These test reports should not be more than 24 months old at the date of the performance of the fire resistance test. If such reports cannot be provided then tests as prescribed in 3.2.3 below should be conducted.

3.2 Control measurements

3.2.1 *General*

The testing laboratory should take reference specimens of all those materials whose characteristics are important to the performance of the specimen (excluding steel and equivalent material). The reference specimens should be used for the non-combustibility test, if appropriate, and for the determination of the thickness, the density and, where appropriate, the moisture and/or binder content.

The reference specimens for sprayed materials should be made when the material is sprayed on the structural core and they should be sprayed in a similar manner and in the same orientation.

The laboratory should conduct the following control tests, as appropriate to the type of material and the proposed classification, on the reference specimens after they have been conditioned as specified in section 4.

For the determination of the thickness, the density and the moisture and/or binder content three specimens should be used, and the value quoted as the mean of the three measurements.

3.2.2 *Encapsulated materials*

When an insulation material is encapsulated within the construction and it is not possible for the laboratory to take specimens of the material prior to the test for conducting the control measurements, the applicant should be requested to provide the requisite samples of the material. In these cases it should be clearly stated in the test report that the measured properties were determined from samples of the material provided by the applicant for the test.

Notwithstanding the above, the laboratory should attempt, wherever possible, to verify the properties by using samples which may be cut from the specimen before test or by checking against similar properties determined after test. When samples of the material are cut from the test specimen before test, the specimen should be repaired in a manner such that its performance in the fire test is not impaired.

3.2.3 *Non-combustibility*

If necessary (see 3.1), non-combustibility tests in accordance with the test method for qualifying marine construction materials as non-combustibility, developed by the Organization, should be conducted. Adhesives used in the construction of the specimen are not required to be non-combustible; however, they are recommended to have low flame-spread characteristics.

3.2.4 *Thickness*

The thickness of each material and combination of materials should be measured by using a suitable gauge or callipers.

The thickness of a sprayed insulation material should be measured using a suitable probe at positions adjacent to each of the unexposed-face thermocouples referred to in 7.5.1 and 7.5.l.2.

3.2.5 *Density*

The density of each material should be determined from measurement of the weight and the dimensions. The density of mineral wool or any similar compressible material should be related to the nominal thickness.

3.2.6 *Moisture content*

Specimens of each material, measuring minimum 60 mm x 60 mm x thickness of the material, should be weighed (initial conditioned weight W_1) and then heated in a ventilated oven at a temperature of 105 +/- 2°C for 24 h and reweighed when cooled (W_2). However, gypsum-based, cementation and similar materials should be dried at a temperature of 55 +/- 5°C to constant weight (W_2).

The moisture content (W_1-W_2) of each specimen should be calculated as a percentage of the dry weight (W_2).

3.2.7 *Binder content*

After the percentage moisture contents have been calculated as specified above, the specimens should be further heated in an oven at a temperature of 550 +/- 20°C for 24 h and again weighed (W_3). The binder content (W_2-W_3) should be calculated as a percentage of the dry weight (W_2).

4 CONDITIONING OF THE TEST SPECTMENS

4.1 General

The test specimen should not be tested until it has reached an air-dry condition. This condition is defined as an equilibrium (constant weight) with an ambient atmosphere of 50% relative humidity at 23°C.

Accelerated conditioning is permissible provided the method does not alter the properties of component materials. In general, high-temperature conditioning should be below temperatures critical for the materials.

4.2 Verification

The condition of the test specimen can be monitored and verified by use of special samples for the determination of moisture content of constituent materials, as appropriate. These samples should be so constructed as to represent the loss of water vapour from the specimen by having similar thicknesses and exposed faces. They should have minimum linear dimensions of 300 mm by 300 mm and a minimum mass of 100 g. Constant weight should be considered to be reached when two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.3% of the mass of the reference specimen or 0.3 g, whichever is the greater.

Other reliable methods of verifying that the material has reached equilibrium moisture content may be used by the testing laboratory.

4.3 Encapsulated materials

When the test specimen incorporates encapsulated materials it is important to ensure that these materials have reached an equilibrium moisture content prior to assembly, and special arrangements should be made with the applicant for the test to ensure that this is so.

5 MOUNTINC OF THE TEST SPECTMENS

5.1 Restraint and support frames

All test specimens should be mounted within substantial concrete, or concrete or masonry-lined, frames which are capable of providing a high degree of restraint to the expansion forces generated during the tests. The concrete or the masonry should have a density between 1,600 kg/m^3 and 2,400 kg/m^3. The concrete or masonry lining to a steel frame should have a thickness of at least 50 mm.

The rigidity of the restraint frames should be evaluated by applying an expansion force of 100 kN within the frame at mid-width between two opposite members of the frame and measuring the increase in the internal dimensions at these positions. This evaluation should be conducted in the direction of the bulkhead or deck stiffeners, and the increase of the internal dimension should not exceed 2 mm.

For frames which are to be used to evaluate “A” class divisions which incorporate “B” class ceilings, the frames should be provided with at least four viewing and access openings, notionally one to each quarter of the test specimen. These openings should facilitate access to the cavity for the determination of the integrity of the ceiling or lining during the test on the deck or bulkhead. The access/viewing openings should normally be sealed with mineral wool insulation slabs except when viewing or accessing to the ceiling or lining is needed.

5.2 “A” class divisions

The structural core to an “A” class division should be fixed into the restraint frame and sealed around its perimeter as shown in figure 3. Steel spacers, with an approximate thickness of 5 mm, may be inserted between the fixing cleats and the restraint frame if the laboratory finds this necessary.

When the structural core of an “A” class division is to be exposed to the heating conditions of the test, i.e. when the fixing cleats are on the exposed side of the structural core, then a 100 mm wide perimeter margin adjacent to the restraint frame should be insulated such that the fixing cleats and the edges of the structural core are protected from direct exposure to the heating conditions. In no other situations, irrespective of the type of test specimen, should the perimeter edges be protected from direct exposure to the heating conditions.

5.3 “B” and “F” class divisions

For a “B” or “F” class bulkhead or lining, the specimen should be supported at the top and secured on the vertical sides and at the bottom in a manner representative of the conditions in service. The support provided at the top of a bulkhead or lining should allow for the appropriate expansion or clearance to be used as in practice. At the vertical edges lateral expansion towards the vertical edges of the restraint frame should be prevented by ensuring a tight fit of the specimen within the frame which may be achieved by inserting a rigid packing between the vertical edges and the frame. lf provision for movement at the edges of a bulkhead or lining is made for a particular construction in service, the specimen should simulate these conditions.

For a “B” or “F” class ceiling, expansion of the ceiling members should be prevented at the perimeter edges since the specimen is intended to simulate a part of a ceiling removed from a much greater area. Expansion should be prevented by ensuring a tight fit of the specimen within the frame which may be achieved by inserting a rigid packing between the ends or edges of ceiling members and the restraint frame. Only if the ceiling is being tested at full size in one or more directions is it allowed to incorporate the expansion allowance at the perimeter edges in the appropriate direction or directions.

6 EXAMINATION OF THE TEST SPECIMENS

6.1 Conformity

The laboratory should verify the conformity of the test specimen with the drawings and method of assembly provided by the applicant (see section 2), and any area of discrepancy should be resolved prior to commencement of the test.

On occasion it may not be possible to verify the conformity of all aspects of the specimen construction prior to the test and adequate evidence may not be available after test. When it is necessary to rely on information provided by the applicant then this should be clearly stated in the test report. The laboratory should nevertheless ensure that it fully appreciates the design of the test specimen and should be confident that it is able to accurately record the constructional details in the test report.

6.2 Door clearances

Following mounting of the door and immediately prior to test, the laboratory should measure the actual clearances between the door leaf and the door frame, and additionally for a double leaf door between the adjacent door leaves. The clearances should be measured for each door leaf at two positions along the top and bottom edges and at three positions along each vertical edge.

6.3 Door operation

Similarly, immediately prior to test, the laboratory should check the operability of the door by opening the door leaf by a distance of at least 300 mm. The door leaf should then be closed, either automatically, if such a closing device is provided, or manually. The door may be latched for the test but should not be locked, and no devices for latching or locking should be included which are not normally incorporated in practice.

7 INSTRUMENTATION

7.1 General

The furnace, the instrumentation of the furnace and the instrumentation of the test specimen should generally be in accordance with the International Standard ISO 834: Part 1, except where amended by this section. The details given in the following paragraphs are supplementary to, an elaboration of, or a deviation from the ISO requirements.

7.2 Furnace temperature thermocouples

7.2.1 *Design*

The furnace temperature should be measured by thermocouples as shown in figure 4. They may be either thermocouples of bare-wire design or sheathed thermocouples having an equivalent response time to that of bare-wire thermocouples. The bare-wire thermocouples should have a wire diameter of between 0.75 and 1.00 mm and a welded or crimped junction. At least 25 mm of wire should project from the insulation. Bare-wire thermocouples should be checked at least after every 20 h of use, and stainless-steel-sheathed thermocouples should be checked at least after every 50 h of use, to establish their accuracy and sensitivity. If any doubt exists as to their serviceability, they should be replaced.

7.2.2 *Number*

At least six furnace thermocouples should be provided for the specimens given in section 2. For specimens larger than specified in section 2, additional thermocouples should be provided in the proportion one per 1.5 m^2 of the specimen area. In the case of a door assembly, specimen area refers to the entire bulkhead construction with the door fitted.

7.2.3 *Positioning*

The thermocouples employed to measure the temperature of the furnace should be uniformly distributed so as to give a reliable indication of the average temperature in the vicinity of the specimen. At the commencement of the test the measuring junctions should be 100 mm from the face of the specimen and they should be maintained at a distance of 50 mm to 150 mm during the test. The method of support should ensure that thermocouples do not fall away or become dislodged during the test. Where it is convenient to pass thermocouple wires through the test construction, then the steel support tube should not be used. The hot junctions of the thermocouples should not be located at positions within the furnace where they are subject to direct flame impingement.

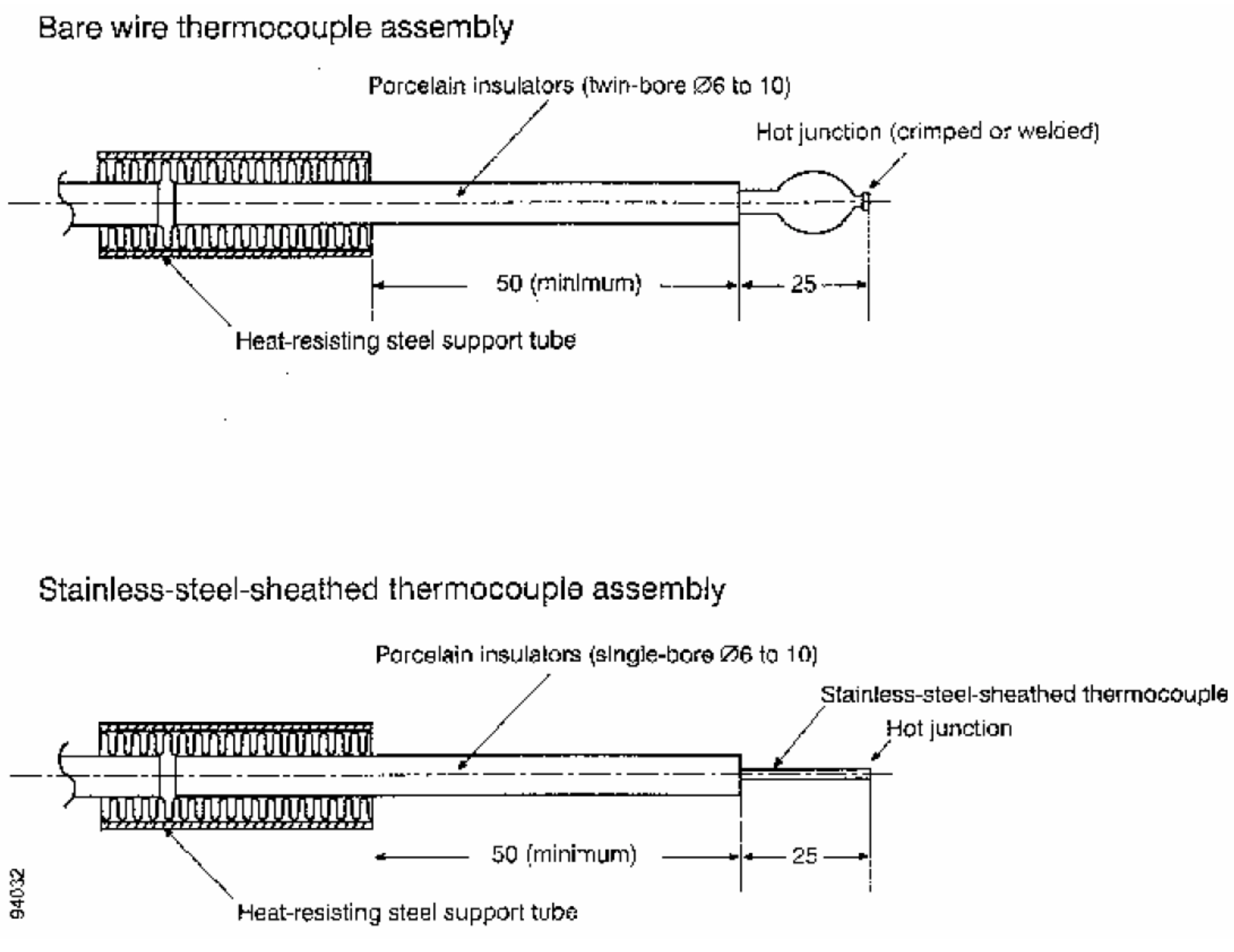


Figure 4 – Furnace thermocouple assembly

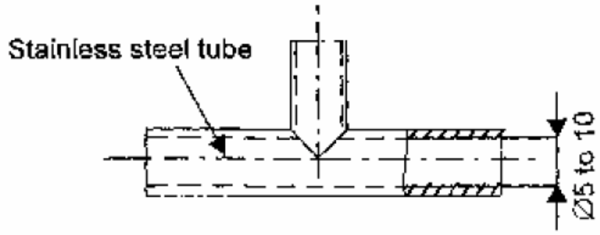
7.2.4 *Connection*

The thermocouple wire should be either continuous to the recording instrument or suitable compensating wire should be used with all junctions maintained as near as possible at ambient temperature conditions.

7.3 Furnace pressure sensors

The mean value of the furnace pressure should be measured using one of the designs of sensing heads described in figure 5.

Type 1 – T-shaped sensor



Note: Tee branches shall be horizontally oriented

Type 2 – tube sensor

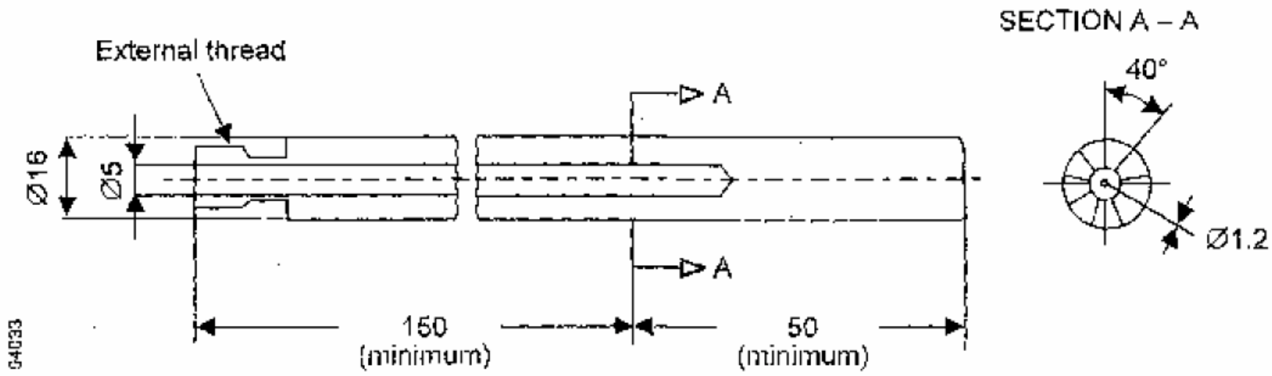


Figure 5 – Pressure-sensing heads

7.4 Unexposed-face temperature thermocouples

7.4.1 *Design*

The temperature of the unexposed surface should be measured by means of disc thermocouples of the type shown in figure 6. Thermocouple wires, 0.5 mm in diameter, should be soldered to a 0.2 mm thick by 12 mm diameter copper disc. Each thermocouple should be covered with a 30 mm square x 2.0 +/- 0.5 mm thick non-combustible insulating pad. The pad material should have a density of 900 +/- 100 kg/m^3.

7.4.2 *Connection*

Connection to the recording instrument should be by wires of similar or appropriate compensating type.

7.4.3 *Preparation of surfaces to receive thermocouples*

Steel – Surface finishes should be removed and the surface cleaned with a solvent. Loose rust and scale should be removed by Wire brush.

Irregular surfaces – A smooth surface, not greater than 2,500 mm^2, to provide adequate adhesive bond should be made for each thermocouple by smoothing the existing surface with a suitable abrasive paper. The material removed should be the minimum to provide adequate bonding surface. Where the surface cannot be smoothed, fillings should be used of minimum quantity to provide a suitable surface. The filling should comprise a ceramic cement and when the filled surface is dry it should be smoothed, if necessary, with abrasive paper.

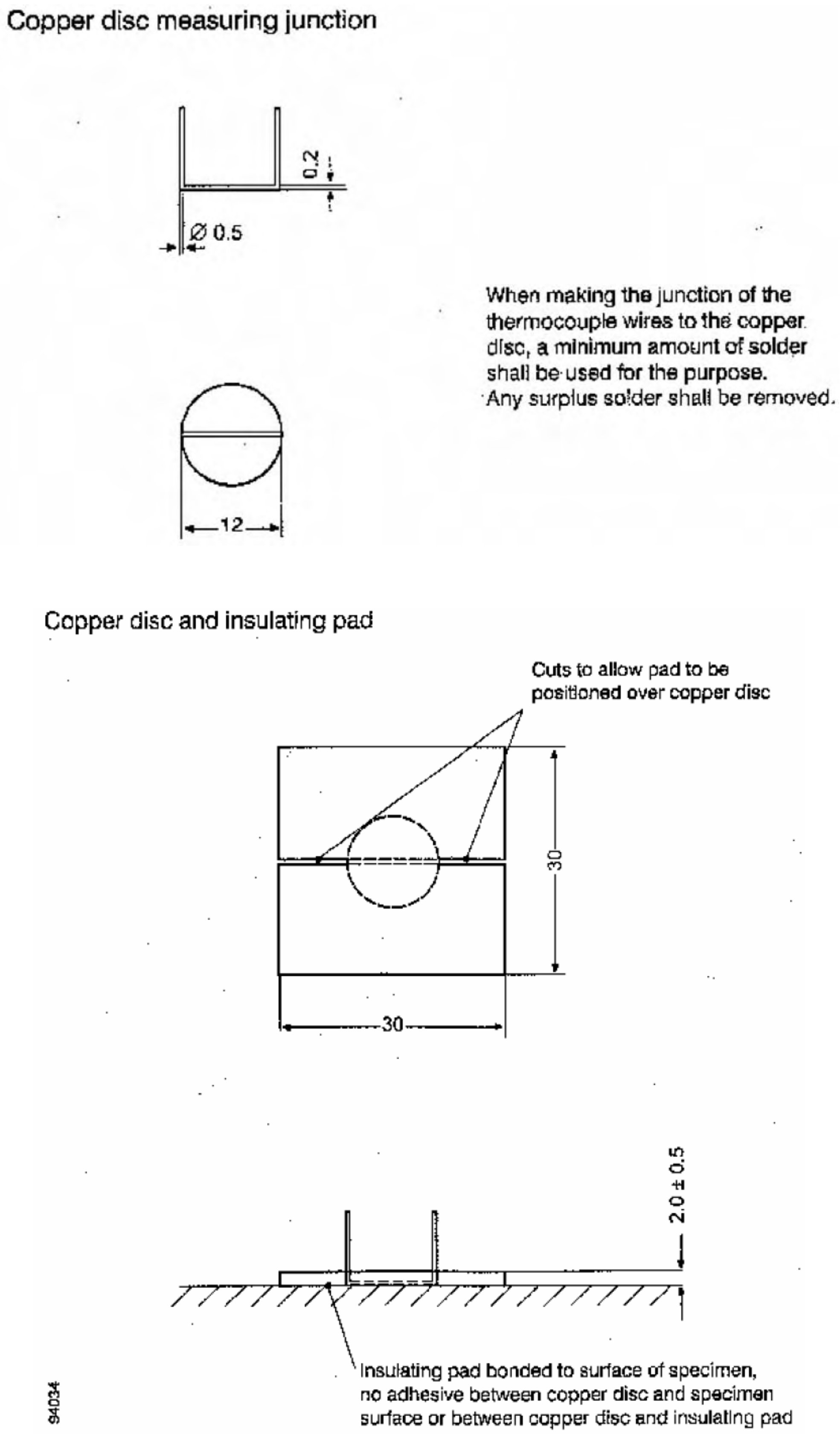


Figure 6 – Unexposed-surface thermocouple junction and insulating pad

7.4.4 *Fixing of thermocouples*

Steel – The insulating pad with the thermocouple fitted should be bonded to the cleaned surface of the steel using a "water-based ceramic cement" produced by integrating the components to form a high-temperature-resistant adhesive. The adhesive should be of such a consistency that no mechanical aid is necessary for retention purposes during the drying process, but, where difficulty in bonding is experienced, retention by adhesive tape may be employed provided that the tape is removed sufficiently Ions in advance of the test to allow complete drying of the adhesive. Care is required in the removal of the tape to ensure that the insulating pad is not damaged. If the thermocouple pad is damaged when the tape is removed then the thermocouple should be replaced.

Mineral wool – The thermocouples with insulating pads fitted should be arranged in such a way that if a surface wire mesh is present it may aid retention, and in all cases the bond to the fibrous surface should be made using a "contact adhesive". The nature of the adhesive necessitates a drying time before mating surfaces are put together, thus obviating the need for external pressure.

Mineral fibre spray – Thermocouples should not be fitted until the insulation has reached a stable moisture condition. In all cases the bonding technique for steel should be used and where a surface wire mesh is present the thermocouples should be affixed to the insulation in such a way that the wire mesh aids retention.

Vermiculite/cement type spray – The technique specified for wet fibrous spray should be employed.

Boards of fibrous or mineral aggregate composition – The bonding technique for steel should be used.

In all cases of adhesive binding the adhesive should be applied in a thin film sufficient to give an adequate bond and there should be a sufficient lapse of time between the bonding of the thermocouples and the test for stable moisture conditions to be attained in the case of the ceramic adhesive and evaporation of the solvent in the case of the "contact adhesive".

For "A" and "B" class divisions the insulation performance of a construction should be given by that part of the construction which is manufactured from non-combustible materials only. However, if a material or panel is only produced with a superimposed finish, or if the Administration considers that the addition of a superimposed finish may be detrimental to the performance of the division, the Administration may allow, or may require, the finish to be incorporated during the test. In these cases the superimposed finish should be removed locally over as small an area as possible to allow fixing of the thermocouples to the non-combustible part, e.g. a deck provided with overlayed non-combustible insulation (a floating floor) should have any combustible top surface finish removed locally to the thermocouples to allow them to be fixed to the insulation material.

7.5 Positioning of thermocouples on the specimen

7.5.1 *"A" class divisions, excluding doors*

The surface temperatures on the unexposed face of the test specimen should be measured by thermocouples located as shown in figures 7 and 8:

.1 five thermocouples, one at the centre of the test specimen and one at the centre of each of the four quarters, all positioned at least 100 mm away from the nearest part of any joints and/or at least 100 mm away from the welds to any stiffeners;

.2 two thermocouples, one placed over each of the central stiffeners and for a bulkhead at 0.75 height of the specimen and for a deck at mid-length of the deck;

.3 two thermocouples, each paced over a vertical (longitudinal) joint, if any, in the insulation system and positioned for a bulkhead at 0.75 height of the specimen and for a deck at mid-length of the deck;

.4 when a construction has two differently orientated joint details, for example normal to each other, then two thermocouples additional to those already described in 7.5.1.3 above should be used, one on each of two intersections;

.5 when a construction has two different types of joint detail, then two thermocouples should be used for each type of joint;

.6 additional thermocouples, at the discretion of the testing laboratory or Administration, may be fixed over special features or specific construction details if it is considered that temperatures higher than those measured by the thermocouples listed above may result; and

.7 the thermocouples specified in 7.5.1.4 to 7.5.1.6 above for measurements on bulkheads, e.g. over different joint types or over joint intersections, should, where possible, be positioned in the upper half of the specimen.

7.5.2 *"B" and "F" class divisions, excluding doors*

The surface temperatures on the unexposed face of the test specimen should be measured by thermocouples located as shown in figure 9:

.1 five thermocouples, one at the centre of the test specimen and one at the centre of each of the four quarters, all positioned at least 100 mm away from the nearest part of any joints;

.2 two thermocouples, each placed over a vertical (longitudinal) joint, if any, in the division/ insulation system and positioned for a bulkhead at 0.75 height of the specimen and for a deck/ceiling at mid-length of the deck/ceiling; and

.3 additional thermocouples, as required by 7.5.1.4 to 7.5.1.7 above.

7.5.3 *"A", "B" and "F" class doors*

The surface temperatures on the unexposed face of the test specimen should be measured by:

.1 five thermocouples, one at the centre of the door leaf and one at the centre of each of the four quarters of the door leaf, all positioned at least 100 mm away from the edge of the door leaf, from any stiffeners, from any door furniture and from any special features or specific constructional details;

.2 if the door leaf incorporates stiffeners, two additional thermocouples, one placed over each of two stiffeners in the central portion of the door;

.3 additional thermocouples, at the discretion of the testing laboratory or Administration, may be fixed over special features or specific constructional details if it is considered that temperatures higher than those measured by the thermocouples listed above may result. Any additional thermocouples fixed to the door frame, or to any part of the door leaf, which is closer than a distance of 100 mm from the gap between the edge of the door leaf and the frame should not be used for the purpose of classification of the test specimen, and if provided are for information only;

.4 the thermocouples specified in 7.5.3.2 and 7.5.3.3 above should, where possible, be positioned in the upper half of the specimen; and

.5 when testing double-leaf door assemblies, the requirements should be applied to each door leaf separately.

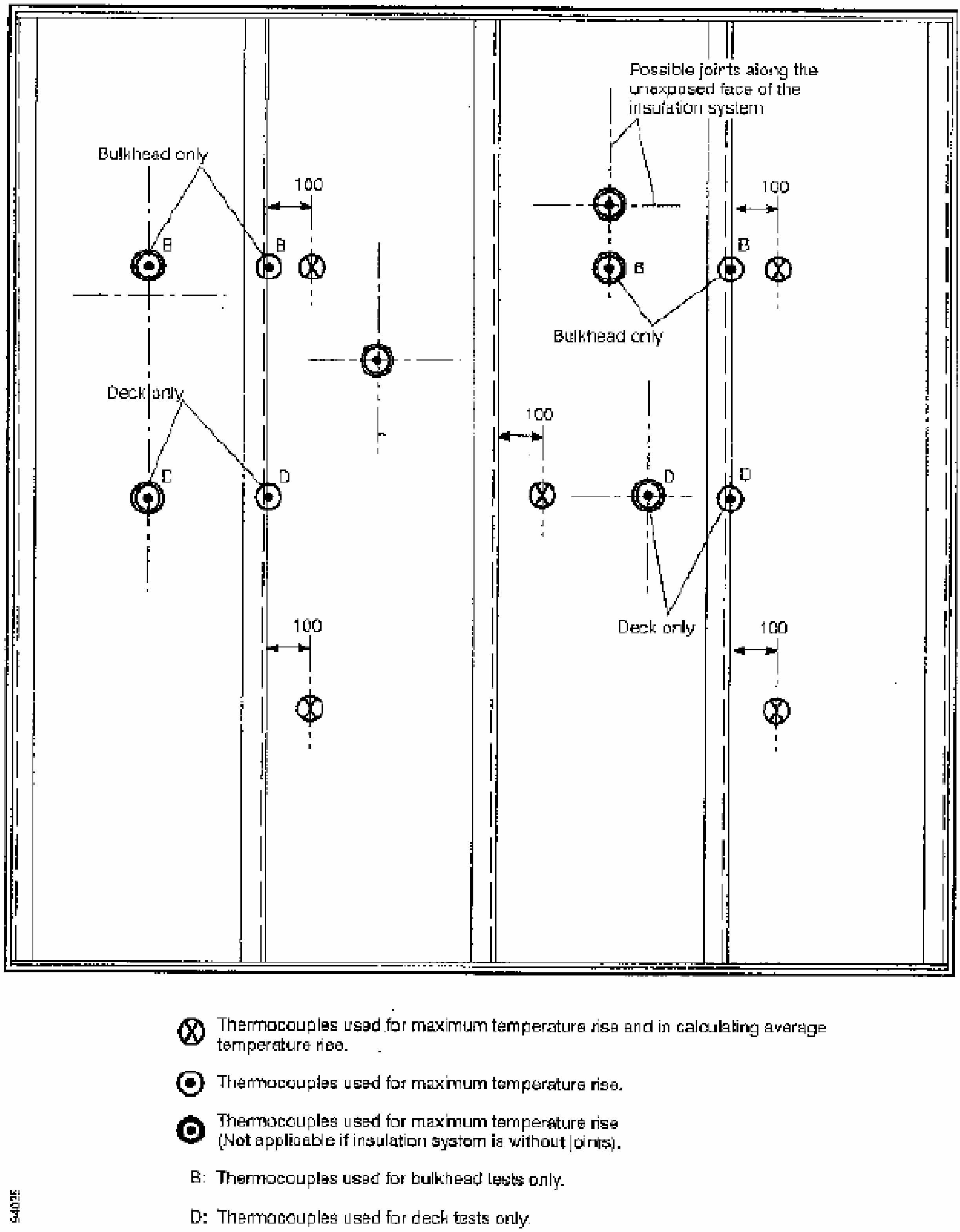


Figure 7 – Position of unexposed-face thermocouples for "A" class division :insulated face to the laboratory

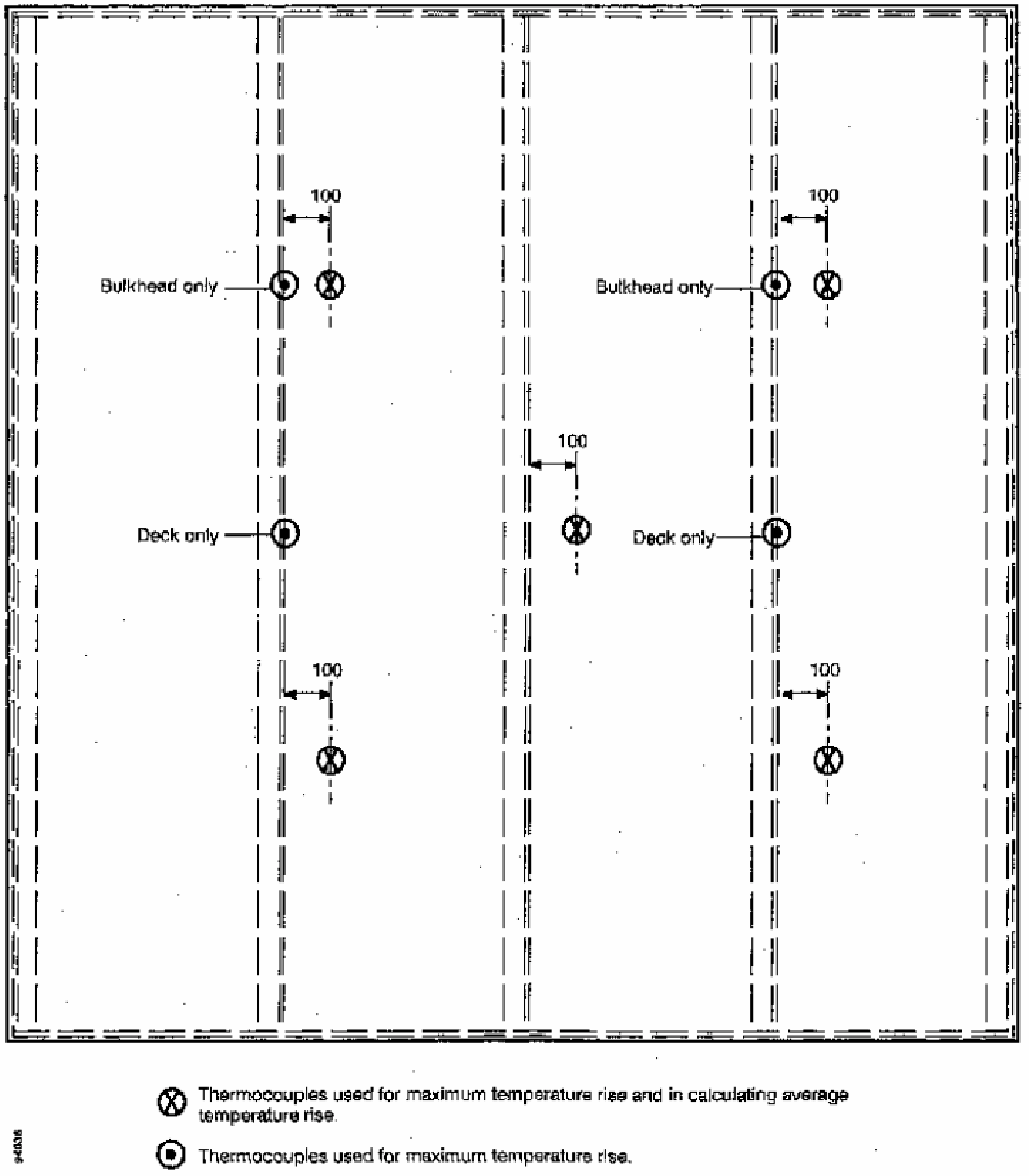


Figure 8 – Position of unexposed-face thermocouples for "A" class division : flat face of structural steel core to the laboratory

