ANNEX

AMENDMENTS TO FORM A AND FORM B OF SUPPLEMENTS TO THE IOPP CERTIFICATE UNDER MARPOL ANNEX I

1 Amendments to the Supplement to the IOPP Certificate (Form A)

The existing paragraph 3.2.1 is replaced by the following:

"3.2.1 Incinerator for oil residues (sludge)………………………………☐"

2 Amendments to the Supplement to the IOPP Certificate (Form B)

The existing paragraph 3.2.1 is replaced by the following:

"3.2.1 Incinerator for oil residues (sludge)………………………………☐"

第 77/2016 號行政長官公告

中華人民共和國於一九九九年十二月十三日以照會通知聯合國秘書長，經修訂的《1974年國際海上人命安全公約》（SOLAS公約）自一九九九年十二月二十日起適用於澳門特別行政區；

國際海事組織海上安全委員會於二零一零年十二月三日透過第MSC.307（88）號決議通過了《2010年國際消防試驗程序應用規則》（2010年消防試驗規則），該規則自二零一二年七月一日起適用於澳門特別行政區；

基於此，行政長官根據第3/1999號法律《法規的公布與格式》第六條第一款的規定，命令公佈包含上指規則的第MSC.307（88）號決議的中文及英文正式文本。

二零一六年十一月十四日發佈。

行政長官　崔世安

Aviso do Chefe do Executivo n.º 77/2016

Considerando que a República Popular da China, por nota datada de 13 de Dezembro de 1999, notificou o Secretário-Geral das Nações Unidas sobre a aplicação da Convenção Internacional para a Salvaguarda da Vida Humana no Mar (SOLAS), 1974, tal como emendada, na Região Administrativa Especial de Macau, a partir de 20 de Dezembro de 1999;

Considerando igualmente que, em 3 de Dezembro de 2010, o Comité de Segurança Marítima da Organização Marítima Internacional, através da sua resolução MSC.307(88), adoptou o Código Internacional dos Procedimentos para as Provas de Fogo (Código FTP 2010), e que tal Código é aplicável na Região Administrativa Especial de Macau desde 1 de Julho de 2012;

O Chefe do Executivo manda publicar, nos termos do n.º 1 do artigo 6.º da Lei n.º 3/1999 (Publicação e formulário dos diplomas), a resolução MSC.307(88), que contém o referido Código, nos seus textos autênticos em línguas chinesa e inglesa.

Promulgado em 14 de Novembro de 2016.

O Chefe do Executivo, *Chui Sai On*.

第MSC.307（88）號決議

（2010年12月3日通過）

2010年國際消防試驗程序應用規則

（2010年消防試驗規則）

海上安全委員會，

憶及《國際海事組織公約》有關本委員會職能的第二十八條第（b）款，

注意到《國際消防試驗程序應用規則》（消防試驗規則）及使（消防試驗規則）在公約下成為強制性的經修正的《1974年國際海上人命安全公約》（安全公約），下文稱公約，第II-2章，

還注意到第MSC.57（67）號決議，經該決議，委員會通過了公約第II–2章修正案，使《國際消防試驗程序應用規則》的規定在公約下對1998年7月1日及之後建造的船舶具有強制性，

進一步注意到第MSC.97（73）號決議，經該決議，委員會通過了《2000年國際高速船安全規則（2000年高速船規則）》，其中規定，按照消防試驗規則對高速船規則所適用的高速船在建造中使用的材料應用消防試驗程序，

認識到，自通過該消防試驗規則以來，由於船舶建造中所用材料的不斷發展及海上安全標準的改進，為了保持最高實際可行的安全水平，有必要對消防試驗程序的規定加以修訂，

在其第八十八屆會議上**審議了**對消防試驗規則做出徹底修訂後擬定的《2010年消防試驗規則》草案，

1. **通過**《2010年國際消防試驗程序應用規則》（2010年消防試驗規則），其文本載於本決議附件；

2. **請**公約締約國政府注意，《2010年消防試驗規則》將於2012年7月1日，在相關公約II-2章修正案生效時具有效力；

3. **注意到**，根據公約第II-2章修正案，對《2010年消防試驗規則》的修正案將按照公約第VIII條適用於除第I章外的公約附件的修正程序通過、生效和具有效力；

4. **要求**本組織秘書長向所有公約締約國政府送發本決議及附件中所含《2010年消防試驗規則》文本的核證無誤副本；

5. **進一步要求**本組織秘書長向所有本組織並非《安全公約》締約國的會員國送發本決議及附件中所含《2010年消防試驗規則》文本的副本。

附 件

2010年國際消防試驗程序應用規則

（2010年消防試驗規則）

目錄

附件1 消防試驗程序

前言

第1部分 不燃性試驗

附錄 — 不燃性試驗消防試驗程序

第2部分 煙氣和毒性試驗

附錄1 — 發煙消防試驗程序

附錄2 — 發生有毒氣體消防試驗程序

第3部分 “A”、“B”和“F”級分隔試驗

附錄1 — “A”、“B”和“F”級分隔耐火試驗程序

附錄2 — 窗、擋火板、管道穿透和電纜穿越的試驗

附錄3 — “A”、“B”和“F”分隔的窗耐火試驗的補充熱輻射試驗

附錄4 — 連續“B”級分隔

第4部分 防火門控制裝置試驗

附錄 — 防火門控制裝置消防試驗程序

第5部分 表面可燃性試驗（表面材料和甲板基層敷料的試驗）

附錄1 — 隔艙壁、天花板、甲板表面材料和甲板基層敷料表面可燃性消防試驗程序

附錄2 — 物理試驗設備的技術資料和校準

附錄3 — 試驗結果的解釋

附錄4 — 消防試驗程序規則第2和第5部分的試樣導則及這些產品的型式認可（認可範圍和使用限制）

第6部分 （空白）

第7部分 垂直懸掛紡織品和薄膜試驗

附錄1 — 垂直懸掛紡織品和薄膜耐焰確定消防試驗程序

附錄2 — 炭化或材料損壞長度測量

附錄3 — 清潔和風化程序

第8部分 軟墊裝飾家具試驗

附錄1 — 軟墊裝飾座具複合物吸煙用具引燃性消防試驗程序

附錄2 — 指導註釋

附錄3 — 罩面和填充材料獨立試驗指南

第9部分 床上用品試驗

附錄 — 床上用品點燃性消防試驗程序

第10部分 高速船限火材料試驗

附錄1 — 消防試驗程序 – 高速船隔艙壁，牆體和天花板襯板表面材料，（包括其支撐結構）實比例艙室試驗

附錄2 — 高速船家具和其他部件所用材料熱釋放，發煙和

質量損失率消防試驗程序

第11部分 高速船耐火分隔試驗

附錄 — 高速船耐火分隔試驗程序

附件2 **無需試驗和（或）認可即安裝的產品**

附件3 **消防保護材料及所要求的認可試驗方法**

表1： 運載36名以上乘客的客船和高速船消防保護材料和所要求的認可試驗方法

表2： 貨船消防保護材料和所要求的認可試驗方法（IC法）

附件4 **對《安全公約》II-2章第5.3和6.2條的解釋（MSC/Circ.1120號通函）**

表1： 客船上第II-2/3.1條定義的居住處所隔艙壁所用材料及其要求（第5.3和6.2條）

表2： 第5.3和6.2條 — 貨船上第II-2/3.1條定義的居住處所所用材料（IC法）

表3： 第5.3和6.2條 — 貨船上第II-2/3.1條定義的居住處所所用材料（IIC－IIIC法）

2010年國際消防試驗程序應用規則

（2010年消防試驗規則）

1 範圍

1.1 本規則供船旗國主管機關和主管當局，按照經修正的《1974年海上人命安全公約》的消防安全要求，對用於懸掛該船旗國國旗的船舶上的產品進行認可時使用。

1.2 試驗實驗室在對本規則所轄產品進行試驗和評定時，須適用本規則。

2 適用

2.1 本規則適用於公約中要求按照《消防試驗程序規則》進行試驗、評定和認可的產品。

2.2 如公約引用本規則時使用“……按照《消防試驗程序規則》”的詞句，則所指產品須按照第4.1節所述一項或多項適用消防試驗程序進行試驗。

2.3 如公約僅在提及產品的防火性能時使用“……及其暴露表面應具有低播焰特性”這類詞句，則所指產品須按照第4.1節所述一項或多項適用消防試驗程序進行試驗。

3 定義

3.1 *主管機關*係指船舶有權懸掛其國旗的國家政府。

3.2 *認可失效日期*係指之後的認可為滿足公約消防安全要求有效證明的最後日期。

3.3 *主管當局*係指經主管機關授權履行本規則要求的職能的機構。

3.4 公*約*係指經修正的《1974年海上人命安全公約》。

3.5 *消防試驗程序規則*係指經修正的《1974年安全公約》第II-2章界定的《國際消防試驗程序應用規則》。

3.6 *《1994年高速船規則》*係指本組織海上安全委員會經第MSC.36（63）號決議通過的經修正的《國際高速船安全規則》。

3.7 *《2000年高速船規則》*係指本組織海上安全委員會經第MSC.97（73）號決議通過的經修正的《2000年國際高速船安全規則》。

3.8 *主管機關承認的實驗室*係指有關主管機關可接受的實驗室。經有關主管機關同意，為具體認可，可逐案對其他實驗室予以承認。

3.9 *標準消防試驗*係指將試樣置於試驗爐內，暴露於大致相當於"標準時間－溫度曲線"溫度的試驗。

3.10 *持續火焰*係指試樣任何部分或其上出現的持續5秒或更長時間的火焰。

3.11 *試驗失效日期*係指給定的試驗程序可用於對任何產品予以試驗並之後按照公約予以認可的最後日期。

3.12 *標準時間－溫度曲線*係指下式定義的時間－溫度曲線：

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

式中：

T — 平均爐溫（℃）；

t — 時間（min）。

4 試驗

4.1 消防試驗程序

4.1.1 本規則附件1列出了所要求的試驗程序，除第8節中所規定者外，這些程序須在對產品的測試中用作認可（包括換證認可）的依據。

4.1.2 試驗程序列明了試驗的方法、認可及分級標準。

4.2 試驗實驗室

4.2.1 試驗須在有關主管機關承認的試驗實驗室進行。

4.2.2 主管機關在承認試驗實驗室時，須掌握下列標準：

.1 作為其日常業務的一部分，實驗室從事與規則適用部分所規定的試驗相同或類似的檢查和試驗；

.2 實驗室具備完成這些試驗和檢查所必需的儀錶、設備、人員和標定儀器；及

.3 實驗室不歸屬或受控於被試產品的製造者、賣主或供貨方。

4.2.3 試驗實驗室須採用經主管當局根據ISO/IEC 17025標準審核通過的質量控制系統。

4.3 試驗報告

4.3.1 通常，試驗報告須符合ISO/IEC 17025標準。

4.3.2 附件1中的消防試驗程序規定了所要求的試驗報告內容。

4.3.3 試驗報告一般屬於試驗委託方所有。

5 認可

5.1 一般規定

5.1.1 主管機關須按照其確立的認可程序採用型式認可程序（見第5.2款）或逐項認可程序（見第5.3款）進行產品認可。

5.1.2 主管機關可授權主管當局代為簽發認可。

5.1.3 尋求認可的申請人對作為申請依據的試驗報告須擁有合法使用權（見第4.3.3款）。

5.1.4 主管機關可要求經認可的產品標有特定的認可標記。

5.1.5 當產品用於船上時，對其認可須為有效。如果產品在生產時獲得認可，但當該產品用於船上時其認可已過期，只要自認可證書失效之日起，評定標準並無改變，該產品可作為已認可材料用於船上。

5.1.6 認可申請須向主管機關或主管當局提出。申請須至少包含下列內容：

.1 申請人和製造商姓名、地址；

.2 產品名稱或商標名稱；

.3 申請認可的具體規格；

.4 產品組裝件和材料的圖紙或說明書以及安裝和使用須知（需要時）；

.5 消防試驗報告；及

.6 如在最後認可試驗前曾進行過不成功的試驗，對導致試驗成功所做的試樣修改做出說明。

5.1.7 產品的任何重大修改將使相關認可失效。為獲得新認可，須重新進行產品試驗。

5.2 型式認可

5.2.1 不得依據提交主管機關時已超過5年的試驗報告簽發型式認可證書。如認可有賴於日期不同的多份試驗報告，以最老的報告日期為準。但是，只要試驗報告不超過15年，且產品的部件和製造並未改變，主管機關可換新認可，毋需重新試驗。

5.2.2 主管機關須要求製造商具備經主管當局審核通過的質量控制系統，以確保其始終符合型式認可條件。作為替代，主管機關可採用最終產品核實程序，即在用於船上之前由主管當局核實產品與型式認可證書要求相符。

5.2.3 型式認可證書的有效期，自其簽發日起不得超過5年。

5.2.4 型式認可證書須至少包括下列內容：

.1 產品標識（名稱或商標名稱和說明）；

.2 表面材料的型式認可證書須闡明試驗所用的基底。基礎材料的限制，將用於何種產品之上，須予以考慮（見附件1，第5部分，附錄4，第3段）；

.3 表面材料的形式認可證書須闡明試樣信息，如產品的顏色、有機成分和厚度。該信息須考慮到對產品的限制（見附件1，第5部分，附錄4，第3段）；

.4 “A”、“B”和“F”級分隔的型式認可證書須闡明隔熱材料的厚度和密度、如何將該材料固定在分隔之上、及如何隔熱至船上加強肋的詳細信息。該信息須考慮到對產品限制；

.5 不燃材料型式認可證書須闡明其有機成分；

.6 產品的級別和任何使用限制；

.7 製造商和申請人名稱和地址；

.8 試驗中採用的消防試驗方法；

.9 試驗報告標識和適用陳述（包括簽發日期、可能的檔案編號和試驗實驗室名稱和地址）；

.10 型式認可證書簽發日期和可能的編號；

.11 證書失效日期；

.12 簽發機構（主管當局）名稱及，如適用，授權；

.13 窗戶型式認可證書須闡明試驗時，窗的哪一面暴露於加熱條件之下；

.14 證書須包括對可選試驗的提及，如水龍水流試驗和（或）熱輻射試驗；及

.15 第.2至.5段所要求的信息可在證書中明確提及的手冊/小冊子中列明。

5.2.5 經型式認可的產品一般可按照其設計用途用於懸掛認可主管機關國旗的船舶上。

5.3 逐項認可

5.3.1 逐項認可係指不使用型式認可證書而對用於某一特定船舶的產品的認可。

5.3.2 主管機關可運用適用試驗程序對用於特定船舶的產品進行認可而不頒發型式認可證書。逐項認可僅對特定船舶有效。

6 無需試驗和（或）認可即可安裝的產品

本規則附件2列明了可視為符合公約有關消防安全規定並無需試驗和（或）認可即可用於船上的產品組別。

7 等效和新技術的使用

7.1 為適應產品新技術的運用和開發，主管機關可依據未在本規則中專門提到的、但主管機關認為與公約中所規定的適用消防安全要求等效的試驗和驗證方法對用於船上的產品進行認可。

7.2 根據公約第I/5條的規定進行7.1段中所述認可時，主管機關須通知國際海事組織並遵循下述文件記錄程序：

.1 對新的和非常規產品，一份為什麼現有試驗方法不能用於這一具體產品試驗的書面分析；

.2 一份表明所建議的替代試驗程序將如何證明達到公約所要求的性能的書面分析；

.3 一份對所建議的替代試驗程序與本規則要求的試驗程序加以比較的書面分析。

8 對按照以前的消防試驗規則簽發的型式認可的寬限期

8.1 本組織所通過的最新試驗程序被視為證明相關產品符合公約有關消防安全要求的最適用程序。

8.2 主管機關可對按照本規則以前版本進行試驗的產品簽發型式認可證書，但試驗須在本規則生效後一年之內進行。其目的是允許試驗實驗室有一個實用寬限期以獲得符合本規則所需的試驗設備。本規則生效一年之後進行的試驗須按照本規則現版本進行。

8.3 主管機關可對按照本規則以前版本試驗的產品進行認可換新並無需重新試驗，但試驗報告不得老於15年，且產品的部件和製造未曾改變。

9 參考文件一覽表

本規則中提及下列ISO和IEC標準。當提及ISO或IEC標準時，其出版年度須被理解為以下所列明者：

.1 ISO 834-1：1999，耐火試驗 － 建築構造部件 － 第1部分；一般要求；

.2 ISO 1182：2010，對消防試驗的反應 － 不燃性試驗；

.3 ISO 1716：2010，建築產品對消防試驗的反應 － 確定燃燒熱度；

.4 ISO 5658-2：2006，對消防試驗的反應 – 播焰 – 第2部分：垂向構成建築和運輸產品上的橫向傳播；

.5 ISO 5659-2：2006，塑料，發煙 – 第2部分：單室試驗確定光密度；

.6 ISO 5660-1：2002，對消防試驗的反應 – 熱釋放，發煙和質量損耗率 – 第1部分：熱釋放率（錐量熱計法）；

.7 ISO 5660-2：2002，對消防試驗的反應 – 熱釋放，發煙和質量損耗率 – 第2部分；發煙率（動態測量）；

.8 ISO 9705：1993，消防試驗 – 表面產品實比例艙室試驗；

.9 ISO 13943：2008，消防安全 – 詞彙；

.10 ISO 14934-3：2006，消防試驗 – 熱通量計的校準和使用 – 第3部分：二級校準方法；

.11 ISO/IEC 17025：2005，試驗和校準實驗室能力一般要求；

.12 ISO 19702：2006，火排出物毒性試驗 – 運用FTIR氣體分析進行火排出物中氣體和蒸氣分析的指南；

.13 ISO 291：2005；塑料 – 調理和試驗的標準大氣；

.14 ISO 554：1976；調理和（或）試驗的標準大氣 – 規範；

.15 ISO 14697：2007；對消防試驗的反應 — 建築和運輸產品基底選擇指南；及

.16 IEC 60584-1：1995，熱電偶 — 第1部分：參照表。

附件1

消防試驗程序

前言

1 本附件所含消防試驗程序須用於驗證產品是否符合適用要求。對於其他試驗程序，本規則第7和第8.2段的規定須適用。

2 提及本附件的消防試驗程序，須通過（例如，在試驗報告和型式認可證書上）援引適用部分編號如下：

示例： 如甲板基層敷料試驗係按照附件1第2部分和第5部分規定進行，則須援引為："國際海事組織《2010年消防試驗程序規則》第2和第5部分"。

3 某些產品或其部件要求按照一個以上的消防試驗程序進行試驗。為此，在本附件的某些部分中提及了其他部分。這僅作為信息提供，其適用指南須在公約的相關要求中查尋。

4 無需試驗和（或）認可即可安裝的產品，見本規則附件2。

第1部分 — 不燃性試驗

1 適用

1.1 如一種材料要求為不燃，則須按照本部分加以確定。

1.2 如一種材料通過了第3段中規定的試驗，即便係由無機物和有機物組合而成，須視為不燃。

2 消防試驗程序

不燃性須按照本部分附錄中的試驗程序（ISO 1182）加以驗證。但是，試驗暴露時間無需超過30分鐘。

3 不燃性接受標準

歸類為不燃材料須滿足下列標準：

.1 按照附錄第8.4和8.5段計算出的爐熱電偶平均溫升不超過30℃；

.2 按照附錄第8.4和8.5段計算出的試樣表面熱電偶平均溫升不超過30℃；

.3 按照附錄第8.3段計算出的持續火焰平均沿續時間不超過10秒；及

.4 按照附錄第8.2段計算出的平均質量損失率不超過50%。

4 試驗報告

試驗報告須包含本附錄第9段中的信息及按照上述第3段中規定的試驗標準對材料的分類。

5 参照文件

ISO 1182，建築和運輸產品對消防試驗的反應—不燃性試驗。

附 錄

不燃性試驗消防試驗程序

前言

本消防試驗用於識別當暴露於約750℃的溫度時，僅產生極為有限熱量和火焰的產品。

安全警告

所有管理和進行此試驗的有關人員須注意，消防試驗具有風險並在試驗期間有可能產生有毒和（或）有害煙氣和氣體。在測試試樣和處理試驗殘餘物時亦會出現操作風險。

須對所有潛在危險和健康風險加以評估並列明及提出安全警告。須發出書面安全須知。對有關人員須給予適當培訓。實驗室人員須確保時時遵循書面安全須知。

1 範圍

1.1 本附錄規定了確定不燃性的試驗程序。

1.2 關於試驗方法精確度的信息在ISO 1182標準附件A中給出。

2 規範參照

下列規範性文件所含規定構成本附錄規定。

.1 ISO1182，建築和運輸產品對消防試驗的反應 － 不燃性試驗；及

.2 ISO 13943，消防安全 － 詞彙。

3 術語與定義

就本附錄而言，消防安全－詞彙（ISO 13943）中給出的、及以下所列術語與定義，適用：

3.1 *均質產品*係指由單一材料構成，在全部產品中密度和成分一致的產品。

3.2 *鬆散填充材料*係指無任何物質形態的材料。

3.3 *材料*係指一種單一基本物質或均勻分佈的混合物質，如，金屬、石頭、木材、水泥、具有均勻分佈的黏合劑的礦物棉，聚合物。

3.4 *非均質產品*係指一種不符合均質產品要求的產品。係由一種以上實質和（或）非實質性成分構成的產品。

3.5 *產品*係指需要信息的材料、元素或成分。

3.6 *持續火焰*須被視為試樣的任何可見部分或其上延續5秒或以上時間的火焰持續。

3.7 水分

3.7.1 用於確定水分和有機成分的試樣不得用於不燃性試驗。

3.7.2 各試樣的水分（W_1-W_2）須使用下列方法計算，並表明乾重（W_2）的百分比及所要求的信息。

3.7.3 下文中，W_1、W_2和W_3係三個重量測量的平均值。W_1須大於25g。各個材料的三個試樣，從生產方向寬度中提取，尺寸為材料的寬度×至少20mm × 厚度，需加以稱重（初始狀態重量W_1），之後在通風烤爐中於105±2℃下加熱24小時，並在冷卻後稱重（W_2）。但是石膏基，黏結和類似材料，須在55±5℃溫度下乾燥至恆重（W_2）。

3.7.4 各試樣的水分（W_1-W_2）須計算為乾重（W_2）的百分比。

3.8 有機成分

3.8.1 需要有機成分的信息。按照上述規定計算出水分百分比之後，三個試樣須在爐中於500±20℃的溫度下再加熱2小時，並再次稱重（W_3）。有機成分（W_2-W_3）須計算為乾重（W_2）的百分比。

3.8.2 試驗試樣中所用各材料的有機成分須在作為標定有機成分申報的絕對值的±0.3%之內。

註： 只要試驗試樣代表着公差上限，可以接受更大的公差。在此情況下，須在試驗報告和型式認可證書中列明。

4 試驗儀器

試驗儀器包括熱電偶，試樣夾和其他必要外圍設備，須符合建築和運輸產品對消防試驗的反應 － 不燃性試驗（ISO 1182）。試驗儀器的校準須按照ISO標準進行。

5 試驗樣品

5.1 一般規定

5.1.1 試樣須取自大到足以對產品有代表性的取樣。

5.1.2 試樣須為圓柱形，每一個的直徑須為43mm至45mm，高度須為50±3 mm。

5.2 準備

5.2.1 如果材料的厚度不同於50±3mm，須採用足夠層數的材料和(或)調整材料的厚度以製備高度為50±3mm的試樣。

5.2.2 對於非均質材料，其高度為50±3mm的試樣的製作須使試樣中的各層與原試樣中的構成在體積上成比例。

5.2.3 各層在試樣夾中須處於水平位並須通過兩條直徑最大為0.5mm的鋼絲牢固固定，但無明顯壓縮，以避免各層之間有空氣間隙。鬆散填充材料的試樣須對其使用中的外形、密度等具代表性。

註： 當試樣由多層構成時，其總體密度應儘可能接近生產者提供的產品密度。

5.3 數量

均質產品，須製備5份試樣，非均質產品，須製備10份試樣。

6 調理

試驗試樣須在通風烤爐中保持在60±5℃溫度下乾燥20小時至24小時，並在試驗前在乾燥器中冷卻至環境溫度。各試樣的質量須在試驗之前確定至0.01克的精確度。

7 試驗程序

7.1 試驗環境

試驗儀器不得暴露在會對爐內火焰觀測產生不利影響的氣流或任何強陽光直射或人工照明之下。試驗期間，室溫變化不得超過5℃。

7.2 裝設程序

7.2.1 ***試樣夾***

從爐中取下試樣夾，及其支架。

7.2.2 ***熱電偶***

7.2.2.1 爐熱電偶

爐熱電偶的位置須為：其熱端距爐管壁10±0.5mm，其高度對應於爐管的幾何中心。

7.2.2.2 試樣表面熱電偶

試樣表面熱電偶的位置須為：在試驗開始時其熱端與試樣高度中間處接觸並須直接相對於爐熱電偶。

7.2.3 *電力供應*

將爐的發熱元件與穩壓器、可變變壓器和電力輸入監測器或電源控制器聯接。試驗期間不得使用爐溫度自動調節控制。

註1： 發熱元件通常在穩定狀態下於約100V時汲用9A至10A的電流。為避免線圈繞組超載，建議最大電流不超過11A。

註2： 對新爐管初始時應緩慢加熱。業已發現，以約 200℃的步級增加爐溫，並在各溫度上加熱2小時是一個適當程序。

7.2.4 *爐穩定*

調整爐的電力輸入，使爐熱電偶顯示的爐平均溫度在750±5℃上至少穩定10分鐘。在該10分鐘內漂移（線性回歸）不得超過 2℃並且在該10分鐘內與平均溫度的最大背離不得超過10℃。

註： ISO 1182標準附件D中給出了一個爐溫穩定範例。

7.3 標準試驗程序

7.3.1 按照第7.2.4段中所述進行爐穩定。如所用記錄儀不允許實時計算，須在事後對溫度穩定進行核查。如7.2.4段中規定的條件未獲滿足，須重新試驗。

7.3.2 開始試驗之前，確定全部設備處於良好工作狀態，例如，穩定器乾淨，試樣插入裝置運作平穩及試樣夾在爐中準確處於所要求的位置。

7.3.3 將一份按照第6段的規定製備和處理過的試樣插入懸掛在支架

上的試樣夾之中。

7.3.4 將該試樣夾置於爐內位置上，此項操作時間不得超過5秒。該試樣位置須為：試樣的幾何中心在試驗期間嚴格地位於爐的幾何中心。

7.3.5 在試樣降入爐內之前開始火焰觀測。

7.3.6 在試樣降入爐內後立即啟動計時裝置。

7.3.7 在整個試驗期間，以不超過1秒的間隔記錄爐熱電偶和試樣表面熱電偶測出的溫度。

7.3.8 將試驗進行30分鐘。

7.3.9 將試樣在乾燥器中冷卻至環境溫度後，對試樣進行稱重。回收試樣在試驗中或試驗後脫落並落到管下的任何結焦、灰燼或其他殘骸，並將其包括為未耗盡試樣的一部分。

7.3.10 對於均質產品，按照第7.3.1至7.3.9段所述，對5份試樣進行試驗。

7.3.11 對於非均質產品，按照第7.3.1至7.3.9段所述，對5份試樣以一個表面向上進行試驗。對餘下的5份試樣以該表面向下重複試驗。

7.4 試驗期間的觀測

7.4.1 對按照7.3段試驗的各個試樣，記錄其試驗前後的質量，以克計，並在試驗期間包括插入設備期間，對與試樣表現有關的任何觀測加以記錄。

7.4.2 記錄所發生的任何持續火焰並記錄此等火焰的延續時間，以秒計。

註： 一些試樣僅呈現一個穩定的藍色發光氣體區；這不得被視為火焰，而須在試驗報告中"試驗期間的觀測"之下加以記錄。

7.4.3 對熱電偶測出的下列溫度進行記錄，以攝氏度℃計：

.1 爐初始溫度$T_{i（爐）}$，為7.2.4段所定義的穩定期最後10分鐘的平均溫度；

.2 爐最高溫度$T_{m（爐）}$及試樣表面最高溫度$T_{m（表面）}$，為整個試驗期間任何地方的最高溫度離散值；及

.3 爐最終溫度$T_{f（爐）}$及試樣表面最終溫度$T_{f（表面）}$，為7.3.8段所定義的試驗期最後1分鐘的平均溫度。

8 結果的表達

8.1 計算平均值

8.1.1 對於均質產品，對5份試樣計算8.2（質量損失）至8.5段（平均溫度上升）的平均值。

8.1.2 對於非均質產品，對同一取向的每一套5份試樣計算8.2（質量損失）至8.5段（平均溫度上升）的平均值。各取向的結果須分別提出，並不得組合。定級須以最為困難的取向為依據，各套5份試樣的全部平均值均須滿足第1部分第3段中的要求。

8.2 質量損失

8.2.1 對5份試樣的每一份按照百分比計算並記錄按照第7.4.1段中的規定測定的質量損失，以試樣的初始質量的百分比表示。

8.2.2 按照百分比計算質量損失平均值，為5份試樣的質量損失平均值。

8.3 火焰

8.3.1 對5份試樣的每一份計算並記錄按照第7.4.2段中的規定測定的持續火焰的總計延續時間，以秒計。

8.3.2 計算持續火焰的平均延續時間，為5份試樣持續火焰總計延續時間的平均值。

8.4 溫度上升

對5份試樣的每一份計算和記錄按照第7.4.3段的規定由熱電偶記錄的下列溫度上升，以攝氏度℃計：

.1 爐溫度上升： $T_{\mathrm{r}（爐）} = T_{\mathrm{m}（爐）} - T_{\mathrm{f}（爐）}$；及

.2 試樣表面溫度上升： $T_{\mathrm{r}（表面）} = T_{\mathrm{m}（表面）} - T_{\mathrm{f}（表面）}$。

8.5 平均溫度上升

從8.4段獲得的數值中計算平均爐溫度上升 $T_{\mathrm{ave\ r}（爐）}$ 和平均試樣表面溫度上升$T_{\mathrm{ave\ r}（表面）}$。

9 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗確定的數據須做出明確區分：

.1 表明試驗係按照《2010年消防試驗程序規則》第1部分進行（另見第.2小段）；

.2 對試驗方法的任何偏離；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱和地址（如已知）；

.7 所試驗產品的名稱和（或）識別；

.8 相關時，取樣程序描述；

.9 所試驗產品描述，包括密度、每一單位面積的質量和厚度、以及產品構造細節、水分和有機成分；

.10 試樣描述，包括尺寸、取向和構造；

.11 樣品抵達日期；

.12 試樣調理細節；

.13 試驗日期；

.14 按照第8段表達的試驗結果；

.15 試驗期間所作的觀測；

.16 材料定級；及

.17 下列聲明：

“試驗結果與一種產品的試驗試樣在試驗的特殊條件下的表現相關;試驗結果並非擬為評定該產品使用中潛在失火風險的唯一標準”。

第2部分 － 煙及毒性試驗

1 適用

如要求一種材料在溫度升高時不能產生過量的煙和有毒產物或不得產生中毒危險，該材料須符合本部分的規定。

2 消防試驗程序

2.1 總則

發煙試驗須按照附錄1進行，氣體測量方法須符合本部分附錄2，及本規則本部分中規定的補充試驗程序。為按照本部分進行試驗，必要時，為進行有毒氣體測量，須對ISO5659-2標準的安排和程序做出調整。

2.2 試驗試樣

試驗試樣的製備須符合本規則第5部分附錄4中概述的做法。如產品有兩面且任何一面在使用中均有可能暴露於失火條件之下，則兩面均須得到評估。

2.3 試驗結果

2.3.1 按照本部分附錄1第9段進行的每一試驗須獲取煙最大比光密度（*Ds max*）。

2.3.2 在進行毒性測量時，須在每一試驗條件下的第2和第3試樣試驗期間，在達到煙最大比光密度時，從試驗倉的幾何中心做煙氣取樣。各有毒氣體的濃度須以試驗倉容積的百萬分之幾確定。

2.4 定級標準

2.4.1 ***煙***

對於附錄1第8.8.1段中的每一試驗條件下的三次試驗，須計算出煙最大比光密度（*Ds max*）的平均值（*Dm*）：

.1 對於用作隔艙壁、襯板或天花板表面的材料，任何試驗條件下的平均值*Dm*均不得超過200；

.2 對於用作甲板基層敷料的材料，任何試驗條件下的平均值*Dm*均不得超過400；

.3 對於用作地板敷料的材料，任何試驗條件下的平均值*Dm*均不得超過500；

.4 對於塑料管，任何試驗條件下的平均值*Dm*均不得超過400。

2.4.2 ***毒性***

在附錄1第8.8.1段中的每一試驗條件下測量出的氣體濃度最大值的平均值不得超過下列限度：

CO	1,450 ppm	HBr	600 ppm
HC/	600 ppm	HCN	140 ppm
HF	600 ppm	SO_2	120 ppm（地板敷料200 ppm）
NO_x	350 ppm		

3 補充要求

本附件第5部分亦適用於油漆、地板敷料、甲板基層敷料、清漆和用在室內暴露表面上的其他最後塗層。

4 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗確定的數據須做出明確區分。

.1 表明試驗係按照《2010年消防試驗程序規則》第2部分進行（另見第.2小段）；

.2 對試驗方法的任何偏離；

.3 試驗實驗室的名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱和地址（如已知）；

.7 材料種類，即表面最後塗層、地板敷料、甲板基層敷料、管道，等；

.8 所試驗產品名稱和（或）識別；

.9 取樣程序描述，如相關；

.10 所試驗產品描述，包括密度和（或）每一單位面積的質量、厚度和尺寸、顏色、任何塗層的數量和道數、以及產品構造細節；

.11 試樣描述，包括密度和（或）每一單位面積的質量、厚度和尺寸、顏色、任何塗層的數量和道數、所試驗的取向和面、和構造；

.12 樣品抵達日期；

.13 試樣調理細節；

.14 試驗日期；

.15 試驗條件（見附錄1，第8.8段）；

.16 試驗結果：

.1 煙試驗：

.1 每一試驗的*Ds max*（附錄1第9段）；及

.2 每一試驗條件下的*Dm*（上述第2.4.1段）；及

.2 毒性試驗，附錄2第10段中所列的數值；

.17 試驗期間所作的觀測；及

.18 材料定級。

5 參照文件

ISO 5659-2，塑料 － 發煙，第2部分：單室試驗確定光密度。

ISO 13943，消防安全 － 詞彙。

ISO 19702，火釋放物毒性試驗 － 使用傅氏轉換紅外線光譜氣體分析進行火釋放物中的氣體和蒸氣分析指南。

附錄1

發煙消防試驗程序

参照文件：ISO 5659-2 塑料 — 發煙 — 第2部分：單室試驗確定光密度

避免對試驗操作者造成危險

提請所有消防試驗有關人員注意，試樣燃燒時會釋放出有害氣體，為保護健康要採取適當防範措施。對煙室進行清潔作業時，須小心不要吸入煙氣或與煙沉積物發生皮膚接觸。

要注意熱輻射錐、及使用主電壓電源會產生的危險。ISO5659-2標準第7.2.1.1段中規定的安全防爆板對於保護操作員防範壓力突增導致爆炸的風險至關重要。

1 範圍

1.1 本附錄規定了對厚度不超過25mm的基本平整的材料、複合物或組件的試樣的暴露表面，水平取向放置在封閉櫃中，使用或不使用引燃火焰，在特定熱輻射水平下發煙的一種測量方法。此試驗方法適用於所有塑料，並亦可用於對其他材料的評定（例如，橡膠、紡織物罩面、油漆表面、木材和其他材料）。

1.2 通過此方法確定的光密度值僅限於所測試形狀和厚度的試樣或組件材料，不可視為固有的、基本性質。

1.3 此試驗擬主要用於建築、火車、船舶等的研發和消防安全工程，而不作為建築規則或其他目的的等級評定依據。對於預測材料在其他暴露條件下暴露於熱和火焰之下時會發煙的密度不提供任何依據，與通過其他試驗方法得出的測量結果也沒有大體上確立對應關係。此試驗程序未包括刺激物對眼的影響，此事實在應用試驗結果時亦須得到考慮。

1.4 要加以強調的是，材料的發煙根據試樣所接觸的輻射水平會有不同。在應用此方法的試驗結果時，須牢記該結果以暴露於特定的 $25kW/m^2$ 和 $50\ kW/m^2$輻射水平為基礎。

2 参照規範

下列規範性文件所含規定構成本附錄規定：

.1 ISO 291，塑料 － 調理和試驗的標準大氣；

.2 ISO 5659-2，塑料 － 發煙，第2部分：單室試驗確定光密度；及

.3 ISO 13943，消防安全 － 詞彙。

3 術語與定義

就本附錄而言，ISO 13943標準中給出的、及下列術語與定義適用。

3.1 *組件* 係指材料和（或）複合物的構成，例如夾芯板。可包含空

氣間隙。

3.2 *複合物* 係指通常在建築中被認作分離實體的材料組合，例如塗有塗層或貼附薄片的材料。

3.3 *基本平整表面* 係指平面偏離不超過±1mm的表面。

3.4 *暴露表面* 係指暴露於試驗加熱條件下的表面。

3.5 *膨脹材料* 係指在試驗中暴露於熱源之下，錐加熱器距試樣25mm時，產生碳質膨脹結構大於10mm的尺度不穩定材料。

3.6 *輻照度（對表面上的某一點）*係指表面極微小單元、包含該單元面積所劃分的點上傳入的輻射通量。

3.7 *材料* 係指一種基本的單一物質或均一分佈的混合物，例如，金屬、石頭、木材、混凝土、礦物纖維、聚合物。

3.8 *質量光密度（MOD）*係指對煙的不透光程度就實驗條件下物質質量損失而言的一種測量。

3.9 *煙光密度（D）*係指對煙的不透光程度的一種測量；光相對傳播的負常用對數。

3.10 *產品* 係指需要其信息的材料、複合物或組件。

3.11 *比光密度（Ds）*係指光密度乘以通過將試驗倉的容積除以試樣暴露面積與光束路徑長度的乘積而計算出的因數（見第9.1.1段）。

3.12 *試樣* 係指待與任何基底或處理一同進行試驗的、有代表性的一塊產品。可包含空氣間隙。

4 試樣的構造與製備

4.1 試樣數量

4.1.1 如要按全部三種實驗條件進行試驗，試驗樣品須由至少九份試樣構成：六份試樣須在25kW/m^{2}之下進行試驗（三份試樣有引燃火焰，三份試樣無引燃火焰）及三份試樣須在50kW/m^{2}之下進行無引燃火焰試驗。

4.1.2 額外數量的4.1.1段中規定的試樣須按照第2部分第2.2段中的要求，用於對每一面的試驗。

4.1.3 如第8.8.2段中規定的條件要求，另外九份試樣（即每一試驗模式三份試樣）須留作後備。

4.1.4 對於膨脹材料，需要使用錐加熱器距試樣50mm進行預試驗。因此至少需要另外兩份試樣。

4.2 試樣尺寸

4.2.1 試樣須為方形，各邊長為75±1mm。

4.2.2 標定厚度25mm或以下的材料須以其全厚度進行評定。對於比較試驗，材料須以1±0.1mm的厚度進行評定。所有材料在倉中燃燒時要消耗氧氣，某些材料的發煙（尤其是燃燒迅速或厚的試樣）受倉中氧氣濃度下降的影響。材料須儘可能按其最終使用厚度進行試驗。

4.2.3 厚度大於25mm的材料須加以切割使試樣的厚度在24mm和25mm之間，切割方式要使原（未切割）面能夠得到評定。

4.2.4 由核心材料和不同面料構成的、厚度大於25mm的多層材料試樣，須按照第4.2.3段中的規定加以製備（另見第4.3.2段）。

4.3 試樣製備

4.3.1 試樣對材料須具代表性並須按照第4.3.2及4.3.3段中規定的程序製備。試樣須從材料同一取樣區域切下、鋸下、模制或沖下，並須保持其厚度和，需要時，其質量的記錄。

4.3.2 如使用厚度和構造相同的平面部位替代彎曲、鑄型或特別部位進行試驗，須在試驗報告中闡明。試樣的任何基底或核心材料須與實際使用中的相同。

4.3.3 當塗層材料，包括油漆和黏合劑要按照實際應用與基底或核心一同試驗時，試樣須遵照一般做法進行製備，並且在這種情況下，塗層的塗裝方法、塗層的道數和基底的類型須包括在試驗報告中。

4.4 包裹試樣

4.4.1 所有試樣均須對其反面、沿其邊緣並對正表面的外緣用單層鋁箔（約0.04mm厚）以無光面接觸試樣加以覆蓋，僅留出65 mm × 65 mm的中心暴露試樣區。須小心不要刺破鋁箔或在包裹作業中造成不必要的皺紋。鋁箔的折疊方式應盡力減少試樣夾底部任何熔化材料的流失。在將試樣裝在試樣夾上後，沿着前沿的任何多餘鋁膜在適當時須加以修剪。

4.4.2.1 包裹後厚度不超過12.5mm的試樣須以烘乾密度為950±100kg/m^3及標定厚度為12.5mm的不燃隔熱板和在不燃板之下的一層低密度（標定密度65kg/m^3）耐熔纖維墊為後襯。

4.4.2.2 包裹後的厚度大於12.5mm但小於25mm的試樣須以一層低密度（標定密度65kg/m^3）耐熔纖維墊為後襯。

4.4.2.3 包裹後的厚度為25mm的試樣須在沒有任何板或耐熔纖維墊後襯的情況下進行試驗。

4.4.3 對於彈性材料，各個包裹於鋁箔內的試樣在試樣夾中的安裝須使其暴露表面與試樣夾開口的內表面齊平。暴露表面不平整的材料不得突出於試樣夾開口平面之外。

4.4.4 當非滲透性試樣，如熱塑薄膜，因薄膜與後襯間困有氣體而在試驗期間發生鼓脹時，須通過在薄膜中部間隔20mm做兩個長度為20mm的平行切口作為排氣口而使試樣保持基本平坦。

4.5 調理

4.5.1 為試驗製備試樣之前，試樣須在溫度23±2℃和相對濕度50±5%之下調理至恆定質量。當間隔24小時進行的兩次相連稱重區別不大於試樣質量的0.1%或0.1克時（以大者為準），須視為業已達到恆定質量。

4.5.2 試樣在調理室中須以支架支撐令空氣接觸到所有表面。

註1： 為有助於加速調理過程，在調理室中可使用強制通風。

註2： 通過此方法獲得的結果對試樣調理的微小不同敏感。因此確保認真遵循4.5段中的要求至關重要。

5 儀器和輔助設備

儀器和輔助設備須符合ISO 5659-2標準，塑料 — 發煙 — 第2部分：單室試驗確定光密度。

6 實驗環境

6.1 對實驗儀器須給予直射陽光或任何強光源防護，以排除假性光讀數的可能性。

6.2 須作出充分安排，從操作區域排除有潛在危害和令人不快的煙和氣體，並須採取其他適當防範措施防止操作員接觸到煙和其他氣體，尤其是在從實驗倉中取出試樣期間或清潔儀器時。

7 校準程序

進行試驗儀器校準須遵循ISO 5659-2標準，塑料 — 發煙 — 第2部分：單室試驗確定光密度。

8 試驗程序

8.1 準備試驗倉

8.1.1 按照ISO 5659-2標準第9條的要求準備試驗倉，將錐形加熱器調定為25kW/m^{2}或50kW/m^2。對於膨脹材料，錐形加熱器和試樣之間的距離須為50mm，引燃燃燒器須位於錐形加熱器下沿之下15mm處。

8.1.2 一旦一次試驗完成，關閉倉門，打開排氣和進氣口，用空氣清掃試驗倉直至完全無煙。檢查倉室內部，必要時清潔倉壁和支撐框架（見ISO 5659-2標準第9.9段）。在每次試驗前，清潔倉內的光學窗口。如使用25kW/m^2 的輻射錐，讓儀器穩定至倉壁溫度達40±5℃的範圍之內，或如使用50 kW/m^{2}的輻射錐，則至55±5℃的範圍之內。關閉進氣閥門。

8.1.3 對於膨脹材料試驗，倉壁溫度，如果使用25kW/m^{2}的輻射錐，須在50±10℃的範圍之內或如使用50 kW/m^{2}的輻射錐，在60±10℃的範圍之內。

註： 如溫度過高，可以使用排風扇吸入實驗室中的冷空氣。

8.2 使用引燃火焰的試驗

對於使用引燃火焰的試驗，將燃燒器置於正確位置，打開瓦斯和空氣供應並點燃燃燒器，檢查流率及，如需要，調整流率以確保火焰符合ISO 5659-2標準第7.3.6段中的規定。

8.3 光度測定系統的準備

置零，之後打開光閘確定100%透射讀數。關閉光閘進行核查，並在必要時使用最敏感的（0.1%）的量程重新置零。再次核查100%的設定。重複此作業順序直至放大器和記錄器在光閘打開和關閉時，得出準確的零和100%的讀數。

8.4 裝入試樣

8.4.1 裝置按照第4.3和4.4段製備的包裹好的試樣，將試樣夾和試樣置於輻射錐下的支撐框架上。除去錐下的輻射屏蔽並同時打開記錄系統並關閉進氣口。試驗倉門和進氣口須在試驗開始後立即關閉。

8.4.2 如初步試驗表明引燃火焰在取出屏蔽之前熄滅，立即重新點燃引火燃燒器並同時釋放屏蔽。

8.5 記錄光度透射

8.5.1 從試驗一開始（即，當輻射屏蔽移除後）連續記錄光度透射百分比和時間。需要時，將光電探測放大器轉換到下一十進位級，以避免讀數小於全偏轉的10%。

8.5.2 如果光度透射降至0.01%之下，遮住倉門上的觀察窗並從光通路上撤除擴大量程過濾器。

8.6 觀測

8.6.1 注意試樣的任何特別燃燒特點，例如層離、膨脹、收縮、熔化和坍塌，並從試驗開始注意特別狀況何時發生，包括點燃時間和火焰延續時間。另外注意發煙特性，例如沉降顆粒物質的顏色和性質。

註1： 某些材料的發煙，隨燃燒發生於有火焰狀態或無火焰狀態而有很大不同（見ISO 5659-2標準）。因此，在試驗期間儘可能多地記錄燃燒狀態信息很重要。

註2： 有塗層和貼面的材料，包括層壓片板、瓦、織物和其他用黏合劑固定在基底上的材料，和不附在基底上的複合材料，會由於其層離、開裂、脫皮或其他類型的分離而影響其發煙。

8.6.2 如果引燃火焰在試驗期間被氣體排出物撲滅並在10秒內未能重新點燃，則須立即關閉點火燃燒器的瓦斯供應（見ISO 5659-2標準第7.3.6段）。

8.6.3 如未經切出開口的薄型試樣發生鼓脹（見上述第4.4.4段），須忽略該試樣的結果，並對另經切出開口的試樣進行試驗。

8.7 結束試驗

8.7.1 第8.8.1段中各個試驗條件下的初試須進行20分鐘，以核實可能存在的第二最小透射值。若在初試中，最小透射值發生於第一個10分鐘之內，則之後的該試驗條件下的試驗可進行10分鐘。否則，試驗須延續20分鐘。

8.7.2 如使用了引燃火焰，熄滅燃燒器。

註： 熄滅燃燒器是為了避免空氣和所出現的燃燒產物發生混合並引起爆炸的可能性。

8.7.3 移動錐下的輻射屏蔽。

8.7.4 開啟排風扇，並在水柱壓力計表明有小小負壓時打開進氣口並繼續排風直至選定在適當檔位時，記錄到最大光度透射值，並將其記錄為“清澈光束”*Tc*，以用於對光窗上沉澱物的校正。

8.8 重複試驗

8.8.1 在下列每一個條件下，須對三份試樣進行試驗：

.1 輻照度為25 kW/m^2，有引燃火焰；

.2 輻照度為25 kW/m^2，無引燃火焰；及

.3 輻照度為50 kW/m^2，無引燃火焰。

8.8.2 對每一份試樣確定其光度透射的百分比值，並據此計算第9.1段中給出的適當比光密度。如果任何一份試樣的$Ds\ max$ 值，與該試樣所屬的一批三份試樣的平均值相差超過50%，且無明顯原因，則在同樣模式下用同一取樣的另一批三份試樣進行試驗並記錄所獲得的所有六個結果的平均值。

註： 即便在同樣試驗條件下，一份試樣會有火焰燃燒而其他試樣會無火焰燃燒。這會是一個明顯原因。

9 結果的表達

9.1 比光密度*Ds*

9.1.1 對於每一份試樣，製出一份相對於時間的光度透射圖並確定最小透射$Tmin$。通過使用下列方程式對兩個有效數字進行計算，將最小透射$Tmin$換算成最大比光密度$Ds\ max$：

$$Ds\ max = 132 \log_{10} (100/Tmin)$$

式中：

132 源自試驗倉V/AL 的因數，

V 是倉的容積，

A 是試樣的暴露面積，

L 是光路的長度。

註： 此方程式中所用的透射是所測量的透射。對於頭四個十進位級，這是系統記錄的數值。對於最後兩個十進位級（當擴大量程過濾器從光路上除去後），透射須相對於0.01%或0.001%的實際測量範圍計算。例如，如果測量範圍定在1%且已除去擴大量程過濾器，則實際測量範圍為0.01%。如果所顯示的透射值是0.523，則實際測量的透射為0.00523%。

9.1.2 如果需要，對每一個按照第9.1.1段確定的$Ds\ max$ 值加上修正因數C_f，這有賴於擴大量程過濾器的使用。C_f 的值是：

.1 零：

.1 如果記錄該透射時光路上有過濾器（$T \geq 0.01\%$）；或

.2 如果光度測定系統沒有配備可移除的過濾器；或

.3 如果發現 ND-2 過濾器屬於正確的光密度2；及

.2 如果在測定時過濾器已從光路上移除（$T < 0.01\%$），按照ISO 5659-2標準第9.5中描述的程序加以確定。

9.2 清澈光束修正因數*Dc*

對每份試樣，記錄“清澈光束”讀數值*Tc*（見第8.7.4段）以確定修正因數*Dc*。如第9.1.1段對 *Ds max* 那樣計算 *Dc*。如果*Dc* 小於 *Ds max* 的5%，不要記錄修正因數*Dc*。

10 其他參照

“熱通量計的校準”，“單室試驗中測量的煙比光密度的可變性”和“質光密度（MOD）的測定”應參照ISO 5659-2標準的A、B和C附件。

附錄2

有毒氣體產生消防試驗程序

1 範圍

1.1 本附錄規定了採用傅氏轉換紅外光譜計對累積煙/消防試驗中產生的氣體進行測量的方法。對氣體取樣系統和氣體測量條件給予了特別注意。

1.2 應當指出，除氣體外，火還有其他釋出物，如顆粒、煙或蒸氣，這都可能是有毒的並且某些氣體例如鹵化氫可被水分滯留在取樣管路之中或被滯留在僅為去除煙氣顆粒而設計的過濾器之中。

1.3 傅氏轉換紅外光譜計氣體測量須在獲得最大煙密度時進行。該時機通過按照附錄1進行的煙密度測量試驗確定。

2 參照規範

下列規範性文件中所含規定構成本附錄規定：

ISO 5659-2，塑料 － 發煙 － 第2部分：單室試驗確定光密度。

ISO 13943，消防安全 － 詞彙。

ISO 19702，火釋出物毒性試驗 － 使用傅氏轉換紅外光譜計分析火釋出物的中氣體和蒸氣。

3 術語和定義

就本文件而言，ISO 13943和ISO 19702標準中給出的、及下列術語和定義適用。

3.1 *最大煙密度取樣時間（DmST）*係指以秒表達的、用於毒性試驗中與按照第2部分第2.4.1段達到最大比光密度的時間相應的取樣時間。

3.2 *取樣反應期（SRP）*係指在取樣期間完全裝填傅氏轉換紅外光譜計氣室所需要的時間，包括釋出物流從煙室轉移至該氣室的時間。

4 原理

火釋出物從煙試驗的累積煙室中，在一個稱為*Dm取樣時間（DmST）*的單一時間點取樣，該時間點由附錄1中的首次煙密度試驗確定。這一時間代表着煙密度在標準20分鐘試驗中達到最高水平的時間。氣體取樣須為：樣品對煙室中的氣體、火釋出物、在質和量上具代表性，及氣體取樣系統（過濾器、探頭、管、筒和泵）所造成的影響減至最低。建議盡力減少火釋出物通過氣體取樣系統的時間和距離。在氣體取樣系統之內須安裝火釋出物過濾系統，以防止煙顆粒進入氣體分析器。須使用傅氏轉換紅外光譜計對所取樣的氣體進行分析。

5 氣體取樣系統

氣體取樣系統應由探頭、經加熱的氣體取樣管路、過濾器、閥門和取樣泵構成。

6 氣體分析技術

須使用ISO 19702 標準中規定的傅氏轉換紅外光譜計系統。

7 校準

傅氏轉換紅外光譜計系統須按照ISO 19702標準針對擬測量的氣體進行校準。

8 試驗程序

8.1 各次試驗前的操作

8.1.1 檢查試驗倉內壁狀況，最後清潔內壁，清除所有髒污層和顆粒。對傅氏轉換紅外光譜計取樣內部探頭的表面須做同樣處理。

8.1.2 對探頭的進氣口須進行清潔。

8.1.3 在試驗之前，將過濾器、取樣管路和閥門及氣室在150℃至180℃度保持至少10分鐘。

8.1.4 分光計波長分辨率須為$4cm^{-1}$或更佳。將中－紅外全光譜收集區設定在$650cm^{-1}$至 $4,500cm^{-1}$之間。

8.1.5 關閉倉門，並將倉中的空氣引入傅氏轉換紅外光譜計的氣室。等待1分鐘並記錄本底光譜。

8.1.6 轉動取樣閥門，將大氣空氣引入氣室。

註： 建議在一天中開始任何煙試驗之前，進行一次虛擬氣體測量，對煙試驗倉中的環境空氣按照正常程序進行取樣和分析，並確保未探測到任何瓦斯氣體。還建議每當獲得有疑問的氣體測量結果時，均進行一次虛擬氣體測量。還建議在使用揮發性溶劑清潔煙倉之後，進行一次這樣的檢查測量。

8.2 試驗期間的操作

8.2.1 在進行附錄1規定的煙密度試驗期間，取樣須首先從轉動取樣閥門將試驗倉中的氣體，在$DmST$ －（SRPx0.5）（s）時引入取樣管路開始。

8.2.2 等待至少與取樣反應期SRP相等的一段時間後收集光譜，停止從該倉中取樣並將取樣閥門轉至引入大氣空氣一側。

8.2.3 繼續進行煙密度試驗直至20分鐘期限期滿。為對實驗的結束加以核實，確定煙密度高峰業已發生。

8.2.4 試驗結束時，遵循附錄1中規定的試驗結束程序。

8.2.5 若煙倉壓力因任何試樣燃燒現象而降至ISO 5659-2標準中規定的允許最低壓力之下，該倉的氣體進口閥門將按照ISO 5659-2標準自動開啟。如發生這種情況，須做出報告。

8.2.6 若煙倉壓力因任何試樣燃燒現象而超出ISO 5659-2標準中規定的允許最高壓力，該倉的氣體釋放閥門將按照ISO 5659-2標準自動開啟。如發生這種情況，須做出報告。

8.3 重複試驗

如果按照附錄1第8.8.2段，在附錄1第8.8.1段中規定的任何試驗條件下重複進行另一批3次煙測量試驗，則須對按照本附錄對第二批試驗的第2和第3次試驗進行氣體測量，試驗結果須按照第10段做出報告。

9 氣體分析

9.1 傅氏轉換紅外光譜計分析

傅氏轉換紅外光譜計氣體分析須按照 ISO 19702標準進行。

9.2 計算酸性氣體濃度的修正

9.2.1 須對取樣管路中使用的過濾材料進行分析，並獲取滯留於過濾材料中的酸性氣體的總值（Qa（g））。

9.2.2 須根據在氣體取樣期間通過過濾器的氣體總體積計算相對濃度：

$$Vs = Sfl \times St$$

式中：

Sfl 是氣體取樣流率（l/s），

St 是氣體取樣時間（s）。

9.2.3 氣體相對體積（Va（l））須按照下式計算：

$Va =$ （Qa/PMa）$\times$ Vm

式中：

Vm 是標準情況下的摩爾體積，

PMa 是氣體的摩爾質量。

9.2.4 對酸性氣體的濃度修正（Cca（ppm））須按照下式獲得：

$Cca = Va/Vs \times 10^6$

10 試驗結果

下列試驗結果須包括在試樣報告之中：

.1 對於每一次試驗：

.1 傅氏轉換紅外光譜計測量出的列於本部分第2.4.2段中的每一種氣體的最大氣體濃度C（ppm）；

.2 氣體濃度修正（Cca），如適用；

.3 經修正的最大氣體濃度（$C + Cca$），如適用；及

.4 *最大煙取樣時間DmST*和*取樣反應期SRP*；

.2 對於每一種試驗條件（見附錄1第8.8.1段），每一種試驗條件下所測量的並，適用時，經修正的氣體濃度最大值的平均值；及

.3 關於試驗儀器的數據：

.1 氣室的內部容積；

.2 氣體取樣管路的內容積和長度；及

.3 氣體取樣泵的能力。

第3部分 — “A”、“B”和“F”級分隔試驗

1 適用

產品（如甲板、隔艙壁、門、天花板、襯板、窗、擋火閘、管道貫穿和電纜穿越）如要求為“A”、“B”或“F”級分隔，須符合本部分的規定。

2 消防試驗程序

產品須按照本部分附錄1和附錄2中規定的消防試驗程序加以試驗和評定。附錄2中含有對窗、擋火閘和管道及導管貫穿的試驗程序。

3 性能標準

3.1 隔熱

3.1.1 *“A”級分隔，包括“A”級門*

在各個等級的下列時限內，按照附錄1第8.4.1段確定的非暴露面平均溫度上升不得超過140℃，非暴露面的任何單獨熱電偶所記錄的溫度上升不得超過180℃：

“A-60”級	60分鐘
“A-30”級	30分鐘
“A-15”級	15分鐘

“A-0”級　　0分鐘

3.1.2 *“B”和“F”級分隔，包括“B”和“F”級門*

在各等級的下列時限內，按照附錄1第8.4.1段確定的非暴露面平均溫度上升不得超過140℃，非暴露面的任何單獨熱電偶所記錄的溫度上升不得超過225℃：

“B-15”級　　15分鐘

“B-0”級　　0分鐘

“F-15”級　　15分鐘

“F-0”級　　0分鐘

3.2 完整性

所有“A”、“B”和“F”級分隔，包括“A”、“B”和“F”級門，在有關各等級的最低試驗時限內（見附錄1第8.5段），須滿足下列要求：

.1 火焰：非暴露面不得有火焰；

.2 棉－毛墊：棉－毛墊在按照附錄1第8.4.3段應用時，或用於幫助評定火焰時（見附錄1第8.4.2段）不得燃着，即，有焰或無焰燃燒；及

.3 隙規：隙規須不可能以附錄1第8.4.4段所述的方式進入試樣的任何開口。

“A”、“B”和“F”級門，在所規定的試驗時限期間或之後，不要求能夠開啟或關閉。

3.3 構芯溫度

對於鋁合金承重分隔，附錄1第7.7段所述熱電偶所獲得的構芯平均溫度上升，在相關等級的最低試驗時限內（見附錄1第8.5段）的任何時刻，不得超過其初始溫度以上200℃。如構芯為除鋼或鋁合金之外的其他材料，主管機關須確定試驗時限內不得超過的溫度上升。