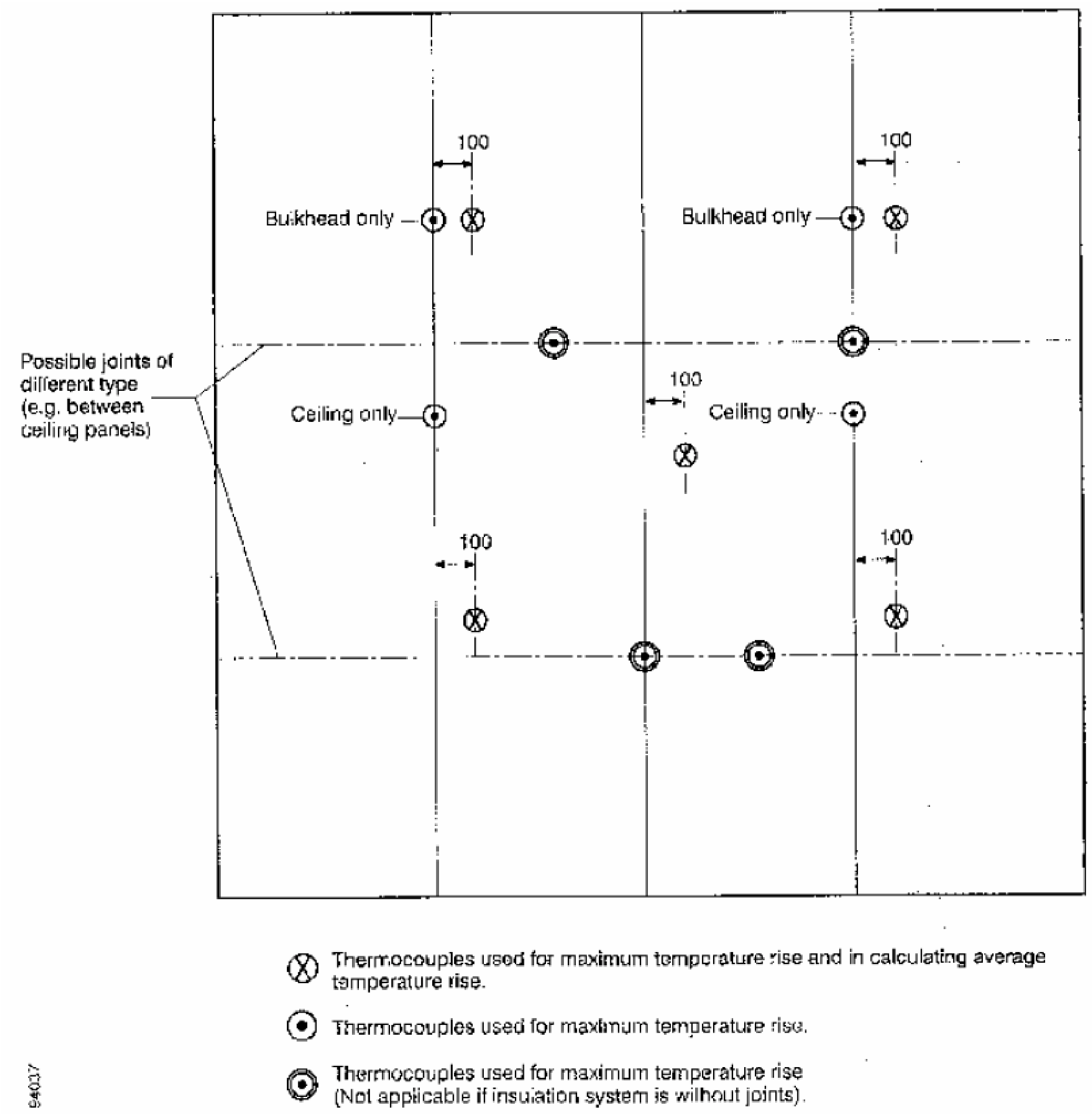


Figure 9 – Position of unexposed-face thermocouples for "B" and "F" class division

7.6 Structural core temperature thermocouples

When testing a specimen with a structural core other than steel, thermocouples should be fixed to the core material in positions corresponding to the surface thermocouples mentioned in 7.5.1.1.

The thermocouples should be fixed so that their hot junctions are attached to the appropriate positions by suitable means, including peening into the structural core. The wires should be prevented from becoming hotter than the junction. The first 50 mm should be in an isothermal plane.

7.7 Cotton-wool pads and gap gauges

7.7.1 *Cotton-wool pads*

The cotton-wool pad employed in the measurement of integrity should consist of new, undyed and soft cotton fibres, 20 mm thick x 100 mm square, and should weigh between 3 g and 4 g. It should be conditioned prior to use by drying in an oven at 100+/- 5°C for at least 30 min. After drying, it should be allowed to cool to ambient temperature within a desiccator, where it may be stored until needed to be used. For use it should be mounted in a wire frame, as shown in figure 10, provided with a handle.

7.7.2 *Gap gauges*

Two types of gap gauge, as shown in figure 11, should be available for the measurement of integrity. They should be made of stainless steel of the diameter specified to an accuracy of +/- 0.5 mm. They should be provided with appropriate handles.

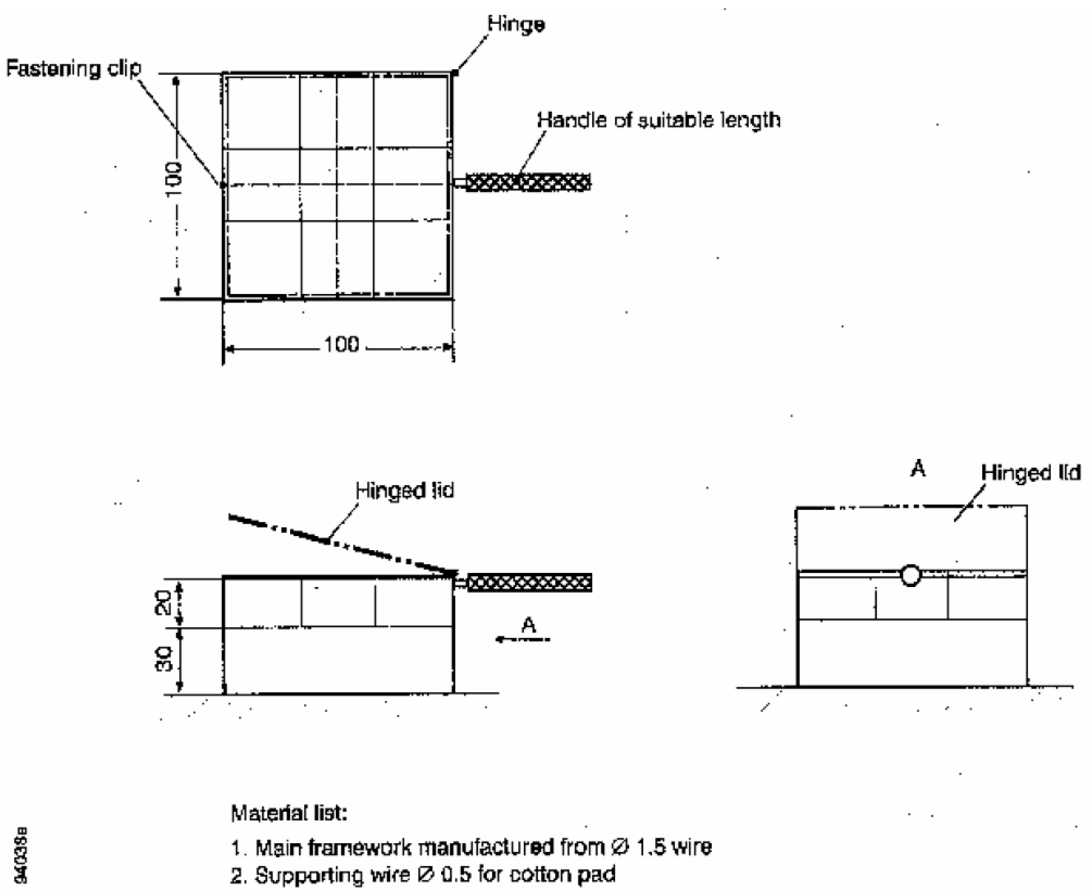


Figure 10 – Cotton pad holder

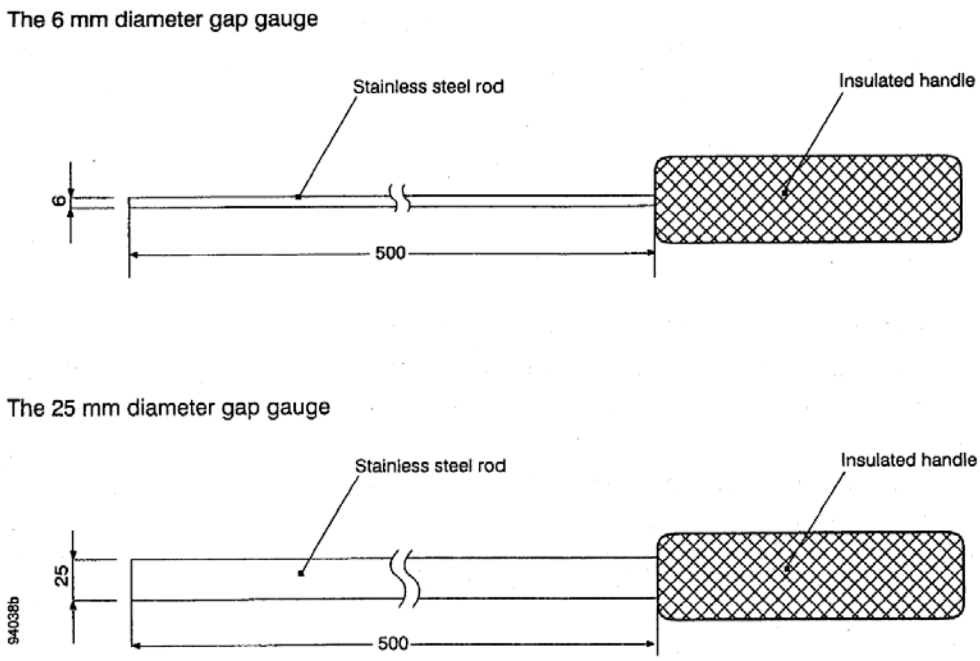


Figure 11 – Gap gauges

8 METHOD OF TEST

8.1 General

The test should be carried out generally in accordance with the International Standard ISO 834: Part 1, except where amended by this section. The procedures given in the following paragraphs are supplementary to, an elaboration of, or a deviation from the ISO requirements.

8.2 Commencement of test

Not more than 5 min before the commencement of the test, the initial temperatures recorded by all thermocouples should be checked to ensure consistency and the datum values should be noted. Similar datum values should be obtained for deformation, and the initial condition of the test specimen should be noted.

At the time of the test, the initial average internal temperature and unexposed surface temperature of the specimen should be 20 +/- 10°C and should be within 5°C of the initial ambient temperature.

8.3 Furnace control

8.3.1 Furnace temperature

8.3.1.1 The average temperature of the furnace as derived from the furnace thermocouples specified in 7.2 should be monitored and controlled such that it follows the relationship (i.e. the standard heating curve)

$$T = 345 \log_{10} (8t+1) + 20$$

where:

T is the average furnace temperature (°C)

t is the time (minutes)

8.3.1.2 The following points are defined by the above relationship:

- at the end of the first 5 min 576°C
- at the end of the first 10 min 679°C
- at the end of the first 15 min 738°C
- at the end of the first 30 min 841°C
- at the end of the first 60 min 945°C

8.3.1.3 The per cent deviation 'd' in the area of the curve of the average temperature recorded by the specified furnace thermocouples versus time from the area of the standard heating curve should be within:

+/- 15%	from $t = 0$ to $t = 10$	(i)
+/- 15 - 0.5 (t - 10)%	from $10 < t < 30$	(ii)
+/- 5 - 0.083 (t - 30)%	from $30 < t < 60$	(iii)
+/- 2.5%	from $t = 60$ and above	(iv)

where:

$d = (A - A_s) \times 1/A_s \times 100$, and

A is the area under the actual average furnace time-temperature curve

A_s is the area under the standard time-temperature curve

All areas should be computed by the same method, i.e. by the summation of areas at intervals not exceeding 1 min for (i), 2 min for (ii), and 5 min for (iii) and (iv)

8.3.1.4 At any time after the first 10 min of test, the temperature recorded by any thermocouple should not differ from the corresponding temperature of the standard time-temperature curve by more than +/- 100°C.

8.3.2 *Furnace pressure*

8.3.2.1 A linear pressure gradient exists over the height of a furnace, and although the gradient will vary slightly as a function of the furnace temperature, a mean value of 8 Pa per metre height may be assumed in assessing the furnace pressure conditions. The value of the furnace pressure should be the nominal mean value, disregarding rapid fluctuations of pressure associated with turbulence, etc., and should be established relative to the pressure outside the furnace at the same height. It should be monitored and controlled continuously and by 5 min from the commencement of the test should be achieved within +/- 5 Pa and by 10 min from the commencement of the test should be achieved and maintained within +/- 3 Pa.

8.3.2.2 For vertically orientated specimens the furnace should be operated such that a pressure of zero is established at a height of 500 mm above the notional floor level to the test specimen. However, for specimens with a height greater than 3 m, the pressure at the top of the test specimen should not be greater than 20 Pa, and the height of the neutral pressure axis should be adjusted accordingly.

8.3.2.3 For horizontally Orientated specimens the furnace should be operated such that a pressure of 20 Pa is established at a position 100 mm below the underside of the specimen.

8.4 Measurements and observations on the test specimen

8.4.1 *Temperature*

8.4.1.1 All temperature measurements should be recorded at intervals not exceeding 1 min.

8.4.1.2 When calculating temperature rise on the unexposed surface of the test specimen, this should be done on an individual thermocouple-by-thermocouple basis. The average temperature rise of the unexposed surface should be calculated as the average of the rises recorded by the individual thermocouples used to determine the average temperature.

8.4.1.3 For “A” class divisions, excluding doors, the average temperature rise on the unexposed face of the specimen should be calculated from the thermocouples specified in 7.5.1.1 only.

8.4.1.4 For “B” and “F” class divisions, excluding doors, the average temperature rise on the unexposed face of the specimen should be calculated from the thermocouples specified in 7.5.2.1 only.

8.4.1.5 For “A”, “B” and “F” class doors, the average temperature rise on the unexposed face of the specimen should be calculated from the thermocouples specified in 7.5.3.1 only. For a double-leaf door, all ten thermocouples used on both door leaves should be used for this calculation.

8.4.2 *Flaming on unexposed face*

The occurrence and duration of any flaming on the unexposed surface, together with the location of the flaming, should be recorded. In cases where it is difficult to identify whether or not there are flames then the cotton-wool pad should be applied to the area of such disputed flaming to establish whether ignition of the pad can be initiated.

8.4.3 *Cotton-wool pad*

8.4.3.1 Tests with the cotton-wool pad are used to indicate whether cracks and openings in the test specimen are such that they could lead to the passage of hot gases sufficient to cause ignition of combustible materials.

8.4.3.2 A cotton-wool pad is employed by placing the frame within which it is mounted against the surface of the test specimen, adjacent to the opening or naming under examination, for a period of 30 s, or until ignition (defined as glowing or naming) of the cotton-wool pad occurs (if this happens before the elapse of the 30 s period). Small adjustments in position may be made so as to achieve the maximum effect from the hot gases. A cotton-wool pad should be used only once.

Where there are irregularities in the surface of the test specimen in the area of the opening, care should be taken to ensure that the legs of the support frame are placed so that clearance between the pad and any part of the test specimen surface is maintained during the measurements.

The cotton-wool pad should be applied freely and not necessarily parallel to the surface of the specimen, and not always such that the crack or opening is central to the pad. The pad should be positioned in the flow of hot gases but should never be positioned such that any part of the pad is closer than approximately 25 mm from any point of the test specimen. For example, to adequately evaluate the hot gas leakage around a door it may be necessary to use the pad both parallel and normal to the face of the door or possibly at an oblique angle within the confines of the door frame.

The operator may make “screening tests” to evaluate the integrity of the test specimen. Such screening may involve selective short duration applications of the cotton pad to areas of potential failure and/or the movement of a single pad over and around such areas. Charring of the pad may provide an indication of imminent failure, but an unused pad should be employed in the prescribed manner for an integrity failure to be confirmed.

8.4.4 *Gap gauges*

8.4.4.1 Tests with the gap gauges are used to indicate whether cracks and openings in the test specimen are of such dimensions that they could lead to the passage of hot gases sufficient to cause ignition of combustible materials.

8.4.4.2 The gap gauges should be used at intervals which will be determined by the apparent rate of the specimen deterioration. Two gap gauges should be employed, in turn, and without undue force to determine:

– whether the 6 mm gap gauge can be passed through the specimen such that the gauge projects into the furnace, and can be moved a distance of 150 mm along the gap, or

– whether the 25 mm gap gauge can be passed through the specimen such that the gauge projects into the surface.

Any small interruption to the passage of the gauge that would have little or no effect upon the transmission of hot gases through the opening should not be taken into account, e.g. small fastening across a construction joint that has opened up due to distortion.

8.4.5 *Deformation*

The deflection of an "A", "B" or "F" class test specimen, and additionally in the case of a door the maximum displacement of each corner of the door leaf relative to the door frame, should be recorded during the test. These deflections and displacements should be measured with an accuracy of +/- 2 mm.

8.4.6 *General behaviour*

Observations should be made of the general behaviour of the specimen during the course of the test and notes concerning the phenomena such as cracking, mating or softening of the materials, spalling or charring, etc., of materials of construction of the test specimen should be made. If quantities of smoke are emitted from the unexposed face this should be noted in the report. However, the test is not designed to indicate the possible extent of hazard due to these factors.

8.5 Duration of testing

8.5.1 *"A" class divisions*

For all "A" class divisions, including those with doors, the test should continue for minimum 60 min. when the specimen is of an "A" class division, with a structural steel core which is imperforate (e.g. without door), and where insulation is provided to the exposed face only (i.e. the structural steel core is the unexposed face of the construction), it is permitted to terminate the test prior to 60 min once the unexposed-face temperature-rise limits have been exceeded.

8.5.2 *"B" and "F" class divisions*

For all "B" and "F" class divisions, including those with doors, the test should continue for minimum 30 min.

9 PERFORMANCE CRITERIA

9.1 Insulation

9.1.1 *"A" class divisions, including "A" class doors*

The average unexposed-face temperature rise as determined in accordance with 8.4.1 should not be more than l40°C, and the temperature rise recorded by any of the individual unexposed-face thermocouples should not be more than l80°C during the periods given below for each classification:

class "A-60"	60 min
class "A-30"	30 min
class "A-15"	15 min
class "A-0"	0 min

9.1.2 *"B" and "F" class divisions, including "B" and "F" class doors*

The average unexposed-face temperature rise as determined in accordance with 8.4.1 should not be more than 140°C, and the temperature rise recorded by any of the individual unexposed-face thermocouples should not be more than 225°C during the periods given below for each classification:

class "B-30"	30 min
class "B-15"	15 min
class "B-0"	0 min
class "F-30"	30 min
class "F-15"	15 min
class "F-0"	0 min

9.2 Integrity

For all "A", "B" and "F" class divisions, including "A", "B" and "F" class doors, the following requirements should be satisfied for the minimum test duration relevant to the classification (see 8.5).

Flaming: there should be no framing on the unexposed face

Cotton-wool pad: there should be no ignition, i.e. flaming or glowing, of the cotton-wool pad when applied in accordance with 8.4.3 or when used to assist evaluation of flaming (see 8.4.2)

Gap gauges: it should not be possible to enter the gap gauges into any opening in the specimen in the manner described in 8.4.4.

There exist no expectations that "A" and "B" class fire doors remain functional, in the ability to be opened/closed, during or after the specified test duration. (MSC/Circ.1120)

9.3 Structural core temperature

In the case of load-bearing divisions of aluminium alloy, the average temperature of the structural core obtained by the thermocouples described in 7.6 should not rise more than 200°C above its initial temperature at any time during the minimum test duration relevant to the classification (see 8.5). Where the structural core is of a material other than steel or aluminium alloy the Administration should decide the rise in temperature which should not be exceeded during the test duration.

10 TEST REPORT

The test report should include all important information relevant to the test specimen and the fire test, including the following specific items:

.1 The name of the testing laboratory and the test date.

.2 The name of the applicant for the test.

.3 The name of the manufacturer of the test specimen and of the products and components used in the construction, together with identification marks and trade names.

.4 The constructional details of the test specimen, including description and drawing and principal details of components. All the details requested in section 2 should be given. The description and the drawings which are included in the test report should, as far as practicable, be based on information derived from a survey of the test specimen. When full and detailed drawings are not included in the report, then the applicant's drawing(s) of the test specimen should be authenticated by the laboratory and at least one copy of the authenticated drawing(s) should be retained by the laboratory; in this case reference to the applicant's drawing(s) should be given in the report together with a statement indicating the method of endorsing the drawings.

.5 All the properties of materials used that have a bearing on the fire performance of the test specimen together with measurements of thickness, density and, where applicable, the moisture and/or binder content of the insulation material(s) as determined by the test laboratory.

.6 A statement that the test has been conducted in accordance with the requirements of this IMO resolution, and, if any deviations have been made to the prescribed procedures (including any special requirements of the Administration), a clear statement of the deviations.

.7 The name of the representative of the Administration present at the test; when a test is not witnessed by a representative of the Administration a note to this effect should be made in the report in the following form:

"The ... (name of the Administration) ... was notified of the intention to conduct the test detailed in this report and did not consider it necessary to send a representative to witness it".

.8 Information concerning the location of all thermocouples fixed to the specimen, together with tabulated data obtained from each thermocouple during the test. Additionally, a graphical depiction of the data obtained may be included. A drawing should be included which clearly illustrates the positions of the various thermocouples and identifies them relative to the temperature-time data.

.9 The average and the maximum temperature rises and the average core temperature rise, when applicable, recorded at the end of the period of time appropriate to the insulation performance criteria for the relevant classification (see 9.1 and 9.3) or, if the test is terminated due to the insulation criteria having been exceeded, the times at which limiting temperatures were exceeded.

.10 The maximum deflection of an "A", "B" and "F" class specimen or the maximum deflection at the centre of an "A", "B" or "F" class door and the maximum displacement of each corner of the door leaf relative to the door frame.

.11 Observations of significant behaviour of the test specimen during the test and photographs, if any.

.12 The classification attained by the test specimen should be expressed in the form of "class A-60 deck", i.e. including the qualification on orientation of the division.

The result should be presented in the test report in the following manner, which includes proviso regarding non-combustibility, under the heading "Classification":

"A deck constructed as described in this report may be regarded as a Class A-60 Deck according to IMO resolution A.754(18) if all the materials of the construction (except adhesives) are non-combustible.

Approval of the construction may be obtained only on application to the appropriate Administration."

Appendix

**Testing of windows, fire dampers,
pipe penetrations and cable transits**

INTRODUCTION

This appendix covers the testing of windows, fire dampers, pipe penetrations and cable transits, all of which may be incorporated within "A" class divisions.

Irrespective of the fact that this appendix is written only for "A" class divisions, the prescriptions given can be used by analogy when testing windows, fire dampers, pipe and duct penetrations and cable transits incorporated in "B" class divisions, where appropriate.

The testing and reporting of these components should be generally in accordance with the requirements given in IMO resolution A.754(18). Where additional interpretation, adoption and/or supplementary requirements may be necessary, these are detailed in this appendix. Since it is not possible to introduce the distortions which are experienced by the structural core during tests corresponding to procedures given in the resolution, into specimens of smaller scale, all the tests of the components covered by this appendix should be undertaken with those components installed in fun-size dimensioned structural cores as specified in the resolution.

A.I – WINDOWS

1 GENERAL

The term window is taken to include windows, sidescuttles and any other glazed opening provided for light transmission or vision purposes in "A" class bulkheads. Windows in "A" class doors are considered to be part of the door and they should be tested within the appropriate door.

The approach adopted for testing windows should generally follow the requirements for testing "A" class doors where relevant and appropriate.

2 NATURE OF TEST SPECIMENS

2.1 Dimensions

The test should be conducted on the window of the maximum size (in terms of both the width and the height) for which approval is sought.

<u>The test should be conducted on a window of the maximum size (in terms of both the height and the width) and the type of the glass pane and/or the minimum thickness of the glass pane or panes and gaps, if appropriate, for which approval is sought. Test results obtained on this configuration should, by analogy, allow approval of windows of the same type, with lesser dimensions in terms of height and width and with the same or greater thickness. (MSC/Circ.1036)</u>

2.2 Design

The bulkhead which includes the window should be insulated to class A-60 on the stiffened face, which should be the face exposed to the heating conditions of the test. This is considered to be most typical of the use of windows on board ships, not necessarily being the worst way round. There may be special applications of windows where the Administration considers it appropriate to test the window with the insulation of the bulkhead to the unexposed face of the structural core, or within bulkheads other than class A-60.

The window should be positioned within the bulkhead, shown in figure 1 of the resolution, at that height which is intended for practical application. When this is not known, the window should be positioned with the top of its frame as close as possible, but not closer than 300 mm, to the top of the bulkhead.

3 INSTRUMENTATION

When a window is required by the Administration to be of a classification other than class AJD, thermocouples should be fixed to the window pane as specified for the leaf of a door. In addition, thermocouples should be provided to the window frame, one at mid-length of each perimeter edge. When windows are fitted with transoms and/or mullions, five thermocouples should be fixed to each window pane as specified for the leaf of a door, and, in addition to the thermocouples fixed to the window frame, a single thermocouple should be fixed at mid-length of each transom or mullion member.

4 METHOD OF TEST

4.1 Temperature

For the calculation of the average temperature rise on the unexposed face, only those thermocouples fixed to the face of the window pane(s) should be used.

4.2 Cotton-wool pad and gap gauges

For windows which are to be of a classification of A-0 the cotton-wool pad test need not be used to evaluate the integrity of a window since radiation through the window pane could be sufficient to cause ignition of the cotton-wool pad. In such cases cracks or openings in windows should not be such as to allow the gap gauges to enter in the manner described in 8.4.4 of the recommendation. The cotton-wool pad has to be used for windows required to have a classification other than A-0.

5 HOSE STREAM TEST

5.1 General

This procedure is an optional requirement and may be requested by some Administrations for windows used in specific areas of a ship. The window is subjected to the impact, erosion and cooling effects of a hose stream.

5.2 Method of test

The hose-stream test should be applied to the exposed face of the specimen immediately, but at least within not more than 1 1/2 min following the termination of the heating period.

The water stream is delivered through a standard fire hose and discharged through a 19 mm nozzle of tapered smooth-bore pattern without shoulder at the orifice. The nozzle orifice should be 6 m from the centre and normal to the exposed face of the specimen.

The water pressure at the nozzle should be 310 kPa when measured with the water flow in progress.

The duration of application of the hose stream to the surface of the specimen should be 0.65 min for each square metre of the exposed area of the specimen. The stream should be directed firstly at the centre and then at all parts of the exposed face, changes in direction being made slowly.

5.3 Performance criteria

The specimen is considered to have satisfied the criteria of the hose-stream test if no openings develop during the application of the stream which allow water to pass to the unexposed face.

The window should be considered to have failed the hose-stream test if an opening develops that allows an observable projection of water from the stream beyond the unexposed surface during the hose stream test. Gap gauges need not be applied during or after the hose stream test. (MSC/Circ.1120)

A.II – FIRE DAMPERS

1 GENERAL

"A" class divisions may have to be pierced for the passage of ventilation ducting, and arrangements should be made to ensure that the effectiveness of the division in relation to the criterion for integrity, as specified in 9.2 of the recommendation, is not impaired. Provisions should also be made to ensure that, should a fire be initiated within, or gain access to, ventilation ductwork, such a fire does not pass through the division within the ductwork.

To provide for both these requirements, fire dampers are provided within or fixed to spigots or coamings which are welded to the structural core and are insulated to the same standard as the division.

2 NATURE OF TEST SPECIMENS

2.1 Dimensions

The maximum and minimum sizes (in terms of both the width and the height, or the diameter) of each type of fire damper for which approval is sought should be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the damper should be constructed in accordance with 2.1.1 of the recommendation and should be insulated to class A-60 on the stiffened face, which should be the face which is not exposed to the heating conditions of the test. A deck which includes the constructed in accordance with 2.2.1 of the recommendation and should be insulated damper should be to class A-60 on the stiffened face, which should be the face which is exposed to the heating conditions of the test.

2.2.2 Fire dampers should be incorporated into or fixed to coamings or spigots, which should be welded or bolted into the structural core. The coaming or spigot including the damper should have a length of 900 mm (450 mm on each side of the structural core) and a thickness as follows:

Width[*] *or diameter of the duct*	*Minimum thickness of coaming or spigot*
Up to and including 300 mm	3 mm
760 mm and over	5 mm

For widths or diameters of ducts in excess of 300 mm but Jess than 760 mm, the thickness of the coaming or spigot should be obtained by interpolation.

The coaming or spigot should be insulated as shown in figure A1.

[*] *Width* means the greater of the two cross-sectional dimensions.

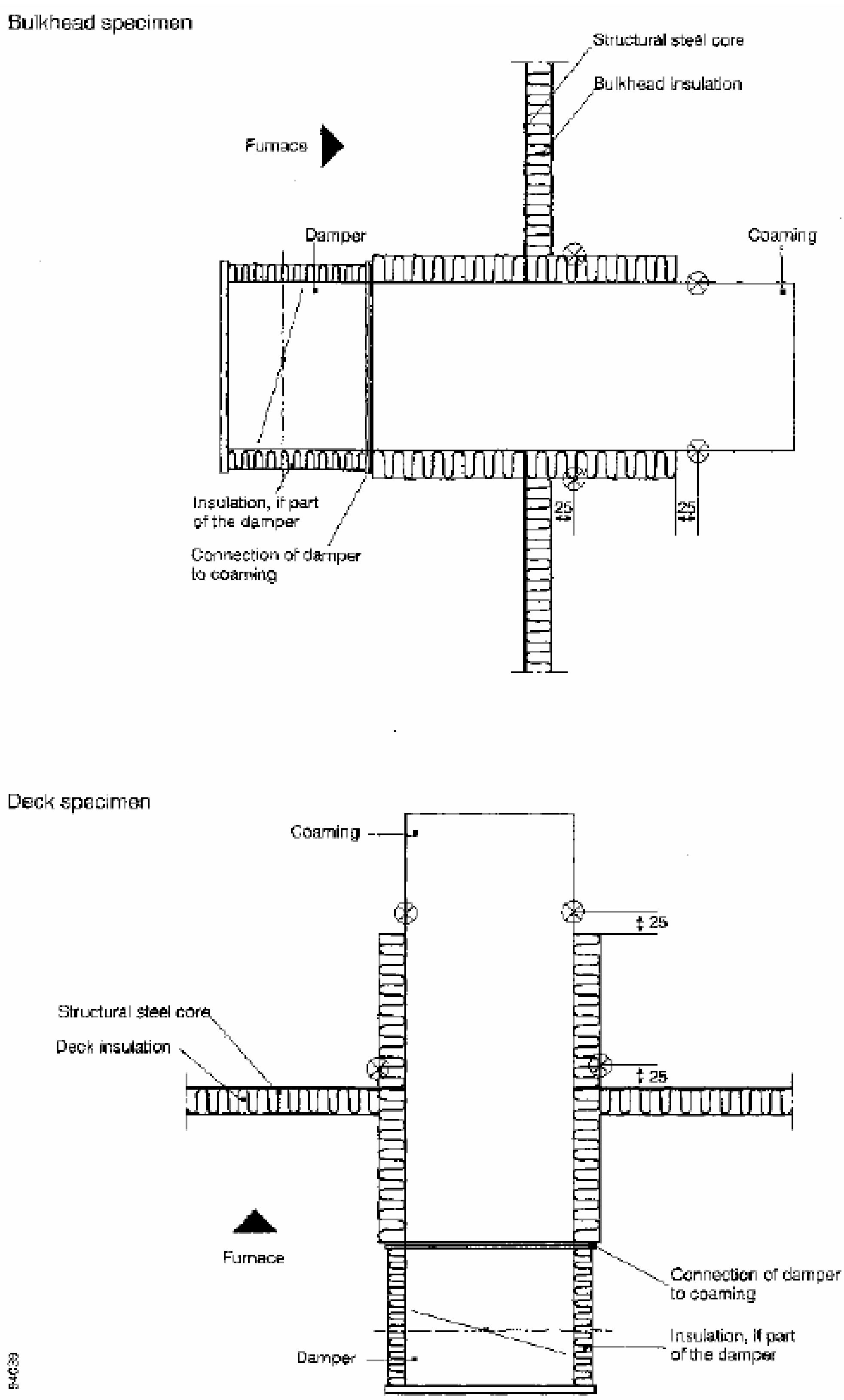


Figure A1 – Fire dampers: insulation on test specimens
and position of unexposed-face thermocouples

2.2.3 The coamings or spigots (including insulation) should be positioned only in the top half of a bulkhead but should be no closer than 200 mm from the edges of a bulkhead or a deck. Where more than one damper is to be tested simultaneously in a division, the separation between adjacent coamings or spigots (including insulation) should not be less than 200 mm. When more than one damper is included in a bulkhead, the top edges of all dampers should be, as far as possible, at the same height.