3.4 “B”級連續天花板和襯板

天花板或襯板如要求為“B”級連續天花板或襯板，則可按照本部分附錄4進行試驗和評定。

3.5 補充要求

3.5.1 “A”和“B”級構造的試樣須由不燃材料製成。但允許下列例外：

.1 製造試樣中所使用的黏合劑和防潮層不要求為不燃；但是，須具有低播焰特性；

.2 用於貫穿系統中的密封材料；

.3 氣密、水密和氣候密門的密封；

.4 窗的密封；及

.5 玻璃窗系統中的填充材料。

貫穿系統試驗中使用的黏合劑和密封材料須在實際結構中使用。第3.5.1.3至3.5.1.5段中所述材料可以安裝在試樣構造之中。此種包含須在試驗報告中闡明。不得使用未經按照本規則試驗和（或）未經主管機關接受的任何其他材料取代試驗中所用材料。

3.5.2 ***透過窗的熱輻射***

3.5.2.1 如主管機關要求限制透過窗的熱輻射,可按照本部分附錄3對窗的組件進行試驗和評定。

3.5.2.2 在產品隔熱等級相關時限之後,非暴露面上不需要使用棉－毛墊。

4 其他參照

4.1 用於“A”和“B”級分隔中的材料，其不燃性須按照第1部分進行核實。

4.2 如允許“A”和“B”級分隔中裝設可燃貼面，則如有要求，此等貼面的低播焰性須按照第5部分進行核實。

4.3 如隔熱裝設在甲板之下對鋁甲板進行了試驗，則該結果將適用於頂面光裸的甲板。除非為核實鋁的溫度未超過200℃的試驗中包括了甲板覆蓋物或隔熱，否則鋁甲板不得在頂面上裝設覆蓋物和隔熱。

5 試驗報告

試驗報告須包括附錄1第9段中所含信息。

6 参照文件

ISO 834-1 — 耐火試驗 — 建築構造部分 — 第1部分：一般規定。

IEC 60584-1 — 熱電偶 — 第1部分參照表。

附錄1

“A”、“B”和“F”級分隔耐火試驗程序

1 總則

1.1 對構造的認可將僅限於其被試驗的朝向，因此艙壁，襯板和門須垂直安裝進行試驗，而甲板和天花板須水平安裝進行試驗。甲板僅需在底面暴露在加熱狀態下進行試驗，“B”級和“F”級天花板和襯板只要求對帶有天花板或襯板的一面進行試驗。

1.2 對於“通用”“A”級艙壁和門，即在構芯兩側均使用隔熱材料者，及對於“B”級艙壁和門，其認可通常需要分別使用兩個樣品對每一側分別進行試驗，除非主管機關認為只對性能較差的一側進行單一試驗即為適當。

1.3 在試驗“通用”“A”級艙壁時，可僅根據單一試驗給予認可，但對該艙壁的試驗應以最嚴格的方式進行，即隔熱物在非暴露面、加強筋也在該側。

1.4 在試驗“有限使用”的“A”級艙壁時，即火災危害被證明僅在隔熱一側時，艙壁可在隔熱物在暴露面、加強筋也在該側的情況下進行測試。

1.5 在尋求認可“雙面使用”隔熱物的“A”級艙壁，即在構芯兩側使用厚度相等的隔熱物時，須在加強筋在艙壁的非暴露側的情況下進行測試，否則須對暴露面上隔熱物最薄的一側進行試驗。

1.6 加強筋上的隔熱物，其厚度無需與鋼板上的相同。

1.7 如果“A”級分隔的隔熱係由表層保護提供，即由“B”級天花板為鋼質構芯提供或由“B”級襯板為鋼質構芯提供，則，表層，即天花板或襯板，與構芯之間的距離必須是所尋求認可的最小值。對於“A”級艙壁，該分隔要求既從構芯一側又從“B”級襯板一側進行測試。可構成此種甲板或艙壁構造組成部分的天花板和襯板，須至少滿足“B-O”級要求。

1.8 當“A”級分隔的隔熱係由表層保護提供時，構芯的加強筋須位於構芯鋼板和表層保護之間的空腔中。對於“A”級艙壁，主管機關可接受或要求加強筋裝於構芯鋼板的另一側，以使表層保護和構芯之間的距離減至最小。

1.9 第2段中給出的試樣構芯尺寸擬用於鋼質或鋁合金加強平板構芯。如非鋼質或非鋁合金材料對船上所用結構更具代表性，主管機關可要求對此類材料的構芯試樣進行試驗。

1.10 由適當船材尺度的無隔熱鋼質艙壁或甲板構成、且無開口的“A”級分隔，可被視為滿足A-O級分隔要求，即滿足煙火通過要求，而毋需試驗。對所有其他分隔，包括鋁質構芯的A-O級分隔在內，均要求進行試驗。

1.11 與“A”級分隔共用的隔熱材料，其試驗結果可適用於比所試驗的結構具有更重船材尺度的結構，只要該結構的朝向相同，即艙壁試驗的結果不得適用於甲板，反之亦然。

1.12 待測試的結構須儘可能地對船上採用的結構，包括其材料和組裝方法，具有代表性。

1.13 本附錄中建議的試樣設計，被視為反映了最劣情況，以便對最後應用的定級提供最大幫助。然而，主管機關可接受或要求提供認可所需補充信息的特殊試驗安排，尤其是對不使用水平和垂直分隔傳統構件的結構類型，例如，船艙可能是在艙壁、甲板和天花板之間為連續性連接的模塊式構造。

1.14 擬在非鋼質材料製造的防火分隔上安裝的門、窗和其他分隔貫穿件須與在使用此種材料製造的分隔上所試驗的原型相當，除非主管機關滿意地認為所認可的結構，無論其分隔製造如何，均不會削弱分隔的耐火性。

1.15 結構須在未上油漆或未加其他附着飾面材料的情況下進行試驗，但如果材料僅附着飾面材料而生產，當主管機關同意時，可對所生產的產品進行試驗。如果主管機關認為在試驗中飾面材料對結構的性能具有不利影響，可要求此類結構帶着飾面材料進行試驗。

1.16 “B”級結構須不加飾面進行試驗。對於不可行的結構，其飾面可包括在“B”級試樣內，並須包括在該結構的不燃性試驗之內。

2 試樣的性質

2.1 “A”級艙壁

2.1.1 *尺寸*

2.1.1.1 試樣的最小總體尺寸，包括頂部，底部和垂直邊緣的周長細節，為2,440毫米寬和2,500毫米高。當實際應用中的最大總體高度小於以上所述時，則試樣須為實際應用中的最大高度。

2.1.1.2 艙壁板最小高度須為成品板的標準高度，尺寸為2,400mm。

2.1.1.3 構芯的總體尺寸，無論是寬度還是高度，均須比試樣的總體尺寸小20毫米，構芯的其他尺寸須如下：

— 板厚：	鋼	4.5±0.5 毫米
	鋁	6.0±0.5 毫米
— 以600毫米為間隔的加強筋：	鋼	（65±5）x（65±5）x（6±1）毫米
	鋁	（100±5）x（75±5）x（9±1）毫米

2.1.1.4 構芯的寬度可大於所規定的尺寸，但條件是所增加的寬度以600毫米的增量遞升以保持加強件的中心及加強件和周邊細節的關係。

2.1.1.5 板上的任何連接均須至少從一面完全焊接。

2.1.1.6 具有建議尺寸的鋼質構芯結構載於圖1；圖中所示板的厚度和加強筋的尺寸為標定尺寸。不管構芯的尺寸和製造的材料如何，其周邊細節須如圖3所示。

2.1.2 *設計*

2.1.2.1 如隔熱由面板（例如“B”級襯板）提供，則試樣須為：至少一個完整寬度面板及，這個或這些面板的定位須為其縱向的兩邊與相鄰板相接並不得固定於束框之上。

2.1.2.2 板材隔熱系統的總尺寸，包括所有各邊的周邊細節在內，須在各個方向上均比構芯的相應尺寸大20毫米。

2.1.2.3 如果隔熱系統是裝有電氣裝置（如照明裝置和（或）通風裝置）的襯板，則有必要對未安裝這些裝置的襯板本身的試樣先做試驗，以確定其基本性能。對裝有這些裝置的試樣須另做試驗，以確定它們對襯板性能的影響。

2.1.2.4 如隔熱由氈毯構成，氈毯的安排須包括不少於兩個橫向接縫。接縫的位置距艙壁邊緣須不小於600毫米。

2.1.3 *說明*

2.1.3.1 申請人須以繪圖方式提供試樣的全部結構詳情（包括部件詳圖）和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括板材和加強筋所用隔熱物的尺寸和厚度詳情、固定隔熱系統的方法及固定部件的細節、接頭、連接、空氣間隔的細節，以及所有其他詳情。

2.1.3.2 如隔熱由板材提供，生產者須提供第2.4.3（艙壁）、2.7.3（襯板）、或2.8.3（天花板）段所要求的信息。須闡明鋼質艙壁/甲板和隔熱表層之間的距離。

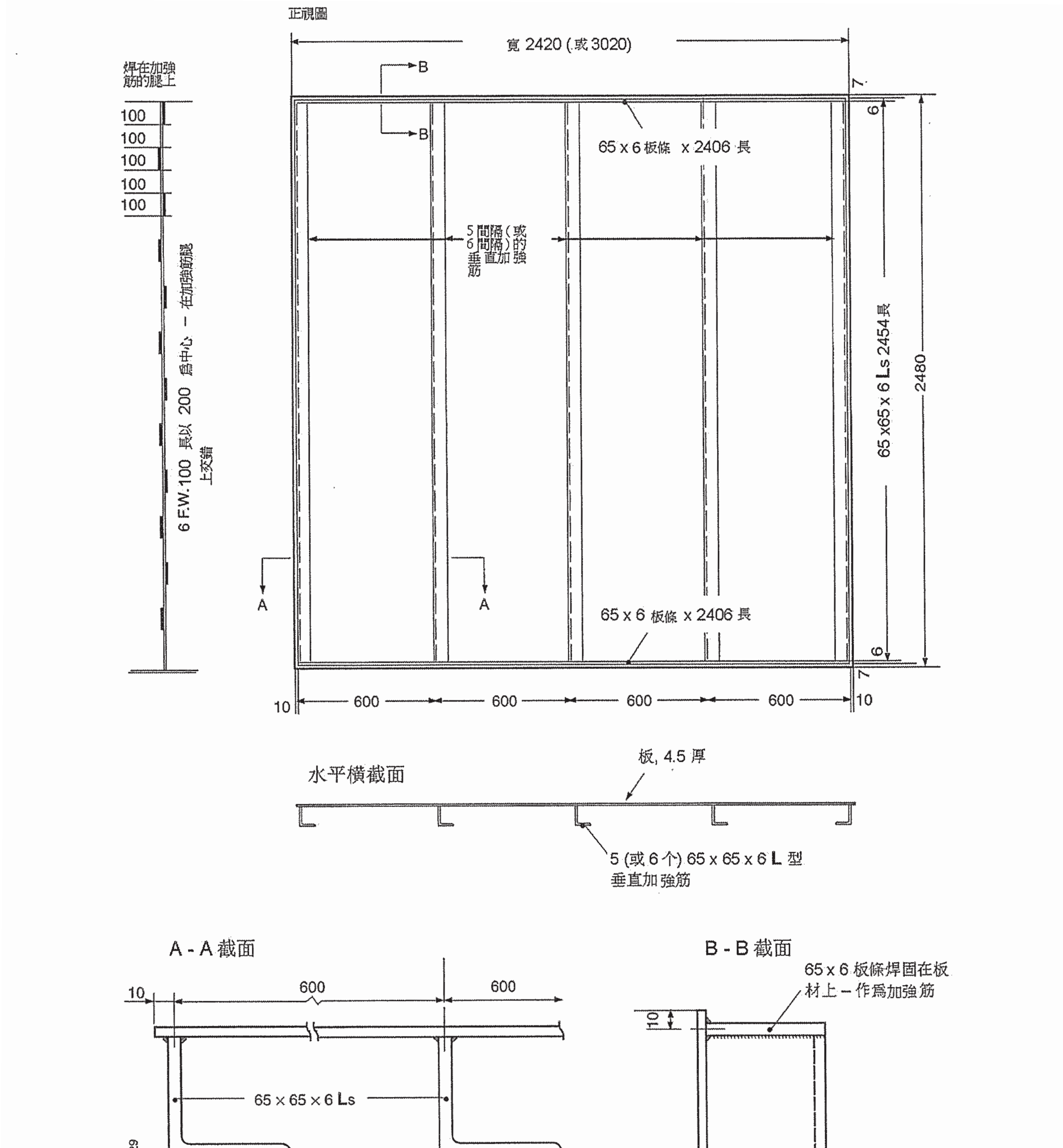


圖 1－ “A” 級鋼質構芯艙壁和 “B” 級襯板

2.2 "A"級甲板

2.2.1 *尺寸*

2.2.1.1 試樣的最小總體尺寸，包括各邊緣的周長細節，為2,440毫米寬和3,040毫米長。

2.2.1.2 構芯的總體尺寸，在寬度和長度上，均須比試樣的總體尺寸小20毫米，構芯的其他尺寸須如下：

— 板厚：	鋼	4.5±0.5毫米
	鋁	6.0±0.5毫米
— 以600毫米為間隔的加強筋：	鋼	(100±5)×(70±5)×(8±1)毫米
	鋁	(150±5)×(100±5)×(9±1)毫米

2.2.1.3 構芯寬度可大於所規定的尺寸，但條件是所增加的寬度以600毫米的增量遞升以保持加強件的中心及加強件和周邊細節的關係。

2.2.1.4 板上的任何連接均須至少從一面完全焊接。

2.2.1.5 具有建議尺寸的鋼質構芯結構示於圖2之中；圖中所示板的厚度和加強筋的尺寸為標定尺寸。不論構芯的尺寸和製造的材料如何，其周邊細節須如圖3所示。

2.2.2 *設計*

2.2.2.1 如隔熱由板材（例如“B”級襯板）提供，則試樣須設計為：至少有一個完整寬度面板及，這個或這些板的定位須為其縱向的兩邊均與相鄰板相接並不得固定於東框上。板隔熱系統的總體尺寸，包括各邊緣的周邊細節，須在各個方向上比與構芯的相應尺寸大20毫米。

2.2.2.2 如天花板包括面板，試樣須包括板間橫向和縱向連接的取樣。如試樣擬模擬面板最大長度大於試樣長度的天花板，則一個連接處須位於距試樣某一個短的邊緣約600毫米之處。

2.2.2.3 如隔熱系統是裝設有電氣裝置（如照明和（或）通風裝置）的天花板，則有必要對未安裝這些裝置的天花板本身的試樣先做試驗，以確定其基本性能。對裝有這些裝置的試樣須另做試驗，以確定這些裝置對天花板性能的影響。

2.2.2.4 如隔熱由氈毯構成，氈毯的安排須包括不少於兩個橫向接縫。接縫的位置距甲板邊緣不得小於600毫米。

2.2.3 *說明*

2.2.3.1 申請人須以繪圖方式提供試樣的全部結構詳情（包括部件詳圖）和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括板材和加強筋所用隔熱物的尺寸和厚度詳情、固定隔熱系統的方法及固定部件的細節、接頭、連接、空氣間隔的細節，以及所有其他詳情。

2.2.3.2 如隔熱由板材提供，生產者須提供第2.8.3（天花板）段所要求的信息。須闡明鋼質甲板和隔熱表層之間的距離。

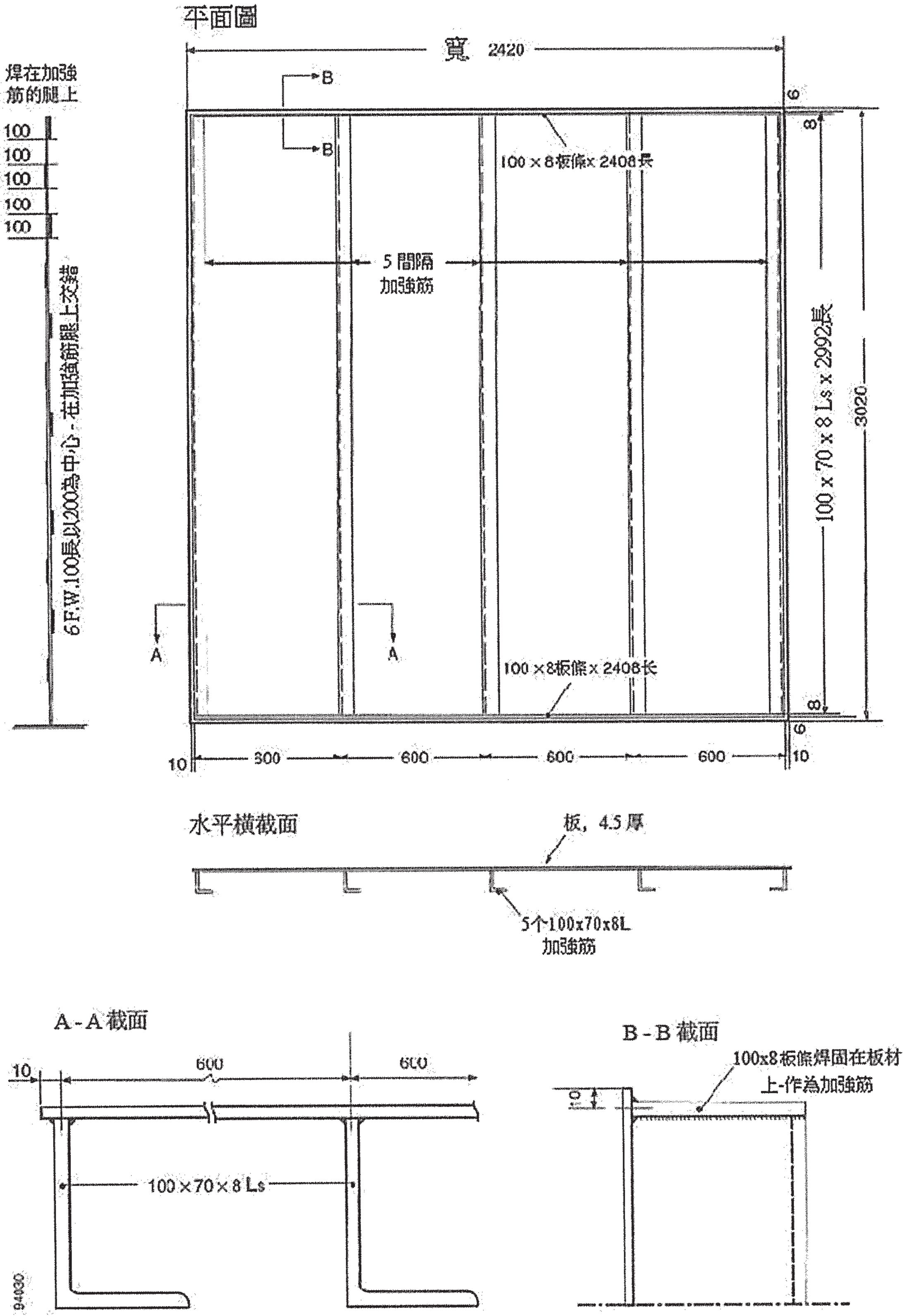
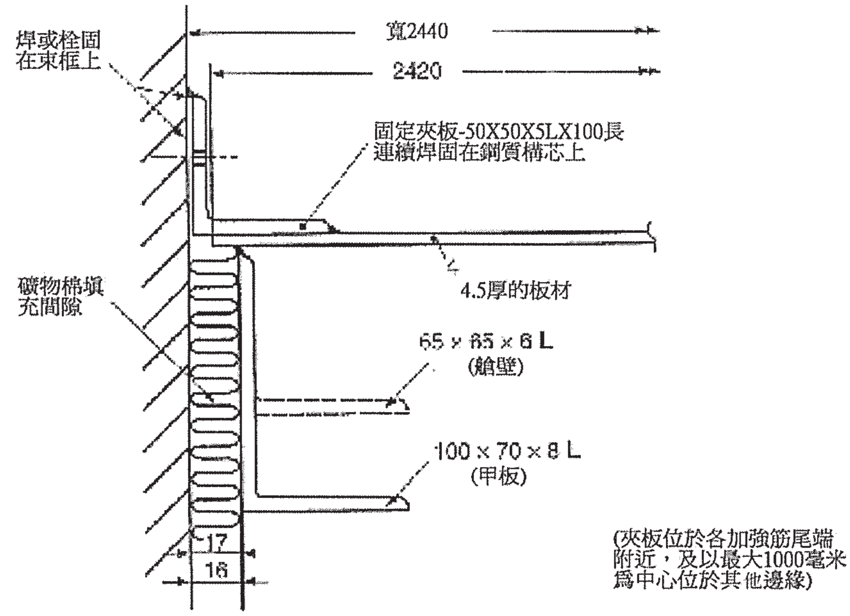


圖2 - “A” 級甲板鋼質構芯和 “B” 級天花板

截面A-A(見圖1和圖2)



截面B-B(見圖1和圖2)

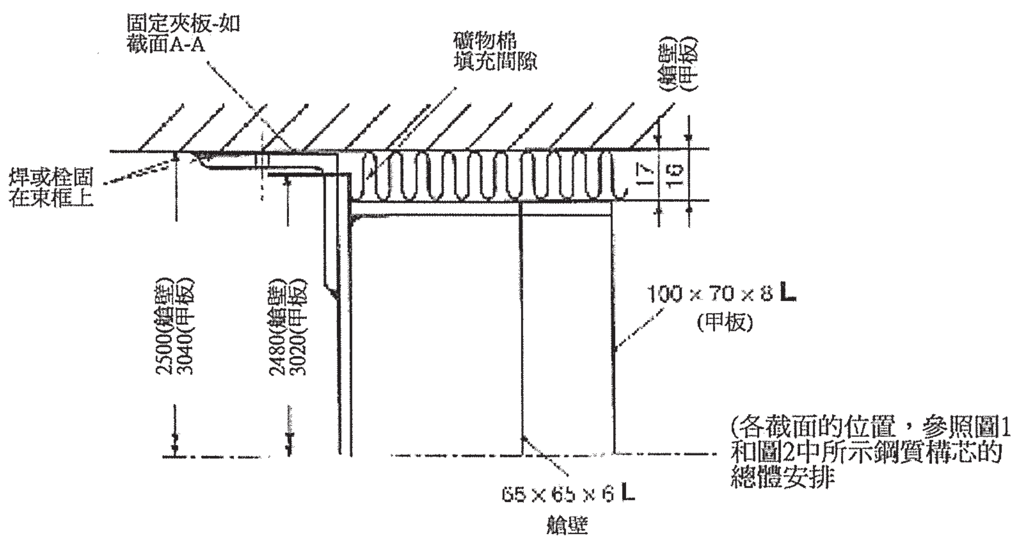


圖3 - 束框與鋼質構芯的連接

2.3 "A"級門

2.3.1 *尺寸*

試樣須包含尋求認可的門扇(就寬度和高度而言)的最大尺寸。門的可測試最大尺寸將由保持某些構芯尺寸的要求決定(見下述第2.3.2.4段)。

2.3.2 *設計*

2.3.2.1 門扇和門框須為鋼製或其他相等材料製作並做必要隔熱,以達到所期隔熱標準。

2.3.2.2 門上裝置如合葉、鎖、門栓、插銷、把手、等等須為熔點不低於950℃的材料所製造,除非可經消防試驗表明,熔點低於950℃的材料對門的性能不會產生不利影響。

2.3.2.3 門扇和門框須安裝在按照第2.1.1段製造的構芯中。

2.3.2.4 在構芯上須提供容納門組合的開口;該開口的最大尺寸將由在開口的各垂直邊保留至少300毫米寬的構芯及距構芯上沿至少100毫米的要求所決定。

2.3.2.5 除作為門框的一部分所提供者外,不得為構芯提供任何附加加強。

2.3.2.6 將門框固定在構芯中的方法須與實際應用中的相同。如在實驗中使用栓固方法固定門框,主管機關亦可接受焊固作為固定門框的方法而無需進一步試驗。

2.3.2.7 對於裝在三邊門框中的門，該門在安裝時須在門底端和試驗框架之間留出12毫米至25毫米的空隙。

2.3.2.8 構芯的安裝須為：加強筋在非暴露面，隔熱系統須在暴露面。

2.3.2.9 隔熱系統須至少按照門擬達到的同樣標準獲得主管機關認可。如果門的隔熱性能未知，則構芯須隔熱至“A-60”標準。構芯的隔熱物不得超出門框外板。

2.3.2.10 門在構芯上須安裝成使預期性能較差的一側暴露於試驗加熱狀況之下。

2.3.2.11 對合葉門的試驗，須在門扇向加熱狀況相反方向打開的情況下進行，除非主管機關另有規定。

2.3.2.12 對於滑動拉門不可能籠統地說以哪一側作為性能較差的一側進行試驗。因此將有必要分開進行兩次試驗，即一次將門裝於艙壁暴露面及另一次將門裝於艙壁的非暴露面。如果由於實際原因，拉門不能夠安裝於構芯的加強面，則經主管機關同意，加強筋可位於暴露面。

2.3.2.13 電梯樓層門可以預期僅對走廊的一面會暴露於失火，因而僅該面須暴露於試驗加熱狀況之下。

2.3.2.14 對雙門扇門進行的實驗將不被接受為單門扇門的認可文件。

2.3.2.15　雙門扇門應使用同樣尺寸的門扇進行試驗，除非該門有意具有尺寸不同門扇。

2.3.3 ***說明***

申請人須以繪圖方式提供試樣的全部結構詳情（包括部件詳圖）和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。繪圖須包括下列尺寸和細節：

.1　艙壁；

.2　門扇和門框構造，包括門扇和框架之間的間隙；

.3　門框與艙壁的連接；

.4　隔熱物固定方法及所用固定部件的細節（例如，任何黏合劑應用的類型和比率）；及

.5　裝具例如合葉、門栓、插銷、鎖、等等。

2.4　“B”級和“F”級艙壁

2.4.1 ***尺寸***

2.4.1.1　試樣的最小總體尺寸，包括頂部、底部和垂直邊緣的周長細節，為2440毫米寬和2500毫米高。如實際應用中的最大總體高度小於以上所述，則試樣須為實際應用中的最大高度。

2.4.1.2 艙壁面板的最小高度須為尺度為2400毫米的成品面板的標準高度。

2.4.2 ***設計***

2.4.2.1 如構造中包括面板，試樣構造須為：至少一個完整寬度面板及，這個或這些面板的定位須為其縱向的兩邊與相鄰板相接並不得固定於束框上。

2.4.2.2 如艙壁包含電氣裝置（如照明和（或）通風裝置），則有必要對未安裝這些裝置的艙壁試樣本身先做試驗，以確定其基本性能。對裝有這些裝置的試樣須另做試驗，以確定它們對艙壁的影響。

2.4.3 ***說明***

申請人須以繪圖方式提供試樣的全部結構詳情（包括部件詳圖）和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括隔熱系統中所用材料的（如任何面板的）尺寸和厚度詳情、固定面板的方法及固定部件的細節、接頭、連接、空氣間隔的細節，以及所有其他詳情。

2.5 "B"級和"F"級甲板

2.5.1 ***尺寸***

2.5.1.1 試樣的總體最小尺寸，包括所有邊緣的周邊細節，為2,440毫米寬和3,040毫米長。

2.5.1.2 如實際應用中的最大尺寸小於以上所述，則試樣須為實際應用的最大尺寸，並須報告試驗寬度。

2.5.2 *設計*

如構造包含面板，試樣的構造須為：至少有一個完整寬度的面板及，這個或這些面板的定位須為：其縱向的兩邊與相鄰板相接並不得固定於束框上。

2.5.3 *說明*

申請人須以繪圖方式提供試樣的全部結構詳情（包括部件詳圖）和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括隔熱系統（如任何面板）所用材料的尺寸和厚度細節，固定隔熱系統的方法及所用固定部件的細節、接頭、連接、空氣間隔的細節，以及所有其他詳情。

2.6 “B”級和“F”級門

2.6.1 *尺寸*

試樣須包含尋求認可的門扇（就寬度和高度而言）的最大尺寸。門的可試驗最大尺寸將由保持艙壁的某些尺寸的要求決定（見第2.6.2.6段）。

2.6.2 *設計*

2.6.2.1 門上的裝置如合葉、鎖、插銷、門栓、把手、等等須為熔點不低於850℃的材料所製造，除非可經消防試驗表明，熔點低於850℃的材料對門的性能不會產生不利影響。

2.6.2.2 門扇和門框須視情裝入相應結構的“B”級或“F”級艙壁，從而反映出最終實際使用情況。艙壁須具有第2.4.1段中所述的尺寸。

2.6.2.3 艙壁須為經主管機關認可、具有等級至少與對門所要求的等級相等的構造，且認可須僅限於在其中做過門的試驗的構造類型。

2.6.2.4 將門框固定於艙壁上的方法須為實際應用中所用的方法。如試驗中使用栓固法固定門框，主管機關亦可接受焊固法固定門框，而無需再做試驗。

2.6.2.5 對於裝在三邊門框中的門，該門在安裝時須在門底端和試驗框架之間留出12毫米至25毫米的空隙。

2.6.2.6 門的定位須為：在門的各個垂直邊有至少300毫米的艙壁，距艙壁頂邊的距離至少為100毫米。

2.6.2.7 門在艙壁上的安裝須使預期性能較差的一面暴露於試驗加熱狀況之下。

2.6.2.8 對合葉門的試驗須在門扇向加熱狀況相反的一面打開的情況下進行，除非主管機關另有要求。

2.6.2.9 對於滑動拉門不可能籠統地說以哪一側作為性能較差的一側進行試驗。因此將有必要分開進行兩次試驗，即一次將門裝於艙壁暴露面及另一次將門裝於艙壁的非暴露面。