2.2.4 The fire dampers should be positioned on the exposed face of the bulkhead or deck, at a distance of at least 225 mm from the structural core, with their operative controls also on that side of the division.

<u>The distance between the fire damper and the structural core specified in paragraph 2.2.4 means the distance between the fire damper centre and the structural core. (MSC/Circ.964)</u>

2.2.5 Fire dampers which are operated automatically should be in the open position at the start of the test.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

For each fire damper, two thermocouples should be fixed to the unexposed face at each of the following locations:

- on the surface of the insulation provided to the coaming or spigot at a distance of 25 mm from the unexposed surface of the division; and

- on the surface of the coaming or spigot at a distance of 25 mm from where the coaming or spigot emerges from its insulation.

For fire dampers in bulkheads, for each of the positions indicated above, one of the thermocouples should be fixed on the top surface of the coaming or spigot and the other thermocouple should be fixed on the bottom surface of the coaming or spigot.

4 METHOD OF TEST

It will not always be possible to utilize the cotton-wool-pad test to evaluate the integrity of a fire damper since radiation through the damper could be sufficient to cause ignition of the cotton-wool pad. In such cases, cracks or openings in fire dampers should not be such as to allow the gap gauges to enter in the manner described in 8.4.4 of the recommendation.

The performance of fire dampers may be related to their ability to satisfy both the insulation and the integrity criteria or may be related only to the requirements for integrity, depending on the requirements of the Administration.

<u>If evaluation of insulation is required, it should prevent a temperature rise at any point on the surface not exceeding 180°C above the initial temperature. The average temperature rise is not relevant. (MSC/Circ.964)</u>

A.III – PIPE AND DUCT PENETRATIONS

1 GENERAL

"A" class divisions may have to be provided with apertures to allow them to be penetrated by service pipes and ducts, and it is necessary to reinstate the insulation and/or integrity performance of the division at the position where it has been penetrated.

Administrations may have different requirements relating to the need to classify Pipe and/or duct penetrations, e.g. related to the pipes' diameter and their direct attachment or not to the structural core.

This section refers from hereon to pipe penetrations but may be read as equally applicable to duct penetrations.

2 NATURE OF TEST SPECIMENS

2.1 Dimensions

The maximum and minimum sizes (in terms of both the width and the height, or diameter) of each type of pipe penetration for which approval is sought should be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the pipe penetration should be constructed in accordance with 2.1.1 of the recommendation and should be insulated to class A-60 on the stiffened face, which should be the face which is not exposed to the heating conditions of the test. A deck which includes the pipe penetration should be constructed in accordance with 2.2.1 of the recommendation and should be insulated to class A-60 on the stiffened face, which should be the face which is exposed to the heating conditions of the test.

2.2.2 The pipe penetrations should be positioned only in the top half of a bulkhead but should not be closer than 200 mm from the edges of a bulkhead or a deck. Where more than one pipe penetration is to be tested simultaneously in a division, the separation between adjacent penetrations should not be less than 200 mm. Both measurements should relate to the distance to the nearest part of the penetration system, including any insulation which is part of the system.

2.2.3 Each pipe passing through a penetration should project 500 +/- 50 mm beyond the exposed end of the penetration and 500 +/- 50 mm beyond the unexposed end of the penetration. The exposed end of the pipe should be blanked off, using an appropriate methodology to ensure that any fire penetration into the pipe does not occur via the end of the pipe in advance of it occurring through the exposed perimeter of the pipe.

2.2.4 Each pipe should be firmly supported and fixed independent of the bulkhead or deck on the unexposed side of the test specimen, e.g. by a framework mounted from the restraint frame. The support and fixing of the pipe should restrain it from movement during the test.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

For each pipe penetration, two thermocouples should be fixed on the unexposed face at each of the following locations:

- on the surface of the pipe at a distance of 25 mm from the centre of the thermocouples to the position where the pipe emerges from the penetration seal;
- on the pipe penetration at a distance of 25 mm from the centre of the thermocouples to the face of the insulation on the unexposed side of the test specimen; and
- on the surface of any insulation or filling material used between the pipe and any coaming or spigot fixed to the division (provided that the gap between pipe or any such coaming or spigot is greater than 30 mm), or on the surface of any collar or shroud used between the pipe and the division (e.g. vapour barrier).

For pipe penetrations in bulkheads, for each of the positions indicated above, one of the thermocouples should be fixed directly above the centre of the pipe and the other thermocouple should be fixed directly below the centre of the pipe.

Additional thermocouples may be required to be fitted, dependent upon the complexity of the pipe penetration.

4 PERFORMANCE CRITERIA

4.1 General

The performance of pipe penetrations may be related to their ability to satisfy both the insulation and the integrity criteria or may be related only to the requirements for integrity, depending on the requirements of the Administration.

<u>Penetrations and transits should meet both integrity and insulation criteria. (MSC/Circ.916)</u>

4.2 Insulation

Since the pipe penetration is a local weakness in the division it should be capable of preventing a temperature rise at any point on the surface not exceeding 180°C above the initial temperature. The average temperature rise is not relevant.

A.IV – CABLE TRANSITS

1 GENERAL

"A" class divisions may have to be provided with apertures to allow them to be penetrated by cables, and it is necessary to reinstate the insulation and integrity performance of the division at the position where it has been penetrated. A cable transit consists of a metal frame, box or coaming, a sealant system or material and the cables, and it may be uninsulated, partially insulated or fully insulated.

2 NATURE OF TEST SPECIMENS

2.1 Dimensions

The maximum and minimum sizes (in terms of both the height and the width) of each type of cable transit for which approval is sought should be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the cable transit should be constructed in accordance with 2.1.1 of the recommendation and should be insulated to class A-60 on the stiffened face, which should be the face which is not exposed to the heating conditions of the test. A deck which includes the cable transit should be constructed in accordance with 2.2.1 of the recommendation and should be insulated to class A-60 on the stiffened face, which should be the face which is exposed to the heating conditions of the test.

2.2.2 The cable transits should be positioned only in the top half of a bulkhead but should not be closer than 200 mm from the edges of a bulkhead or a deck. Where more than one cable transit is to be tested simultaneously in a division, the separation between adjacent transits should not be less than 200 mm. Both measurements should relate to the distance to the nearest part of the transit system, including any insulation which is part of the system.

2.2.3 Notwithstanding the above, the distance between transits should be sufficient to ensure that the transits do not influence each other during the test, except that this requirement does not apply to multi-transits which are intended to be positioned adjacent to one another.

2.2.4 The cables should project 500 +/- 50 mm beyond the transit on the exposed side of the division and 500 +/- 50 mm on the unexposed side.

2.2.5 Cable transits should be welded or bolted into the bulkhead or deck. The cables and sealing compounds or blocks should be incorporated into the transits with the bulkhead and deck panels placed respectively in vertical and horizontal positions. Any insulation should be applied to the panels and transits with the panels in the same respective positions.

2.2.6 The transit(s) should be tested incorporating a range of different types of cables (e.g. in terms of number and type of conductor, type of sheathing, type of insulation material, size) and should provide an assembly which represents a practical situation which may be found on ships.

An individual Administration may have its own specification for a "standard" configuration of penetrating cables which it may use as a basis of its approvals.

The test results obtained from a given configuration are generally valid for the tested types of cables of size equal to or smaller than tested.

2.2.7 No more than 40% of the inside cross-sectional area of each transit should be occupied by cables and the distances between adjacent cables and between the cables and the inside of the transit should be the minimum which is allowable for the actual penetration sealing system.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

For each uninsulated cable transit, thermocouples should be fixed on the unexposed face at each of the following locations:

- at two positions on the surface of the outer perimeter of the frame, box or coaming at a distance of 25 mm from the unexposed surface of the division;
- at two positions at the end of the transit, on the face of the sealant system or material at a distance of 25 mm from a cable; and
- on the surface of each type of cable included in the cable transit, at a distance of 25 mm from the face of the sealant system or material. In case of a group or bunch of cables the group should be treated as a single cable. In case of horizontal cables the thermocouples should be mounted on the uppermost surface of the cables.

For those thermocouples placed on the outer perimeter of the frame, box or coaming, one thermocouple should be fixed on each of two opposite faces, which in the case of bulkheads should be the top and bottom faces.

For each partially insulated or fully insulated cable transit, thermocouples should be fixed on the unexposed face at equivalent positions to those specified for an uninsulated transit as illustrated in figure A2.

Additional thermocouples may be required to be fixed, dependent upon the complexity of the cable transit.

When fixing thermocouples to the unexposed surface of the cables, the copper disc and the insulating pad should be formed over the surface to provide good contact with the surface of the cable. The copper disc and the pad should be retained in position by some mechanical means, e.g. wiring or spring clips, such that they do not become detached during the test. The mechanical retention should not provide any significant heat-sink effect to the unexposed face of the thermocouple.

4 PERFORMANCE CRITERIA

4.1 General

The performance of cable transits may be related to their ability to satisfy both the requirements for insulation and integrity or may be related only to the requirements for integrity, depending on the requirements of the Administration.

Penetrations and transits should meet both integrity and insulation criteria. (MSC/Circ.916)

4.2 Insulation

Since the cable transit is a local weakness in the division it should be capable of preventing a temperature rise at any point on the surface not exceeding l80°C above the initial temperature. The average temperature rise is not relevant.

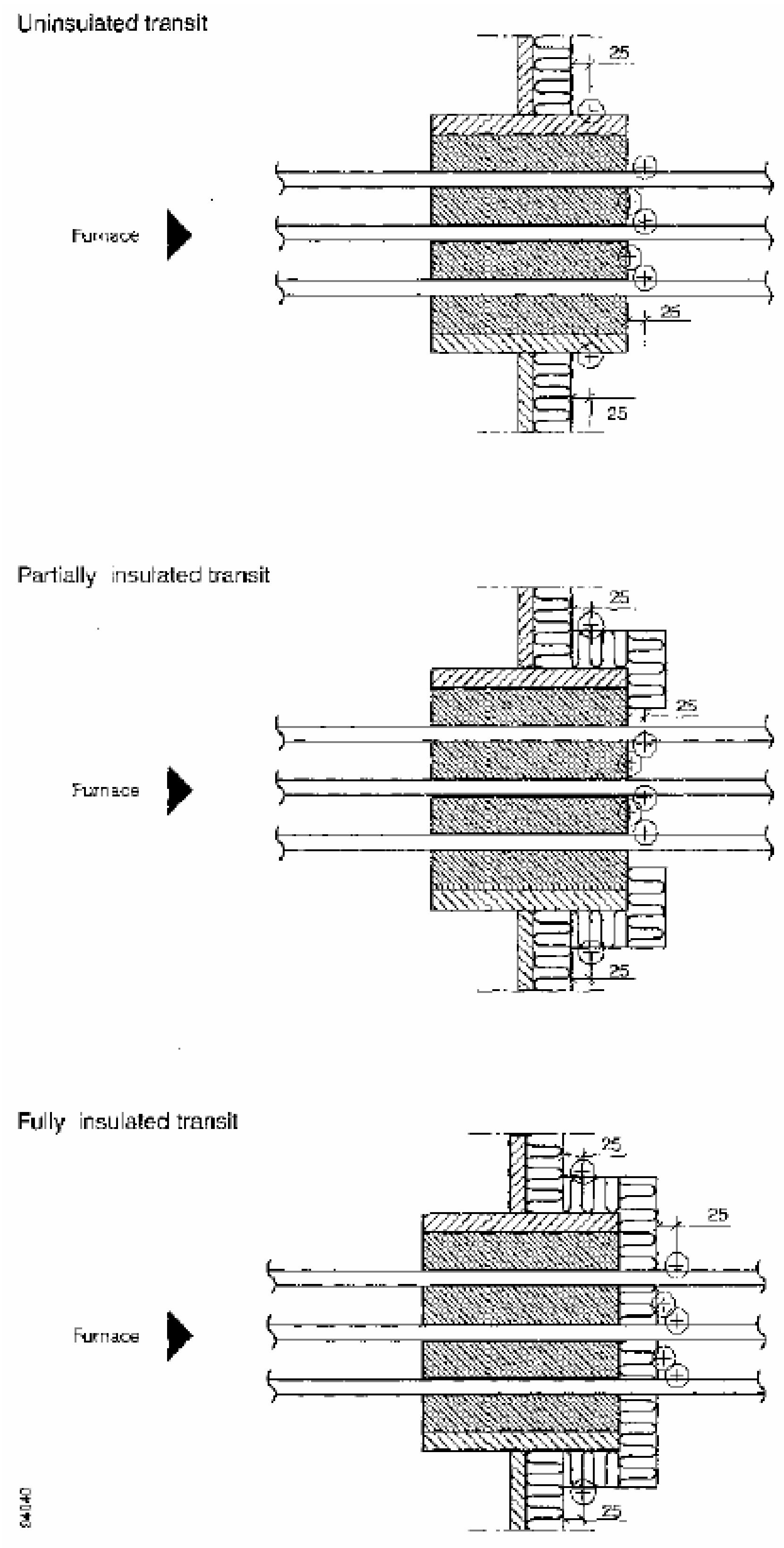


Figure A2 – Cable transits: position of unexposed-face thermocouples (shown for bulkhead)

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INTERNATIONAL MARITIME ORGANIZATION

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SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 10

FP 50/10/4
28 October 2005
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COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE

Related revision to resolution A.653(16) Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials

Submitted by Japan

SUMMARY

Executive summary:	This document contains the draft revision to resolution A.653(16) "Recommendation on Improved Fire Test Procedures for Surface flammability of Bulkhead, Ceiling and Deck Finish Materials", which is the consequence of the draft revision to part 5 of the FTP Code, for consideration of the Sub-Committee on the comprehensive review to the FTP Code
Action to be taken:	Paragraph 5
Related documents:	MSC 80/21/5, MSC 80/24, FP 50/10/1 and FP 50/10/1/Add.1

Background

1 Japan proposed a new work programme entitled "Comprehensive Review of Fire Test Procedures Code" to the Maritime Safety Committee at its eightieth session, as a work item of the Sub-Committee (MSC 80/21/5). The Committee agreed to include the work item in the Sub-Committee's work programme and the provisional agenda for FP 50 as high priority item with a target completion date of 2008 (as reported in paragraph 21.11 of MSC 80/24).

2 Japan has submitted documents (FP 50/10/1 and Add.1), which contain proposals for the comprehensive review of the FTP Code.

Revision to part 5 of the FTP Code

3 As described in the document FP 50/10/1, part 5 of the FTP Code needs to be revised. As consequence, the related test procedures in IMO Assembly resolution A.653(16) should also be revised to reflect the revision to part 5 of the Code. There have also been an extensive number of the IMO unified interpretations to the test procedures in resolution A.653(16), which may also be included into the revised test procedures.

Draft of revised resolution A.653(16)

4 In order to facilitate the Sub-Committee's consideration on comprehensive review of the FTP Code, Japan has prepared a draft of revised resolution A.653(16) "Recommendation on improved fire test procedures for surface flammability of bulkhead, ceiling and deck finish materials", which includes modifications from the existing resolution A.653(16) based on the adopted amendments and approved interpretations to the existing resolution A.653(16), as set out in the annex to this document.

Action requested of the Sub-Committee

5 The Sub-Committee is invited to consider the draft of revised resolution A.653(16) as set out in the annex to this document and take action as appropriate.

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ANNEX

RECOMMENDATION ON IMPROVED FIRE TEST PROCEDURES FOR SURFACE FLAMMABILITY OF BULKHEAD, CEILING AND DECK FINISH MATERIALS

1 SCOPE

This Recommendation specifies a procedure for measuring fire characteristics of bulkhead, ceiling and deck finish materials as a basis for characterizing their flammability and thus their suitability for use in marine construction.

2 WARNING

2.1 Ignition hazards

The use of this test method involves the generation of very high heat flux levels which are capable of causing ignition of some materials such as clothing following even brief exposures. Precautions should be taken to avoid accidental ignitions of this type.

2.2 Toxic fume hazards

The attention of the user of this test is drawn to the fact that the fumes from burning materials often include carbon monoxide. Other more toxic products may in many instances be produced. Suitable precautions should be taken to avoid any extended exposure to these fumes.

3 DEFINITIONS

Certain terms used in this Recommendation require definition for clarity. Other fire characteristic terms are also used; these are defined hereunder but relate only to the results of measurements by this specific test method.

3.1 Compensating thermocouple

A thermocouple for the purpose of generating an electrical signal representing long-term changes in stack metal temperatures. A fraction of the signal generated is subtracted from the signal developed by the stack gas thermocouples.

3.2 Critical flux at extinguishment

A flux level at the specimen surface corresponding to the distance of farthest advance and subsequent self-extinguishment of the flame on the centreline of a burning specimen. The flux reported is based on calibration tests with a dummy specimen.

3.3 Dummy specimen

A specimen used for standardizing the operating condition of the equipment; it should be roughly 20 mm thickness, 800 + 100 kg/m^3 density and should meet the requirements of resolution A.472(XII) as non-combustible.

3.4 Special calibration dummy specimen

A dummy specimen as defined by figure 14 intended only for use in calibration of heat flux gradient along with specimen.

3.5 Fume stack

A box-like duct with thermocouples and baffles through which flames and hot fumes from a burning specimen pass. Its purpose is to permit measurement of the heat release from the burning specimen.

3.6 Heat for ignition

The product of the time from initial specimen exposure until the flame front reaches the 150 mm position and the flux level at this position; this latter obtained in prior calibration of the apparatus.

3.7 Heat release of specimen

The observed heat release under the variable flux field imposed on the specimen and measured as defined by the test method.

3.8 Heat for sustained burning

The product of time from initial specimen exposure until arrival of the flame front and the incident flux level at that same location as measured with a dummy specimen during calibration. The longest time used in this calculation should correspond to flame arrival at a station at least 30 mm prior to the position of furthest flame propagation on the centreline of the specimen.

3.9 Reverberatory wires

A wire mesh located in front of, but close to, the radiating surface of the panel heat source. This serves to enhance the combustion efficiency and increase the radiance of the panel.

3.10 Viewing rakes

A set of bars with wires spaced at 50 mm intervals for the purpose of increasing the precision of timing flame front progress along the specimen.

4 PRINCIPLE OF THE TEST

This test provides methods for evaluating flammability characteristics of 155 mm x 800 mm specimens in vertical orientation. The specimens are exposed to a graded radiant flux field supplied by a gas-fired radiant panel. Means are provided for observing the times to ignition, spread and extinguishment of flame along the length of the specimen as well as for measuring the compensated millivolt signal of the stack gas thermocouples as the burning progresses. Experimental results are reported in terms of: heat for ignition, heat for sustained burning, critical flux at extinguishment and heat release of specimen during burning.

5 FACILITY AND APPARATUS REQUIREMENTS

5.1 General

A detailed description of the facility and apparatus required for conduct of this test is included in the appendix. Compliance with the appendix forms an essential requirement of the test method. The equipment needed may be summarized as follows:

5.1.1 Special test room fitted with fume exhaust system as well as fresh air inlet.

5.1.2 Radiant panel frame fitted with blower or other source of combustion air, a methane* or natural gas supply system with suitable safety controls, and a radiant panel heat source, with reverberatory wires, arranged to radiate on a vertical specimen. Alternatively, an electrically heated radiant source of the same dimensions may be used provided it can expose the specimen to the heat flux distribution shown in table 1 (see appendix). The effective source temperature of any radiant panel is not greater than 1,000˚C.

5.1.3 The specimen holder frame, three specimen holders, two parts of pilot burners, specimen holder guides, viewing rakes and a viewing mirror.

5.1.4 A specimen fume stack with both stack gas and stack temperature compensating thermocouples together with a means for adjusting the magnitude of the compensation signal.

5.1.5 Instrumentation comprising a chronograph, digital or sweep second electric clock, a digital millivoltmeter, a two-channel millivolt recorder, gas-flowmeter, heat-fluxmeters, a wide angle total radiation pyrometer and a stopwatch. Use of a data acquisition system to record both panel radiance and the heat release stack signal during test will facilitate data reduction.

6 CALIBRATION

Mechanical, electrical and thermal calibrations should be performed as described in the appendix. These adjustments and calibrations should be performed following initial installation of the apparatus and at other times, as the need arises.

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* The use of gases other than methane or natural gas is not recommended although with changes in panel-specimen spacing it has been reported possible to use the equipment with propane up to flux levels of 50 kw/m^2.

6.1 Monthly verification

The calibration of the flux distribution on the specimen and the proper operation of the fume stack with its thermocouple system should be confirmed by monthly tests, or at more frequent intervals if this is found necessary (see 4.3.1 and 4.6 in the appendix).

6.2 Daily verification

As a means of assuring continued proper adjustment of the apparatus, the following tests should be performed on a daily basis, or more frequently if the nature of the specimens makes this necessary.

6.2.1 Adjustment of the pilot burner, the acetylene and air supply should be adjusted to provide a flame length of about 230 mm*. When this has been done, the flame length as viewed in a darkened laboratory will be seen to extend about 40 mm above the upper retaining flange of the specimen holder. The burner spacing from the specimen is adjusted while the radiant source is operating by the use of softwood splines of 3 mm thickness and of 10 mm and 12 mm width. When these splines are moved during a two second exposure along the flame length, between the pilot burner flame and a dummy specimen surface, the 10 mm spline should not be charred but the 12 mm spline should show char. With the specimen in the vertical position, the charring of the 12 mm spline should occur over a vertical distance of at least 40 mm from the upper exposed edge of the specimen (see figure 9 in the appendix).

6.2.2 The stack gas thermocouples should be cleaned by light brushing at least daily. This cleaning may be required even more frequently, in some instances before each test, when materials producing heavy soot clouds are tested. These thermocouples should also be individually checked for electrical continuity to ensure the existence of a useful thermojunction. Following daily cleaning of the parallel connected stack gas thermocouples, both they and the compensating junction should be checked to verify that the resistance between them and the stack is in excess of 10^6 ohms.

6.3 Continuous monitoring of operation

A dummy specimen should remain mounted in the position normally occupied by a specimen whenever the equipment is in stand-by operation. This is a necessary condition of the continuous monitoring procedure which is accomplished by measuring:

.1 the millivolt signals from both the stack thermocouples and the total radiation pyrometer mounted securely on the specimen holder frame facing the surface of the radiant panel; or

.2 the millivolt signals from both the stack thermocouples and a heat-fluxmeter positioned at 350 mm from the exposed hot end of a marine board specimen of about 20 mm thickness (see appendix, paragraph 4.3.2).

Either of these measurement methods would be satisfactory for determining that an appropriate thermal operating level has been achieved. The use of the radiation pyrometer is preferable since it permits continuous monitoring of panel operating level even when tests are in progress. Both

* It is recommended that, to give increased precision, acetylene rather than other gases be used wherever possible.

signals should remain essentially constant for three minutes prior to the test. The observed operating level of either the radiation pyrometer or the fluxmeter should correspond, within 2%, to the similar required level specified in table 1 (see appendix) and referred to in the calibration procedure mentioned in 6.1 above.

7 SPECIMENS

Where a product is approved based on a test of a specimen applied on a non-combustible substrate, that product should be approved for application to any non-combustible substrate with similar or higher density (similar density may be defined as a density ³ 0.75 x the density used during testing) or with a greater thickness if the density is more than 400 kg/m^3. Where a product is approved on the basis of a test result obtained after application on a metallic substrate (e.g., thin film of paints or plastic films on steel plates), such a product should be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness ³ 0.75 x the thickness of metallic substrate used during testing). (MSC/Circ.1004)

7.1 Number required

Three specimens should be tested for each different exposed surface of the product evaluated and applied.

7.2 Dimensions

The specimens should be 155 +0/-5 mm wide by 800 +0/-5 mm long, and should be representative of the product.

7.2.1 Specimen thickness: materials and composites of normal thickness 50 mm or less should be tested using their full thickness, attaching them, by means of an adhesive if appropriate, to the substrate to which they will be attached in practice. For materials and composites of normal thickness greater than 50 mm, the required specimens should be obtained by cutting away the unexposed face to reduce the thickness to 50 +3/-0 mm.

7.3 Composites

Assembly should be as specified in 7.2. However, where thin materials or composites are used in the fabrication of an assembly, the presence of an air gap and/or the nature of any underlying construction may significantly affect the flammability characteristics of the exposed surface. The influence of the underlying layers should be recognized and care taken to ensure that the test result obtained on any assembly is relevant to its use in practice.

Vapour barriers used in conjunction with insulation should be tested without any other components of “A” or “B” class constructions that will shield the barrier being tested from the radiant panel. (MSC/Circ.1120)

7.4 Metallic facings

If a bright metallic faced specimen is to be tested, it should be painted with a thin coat of flat black paint prior to conditioning for test.

7.5 Marking specimens

A line should be marked centrally down the length of the tested face of each specimen. Caution should be exercised to avoid the use of a line which would influence specimen performance.

7.6 Conditioning of specimens

Before test, the specimens should be conditioned to constant moisture content, at a temperature of 23 +/- 2˚C, and a relative humidity of 50 +/-10%. Constant moisture content is considered to be reached when, following two successive weighing operations, carried out at an interval of 24 hours, the measured masses do not differ by more than 0.1% of the mass of the specimen.

8 TEST PROCEDURE

8.1 General considerations

The test method involves mounting the conditioned specimen in a well-defined flux field and measuring the time of ignition, spread of flame, its final extinguishment together with a stack thermocouple signal as an indication of heat release by the specimen during burning.

8.1.1 Prepare a properly conditioned specimen for test in a cool holder away from the heat of the radiant panel. Prior to insertion in the specimen holder, the back and edges of the specimen should be wrapped in a single sheet of aluminium foil of 0.02 mm thickness and dimensions of (175 + a) mm x (820 + a) mm where “a” is twice the specimen thickness. When inserted in the specimen holder each specimen should be backed by a cool 10 +/-2 mm board of non-combustible refractory insulating material with the same lateral dimensions and density as the dummy specimen. When mounting non-rigid specimens in the holder, shims should be placed between specimen and holder flange to ensure that the exposed specimen face remains at the same distance from the pilot flame as a rigid specimen. For such materials, the shims may often only be required for a 100 mm length at the hot end of the specimen.

8.1.2 The dummy specimen in a specimen holder should be mounted in position facing the radiant panel. The equipment fume exhaust system should be started.

8.1.3 The radiant panel is operated to realize the test conditions as specified in 6.3. Start the millivolt recorder recording the output signal of the stack thermocouples, as well as signal from the total radiation pyrometer or heat-fluxmeter positioned, as described in 6.3.2.

8.1.4 When the radiant panel and stack signals have attained equilibrium, after the preheat period, light the pilot flame, adjust its fuel flow rate and observe both signals for at least three minutes and verify continued signal stability.

8.1.5 After both signals reach stable levels, remove the dummy specimen holder and insert the specimen in the test position within 10 s. Immediately start both the clock and chronograph.

8.1.6 Operate the event marker of the chronograph to indicate the time of ignition and arrival of the flame front during the initial rapid involvement of the specimen. The arrival at a given position should be observed as the time at which the flame front at the longitudinal centreline of the specimen is observed to coincide with the position of two corresponding wires of the viewing rakes. These times are recorded manually both from measurement on the chronograph chart and from observations of the clock. As far as possible, the arrival of the flame front at each 50 mm position along the specimen should be recorded. Record both the time and the position on the specimen at which the progress of flaming combustion ceases. The panel operating level, as well as stack signals, should be recorded throughout the test and continued until test termination.

8.1.7 Throughout the conduct of the test, no change should be made in the fuel supply rate to the radiant panel to compensate for variations in its operating level.

8.2 Duration of test

The test should be terminated, the specimen removed, and the dummy specimen in its holder reinserted when any one of the following is applicable:

.1 the specimen fails to ignite after a 10 min exposure;

.2 3 min have passed since all flaming from the specimen ceased; and

.3 flaming reaches the end of the specimen or self-extinguishes and thus ceases progress along the specimen. This criterion should only be used when heat release measurements are not being made.

8.2.1 Operations 8.1.1 to 8.1.7 should be repeated for two additional specimens (see 8.3).

8.3 Conditions of retest

In the event of failure, during test of one or more specimens, to secure complete flame spread times or a reasonable heat release curve, the data secured should be rejected and a new test or tests performed. Such failures might involve, but not be limited to, incomplete observational data or malfunction of data logging equipment. Excessive stack signal baseline drift should also require further equipment stabilization and retest.

8.3.1 In the event that the first two ~~or~~ of three specimens do not ignite following exposure for 10 min, at least one specimen should be tested with the pilot flame angled to impinge on the upper half of the specimen. If this specimen ignites, two additional tests should be run under the same conditions. (MSC/Circ.1004)

8.3.2 If a specimen shows extensive loss of incompletely burned material during test, at least one additional specimen, restrained in the testing frame by poultry netting, should be tested and the data secured reported separately.

8.4 Observations

In addition to the recording of the experimental data, observations should be made and recorded on general behaviour of the specimen including: glowing, charring, melting, flaming drips, disintegration of the specimen, etc.

9 DERIVED FIRE CHARACTERISTICS

Experimental results should be reported in terms of the thermal measurements of incident flux measured with a dummy specimen in place. The results should not be adjusted to compensate for changes in the thermal output of the radiant panel during the conduct of the test. The following data should be derived from the test results.

9.1 Heat for ignition

As defined in 3.6.

9.2 Heat for sustained burning

A list of the values of this characteristic as defined in paragraph 3.8.

9.3 Average heat for sustained burning

An average of the values for the characteristic defined in 3.8 measured at different stations, the first at 150 mm and then at subsequent stations at 50 mm intervals through the final station or the 400 mm station, whichever value is the lower.

9.4 Critical flux at extinguishment

A list of the values of this characteristic for the specimens tested and the average of these values.

9.5 Heat release of the specimen

Both a heat release time curve and a listing of the peak and total integrated heat release should be secured from the experimental data. They should be corrected for the non-linearity of the heat release calibration curve.

The curve of the millivolt signal from the stack thermocouples should include at least 30 s of the initial 3 min steady state verification period as well as the starting transient just prior to and following specimen insertion. In converting millivolt signals to heat release rate, the zero release level of the calibration curve should be set at the level of the initial steady state just prior to test of the specimen involved. See figure 13.

9.5.1 Total heat release

The total heat release is given by integration of the positive part of the heat release rate during the test period (see figure 13).

9.5.2 Peak heat release rate

The peak heat release rate is the maximum of the heat release rate during the test period (see figure 13).

10 CLASSIFICATION

Materials giving average values for all of the surface flammability criteria as listed in the following table not exceeding those listed in the following table, are considered to meet the requirement for low flame spread in compliance with regulations II-2/3.8, II-2/34 and II-2/49 of the International Convention for the Safety of Life at Sea, 1974, as amended. (MSC/Circ.1036)

Qsb means an average of three values of average heat for sustained burning, as defined in paragraph 9.3. (MSC/Circ.1004)

SURFACE FLAMMABILITY CRITERIA

Bulkhead, wall and ceiling linings				**Floor coverings**			
CFE (kW/m2)	Qsb (MJ/m2)	Qt (M~~j~~ J)	Qp (kW)	CEF (MJ/m2)	Qsb (MJ/m2)	Qt (MJ)	Qp (kW)
□20.0	□1.5	□0.7	□0.4	□7.0	□0.25	□~~1.5~~ 2.0	□10.0

(MSC/Circ.1120)

Where CFE	=	Critical flux at extinguishment
Qsb	=	Heat for sustained burning
Qt	=	Total heat release
Qp	=	Peak heat release rate

11 TEST REPORT

The test report should include both the original data, observations made on each specimen tested and the derived fire characteristics. The following information should be supplied:

.1 Name and address of testing laboratory.

.2 Name and address of sponsor.

.3 Name and address of manufacturer/supplier.

.4 Full description of the product tested including trade name, together with its construction, orientation, thickness, density and, where appropriate, the face subjected to test. In the case of specimens which have been painted or varnished, the information recorded should include the quantity and number of coats applied, as well as the nature of the supporting materials.

.5 Data from the test including:

.5.1 number of specimens tested;

.5.2 type of pilot flame used;

.5.3 duration of each test;

.5.4 observations recorded in accordance with 8 above;

.5.5 other relevant observations from the test, such as flashing, unstable flame front, whether or not pieces of burning materials fall off, separations, fissures, sparks, fusion, changes in form;

.5.6 derived fire characteristics as described in 9 above;

.5.7 classification of the material.

.6 A limiting use statement.

Note: The test results relate only to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use.

APPENDIX

This appendix provides technical information intended to permit construction, erection, alignment and calibration of the physical equipment required for the conduct of tests by this procedure.

1 TEST EQUIPMENT FABRICATION

Figures 1 to 5 show photographs of the equipment as assembled ready for test. Detailed drawings and a parts list are available from the IMO Secretariat. These provide engineering information necessary for the fabrication of the main frame, specimen holders, stack and other necessary parts of the equipment.

1.1 Brief parts list for the test equipment assembly includes:

.1 The main frame (figure 1) which comprises two separate sections, the burner frame and the specimen support frame. These two units are bolted together with threaded rods permitting flexibility in mechanical alignment.

.2 Specimen holders which provide for support of the specimens during test. At least two of these are required. Three prevent delays resulting from required cooling of holders prior to mounting specimens.

.3 A specimen fume stack fabricated of stainless steel sheet of 0.5 +/-0.05 mm thickness complete with gas and stack metal compensating thermocouples.

.4 The radiant panel which has radiating surface dimensions of 280 mm x 483 mm. It has been specially fabricated for use with this equipment through use of commercially available porous refractory tiles.

.5 The blower for combustion air supply, radiant panel, air flow metering device, gas control valves, pressure reducer and safety controls which are all mounted on the burner frame (figure 3). Requirements are summarized below:

.5.1 Air supply of about 30 m^3/h at a pressure sufficient to overcome the friction losses through the line, metering device and radiant panel. The radiant panel drop amounts to only a few millimetres of water.

.5.2 The gas used may be either natural gas or methane. The use of gas other than methane or natural gas is not recommended*, although with changes in panel-specimen spacing, it is possible to use the equipment with propane at flux levels of 50 kW/m^2. A pressure regulator should be provided to maintain a constant supply pressure. Gas is controlled by a manually adjusted needle valve. No venturi mixer is necessary. Safety devices include an electrically operated shutoff valve to prevent gas flow in the event of electric power failure, air pressure failure and loss of heat at the burner surface. The gas flow requirements are roughly 1.0 m^3/h to 3.7 m^3/h for natural gas or methane at a pressure to overcome line pressure losses.

* Flashback limits the maximum operating level with propane.

.6 The specimen holder, pilot flame holder, fume stack, flame front viewing rakes, radiation pyrometer and mirror are all assembled on the specimen support frame. The arrangement of parts on this frame is shown in figures 1 and 2.

.7 A dummy specimen approximately 20 mm thick, made of non-combustible refractory board of 800 +/-100 kg/m^3 density should be continuously mounted on the apparatus in the position of the specimen during operation of the equipment. This dummy specimen should only be removed when a test specimen is to be inserted.

2 INSTRUMENTATION

2.1 Total radiation pyrometer

This should have sensitivity substantially constant between the thermal wave lengths of 1 m and 9 m and should view a centrally-located area on the panel of about 150 mm x 300 mm. The instrument should be mounted on the specimen support frame in such a manner that it can view the panel surface.

2.2 Heat fluxmeters

It is desirable to have at least two fluxmeters for this test method. They should be of the thermopile type with a nominal range of 0 kW/m^2 to 50 kW/m^2 and capable of safe operation at three times this rating. One of these should be retained as a laboratory reference standard. They should have been calibrated to an accuracy of within +5%. The target sensing the applied flux should occupy an area not more than 80 mm^2 and be located flush with and at the centre of the water-cooled 25 mm circular exposed metallic end of the fluxmeter. If fluxmeters of smaller diameter are to be used, these should be inserted into a copper sleeve of 25 mm outside diameter in such a way that good thermal contact is maintained between the sleeve and water-cooled fluxmeter body. The end of the sleeve and the exposed surface of the fluxmeter should lie in the same plane. Radiation should not pass through any window before reaching the target.

2.3 Timing devices

Both a chronograph and either an electric clock with a sweep second hand or a digital clock should be provided to measure time of ignition and flame advance. The chronograph for timing ignition and initial flame advance may comprise a strip chart recorder with paper speed of at least 5 mm/s and an event marker pen. Both the chronograph paper drive and the electric clock should be operated through a common switch to initiate simultaneous operation when the specimen is exposed. This may be either hand operated or actuated automatically as a result of complete specimen insertion.

2.4 Recording millivoltmeter

A two-channel strip chart recording millivoltmeter having at least one megohm input resistance should be used to record signals from the fume stack thermocouples and the output from the radiation pyrometer. The signal from the fume stack will in most instances be less than 15 mV but in some cases this may be exceeded by a small amount. The sensitivity of the other channel should be selected to require less than full scale deflection with the total radiation pyrometer of fluxmeter chosen. The effective operating temperature of the radiant panel should not normally exceed 935° C.

2.5 Digital voltmeter

A small digital millivoltmeter will be found convenient for monitoring changes in operating conditions of the radiant panel. It should be capable of indicating signal changes of 10 micro V or less.

3 SPACE FOR CONDUCTING TESTS

3.1 Special room

A special room should be provided for performance of this test. The dimensions of it are not critical but it may be roughly 45 m^3 volume with a ceiling height of not less than 2.5 m.

3.2 Fume exhaust system

An exhaust system should be installed above the ceiling with a capacity for moving air and combustion products at a rate of 30 m^3/min. The ceiling grill opening to this exhaust system should be surrounded by a 1.3 m x 1.3 m refractory fibre fabric skirt hanging from the ceiling down to 1.7 +/-0.1 m from the floor of the room. The specimen support frame and radiant panel should be located beneath this hood in such a way that all combustion fumes are withdrawn from the room.

3.3 The apparatus

This should be located with a clearance of at least one metre separation between it and the walls of the test room. No combustible finish material of ceiling, floor or walls should be located within 2 m of the radiant heat source.

3.4 Air supply

Access to an exterior supply of air, to replace that removed by the exhaust system, is required. This should be arranged in such a way that the ambient temperature remains reasonably stable (for example: the air might be taken from an adjoining heated building).

3.5 Room draughts

Measurements should be made of air speeds near a dummy specimen while the fume exhaust system is operating but the radiant panel and its air supply are turned off. At a distance of 100 mm the air flow perpendicular to the lower edge at mid-length of the specimen should not exceed 0.2 m/s in any direction.

4 ASSEMBLY AND ADJUSTMENT

4.1 General

The test conditions are essentially defined in terms of the measured heat flux incident on a dummy specimen during calibration. Radiation transfer will predominate, but convection transfer will also play a part. The flux level incident at the specimen surface is a result of the geometrical configuration between the radiant panel and the specimen, as well as the thermal output from the radiant panel.

4.1.1 Both in original adjustments of test operating conditions and periodic verification of this adjustment, the measured heat flux at the surface of the specimen is the controlling criterion. This heat flux is measured by a fluxmeter (see 2.2) mounted in a special dummy specimen (figure 14).

4.1.2 Between consecutive tests, the operating level should be monitored either by use of a fluxmeter mounted in a dummy specimen as defined in paragraph 3.3 of the Recommendation under "Definitions" or preferably by use of a radiation pyrometer which has been previously periodically calibrated on the basis of the readings of such a fluxmeter. This radiation pyrometer should be rigidly fixed to the specimen-holder frame in such a manner that it continuously views the radiating panel surface (see 2.1).

4.2 Mechanical alignment

Most of the adjustments of the components of the test apparatus may be conducted in the cold condition. The position of the refractory surface of the radiant panel with respect to the specimen must correspond with the dimensions shown in figure 6.

These relationships can be achieved by appropriate use of shims between the panel and its mounting bracket, adjustment or separation between the two main frames, and adjustment of the position of the specimen holder guides. Detailed procedures for making these adjustments are suggested in paragraph 5.

4.2.1 The fume stack for heat release measurements should be mechanically mounted on the specimen support frame in the position shown in figure 7.

The method of mounting should ensure the relative positions shown but should allow easy stack removal for cleaning and/or repair. The compensating thermocouple should be mounted in such a manner that good thermal contact is achieved while ensuring greater than one megohm electrical resistance from the stack metal wall.

4.3 Thermal adjustment of panel operating level

Thermal adjustment of the panel operating level is achieved by first setting an air flow of about 30 m^3/h through the panel. Gas is then supplied and the panel ignited and allowed to come to thermal equilibrium with a dummy specimen mounted before it. At proper operating condition, there should be no visible flaming from the panel surface except when viewed from one side parallel to the surface plane. From this direction, a thin blue flame very close to the panel surface will be observed. An oblique view of the panel after a 15 min warm-up period should show a bright orange radiating surface.

4.3.1 With a water-cooled* fluxmeter mounted in a special dummy specimen, the flux incident on the specimen should correspond to the values shown in table1.Compliance with this

* Water cooling of the fluxmeter is required to avoid erroneous signals at low flux levels. The temperature of the cooling water should be controlled in such a manner that the fluxmeter body temperature remains within a few degrees of room temperature. If this is not done, correction of the flux measurement should be made for temperature difference between the fluxmeter body and room temperature. Failure to supply water-cooling may result in thermal damage to the thermal sensing surface and loss of calibration of the fluxmeter. In some cases repairs and recalibration are possible.

requirement is achieved by adjustment of the gas flow. If necessary, small changes in air flow can be made to achieve the condition of no significant flaming from the panel surface. Precise duplication of the flux measurements specified in table 1 for the 50 mm and 350 mm positions on the basis of the fluxmeter calibration used will fix the flux at the other stations well within the limits called for. This does not mean that all other flux levels are correct, but it does ensure that a fixed configuration or view geometry between the panel and specimen has been achieved. To meet these requirements, it may be necessary to make small changes in the specimen longitudinal position shown in figure 6. A plot and smooth curve should be developed on the basis of the eight flux measurements required. The shape of the curve should be similar to that defined by the typical data shown in table1. These measurements are important, since the experimental results are reported on the basis of these flux measurements. If a total radiation pyrometer is to be used to monitor panel operation, records of its signal should be kept following successful completion of this calibration procedure. If a change in panel-specimen axial position is necessary to meet the requirements for flux at the 50 mm and 350 mm positions, this should be accomplished by adjusting the screws connecting the two frames. In this way, the pilot position with respect to the specimen will remain unchanged. The specimen stop screw adjustment may be changed to meet the flux requirements in the standard and then the position of the pilot burner mount may require adjustment to maintain the 10 +/-2 mm pilot spacing.

4.3.2 Once these operating conditions have been achieved, all future panel operation should take place with the established air flow with gas supply as the variable to achieve the specimen flux level as calibrated. This level should be monitored with use of either a radiation pyrometer fixed to view an area of the source surface or a fluxmeter mounted in a dummy specimen, as defined in paragraph 3.3 under "Definitions", at the 350 mm position. If the latter method is used, the assembly of dummy specimen and fluxmeter should remain in place between tests.

4.4 Adjustments and calibrations - general

The following adjustments and calibrations are to be achieved by burning methane gas from the line heat source located parallel to, and in the same plane as, the centreline of a dummy specimen located in position and without fluxmeters. This line burner comprises a 2 m length of pipe of 9.1 mm internal diameter. One end is closed off with a cap and a line of 15 holes of 3 mm diameter are drilled at 16 mm spacing through the pipe wall. The gas burned as it flows through this line of vertically positioned holes flames up through the stack. The measured flow rate and the net or lower heat of combustion of the gas serve to produce a known heat release rate which can be observed as a compensated stack millivolt signal change. Prior to performing calibration tests, measurements must be conducted to verify that the stack thermocouple compensation has been properly adjusted.

4.5 Compensation adjustment

The fraction of the signal from the compensator thermocouple which is subtracted from the stack thermocouple output should be adjusted by means of the resistance of one leg of the potential divider shown in figure 10.

The purpose of this adjustment is as far as practical, to eliminate from the stack signal the long-term signal changes resulting from the relatively slow stack metal temperature variations. Figure 11 shows the curves resulting from under-compensation, correct compensation, and over-compensation. These curves were obtained by abruptly placing the lighted gas calibration burner adjacent to the hot end of a dummy specimen and then extinguishing it. For this adjustment, the calibration gas feed rate should be set to correspond to a heat rate of one kW. The compensator potential divider should be adjusted to yield curves that show a rapid rise to a steady state signal which is essentially constant over a 5 min period following the first minute of transient signal rise. When the calibration burner is shut off, the signal should rapidly decrease and reach a steady state value within two minutes. Following this, there should be no long-term rise or fall of the signal. Experience has shown that between 40% and 50% of the compensation thermocouple signal should be included in the output signal to achieve this condition. When properly adjusted, a square thermal pulse of 7kW should show not more than approximately 7% overshoot shortly after application of the calibration flame (see figure 11).

4.6 Fume stack calibration

With the adjustment described in 4.5 completed and a steady state base signal having been achieved, stack calibration should be carried out with the radiant panel operating at 50.5 kW/m^2 and the pilot burner not lit. The calibration of the stack millivolt signal rise should be made by introducing and removing the line burner, as described in 4.4. The flow rate of methane gas of at least 95% purity should be varied over the range of about $0.004m^3/min$ to $0.02m^3/min$ in sufficient increments to permit plotting the data in a well defined curve of stack compensated millivolt signal rise against the net or lower heat input rate. A similar calibration should be performed with the calibration burner located at the cool end of the specimen. The two curves should show agreement in indicated heat release rate within about 15%. A typical curve is shown in figure 12. The curve for the calibration burner at the hot end of the specimen should be the one used for reporting all heat release measurements. This completes the calibration and the test equipment is ready for use.

5 ASSEMBLY AND MECHANICAL ADJUSTMENT OF THE FLAMMABILITY TEST APPARATUS

The following instructions assume that parts of the flammability test apparatus have been made according to the drawings. The radiant panel sub-assembly has been completed with the exception of the support brackets and reverberatory screen. The equipment can be assembled to permit test of specimens of thickness up to 50 mm or 75 mm. Unless there is a real need for test of thicker specimens, assembly for 50 mm specimens is preferable.

5.1 The panel frame should be placed upright on a level floor, preferably in the location in which the equipment will be used.

5.2 The rotating ring should be mounted on its three guide bearings.

5.3 The panel mount frame should be bolted together, and to the ring, by four bolts.

5.4 A check should be made that the ring lies in a vertical plane. If the error is large, an adjustment of the upper ring support-bearing location may be necessary. Prior to making such an adjustment, it should be determined whether the error is due to excessive clearance between the ring and bearing rollers. If this is the case, rollers of larger diameter may correct the problem.

5.5 The four panel support brackets should be fastened to the radiant panel at four corners. Do not use too much force in bolting these brackets in place. Prior to mounting these brackets, one 35 mm M9 cap screw is placed in the hold that will be farthest from the panel end. These screws provide a means for mounting the panel.

5.6 Four washers should be placed on each of the panel mounting screws and the panel assembled on the mount bracket.

5.7 The angularity of the radiant panel surface with the plane of the mounting ring should be checked. This can be accomplished by means of a carpenter's square and measurements to the refractory tile surface at both ends of the panel. Any deviation from the required 15? angle may be adjusted by increasing or reducing the number of washers on the mounting screws.

5.8 The radiant panel should be rotated to face a specimen mounted in a vertical plane.

5.9 The panel surface should be checked with a level to ensure that it also lies in a vertical plane.

5.10 The specimen frame with specimen support rails on side and bottom positions and pilot burner holders assembled in approximate positions should be brought up to the burner frame and the two frames fastened together with two bolts and six nuts or two threaded rods and eight nuts. The spacing between the frames is roughly 100 mm.

5.11 The spacing of the two sides of the frames is adjusted to ensure that the specimen support frame longitudinal members are at a 15 degrees angle to the radiant panel surface.

5.12 The single specimen holder side guide rail for vertical specimen orientation should be adjusted so that it is at the required 15 degrees angle to the radiant panel surface.

5.13 An empty specimen holder should be slid into position on the rail and the position of the upper guide fork adjusted to ensure that when a specimen is inserted in the holder its surface will lie in a vertical plane.

5.14 The stop screw determining the axial position of the specimen holder should be adjusted to ensure that the axis of the pilot burner is 10 +/-2 mm from the closest exposed edge of the specimen. This adjustment should again be made by use of an empty specimen holder and substitution of a 6 mm steel rod of 250 mm length for the pilot burner ceramic tube. When viewed from the back of the specimen holder, the spacing between rod axis and the edge of the specimen retaining flange of the holder should be 10 +/-2 mm.

5.15 With the specimen holder still in place against the top screw, the spacing between the panel and specimen support frames should be adjusted to make dimension B, figure 6, equal to about 125 mm. This adjustment is made by means of the two screws fastening the frames together. In making this adjustment, it is important to make equal adjustments on ach side to maintain the angular relationship called for in adjustments 5.11 and 5.12.

5.16 The nuts supporting the specimen holder side guide rail should be adjusted to ensure that dimension A, figure 6, is 125 +/-2 mm. Again, equal adjustments to the two mounting points are required. When doing this, a check should be made to ensure that the guide rail and edge of the specimen holder are in a horizontal plane. In making this adjustment, it is important t to ensure that the 45 mm stack position dimension shown in figure 7 is maintained. Another way of adjustment to dimension A is through changes in the number of washers mentioned in 5.6.

5.17 If necessary, procedure 5.13 should be repeated.

5.18 The reverberatory screen should be mounted on the radiant panel. This must be done in such a manner that it is free to expand as it heats up during operation.

5.19 The viewing rake with 50 mm pins is mounted on an angle fastened to the specimen holder guide rail. Its position is adjusted so that pins are located at multiples of 50 mm distance from the closest end of the specimen exposed to the panel. It should be clamped in this position.

TABLE 1 - ***CALIBRATION OF FLUX TO THE SPECIMEN***

Distance from exposed end of the specimen (mm)	**Typical flux levels at the specimen (kW/m^2)**	**Calibration position to be used (kW/m^2)**
0	49.5	
50	50.5	50.5
100	49.5	
150	47.1	x
200	43.1	
250	37.8	x
300	30.9	
350	23.9	23.9
400	18.2	
450	13.2	x
500	9.2	
550	6.2	x
600	4.3	
650	3.1	x
700	2.2	
750	1.5	x

Typical flux incident on the specimen and specimen positions at which the calibration measurements are to be made. The flux at the 50 mm and 350 mm positions should be matched. Calibration data at other positions should agree with typical values within 10%.