2.6.2.10 對於構造中帶有通風開口的門，在實驗開始時，通風格子窗須打開。

2.6.3 ***說明***

申請人須以繪圖方式提供試樣的全部結構詳情（包括部件詳圖）和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括下列尺寸和細節：

.1 艙壁；

.2 門扇和門框構造，包括門扇和框架之間的間隙；

.3 門框與艙壁的連接；

.4 隔熱物固定方法及所用固定部件的細節（例如，任何黏合劑應用的類型和比率）；及

.5 裝具例如合葉、門栓、插銷、鎖、把手、通風百葉窗、逃生板、等等。

2.7 “B”級和“F”級襯板

對襯板須如同艙壁一樣進行試驗，並須將擬面對艙室的一面，暴露於消防試驗的加熱狀況之下。

2.7.1 *尺寸*

2.7.1.1 試樣的最小總體尺寸，包括其頂部、底部、和垂直邊緣的周邊細節，為2,440毫米寬及2,500毫米高。如實際應用中的最大總體高度小於以上所述，則試樣須為實際應用中的最大高度。

2.7.1.2 艙壁面板的最小高度須為尺度為2,400毫米的成品面板的標準高度。

2.7.2 *設計*

2.7.2.1 襯板須沿按照第2.1.1段製造的構芯安置。襯板的設計須便於在因與構芯接近而提供的有限間距下安裝，即，須在構芯就位的情況下安裝。

註： 為確定襯板的完整性，可在“A”級艙壁上提供觀察和進入開口，開口位置應與面板的連接處相對應，並遠離“A”級艙壁上的熱電偶。除需要觀察或接近襯板時之外，這些開口通常應使用礦物棉隔熱塊密封。

2.7.2.2. 在對其暴露面使用表層保護(例如“B”級襯板)的“A”級艙壁進行試驗時，也有可能為定級之目的，對襯板性能進行評定，但在襯板上要裝有必要的熱電偶並進行必要的完整性測量。

2.7.2.3. 試樣的構造須為：至少有一個完整寬度的面板及，這個或這些面板的定位須為：其縱向的兩邊與相鄰板相接並不得固定於束框上。

2.7.2.4. 如襯板包含電氣裝置（如照明和（或）通風裝置），則有必要對未安裝這些裝置的襯板試樣本身先做試驗，以確定其基本性能。對裝有這些裝置的試樣須另做試驗，以確定它們對襯板的影響。

2.7.3 ***說明***

申請人須以繪圖方式提供試樣的全部結構詳情(包括部件詳圖)和組裝方法，以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括隔熱系統（如任何面板）所用材料的尺寸和厚度細節，隔熱系統固定方法及所用固定部件的細節、接頭、連接、空氣間隔的細節，以及所有其他詳情。

2.8 "B"級和"F"級天花板

2.8.1 ***尺寸***

2.8.1.1 試樣的最小總體尺寸，包括所有邊緣的周邊細節，為2,440毫米寬及3,040毫米長。

2.8.1.2 如實際應用中的最大尺寸小於上述尺寸，則試樣須為實際應用中的最大尺寸，並須報告所試驗的寬度。

2.8.2 ***設計***

2.8.2.1 天花板須置於按照第2.2.1段製造的構芯之下。天花板的設計須便於在因與構芯接近而提供的有限間距下安裝，即，須在構芯就位的情況下安裝。

註： 為確定襯板的完整性，可在“A”級甲板上提供觀察和進入開口，開口的位置應與天花板的連接處相對應，並遠離“A”級甲板上的熱電偶。除需要觀察或接近襯板時之外，這些開口通常應使用礦物棉隔熱塊密封。

2.8.2.2 在對其底面使用表層保護(例如“B”級天花板)的“A”級甲板進行試驗時，也有可能為定級之目的，對天花板性能進行評定，但在天花板上要裝有必要的熱電偶並進行必要的完整性測量。

2.8.2.3 如天花板包括面板，試樣須包括板間橫向和縱向連接的取樣。如試樣擬模擬面板最大長度大於試樣長度的天花板，則一個連接處須位於距試樣某一個短邊緣約600毫米之處。

2.8.2.4 試樣的構造須為：至少有一個完整寬度的面板及，這個或這些面板的定位須為：其縱向的兩邊與相鄰板相接並不得固定於束框上。

2.8.2.5 如天花板包含電氣裝置（如照明和（或）通風裝置），則有必要對未安裝這些裝置的天花板試樣本身先做試驗，以確定其基本性能。對裝有這些裝置的試樣須另做試驗，以確定它們對天花板的影響。

2.8.2.6 如對多孔天花板系統作了試驗，相同構造的無孔天花板和帶有較小開孔程度（就孔的大小、形狀和每面積單位上的開孔而言）的天花板可無需另行試驗而加以認可。

2.8.3 *說明*

申請人須以繪圖方式提供試樣的全部結構詳情(包括部件詳圖)和組裝方法,以使實驗室能在試驗之前確定實際樣品與圖和規格之間的一致性。圖中須包括隔熱系統(如任何面板)所用材料的尺寸和厚度細節,隔熱系統固定方法及所有有關細節包括,特別是,所用固定部件、接頭、連接、空氣間隔的細節。

3 試樣的材料

3.1 規格

試驗前,申請人須向實驗室提供構造中所用各種材料的下列適用信息:

.1 識別標記和商標名稱;

.2 主要構成細節;

.3 標定厚度;

.4 標定密度(對於可壓縮材料,這須與標定厚度相關);

.5 標定平衡含水量(在相對濕度為50%及溫度為23℃時);

.6 標定有機成分;

.7 在環境溫度下的比熱;及

.8 在環境溫度下的導熱性。

3.2 控制測量

3.2.1 *總則*

3.2.1.1 進行試驗的實驗室須對其特性對試樣的性能具有重要性的所有材料（不包括鋼和等效材料）採集基準試樣。基準試樣須用於不燃性試驗（如適用）並用於確定厚度、密度、以及（適用時）水分和（或）有機物含量。

3.2.1.2 噴塗材料的基準試樣，須在該材料噴塗到構芯上時製成，並須以同樣方式和同樣方向加以噴塗。

3.2.1.3 實驗室應在對材料按照第4段規定進行調理後，視其種類和所建議的定級對基準試樣進行下列控制試驗。

3.2.1.4 確定厚度、密度與水分和（或）有機物含量須使用三份試樣，並取三次測量的平均值。

3.2.2 *已封裝材料*

3.2.2.1 如隔熱材料已封裝於結構之內因而實驗室無法在試驗前提取樣品進行控制測量，則須要求申請人提交材料的必要樣品。在此情況下，須在試驗報告中清楚說明，測得的特性係以申請人為試驗提供的材料樣品而確定。

3.2.2.2 儘管如此，凡有可能，實驗室須試圖通過使用試驗前從試樣上切下的樣品或通過對試驗後確定的類似特性進行核對而驗證其特性。如在試驗前從試樣上切下樣品，則該試樣須以其性能在消防試驗中不受影響的方式得到修理。

3.2.3 *不燃性*

如要求樣品結構所用材料為不燃材料，即“A”級和“B”級，則須提供試驗方法與本附件第1部分相符並由經主管機關認可並獨立於材料製造者的實驗室提出的試驗報告作為證據。這些試驗報告須表明，不燃性試驗在進行耐火試驗之日之前不超過24個月進行。如果不能提供此種報告，則須按照本規則附件1第1部分進行試驗。如該材料在進行耐火試驗時具有有效的不燃性材料類型認可證書，則毋需不燃性試驗報告。

3.2.4 *低播焰性*

3.2.4.1 如要求樣品結構所用材料具備低播焰性，則須提供試驗方法與本附件第5部分相符並由經主管機關認可並獨立於材料製造者的實驗室提出的試驗報告作為證據。這些試驗報告須表明，低播焰性試驗在進行耐火試驗之日之前不超過24個月進行。如果不能提供此種報告，則須按照本附件第5部分進行試驗。如該材料在進行耐火試驗時具有有效的低播焰性類型認可證書，則毋需低播焰性試驗報告。

3.2.4.2 試樣製造中使用的黏合劑不要求為不燃；但是須具備低播焰性。

3.2.5 *厚度*

3.2.5.1 各種材料和材料組合的厚度，在用適當的量規或卡鉗測量時，須為所報標定厚度值的±10%。

3.2.5.2 噴塗隔熱材料的厚度須使用適當探頭在各個非暴露面熱電偶的鄰近位置測量。

3.2.6 *密度*

3.2.6.1 各種材料的密度須通過重量和尺寸測量確定。

3.2.6.2 礦物棉或任何類似可壓縮材料的密度須與標定密度相關，試樣中所用各種材料的密度須為所報標定密度±10%。

3.2.7 *含水量*

3.2.7.1 試樣中所用各種不燃材料的含水量（W_1-W_2）須使用下列方法計算，並表明為乾重（W_2）的百分比，及要求何種信息。

3.2.7.2 在下述中，W_1，W_2和W_3為三項重量測量的平均值。W_1須大於 25克。對按生產方向的寬度採集的每一材料的三份試樣，其尺寸為寬度×至少20毫米×材料厚度，須進行稱重（經初始調理的重量W_1）並之後在通風烤爐中於105±2℃加熱24小時，並在冷卻後再次稱重（W_2）。但是，石膏基、固化和類似材料應於55±5℃乾燥至恆重（W_2）。

3.2.7.3 各個試樣的含水量（W_1-W_2）須計算為乾重（W_2）的百分比。

3.2.8 ***有機物成分***

3.2.8.1 需要試樣中所用不燃材料的有機成分信息。當含水量已按照第3.2.7段的規定計算出之後，該三份試樣應在烤爐中於500±20℃的溫度進一步加熱2小時，並再次稱重（W_3）。有機物成分（W_2-W_3）須計算為乾重（W_2）的百分比。

註： 只要試樣代表着公差的上限，可以接受更大的公差限度。在此情況下，應在試樣報告和類型認可證書中註明。

3.2.8.2 試樣中所用各種材料的有機成分應在所報標定有機成分絕對值的±0.3%之內。

4 對試樣的調理

4.1 總則

4.1.1 試驗前應保護試樣不受環境條件的不利影響。試樣在實驗室正常環境條件下達到平衡（恆重）、風乾狀態之前，不得進行試驗。平衡狀態須按照以下第4.2段達至。

4.1.2 只要其方法不會改變構成材料的性質，可允許加速調理。總之，高溫調理須低於材料的臨界溫度。

4.2 核實

4.2.1 試樣的狀態可通過使用特別樣品酌情確定構成材料的含水量而加以監測和核實。這些樣品的構造須通過具有類似厚度和暴露面而對試樣的水蒸氣損耗具有代表性。這些樣品須具有300毫米乘300毫米的最小線性尺寸和100克的最小質量。當間隔24小時的連續兩次稱重作業的差異不大於基準試樣質量的0.3%或0.3克時，以大者為準，須視為已達到恆重。

4.2.2 進行試驗的實驗室可使用其他可靠方法核實材料已達到含水量平衡。

4.3 已封裝材料

4.3.1 如試樣包含已封裝材料，確保這些材料在組裝前已達到含水量平衡至關重要，須與試驗申請人作出特別安排確保如此。

4.3.2 如試樣（例如門）包含已封裝材料，第4.2段中有關含水量平衡的要求須適用。

5 試樣的安裝

5.1 約束和支撐框架

5.1.1 所有試樣須安置在能夠對實驗時產生的膨脹力提供高度約束的堅固的混凝土、或以混凝土或磚石為襯的框架內。混凝土或磚石須具備的密度為：1,600kg/m^3 至2,400kg/m^3。鋼質框架的混凝土或磚石內襯須具有至少50 毫米的厚度。

5.1.2 約束框架的剛性須通過在框架內兩個相對構件之間的寬度中點處施加100千牛的膨脹力並測量在這些位置上的內部尺寸的增加而加以評定。此項評定須沿艙壁或甲板的加強筋方向進行，內部尺寸的增加不得超過2毫米。

5.1.3 用於評定包含“B”級天花板的“A”級分隔的框架，須提供至少4個觀察和進入開口，理論上為每四分之一的試樣一個。這些開口須便利於接近空腔，以在試驗中確定甲板或艙壁上的天花板或襯板的完整性。除需要對天花板或襯板進行觀察或接近時外，這些開口通常須使用礦物棉隔熱塊封閉。

5.2 “A”級分隔

5.2.1 “A”級分隔的構芯須固定於約束框架內，並如圖3所示沿其周邊密封。如果實驗室發現有必要，可在夾板和約束框架之間插入厚度約為5毫米的鋼質墊片。

5.2.2 當“A”級分隔的構芯暴露於試驗的加熱狀況，即當固定夾具在構芯的暴露一側時，與約束框架相鄰的100毫米寬的周邊邊緣須作絕熱，以保護固定夾具和構芯的邊緣，不使其直接暴露於加熱狀況下。在任何其他情況下，不管試驗樣品的類型如何，都不得對周邊邊緣作防止直接暴露於加熱狀況下的保護。

5.3 “B”級和“F”級分隔

5.3.1 對於“B”級或“F”級艙壁或襯板，試樣須以代表實際應用情況的方式，在頂部加以支撐，並在垂直側和底部加以固定。在艙壁或

襯板頂部提供的支撐須如同實際應用，計及適當的膨脹或間隙。在垂直邊緣處朝向約束框架垂直邊緣的橫向膨脹，須通過確保將試樣在框架內安裝緊密予以防止，在垂直邊緣和框架之間插入硬質填料可達到此目的。如實際使用中的特定結構，在艙壁或襯料的邊緣處為移動留有餘量，則試樣須模擬這些情況。

5.3.2 對於“B”級或“F”級天花板，由於試樣旨在模仿大面積天花板的一個部分，因此，須防止天花板構成部分周邊邊緣的膨脹。須通過確保將試樣在框架內安裝密實而防止膨脹，在天花板部件的端部或邊緣和約束框架之間插入硬質填料可達到此目的。僅天花板在一個或多個方向上進行全尺寸試驗時方允許在一個或多個適當的方向上在周邊邊緣包含膨脹餘量。

6 對試樣的檢查

6.1 相符

6.1.1 試驗室須核證試樣與申請人提供的圖紙和組裝方法（見第2節）相符，任何方面的缺陷均須在開始試驗之前得到解決。

6.1.2 有時，在試驗之前也許不可能核證試樣結構在所有方面均相符，在試驗之後也可能得不到適當證據。當有必要依賴於申請人提供的資料時，須在試驗報告中對此做出清楚說明。試驗室仍須確保對試樣的設計有充分瞭解，並須確信能夠在試驗報告中準確記錄構造詳情。

6.2 門縫

門安裝後，在即將試驗之前，實驗室須測量門扇和門框之間的實際縫隙，雙門扇的門，還要測量相鄰門扇之間的實際縫隙。須在門扇頂部和底部邊緣的兩個位置上和每一垂直邊緣的三個位置上測量每一門扇的縫隙。

6.3 門的操作

同樣，在即將試驗前，試驗室須將門打開至少300毫米距離，以檢查門的可操作性。然後，門須自動（如果裝有此類關閉裝置），或手動關閉。試驗時，門可以閂上但不得鎖上；並不得包括在實踐中通常不包括的閂門或鎖門裝置。

7 測量儀器

7.1 總則

7.1.1 *火爐*

火爐的測量儀器和試樣的測量儀器，除經本節修正者外，一般須符合ISO 834-1標準，耐火試驗－建築構造構成元件－第1部分：總則。下列各段中給出的細節是對ISO標準要求的補充、解釋或變更。

7.2 環境溫度熱電偶

在試驗前和試驗期間，須使用熱電偶顯示實驗室內試樣附近的環境溫度。該熱電偶須為標定直徑3毫米、礦物隔熱、並為不鏽鋼質

K型。其測量結點須得到防止輻射熱和氣流的保護。環境溫度須在距試樣非暴露面水平距離1米至3米之間測量。

7.3 爐溫熱電偶

7.3.1 *設計*

7.3.1.1 火爐熱電偶須為板式溫度計，如ISO 834-1標準所述，由折疊鋼板組件，及固定在其上的熱電偶組成，並包含隔熱材料。

7.3.1.2 板的部分須由150±1毫米長、100±1毫米寬、0.7±0.1毫米厚的鎳合金板條按照圖4所示設計折疊製成。

7.3.1.3 其測量結點須由IEC 60584-1標準中限定的鎳鉻/鎳鋁合金（K型）金屬絲構成，在礦物隔熱包裹之下置於標定直徑1毫米的耐熱鋼合金的外鞘之中，其熱結點與外鞘電氣絕緣。熱電偶的熱結點須使用與板為同樣材料的一個小鋼條固定在板的幾何中心，其位置如圖4所示。該鋼條可焊在板上或用螺釘固定在板上，以便於更換熱電偶。該鋼條如點焊在板上須為約18毫米×6毫米，如用螺釘固定在板上須為標定25毫米×6毫米。螺釘直徑須為2毫米。

7.3.1.4 板和熱電偶的組件須裝有一個無機隔熱材料墊，其標定尺寸為97±1毫米×97±1毫米×10±1毫米厚，密度280±30kg/m^3。

7.3.1.5 板式溫度計在首次使用前，須將整個板式溫度計置於預熱到1,000℃的烤箱內熟化1小時。

註： 在標準溫度/時間曲線下暴露於耐火試驗爐內90分鐘，被視為一種可以接受的替代使用烤箱的方法。

7.3.1.6 如一個板式溫度計使用一次以上，則須保持一份其使用記錄，列明每次使用時所作的檢查和使用時間長度。熱電偶和隔熱墊在爐中暴露50小時後，須加以更換。

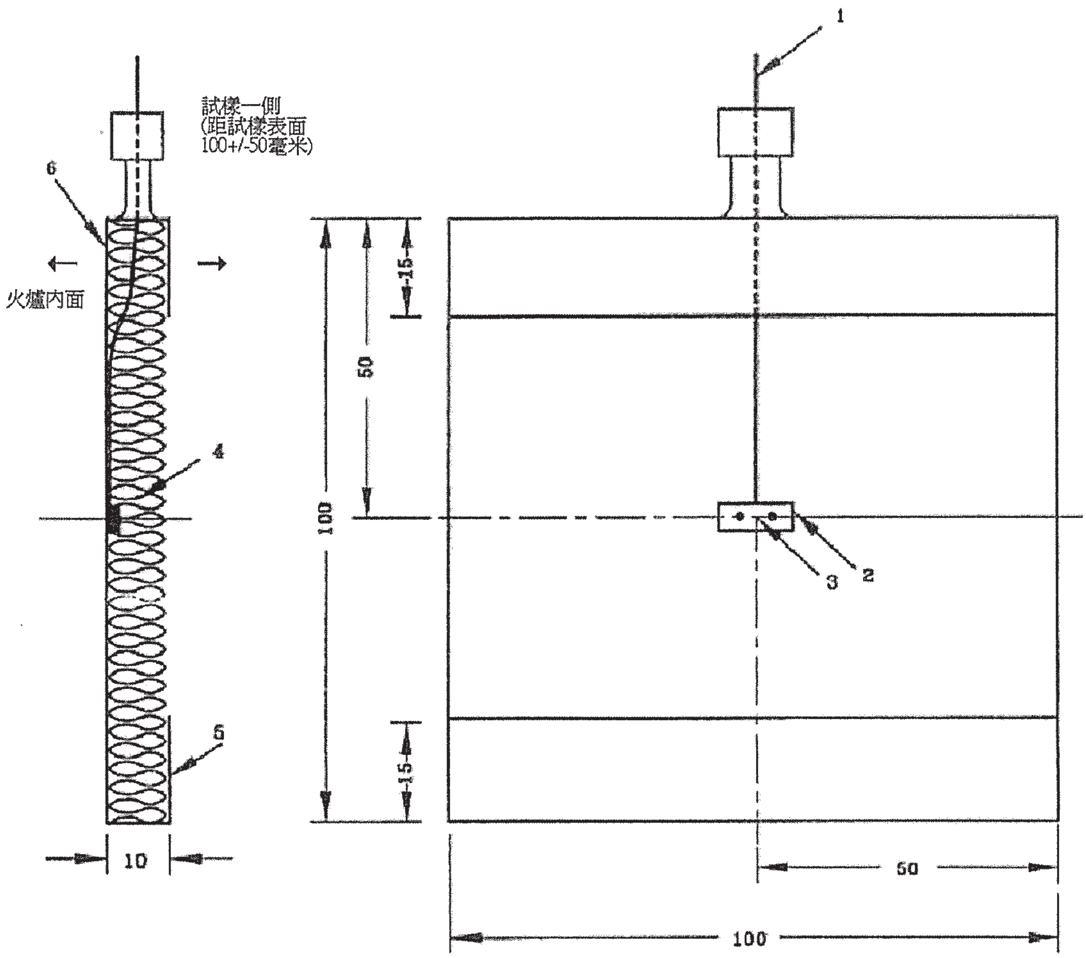
7.3.2 ***數量***

對於第2節所規定的試樣，須至少提供6個火爐熱電偶。對於大於第2節中規定的試樣，須按照每1.5平方米的試樣面積增加一個的比例，提供額外的熱電偶。對於門組件，試樣的面積係指裝有門的整個艙壁結構。此原則亦適用於安裝在艙壁或甲板中的其他組件（如，窗、導管和貫穿件）。

7.3.3 ***定位***

7.3.3.1 用於測量爐溫的熱電偶須均勻分佈，以對試樣附近的平均溫度提供可靠指示。試驗開始時，測量結點須距試樣表面100毫米，試驗期間，須保持50-150毫米的距離。支撐方法須確保試驗期間熱電偶不會偏離或移動。當熱電偶的金屬絲易於通過試驗結構時，不得使用鋼質支撐管。板式溫度計不得位於會受到火焰直接影響的爐內位置。

7.3.3.2 板式溫度計的取向須使其A面面向牆式火爐的後壁及水平火爐的爐底。



1 有外鞘熱電偶，帶有熱結點絕緣
2 點焊或鏍釘固定鋼條
3 熱電偶的熱結點
4 絕緣材料
5 鎳合金條(0.7±/0.1毫米厚)
6 "A"面

圖4 - 火爐電偶組

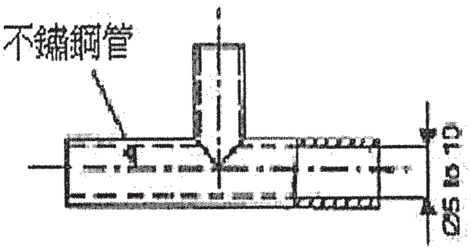
7.3.4 *連接*

熱電偶金屬絲須：或者無間斷地通至記錄儀或者使用適當的補償金屬絲，且所有接點須儘可能保持在環境溫度條件下。

7.4 爐壓感應器

爐壓平均值須使用圖5中所述感應頭設計之一進行測量。

1型 - "T" 型感應頭



註："T" 型管須水平朝向

2型 - 管感應頭

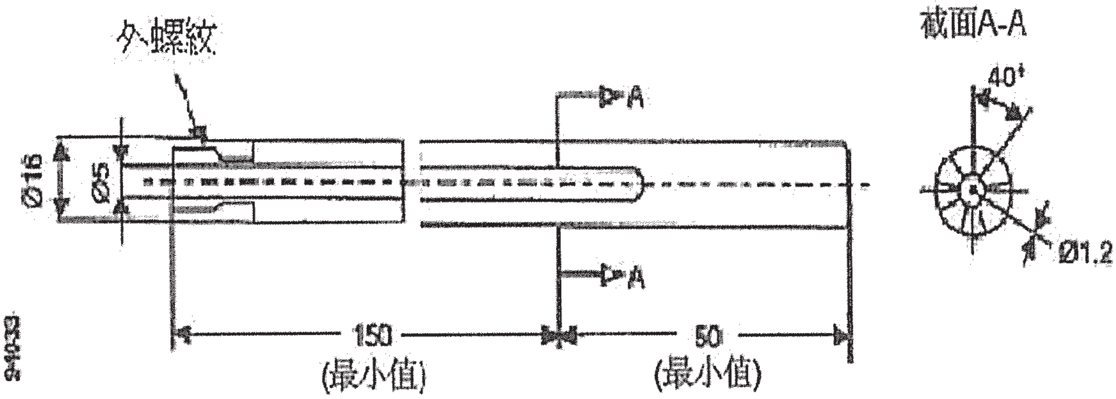


圖5 - 壓力感應頭

7.5 非暴露面溫度熱電偶

7.5.1 *設計*

非暴露面的溫度須使用圖6中所示類型的圓盤型熱電偶進行測量。直徑為0.5毫米的熱電偶金屬絲，須焊在直徑12毫米，厚度0.2毫米的銅盤上。每個熱電偶須用30平方毫米×2.0毫米±0.5毫米厚的不燃隔熱墊覆蓋。墊的材料須具有900±100 kg/m^{3}的密度。

7.5.2 *連接*

須使用相似或適當的補償金屬絲與記錄儀器連接。

7.5.3 *表面處理以承載熱電偶*

7.5.3.1 鋼 — 表面塗層需加以清除並用溶劑清潔表面。須使用鋼絲刷清除鬆動鏽、屑。

7.5.3.2 不規則表面 — 為提供適當黏結，須使用適當砂紙為每一熱電偶磨平不大於2,500mm^{2}的平滑表面。所去除的材料量須為提供適當黏結表面的最少量。如表面無法磨平，須使用最少量的填料以提供適當表面。填料須由陶瓷水泥構成，填補的表面乾燥後，必要時，須用砂紙磨平。

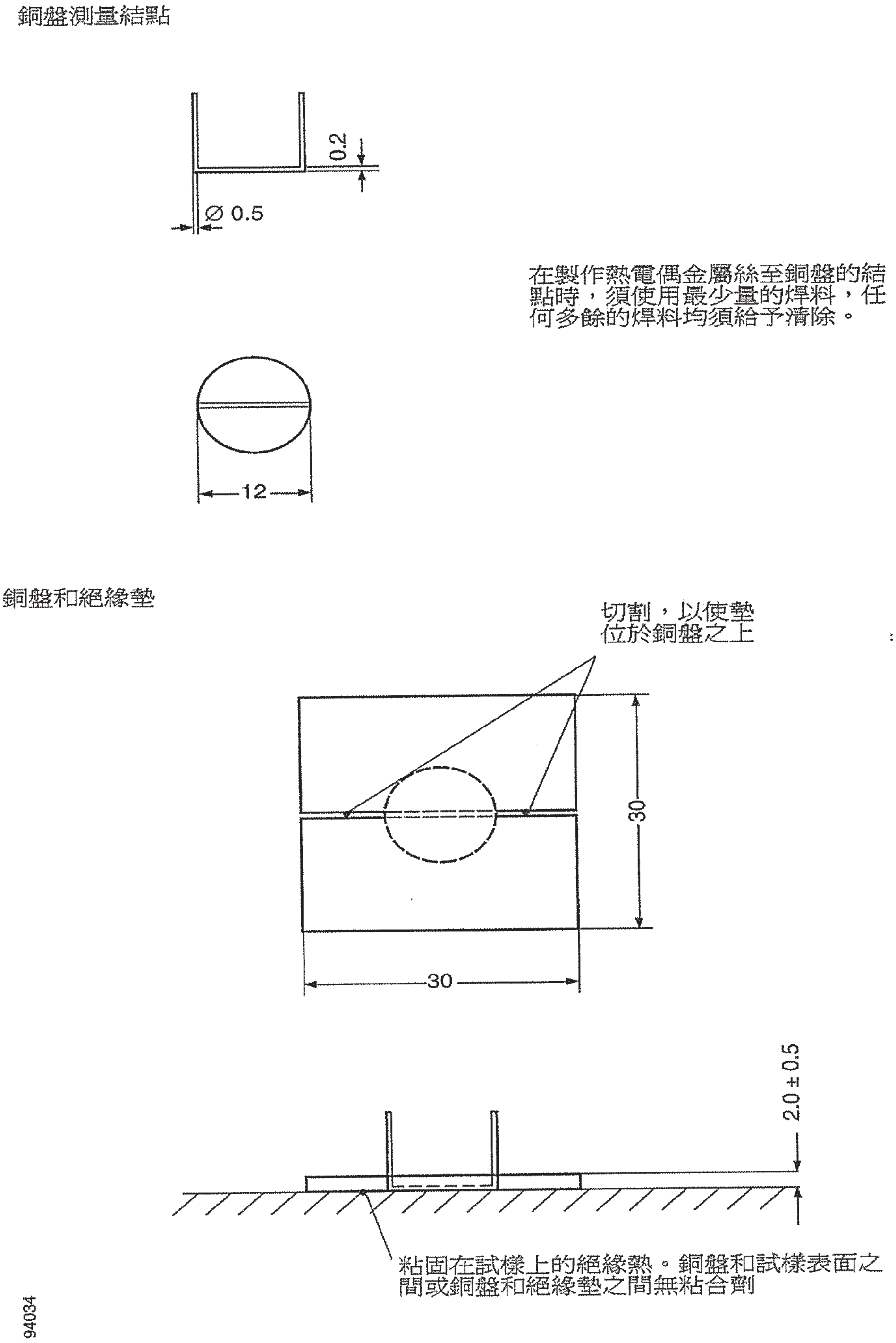


圖 6 — 非暴露面的熱電偶結點和隔熱墊

7.5.4 *固定熱電偶*

7.5.4.1 鋼－裝有熱電偶的隔熱墊須使用“水基陶瓷水泥”（通過融合成分形成的耐高溫黏合劑）黏固在清潔的鋼面上。黏合劑的黏稠度須為：在乾燥過程中不需使用機械輔助加以固定，但是，如黏合時遇到困難，可以使用膠條固定，但膠條要在試驗前及早除去，以使黏合劑完全乾燥。去除膠條時應小心，確保隔熱墊不致損壞。如去除膠條時隔熱墊受損，則需更換熱電偶。

7.5.4.2 礦物棉－裝有隔熱墊的熱電偶佈置須為：如有表面金屬網，可用以協助固定，並在所有情況下，須使用“接觸黏合劑”固定於纖維表面之上。該黏合劑在黏合表面合為一體之前需要一定的乾燥時間，因而無需外部壓力。

7.5.4.3 在不能黏合時，須使用僅接觸隔熱墊不覆蓋（銅）盤部位的針、螺釘或夾子。（例如：尺寸約為30 × 15 × 30 × 0.5 毫米的U型夾，僅與隔熱墊的端角接觸。對銅盤的熱傳導小到可以忽略不計。）

7.5.4.4 礦物纖維噴塗－熱電偶在隔熱達到穩定含水狀態之前不得安裝。在所有情況下，須使用對鋼所規定的固定技術，並在有金屬網時，須使金屬網協助熱電偶在隔熱上的固定。

7.5.4.5 蛭石/水泥類噴塗－須採用為濕纖維噴塗所規定的技術。

7.5.4.6 纖維或礦物聚合板－須採用為鋼所規定的黏合技術。

7.5.4.7 在使用黏合劑黏合的各種情況下，均須施塗足以黏合的一簿層黏合劑。在黏固熱電偶與測試陶瓷水泥黏合劑達到穩定含水狀態和“接觸黏合劑”溶劑揮發之間，須留出足夠的時間。

7.5.4.8 對於“A”級和“B”級分隔，結構的絕熱性能須由該結構中僅由使用不燃材料製成的部分給出。但是，如材料或面板僅帶有附加飾面層製造，或者主管機關認為增加附加飾面層會有損於分隔的性能，則主管機關可允許或要求在試驗時包含飾面。在這種情況下，須對附加飾面層在儘可能小的面積內做局部清除，以便將熱電偶固定在不燃部分，例如具備附加不燃隔熱體的甲板（浮隔地板）須對任何可燃頂層表面飾面做局部清除以使熱電偶得以被固定在絕熱材料上。

7.6 熱電偶在試樣上的定位

7.6.1 *“A”級分隔，不包括門*

試樣非暴露面的表面溫度須由位於圖7和圖8所示位置的熱電偶進行測量：

.1 五個熱電偶，試樣的中心一個，四個分區的中心各一個，均位於至少距任何接頭的最近部分100毫米和（或）距任何加強筋的焊接點100毫米之外；

.2 兩個熱電偶，置於各中間加強筋之上，對於艙壁，於試樣0.75的高度及對於甲板，於甲板長度的中間；

.3 兩個熱電偶，各置於隔熱系統的垂向（縱向）接合處（如有），對於艙壁，於試樣0.75的高度及對於甲板，於甲板長度的中間；

.4 如構造具有兩個不同取向的結合細節，例如相互正交，則除上述第7.6.1.3段所規定者外，需另使用兩個熱電偶，兩個交叉部上各一個；

.5 如構造上具有兩個不同類型的結合細節，則每種結合上須使用兩個熱電偶；

.6 進行試驗的實驗室或主管機關，如認為特殊部件或特定構造細節可能會出現高於以上所列熱電偶所測出的溫度時，可決定在特殊部件或特定構造細節上加設熱電偶；及

.7 上述.4至.6小段中規定的測量艙壁的（例如不同接合類型或接合交叉部之上的）熱電偶，須，但凡可能，位於試樣的上半部。

7.6.2 ***“B”級和“F”級分隔，不包括門***

試樣非暴露面的表面溫度須由位於圖9所示位置的熱電偶進行測量：

.1 五個熱電偶，試樣中心一個，四個分區的中心各一個，均位於至少距任何接頭的最近部分100毫米之外；

.2 兩個熱電偶，各置於分隔/隔熱系統的垂向（縱向）接合處（如有），對於艙壁，於試樣0.75的高度及對於甲板/天花板，於甲板/天花板長度的中間；及

.3 上述第7.6.1.4至7.6.1.7段所要求的附加熱電偶。

7.6.3 ***“A”，“B”和“F”級門***

試樣非暴露面的表面溫度須由下列熱電偶進行測量：

.1 五個熱電偶，門扇中心一個，門扇四個分區的中心各一個，均位於至少距門扇的邊緣、任何加強筋、任何門的裝具和任何特殊部件或特定構造細節100毫米之外；

.2 如門扇包含加強筋，在門中部的兩個加強筋上各放置一個熱電偶；

.3 進行試驗的實驗室或主管機關，如認為特殊部件或特定構造細節可能會出現高於以上所列熱電偶所測出的溫度時，可決定在特殊部件或特定構造細節上加設熱電偶。任何固定在門框上或門扇上、距門扇邊緣和門框之間的縫隙不足100毫米處的熱電偶不得用於試樣定級之目的，如裝設，則僅供參照；

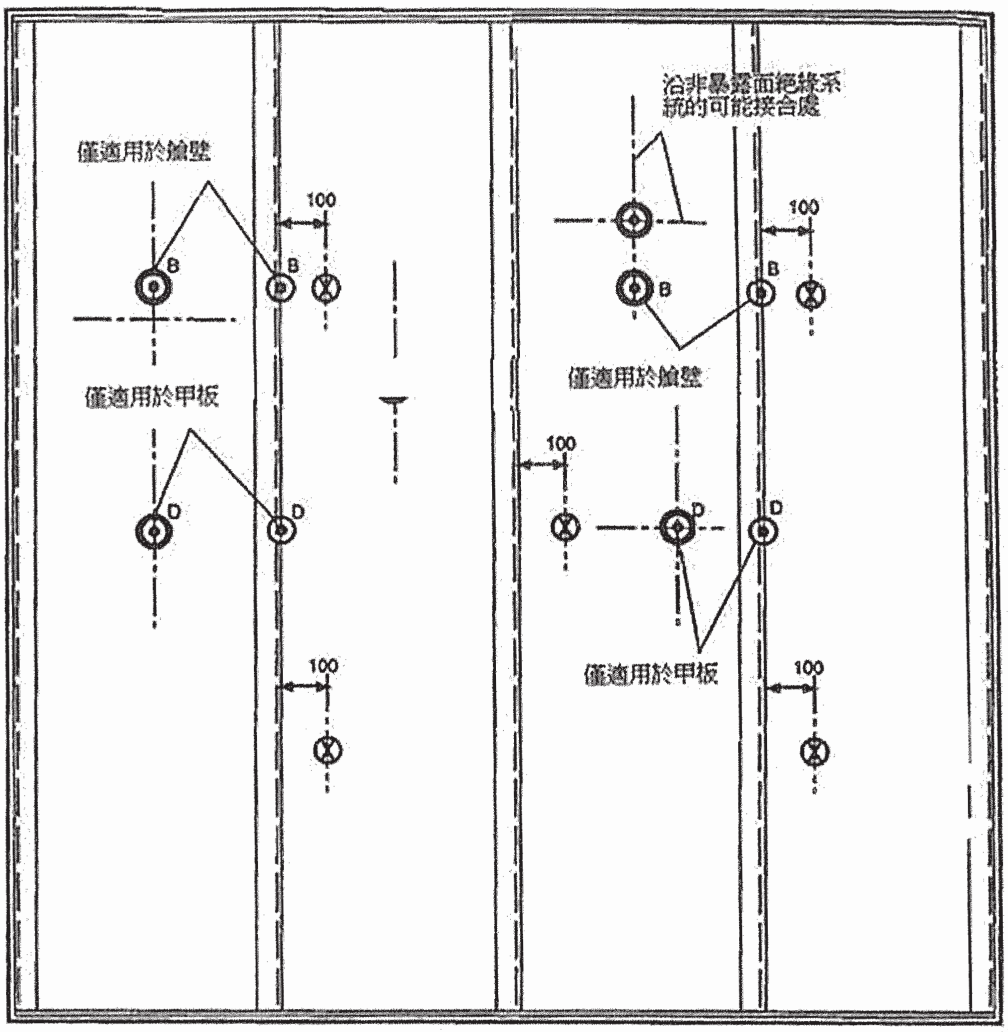
.4 上述第7.6.3.2和7.6.3.3段中規定的熱電偶，但凡可能，須位於試樣的上半部；

.5 "B"級門格柵上的附加熱電偶不得置於穿孔區域及其周圍100毫米寬的區域之內；

.6 對於構造中包含通風開口的門，不得在通風格柵面上進行溫度測量；

.7 對於包含頂面板的門構造，須總是用在頂面板非暴露面上、且在門扇頂部之上至少125毫米的接合處和（或）接合剖面上的熱電偶進行試驗。試樣頂面板的高度應等於或大於225毫米；及

.8 當對雙門扇的門組件進行試驗時，這些要求須對各門扇分別適用。



⊗ 用於測量最大溫升和計算平均溫升的熱電偶。

⊙ 用於測量最大溫升的熱電偶。

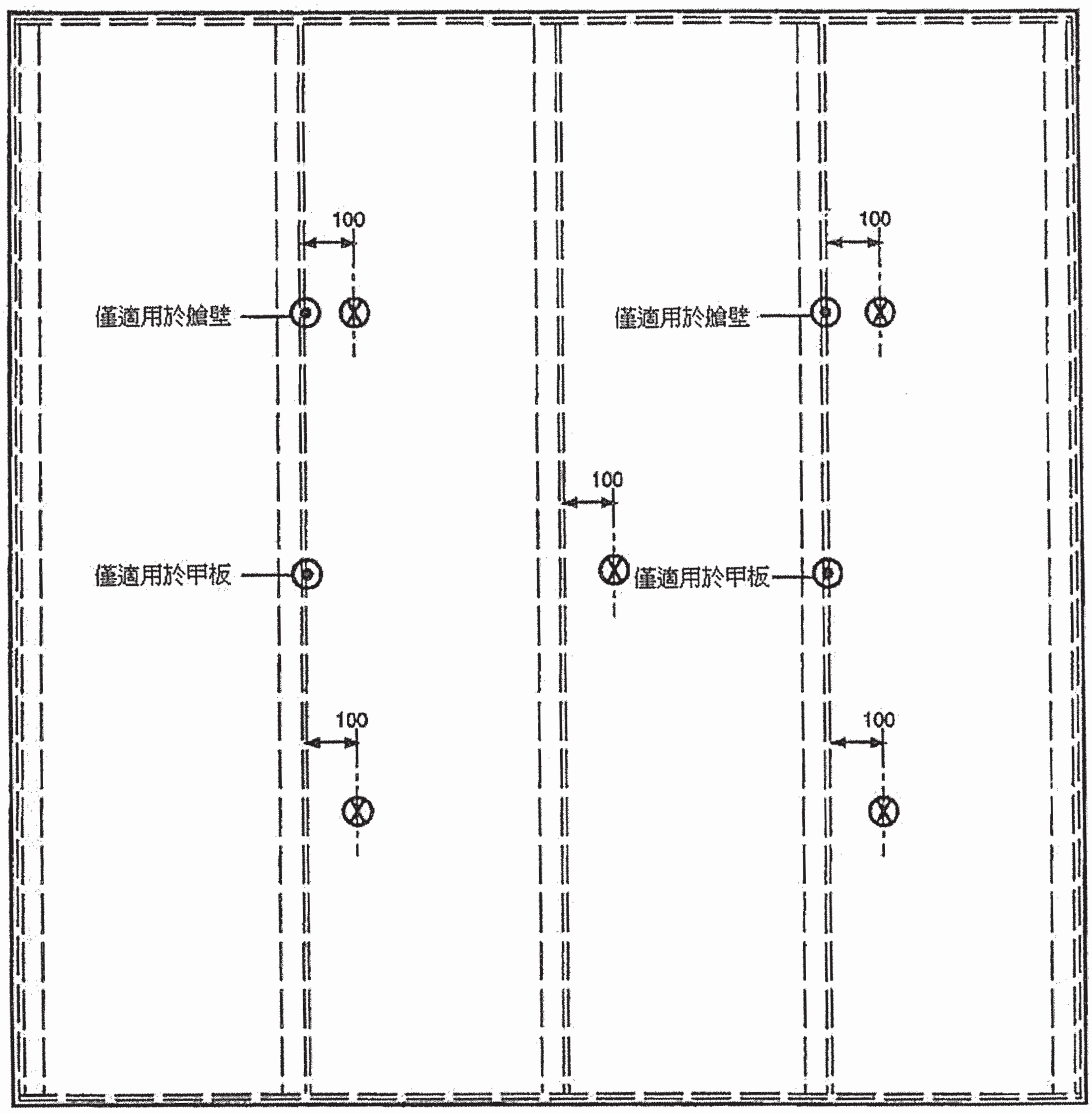
◉ 用於測量最大溫升的熱電偶（不適用於無接合部的絕緣系統）。

94035

B：僅用於艙壁試驗的熱電偶。

D：僅用於甲板試驗的熱電偶。

圖 7－ "A" 級分隔非暴露面熱電偶位置：隔熱面面對實驗室



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⊗ 用於測量最大溫升和計算平均溫升的熱電偶。

⊙ 用於測量最大溫升的熱電偶。

圖8－“A”級分隔非暴露面熱電偶位置：鋼質構芯平坦面面對實驗室

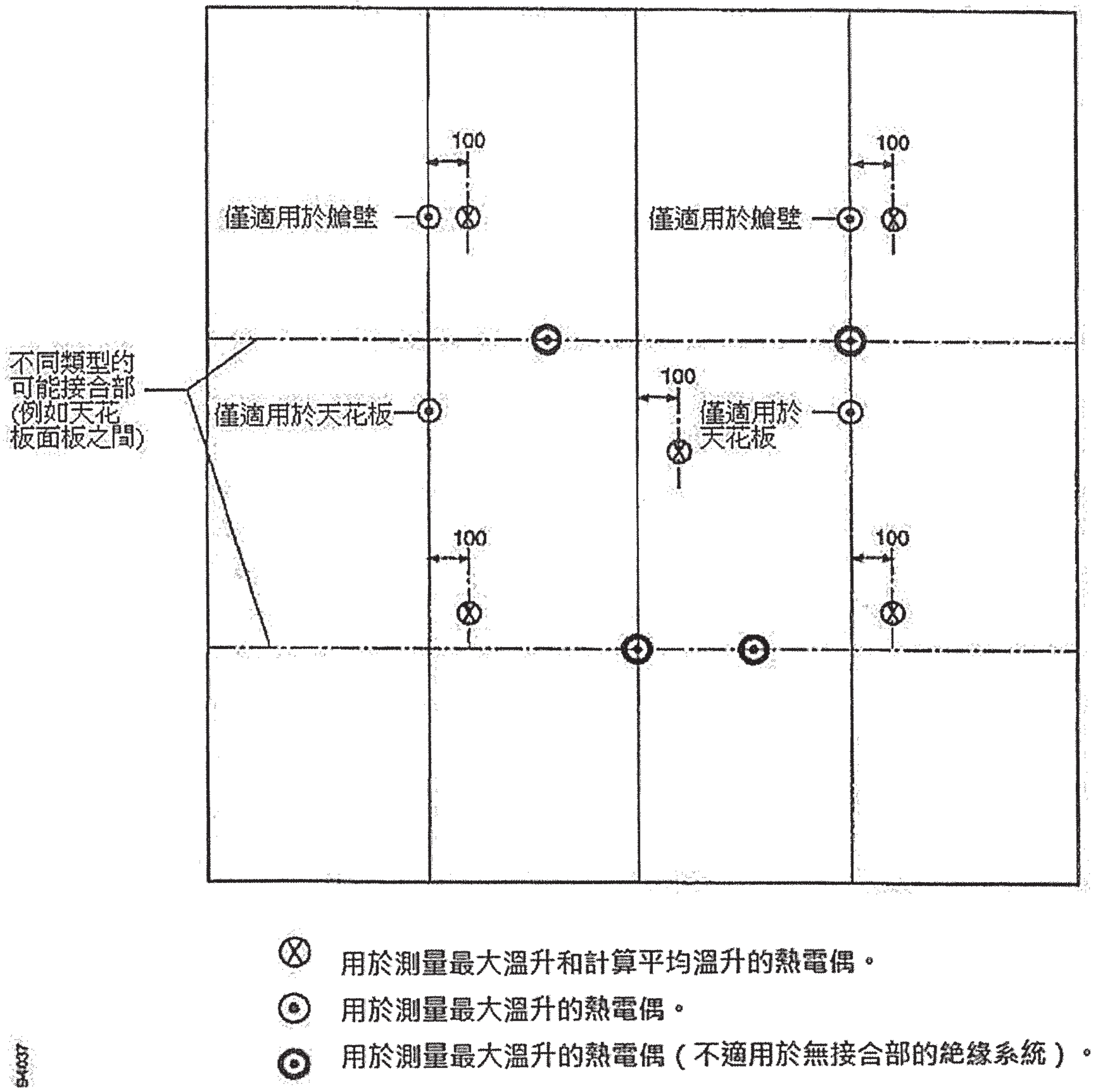


圖9－“B”級和“F”級分隔非暴露面熱電偶位置

7.7 構芯溫度熱電偶

7.7.1 當對非鋼質構芯的試樣進行試驗時，熱電偶須固定在與第7.6.1.1段中提及的表面熱電偶的相應位置。

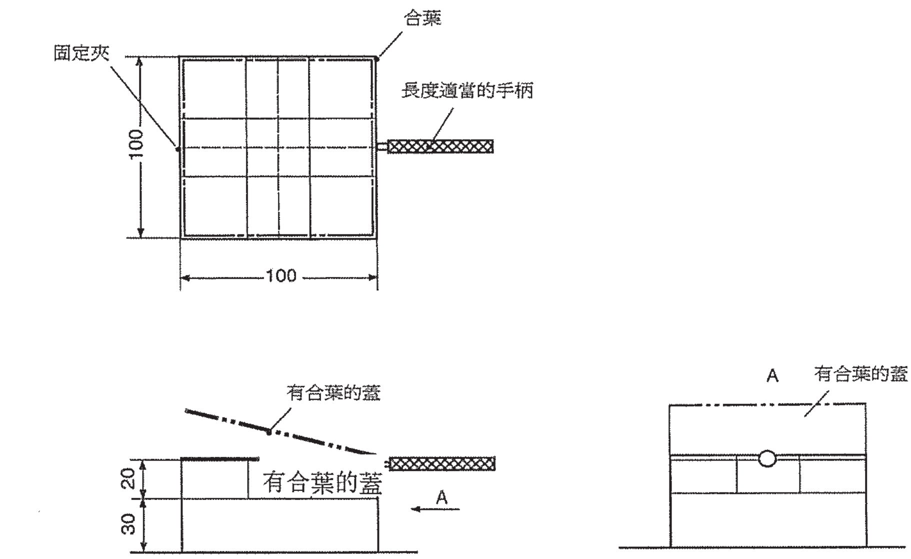
7.7.2 熱電偶的固定須使其熱結點通過適當方法（包括滲鍍入構芯）附着在適當位置上。須防止金屬絲比結點更熱。最初的50毫米須在等溫平面中。

7.8 熱電偶的測量和記錄設備

測量和記錄設備在ISO 834-1標準中規定的限度內須能夠運作。

7.9 棉－毛墊

完整性測量中使用的棉－毛墊須由新的未染色軟棉纖維構成，20毫米厚×100毫米的方形，重量須為3克至4克。使用前須通過在烤箱中於100±5℃溫度下乾燥30分鐘進行調理。乾燥後，須在乾燥器中冷卻至環境溫度，並可在其中存放至需要使用時。使用時，須如圖10所示裝在帶有手柄的網框之中。



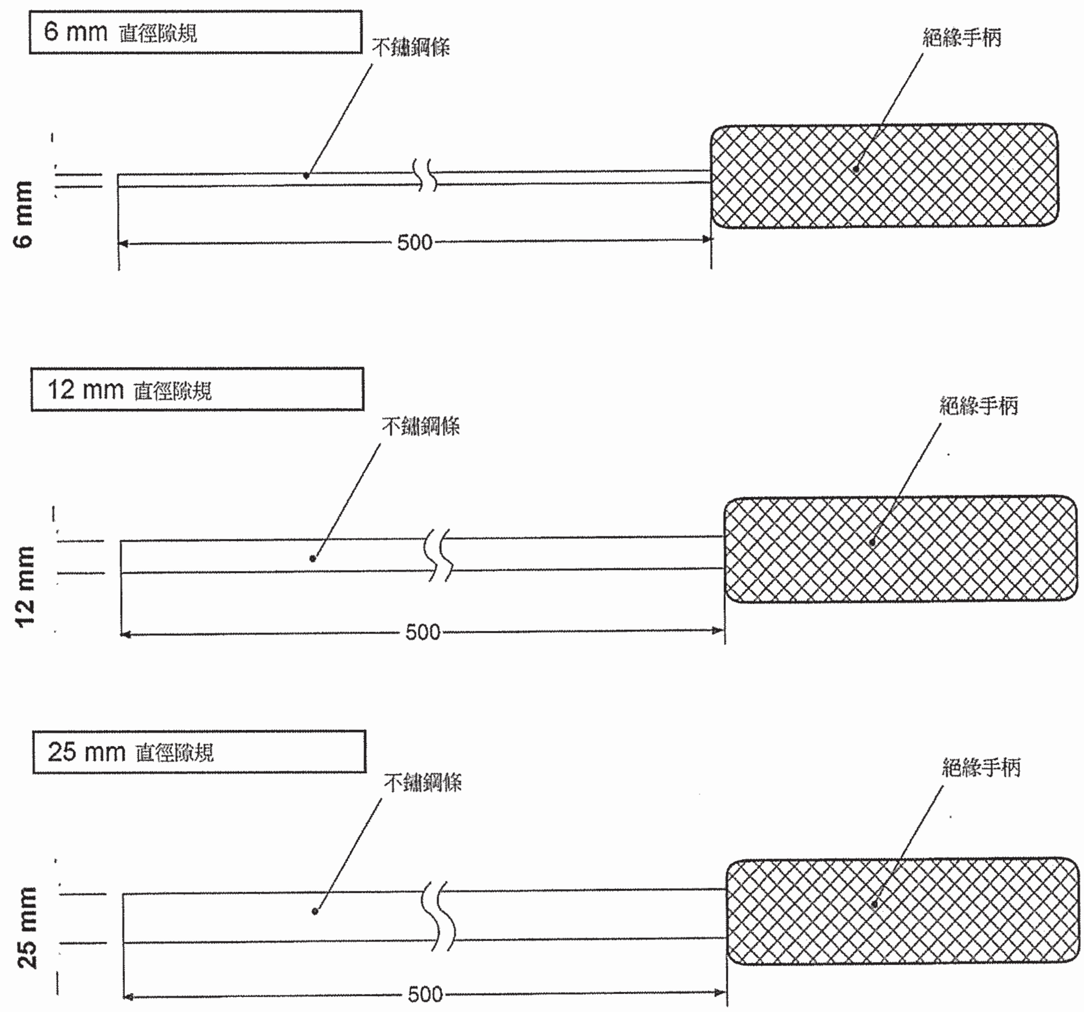
材料清單：

1. Ø1.5 金屬絲製作的主框架
2. 棉墊用 Ø0.5 金屬絲支撐

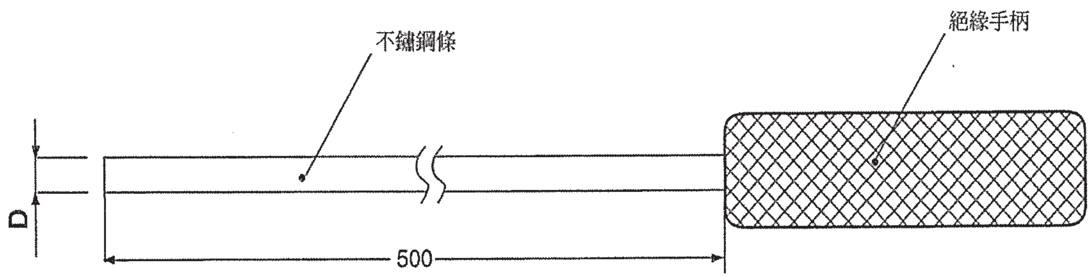
圖10 － 棉 － 毛墊架

7.10 隙規

須提供如圖11所示的三類隙規進行完整性測量。隙規須為不鏽鋼製，其規定直徑精度為±0.5毫米，並須備有適當手柄。



三類隙規



編號	隙規	鋼條直徑（D）mm
1	ϕ6mm	6±0.5
2	ϕ12mm	12±0.5
3	ϕ25mm	25±0.5

圖11 — 隙規

8 試驗方法

8.1 總則

除經本節修正者外，試驗通常須按照ISO 834-1標準進行。以下各節中給出的程序為對ISO標準要求的補充、詳細說明或偏離。

8.2 試驗開始

8.2.1 在試驗開始前5分鐘之內，須核查所有熱電偶記錄的溫度，以確保一致，並記下所有數據值。須獲取同樣的變形數據值，並須記下試樣的初始狀況。

8.2.2 試驗時，試樣初始內部平均溫度和非暴露面表面溫度須為10℃至35℃，並須在初始環境溫度的5℃之內。

8.2.3 開始試驗之前，爐溫須低於50℃。遵循標準加熱曲線程序啟動之時，須視為試驗的開始。

8.2.4 ***環境條件***

試驗期間實驗室須實際上無氣流。試驗開始時的環境溫度須為10℃至35℃，並在試驗期間，對於所有仍然滿足隔熱標準的有隔熱的分立元件，該溫度不得降低超過5℃或上升超過20℃。

8.3 火爐控制

8.3.1 ***爐溫***

8.3.1.1 對源於第7.3段規定的爐熱電偶的平均溫度須加以監測和控制，令其遵循下列關係（即標準加熱曲線）：

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

式中：

T 為平均爐溫（℃），

t 為時間（分鐘）。

8.3.1.2 上述關係對下列各點做出限定：

.1 第一個5分鐘結束時 576℃；

.2 第一個10分鐘結束時 679℃；

.3 第一個15分鐘結束時 738℃；

.4 第一個30分鐘結束時 841℃；及

.5 第一個60分鐘結束時 945℃。

8.3.1.3 指定爐溫熱電偶所記錄的平均溫度曲線區域與標準加熱曲線區域的時間比值之偏差百分比“d”，須在下列範圍之內：

±15%	從 t ＝ 0 至 10	(1)
±(15-0.5(t-10))%	從 t ＝ 10至30	(2)
±(5-0.083(t-30))%	從 t ＝ 30至60	(3)
± 2.5%	從 t ＝ 60 及以上	(4)

式中：

$d=(A - As)\times 1/As\times 100$，及

A 為實際爐平均時間－溫度曲線下的區域；及

As 為標準時間－溫度曲線之下的區域。

所有區域須按照相同方法計算，即，間隔不超過1分鐘的區域總和。

8.3.1.4 在試驗的第一個10分鐘之後，任何熱電偶在任何時間記錄的溫度均不得與標準時間－溫度曲線的相應溫度相差超過±100℃。

8.3.2 *爐壓*

8.3.2.1 有一條線性壓力梯度變化曲線相對於爐的高度而存在，儘管該梯度曲線作為爐溫的一個函數變化很小，在估算爐壓力狀況時可假定平均值為每米高度8帕。爐壓值須為標定平均值，不計及與湍流等相關的快速壓力波動，並須相對於爐外同等高度上的壓力而確定。爐壓須連續得到監測和控制，試驗開始至5分鐘時須在±5帕內達到，試驗開始至10分鐘時須在±3帕內達到並加以保持。

8.3.2.2 對於垂直取向試樣，爐的操作須為：在試樣理論地板水平之上500毫米的高度，壓力確定為零。但是對於高度超過3米的試樣，試樣頂部的壓力不得大於20帕，中性壓力軸的高度亦須得到相應調整。

8.3.2.3 對於水平取向試樣，爐的操作須為：在試樣底面之下100毫米處，壓力確定為20帕。

8.4 對試樣的測量和觀察

8.4.1 *溫度*

8.4.1.1 所有溫度測量的間隔不得超過1分鐘。

8.4.1.2 對試樣非暴露面溫度上升的計算，須在對每個熱電偶逐一計算的基礎上進行。計算非暴露面的平均溫度上升，須取用於確定平均溫度上升的各熱電偶所記錄的溫度上升的平均值。

8.4.1.3 對於不包括門的“A”級分隔，計算試樣非暴露面平均溫度上升須僅使用第7.6.1.1段中指定的熱電偶。

8.4.1.4 對於不包括門的“B”級和“F”級分隔，計算試樣非暴露面平均溫度上升須僅使用第7.6.2.1段中指定的熱電偶。

8.4.1.5 對於“A”級、“B”級和“F”級的門，計算試樣非暴露面平均溫度上升須僅使用第7.6.3.1段中指定的熱電偶。對於雙門扇的門，做此計算時，須使用在兩個門扇上所用的所有十個熱電偶。

8.4.2 *非暴露面上的火焰*

對非暴露面上出現的任何火焰及其持續時間和位置均須作出記錄。如果難以確定是否有火焰，須在有此種爭議的着火區域應用棉毛墊，以確定該墊可否開始燃着。

8.4.3 *棉－毛墊*

8.4.3.1 棉－毛墊試驗是用來表明試樣的縫隙和開口是否會導致足以令可燃材料燃着的熱瓦斯通過。

8.4.3.2 將裝有棉墊的框架放在試樣表面靠近受測試的開口或火焰處，時間為30秒鐘或至棉墊燃着（其定義為無焰燃燒或有焰燃燒）（如果發生於30秒鐘之內）。可做稍許位置調整，以獲得熱瓦斯的最大效用。一個棉墊須只用一次。

8.4.3.3 在產品隔熱級別的相關時限之後，無需在非暴露面使用棉－毛墊。

8.4.3.4 如試樣開口區域表面不規則，則須小心確保使支撐框架支架的放置令該墊和試樣表面的任何部分之間的空隙在測量期間得到保持。

8.4.3.5 棉－毛墊須任意使用並且不一定要與試樣表面平行，及縫隙或開口不一定要總位於該墊的中心。該墊須置於熱瓦斯流中但其位置永遠不得使該墊的任何部分與試樣的任何一點之間的間距小於約25毫米。例如，為充分評定門周邊的熱瓦斯泄漏，會需要與門的表面平行和正交使用該墊或可能在門框的限度之內斜角使用。