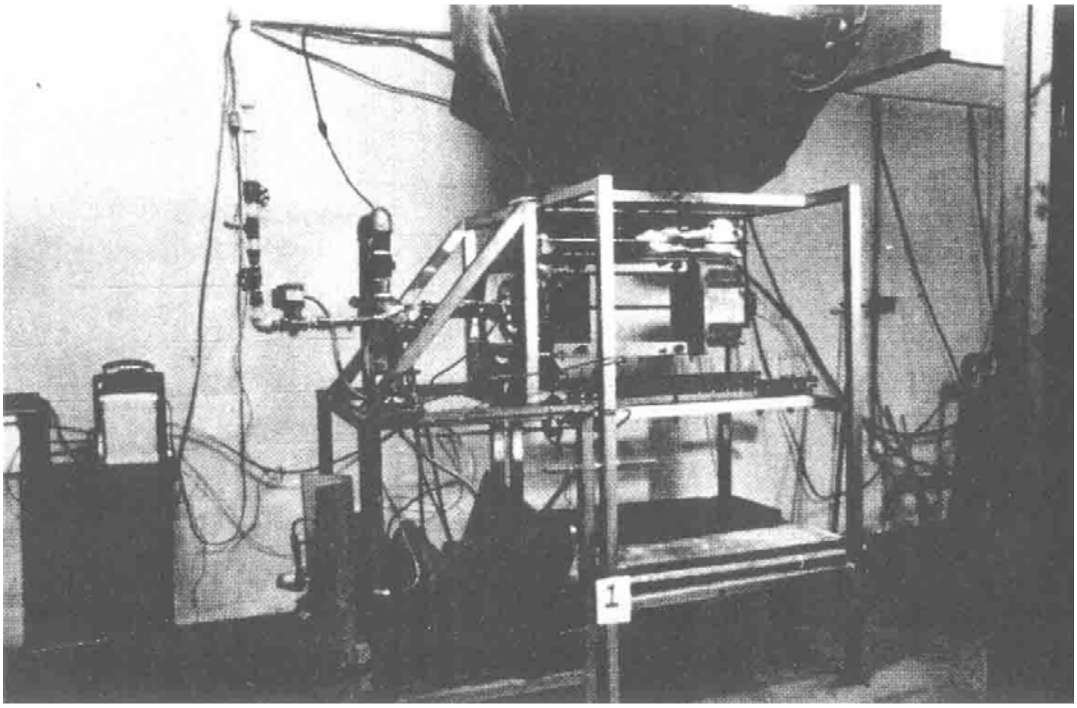

Figure 1 - General view of the apparatus

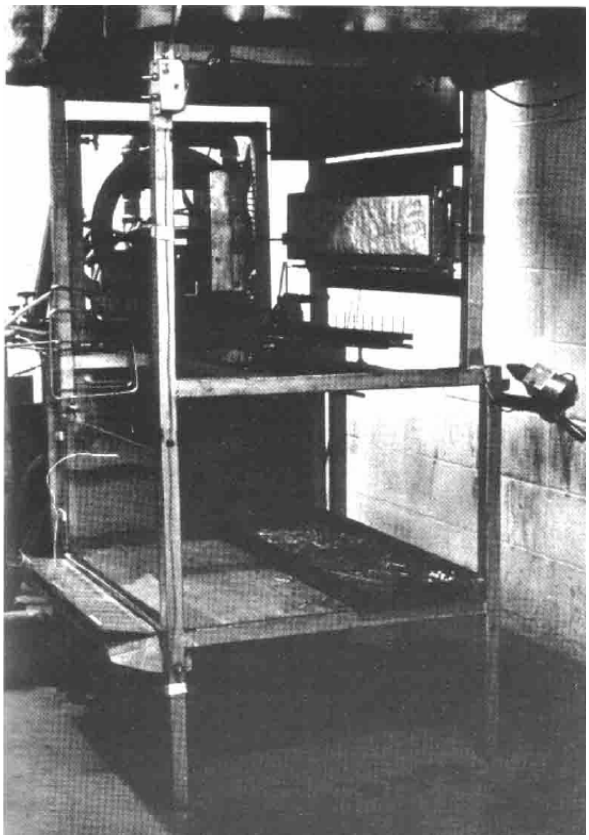

Figure 2 - View from specimen

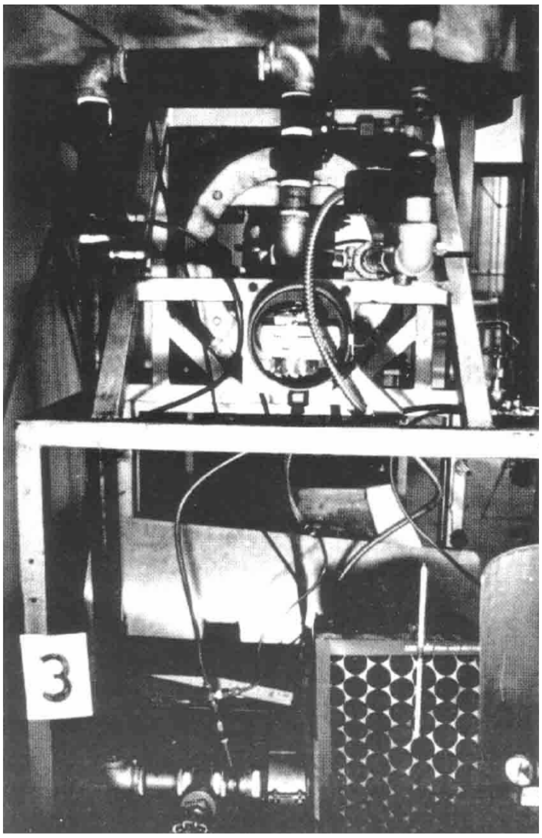

Figure 3 - View from radiant panel end

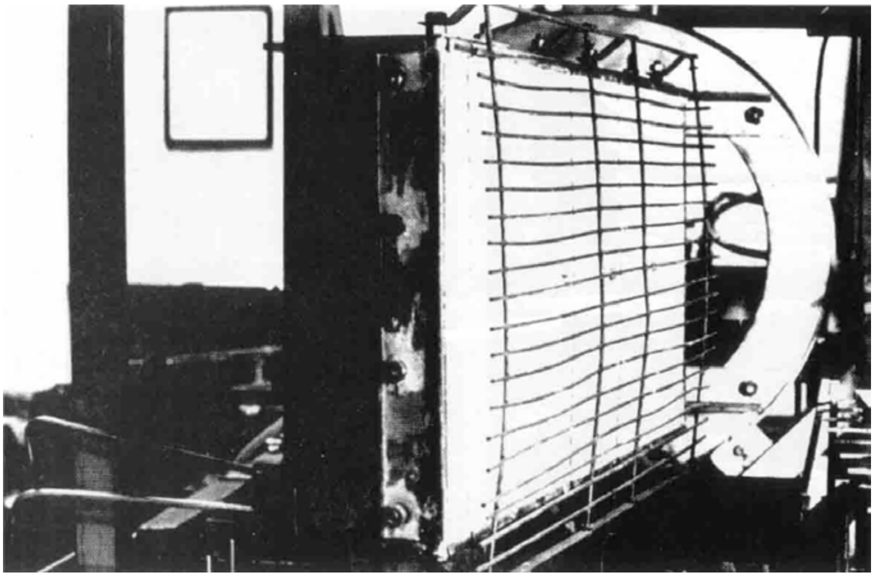

Figure 4 - Radiant panel with reverberatory wires viewed through specimen frames

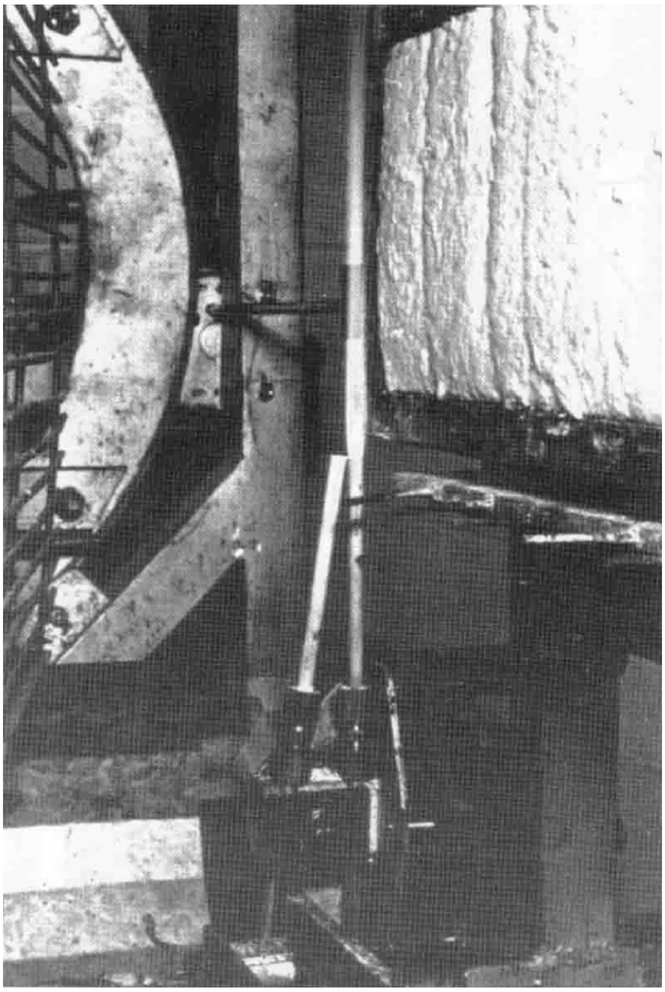

Figure 5 - Pilot burner and mount

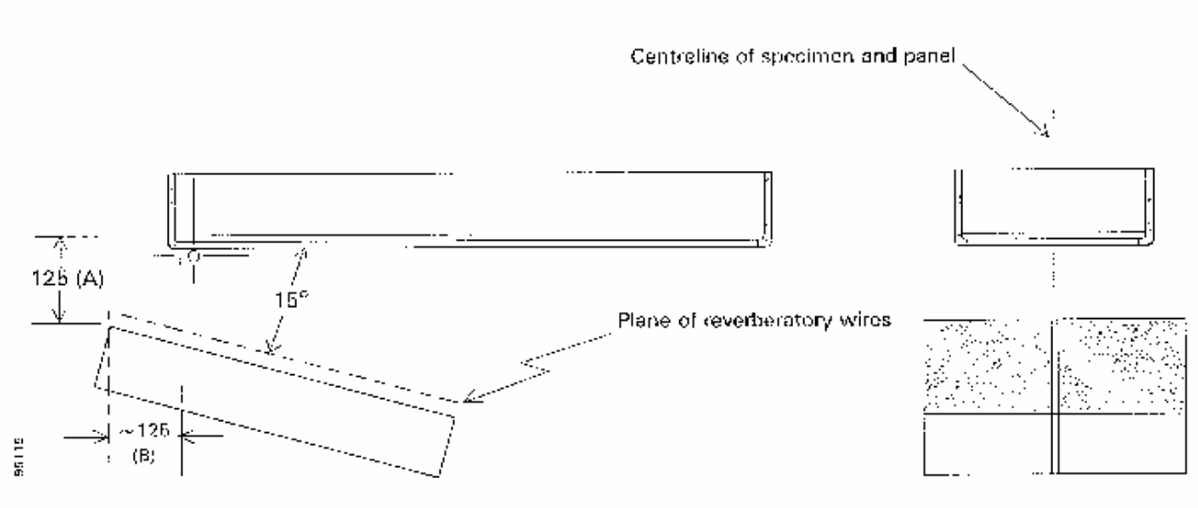

Figure 6 - Specimen – panel arrangements

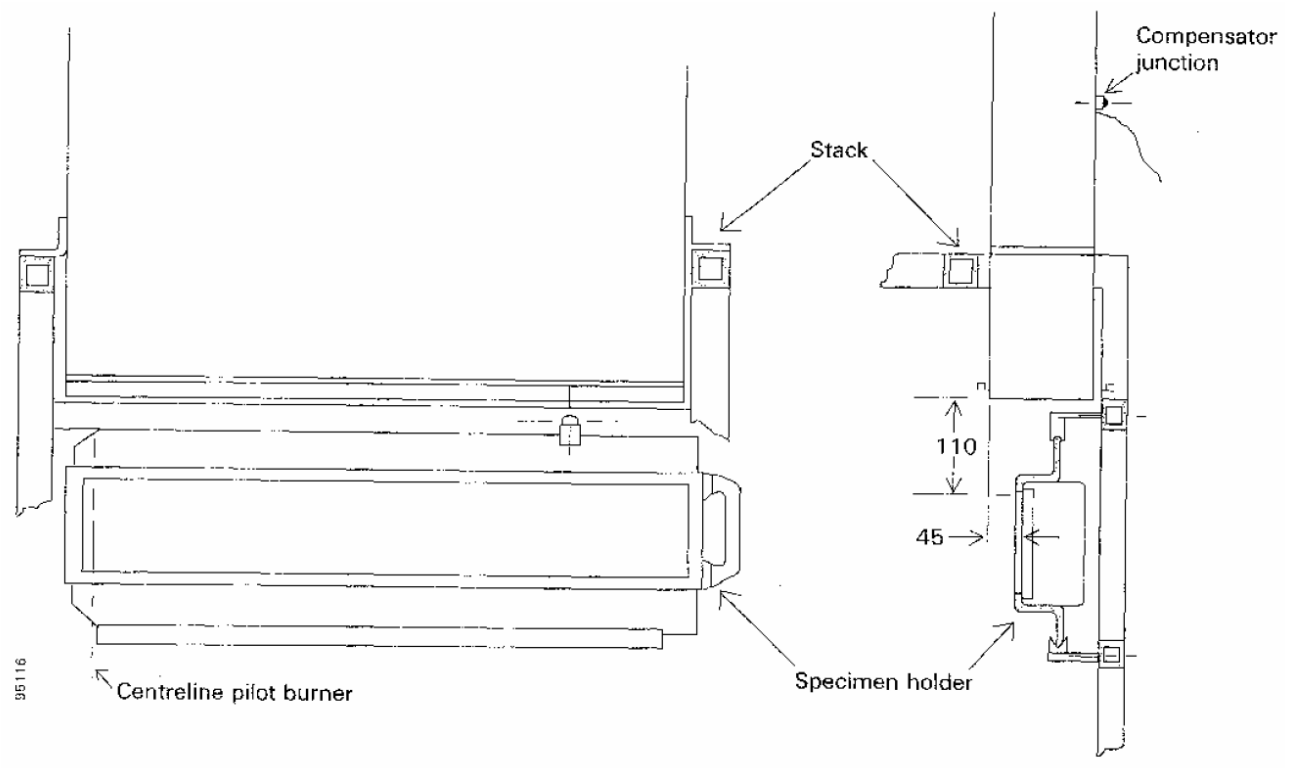

Figure 7 - Position of stack and specimen

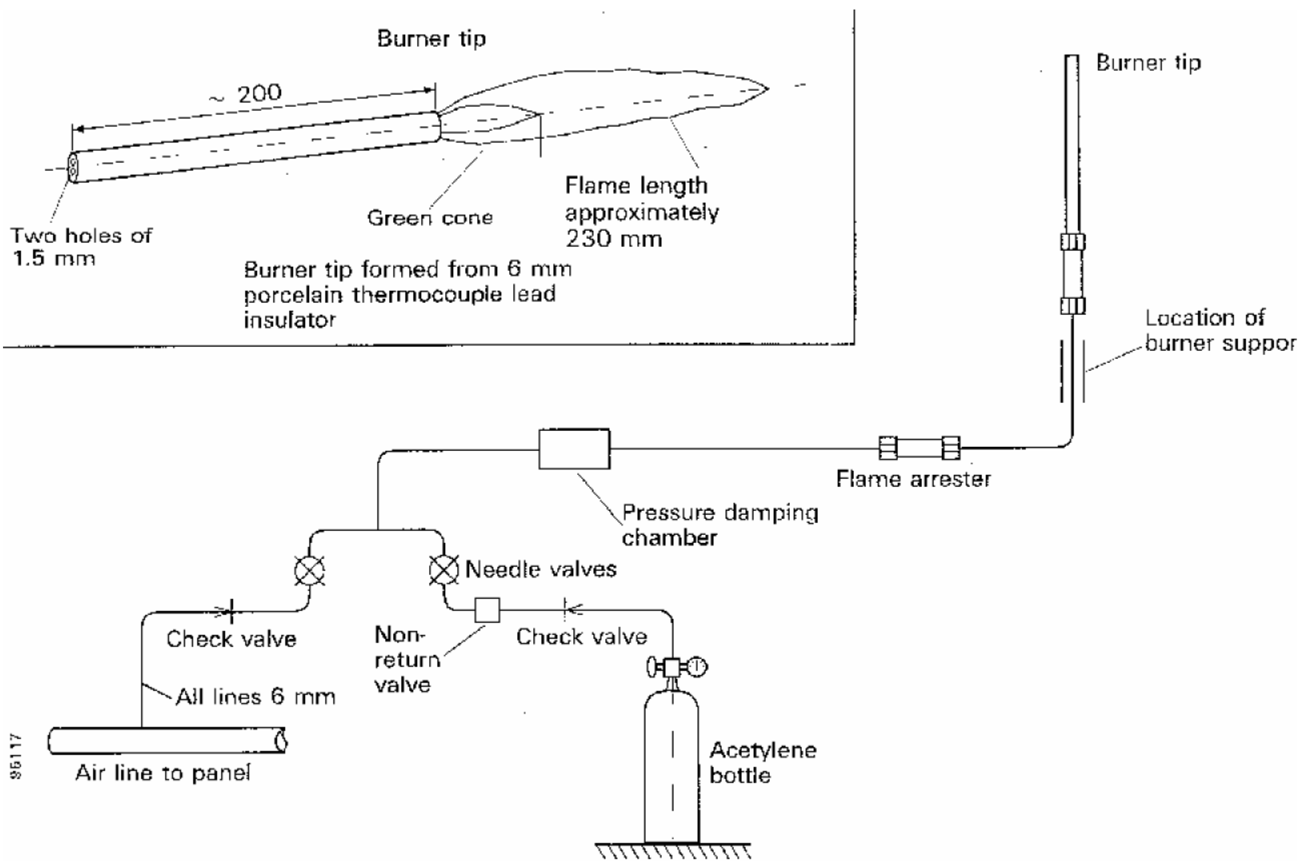

Figure 8 - Pilot burner details and connections

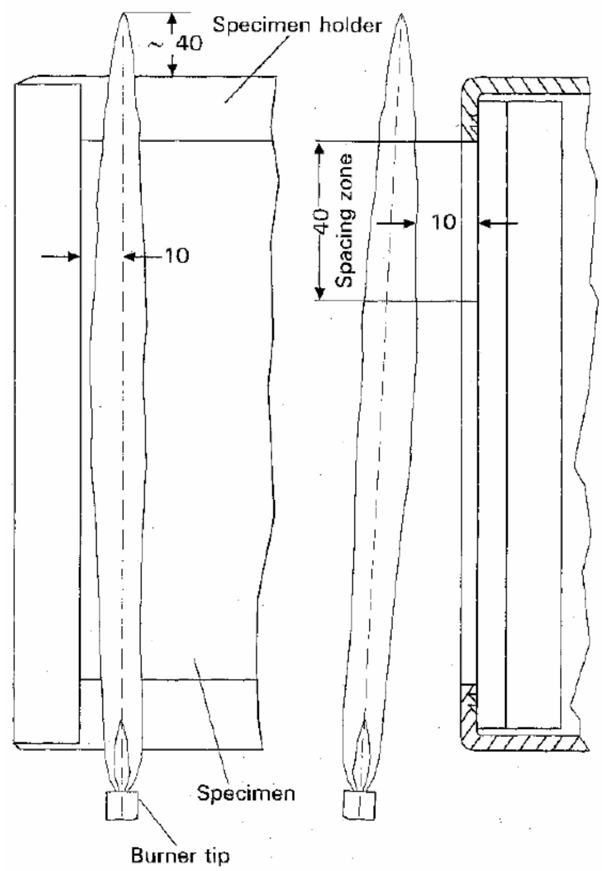

Figure 9 - Position of pilot flame

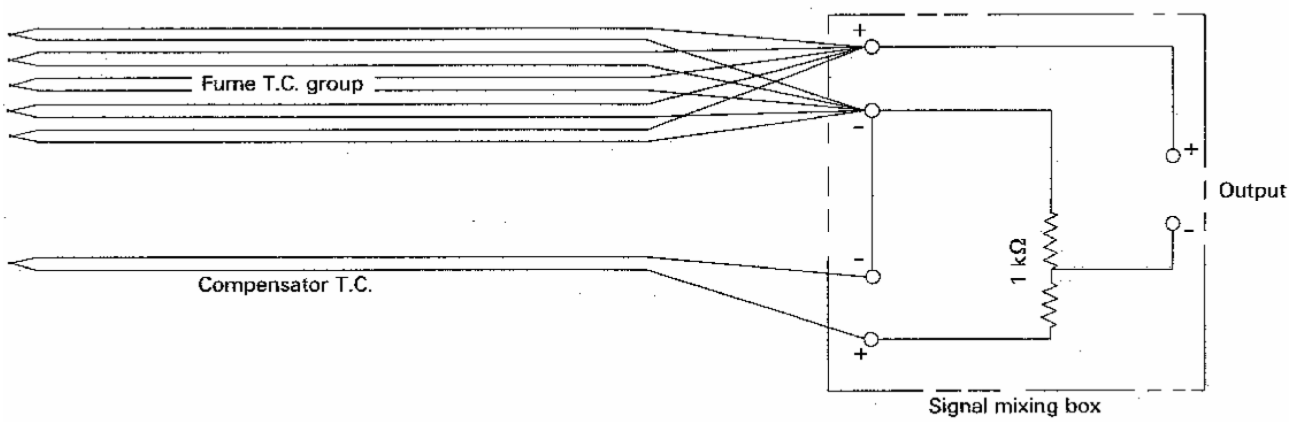

Figure 10 - Diagrammatic sketch of thermocouple circuit

Two sets of thermocouples and lead wires are required. The wire size and lengths within the fume T.C. group must be the same to ensure proper signal averaging. The parallel connection of the couples may be achieved at the mixing box by plug connection of the leads. This allows quick removal and checks for continuity and grounding problems with minimum delay. No cold junction should be used but the signal mixing box should be from panel radiation.

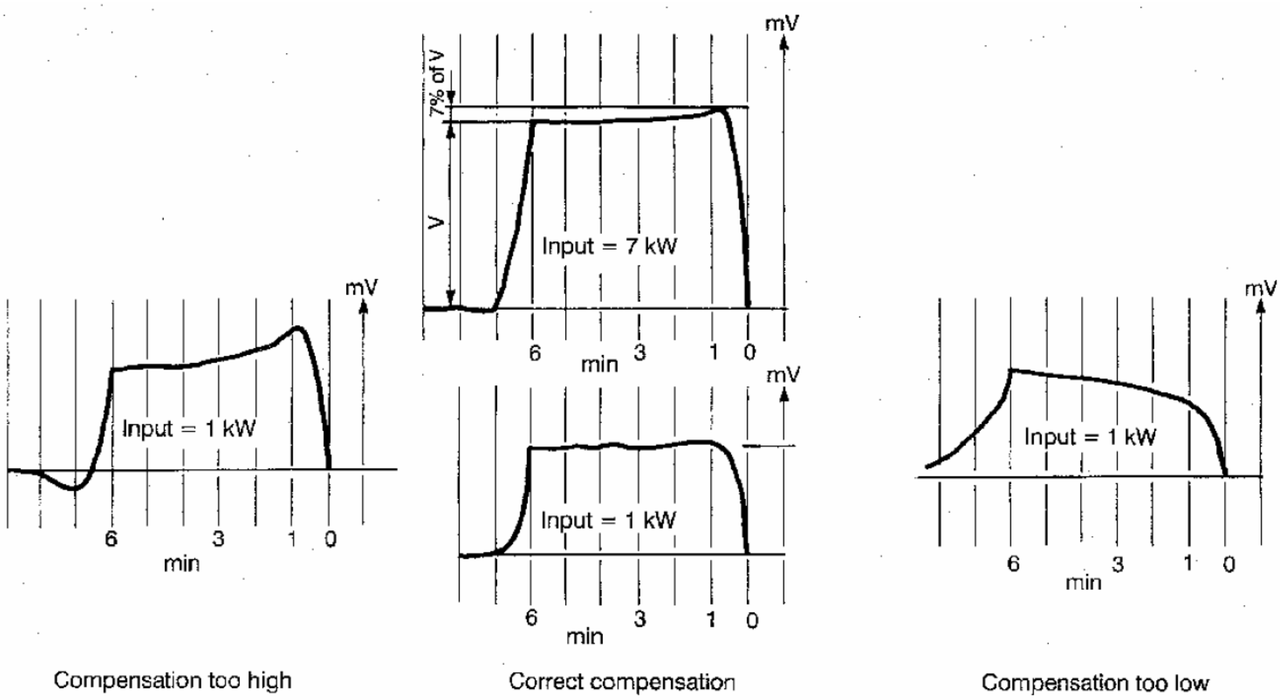

Figure 11 - Response behaviour of heat release signal to a square wave thermal pulse

The four curves shown illustrate changes in the indicated mV signal rise for three different levels of inverse feedback or compensation level.

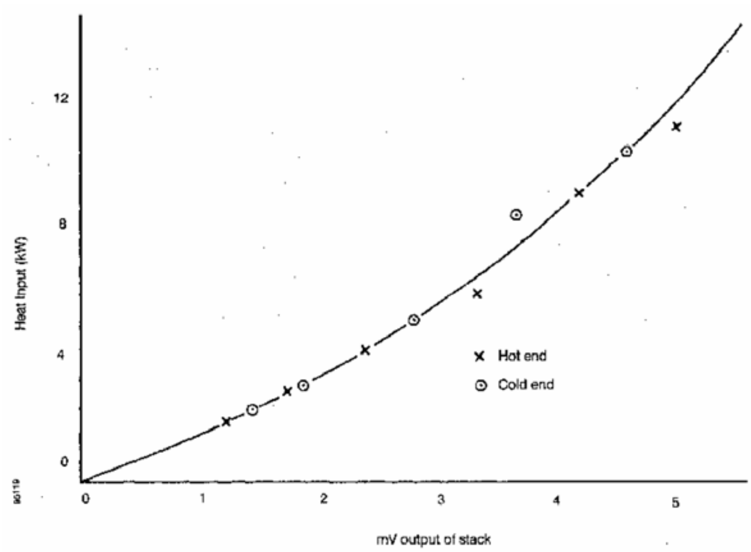

Figure 12 - Typical stack calibration

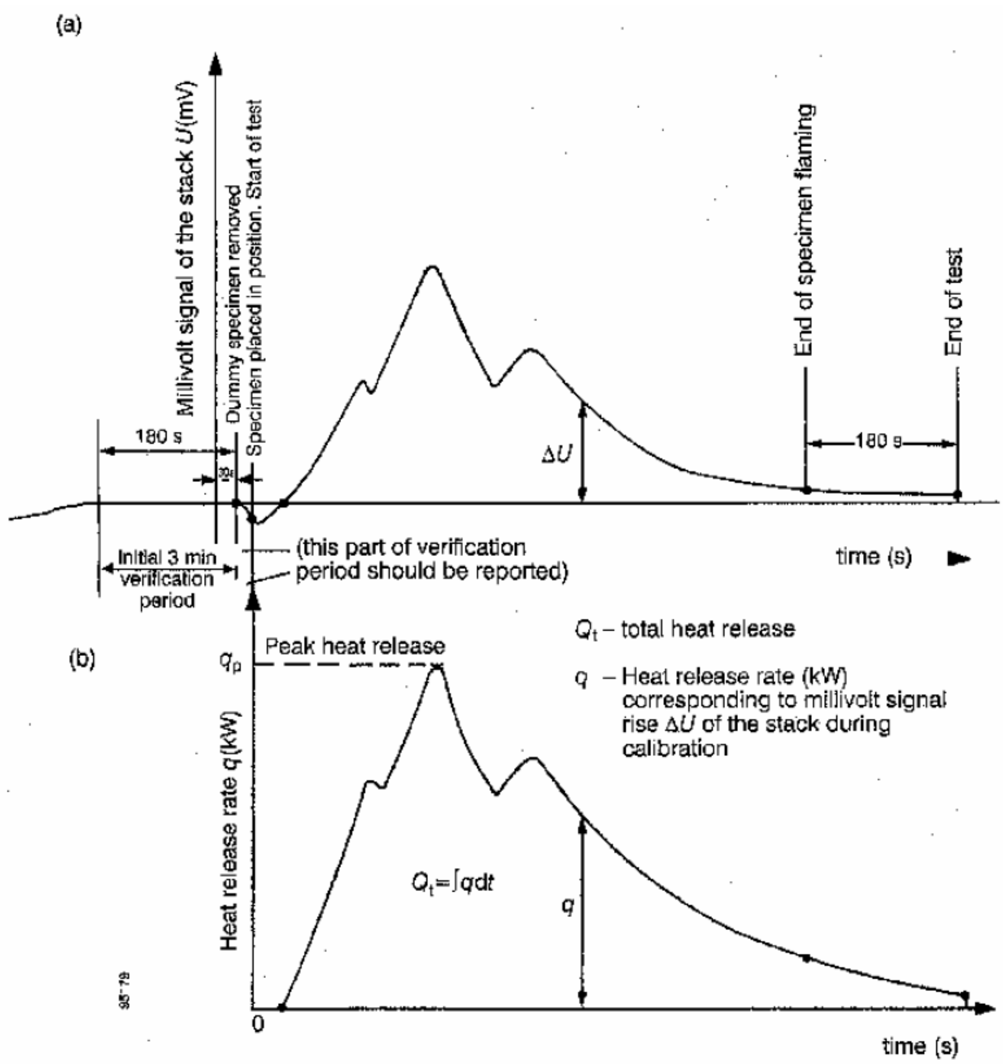

Figure 13 - Conversion of the millivolt signal rise ΔU to heat release rate of the specimen:

(a) millivolt signal change recorded during test
(b) millivolt signal converted to heat release rate curve

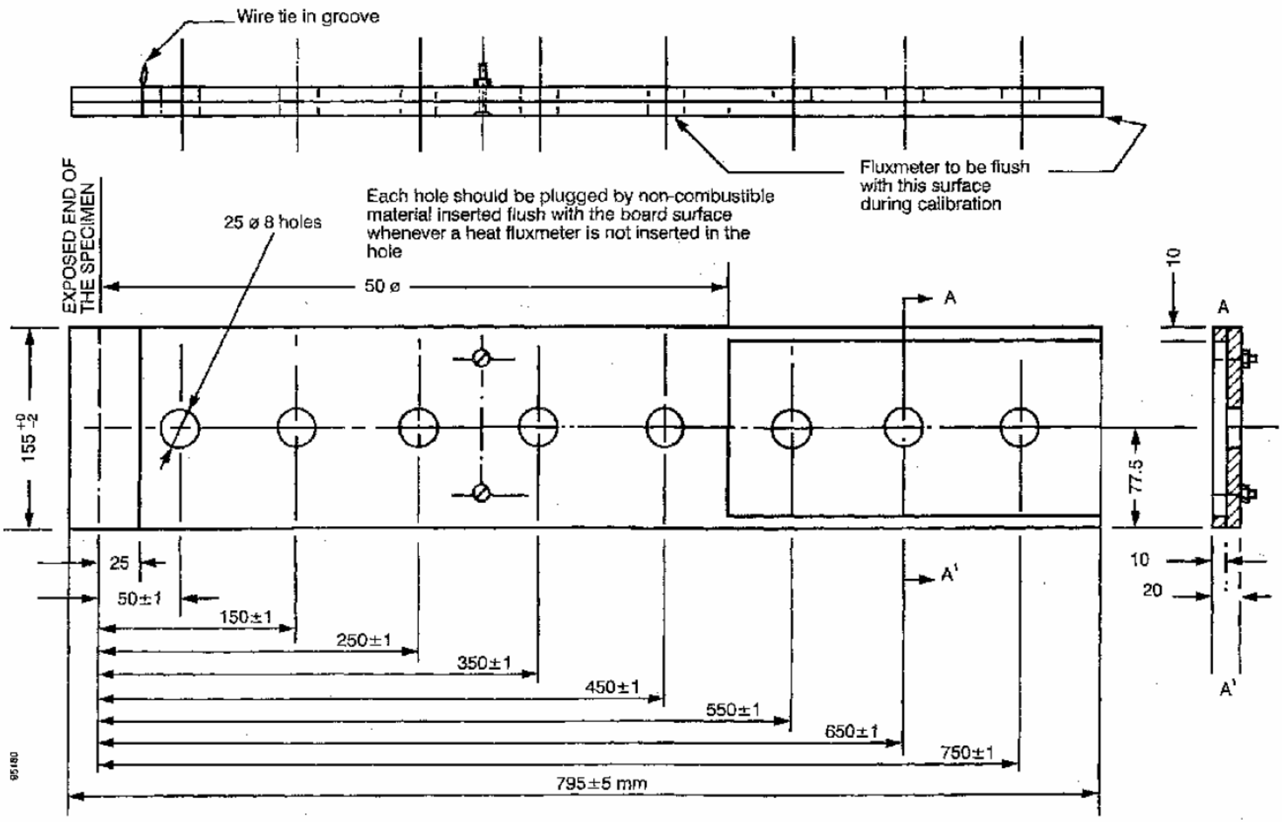

Figure 14 - Special calibration dummy specimen for flux gradient calibration

SUB-COMMITTEE ON FIRE PROTECTION
50th session
Agenda item 10

FP 50/INF.5
7 November 2005
ENGLISH ONLY

COMPREHENSIVE REVIEW OF THE FIRE TEST PROCEDURES CODE

Gas measurement system for part 2 of the FTP Code

Submitted by Japan

SUMMARY	
Executive summary:	This document presents information of gas measurement system to be included into part 2 of the FTP Code for consideration of the Sub-Committee under the new work programme item on "Comprehensive review of the Fire Test Procedures Code"
Action to be taken:	Paragraph 6
Related documents:	MSC 80/21/5, MSC 80/24, FP 50/10/1 and FP 50/10/2

Introduction

1 MSC 80 agreed to include the new work item "Comprehensive review of Fire Test Procedures Code" in the Sub-Committee's work programme and the provisional agenda for FP 50, as a high priority item.

2 Japan is of the opinion that the unified gas measurement system should be introduced to part 2 of the FTP Code to improve the quality and performance of the products and harmonize the FTP Code.

Background

3 MSC/Circ.916 describes "Not only the FTIR (Fourier Transform Infrared Spectrometer) method but also other methods such as GC/MS (Gas Chromatography/Mass Spectrometer) which can produce traceable results can be used for the gas analysis." and timing and position of sampling fumes are provided in the FTP Code, part 2. However, there are no further requirements for sampling methods in the FTP Code or the related interpretations, although, sampling of fumes greatly affect to result of analysis. Therefore, gas sampling methods used by testing laboratories may vary and that may cause the differences in test results to same specimen among testing laboratories.

ISO Standard

4 ISO 21489 has been developed at ISO/TC92/SC1. This ISO standard specifies methods of measurement of gases generated in cumulative smoke/fire test using FTIR. Particular attention is given to the gas sampling systems and conditions of gas measurement. The introduced method from the equipment specified in ISO 5659-2 to gas analytical equipment and analytical method itself are specified clearly by this ISO standard.

Japanese opinion

5 Japan believes that ISO 21489 can be introduced to FTP Code, part 2, and it has been carrying out tests in accordance with the standard. Japan will submit the test results together with considerations derived from test results to the fifty-first session of the Sub-Committee. Japan expects the Member Governments to carry out same tests and submit the results to FP 51 to compare and exchange views on each method.

Action requested of the Sub-Committee

6 The Sub-Committee is invited to note this information.

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INTERNATIONAL MARITIME ORGANIZATION

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IMO

MARITIME SAFETY COMMITTEE
81st session
Agenda item 23

MSC 81/23/5
16 December 2005
Original: ENGLISH

WORK PROGRAMME

Sub-Committee on Fire Protection and Sub-Committee on Dangerous Goods, Solid Cargoes and Containers

Application of requirements for dangerous goods in packaged form

Submitted by Japan

SUMMARY

Executive summary:	This document contains a proposal to include a new item in the work programme of the Sub-Committee on Fire Protection and the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers entitled "Application of requirements for dangerous goods in packaged form", with a view to drawing up draft amendments to regulation II-2/19 of the SOLAS Convention and to chapter 7 of the HSC Code 2000 and with a view to drawing up draft MSC circular for "document of compliance with the special requirements for ships carrying dangerous goods under the provisions of regulation II-2/19 of the 1974 SOLAS Convention, as amended"
Action to be taken:	Paragraph 18
Related documents:	MSC 80/23/3, MSC 80/24, DSC 10/17

1 The following proposal is submitted in accordance with the Guidelines on the organization and method of work of the Committees (MSC/Circ.1099).

Scope of the proposal

2 At the last session of the Committee, Japan, in document MSC 80/23/3, pointed out the possible errors contained in table 19.3 in SOLAS chapter II-2 regarding the application of the requirements to various classes of dangerous goods. The Committee agreed, in principle, with the proposal and invited Japan to consider a submission of an appropriate proposal to this session for a new work programme item for the DSC and FP Sub-Committees, in accordance with the Guidelines on the organization and method of work. (MSC 80/24 paragraphs 23.8 & 23.9) It was also pointed out, at the last session, that similar errors may be contained in table 7.17-3 in HSC Code 2000.

3 Japan proposes to include a new item in the work programme of the Sub-Committees on Fire Protection (FP) and the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers (DSC) entitled "Application of requirements for dangerous goods in packaged form", with a view to drawing up draft amendments to regulation II-2/19 of the SOLAS Convention and chapter 7 of the HSC Code 2000 and with a view to drawing up draft MSC circular for "document of compliance with the special requirements for ships carrying dangerous goods under the provisions of regulation II-2/19 of the 1974 SOLAS Convention, as amended".

4 Japan would like to point out the possible errors, again, in this document that subsidiary risks of dangerous goods are not appropriately addressed in the tables for determining application of requirements for dangerous goods in packaged form, regarding the requirements for bilge pumping, for removal of sources of ignition and for explosion-proof type mechanical ventilation. Draft revised table 19.3 in chapter II-2 of the SOLAS Convention is set out in annex 1 to this document for consideration by these Sub-Committees. Table 7.17-3 in the HSC Code 2000 should also be amended in the similar manner. In the table set out in annex 1, dangerous goods are clearly categorized based on the flash point, in order to provide clear application scheme of the requirements to dangerous goods. Therefore, the new terms "6.1 liquids > 60°C" and "8 liquids > 60°C" are added to existing categories, e.g., "6.1 liquids" and "8 liquids".

5 Japan would like to further point out an inconsistency of the requirements between for removal of sources of ignition and explosion-proof type mechanical ventilation for class 6.1 liquids > 23°C, ≤ 60°C and class 8 liquids > 23°C, ≤ 60°C and invite the Sub-Committees to consider.

6 According to the decision of the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers at its 10th session (DSC 10/17), the IMO instruments would need consequential amendments as a results of the change to the flashpoints temperatures in IMDG Code from 61°C to 60°C. Therefore, this matter also needs to be taken into account at this opportunity.

7 The standard format for document of compliance required by regulation II-2/19.4 is set out in circular MSC/Circ.1027 "document of compliance with the special requirements for ships carrying dangerous goods under the provisions of regulation II-2/19 of SOLAS 74, as amended" and the requirement for the document of compliance is interpreted by circular MSC/Circ.1148 "issuing and renewal of document of compliance with the special requirements applicable to ships carrying dangerous goods". Subject to the decision on the revision of table 19.3 in chapter II-2 of the SOLAS Convention, new MSC circulars should be developed. A draft MSC circular is set out in annex 2 to this document for consideration by the Sub-Committees.

Need for adoption of this proposal

8 Japan is of the opinion that the above mentioned errors should be eliminated as early as possible. Therefore, the proposed new item should be included in the work programme of the Sub-Committee on Fire Protection and the Sub-Committee on Dangerous Goods, Solid Cargoes and Containers as high-priority item.

Costs to the maritime industry

9 Since the amendments to the tables for determining the application of requirements for dangerous goods in packaged form are almost clarification, no additional cost to marine industry is envisaged. The subsequent supersedure of the MSC circular causes no cost to marine industry, as well.

Legal and administrative expenses

10 No expense is necessary for administration. Neither are any legal costs involved.

Ensuing benefits

11 The proposed action will rectify the application of the requirements for dangerous goods in packaged form and will thus help enhance the safety of life at sea.

Level of priority and desired completion date for the work

12 In order to speedily resolve the problems risen, it is proposed that a high priority be attached to this matter and that a session be devoted to it (work completion date 2007).

Indication of required action

13 It is proposed to draw up draft amendments to regulation II-2/19 of the SOLAS Convention and chapter 7 of the HSC Code 2000 and to draw up draft MSC circular for "document of compliance with the special requirements for ships carrying dangerous goods under the provisions of regulation II-2/19 of the 1974 SOLAS Convention, as amended".

Does the matter fall within the scope of IMO's objectives?

14 Yes.

Do suitable regulations exist in the maritime industry?

15 No. (This is a correction of existing SOLAS regulations.)

Do the benefits justify the proposed action?

16 Yes (see paragraph 7 above).

Identify the subsidiary bodies whose assistance is essential to completion of the work

17 Japan proposes that the FP and DSC Sub-Committees be appointed to carry out the work. In this case, the FP Sub-Committee would be appointed to prepare the final draft amendments to the regulations and the final draft MSC circular.

Action requested of the Committee

18 The Committee is invited to include a new high-priority work item into the work programmes of the FP and DSC Sub-Committees.

***

ANNEX 1

DRAFT REVISED TABLE 19.3

Regulation 19 \ Class	1.1 to 1.6	1.4S	2.1	2.2	***2.3 flammable***	***2.3 non-flammable***	3 ≤ 23°C[15]	3 > 23°C[15] ≤**60**°C	4.1	4.2	***4.3 liquids ≤ 23°C[15]***	***4.3 liquids > 23°C[15] ≤60°C***	***4.3 liquids > 60°C[15]***	***4.3 solid***	5.1	5.2	6.1 liquids ≤ 23°C[15]	6.1 liquids > 23°C[15] ≤**60**°C	***6.1 liquids > 60°C[15]***	6.1 solid	8 liquids ≤ 23°C[15]	8 liquids > 23°C[15] ≤**60**°C	***8 liquids > 60°C[15]***	8 solid	9
3.1.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.1.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-
3.1.3	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.1.4	X	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3.2	X	-	X	-	***X***	-	X	***X***	-	-	***X***	***X***	-	-	-	-	X	***X***	-	-	X	***X***	-	-	-
3.3	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	-	X	X	X	X	X	X	X	X	-
3.4.1	-	-	X	-	X	X	X	***X***	X[11]	X[11]	X	X	X	X	X[11]	-	X	X	-	X[11]	X	X	-	-	X[11]
3.4.2	-	-	X	-	***X***	-	X	***X***	-	-	***X***	***X***	-	-	-	-	X	X	-	-	X	X	-	-	-
3.5	-	-	-	-	-	-	X	-	-	-	***X***	-	-	-	-	-	X	X	X	-	X	-	-	-	-
3.6	-	-	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X[14]
3.7	-	-	-	-	-	-	X	X	X	X	X	X	X	X	X	-	X	X	-	-	X	X	-	-	-
3.8	X[12]	-	X	X	X	X	X	X	X	X	X	X	X	X	X[13]	-	X	X	-	-	X	X	-	-	-
3.9	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.10.1	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
3.10.2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

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ANNEX 2

DRAFT MSC CIRCULAR

CARRIAGE OF DANGEROUS GOODS

Document of compliance with the special requirements for ships carrying dangerous goods under the provisions of regulation II-2/19 of the 1974 SOLAS Convention, as amended

1 The Maritime Safety Committee, at its sixty-third session (16 to 25 May 1994), considered and approved a standard format for the document of compliance required by regulation II-2/54.3 of the SOLAS Convention, as amended. The Committee further agreed that the period of validity of the document of compliance should not exceed 5 years and should not be extended beyond the expiry date of the valid Cargo Ship Safety Construction Certificate issued to the ship concerned under the provisions of SOLAS regulation I/12.

2 The Maritime Safety Committee, at its seventy-fifth session (15 to 24 May 2002), in view of the amendments to SOLAS chapter II-2, adopted by resolution MSC.99(73), considered and approved a revised standard format for the document of compliance required by regulation II-2/19.4 of the SOLAS Convention, as amended, applicable as from 1 July 2002. This format is reproduced in circular MSC/Circ.1027.

3 The Maritime Safety Committee, at its seventy-ninth session (1 to 10 December 2004), recognizing the need to take into account the amendments to table 19.3 of SOLAS regulation II-2/19 which had adopted by resolution MSC.134(76), decided that it was necessary to highlight the prohibition on stowage of class 5.2 dangerous goods under deck or in enclosed ro-ro spaces in documents of compliance required by regulation II-2/19 of the SOLAS Convention, as amended, for any ship built on or after 1 July 2004 when issuing or renewing the said documents.

4 The Committee, recognizing also that this prohibition on stowage under the IMDG Code is also applicable to all ships built before 1 July 2004 and subject to regulation II-2/19 (or II-2/54) of the SOLAS Convention, as amended, also decided that the prohibition on stowage would have to be taken into account when renewing documents of compliance for:

- any passenger ship built on or after 1 September 1984 and before 1 July 2004,
- any cargo ship of 500 gross tonnage or above built on or after 1 September 1984 and before 1 July 2004, and
- any cargo ship of less than 500 gross tonnage built on or after 1 February 1992 and before 1 July 2004.

5 In addition, at the same session, the Committee agreed that the standard document of compliance format set out in circular MSC/Circ.1027 should be used when renewing documents of ships subject to SOLAS regulation II-2/54 applicable before 1 July 2002, and that in such cases the references to regulations II-2/19 and II-2/19.4 appearing in the standard format should be replaced by references to regulations II-2/54 and II-2/54.3 respectively.

6 The Maritime Safety Committee, [at its eighty-… session (date)], in view of the amendments to table 19.3 in SOLAS chapter II-2, adopted by resolution MSC.XX(XX), considered and approved again a revised standard format for the document of compliance required by regulation II-2/19.4 of the SOLAS Convention, as amended.

7 The revised standard format of the document of compliance recommended for use and acceptance by Member Governments and Contracting Governments to the SOLAS Convention is annexed hereto.

8 Member Governments are invited to draw this circular to the attention of authorities responsible for issuing and renewing documents of compliance, bodies acting on behalf of these governments, and shipowners, ship operators and masters, with a view to harmonizing the practices of the various administrations.

9 Member Governments are also invited to draw this circular to the attention of authorities tasked by the port State with carrying out inspections of ships, and to recommend them to take the above into account when discharging their responsibilities.

10 This circular supersedes MSC/Circ.1027 and MSC/Circ.1148.

* * *

ANNEX

STANDARD FORMAT OF THE DOCUMENT OF COMPLIANCE

Special Requirements for Ships carrying Dangerous Goods

Issued in pursuance of the requirement of regulation II-2/19.4
of the International Convention for Safety of Life at Sea, 1974,
as amended, under the authority of

the Government of _________________

Name of ship: ____

Distinctive number or letters: ____

Port of registry: ____

Ship type: ____

IMO Number (if applicable): ____

THIS IS TO CERTIFY:

.1 that the construction and equipment of the above mentioned ship was found to comply with the provisions of regulation II-2/19 of the International Convention for the Safety of Life at Sea, 1974, as amended; and

.2 that the ship is suitable for the carriage of those classes of dangerous goods as specified in the appendix hereto, subject to any provisions in the International Maritime Dangerous Goods (IMDG) Code and the Code of Safe Practice for Solid Bulk Cargoes (BC) Code for individual substances, materials or articles also being complied with.

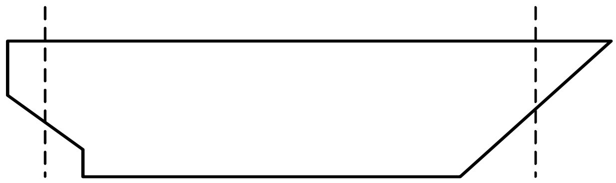
This document is valid until ____

Issued at _____________ ____
(Signature of authorized official issuing the certificate)

NOTE: There are no special requirements in the above-mentioned regulation II-2/19 for the carriage of dangerous goods of classes 6.2 and 7, and for the carriage of dangerous goods in limited quantities, as required in chapter 3.4 of the IMDG Code.

APPENDIX

SPACES TO BE INDICATED IN THE PLANS WITH NUMBERS
CORRESPONDING WITH THE TABLE BELOW



UNDER-DECK SPACES

ON DECK SPACES

Class \ Hold		1	2	3	.	.	.	.
1.1 to 1.6								
1.4S								
2.1								
2.2								
2.3	flammable							
2.3	non-flammable							
3	FP ≤23°C							
3	23°C < FP ≤60°C							
4.1								
4.2								
4.3 liquids	FP ≤ 23°C							
4.3 liquids	23°C< FP ≤60°C							
4.3 liquids	60°C < FP							
4.3 solid								
5.1								
5.2								
6.1 liquids	FP ≤ 23°C							
6.1 liquids	23°C < FP ≤60°C							
6.1 liquids	60°C < FP							
6.1 solid								
8 liquids	FP ≤ 23°C							
8 liquids	23°C < FP ≤ 60°C							
8 liquids	60°C < FP							
8 solid								
9								

"P" indicates PACKAGED GOODS PERMITTED.

"A" indicates PACKAGED AND BULK GOODS ALLOWED.

"X" indicates NOT ALLOWED.

Remarks related to the information in the table above as applicable:

NOTE: Cargoes in bulk may be listed individually by name and class

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添付資料7.10

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Ref. T4/4.01

MSC/Circ.1165
10 June 2005

REVISED GUIDELINES FOR THE APPROVAL OF EQUIVALENT WATER-BASED FIRE-EXTINGUISHING SYSTEMS FOR MACHINERY SPACES AND CARGO PUMP-ROOMS

1 The Maritime Safety Committee, at its sixty-fourth session (5 to 9 December 1994), recognizing the urgent necessity of providing guidelines for alternative arrangements for halon fire-extinguishing systems, approved Guidelines for the approval of equivalent water-based fire-extinguishing systems as referred to in SOLAS 74 for machinery spaces and cargo pump-rooms (MSC/Circ.668).

2 The Committee, at its sixty-sixth session (28 May to 6 June 1996), having considered a proposal by the fortieth session of the Sub-Committee on Fire Protection to revise the interim test method for equivalent water-based fire-extinguishing systems, contained in MSC/Circ.668, approved a revised test method for equivalent water-based fire-extinguishing systems for category A machinery spaces and cargo pump-rooms contained in MSC/Circ.668 (MSC/Circ.728).

3 The Sub-Committee on Fire Protection, at its forty-ninth session (24 to 28 January 2005), reviewed the Guidelines for the approval of equivalent water-based fire-extinguishing systems as referred to in SOLAS 74 for machinery spaces and cargo pump-rooms (annex to MSC/Circ.668, as amended by MSC/Circ.728) and made amendments to the test method for equivalent water-based fire-extinguishing systems for machinery spaces of category A and cargo pump-rooms, taking into account the latest technological progress made in this area.

4 The Committee, at its eightieth session (11 to 20 May 2005), after having considered the above proposal by the forty-ninth session of the Sub-Committee on Fire Protection, approved Revised Guidelines for the approval of equivalent water-based fire-extinguishing systems for machinery spaces and cargo pump-rooms, as set out in the annex.

5 Member Governments are invited to apply the annexed Guidelines when approving equivalent water-based fire-extinguishing systems for machinery spaces and pump-rooms and bring them to the attention of ship designers, ship owners, equipment manufacturers, test laboratories and other parties concerned.

6 Test approvals already conducted in accordance with guidelines contained in MSC/Circ.668, as amended by MSC/Circ.728, should remain valid until 5 years after the date of this circular.

***

ANNEX

REVISED GUIDELINES FOR THE APPROVAL OF EQUIVALENT WATER-BASED FIRE-EXTINGUISHING SYSTEMS FOR MACHINERY SPACES AND CARGO PUMP-ROOMS

General

1 Water-based fire-extinguishing systems for use in machinery spaces of category A and cargo pump-rooms equivalent to fire-extinguishing systems required by SOLAS regulation II-2/10 and chapter 5 of the FSS Code should prove that they have the same reliability which has been identified as significant for the performance of fixed pressure water-spraying systems approved under the requirements of SOLAS regulation II-2/10 and chapter 5 of the FSS Code. In addition, the system should be shown by test to have the capability of extinguishing a variety of fires that can occur in a ship's engine-room.

Definitions

2 *Antifreeze system* is a wet pipe system containing an antifreeze solution and connected to a water supply. The antifreeze solution is discharged, followed by water, immediately upon operation of nozzles.

3 *Bilge area* is the space between the solid engine-room floor plates and the bottom of the engine-room.

4 *Deluge system* is a system employing open nozzles attached to a piping system connected to a water supply through a valve that is opened by the operation of a detection system installed in the same areas as the nozzles or opened manually. When this valve opens, water flows into the piping system and discharges from all nozzles attached thereto.

5 *Dry Pipe system* is a system employing nozzles attached to a piping system containing air or nitrogen under pressure, the release of which (as from the opening of a nozzle) permits the water pressure to open a valve known as a dry pipe valve. The water then flows into the piping system and out of the opened nozzle.

6 *Fire extinction* is a reduction of the heat release from the fire and a total elimination of all flames and glowing parts by means of direct and sufficient application of extinguishing media.

7 *Preaction system* is a system employing automatic nozzles attached to a piping system containing air that mayor may not be under pressure, with a supplemental detection system installed in the same area as the nozzles. Actuation of the detection system opens a valve that permits water to flow into the piping system and to be discharged from any nozzles that may be open.

8 *Water-based extinguishing medium* is fresh water or seawater with or without additives mixed to enhance fire-extinguishing capability.

9 *Wet pipe system* is a system employing nozzles attached to a piping system containing water and connected to a water supply so that water discharges immediately from the nozzles upon system activation.

Principal requirements for the system

10 The system should be capable of manual release.

11 The system should be capable of fire extinction, and tested to the satisfaction of the Administration in accordance with appendix B to these Guidelines.

12 The system should be available for immediate use and capable of continuously supplying water for at least 30 min in order to prevent re-ignition or fire spread within that period of time. Systems which operate at a reduced discharge rate after the initial extinguishing period should have a second full fire-extinguishing capability available within a 5-minute period of initial activation.

13 The system and its components should be suitably designed to withstand ambient temperature changes, vibration, humidity, shock, impact, clogging and corrosion normally encountered in machinery spaces or cargo pump-rooms in ships. Components within the protected spaces should be designed to withstand the elevated temperatures which could occur during a fire.

14 The system and its components should be designed and installed in accordance with international standards acceptable to the Organization[1] and manufactured and tested to the satisfaction of the Administration in accordance with appropriate elements of appendices A and B to these guidelines.

15 The nozzle location, type of nozzle and nozzle characteristics should be within the limits tested to provide fire extinction as referred to in paragraph 10.

16 The electrical components of the pressure source for the system should have a minimum rating of IP 54. The system should be supplied by both main and emergency sources of power and should be provided with an automatic change-over switch. The emergency power supply should be provided from outside the protected machinery space.

17 The system should be provided with a redundant means of pumping. The capacity of the redundant means should be sufficient to compensate for the loss of any single supply pump. The system should be fitted with a permanent sea inlet and be capable of continuous operation using seawater.

18 The piping system should be sized in accordance with an hydraulic calculation technique.[2]

19 Systems capable of supplying water at the full discharge rate for 30 min may be grouped into separate sections within a protected space. The sectioning of the system within such spaces should be approved by the Administration in each case.

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[1] Pending the development of international standards acceptable to the Organization, national standards as prescribed by the Administration should be applied.

[2] Where the Hazen-Williams Method is used, the following values of the friction factor "C" for different pipe types which may be considered should apply:

Pipe type	**C**
Black or galvanized mild steel	100
Copper and copper alloys	150
Stainless steel	150

20 In all cases the capacity and design of the system should be based on the complete protection of the space demanding the greatest volume of water.

21 The system operation controls should be available at easily accessible positions outside the spaces to be protected and should not be liable to be cut off by a fire in the protected spaces.

22 Pressure source components of the system should be located outside the protected spaces.

23 A means for testing the operation of the system for assuring the required pressure and flow should be provided.

24 Activation of any water distribution valve should give a visual and audible alarm in the protected space and at a continuously manned central control station. An alarm in the central control station should indicate the specific valve activated.

25 Operating instructions for the system should be displayed at each operating position. The operating instructions should be in the official language of the flag State. If the language is neither English nor French, a translation into one of these languages should be included.

26 Spare parts and operating and maintenance instructions for the system should be provided, as recommended by the manufacturer.

27 Additives should not be used for the protection of normally occupied spaces unless they have been approved for fire protection service by an independent authority. The approval should consider possible adverse health effects to exposed personnel, including inhalation toxicity.

APPENDIX A

COMPONENT MANUFACTURING STANDARDS OF EQUIVALENT WATER-BASED FIRE-EXTINGUISHING SYSTEMS

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Figures given in square brackets refer to ISO Standard 6182/1.

INTRODUCTION

This document is intended to address minimum fire protection performance, construction, and marking requirements, excluding fire performance, for water-mist nozzles.

Numbers in brackets following a section or sub-section heading refer to the appropriate section or paragraph in the Standard for Automatic sprinkler systems - Part 1: Requirements and methods of test for sprinklers, ISO 6182-1.

The requirements for automatically operating nozzles which involve release mechanism need not be met by nozzles of manually operating systems.

1 DEFINITIONS

1.1 *Conductivity factor* is a measure of the conductance between the nozzle's heat responsive element and the fitting expressed in units of $(m/s)^{0.5}$.

1.2 *Rated working pressure* is the maximum service pressure at which a hydraulic device is intended to operate.

1.3 *Response time index (RTI)* is a measure of nozzle sensitivity expressed as $RTI = tu^{0.5}$, where **t** is the time constant of the heat responsive element in units of seconds, and **u** is the gas velocity expressed in metres per second. RTI can be used in combination with the conductivity factor (C) to predict the response of a nozzle in fire environments, defined in terms of gas temperature and velocity versus time. RTI has units of $(m.s)^{0.5}$.

1.4 *Standard orientation.* In the case of nozzles with symmetrical heat responsive elements supported by frame arms, standard orientation is with the air flow perpendicular to both the axis of the nozzle's inlet and the plane of the frame arms. In the case of non-symmetrical heat responsive elements, standard orientation is with the air flow perpendicular to both the inlet axis and the plane of the frame arms which produces the shortest response time.

1.5 *Worst case orientation* is the orientation which produces the longest response time with the axis of the nozzle inlet perpendicular to the air flow.

2 PRODUCT CONSISTENCY

2.1 It should be the responsibility of the manufacturer to implement a quality control programme to ensure that production continuously meets the requirements in the same manner as the originally tested samples.

2.2 The load on the heat responsive element in automatic nozzles should be set and secured by the manufacturer in such a manner so as to prevent field adjustment or replacement.

3 WATER-MIST NOZZLE REQUIREMENTS

3.1 Dimensions

Nozzles should be provided with a nominal 6 mm (1/4 in.) or larger nominal inlet thread or equivalent. The dimensions of all threaded connections should conform to International Standards where applied. National Standards may be used if International Standards are not applicable.

3.2 Nominal release temperatures (6.2)

3.2.1 The nominal release temperatures of automatic glass bulb nozzles should be as indicated in table 1.

3.2.2 The nominal release temperatures of fusible automatic element nozzles should be specified in advance by the manufacturer and verified in accordance with 3.3. Nominal release temperatures should be within the ranges specified in table 1.

Table 1 – Nominal release temperature

Values in degrees Celsius

GLASS BULB NOZZLES		FUSIBLE ELEMENT NOZZLES	
Nominal release temp.	Liquid colour code	Nominal release temp.	Frame colour code *
57	orange	57 to 77	uncoloured
68	red	80 to 107	white
79	yellow	121 to 149	blue
93-100	green	163 to 191	red
121-141	blue	204 to 246	green
163-182	mauve	260 to 343	orange
204-343	black		

* Not required for decorative nozzles

3.3 Operating temperatures (see 4.6.1) [6.3]

Automatic nozzles should open within a temperature range of

$$X \pm 0.035X + 0.62^{\circ}C$$

where X is the nominal release temperature.

3.4 Water flow and distribution

3.4.1 Flow constant (see 4.10) [6.4.1]

3.4.1.1 The flow constant K for nozzles is given in the following formula:

$$K = Q/P^{0.5}$$

where:

P is the pressure in bars; and
Q is the flow rate in litres per min.

3.4.1.2 The value of the flow constant K published in the Manufacturer's Design and Installation Instructions should be verified using the test method of 4.10. The average flow constant K should be verified within ± 5% of the manufacturer's value.

3.5 Function (see 4.5) [6.5]

3.5.1 When tested in accordance with 4.5, the nozzle should open and, within 5 s after the release of the heat responsive element, should operate satisfactorily by complying with the requirements of 4.10. Any lodgement of released parts should be cleared within 60 s of release for standard response heat responsive elements and within 10 s of release for fast and special response heat responsive elements or the nozzle should then comply with the requirement of 4.11.

3.5.2 The nozzle discharge components should not sustain significant damage as a result of the functional test specified in 4.5.6 and should have the same flow constant range and water droplet size and velocity within 5 per cent of values as previously determined per 3.4.1 and 3.4.3.

3.6 Strength of body (see 4.3) [6.6]

The nozzle body should not show permanent elongation of more than 0.2% between the load-bearing points, after being subjected to twice the average service load, as determined using the method of 4.3.1.

3.7 Strength of release element [6.7]

3.7.1 Glass bulbs (see 4.9.1)

The lower tolerance limit for bulb strength should be greater than two times the upper tolerance limit for the bulb design load based on calculations with a degree of confidence of 0.99 for 99 per cent of the samples as determined in 4.9.1. Calculations will be based on the Normal or Gaussian Distribution except where another distribution can be shown to be more applicable due to manufacturing or design factors.

3.7.2 Fusible elements (see 4.9.2)

Fusible heat-responsive elements in the ordinary temperature range should be designed to:

.1 sustain a load of 15 times its design load corresponding to the maximum service load measured in 4.3.1 for a period of 100 hours in accordance with 4.9.2.1; or

.2 demonstrate the ability to sustain the design load when tested in accordance with 4.9.2.2.

3.8 Leak resistance and hydrostatic strength (see 4.4) [6.8]

3.8.1 A nozzle should not show any sign of leakage when tested by the method specified in 4.4.1.

3.8.2 A nozzle should not rupture, operate or release any parts when tested by the method specified in 4.4.2.

3.9 Heat exposure [6.9]

3.9.1 Glass bulb nozzles (see 4.7.1)

There should be no damage to the glass bulb element when the nozzle is tested by the method specified in 4.7.1.

3.9.2 All uncoated nozzles (see 4.7.2)

Nozzles should withstand exposure to increased ambient temperature without evidence of weakness or failure, when tested by the method specified in 4.7.2.

3.9.3 Coated nozzles (see 4.7.3)

In addition to meeting the requirement of 4.7.2 in an uncoated version, coated nozzles should withstand exposure to ambient temperatures without evidence of weakness or failure of the coating, when tested by the method specified in 4.7.3.

3.10 Thermal shock (see 4.8) [6.10]

Glass bulb nozzles should not be damaged when tested by the method specified in 4.8. Proper operation is not considered as damage.

3.11 Corrosion [6.11]

3.11.1 Stress corrosion (see 4.12.1 and 4.12.2)

When tested in accordance with 4.12.1, all brass nozzles should show no fractures which could affect their ability to function as intended and satisfy other requirements.

When tested in accordance with 4.12.2, stainless steel parts of water-mist nozzles should show no fractures or breakage which could affect their ability to function as intended and satisfy other requirements.

3.11.2 Sulphur dioxide corrosion (see 4.12.3)

Nozzles should be sufficiently resistant to sulphur dioxide saturated with water vapour when conditioned in accordance with 4.12.2. Following exposure, five nozzles should operate, when functionally tested at their minimum flowing pressure (see 3.5.1 and 3.5.2). The remaining five samples should meet the dynamic heating requirements of 3.14.2.

3.11.3 Salt spray corrosion (see 4.12.4)

Coated and uncoated nozzles should be resistant to salt spray when conditioned in accordance with 4.12.4. Following exposure, the samples should meet the dynamic heating requirements of 3.14.2.

3.11.4 Moist air exposure (see 4.12.5)

Nozzles should be sufficiently resistant to moist air exposure and should satisfy the requirements of 3.14.2 after being tested in accordance with 4.12.5.

3.12 Integrity of nozzle coatings [6.12]

3.12.1 Evaporation of wax and bitumen used for atmospheric protection of nozzles (see 4.13.1)

Waxes and bitumens used for coating nozzles should not contain volatile matter in sufficient quantities to cause shrinkage, hardening, cracking or flaking of the applied coating. The loss in mass should not exceed 5% of that of the original sample when tested by the method in 4.13.1.

3.12.2 Resistance to low temperatures (see 4.13.2)

All coatings used for nozzles should not crack or flake when subjected to low temperatures by the method in 4.13.2.

3.12.3 Resistance to high temperature (see 3.9.3)

Coated nozzles should meet the requirements of 3.9.3.

3.13 Water hammer (see 4.15) [6.13]

Nozzles should not leak when subjected to pressure surges from 4 bar to four times the rated pressure for operating pressures up to 100 bars and two times the rated pressure for pressures greater than 100 bar. They should show no signs of mechanical damage when tested in accordance with 4.15 and should operate within the parameters of 3.5.1 at the minimum design pressure.

3.14 Dynamic heating (see 4.6.2) [6.14]

3.14.1 Automatic nozzles intended for installation in other than accommodation spaces and residential areas should comply with the requirements for RTI and C limits shown in figure 1. Automatic nozzles intended for installation in accommodation spaces or residential areas should comply with fast response requirements for RTI and C limits shown in figure 1. Maximum and minimum RTI values for all data points calculated using C for the fast and standard response nozzles should fall within the appropriate category shown in figure 1. Special response nozzles should have an average RTI value, calculated using C, between 50 and 80 with no value less than 40 or more than 100. When tested at an angular offset to the worst case orientation as described in section 4.6.2, the RTI should not exceed 600 $(m.s)^{0.5}$ or 250% of the value of RTI in the standard orientation, whichever is less. The angular offset should be 15º for standard response, 20º for special response and 25º for fast response.

3.14.2 After exposure to the corrosion test described in sections 3.11.2, 3.11.3 and 3.11.4, nozzles should be tested in the standard orientation as described in section 4.6.2.1 to determine the post exposure RTI. All post exposure RTI values should not exceed the limits shown in figure 1 for the appropriate category. In addition, the average RTI value should not exceed 130% of the pre-exposure average value. All post exposure RTI values should be calculated as in section 4.6.2.3 using the pre-exposure conductivity factor (C).

3.15 Resistance to heat (see 4.14) [6.15]

Open nozzles should be sufficiently resistant to high temperatures when tested in accordance with 4.14. After exposure, the nozzle should not show:

.1 visual breakage or deformation;

.2 a change in flow constant K of more than 5 per cent; and

.3 no changes in the discharge characteristics of the Water Distribution Test (see 3.4.2) exceeding 5 per cent.

3.16 Resistance to vibration (see 4.16) [6.16]

Nozzles should be able to withstand the effects of vibration without deterioration of their performance characteristics, when tested in accordance with 4.16. After the vibration test of 4.16, nozzles should show no visible deterioration and should meet the requirements of 3.5 and 3.8.

3.17 Impact test (see 4.17) [6.17]

Nozzles should have adequate strength to withstand impacts associated with handling, transport and installation without deterioration of their performance or reliability. Resistance to impact should be determined in accordance with 4.1.

3.18 Lateral discharge (see 4.18) [6.19]

Nozzles should not prevent the operation of adjacent automatic nozzles when tested in accordance with 4.21.

3.19 30 day leakage resistance (see 4.19) [6.20]

Nozzles should not leak, sustain distortion or other mechanical damage when subjected to twice the rated pressure for 30 days. Following exposure, the nozzles should satisfy the test requirements of 4.22.

3.20 Vacuum resistance (see 4.23) [6.21]

Nozzles should not exhibit distortion, mechanical damage or leakage after being subjected to the test in 4.23.

3.21 Water shield [6.22 and 6.23]

3.21.1 General

An automatic nozzle intended for use at intermediate levels or beneath open grating should be provided with a water shield which complies with 3.21.2 and 3.21.3.

3.21.2 Angle of protection (see 4.21.1)

Water shields should provide an "angle of protection" of 45º or less for the heat responsive element against direct impingement of run-off water from the shield caused by discharge from nozzles at higher elevations. Compliance with this requirement should be determined in accordance with 4.21.1.

3.21.3 Rotation (see 4.21.2)

Rotation of the water shield should not alter the nozzle service load when evaluated in accordance with 4.21.2.

3.22 Clogging (see 4.21) [6.28.3]

A water-mist nozzle should show no evidence of clogging during 30 minutes of continuous flow at rated working pressure using water, which has been contaminated in accordance with 4.21.3. Following the 30 minutes of flow, the water flow at rated pressure of the nozzle and strainer or filter should be within ± 10 per cent of the value obtained prior to conducting the clogging test.

4 METHODS OF TEST [7]

4.1 General

The following tests should be conducted for each type of nozzle. Before testing, precise drawings of parts and the assembly should be submitted together with the appropriate specifications (using SI units). Tests should be carried out at an ambient temperature of (20,±5)ºC, unless other temperatures are indicated.

4.2 Visual examination [7.2]

Before testing, nozzles should be examined visually with respect to the following points:

.1 marking;
.2 conformity of the nozzles with the manufacturer's drawings and specification; and
.3 obvious defects.

4.3 Body strength test [7.3]

4.3.1 The design load should be measured on ten automatic nozzles by securely installing each nozzle, at room temperature, in a tensile/compression test machine and applying a force equivalent to the application of the rated working pressure.

4.3.2 An indicator capable of reading deflection to an accuracy of 0.01 mm should be used to measure any change in length of the nozzle between its load bearing points. Movement of the nozzle shank thread in the threaded bushing of the test machine should be avoided or taken into account.

4.3.3 The hydraulic pressure and load is then released and the heat responsive element is then removed by a suitable method. When the nozzle is at room temperature, a second measurement is to be made using the indicator.

4.3.4 An increasing mechanical load to the nozzle is then applied at a rate not exceeding 500 N/minute, until the indicator reading at the load bearing point initially measured returns to the initial value achieved under hydrostatic load. The mechanical load necessary to achieve this should be recorded as the service load. Calculate the average service load.

4.3.5 The applied load is then progressively increased at a rate not exceeding 500 N/minute on each of the five specimens until twice the average service load has been applied. Maintain this load for 15 ± 5 s.

4.3.6 The load is then removed and any permanent elongation as defined in 3.6 is recorded.

4.4 Leak resistance and hydrostatic strength tests (see 3.8) [7.4]

4.4.1 Twenty nozzles should be subjected to a water pressure of twice their rated working pressure, but not less than 34.5 bar. The pressure is increased from 0 bar to the test pressure, maintained at twice rated working pressure for a period of 3 min and then decreased to 0 bar. After the pressure has returned to 0 bar, it is increased to the minimum operating pressure specified by the manufacturer in not more than 5 s. This pressure is to be maintained for 15 s and then increased to rated working pressure and maintained for 15 s.

4.4.2 Following the test of 4.4.1, the twenty nozzles should be subjected to an internal hydrostatic pressure of four times the rated working pressure. The pressure is increased from 0 bar to four times the rated working pressure and held there for a period of 1 minute. The nozzle under test should not rupture, operate or release any of its operating parts during the pressure increase nor while being maintained at four times the rated working pressure for 1 minute.

4.5 Functional test (see 3.5) [7.5]

4.5.1 Nozzles having nominal release temperatures less than 78°C, should be heated to activation in an oven. While being heated, they should be subjected to each of the water pressures specified in 4.5.3 applied to their inlet. The temperature of the oven should be increased to 400 ± 20°C in 3 min measured in close proximity to the nozzle. Nozzles having nominal release temperatures exceeding 78°C should be heated using a suitable heat source. Heating should continue until the nozzle has activated.

4.5.2 Eight nozzles should be tested in each normal mounting position and at pressures equivalent to the minimum operating pressure, the rated working pressure and at the average operating pressure. The flowing pressure should be at least 75% of the initial operating pressure.

4.5.3 If lodgement occurs in the release mechanism at any operating pressure and mounting position, 24 more nozzles should be tested in that mounting position and at that pressure. The total number of nozzles for which lodgement occurs should not exceed 1 in the 32 tested at that pressure and mounting position.

4.5.4 Lodgement is considered to have occurred when one or more of the released parts lodge in the discharge assembly in such a way as to cause the water distribution to be altered after the period of time specified in 3.5.1.

4.5.5 In order to check the strength of the deflector/orifice assembly, three nozzles should be submitted to the functional test in each normal mounting position at 125 per cent of the rated working pressure. The water should be allowed to flow at 125 per cent of the rated working pressure for a period of 15 min.

4.6 Heat responsive element operating characteristics

4.6.1 Operating temperature test (see 3.3) [7.6]

4.6.1.1 Ten nozzles should be heated from room temperature to 20 to 22°C below their nominal release temperature. The rate of increase of temperature should not exceed 20°C/min and the temperature should be maintained for 10 min. The temperature should then be increased at a rate between 0.4°C/min to 0.7°C/min until the nozzle operates.

4.6.1.2 The nominal operating temperature should be ascertained with equipment having an accuracy of ±0.35% of the nominal temperature rating or ±0.25°C, whichever is greater.

4.6.1.3 The test should be conducted in a water bath for nozzles or separate glass bulbs having nominal release temperatures less than or equal to 80°C. A suitable oil should be used for higher-rated release elements. The liquid bath should be constructed in such a way that the temperature deviation within the test zone does not exceed 0.5%, or 0.5°C, whichever is greater.

4.6.2 Dynamic heating test (see 3.4)

4.6.2.1 Plunge test

4.6.2.1.1 Tests should be conducted to determine the standard and worst case orientations as defined in 1.4 and 1.5. Ten additional plunge tests should be performed at both of the identified orientations. The worst case orientation should be as defined in 3.14.1. The RTI is calculated as described in 4.6.2.3 and 4.6.2.4 for each orientation, respectively. The plunge tests are to be conducted using a brass nozzle mount designed such that the mount or water temperature rise does not exceed 2°C for the duration of an individual plunge test up to a response time of 55 s. (The temperature should be measured by a thermocouple heatsinked and embedded in the mount not more than 8 mm radially outward from the root diameter of the internal thread or by a thermocouple located in the water at the centre of the nozzle inlet.) If the response time is greater than 55 s, then the mount or water temperature in degrees Celsius should not increase more than 0.036 times the response time in seconds for the duration of an individual plunge test.

4.6.2.1.2 The nozzle under test should have 1 to 1.5 wraps of PTFE sealant tape applied to the nozzle threads. It should be screwed into a mount to a torque of 15 ±3 Nm. Each nozzle is to be mounted on a tunnel test section cover and maintained in a conditioning chamber to allow the nozzle and cover to reach ambient temperature for a period of not less than 30 min.

4.6.2.1.3 At least 25 ml of water, conditioned to ambient temperature, should be introduced into the nozzle inlet prior to testing. A timer accurate to ±0.01 s with suitable measuring devices to sense the time between when the nozzle is plunged into the tunnel and the time it operates should be utilized to obtain the response time.

4.6.2.1.4 A tunnel should be utilized with air flow and temperature conditions[1] at the test section (nozzle location) selected from the appropriate range of conditions shown in table 2. To minimize radiation exchange between the sensing element and the boundaries confining the flow, the test section of the apparatus should be designed to limit radiation effects to within ± 3% of calculated RTI values[2].

4.6.2.1.5 The range of permissible tunnel operating conditions is shown in table 2. The selected operating condition should be maintained for the duration of the test with the tolerances as specified by footnotes 4 and 5 in table 2.

4.6.2.2 Determination of conductivity factor (C) [7.6.2.2]

The conductivity factor (C) should be determined using the prolonged plunge test (see 4.6.2.2.1) or the prolonged exposure ramp test (see 4.6.2.2.2).

4.6.2.2.1 Prolonged plunge test [7.6.2.2.1]

.1 the prolonged plunge test is an iterative process to determine C and may require up to twenty nozzle samples. A new nozzle sample must be used for each test in this section even if the sample does not operate during the prolonged plunge test;

.2 the nozzle under test should have 1 to 1.5 wraps of PTFE sealant tape applied to the nozzle threads. It should be screwed into a mount to a torque of 15 + 3 Nm. Each nozzle is to be mounted on a tunnel test section cover and maintained in a conditioning chamber to allow the nozzle and cover to reach ambient temperature for a period of not less than 30 min. At least 25 ml of water, conditioned to ambient temperature, should be introduced into the nozzle inlet prior to testing;

.3 a timer accurate to ± 0.01 s with suitable measuring devices to sense the time between when the nozzle is plunged into the tunnel and the time it operates should be utilized to obtain the response time;

.4 the mount temperature should be maintained at 20 ± 0.5°C for the duration of each test. The air velocity in the tunnel test section at the nozzle location should be maintained with ± 2% of the selected velocity. Air temperature should be selected and maintained during the test as specified in table 3;

---

1 Tunnel conditions should be selected to limit maximum anticipated equipment error to 3%.

2 A suggested method for determining radiation effects is by conducting comparative plunge tests on a blackened (high emissivity) metallic test specimen and a polished (low emissivity) metallic test specimen.