8.4.3.6 為評定試樣的完整性，操作者可進行“篩選試驗”。此種試驗可涉及選擇性地對潛在失效區域短時間使用棉－毛墊和（或）在此種區域之上和周圍移動一個單一棉－毛墊。棉－毛墊的焦黑會表明即將失效，但是對於有待證實的完整性失效，須以所規定的方式使用一個未曾用過的棉－毛墊。

8.4.4 ***隙規***

8.4.4.1 隙規試驗用以表明試樣中的縫隙和開口能否導致足以引燃可燃材料的熱瓦斯通過。

8.4.4.2 隙規須在按照明顯試樣衰退率確定的間隔應用。須順序使用兩個隙規，不得過度用力，以確定：

.1 6毫米隙規向火爐方向插入是否可穿過試樣，並可沿縫隙移動150毫米的距離；或

.2 25毫米隙規向火爐方向插入是否可穿過試樣。

對熱瓦斯通過開口有極小或沒有影響的任何隙規通過的微小障礙不得計入，例如，構造連接上的小扣件因變形而分開。

8.4.4.3 如“A”或“B”級分隔中的間隙用膨脹材料全部或部分密封，則隙規試驗須如同膨脹材料不存在一樣進行。

8.4.4.4 對於安裝在三邊框架之中的門，使用水平把持的隙規所測出的門底部間隙變化沿門的底邊不得增加12毫米以上。可使用12毫米隙規對此間隙的增加進行檢驗。對沿門底水平平面以上的門的邊緣應如同四邊框架門一樣進行核查。

註： 如門按照13毫米間隙安裝，則可使用25毫米隙規確定可接受的間隙變化。

8.4.5 ***變形***

“A”級、“B”級或“F”級試樣的變形，以及就門而言，門扇各角相對於門框的最大位移，在試驗時須記錄在案。這些變形和位移的測量精確度須為±2毫米。

8.4.6 ***一般表現***

在試驗過程中，須對試樣的一般表現進行觀測，並對有關材料的破裂、熔化或軟化，試樣建造材料的剝裂或碳化等現象做出記錄。如果有大量的煙從非暴露面冒出，則須在報告中予以記錄，但試驗並非為表明這些因素帶來的可能危險程度而設計。

8.5 試驗持續時間

8.5.1 *“A”級分隔*

對於所有“A”級分隔，包括有門的“A”級分隔，試驗須持續至少60分鐘。但是，如試樣為鋼質構芯無開孔“A”級分隔，（如無門），且僅在暴露面具有隔熱（即鋼質構芯為結構的非暴露面），則一旦非暴露面的溫升超過限度，允許於60分鐘之前結束試驗。

8.5.2 *“B”級和“F”級分隔*

對於所有“B”級和“F”級分隔，包括有門者在內，試驗需持續至少30分鐘。

8.5.3 *終止試驗*

試驗可因下列一個或多個原因而終止：

.1 人員安全或設備即將損壞；

.2 達到選定標準；或

.3 申請人要求。

在上述第.2小段下失敗之後，為獲得額外數據可繼續試驗。

9 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和經試驗確定的數據需做出明確區分：

.1 提及試驗係按照2010年消防試驗程序規則第3部分進行（另見以下.2小段）；

.2 任何與試驗方法的背離；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 所試驗產品的名稱和（或）識別；

.7 試樣和構造中所用產品及部件製造者名稱；

.8 產品類型，即艙壁、天花板、門、窗、管道貫穿、等等；

.9 試驗的耐火等級，即"A"級，"B"級，"F"級；

.10 試樣的結構細節，包括部件的說明、圖紙和主要細節。須提供第2段中所要求的全部細節。報告中所包括的說明和圖紙須儘實際可行地以得自試樣檢驗的信息為根據。如報告中未包括全部和詳細的圖紙，則申請人的試樣圖紙須經實驗室認證，實驗室須至少保留一份經認證的圖紙副本；在此情況下，報告中須引用申請人的圖紙並有表明圖紙核准方法的陳述；

.11 所用材料對試樣耐火性能有影響的所有特性，以及試驗實驗室確定的隔熱材料的厚度、密度和（適用時）水分和（或）有機物含量；

.12 試樣抵達日期；

.13 試樣調理細節；

.14 試驗日期；

.15 試驗結果：

.1 有關固定於試樣上的所有熱電偶的位置信息，以及試驗期間得自各熱電偶的表列數據。另外可包括所獲數據的圖形描述。須包括一份圖紙清楚說明各熱電偶的位置，並相對於溫度－時間數據對各熱電偶加以標明；

.2 在與有關等級絕熱性能標準（見第3部分第3段）相應的時間結束時記錄的平均溫升和最大溫升及，適用時，構芯平均溫升；或，如因超出隔熱標準而終止試驗，超過各限定溫度的時間；

.3 試樣的最大變形。就門而言，門試樣中心部位的最大變形和門扇各角相對於門框的最大變形；

.16 試樣所達到的等級須以“‘A-60’級甲板”的方式表達，即，包括對分隔取向的限定。

在試驗報告中，結果須以下列方式表達，其中，在“等級”的標題下包括有關不燃性的條款：

“按本報告中所述而建造的甲板，如所有材料符合《2010年消防試驗程序規則》附件1第3部分第3.5.1段的規定，則按照該規則附件1第3部分，可被視為‘A-60’級甲板。”；

.17 試驗時在場的主管機關代表的姓名。如主管機關要求試驗前事先通知，且其代表未曾目擊試驗，則須在報告中以下列方式就此做出記錄：

“……………………（主管機關名稱）已得知擬進行本報告中詳述的試驗，並認為無需派代表目擊試驗。”；及

.18 聲明：

“本試驗結果與產品試樣在特定試驗條件下的表現相關；不擬作為產品使用中潛在着火風險評估的唯一標準”。

附錄2

對窗、擋火板、管道和導管貫穿及電纜穿越的試驗

導言

本附錄涵蓋對一切可包含於“A”級分隔內的窗、擋火板、管道貫穿和電纜穿越的試驗。

儘管本附錄僅為“A”級分隔撰寫，但，適用時，在試驗裝於“B”級分隔內的窗、擋火板、管道貫穿和電纜穿越時，可按類推法使用其說明。

這些部件的試驗和報告通常須符合本部分附錄1中的要求。需要附加解釋、調整和（或）補充要求之處，已詳述於本附錄之中。

由於不可能把構芯在按照本附錄中給出的程序試驗時所經歷的各種變形導入更小比例的試樣，本附錄所涵蓋的各種部件試驗須將這些部件安裝在附錄1中規定的全尺寸構芯之中進行。

A.I — 窗

1 總則

1.1 窗一詞包括窗、舷窗及“A”級艙壁上任何其他為採光或觀察目的而提供的鑲有玻璃的開口。“A”級門上的窗被視為門的一部分，並須在相應的門之內進行試驗。

1.2 在相關和適當時，窗的試驗方法通常須遵循“A”級門的試驗要求。

2 試樣的性質

2.1 尺寸

2.1.1 對於尋求認可的窗，須對其最大尺寸（就寬度和高度而言）進行試驗。

2.1.2 對於尋求認可的窗，須對最大尺寸（就高度和寬度而言）的窗格玻璃和類型和（或）窗格玻璃的最小厚度及（如適用）間隙，進行試驗。對此構成所獲得的試驗結果，經類推，須允許對同樣類型、就高度和寬度而言尺寸較小並具有同樣或更大厚度的窗給予認可。

2.2 設計

2.2.1 包含窗的艙壁須在加強面上隔熱至“A-60”級，該面須為暴露於試驗加熱狀況下的一面。這被視為窗在船上的最典型應用。也許會有一些窗的特殊應用，如油船前艙壁上的窗，或其他非“A-60”級艙壁中的窗，主管機關認為對艙壁隔熱位於構芯非暴露面上的窗進行試驗更為適當。

2.2.2 窗須按照附錄1圖1所示，於擬實際使用的高度，置於艙壁之中。如果此為未知，則窗須置於其窗框頂部儘可能接近艙壁頂部之處，但不得近於距頂部300毫米。

3 測量儀器

當主管機關要求窗為除“A-0”外的其他等級時，熱電偶須如同對門扇的規定，固定於窗格玻璃之上。另外，須在窗框上配置熱電偶，各周邊邊緣長度中間處一個。如窗裝有橫樑和（或）直欞，則須如同對門扇的規定，將五個熱電偶固定在各窗格玻璃上，及，除固定在窗框上的熱電偶外，須在各橫樑或直欞的長度中間處固定一個單獨熱電偶。

4 試驗方法

4.1 溫度

計算試樣非暴露面的平均溫度上升，須僅使用固定在窗格玻璃面上的熱電偶。

4.2 棉－毛墊和隙規

對於擬為“A-0”等級的窗，無需使用棉－毛墊對窗的完整性進行評定，因為透過窗玻璃的輻射會足以引燃棉－毛墊。在此情況下，窗中的裂縫和開口不得允許隙規以附錄1第8.4.4段所述方式進入。

5 軟管水流試驗

5.1 總則

此程序是一項可選擇要求，一些主管機關會對用於船上特定區域的窗提出此項要求。對窗施加軟管水流的衝擊、腐蝕和冷卻效用。

5.2 實驗方法

5.2.1 軟管水流試驗須在加熱期終止後，立即（但最遲不得超過1.5分鐘）應用於試樣暴露面。

5.2.2 水流通過標準消防軟管提供，並經由噴口無突肩的漸縮無膛線型19毫米噴嘴施放。噴嘴口須距中心6米，並與試樣暴露面為正交。

5.2.3 在水流動下測算時，噴嘴處的水壓須為310千帕。

5.2.4 軟管水流對試樣表面的應用時間須為試樣暴露面每平方米0.65分鐘。水流須首先指向中心並之後緩慢變動方向，指向暴露面的所有部位。

5.3 性能標準

5.3.1 計算非暴露面的平均溫度上升須僅使用固定在窗格玻璃面上的熱電偶。

5.3.2 判斷非暴露面的最大溫度上升須使用固定在窗格玻璃面上、窗框上、橫樑和直欞上的所有熱電偶。

5.3.3 如水流施用期間未出現允許水流到非暴露面的開口，則該試樣可視為已滿足軟管水流試驗標準。

5.3.4 在試驗期間，如出現允許可見水流於非暴露面噴出的開口，則須認為該窗軟管水流試驗失敗。軟管水流試驗期間和之後，均無需使用隙規。

A.II － 擋火板

1 總則

1.1 “A”級分隔會需要貫穿以使通風導管通過，並須做出安排以確保就第3部分第3段中所規定的完整性標準而言，分隔的有效性不受影響。還須做出防備，一旦導管內部失火，或火已進入導管，火不致沿導管內部通過分隔。

1.2 為滿足這兩項要求，於焊在構芯上的套管或圍板之內裝設、或在其之上固定擋火板，並按照與分隔相同的標準隔熱。

2 試樣的性質

2.1 尺寸

對尋求認可的各類擋火板的最大尺寸（就寬度和高度、或直徑而言），須在垂直和水平取向上進行試驗。

2.2 設計

2.2.1 包含擋板的艙壁須按照附錄1第2.1段建造，其加強面須隔熱至“A-60”級，該面須為不暴露於試驗加熱狀況的一面。包含擋板的甲板須按照附錄1第2.2段建造，其加強面須隔熱至“A-60”級，該面須為暴露於試驗加熱狀況的一面。

2.2.2 擋火板須為焊在或栓固在構芯中的圍板或套管的一部分或固定於其上。

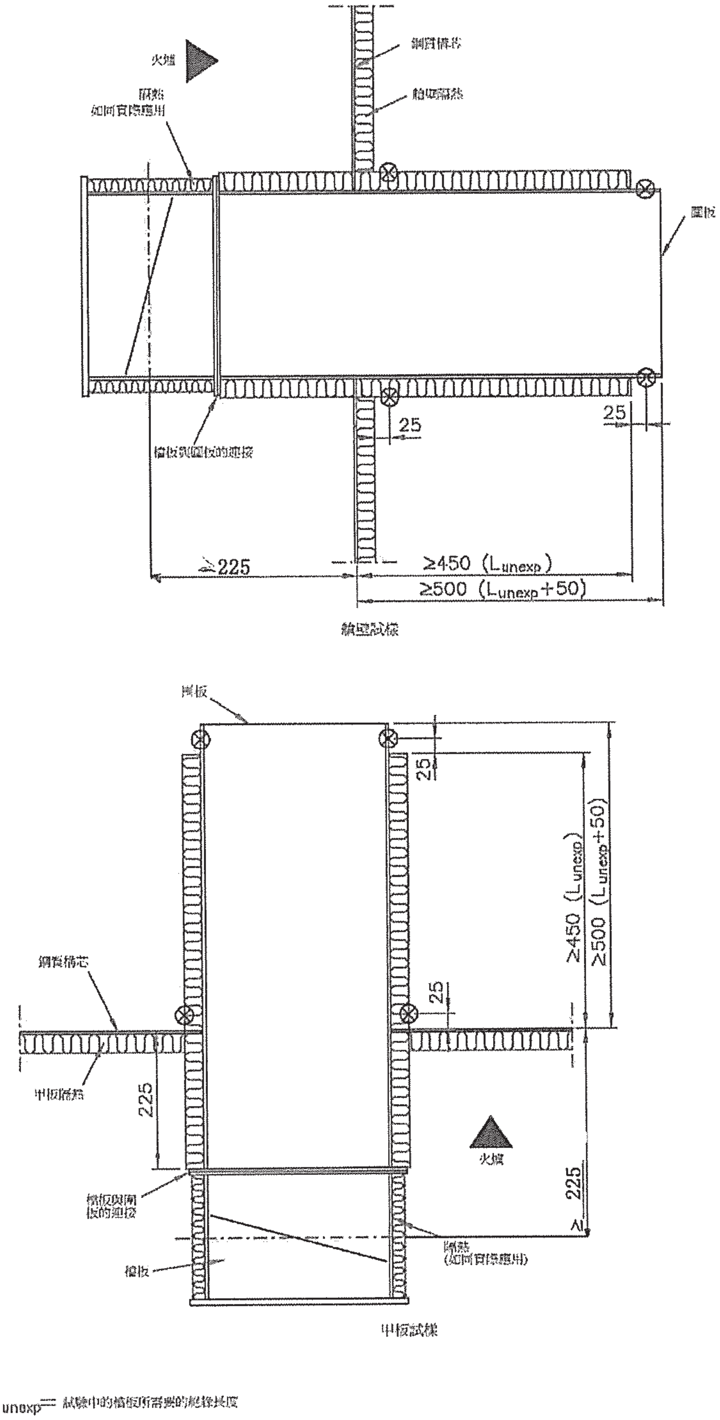
在非暴露面上的長度 ＝ （450毫米或試驗中的擋板所需要的隔熱長度）（Lunexp） ＋50毫米。

圍板或套管的厚度須如下列：

導管的寬度或直徑	**圍板的最小厚度**
300毫米及以下	3毫米
760毫米及以上	5毫米

對於寬度或直徑大於300毫米但小於760毫米的導管，其圍板或套管的厚度須通過內插法獲取。

對圍板或套管須如圖A1所示進行隔熱。



圖A1 － 擋火板：試樣上的隔熱及非暴露面熱電偶的位置

2.2.3 圍板或套管（包括隔熱）須僅位於艙壁上半部。如艙壁中包含多個擋板，則所有擋板的頂緣須儘可能位於相同高度，並與艙壁邊緣或甲板相距至少200毫米。如對多個擋板在一個分隔中同時試驗，則相鄰圍板和套管（包括隔熱）之間的距離不得小於200毫米。

2.2.4 擋火板須位於艙壁或甲板的暴露面上。擋火板中心和構芯之間的距離不得小於225毫米。

擋板的操作控制位於分隔的暴露面一側。如擋板裝於艙壁內，則熔絲元件應如同實際應用位於擋板的最低水平。

2.2.5 自動操作的擋火板在試驗開始時須處於打開位置並須由自動裝置關閉。擋板在試驗開始後2分鐘內須處於關閉位置。如擋火板未能在試驗開始2分鐘後關閉，則該擋火板須被視為失敗並須停止試驗。

2.2.6 手動系統操作的擋火板須在試驗時間1分鐘時加以關閉。

3 試驗儀器

3.1 試樣上熱電偶的定位

3.1.1 對於每個擋火板，須將：如其寬度或直徑不大於200毫米，則兩個、如大於200毫米，則四個熱電偶，固定在非暴露面上下列各個位置：

.1 為圍板或套管提供的隔熱表面上距分隔非暴露表面25毫米處；及

.2 在圍板或套管的表面上，距圍板或套管露出其隔熱體25毫米之處。

3.1.2 在尺寸大於200毫米的擋板上，在第3.1.1.1段和3.1.1.2段所示的每一個位置須固定四個熱電偶，其中的一個須固定在圍板或套管各邊的中心。

3.1.3 在尺寸不大於200毫米的擋板上，在第3.1.1.1段和3.1.1.2段所示每一個位置須固定兩個熱電偶，其中的一個須固定在圍板或套管相對邊的中心及，對於艙壁中的擋板，位於圍板或套管的頂部和底部表面。

4 性能標準

4.1 並非總有可能利用棉毛墊試驗評定擋火板的完整性，因為透過擋板的輻射會足以引燃棉毛墊。在此情況下，擋火板中的裂縫或開口不得允許隙規以附錄1第8.4.4段中所述方式進入。

4.2 取決於主管機關的要求，擋火板的性能會與其滿足隔熱標準和完整性標準的能力相關或會僅與完整性要求相關。

4.3 如要求對隔熱進行評定，隔熱表面上任何一點的溫度上升均不得在初始溫度之上超過180℃。平均溫度上升不得用於此目的。

A.III － 管道和導管貫穿

1 總則

1.1 “A”級分隔會需要提供孔洞供服務管道和導管貫穿，因而有必要在其被貫穿處恢復分隔的隔熱和（或）完整性性能。

1.2 針對管道和（或）導管貫穿的定級需要，例如相對於管道的直徑及是否直接附着於構芯上，主管機關會有不同要求。

1.3 自此處起，本節述及管道貫穿，但可讀為同樣適用於導管貫穿。

2 試樣的性質

2.1 尺寸

尋求認可的各類管道貫穿的最大和最小尺寸（就寬度和高度、或直徑而言）均須在垂直和水平取向上進行試驗。

2.2 設計

2.2.1 包含管道貫穿的艙壁須按照附錄1第2.1.1段建造，其加強面須隔熱至“A-60”級，該面須為不暴露於試驗加熱狀況下的一面。包含管道貫穿的甲板須按照附錄1第2.2.1段建造，其加強面須隔熱至“A-60”級，該面須為暴露於試驗加熱狀況下的一面。

2.2.1.1 在無隔熱（“A-0”級）艙壁/甲板中，建議進行“A-0”級管道貫穿。如對管道貫穿作為“A-60”級進行試驗，（貫穿本身及其周圍200毫米）所安裝的任何隔熱將也要求為“A-0”級。

2.2.1.2 “A-0”級貫穿未經“A-0”級試驗不得予以認可，即便已作為“A-60”級進行過試驗並獲得認可。

2.2.2 管道貫穿須僅位於艙壁上半部，但距艙壁或甲板邊緣不得小於200毫米。如對一個分隔上的多個管道貫穿同時進行試驗，則相鄰貫穿之間的間隔不得小於200毫米。這兩項測量相關於距貫穿系統最近部件的距離。包括為系統一部分的任何隔熱在內。

2.2.3 穿過貫穿的各管道須在貫穿暴露端伸出500±50毫米並在貫穿非暴露端伸出500±50毫米。管道的暴露端須使用適當技術封死，確保任何的火不在經管道周邊透入之前經管道末端透入。

2.2.4 各管道須在試樣的非暴露面得到獨立於艙壁或甲板的穩固支撐和固定，如，由安裝在約束框架上的構架予以支撐和固定。管道的支撐和固定須在試驗中制止管道移動。

2.2.5 如甲板貫穿設於暴露面或對稱裝設，則將給予通用認可。如甲板貫穿設於非暴露面，則認可將僅限於測試取向的貫穿。

2.2.5.1 如艙壁管道貫穿對稱裝設，應給予通用認可。對於具有暴露和非暴露安裝框架的艙壁貫穿，需對每一種安裝進行試驗以獲得通用認可。

2.2.6 管道和導管的密封：在消防實驗開始之前，不得有任何可見開口。

2.2.6.1 當包含貫穿原型的（甲板）試樣並非置於剛性束框內而是通過邊牆圍板與爐頂連接時，該圍板的剛性將與束框的剛性相當並將按照附錄1第5.1段加以評定。

2.2.6.2 如隔熱裝設於試驗管道上，第2.2.3段中要求的管子要伸出的500±50毫米的距離當自隔熱末端算起，因為這被視為所測試的貫穿的構成部分及需要有一段無保護的管子暴露於火爐。

2.2.6.3 在所有情況下，試驗管道須由裝設在束框上的構架予以支撐和固定，以使被測試的貫穿承受艙壁或甲板相對於管道的任何移動。

3 試驗儀器

3.1 熱電偶在試樣上的定位

3.1.1 對於每一管道貫穿，須在非暴露面上下述每一位置固定兩個熱電偶：

.1 管道表面上，於熱電偶的中心距管子自貫穿密封露出位置25毫米之處；

.2 管道貫穿上，於熱電偶的中心距試樣非暴露一側的隔熱表面25毫米之處；及

.3 管道和任何固定在分隔上的圍板或套管之間所使用的任何隔熱或填充材料的表面上（只要管道和任何此種圍板或套管之間的間距大於30毫米），或在管道和分隔之間使用的任何套環或套筒（例如，隔氣層）的表面上。

3.1.2 就艙壁貫穿而言，對於每一以上所示位置，須將一個熱電偶固定在管子中心正上方，將另一個熱電偶固定在管子中心正下方。

3.1.3 視管道貫穿的複雜性，可要求安裝額外熱電偶。

4 性能標準

4.1 總則

4.1.1 取決於主管機關的要求，管道貫穿的性能會與其滿足隔熱標準和完整性標準的能力相關或會僅與完整性要求相關。

4.1.2 導管貫穿須符合完整性及隔熱標準。

4.2 隔熱

由於管道貫穿是分隔的局部弱點，因此表面上任何一點的溫度上升均不得超過初始溫度180℃。平均溫度上升無關緊要。

A.IV － 電纜穿越

1 總則

“A”級分隔會需要提供孔洞供電纜穿越，因而有必要在其被穿越處恢復分隔的隔熱和完整性性能。電纜穿越由金屬框架、盒或圍板、密封系統或材料及電纜構成，可為無隔熱、部分隔熱或完全隔熱。

2 試樣的性質

2.1 尺寸

尋求認可的各種類型電纜穿越的最大和最小尺寸（就高度和寬度而言）須在垂直和水平取向上進行試驗。

2.2 設計

2.2.1 包含電纜穿越的艙壁須按照附錄1第2.1.1段建造並須在加強面隔熱至“A-60”級，該面須為不暴露於試驗加熱狀況下的一面。包含電纜穿越的甲板須按照附錄1第2.2.1段建造，其加強面須隔熱至“A-60”級，該面須為暴露於試驗加熱狀況下的一面。

2.2.1.1 在無隔熱（“A-0”級）艙壁/甲板中，建議進行“A-0”級電纜穿越。如對電纜穿越作為“A-60”級進行試驗，（穿越本身及其周圍200毫米）所安裝的任何隔熱將也要求為“A-0”級。

2.2.1.2 “A-0”級電纜穿越未經“A-0”級試驗不得予以認可，即便已作為“A-60”級進行過試驗並獲得認可。

2.2.2 電纜穿越須僅位於艙壁上半部，但距艙壁邊緣或甲板不得小於200毫米。如對一個分隔上的多個電纜穿越同時進行試驗，則相鄰穿越之間的間隔不得小於200毫米。這兩項測量相關於距穿越系統最近部件的距離。包括任何系統構成部分的隔熱在內。

2.2.3 雖有以上規定，各穿越之間的距離須足以確保各穿越在試驗期間不致相互影響，但本項要求不適用於原擬位置相互毗連的多重穿越。

2.2.4 電纜須在穿越的暴露端伸出500±50毫米並在穿越的非暴露端伸出500±50毫米。

2.2.4.1 各條電纜須在試樣的非暴露面得到獨立於艙壁或甲板的穩固支撐和固定，如，由安裝在約束框架上的構架予以支撐和固定。電纜的支撐和固定須在試驗中制止電纜移動。

2.2.5 電纜穿越須按照生產者的規範安裝於艙壁或甲板中。電纜和密封填料或密封塊須分別在艙壁和甲板面板處於垂直和水平位置時納為穿越的構成部分。任何隔熱須在面板分別處於同樣相關位置時應用於電纜和穿越。

2.2.6 須對包含不同類型電纜（例如，就導體的數量和類型、包皮的類型、絕緣材料的類型和尺寸而言）的穿越進行試驗並須提供代表船上實際應用的組合。各主管機關會有其自己的可用作其認可依據的穿越電纜標準構成規範。

2.2.6.1 對某一特定構成的試驗結果通常對尺寸相等或比所測試尺寸更小的經測試的電纜類型有效。

2.2.7 根據各穿越處的內橫截面積，須對最大和最小填充進行試驗。相鄰電纜之間的距離須為生產者規定的最小距離，且電纜須置於接近穿越中心之處。

2.2.8 如甲板電纜穿越裝設於暴露面或對稱裝設，將給予通用認可。如甲板電纜穿越裝設於非暴露面，則認可僅限於所測試的穿越取向。

2.2.8.1 如艙壁電纜穿越對稱裝設，應給予通用認可。對於有暴露或非暴露安裝框架的艙壁電纜穿越，為取得通用認可需要對每一種安裝進行一次試驗。

2.2.9 電纜密封在消防試驗開始之前不得有任何可見開口。

3 試驗儀器

3.1 熱電偶在試樣上的定位

3.1.1 對於無隔熱電纜穿越，熱電偶須固定在非暴露面的以下各個位置：

.1 框架、盒或圍板表面的兩個位置上，距分隔非暴露表面25毫米處。如穿越自艙壁或甲板非暴露面組合未伸出至少25毫米，則這些熱電偶須置於框架、盒或圍板的末端；

.2 穿越末端、位於密封系統或材料面上的兩個位置上，距離電纜25毫米處。如面積不足，無法按照規定固定熱電偶，一個或者兩個可置於距電纜25毫米的距離之內；及

.3 電纜穿越所包含的各類電纜的表面上，距密封系統或材料表面25毫米處。如為一組或一束電纜，該組須作為單一電纜對待。如為水平電纜，則熱電偶須安裝在電纜最上層表面。如果電纜直徑太小無法將熱電偶有效地固定在電纜上，則這些熱電偶可以排除。這須由主管機關決定。

3.1.2 對於置於框架、盒或圍板外緣上的熱電偶，兩個相對面上，須各固定一個熱電偶，對於艙壁而言，須為頂面和底面。

3.1.3 對於每個部分隔熱或完全隔熱的電纜穿越，熱電偶須固定在非暴露面上與圖A2所示、對無隔熱穿越所規定的等效位置。

3.1.4 根據電纜穿越的複雜性，可要求額外裝設熱電偶。

3.1.5 在電纜的非暴露表面上固定熱電偶時，須在該表面上組成銅盤和隔熱墊以與電纜表面良好接觸。銅盤和墊子須通過機械手段，如，金屬絲或彈簧夾，保持在原位，使其在實驗中不致脫落。機械保持不得對熱電偶的非暴露面造成任何顯著的熱沉效應。