.5 the range of permissible tunnel operating conditions is shown in table 3. The selected operating condition should be maintained for the duration of the test with the tolerances as specified in table 3; and

.6 to determine C, the nozzle is immersed in the test stream at various air velocities for a maximum of 15 min.[1] Velocities are chosen such that actuation is bracketed between two successive test velocities. That is, two velocities must be established such that at the lower velocity (u_j) actuation does not occur in the 15 min test interval. At the next higher velocity (u_h), actuation must occur within the 15 min time limit. If the nozzle does not operate at the highest velocity, select an air temperature from table 3 for the next higher temperature rating.

Table 2 – Plunge oven test conditions

	Air temperature ranges*			Velocity ranges**		
Normal Temperature, ºC	**Standard Response, ºC**	**Special Response, ºC**	**Fast Response, m/s**	**Standard Response, m/s**	**Special Response, m/s**	**Fast Response Nozzle, m/s**
57 to 77	191 to 203	129 to 141	129 to 141	2.4 to 2.6	2.4 to 2.6	1.65 to 1.85
79 to 107	282 to 300	191 to 203	191 to 203	2.4 to 2.6	2.4 to 2.6	1.65 to 1.85
121 to 149	382 to 432	282 to 300	282 to 300	2.4 to 2.6	2.4 to 2.6	1.65 to 1.85
163 to 191	382 to 432	382 to 432	382 to 432	3.4 to 3.6	2.4 to 2.6	1.65 to 1.85

* The selected air temperature should be known and maintained constant within the test section throughout the test to an accuracy of ±1ºC for the air temperature range of 129 to 141ºC within the test section and within ±2ºC for all other air temperatures.

** The selected air velocity should be known and maintained constant throughout the test to an accuracy of ±0.03 m/s for velocities of 1.65 to 1.85 and 2.4 to 2.6 m/s and ±0.04 m/s for velocities of 3.4 to 3.6 m/s.

Table 3 – Plunge oven test conditions for conductivity determination

Nominal nozzle temperature, ºC	Oven temperature, ºC	Maximum variation of air temperature during test, ºC
57	85 to 91	± 1.0
58 to 77	124 to 130	± 1.5
78 to 107	193 to 201	± 3.0
121 to 149	287 to 295	± 4.5
163 to 191	402 to 412	± 6.0

[1] If the value of C is determined to be less than 0.5 $(m.s)^{0.5}$ a C of 0.25 $(m.s)^{0.5}$ should be assumed for calculating RTI value.

Test velocity selection should ensure that:

$(U_H/U_L)^{0.5} \leq 1.1$

The test value of C is the average of the values calculated at the two velocities using the following equation:

$$C = (\Delta T_g / \Delta T_{ea} - 1)u^{0.5}$$

where:

ΔT_g Actual gas (air) temperature minus the mount temperature (Tm) in ºC.

ΔT_{ea} Mean liquid bath operating temperature minus the mount temperature (Tm) in ºC.

u Actual air velocity in the test section in m/s.

The nozzle C value is determined by repeating the bracketing procedure three times and calculating the numerical average of the three C values. This nozzle C value is used to calculate all standard orientation RTI values for determining compliance with 3.14.1.

4.6.2.2.2 Prolonged exposure ramp test [7.6.2.2.2]

.1 the prolonged exposure ramp test for the determination of the parameter C should be carried out in the test section of a wind tunnel and with the requirements for the temperature in the nozzle mount as described for the dynamic heating test. A preconditioning of the nozzle is not necessary;

.2 ten samples should be tested of each nozzle type, all nozzles positioned in standard orientation. The nozzle should be plunged into an air stream of a constant velocity of 1 m/s ± 10% and an air temperature at the nominal temperature of the nozzle at the beginning of the test; and

.3 the air temperature should then be increased at a rate of 1 ± 0.25ºC/min until the nozzle operates. The air temperature, velocity and mount temperature should be controlled from the initiation of the rate of rise and should be measured and recorded at nozzle operation. The C value is determined using the same equation as in 4.6.2.2.1 as the average of the ten test values.

4.6.2.3 RTI value calculation [7.6.2.3]

The equation used to determine the RTI value is as follows:

$$RTI = \frac{-t_r\,(u)^{0.5}(1 + C/u^{0.5})}{In[1 - \Delta T_{ea} \quad (1 + C/(u)^{0.5}) / \Delta T_g]}$$

where:

t_r Response time of nozzles in seconds

u Actual air velocity in the test section of the tunnel in m/s from table 2

ΔT_{ea} Mean liquid bath operating temperature of the nozzle minus the ambient temperature in ºC

ΔT_g Actual air temperature in the test section minus the ambient temperature in ºC

C Conductivity factor as determined in 4.6.2.2

4.6.2.4 Determination of worst case orientation RTI

The equation used to determine the RTI for the worst case orientation is as follows:

$$RTI_{wc} = \frac{-t_{r-wc}\,(u)^{0.5}[(1+C(RTI_{wc}/RTI)/(u)^{0.5})]}{In\{1 - \Delta T_{ea}\quad [1+C(RTI_{wc}/RTI)/(u)^{\,0.5})]/\Delta T_g\}}$$

where:

$T_{t\text{-}wc}$ Response time of the nozzles in seconds for the worst case orientation

All variables are known at this time per the equation in paragraph 4.6.2.3 except RTI_{wc} (Response Time Index for the worst case orientation) which can be solved iteratively per the above equation.

In the case of fast response nozzles, if a solution for the worse case orientation RTI is unattainable, plunge testing in the worst case orientation should be repeated using the plunge test conditions under Special Response shown in table 2.

4.7 Heat exposure test [7.7]

4.7.1 Glass bulb nozzles (see 3.9.1):

.1 glass bulb nozzles having nominal release temperatures less than or equal to 80°C should be heated in a water bath from a temperature of (20 ± 5)ºC to (20 ± 2) ºC below their nominal release temperature. The rate of increase of temperature should not exceed 20°C/min. High temperature oil, such as silicone oil should be used for higher temperature rated release elements; and

.2 this temperature should then be increased at a rate of 1°C/min to the temperature at which the gas bubble dissolves, or to a temperature 5°C lower than the nominal operating temperature, whichever is lower. Remove the nozzle from the liquid bath and allow it to cool in air until the gas bubble has formed again. During the cooling period, the pointed end of the glass bulb (seal end) should be pointing downwards. This test should be performed four times on each of four nozzles.

4.7.2 All uncoated nozzles (see 3.9.2) [7.7.2]

Twelve uncoated nozzles should be exposed for a period of 90 days to a high ambient temperature that is 11°C below the nominal rating or at the temperature shown in table 4, whichever is lower, but not less than 49°C. If the service load is dependent on the service pressure, nozzles should be tested under the rated working pressure. After exposure, four of the nozzles should be subjected to the tests specified in 4.4.1, four nozzles to the test of 4.5.1, two at the minimum operating pressure and two at the rated working pressure, and four nozzles to the requirements of 3.3. If a nozzle fails the applicable requirements of a test, eight additional nozzles should be tested as described above and subjected to the test in which the failure was recorded. All eight nozzles should comply with the test requirements.

4.7.3 Coated nozzles (see 3.9.3) [7.7.3]:

.1 in addition to the exposure test of 4.7.2 in an uncoated version, twelve coated nozzles should be exposed to the test of 4.7.2 using the temperatures shown in table 4 for coated nozzles; and

.2 the test should be conducted for 90 days. During this period, the sample should be removed from the oven at intervals of approximately 7 days and allowed to cool for 2 h to 4 h. During this cooling period, the sample should be examined. After exposure, four of the nozzles should be subjected to the tests specified in 4.4.1, four nozzles to the test of 4.5.1; two at the minimum operating pressure and two at the rated working pressure, and four nozzles to the requirements of 3.3.

Table 4 – Test temperatures for coated and uncoated nozzles

Values in degrees Celsius		
Nominal release Temperature	**Uncoated nozzle test temperature**	**Coated nozzle test temperature**
57-60	49	49
61-77	52	49
78-107	79	66
108-149	121	107
150-191	149	149
192-246	191	191
247-302	246	246
303-343	302	302

4.8 Thermal shock test for glass bulb nozzles (see 3.10) [7.8]

4.8.1 Before starting the test, condition at least 24 nozzles at room temperature of 20 to 25ºC for at least 30 min.

4.8.2 The nozzle should be immersed in a bath of liquid, the temperature of which should be 10 ± 2ºC below the nominal release temperature of the nozzles. After 5 min., the nozzles are to be removed from the bath and immersed immediately in another bath of liquid, with the bulb seal downwards, at a temperature of 10 ± 2ºC. Then test the nozzles in accordance with 4.5.1.

4.9 Strength test for release elements [7.9]

4.9.1 Glass bulbs (see 3.7.1) [7.9.1]

4.9.1.1 At least 15 sample bulbs in the lowest temperature rating of each bulb type should be positioned individually in a text fixture using the sprinkler seating parts. Each bulb should then be subjected to a uniformly increasing force at a rate not exceeding 250 N/s in the test machine until the bulb fails.

4.9.1.2 Each test should be conducted with the bulb mounted in new seating parts. The mounting device may be reinforced externally to prevent its collapse, but in a manner which does not interfere with bulb failure.

4.9.1.3 Record the failure load for each bulb. Calculate the lower tolerance limit (TLI) for bulb strength. Using the values of service load recorded in 4.3.1, calculate the upper tolerance limit (TL2) for the bulb design load. Verify compliance with 3.7.1.

4.9.2 Fusible elements (see 3.7.2)

4.10 Water flow test (see 3.4.1) [7.10]

The nozzle and a pressure gauge should be mounted on a supply pipe. The water flow should be measured at pressures ranging from the minimum operating pressure to the rated working pressure at intervals of approximately 10% of the service pressure range on two sample nozzles. In one series of tests, the pressure should be increased from zero to each value and, in the next series, the pressure shall be decreased from the rated pressure to each value. The flow constant, K, should be averaged from each series of readings, i.e., increasing pressure and decreasing pressure. During the test, pressures should be corrected for differences in height between the gauge and the outlet orifice of the nozzle.

4.11 Corrosion tests [7.12]

4.11.1 Stress corrosion test for brass nozzle parts (see 3.11.1)

4.11.1.1 Five nozzles should be subjected to the following aqueous ammonia test. The inlet of each nozzle should be sealed with a nonreactive cap, e.g., plastic.

4.11.1.2 The samples are degreased and exposed for 10 days to a moist ammonia-air mixture in a glass container of volume 0.02 ± 0.01 m^3.

4.11.1.3 An aqueous ammonia solution, having a density of 0.94 g/cm^3, should be maintained in the bottom of the container, approximately 40 mm below the bottom of the samples. A volume of aqueous ammonia solution corresponding to 0.01 ml per cubic centimetre of the volume of the container will give approximately the following atmospheric concentrations: 35% ammonia, 5% water vapour, and 60% air. The inlet of each sample should be sealed with a nonreactive cap, e.g., plastic.

4.11.1.4 The moist ammonia-air mixture should be maintained as closely as possible at atmospheric pressure, with the temperature maintained at 34 ± 2°C. Provision should be made for venting the chamber via a capillary tube to avoid the build-up of pressure. Specimens should be shielded from condensate drippage.

4.11.1.5 After exposure, rinse and dry the nozzles, and conduct a detailed examination. If a crack, delamination or failure of any operating part is observed, the nozzle(s) should be subjected to a leak resistance test at the rated pressure for 1 min and to the functional test at the minimum flowing pressure (see 3.1.5).

4.11.1.6 Nozzles showing cracking, delamination or failure of any non-operating part should not show evidence of separation of permanently attached parts when subjected to flowing water at the rated working pressure for 30 min.

4.11.2 Stress-Corrosion Cracking of Stainless Steel Nozzle Parts (see 3.11.1)

4.11.2.1 Five samples are to be degreased prior to being exposed to the magnesium chloride solution.

4.11.2.2 Parts used in nozzles are to be placed in a 500-millilitre flask that is fitted with a thermometer and a wet condenser approximately 760 mm long. The flask is to be filled approximately one-half full with a 42% by weight magnesium chloride solution, placed on a thermostatically-controlled electrically heated mantel, and maintained at a boiling temperature of 150 ± 1°C. The parts are to be unassembled, that is, not contained in a nozzle assembly. The exposure is to last for 500 hours.

4.11.2.3 After the exposure period, the test samples are to be removed from the boiling magnesium chloride solution and rinsed in deionised water.

4.11.2.4 The test samples are then to be examined using a microscope having a magnification of 25X for any cracking, delamination, or other degradation as a result of the test exposure. Test samples exhibiting degradation are to be tested as described in 4.12.5.5 or 4.12.5.6, as applicable. Test samples not exhibiting degradation are considered acceptable without further test.

4.11.2.5 Operating parts exhibiting degradation are to be further tested as follows. Five new sets of parts are to be assembled in nozzle frames made of materials that do not alter the corrosive effects of the magnesium chloride solution on the stainless steel parts. These test samples are to be degreased and subjected to the magnesium chloride solution exposure specified in paragraph 4.12.5.2. Following the exposure, the test samples should withstand, without leakage, a hydrostatic test pressure equal to the rated working pressure for 1 minute and then be subjected to the functional test at the minimum operating pressure in accordance with 4.5.1.

4.11.2.6 Non-operating parts exhibiting degradation are to be further tested as follows. Five new sets of parts are to be assembled in nozzle frames made of materials that do not alter the corrosive effects of the magnesium chloride solution on the stainless steel parts. These test samples are to be degreased and subjected to the magnesium chloride solution exposure specified in paragraph 4.12.5.1. Following the exposure, the test samples should withstand a flowing pressure equal to the rated working pressure for 30 minutes without separation of permanently attached parts.

4.11.3 Sulphur dioxide corrosion test (see 3.11.2 and 3.14.2)

4.11.3.1 Ten nozzles should be subjected to the following sulphur dioxide corrosion test. The inlet of each sample should be sealed with a nonreactive cap, e.g., plastic.

4.11.3.2 The test equipment should consist of a 5 litre vessel (instead of a 5 litre vessel, other volumes up to 15 litre may be used in which case the quantities of chemicals given below shall be increased in proportion) made of heat-resistant glass, with a corrosion-resistant lid of such a shape as to prevent condensate dripping on the nozzles. The vessel should be electrically heated through the base, and provided with a cooling coil around the side walls. A temperature sensor placed centrally 160 mm ± 20 mm above the bottom of the vessel should regulate the heating so that the temperature inside the glass vessel is 45°C ± 3ºC. During the test, water should flow through the cooling coil at a sufficient rate to keep the temperature of the discharge water below 30°C. This combination of heating and cooling should encourage condensation on the surfaces of the nozzles. The sample nozzles should be shielded from condensate drippage.

4.11.3.3 The nozzles to be tested should be suspended in their normal mounting position under the lid inside the vessel and subjected to a corrosive sulphur dioxide atmosphere for 8 days. The corrosive atmosphere should be obtained by introducing a solution made up by dissolving 20 g of sodium thiosulphate ($Na_2S_20_3H_2O$) crystals in 500 ml of water.

4.11.3.4 For at least six days of the 8-day exposure period, 20 ml of dilute sulphuric acid consisting of 156 ml of normal H_2SO_4 (0.5 mol/litre) diluted with 844 ml of water should be added at a constant rate. After 8 days, the nozzles should be removed from the container and allowed to dry for 4 to 7 days at a temperature not exceeding 35°C with a relative humidity not greater than 70%.

4.11.3.5 After the drying period, five nozzles should be subjected to a functional test at the minimum operating pressure in accordance with 4.5.1 and five nozzles should be subjected to the dynamic heating test in accordance with 3.14.2.

4.11.4 Salt spray corrosion test (see 3.11.3 and 3.14.2) [7.12.3]

4.11.4.1 Nozzles intended for normal atmospheres

4.11.4.1.1 Ten nozzles should be exposed to a salt spray within a fog chamber. The inlet of each sample should be sealed with a nonreactive cap, e.g., plastic.

4.11.4.1.2 During the corrosive exposure, the inlet thread orifice is to be sealed by a plastic cap after the nozzles have been filled with deionised water. The salt solution should be a 20% by mass sodium chloride solution in distilled water. The pH should be between 6.5 and 7.2 and the density between 1.126 g/ml and 1.157 g/ml when atomized at 35ºC. Suitable means of controlling the atmosphere in the chamber should be provided. The specimens should be supported in their normal operating position and exposed to the salt spray (fog) in a chamber having a volume of at least 0.43 m^3 in which the exposure zone shall be maintained at a temperature of 35 ± 2ºC. The temperature should be recorded at least once per day, at least 7 hours apart (except weekends and holidays when the chamber normally would not be opened). Salt solution should be supplied from a recirculating reservoir through air-aspirating nozzles, at a pressure between 0.7 bar (0.07 MPa) and 1.7 bar (0.17 MPa). Salt solution runoff from exposed samples should be collected and should not return to the reservoir for recirculation. The sample nozzles should be shielded from condensate drippage.

4.11.4.1.3 Fog should be collected from at least two points in the exposure zone to determine the rate of application and salt concentration. The fog should be such that for each 80 cm^2 of collection area, 1 m1 to 2 ml of solution should be collected per hour over a 16 hour period and the salt concentration shall be 20 ± 1% by mass.

4.11.4.1.4 The nozzles should withstand exposure to the salt spray for a period of 10 days. After this period, the nozzles should be removed from the fog chamber and allowed to dry for 4 to 7 days at a temperature of 20°C to 25°C in an atmosphere having a relative humidity not greater than 70%. Following the drying period, five nozzles should be submitted to the functional test at the minimum operating pressure in accordance with 4.5.1 and five nozzles should be subjected to the dynamic heating test in accordance with 3.14.2.

4.11.4.2 Nozzles intended for corrosive atmospheres [7.12.3.2]

Five nozzles should be subjected to the tests specified in 4.12.3.1 except that the duration of the salt spray exposure shall be extended from 10 days to 30 days.

4.11.5 Moist air exposure test (see 3.11.4 and 3.14.2) [7.12.4]

Ten nozzles should be exposed to a high temperature-humidity atmosphere consisting of a relative humidity of 98% ± 2% and a temperature of 95°C ± 4ºC. The nozzles are to be installed on a pipe manifold containing de-ionized water. The entire manifold is to be placed in the high temperature humidity enclosure for 90 days. After this period, the nozzles should be removed from the temperature-humidity enclosure and allowed to dry for 4 to 7 days at a temperature of 25 ± 5°C in an atmosphere having a relative humidity of not greater than 70%. Following the drying period, five nozzles should be functionally tested at the minimum operating pressure in accordance with 4.5.1 and five nozzles should be subjected to the dynamic heating test in accordance with 3.14.2[1].

4.12 Nozzle coating tests [7.13]

4.12.1 Evaporation test (see 3.12.1) [7.13.1]

A 50 cm^3 sample of wax or bitumen should be placed in a metal or glass cylindrical container, having a flat bottom, an internal diameter of 55 mm and an internal height of 35 mm. The container, without lid, should be placed in an automatically controlled electric, constant ambient temperature oven with air circulation. The temperature in the oven should be controlled at 16°C below the nominal release temperature of the nozzle, but at not less than 50°C. The sample should be weighed before and after 90 days exposure to determine any loss of volatile matter; the sample should meet the requirements of 3.12.1.

4.12.2 Low-temperature test (see 3.12.2) [7.13.2]

Five nozzles, coated by normal production methods, whether with wax, bitumen or a metallic coating, should be subjected to a temperature of -10°C for a period of 24 hours. On removal from the low-temperature cabinet, the nozzles should be exposed to normal ambient temperature for at least 30 min before examination of the coating to the requirements of 3.1.12.2.

4.13 Heat-resistance test (see 3.15) [7.14]

One nozzle body should be heated in an oven at 800°C for a period of 15 min, with the nozzle in its normal installed position. The nozzle body should then be removed, holding it by the threaded inlet, and should be promptly immersed in a water bath at a temperature of approximately 15°C. It should meet the requirements of 3.14.

4.14 Water-hammer test (see 3.13) [7.15]

4.14.1 Five nozzles should be connected, in their normal operating position, to the test equipment. After purging the air from the nozzles and the test equipment, 3,000 cycles of pressure varying from 4 ± 2 bar ((0.4 ± 0.2)MPa) to twice the rated working pressure should be generated. The

[1] At the manufacturer's option, additional samples may be furnished for this test to provide early evidence of failure. The additional samples may be removed from the test chamber at 30-day intervals for testing.

pressure should be raised from 4 bar to twice the rated pressure at a rate of 60 ± 10 bar/s. At least 30 cycles of pressure per minute should be generated. The pressure should be measured with an electrical pressure transducer.

4.14.2 Visually examine each nozzle for leakage during the test. After the test, each nozzle should meet the leakage resistance requirement of 3.8.1 and the functional requirement of 3.5.1 at the minimum operating pressure.

4.15 Vibration test (see 3.16) [7.16]

4.15.1 Five nozzles should be fixed vertically to a vibration table. They should be subjected at room temperature to sinusoidal vibrations. The direction of vibration should be along the axis of the connecting thread.

4.15.2 The nozzles should be vibrated continuously from 5 Hz to 40 Hz at a maximum rate of 5 min/octave and an amplitude of 1 mm (1/2 peak-to-peak value). If one or more resonant points are detected, the nozzles after coming to 40 Hz, should be vibrated at each of these resonant frequencies for 120 hours/number of resonances. If no resonances are detected, the vibration from 5 Hz to 40 Hz should be continued for 120 hours.

4.15.3 The nozzle should then be subjected to the leakage test in accordance with 3.8.1 and the functional test in accordance with 3.5.1 at the minimum operating pressure.

4.16 Impact test (see 3.17) [7.17]

4.16.1 Five nozzles should be tested by dropping a mass onto the nozzle along the axial centreline of waterway. The kinetic energy of the dropped mass at the point of impact should be equivalent to a mass equal to that of the test nozzle dropped from a height 1 m (see figure 2). The mass is to be prevented from impacting more than once upon each sample.

4.16.2 Following the test a visual examination of each nozzle shall show no signs of fracture, deformation, or other deficiency. If none is detected, the nozzles should be subjected to the leak resistance test, described in 4.4.1. Following the leakage test, each sample should meet the functional test requirement of 4.5.1 at a pressure equal to the minimum flowing pressure.

4.17 Lateral discharge test (see 3.18) [7.19]

4.17.1 Water is to be discharged from a spray nozzle at the minimum operating and rated working pressure. A second automatic nozzle located at the minimum distance specified by the manufacturer is mounted on a pipe parallel to the pipe discharging water.

4.17.2 The nozzle orifices or distribution plates (if used), are to be placed 550 mm, 356 mm and 152 mm below a flat smooth ceiling for three separate tests, respectively at each test pressure. The top of a square pan measuring 305 mm square and 102 mm deep is to be positioned 152 mm below the heat responsive element for each test. The pan is filled with 0.47 litres of heptane. After ignition, the automatic nozzle is to operate before the heptane is consumed.

4.18 30-day leakage test (see 3.19) [7.20]

4.18.1 Five nozzles are to be installed on a water filled test line maintained under a constant pressure of twice the rated working pressure for 30 days at an ambient temperature of (20 ± 5°C).

4.18.2 The nozzles should be inspected visually at least weekly for leakage. Following completion of this 30-day test, all samples should meet the leak resistance requirements specified in 3.2.4 and should exhibit no evidence of distortion or other mechanical damage.

4.19 Vacuum test (see 3.20) [7.21]

Three nozzles should be subjected to a vacuum of 460 mm of mercury applied to a nozzle inlet for 1 min at an ambient temperature of 20 ± 5°C. Following this test, each sample should be examined to verify that no distortion or mechanical damage has occurred and then should meet the leak resistance requirements specified in 4.4.1.

4.20 Clogging Test (see 3.22) [7.28]

4.20.1 The water flow rate of an open water-mist nozzle with its strainer or filter should be measured at its rated working pressure. The nozzle and strainer or filter should then be installed in test apparatus described in Figure 3 and subjected to 30 minutes of continuous flow at rated working pressure using contaminated water which has been prepared in accordance with 4.20.3.

4.20.2 Immediately following the 30 minutes of continuous flow with the contaminated water, the flow rate of the nozzle and strainer or filter should be measured at rated working pressure. No removal, cleaning or flushing of the nozzle, filter or strainer is permitted during the test.

4.20.3 The water used during the 30 minutes of continuous flow at rated working pressure specified in 4.20.1 should consist of 60 litres of tap water into which has been mixed 1.58 kilograms of contaminants which sieve as described in table 6. The solution should be continuously agitated during the test.

4.20.4 Alternative supply arrangements to the apparatus shown in figure 3 may be used where damage to the pump is possible. Restrictions to piping defined by note 2 of table 5 should apply to such systems.

Table 5 – Contaminant for the contaminated water cycling test

SIEVE DESIGNATION*	NOMINAL SIEVE OPENING, MM	GRAMS OF CONTAMINANT (± 5%)**		
		PIPE SCALE	TOP SOIL	SAND
No. 25	0.706	-	456	200
No. 50	0.297	82	82	327
No. 100	0.150	84	6	89
No. 200	0.074	81	-	21
No. 325	0.043	153	-	3
	TOTAL	400	544	640

* Sieve designations correspond with those specified in the standard for wire-cloth sieves for testing purposes, ASTM E11-87, CENCO-MEINZEN sieve sizes 25 mesh, 50 mesh, 100 mesh, 200 mesh and 325 mesh, corresponding with the number designation in the table, have been found to comply with ASTM E11-87.

** The amount of contaminant may be reduced by 50 per cent for nozzles limited to use with copper or stainless steel piping and by 90 per cent for nozzles having a rated pressure of 50 bar or higher and limited to use with stainless steel piping.

5 WATER-MIST NOZZLE MARKING

5.1 General

Each nozzle complying with the requirements of this Standard should be permanently marked as follows:

(a) trademark or manufacturer's name;

(b) model identification;

(c) manufacturer's factory identification. This is only required if the manufacturer has more than one nozzle manufacturing facility;

(d) nominal year of manufacture[1] (automatic nozzles only);

(e) nominal release temperature[2]; and

(f) K-factor. This is only required if a given model nozzle is available with more than 1 orifice size.

In countries where colour-coding of yoke arms of glass bulb nozzles is required, the colour code for fusible element nozzles should be used.

5.2 Nozzle housings

Recessed housings, if provided, should be marked for use with the corresponding nozzles unless the housing is a non-removable part of the nozzle.

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[1] The year of manufacture may include the last three months of the preceding year and the first six months of the following year. Only the last two digits need be indicated.

[2] Except for coated and plated nozzles, the nominal release temperature range should be colour-coded on the nozzle to identify the nominal rating. The colour code should be visible on the yoke arms holding the distribution plate for fusible element nozzles, and should be indicated by the colour of the liquid in glass bulbs. The nominal temperature rating should be stamped or cast on the fusible element of fusible element nozzles. All nozzles should be stamped, cast, engraved or colour-coded in such a way that the nominal rating is recognizable even if the nozzle has operated. This should be in accordance with table 1.

FIGURE 1

RTI AND C LIMITS FOR STANDARD ORIENTATION

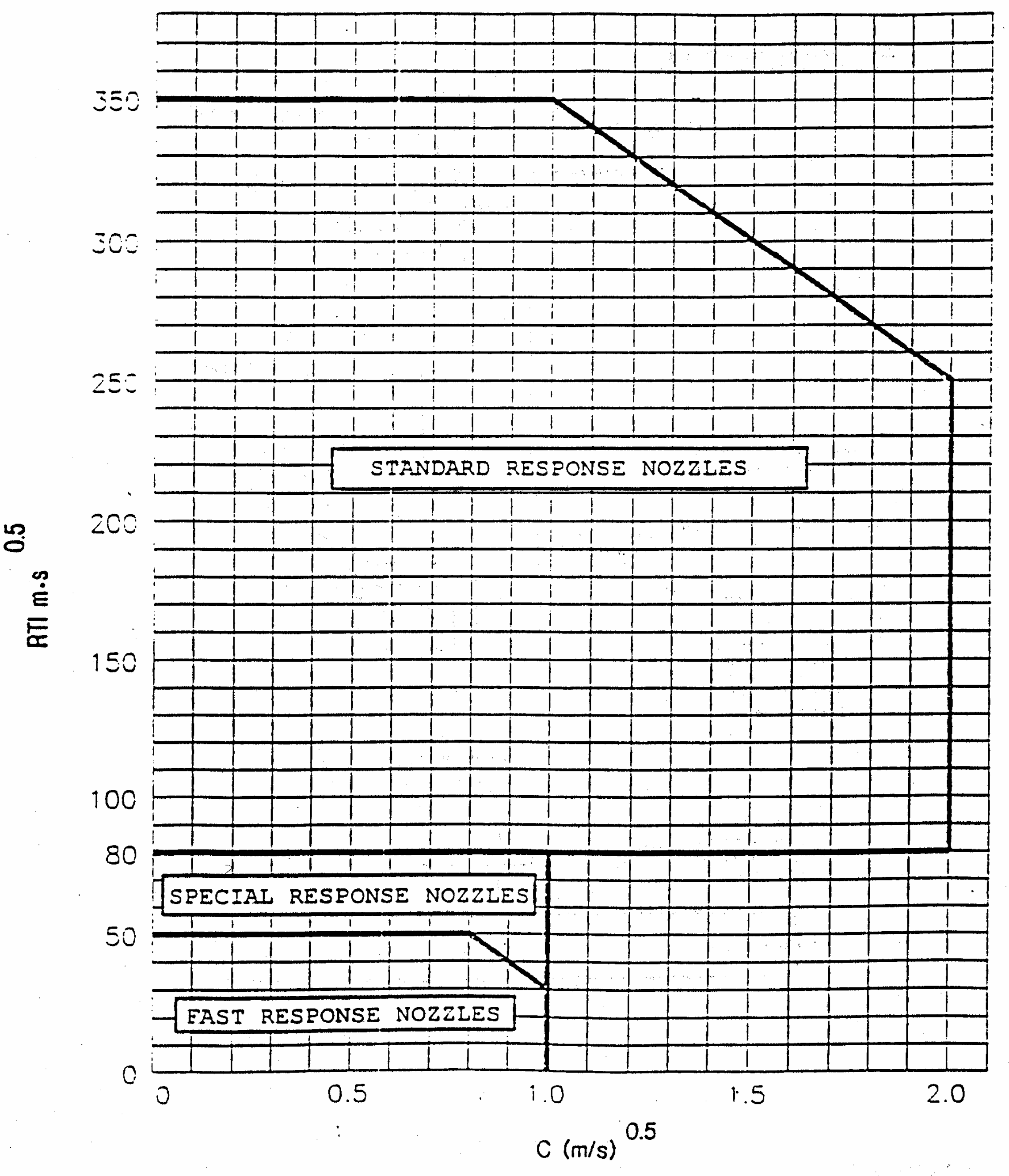


FIGURE 2

IMPACT TEST APPARATUS

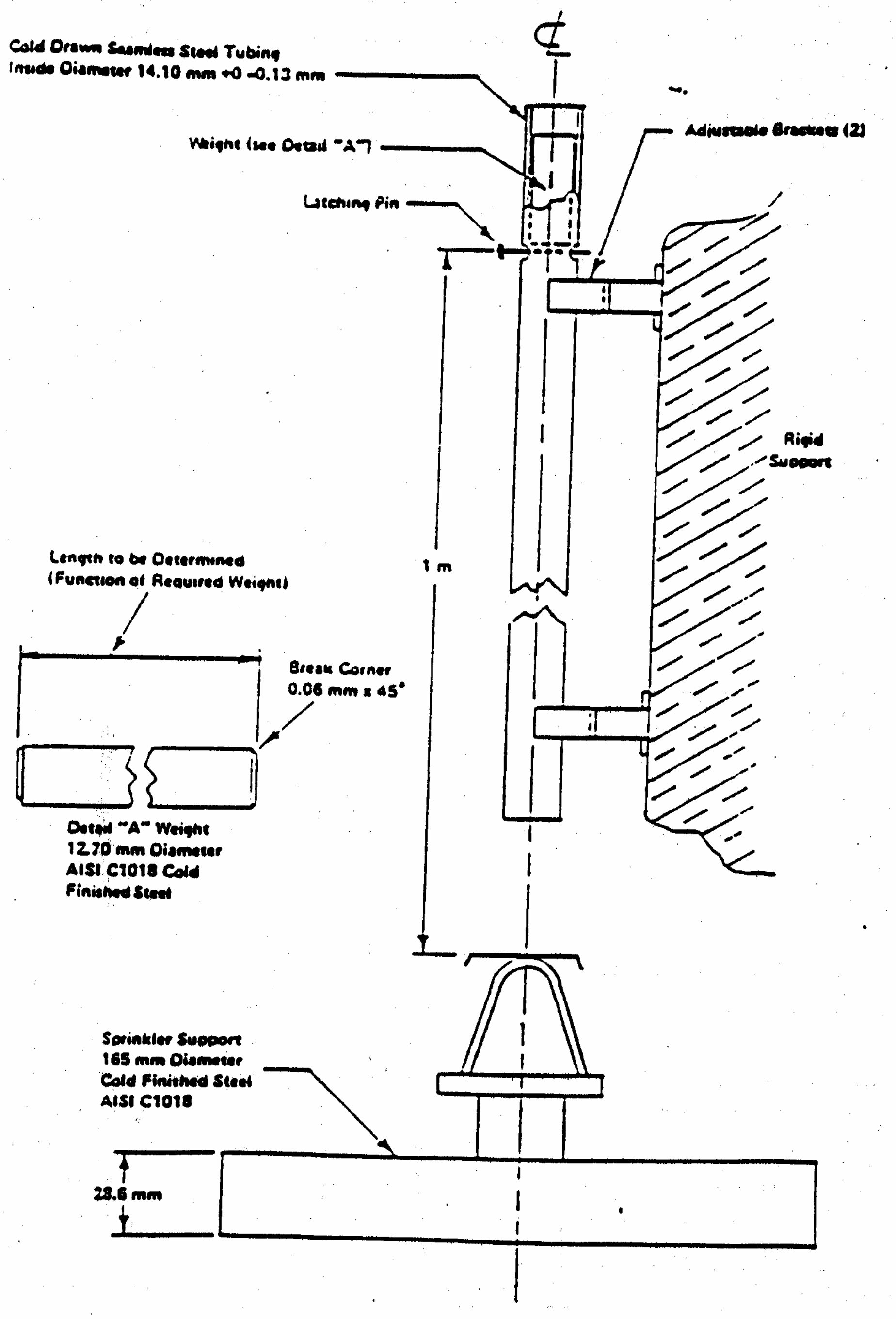
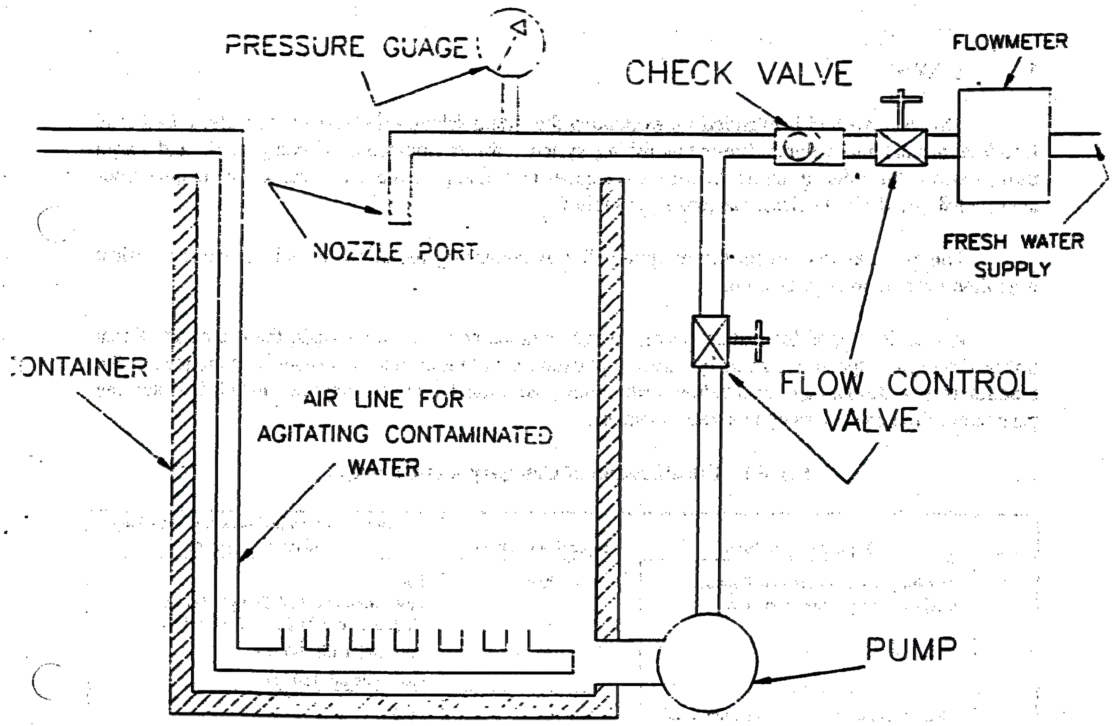


FIGURE 3

CLOGGING TEST APPARATUS



APPENDIX B

TEST METHOD FOR FIRE TESTING EQUIVALENT WATER-BASED FIRE-EXTINGUISHING SYSTEMS FOR MACHINERY SPACES OF CATEGORY A AND CARGO PUMP-ROOMS

1 SCOPE

1.1 This test method is intended for evaluating the extinguishing effectiveness of water-based total flooding fire-extinguishing systems for the protection of engine-rooms of category A and cargo pump-rooms.

1.2 The test method covers the minimum fire-extinguishing requirement and prevention against reignition for fires in engine-rooms.

1.3 It was developed for systems using ceiling mounted nozzles or multiple levels of nozzles. Bilge nozzles are required for all systems. The bilge nozzles may be part of the main system, or they may be a separate bilge area protection system.

1.4 In the tests, the use of additional nozzles to protect specific hazards by direct application is not permitted. However for ship board applications additional nozzles may be added as recommended by the manufacturer.

2 FIELD OF APPLICATION

The test method is applicable for water-based fire-extinguishing systems which will be used as alternative fire-extinguishing systems as required by SOLAS regulation II-2/10.4.1 and II-2/10.9.1. For the installation of the system, nozzles shall be installed to protect the entire hazard volume (total flooding). The installation specification provided by the manufacturer should include maximum horizontal and vertical nozzle spacing, maximum enclosure height, and distance of nozzles below the ceiling and maximum enclosure volume which, as a principle, should not exceed the values used in approval fire test. However, when based on the scientific methods developed by the Organization*, scaling from the maximum tested volume to a larger volume may be permitted. The scaling should not exceed twice the tested volume.

3 SAMPLING

The components to be tested should be supplied by the manufacturer together with design and installation criteria, operational instructions, drawings and technical data sufficient for the identification of the components.

* To be developed by the Organization.

4 METHOD OF TEST

4.1 Principle

This test procedure enables the determination of the effectiveness of different water-based extinguishing systems against spray fires, cascade fires, pool fires, and Class A fires which are obstructed by an engine mock-up.

4.2 Apparatus

4.2.1 *Engine mock-up*

The fire test should be performed in a test apparatus consisting of:

.1 an engine mock-up of the size (width × length × height) of 1 m × 3 m × 3 m constructed of sheet steel with a nominal thickness of 5 mm. The mock-up is fitted with two steel tubes of 0.3 m in diameter and 3 m in length that simulate exhaust manifolds and a grating. At the top of the mock-up, a 3 m^2 tray is arranged (see figure 1); and

.2 a floor plate system of the size (width × length × height) of 4 m × 6 m × 0.5 m, surrounding the mock-up. Provision shall be made for placement of the fuel trays, described in table 1, and located as described in figure 1.

4.2.2 *Fire test compartment*

The tests should be performed in a room having a specified area greater than 100 m^2, a specified height of at least 5 m and ventilation through a door opening of 2 m × 2 m in size. Fires and engine mock-up should be according to tables 1, 2, 3 and figure 2. The test hall should have an ambient temperature of between 10°C and 30°C at the start of each test.

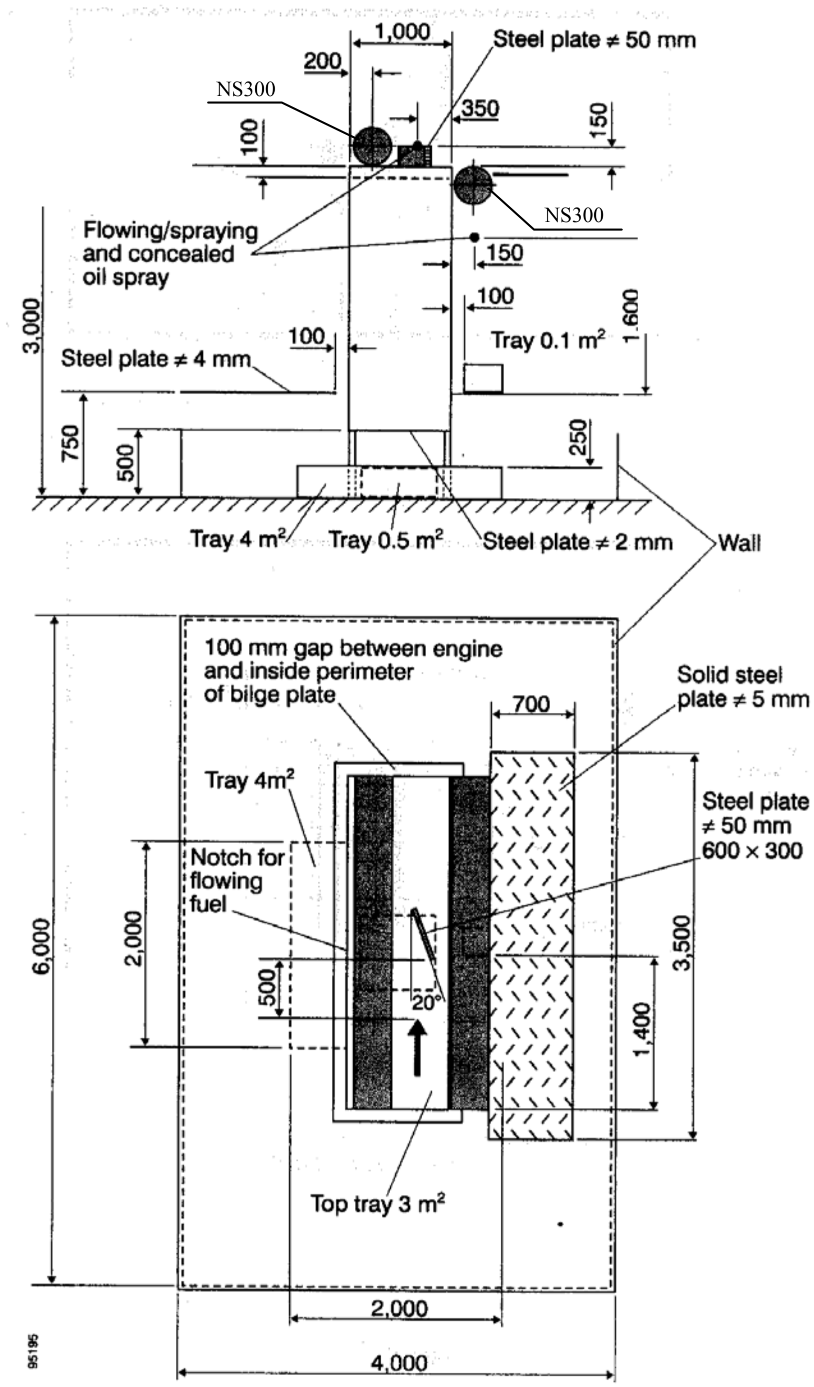

1,000
Steel plate ≠ 50 mm
200
NS300
350
100
150
NS300
Flowing/spraying
and concealed
oil spray
150
100
3,000
1,600
100
Tray 0.1 m²
Steel plate ≠ 4 mm
750
500
250
Tray 4 m²
Tray 0.5 m²
Steel plate ≠ 2 mm
Wall
100 mm gap between engine
and inside perimeter
of bilge plate
Solid steel
plate ≠ 5 mm
700
Tray 4m²
Steel plate
≠ 50 mm
600 × 300
Notch for
flowing
fuel
6,000
2,000
500
20°
3,500
1,400
Top tray 3 m²
2,000
4,000
95195

Figure 1

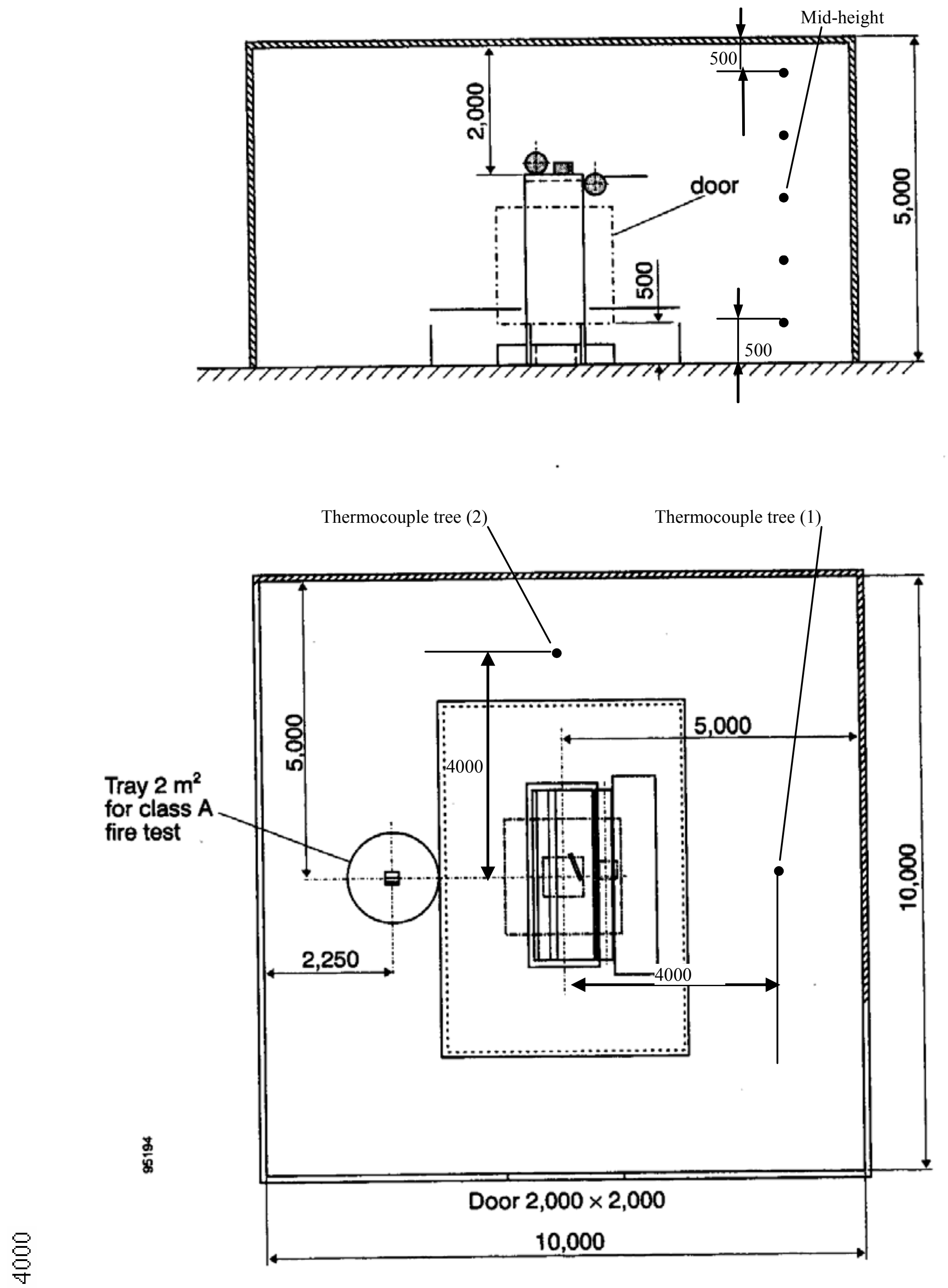

Mid-height
500
2,000
door
500
5,000
500
Thermocouple tree (2)
Thermocouple tree (1)
5,000
4000
Tray 2 m²
for class A
fire test
2,250
4000
10,000
95194
Door 2,000 × 2,000
10,000
4000

Figure 2

4.3 Test scenario

4.3.1 *Fire-extinguishing tests*

Table 1

Test No.	Fire Scenario	Test Fuel
1	Low pressure horizontal spray on top of simulated engine between agent nozzles.	Commercial fuel oil or light diesel oil
2	Low pressure spray in top of simulated engine centred with nozzle angled upward at a 45° angle to strike a 12-15 mm diameter rod 1 m away.	Commercial fuel oil or light diesel oil
3	High pressure horizontal spray on top of the simulated engine.	Commercial fuel oil or light diesel oil
4	Low pressure concealed horizontal spray fire on the side of simulated engine with oil spray nozzle positioned 0.1 m in from the end of the engine and 0.1 m^2 tray positioned on tope of the bilge plate 1.4 m in from the engine end at the edge of the bilge plate closest to the engine.	Commercial fuel oil or light diesel oil
5	Concealed 0.7 m × 3.0 m fire tray on top of bilge plate centred under exhaust plate.	Heptane
6	Flowing fire 0.25 kg/s from top of mock-up (see figure 3).	Heptane
7	Class A fires wood crib (see Note) in 2 m^2 pool fire with 30 s preburn. The test tray should be positioned 0.75 m above the floor as shown in figure 1.	Heptane
8	A steel plate (30 cm × 60 cm × 5 cm) offset 20° to the spray is heated to 350°C by the top low pressure spray nozzle positioned horizontally 0.5 m from the front edge of the plate. When the plate reaches 350°C, the system is activated. Following system shutoff, no reignition of spray is permitted.	Heptane

Note: 1 The wood crib is to weigh 5.4 to 5.9 kg and is to be dimensioned approximately 305 mm × 305 mm × 305 mm. The crib is to consist of eight alternate layers of four trade size 38.1 mm × 38.1 mm kiln-dried spruce or fir lumber 305 mm long. The alternate layers of the lumber are to be placed at right angles to the adjacent layers. The individual wood members in each layer are to be evenly spaced along the length of the previous layer of wood members and stapled. After the wood crib is assembled, it is to be conditioned at a temperature of 49 ± 5°C for not less than 16 h. Following the conditioning, the moisture content of the crib is to be measured with a probe type moisture meter. The moisture content of the crib should not exceed 5% prior to the fire test.

Table 2 - *Test Programme for Bilge Nozzles*

Test No.	Fire Scenario	Test Fuel
1	0.5 m^2 central under mock-up	Heptane
2	0.5 m^2 central under mock-up	SAE 10W30 mineral based lubrication oil
3	4 m^2 tray under mock-up	Commercial fuel oil or light diesel oil

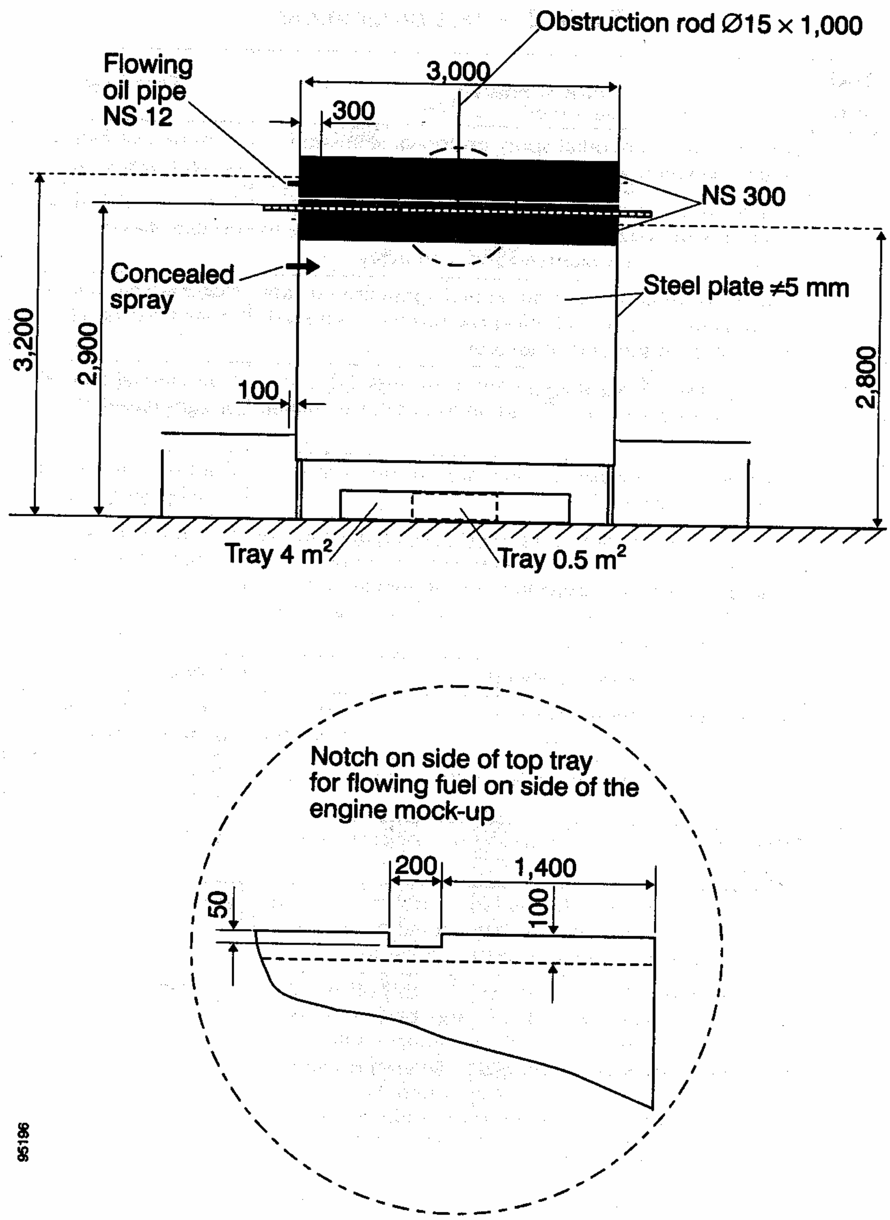


Figure 3

Table 3 - S*pray fire test parameters*

Fire type	**Low pressure**	**High pressure**
Spray nozzle	Wide spray angle (120° to 125°) full cone type	Standard angle (at 6 bar) full cone type
Nominal fuel pressure	8 bar	150 bar
Fuel flow	0.16 ± 0.01 kg/s	0.050 ± 0.002 kg/s
Fuel temperature	20 ± 5°C	20 ± 5°C
Nominal heat release rate	5.8 ± 0.6 MW	1.8 ± 0.2 MW

4.3.2 *Thermal management tests*

4.3.2.1 Instrumentation

4.3.2.1.1 Thermocouples should be installed in two trees. One tree should be located 4 m from the centre of the mock-up, on the opposite side of the 2 m^2 tray for class A fire test as shown in figure 2. The other tree should be located 4 m from the centre of the mock-up, on the opposite side of the door opening.

4.3.2.1.2 Each tree should consist of five thermocouples of diameter not exceeding 0.5 mm, positioned at the following heights: (1) 500 mm below the ceiling; (2) 500 mm above floor level; (3) at mid-height of the test compartment; (4) between the uppermost thermocouple and the thermocouple at mid-height and (5) between the lowest thermocouple and the thermocouple at mid-height.

4.3.2.1.3 Measures should be provided to avoid direct water spray impingement of the thermocouples.

4.3.2.1.4 The temperatures should be measured continuously, at least once every two seconds, throughout the test.

4.3.2.2 Fire size and position

4.3.2.2.1 For the determination of the thermal management, an obstructed n-Heptane pool fire scenario should be used. The nominal fire sizes should be correlated to the test compartment volume according to table 4. The test tray should be positioned in accordance with test No.7 as shown in table 1 and figure 2.

Table 4 - Correlation between nominal pool fire sizes and test compartment volume

Test compartment volume	Pool fire scenario
500 m^3	1 MW
1000 m^3	2 MW
1500 m^3	3 MW
2000 m^3	4 MW
2500 m^3	5 MW
3000 m^3	6 MW

Note: Interpolation of the data in the table is allowed.

4.3.2.2.2 The rim height of the trays should be 150 mm and the tray should be filled with 50 mm of fuel. Additional water should be added to provide a freeboard of 50 mm. Table 5 provides examples of pool tray diameters and the corresponding area, for a selection of nominal heat release rates.

Table 5 - Pool tray diameters and the corresponding area, for a selection of nominal heat release rates

Nominal HRR	Diameter (cm)	Area (m^2)	Size of obstruction steel plate (m x m)
0.5 MW	62	0.30	2.0 x 2.0
1 MW	83	0.54	2.0 x 2.0
2 MW	112	0.99	2.0 x 2.0
3 MW	136	1.45	2.25 x 2.25
4 MW	156	1.90	2.25 x 2.25
5 MW	173	2.36	2.5 x 2.5
6 MW	189	2.81	2.5 x 2.5

Note: Interpolation or extrapolation of the data is allowed according to the following equation:

$$Q = 2.195A - 0.18$$

where:

Q = the desired nominal heat release rate (MW)
A = the area of the fire tray (m^2)

4.3.2.2.3 A square horizontal obstruction steel plate should shield the pool fire tray from direct water spray impingement. The size of the obstruction steel plate is dictated by the size of the fire tray, as indicated in table 5. The vertical distance measured from the floor to the underside of the obstruction steel plate should be 1.0 m.

4.3.2.2.4 The thickness of the steel plate should be a nominal 4 mm. The vertical distance measured from the rim of the trays to the underneath of the horizontal obstruction steel plate should be 0.85 m.

4.4 Extinguishing system

4.4.1 During fire test conditions the extinguishing system should be installed according to the manufacturer's design and installation instructions in a uniformly spaced overhead nozzle grid. The lowest level of nozzles should be located at least 5 m above the floor. For actual installations, if the water-mist system includes bilge area protection, water-mist nozzles must be installed throughout the bilges in accordance with the manufacturer's recommended dimensioning, as developed from bilge system testing using the tests in table 2, conducted with the bilge plate located at the maximum height for which approval is sought. Tests should be performed with nozzles located in the highest and lowest recommended position above the bilge fires. Bilge systems using the nozzle spacing tested may be approved for fire protection of bilge areas of any size.

4.4.2 The system fire tests should be conducted at the minimum system operating pressure, or at the conditions providing the minimum water application rate.

4.4.3 During the laboratory fire tests the bilge system nozzles may not be located beneath the engine mock-up, but should be located beneath the simulated bilge plates at least one-half the nozzle spacing away from the engine mock-up.

4.5 Procedure

4.5.1 *Ignition*

The trays used in the test should be filled with at least 50 mm fuel on a water base. Freeboard is to be 150±10 mm.

4.5.2 *Flow and pressure measurements (Fuel system)*

The fuel flow and pressure in the fuel system should be measured before each test. The fuel pressure should be measured during the test.

4.5.3 *Flow and pressure measurements (Extinguishing system)*

Agent flow and pressure in the extinguishing system should be measured continuously on the high pressure side of a pump or equivalent equipment at intervals not exceeding 5 s during the test, alternatively, the flow can be determined by the pressure and the *K* factor of the nozzles.

4.5.4 *Duration of test*

4.5.4.1 After ignition of all fuel sources, a 2-min preburn time is required before the extinguishing agent is discharged for the fuel tray fires and 5-15 s for the fuel spray and heptane fires and 30 s for the Class A fire test (Test No.7).

4.5.4.2 The fire should be allowed to burn until the fire is extinguished or for a period of 15 minutes, whichever is less, measured from the ignition. The fuel spray, if used, should be shut off 15 s after the end of agent discharge.

4.5.5 *Observations before and during the test*

4.5.5.1 Before the test, the test room, fuel and mock-up temperature is to be measured.

4.5.5.2 During the test the following items should be recorded:

.1 the start of the ignition procedure;

.2 the start of the test (ignition);

.3 the time when the extinguishing system is activated;

.4 the time when the fire is extinguished, if it is;

.5 the time when the extinguishing system is shut off;

.6 the time of re-ignition, if any;

.7 the time when the oil flow for the spray fire is shut off;

.8 the time when the test is finished; and

.9 data from all test instrumentation.

4.5.6 *Observations after the test*

.1 damage to any system components;

.2 the level of fuel in the tray(s) to make sure that the fuel was not totally consumed; and

.3 test room, fuel and mock-up temperature.

5 CLASSIFICATION CRITERIA

5.1 Fire-extinguishing tests

All fires in the fire-extinguishing tests should be extinguished within 15 minutes of system activation and there should be no re-ignition or fire spread.

5.2 Thermal management tests

The 60 s time-weighted average temperature should be kept below 100°C, no later than 300 s after activation of the system for the thermal management test in 4.3.2.

6 TEST REPORT

The test report should include the following information:

.1 name and address of the test laboratory;

.2 date and identification number of the test report;

.3 name and address of client;

.4 purpose of the test;

.5 method of sampling;

.6 name and address of manufacturer or supplier of the product;

.7 name or other identification marks of the product;

.8 description of the tested product:

- drawings,
- descriptions,
- assembly instructions,
- specification of included materials, and
- detailed drawing of test set-up;

.9 date of supply of the product;

.10 date of test;

.11 test method;

.12 drawing of each test configuration;

.13 measured nozzle characteristics;

.14 identification of the test equipment and used instruments;

.15 conclusions;

.16 deviations from the test method, if any;

.17 test results including observations during and after the test; and

.18 date and signature.

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添付資料7.11

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MSC/Circ.1169
1 June 2005

UNIFIED INTERPRETATIONS OF SOLAS CHAPTER II-2

1 The Maritime Safety Committee, at its eightieth session (11 to 20 May 2005), with a view to providing more specific guidance for vague expressions such as "to the discretion of the Administration", which are open to different interpretations contained in IMO instruments, approved the unified interpretations of SOLAS chapter II-2 prepared by the Sub-Committee on Fire Protection, as set out in the annex.

2 Member Governments are invited to use the annexed unified interpretations as guidance when applying relevant provisions of SOLAS chapter II-2 to fire protection construction, installation, arrangements and equipment to be installed on board ships on or after 13 May 2005 and to bring the unified interpretations to the attention of all parties concerned.

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ANNEX

UNIFIED INTERPRETATIONS OF SOLAS CHAPTER II-2

Regulation II-2/4.5.3.3 – Safety devices in venting systems

1 Ullage openings do not include cargo tank openings that are fitted with standpipe arrangements with their own manually operated shutoff valves.

2 Examples include the common 2.54 cm (1") and 5.08 cm (2") diameter standpipe arrangements that are used for sampling, monitoring or measuring of ullage/temperature/interface, oxygen, liquid and hand dipping in the cargo tank.

Regulation II-2/9.7.1.1 – Ventilation systems

1 Combustible gaskets in flanged ventilation duct connections are not permitted within 600 mm of an opening in an “A” or “B” class divisions and in ducts required to be of “A” class construction.

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MSC/Circ.1170
15 June 2005

APPLICATION OF SOLAS REGULATION II-2/15 FOR LUBRICATING OIL AND OTHER FLAMMABLE OIL ARRANGEMENTS FOR SHIPS BUILT BEFORE 1 JULY 1998

1 The Maritime Safety Committee, at its eightieth session (11 to 20 May 2005), recalled that, at its sixty-third session, it had adopted, by resolution MSC.31(63), amendments to SOLAS regulation II-2/15, prescribing additional requirements to oil fuel arrangements, lubricating oil arrangements and arrangements for other flammable oils as well as the application of these requirements. The amendments entered into force on 1 July 1998.

2 The amendments to SOLAS regulation II-2/15, in particular the requirements for oil fuel systems, applied to all ships constructed before, on or after 1 July 1998 because the above amendments stipulated to do so. However, the Committee agreed that the amendments to SOLAS regulations II-2/15.3 and II-2/15.4 were not intended to apply to existing ships constructed before 1 July 1998. The Committee, therefore, clarified that paragraphs 3 and 4 of SOLAS regulation II 2/15, in terms of compliance with the provisions of paragraphs 2.10 and 2.11 of SOLAS regulation II-2/15, should only be applied to ships constructed on or after 1 July 1998.

3 The Committee noting that an amendment to SOLAS regulation II-2/15 had been considered by the Sub-Committee on Fire Protection with a view to clarifying the application of the aforementioned provisions, approved the attached draft amendment with a view to subsequent adoption at MSC 81.

4 Member Governments are invited to bring the above information to the attention of all parties concerned.

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ANNEX

DRAFT AMENDMENTS TO SOLAS REGULATION II-2/15

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

Regulation II-2/15 – Arrangements for oil fuel, lubricating oil and other flammable oils

An amendment No.1 to regulation II-2/15, as adopted by resolution MSC.31(63), is replaced by the following text:

"1 The text after the title is replaced by the following:

"(Paragraphs 2.9 to 2.12 of this regulation apply to ships constructed on or after 1 February 1992, except that the references to paragraphs 2.10 and 2.11 in paragraphs 3 and 4 apply to ships constructed on or after 1 July 1998)"."

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