4 性能標準

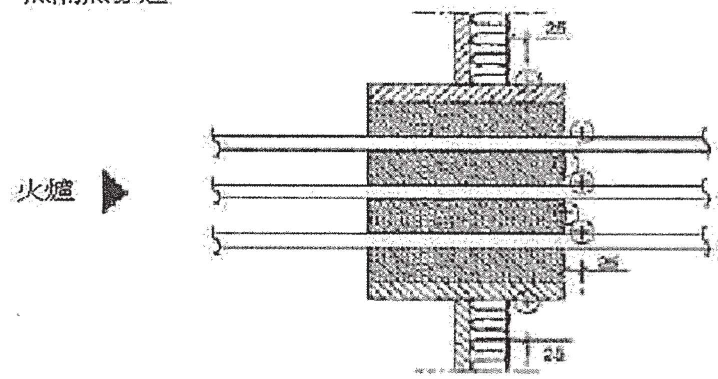
4.1 總則

電纜穿越須滿足完整性標準和隔熱標準。

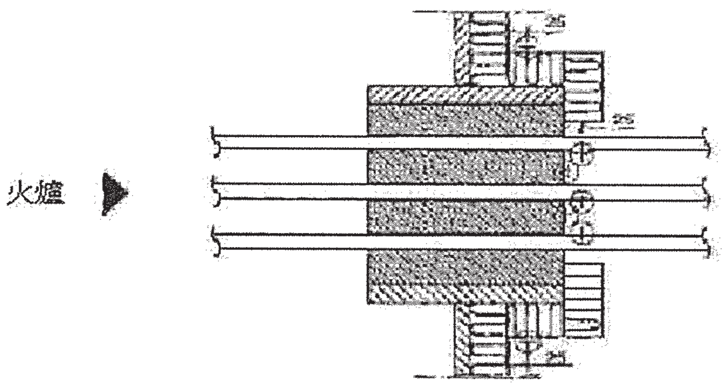
4.2 隔熱

由於電纜穿越是分隔中的局部弱點，因而必須能夠防止其表面上任何一點的溫度上升超過初始溫度180℃以上。平均溫度上升不得用於此目的。

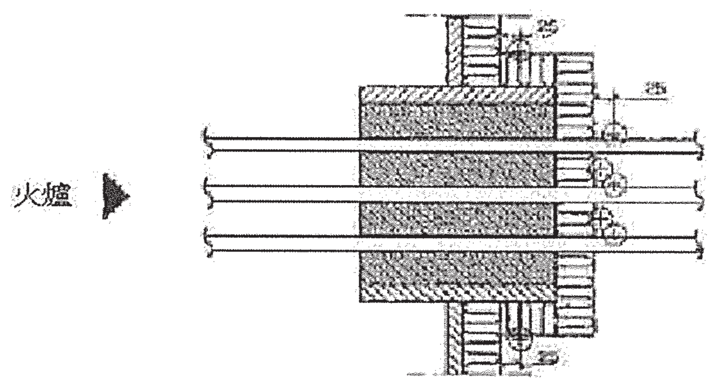
無隔熱穿越



部分隔熱穿越



全隔熱穿越



圖A2 － 電纜穿越：非暴露面熱電偶的位置

（對艙壁的顯示）

附錄3

"A"級、"B"級和"F"級分隔中的窗耐火試驗的補充熱輻射試驗

1 範圍

1.1 本附錄規定了對通過窗的熱通量進行測量的程序，以作為依據，確定窗限制熱輻射，防止火的傳播並使逃生通道能夠在其附近通過的能力。

1.2 本程序是一項選擇性要求，一些主管機關會對船上特定區域中的窗提出此項要求。

2 試驗程序

2.1 窗需按照本部分附錄2，使用下述補充儀器進行試驗。

2.2 "窗"一詞包括耐火分隔上的窗、舷窗和任何其他為透光或觀察的目的而提供的裝有玻璃的開口。"耐火分隔"一詞包括艙壁和門。

3 補充儀器

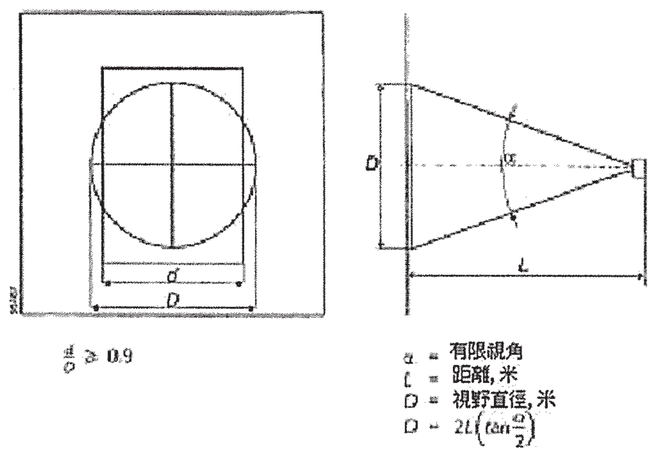
3.1 補充儀器由經過有限視野校準以顯示入射熱通量的有限視野全熱通量計構成。該熱通量計須為水冷式並能夠測量0 kW/m^{2}至60 kW/m^{2}的熱通量。該通量計應至少每年比對標準裝置校準一次。

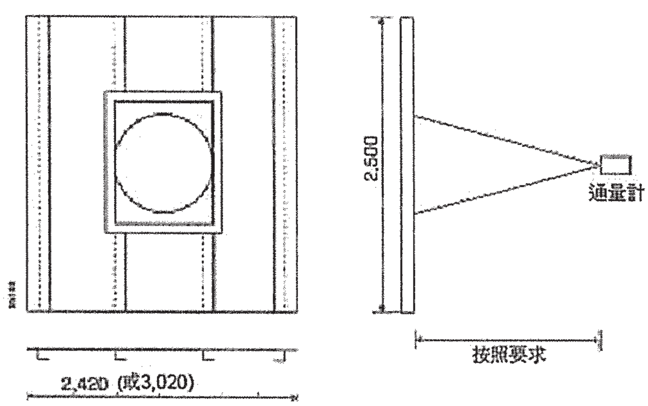
3.2 熱通量計應與所試驗的窗成直角放置，並處於其視野中心與窗的中心相一致的位置（見示意圖）。通量計的位置和窗的距離應大於

0.5米，使通量計的視野剛好包括部分框架。但通量計距窗的距離不應大於2.5米。通量計所看到的、處於窗之外的邊界和框架的尺度，不應超過通量計對試樣表面所視寬度的10%。應根據通量計的有限視角及其距樣品表面的距離進行計算。

3.3　其較大尺度小於其較小尺度1.57倍的窗，僅需一台通量計。

3.4　對於其較大尺度大於其較小尺度1.57倍的長方形的窗應提供額外通量計。對通量計距窗的距離應加以調整使通量計的視野至少覆蓋窗的50%。但是，通量計距窗的距離既不應小於0.5米亦不應大於2.5米。





圖

4 性能標準

4.1 熱通量峰值應在第一個15分鐘、第一個30分鐘和整個實驗期間（即，“A”級限界60分鐘，“B”級限界30分鐘）進行測量。

4.2 按照第4.1段測量的熱通量峰值（E_w）應與下列表1中的參照值（E_c）進行對比。

4.3 如（E_w）小於（E_c），則該窗在相應耐火等級限界中的安裝可以接受。

表1 － 熱通量標準

耐火分隔等級	實驗開始後的時限	熱通量 E_c（kW/m²）
"A-0"	60分鐘	56.5
"A-15"	15分鐘	2.34
	60分鐘	8
"A-30"	30分鐘	2.34
	60分鐘	6.4
"A-60"	60分鐘	2.34
"B-0"	30分鐘	36.9
"B-15"	15分鐘	2.34
	30分鐘	4.3

附錄4

連續“B”級分隔

1 範圍

1.1 本附錄規定了核實襯板和天花板為“連續‘B’級襯板”和“連續‘B’級天花板”及評定全部構造為“連續‘B’級構造”的試驗程序。

1.2 本程序為選擇性要求，一些主管機關會對連續“B”級分隔做此要求。

2 試驗程序和評定

2.1 襯板、天花板和構造應按照本部分使用下述安排進行評定。

2.2 天花板應按照附錄1第2.8段進行試驗，但天花板應裝於水平火爐之上，使至少150毫米高的“B”級艙壁安裝於火爐之上並使用實際應用中的連接方法將天花板固定在這些不完全的艙壁上。對此等天花板和連接方法應按照本部分附錄1對天花板的要求進行評定並應相應地確定為“連續‘B’（酌情為“B-0”或“B-15”）級天花板。

2.3 按照本部分業已評定為“B”（根據襯板試驗酌情為“B-0”或“B-15”）級的襯板，連同“連續‘B’（酌情為“B-0”或“B-15”）級天花板”和試驗中所用連接方法（見上述第2.2段）可被視為構成“連續B（酌情為“B-0”或“B-15”）級襯板”而無需另行試驗。

2.4 安裝在“A”級甲板上並由“連續B（酌情為“B-0”或“B-15”）級襯板”和“連續‘B’（酌情為“B-0”或“B-15”）級天花板”構成的圍閉構造應被視為構成一個“連續‘B’級構造”。

第4部分 – 防火門控制系統試驗

1 適用

若要求防火門控制系統能夠在失火時運作，該系統須符合本部分的要求。

2 消防試驗程序

防火門控制系統須按照本部分附錄中提出的試驗程序進行試驗和評定。

3 補充要求

本附件第1部分亦適用於與防火門控制系統相關使用的隔熱材料。本附件第5部分適用於與防火門控制系統相關使用的黏合劑。

附 錄

防火門控制系統消防試驗程序

1 總則

1.1 擬用於防火門上能夠在失火時運作的控制系統須按照本附錄中所述消防試驗程序進行試驗而不依賴於其動力供應（氣動、液壓或電力）。

1.2 消防試驗須為原型試驗並帶有完整的控制系統，在尺度與本規則第3部分附錄1的規定相符的試驗爐中進行。

1.3 有待試驗的構造，包括材料和組裝方法，須儘實際可能地代表船上的實際應用。

1.4 控制系統的功能包括其關閉機制須經試驗，即其正常功能，及，如需要，應急功能，包括切換功能，如果這是生產者設計的基礎。所要求的安裝和功能須有詳細的功能說明。

2 原型控制系統的性質

2.1 原型控制系統的安裝須與生產者的安裝手冊完全相符。

2.2 原型控制系統須包括門與關閉機制連接的典型安排。為試驗目的須使用樣品門。如為滑動門，樣品門須在原門滑軌中運行並使用原支撐和導滾輪。樣品門須具有此控制系統驅動的最大的門的重量。

2.3 如為氣動或液壓系統，則其驅動器（缸）須具有火爐所允許的最大長度。

3 原型控制系統的材料

3.1 規範

試驗前，申請人須向實驗室提交試驗佈置材料清單。

3.2 控制測量

3.2.1 試驗實驗室須對所有其特性對原型控制系統的性能具重要性的材料（除鋼和等效材料外）提取參照試樣。

3.2.2 如有必要，須按照第1部分進行隔熱材料不燃性試驗。試樣製造中使用的黏合劑無需不燃，但須具有低播焰特性。

3.2.3 各隔熱材料的密度須加以確定。礦物棉或任何類似可壓縮材料的密度須與其標定厚度相關。

3.2.4 各隔熱材料和材料組合的厚度須使用適當量規或卡尺測量。

4 調理

4.1 原型控制系統（除隔熱外）無需調理。

4.2 如構造中使用了隔熱材料，在隔熱材料達到風乾狀態之前不得進行原型控制系統試驗。此狀態設計為在環境大氣相對濕度50%、溫度23℃時的平衡（第3部分附錄1第4段規定的恆重）。

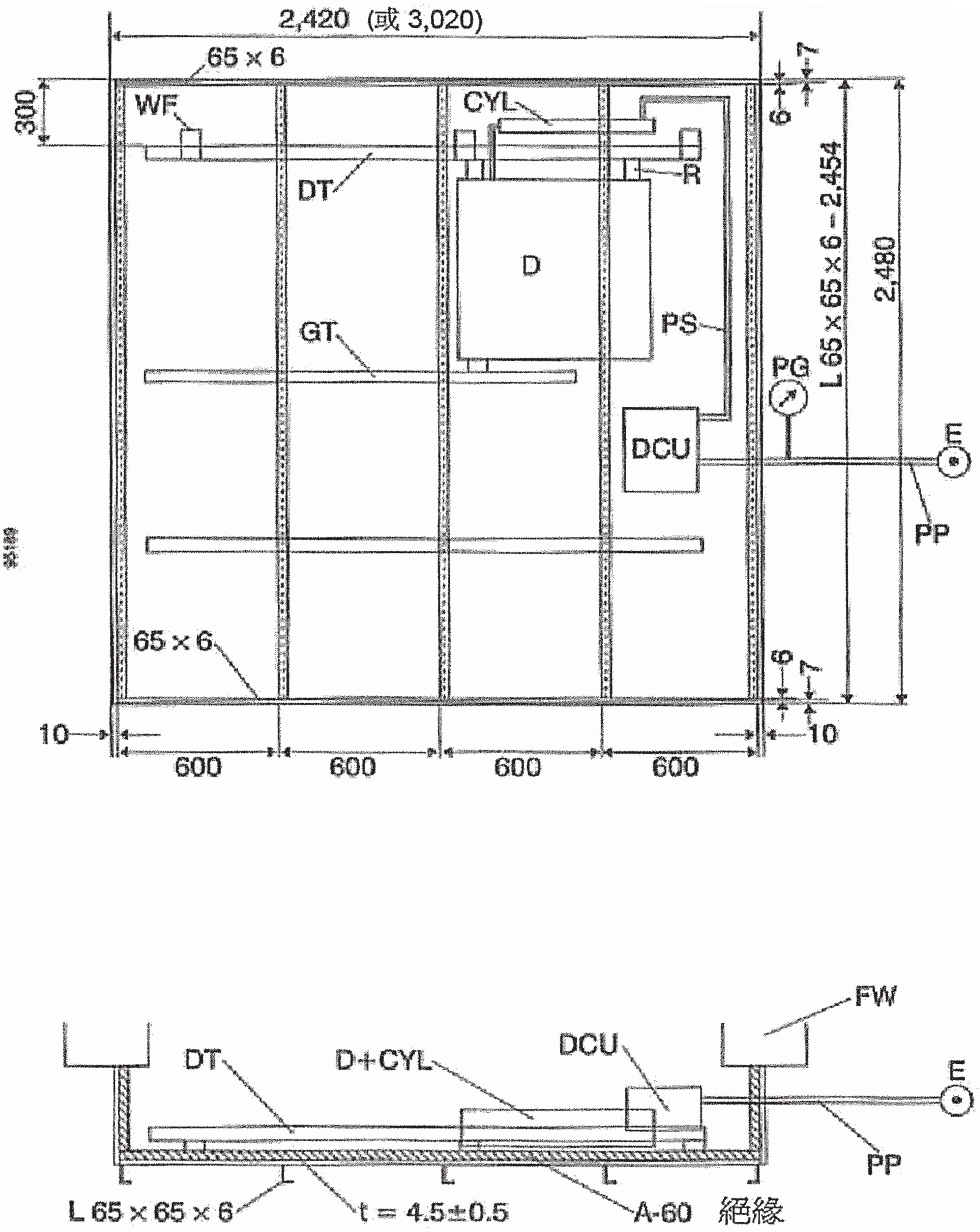
4.3 允許加速調理，但所用方法不得改變構成材料的特性。高溫調理須低於材料的臨界溫度。

5 安裝

5.1 原型防火門控制系統及其隔熱（如用於該系統或系統部件的保護）須如圖1所示安裝在艙壁板上。

5.2 構芯須按照本規則第3部分附錄1第5段中“A”級分隔的原則在火爐處安裝。

5.3 樣品門須佈置於爐內。裝有該系統和樣品門的構芯須無門開口，但為控制系統釋放機制開的小開口可以允許。



D = 樣板門， DCU = 門控制單元， DT = 門軌， WF = 焊接緊固件，
GT = 導軌， CYL = 門缸， R = 支撐滾輪， PS = 管道系統，
PG = 壓力錶， PP = 壓力管道， E = 能源， FW = 爐壁。

圖1 — 供安裝原型消防控制系統的構芯

6 檢查

6.1 符合度

實驗室須核實原型控制系統與申請人（見第2段）所提供的圖紙和組裝方法相符，任何有差異之處須在開始試驗之前得到解決。

6.2 原型控制系統的運作

在即將開始試驗前，實驗室須通過開啟門至少300毫米的距離檢查樣品門的運轉性能。之後，樣品門須予以關閉。

7 試驗儀器

火爐和火爐試驗儀器須符合本規則第3部分附錄1第7段的規定。

8 試驗程序

8.1 試驗開始

8.1.1 在試驗開始前5分鐘內，須檢查所有熱電偶所記錄的初始溫度，以確保一致，並對數據值做出記錄。同樣獲得的變形數據值，及對原型控制系統的初始狀況須做出記錄。

8.1.2 試驗時，初始平均內部溫度須為20±10℃，並須在初始環境溫度的5℃以內。

8.1.3 試驗之前，門須處於開啟狀態。試驗開始時，門控制系統須顯示出其閉門能力。

8.1.4 門控制系統須以對其所有裝置具代表性的方式安裝，並在整個試驗期間具有動力。

8.2 火爐控制

火爐控制須符合本規則第3部分附錄1第8.3段。

8.3 試驗期間的溫度、時限和行動

8.3.1 平均爐溫須在5分鐘內增加至並穩定在200±50℃度，並保持在200±50℃的溫度上直至第一個60分鐘結束。之後平均爐溫須按照標準時間－溫度曲線自200℃增加至945℃。

8.3.2 門控制機制的開啟和關閉功能在自試驗開始的60分鐘內每5分鐘啟動一次。

8.3.3 自動切換須在平均爐溫至300℃時，切斷門控制系統的動力供應並須保持門的關閉至少至945℃。

8.4 對原型控制系統的測量與觀察

如為氣動或液壓系統，對須與經認可的系統壓力相同的輸入壓力須做出記錄。由於輸入壓力高，試驗時，須採取必要安全防範措施。

9 定級標準

9.1 在試驗的首個60分鐘內，原型防火門控制系統不得失效。

9.2 在首個60分鐘結束後直至試驗結束，門須保持關閉。

10 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗確定的數據須作出明確區分。

.1 提及試驗係按照《2010年消防試驗程序規則》第4部分進行（另見以下.2小段）；

.2 任何與試驗方法的不同；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 所試驗的原型控制系統名稱和（或）識別；

.7 原型控制系統和構造中所用產品及部件製造者名稱；

.8 原型控制系統結構細節，包括部件的說明、圖紙和主要的細節。須提供第2段中所要求的全部細節。報告中所包括的說明和圖紙須儘實際可行地以得自試樣檢驗的信息為根據。如報告中未包括全部和詳細圖紙，則申請人的原型控制系統圖紙須經實驗室認證，實驗室須至少保留一份經認證的圖紙副本；在此情況下，報告中須援引申請人的圖紙並提供表明圖紙核准方法的陳述；

.9 所用材料對原型控制系統消防性能有影響的所有特性，以及實驗室所確定的隔熱材料的厚度、密度和（適用時）水分和（或）有機成分；

.10 試樣抵達日期；

.11 試樣調理細節；

.12 試驗日期；

.13 試驗結果：

.1 有關壓力計或其他儀器的位置信息，以及試驗期間獲得的表列數據；

.2 試驗期間觀察到的原型控制系統的重要表現及照片（如有）；及

.3 聲明該原型控制系統已通過試驗並符合定級標準；

.14 試樣所達到的等級須以“門控制系統”的形式表達，即，包括對分隔取向的限定。

在試驗報告中，結果須以下列方式表達，其中，在“等級”的標題下包括有關不燃性的附文：

“如本報告中所述而建造的防火門控制系統，可被視為符合《2010年消防試驗程序規則》附件1第4部分的防火門控制系統。”；

.15 試驗時在場的主管機關代表姓名。如主管機關要求試驗前事先通知，且其代表未曾目擊試驗，則須在報告中以下列方式就此做出記錄：

> “………………………（主管機關名稱）已得知擬進行本報告中詳述的試驗，並認為無需派代表目擊試驗。”。

第5部分 － 表面可燃性試驗（表面材料和甲板基層敷料試驗）

1 適用

1.1 如要求產品具有低播焰特性表面，則該產品須符合本部分的規定。

1.2 如要求甲板基層敷料不易點燃，則該敷料須符合本部分的規定。

1.3 如一種表面材料產品根據應用於不燃和非金屬基底上的試樣試驗獲得認可，則須認可該產品在任何具有類似或更高密度（類似密度可定義為等於或大於試驗中所用密度0.75倍的密度）或，如密度大於400kg/m^3，更大厚度的不燃和非金屬基底上的應用。如一種產品根據在金屬基底上應用（例如鋼板上的薄漆膜或塑料膜）後所獲得的試驗結果獲得認可，則須認可該產品在任何類似或更大厚度（類似厚度係指所得到的等於或大於試驗中所用厚度0.75倍的厚度）的金屬基底上的應用。

2 消防試驗程序

2.1 表面材料和甲板基層敷料須按照本部分附錄1中規定的試驗程序進行試驗和評定。試驗可在40分鐘後終止。

2.2 在艙壁、天花板和甲板飾面材料和甲板基層敷料消防試驗中，會有一些試樣顯示出對材料的定級造成困難的不同現象。本部分附錄3提供了對這類結果作出統一解釋的指南。

2.3 關於試樣的製備參閱本部分附錄4，其中提供了消防試驗規則第2和第5部分的試樣導則和這些產品的類型認可導則（認可範圍和使用限制）。

3 性能標準

3.1 表面可燃性標準

所有材料，如其全部表面可燃性標準平均值符合表1中所列數值，則被視為達到低播焰性要求，符合公約第II-2章的相關規定。

3.2 試驗中的燃燒熔滴

用作艙壁、牆和天花板襯板及甲板基層敷料的材料，不得在試驗中產生燃燒熔滴。無論表面可燃性標準如何，產生燃燒熔滴者須被視為不合格材料。對於地板敷料，可以接受不超過10個燃燒熔滴。

表1 — 表面可燃性標準

	艙壁、牆和天花板襯板	地板敷料	甲板基層敷料
CFE (kW/m^2)	≥ 20.0	≥ 7.0	≥ 7.0
Qsb (MJ/m^2)	≥ 1.5	≥ 0.25	≥ 0.25
Qt (MJ)	≤ 0.7	≤ 2.0	≤ 2.0
Qp (kW)	≤ 4.0	≤ 10.0	≤ 10.0
燃燒熔滴	不產生	10個燃燒熔滴以下	不產生

表中：

CFE ＝ 熄滅臨界通量
Qsb ＝ 持續燃燒熱量
Qt ＝ 熱釋放總量
Qp ＝ 熱釋放率峰值

註： *Qsb*係指附錄1第9.3段中定義的持續燃燒平均熱量。

4 補充要求

4.1 艙壁和天花板及類似暴露面的表面材料

如最大總熱值（例如45 MJ/m^2）要求對某一產品適用，則須採用ISO 1716標準中規定的試驗方法確定總熱值。

4.2 地板敷料和甲板基層敷料

4.2.1 甲板基層敷料係指在甲板板材頂上直接塗施的地板構造的第一層，並包含任何底漆、對甲板板材提供保護或黏合所需的防腐蝕複合劑或黏合劑。甲板板材之上的地板構造其他各層為“地板敷料”。

4.2.2 如產品係在甲板板材頂上直接塗施的地板構造的第一層並係暴露表面（即，在其之上未塗施任何塗層），則該產品須被視為“地板敷料”，並須符合對“地板敷料”的要求。

4.2.3 如要求地板敷料為低播焰，則所有各層均須符合本部分的規定。如地板敷料為多層構造，主管機關可要求對地板敷料各層或一些層的組合進行試驗。地板敷料的各層須分別、或一些層的組合（即，試驗和認可僅適用於此組合）、須符合本部分的規定。

4.2.4 甲板板材上的底漆或類似漆的薄層無需符合上述要求。

4.3 可燃通風導管

如要求可燃通風導管為具有低播焰特性的材料製成，則本部分表面可燃性試驗程序和襯板和天花板飾面標準須對此種導管適用。如該導管使用均質材料，則試驗須適用於導管外部表面，而複合材料導管的兩面均須進行試驗。

4.4 低溫服務系統的隔熱材料

如要求低溫服務系統所用隔熱以及管道設備隔熱的防潮層暴露面和黏合劑具有低播焰特性，本部分表面可燃性試驗程序和襯板及天花板標準須對此等暴露面適用。

4.5 "A"級、"B"級和"F"級分隔所用的黏合劑

"A"級、"B"級和"F"級分隔所用的黏合劑須為具有低播焰特性的材料。按照本部分附錄1，表面可燃性試驗程序和襯板及天花板標準須對作為暴露面的黏合劑適用。本部分附錄1第3.5段中規定為模擬試樣的硅酸鈣板須用作黏合劑的標準基底。

5 試驗報告

試驗報告中須包括附錄1第10段中所含信息。

6 参照文件

ISO 5658-2，對消防試驗的反應 — 播焰 — 第2部分：垂向構形建築和運輸產品上的橫向傳播。

ISO 13943，消防安全 — 詞彙。

ISO 14934-3，消防試驗 — 熱通量計的校準和使用 — 第3部分：第二級校準方法。

附錄1

艙壁、天花板、甲板飾面材料和甲板基層敷料表面

可燃性消防試驗程序

警告

引燃風險

使用此試驗方法會產生極高熱通量水平，能夠在短暫暴露後引燃某些材料（如布）。須採取防範措施避免此類意外燃着。

毒煙風險

提請此方法使用者注意：燃着材料發出的煙常含有一氧化碳。在許多情況下會產生其他更為有毒的產物。須採取適當預防措施，避免長期接觸此類煙氣。

1 範圍

本附錄規定出艙壁、天花板、甲板飾面材料和甲板基層敷料的燃燒特性測量程序，作為確定其可燃特性的根據並進而確定其用於海洋構造中的適宜性。

2 參照規範

本附錄的規定由下列規範性文件所含規定構成：

.1 ISO 13943，消防安全 － 詞彙；及

.2 ISO 5658-2，對消防試驗的反應 － 播焰 － 第2部分：垂向構形建築和運輸產品上的橫向傳播。

3 定義

就本附錄1而言，ISO 13943標準和ISO 5658-2標準中給出的、及下列術語和定義適用。

3.1 *載模板*係指寬度和長度與試樣相同，厚度為12.5±3毫米、密度為950±100kg/m^3的不燃板，用以承載試樣。

3.2 *校準板*係指附錄2圖11所定義的模擬試樣，僅擬與試樣共用進行熱通量梯度校準。

3.3 *補償熱電偶*係指產生代表長期煙囪金屬溫度變化電信號的熱電偶。所產生信號的一個分數從煙囪氣體熱電偶產生的信號中減除。

3.4 *熄滅臨界通量*係指試樣表面火焰沿其水平中線停止前進並之後會熄滅的一點上的入射熱通量。

註： 所報告的熱通量值基於不燃校準板測量值的內插值。

3.5 *模擬試樣*係指用於使設備運作條件標準化的試樣。該試樣須為不燃板（例如硅酸鈣板）烘乾密度為950±100kg/m^3且其尺寸須為：長度795毫米至800毫米，寬度150毫米至155毫米，厚度25±2毫米。

3.6 *煙囪*係指設有熱電偶和節氣門的箱形導管，供試樣燃燒所產生的火焰和熱煙氣通過。其目的是使試樣燃燒所釋放的熱得到測量。

3.7 *引燃熱度*係指自初始試樣暴露直至火焰前鋒到達150毫米位置的時間與此位置的通量水平的乘積；後者在儀器預先校準時獲得。

3.8 *試樣的熱釋放*係指在加於試樣上的可變通量場之下觀測到的並按照試驗方法的定義測量的熱釋放。

3.9 *持續燃燒熱度*係指自試樣暴露至火焰前鋒到達一個特定位置的時間與量自不燃校準板的該位置相應入射熱通量的乘積。這須對始自150毫米測點的各個測點進行計算，但是，對某一給定測點的計算須在觀測到火焰沿試樣中線傳播至距下一測點的半途以上時方可進行。

3.10 *反射金屬絲*係指位於板熱源表面之前但與之靠近的金屬絲網。該網用於增強燃燒效率並增加板的輻射。

3.11 *觀測耙*係指一套帶有間距為50毫米的金屬絲的量杆，其目的為增加對火焰沿試樣進展計時的精確度。

4 試驗原理

4.1 本試驗提供了垂直取向155毫米×800毫米試樣的可燃特性評定方法。

4.2 將試樣暴露於燃氣輻射板供給的分級輻射通量場。備有對火焰沿試樣長度的點燃、傳播和熄滅時間進行觀測的手段，以及對燃燒進展中煙囪氣體熱電偶的經補償毫伏信號進行測量的手段。對試驗結果作如下報告：點燃熱度、持續燃燒熱度、熄滅時的臨界通量和試樣在燃燒期間的熱釋放。

5 設施與儀器要求

5.1 總則

ISO 5658-2標準中對除熱釋放測量設備（即煙囪及其熱電偶）之外的試驗儀器作出了規定。進行此試驗所需設施和儀器的詳細說明包含於本部分附錄2之中。符合該附錄的規定是本試驗方法的一項關鍵要求。所需設備可概述如下。

5.1.1 設有煙氣排氣系統和新鮮空氣進氣系統的特殊試驗房間。

5.1.2 裝有鼓風機或其他燃燒空氣源的輻射板框架，設有適當安全控制的甲烷或天然氣供應系統，及帶有反射網、設置為對垂直試樣輻射的輻射熱源。或者可使用同樣尺寸的電熱輻射源，但須使試樣暴露於附錄2表1中所示的熱通量分佈。任何輻射板的有效源溫度不大於1,000℃。

5.1.3 試樣夾框架，三個試樣夾，一個點火燃燒器，試樣夾導軌，觀測耙和一面觀測鏡。

5.1.4 裝有煙囪氣體和煙囪溫度補償熱電偶以及補償信號幅度調節裝置的試樣煙囪。

5.1.5 測量儀器包括一台計時器、數字或長秒針電動鐘，一台數字毫伏計，一台雙頻道毫伏記錄儀，瓦斯流量計，熱通量計，一台廣角全輻射高溫計和一塊秒錶。在試驗中運用數據獲取系統記錄板輻射和熱釋放煙囪信號將有利於數據整理。

6 校準

機械、電氣和熱校準須按照附錄2中的規定進行。這些調整和校準須在初始安裝之後以及其他有需要時進行。

6.1 每月核實

試樣上熱通量分佈校準和煙囪帶有其熱電偶系統的正確運作須通過每月、或如有必要，更加經常的測試加以證實（見附錄2第4.3和4.6段）。

6.2 每日核實

作為保證儀器不斷得到正確調整的手段，須每日、或如因試樣性質需要，更加經常地進行下列測試。

6.2.1 *調整點火燃燒器*

6.2.1.1 將丙烷氣體和空氣的流率分別調整至約0.4*l*/min和1*l*/min，以提供長度為230±20毫米的垂直火焰。在暗室中觀測時，火焰須在垂向試樣夾之上延伸出約40毫米（見附錄2圖6）。記錄點火燃燒器的丙烷和空氣流率。

6.2.1.2 通過將燃燒器移近或移離模擬試樣暴露面的平面，調整火焰對模擬試樣的作用區域。旋轉位於其支架中的點火燃燒器，直至火焰觸及到試樣暴露高度的上半部分。

6.2.1.3 須對點火火焰進行檢查，如有必要，每天按照上述方式加以調整。某些試樣的性質會使此調整有更為經常進行的必要。

6.2.2 *煙囪氣體熱電偶*

煙囪氣體熱電偶須至少每日通過輕刷加以清潔。對產生濃重煙灰雲團的材料進行實驗時，會需要更加經常地進行這種清潔，在某些情況下，每次試驗之前需要進行一次。對這些熱電偶須逐一檢查其電氣連接，以確保有效熱接點的存在。對並聯煙囪熱電偶進行每日清潔之後，須對其本身和補償連接點進行檢查，以核實它們和煙囪之間的電阻大於10^6歐姆。

6.3 對作業的連續監測

6.3.1 每當設備處於待命作業狀態時，須將一個模擬試樣繼續安裝在通常試樣所佔據的位置上。這是連續監測程序的必要條件，實現連續監測要測量：

.1 煙囪熱電偶和牢固安裝在試樣夾框架上、面對輻射板的全輻射高溫計的毫伏信號；或

.2 煙囪熱電偶和位於距第3.5段中定義的模擬試樣暴露熱端350毫米處的熱通量計（見附錄2第4.3.2段）的毫伏信號。

6.3.2 這些測量方法的任何一種都可令人滿意地確定業已達到適當的熱作業水平。使用輻射高溫計更好，因為這對板的運作水平即便在實驗進行中也可以進行連續監測。在試驗之前，兩種信號均須實質上保持恆定3分鐘。輻射高溫計或熱通量計所觀測到的作業水平須，在2%之內，與附錄2表1中規定的和上述第6.1段中所述校準程序中提到的類似要求水平相當。

7 試樣

7.1 所需數量

7.1.1 *所需試樣*

對於每一不同暴露表面，須至少提供六份試樣。

7.1.2 *試驗所需數量*

對於所評定和應用的產品，對其每一不同暴露表面須對三份試樣進行試驗。第8.3段中規定了再試驗的條件。

7.2 尺寸

7.2.1 試樣須為150毫米至155毫米寬，795毫米至800毫米長，並須對產品具有代表性。

7.2.2 試樣厚度：常規厚度為50毫米或以下的材料和複合物須使用其完整厚度進行試驗。厚度大於50毫米的材料和複合物，須通過切削非暴露面將厚度減至47毫米與50毫米之間而獲得所需試樣。

7.3 基底

7.3.1 *表面材料和地板敷料的基底*

材料和複合材料須使用其完整厚度，在適用時，用黏合劑附在其實際應用時所附着的基底上進行試驗。試樣須反映出實際應用。

7.3.2 *甲板基層敷料的基底*

試樣須塗施於厚度為3±0.3毫米的鋼板上。試樣須具有標定厚度；甲板敷料的構成和構造須反映出實際應用。

7.4 複合材料

7.4.1 組合須符合第7.2段的規定。但是，如在組合製造中使用了薄的材料或複合物，出現的空氣間隙和（或）任何底層構造的性質可能會顯著影響暴露面的可燃特性。須認識到底層的影響並小心確保對任何組合所獲的實驗結果切合於其實際應用。

7.4.2 與隔熱共用的防潮層須在沒有任何其他構成給予輻射板防護的情況下進行試驗。試樣的基底須反映出船上的實際應用。

7.5 金屬表面

如擬對金屬光亮表面試樣進行試驗，則須對其原樣進行試驗。

7.6 試樣標記

在每個試樣待試驗面上須沿其長度標出一條中心線。須小心避免使用會影響試樣性能的線。

7.7 試樣的調理

試驗前，試樣須在溫度23±2℃和相對濕度50±5%之下，調理至恆定含水量。間隔為24小時的連續兩次稱重作業所測得的質量與試樣質量之差不大於0.1%時，可視為已到達到恆定含水量。

8 試驗程序

8.1 總則

試驗方法涉及到將調理後的試樣裝設於清楚限定的通量場之中並對燃着時間、火焰傳播及其最終熄滅，以及表明試樣燃燒期間熱釋放的煙囪熱電偶信號進行測量。

8.1.1 在一個冷卻的夾具中，遠離輻射板的熱度製備經適當處理的試樣。在將試樣插入試樣夾之前，試樣的背部和邊緣須用厚度為0.02毫米、尺寸為175+a毫米×820+a毫米（其中“a”為試樣厚度的兩倍）的單張鋁箔加以包裹。插入試樣夾中時，各試樣須使用冷卻載模板為後墊。在試樣夾中裝入非剛性試樣時，須在試樣和夾具凸緣之間放置薄墊片，以確保試樣暴露面與點火燃燒器保持和剛性試樣同樣的距離。對於這種材料，經常僅在試樣熱端100毫米的長度會需要薄墊片。

8.1.2 試樣夾中的模擬試樣須安裝到位，面對輻射板。設備上的煙氣排風系統須啟動。

8.1.3 運作輻射板以實現第6.3段中規定的試驗條件。啟動毫伏記錄儀記錄煙囪熱電偶的輸出信號以及按照第6.3.1.2段中的規定定位的全輻射高溫計或熱通量計的輸出信號。

8.1.4 預熱後，當輻射板和煙囪信號達到平衡時，點燃引火火焰，調整其燃料流率並對兩種信號觀測至少3分鐘並核實連續信號穩定性。

8.1.5 在兩種信號均達到穩定水平之後，移出模擬試樣夾並在10秒鐘內將試樣插入試驗位置。立即啟動時鐘和計時計。

8.1.6 操作計時計上的結果標示器標示燃着時間和試樣初始快速投入期間的火焰前鋒到達時間。到達某一給定位置須作為觀測到試樣縱向中心線上的火焰前鋒與觀測耙的兩個相應金屬絲的位置相一致的時間加以觀測。從計時計圖表上測量出的和從時鐘上觀測到的這些時間均做手工記錄。須儘可能記錄火焰前鋒沿試樣到達每一個50毫米位置的時間。記錄試樣上火焰燃燒進展停止的時間和位置。輻射板的運作水平以及煙囪信號，須在試驗全程進行記錄並繼續到試驗結束。

8.1.7 試驗過程中，不得為補償其運作水平變化而對輻射板燃料供應率做任何調整。

8.2 試驗時限

8.2.1 當下列任何一項適用時，須終止試驗、移除試樣，並將在試樣夾中的模擬試樣重新插入：

.1 試樣在暴露10分鐘後未點燃；或

.2 試樣上所有火焰已熄滅3分鐘或10分鐘暴露，以時間長者為準。

8.2.2 須對另外兩份試樣重複第8.1.1至8.1.7段中的作業（見第8.3段）。

8.3 再試驗的條件

8.3.1 在對一份或兩份試樣進行試驗期間，如未能獲得完整火焰傳播時間或合理的熱釋放曲線而試驗失敗，則須放棄所獲得的數據並進行新的試驗。此類失敗會涉及到，但不限於，觀測數據不完整或數據記錄設備故障。煙囪信號基線的過度漂移亦須要求進行進一步設備穩定和再試驗。

8.3.2 如試樣在試驗中出現不完全燃燒材料的大量損失，則須對至少一個補充試樣用家禽網固定在試驗框架中進行試驗，並將所獲得的數據另行報告。

8.3.3 針對試樣在試驗中的表現，須採用下列程序：

.1 如點火火焰熄滅：報告發生的情況，放棄數據並重新試驗；或

.2 如試樣碎裂並掉出試樣夾，報告此表現，但依據使用、或不使用本部分第8.3.2段中的試樣固定的最差性能定級。

8.4 觀測

除記錄試驗數據外，對試樣的表現，包括但不限於閃光、火焰前鋒不穩定、火星、燒紅、燒黑、熔化、火焰熔滴、試樣解體、裂縫、熔合、變形，須進行觀測和記錄。

9 所獲得的燃燒特性

試驗結果須以熱電偶電路輸出的熱基線和在模擬試樣就位之下測定的入射通量測量作出報告。試驗結果不得為補償試驗期間輻射板和點燃火焰的熱輸出變化而加以調整。下列數據須從試驗結果中得出。

9.1 引燃熱度

如第3.7段中的定義。

9.2 持續燃燒熱度

如第3.9段中定義的此特性數值列表。

9.3 持續燃燒平均熱度

9.3.1 在不同測點上測出的第3.9段定義的特性數值的平均值，第一測點位於150毫米處及之後在間隔50毫米的測點直至最後測點或位於400毫米處的測點，以低值者為準。

9.3.2 對於每個火焰前鋒未至175毫米位置的試樣，持續燃燒熱度未能確定。如對一個試樣未能確定持續燃燒熱度，則使用另外兩個試樣的數據計算出Qsb。如對兩個試樣未能確定持續燃燒熱度，則使用第三個試樣的數據計算出Qsb。如三個試樣均未能確定持續燃燒熱度，則Qsb為未確定，並視為業已滿足Qsb標準。

9.4 熄滅臨界通量

所測試試樣的此特性數值列表及其平均值（見第3.4段）。

9.5 試樣的熱釋放

熱釋放時間曲線和熱釋放峰值及總計綜合熱釋放列表須從試驗數據中獲得，並須對熱釋放校準曲線的非線性做出修正。煙囪熱電偶的毫伏信號曲線須包括至少30秒的初始3分鐘的穩定狀態核實期以及插入試樣一刻之前和之後的起始瞬態。將毫伏信號轉換為熱釋放率時，校準曲線的零釋放水平須設定在對有關試樣試驗之前一刻的初始穩定狀態的水平（見附錄2圖10）。

9.5.1 ***總熱釋放***

總熱釋放通過將試驗期間熱釋放率的正數部分整合而得出（見附錄2圖10）。

9.5.2 ***熱釋放率峰值***

熱釋放率峰值係指試驗期間熱釋放率的最大值(見附錄2圖10)。

10 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗確定的數據須做出明確區分：

.1 提及試驗係按照《2010年消防試驗程序規則》附件第5部分進行（另見以下.2小段）；

.2 任何與試驗方法的不同；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱和地址，（如已知）；

.7 材料類型，即，表面飾面、地板敷料、甲板基層敷料，管道、等；

.8 所測試產品的名稱和（或）識別；

.9 取樣程序說明，如相關；

.10 對所測試產品的說明，包括密度和（或）每單位面積的質量、厚度和尺寸、顏色、任何塗層的量和道數、以及產品構造的細節；

.11 對試樣的說明，包括密度和（或）每單位面積的質量、厚度和尺寸、顏色、任何塗層的量和道數、試驗取向和經受測試的面、及構造；

.12 樣品抵達日期；

.13 試樣調理細節；

.14 試驗日期；

.15 試驗結果：

.1 各次試驗的時限；

.2 第9段中述及的推導出的燃燒特性；及

.3 按照第8.4段記錄的觀測；及

.16 確定所測試的材料是否滿足本部分第3和第4段中的性能標準。

附錄2

物理試驗設備技術信息和校準

本附錄規定了用於允許按照本程序進行試驗所需物理設備的建造、架設、調校和校準的技術信息。

1 試驗設備的裝配

圖1和圖2顯示了組裝完畢可進行試驗的設備照片。ISO 5658-2標準中對試驗儀器，除熱釋放測量設備外（即，煙囪及其熱電偶），做出了詳細規定。

1.1 試驗設備組合的簡要部件清單包括：

.1 主框架（圖1），其中包含兩個單獨部分，燃燒器框架和試樣支撐框架。這兩個部分用螺栓拴接在一起，因而在機械調校中提供了機動性；

.2 試樣夾，在試驗期間為試樣提供支撐。需要至少兩個。三個則會避免因安裝試樣時需要冷卻而造成的延遲；

.3 一個試樣煙氣煙囪，用厚度為0.5±0.05毫米的不鏽鋼片製成並具備全套氣體和煙囪金屬補償熱電偶；

.4 輻射板，輻射表面的尺寸為280毫米×483毫米。為用於此設備之中，用可商業購買的多孔反射瓦專門定製；

.5 燃燒空氣供應鼓風機、輻射板、空氣流量計量裝置、瓦斯控制閥、減壓器和安全控制均安裝在燃燒器框架上。要求概述如下：

.1 以足以克服經過管道、計量裝置和輻射板的摩擦損失的壓力提供約30m^3/h的空氣供應。輻射板滴量僅為數毫米的水；及

.2 所用瓦斯可以是天然氣、甲烷或丙烷－丁烷。不建議使用甲烷或天然氣以外的其他瓦斯氣體，雖然對板－試樣的間隔做出改變後，有可能使用丙烷在50kW/m^{2}的通量水平使用該設備。須提供壓力調節器以保持恆定供應壓力。瓦斯通過手動針閥控制。無需文氏混合器。安全裝置包括電動截止閥，在發生電力故障、空氣壓力故障和燃燒表面失熱時切斷瓦斯流。在克服管線壓力損耗的壓力下，天然氣或甲烷的瓦斯流量要求為約1.0m^3/h至3.7m^3/h；

.6 試樣夾、點火火焰夾、煙囪、火焰前鋒觀測耙、輻射高溫計和觀測鏡均組裝在試樣支撐框架上。此框架上的部件佈置顯示於圖1和圖2之中；及

.7 本部分附錄1第3.5段定義的模擬試樣須持續安裝在器械上試樣在設備運作期間所處的位置。此模擬試樣應僅在插入試樣時方取下。

2 測試儀器

2.1 全輻射高溫計

此高溫計在1米和9米的熱波長之間具有充分恆定的敏感度並應觀測板中心處約150毫米×300毫米的區域。此儀器應安裝在試樣支撐框架上能觀測到板表面之處。

2.2 熱通量計

2.2.1 此試驗方法最好有至少三個熱通量計。熱通量計應為熱電堆型，標定範圍為0kW/m^{2}至50kW/m^{2}並能在此額定值的三倍上安全運作。

2.2.2 熱通量計須按照ISO 14934-3標準，消防試驗－熱通量計的校準和使用－第3部分：二級校準方法進行校準。其中兩個應留作實驗室參照標準。其精度應校準至±5%之內。

2.2.3 應用通量目標感測應佔用不大於80毫米^{2}的面積，並位於熱通量計水冷25毫米圓形暴露金屬端的中心並與之齊平。如使用直徑較小的熱通量計，則應將其插入外直徑為25毫米的銅套管內，並在套管和水冷熱通量計體之間保持良好熱接觸。套管末端和熱通量計暴露表面應處於同一平面上。輻射在到達目標之前不應穿過任何窗口。

2.3 計時裝置

應提供一台計時計和，或者一台帶有長秒針的電動時鐘或者一台數字時鐘，用以測定引燃時間和火焰推進時間。測定引燃時間和初

始火焰推進時間的計時計可包含紙速為5毫米/秒的紙帶記錄儀和結果標示筆。計時計的紙驅動器和電動時鐘應通過共用開關操縱，在試樣暴露時，同時開始運作。這可為手動或由完成試樣插入自動啟動。

2.4 記錄毫伏計

應使用輸入阻抗至少為一兆歐姆的雙頻道紙帶記錄毫伏計，記錄煙囪熱電偶信號和輻射高溫計的輸出。來自煙囪的信號在大多數情況下將低於15毫伏，但在某些情況下會有少許超出。另一頻道的敏感度應選定為要求小於所選用的全輻射高溫計或通量計的全刻度偏轉。輻射板的有效運行溫度通常不應超過935℃。

2.5 數字伏特計

一台小型數字伏特計將便於監測輻射板運作條件的變化。該伏特計應能夠顯示10μV或以下的信號變化。

3 試驗空間

3.1 特殊房間

應為進行此試驗提供特殊房間。其尺寸並非關鍵，但可為大約45立方米，天花板高度不低於2.5米。

3.2 煙氣排氣系統

在天花板之上應安裝空氣和燃燒產物排除能力為30立方米/分鐘的排氣系統。此系統在天花板上的格柵開口應用自天花板降至距房間地面1.7±0.1米、1.3米×1.3米的耐熔纖維織物裙圍繞。試樣支撐框架

和輻射板應位於此罩之下、使全部燃燒煙氣均從房間內排出的位置。

3.3 器械

這應位於距試驗房間邊牆有至少1米淨空間隔的位置。輻射熱源2米之內不得有天花板、地板或牆壁的可燃飾面材料。

3.4 空氣供應

要求有室外空氣供應通道，以置換排氣系統排出的空氣。其佈置方式須使環境溫度保持合理穩定（例如：空氣可從相鄰有供暖的建築中汲取）。

3.5 房間通風

應在煙氣排氣系統運作、但輻射板及其空氣供應關閉的情況下，測量模擬試樣附近的空氣速度。在距離為100毫米時，與試樣長度中間下沿成直角的氣流在任何方向上均不得大於0.2米/秒。

4 組裝和調整

4.1 總則

試驗條件實質上以校準期間模擬試樣上測定的入射熱通量限定。以輻射傳導為主，但對流傳導亦將起到部分作用。試樣表面的入射通量水平是輻射板和試樣之間幾何構型的結果和輻射板熱輸出的結果。

4.1.1 在原試驗條件調整中以及對該調整的定期核實中，以試樣表面

測定出的熱通量為控制標準。此熱通量由安裝在特殊模擬試樣上的熱通量計（見上述第2.2段）測定（見圖11）。

4.1.2 在連續試驗之間，應或者使用如附錄1定義之下第3.5段中限定的、安裝在模擬試樣中的熱通量計，或者最好使用根據熱通量計的讀數事先已定期校準的輻射高溫計對運作水平進行監測。此輻射高溫計應剛性地固定在試樣夾框架上，並對輻射板表面進行連續觀測（見第2.1段）。

4.2 機械調校

4.2.1 對大多數試驗儀器部件的調校可在冷狀態下進行。輻射板反射面相對於試樣的位置必須與圖3中所示尺寸相符。

4.2.2 這些相對關係可通過在板及其安裝架之間適當使用墊片、調整兩個主框架之間的分離及調整試樣夾導軌而實現。在第5段中，就這些調整的詳細程序提出了建議。

4.2.3 測量熱釋放的煙囪應以機械方式安裝在試樣支撐框架上圖4中所示的位置。

4.2.4 安裝方法應確保所示相對位置並應允許煙囪易於拆除以供清潔和（或）修理。補償熱電偶的安裝方式應在實現良好熱接觸的同時確保與煙囪金屬壁之間的電阻大於一兆歐姆。

4.3 板運作水平的熱調節

4.3.1 板運作水平的熱調節通過首先將通過板的氣流設定為$30m^3/h$而

實現。之後供應並點燃瓦斯及在其之前裝好模擬試樣的情況下待其達至熱平衡。在正確運作條件下，除在側面與表面平面平行觀察時之外，板表面不應有可見火焰。在側面觀察時，可見到一薄層藍色火焰緊貼板的表面。在15分鐘預熱期之後，斜視板的表面可見到亮橙色輻射表面。

4.3.2 將水冷熱通量計裝於校準板中，試樣上測出的入射熱通量應與表1中所示相符。通過調節瓦斯流量達到此要求。如需要，可對空氣流量稍作調整以取得板表面無明顯火焰的狀態。在使用熱通量計校準的基礎上，準確再現表1中規定的50毫米和350毫米處的熱通量測量值，就會將其他各測點上的通量確定在所要求的界限之內。這並不意味着所有其他通量水平都是正確的，但能確保板與試樣之間的固定構形或觀測幾何構形業已達到。為達到這些要求，可能需要對圖6中所示試樣縱向位置稍作調整。應在所要求的八個通量測量的基礎上製作出分區和平滑曲線。曲線的形狀應與表1中所示典型數據所限定的相似。這些測量很重要，因為試驗結果將在這些通量測量值的基礎上報告。如使用全輻射高溫計監測板的運作，則其信號記錄應在成功完成此校準程序後加以保存。如為滿足50毫米和350毫米處的通量要求需要改變板－試樣的軸向位置，這應通過調整兩個主框架的連接螺栓而實現。這樣，相對於試樣的點火位置將保持不變。為滿足標準中的通量要求可改變試樣止動螺絲的調定，之後，可能需要調整點火燃燒器的安裝位置以保持10±2毫米的引燃間距。

4.3.3 為避免低通量水平時的錯誤信號，熱通量計需要水冷。對冷卻水的溫度應加以控制以使熱通量計計體的溫度保持在室溫溫度的數度之內。如不這樣做，則應就熱通量計計體溫度和室溫溫度之差對通

量測量值作出修正。不提供水冷會導致熱感測表面的熱損壞及熱通量計失去校準。在某些情況下，有修理和再校準的可能。

4.3.4 一旦實現這些運作條件之後，所有未來的板運作應在確定的空氣流量之下，以瓦斯供應量為變量來實現所校準的試樣通量水平。此通量水平應，或者使用固定觀測源表面的一個區域的輻射高溫計，或者使用按照附錄1－（定義）第3.5段中限定的、安裝在一個模擬試樣上的熱通量計於350毫米處加以監測。如使用後一方法，模擬試樣和熱通量計的組合應在試驗之間留在原位。

4.4 調校與校準 － 總則

下列調校與校準在無熱通量計的情況下，用位於與就位的試樣中線平行並處於同一平面上的線型熱源燃燒甲烷氣體而實現。此線型燃燒器由一條長度為2米、內徑為9.1毫米的管子構成。其一端用封帽封閉並在一條線上有15個間隔為16毫米、直徑為3毫米的鑽穿管壁的鑽孔。瓦斯在流經這一線垂直定位的鑽孔時燃燒，火焰向上通過煙囪。用所測定的流率和瓦斯燃燒的淨熱值或低熱值得出已知熱釋放率，這可作為經補償的煙囪毫伏信號的變化加以觀測。在進行校準試驗之前，應進行測量以核實煙囪熱電偶補償業已得到正確調整。

4.5 補償調整

4.5.1 從煙囪熱電偶輸出中減去的補償熱電偶的部分信號，應通過圖7中所示的分壓器的一條支線的電阻加以調整。

4.5.2 此調整的目的是，儘實際可行地從煙囪信號中排除相對緩慢的

煙囪金屬溫度變化導致的長期信號變化。圖8顯示了補償不足、補償正確、和補償過度所導致的曲線。這些曲線通過突然將燃着的瓦斯校準燃燒器靠近試樣的熱端並之後將其熄滅而取得。對於此項調整，校準瓦斯供給率應設定在相當於1千瓦熱率。補償分壓器應調整為所產生的曲線急劇上升至一個穩定狀態的信號，該信號在第一分鐘的瞬間信號上升之後的5分鐘期間基本保持恆定。當校準燃燒器關閉時，該信號應迅速下降並在2分鐘內達到穩定狀態值。在此之後，不應有長期信號上升或下降。經驗表明，補償熱電偶信號的40%至50%應被包括在輸出信號內以達到此條件。正確調定後，在應用校準火焰後不久（見圖8），一個7千瓦的方形熱脈衝應顯示出不大於約7%的跳升。

4.6 煙囪校準

在完成第4.5段中所述的調整並已獲得穩定狀態的基準信號之後，應在輻射板於50.5kW/m^{2}下運行及點火燃燒器未點燃的狀態下，進行煙囪校準。對煙囪毫伏信號上升的校準應通過按照第4.4段中所述的插入和移出線型燃燒器而進行。純度至少為95%的甲烷氣體流率應在0.004m^3/分鐘至0.02m^3/分鐘的範圍內，以足夠的增量變化，令數據可相對於淨或低熱輸入率，以良好界定的煙囪補償毫伏信號上升曲線標繪出。應在將校準燃燒器置於試樣冷端的情況下進行類似校準。兩條曲線在顯示出所標示的熱釋放率上，應在相差約15%以內相互一致。圖9顯示了一條典型曲線。校準燃燒器置於試樣熱端的曲線應為在報告中用來報告所有熱釋放測量值的曲線。至此，試驗設備已校準完畢，可供使用。

5 可燃性試驗儀器的組裝和機械調校

輻射板的部分組裝除支架和反射網外，已經完成。可對設備進行組裝已允許對厚度至50毫米的試樣進行試驗。

5.1 板的框架應直立於水平地面上，最好置於將使用該設備的位置。

5.2 轉環應安裝在其三個導向軸承上。

5.3 板安裝架應栓固在一起，並用四個螺栓栓固在轉環上。

5.4 應檢查該環處於垂直平面上。如誤差很大，可能有必要調整上環支撐軸承的位置。在做此調整之前，應確定誤差是否是該環和軸承滾柱之間間隙過大造成的。如是，則使用大一些的滾柱會解決此問題。

5.5 四個板支撐托架應固定在板的四角。拴固這些托架時不要太用力。安裝這些托架之前，在距板的邊緣最遠的孔中放置一個35毫米的M9帽螺釘。這些螺釘提供了安裝板的手段。

5.6 在每一個板安裝螺釘上放置四個墊圈並將板裝在安裝托架上。

5.7 對輻射板表面與安裝環平面之間的斜度應加以核查。這可以通過使用木匠矩尺和測量板兩端的耐火瓦表面而實現。任何與所要求的15°度角的背離，可通過增加或減少墊圈數量的方式加以調整。

5.8 應轉動輻射板令其面對安裝在垂直面上的試樣。

5.9 板的表面應使用水平儀測量以確保它也在垂直平面上。

5.10 應將試樣支撐導軌位於側面和底部及將點火燃燒器安裝在大概

位置上的試樣框架提至燃燒器框架旁邊，並將兩個框架用兩條螺栓和六個螺母或兩條螺杆和八個螺母緊固在一起。框架之間的間距約為125毫米。

5.11 對框架兩側的間距應進行調整，以確保試樣支撐框架的縱向部件與輻射板的表面成15°度角。

5.12 單試樣夾試樣垂直取向的側導軌應調整為與輻射板表面成所要求的15°度。

5.13 一個空的試樣夾應在導軌上滑行到位，並調整上導軌叉的位置以確保當試樣插入該試樣夾中時，其表面將處於垂直面上。

5.14 對確定試樣軸向位置的止動螺絲應進行調整，以確保點火燃燒器的軸線距試樣的最近的暴露邊的距離為10±2毫米。此調整應使用空的試樣夾和取代點火燃燒器磁管的6毫米直徑250毫米長度的鋼棒再進行一次。當從試樣夾的背面觀察時，該鋼棒軸線和試樣夾的試樣留置凸緣之間的間距應為10±2毫米。

5.15 在試樣夾仍處於緊靠止動螺絲的位置的情況下，應對板與試樣支撐框架之間的間距進行調整，以使尺寸B（見圖3）約等於125毫米。此項調整應通過將兩個框架緊固在一起的兩條螺栓進行。在進行此項調整時，重要的是對各邊作出相同調整以保持第5.11和5.12段中所述調整中要求的角度關係。

5.16 對支撐試樣夾邊導軌的螺母應進行調整以確保尺寸A（見圖3）為125±2毫米。同樣，需要對兩個安裝點做出相同調整。在這樣做時，

應作出核查以確保導軌和試樣夾的邊緣處於一個水平平面上。在進行此項調整時，重要的是確保圖4所示的45毫米的煙囪位置尺寸得到保持。調整尺寸A的另一方法是通過改變第5.6段中提及的墊圈數量。

5.17 如有必要，應重複第5.13段中所述程序。

5.18 應將反射網安裝在輻射板上。其安裝方式必須使它在運作期間受熱時自由擴張。

5.19 帶有50毫米的針的觀測耙安裝在固定於試樣夾導軌上的角鐵之上。將其位置調整為各針位於自試樣暴露於板的最近的一端起每間隔50毫米之處。將觀測耙在該位置上夾緊。

表1 — 至試樣的通量校準

距試樣暴露端的距離(毫米)	試樣上的典型通量水平（kW/m²)	所用校準位置(kW/m²)
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

試樣上的典型入射通量及進行校準測量的試樣位置。50毫米和350毫米處的通量應與典型數值在5%之內相符。其他位置上的校準數據應與典型數值在10%之內相符。

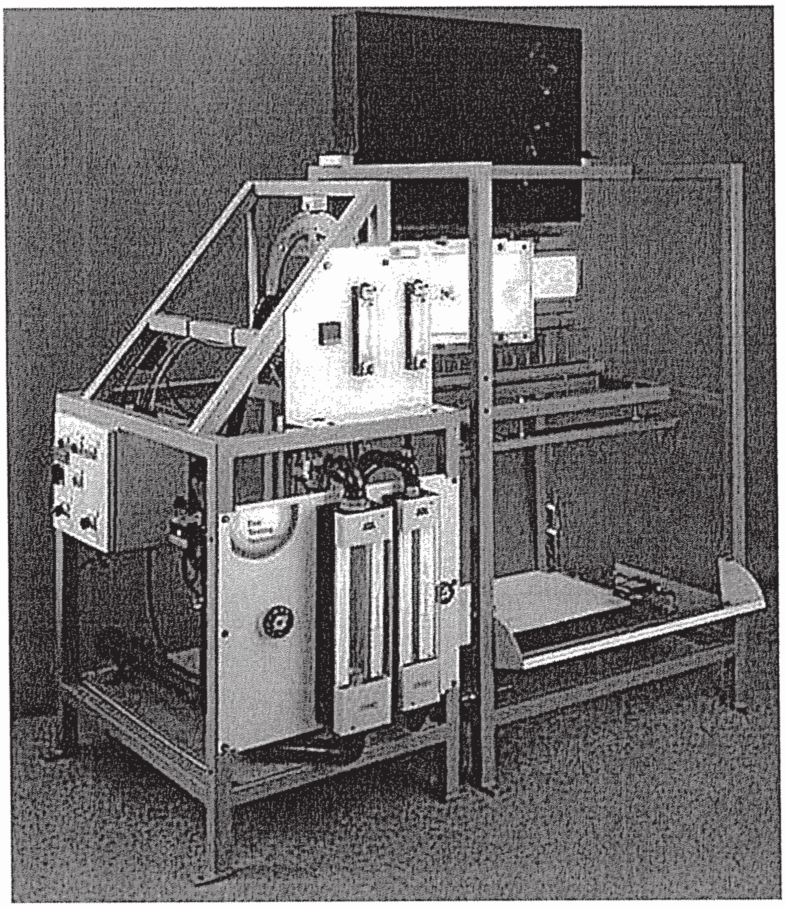


圖1 — 設備概觀

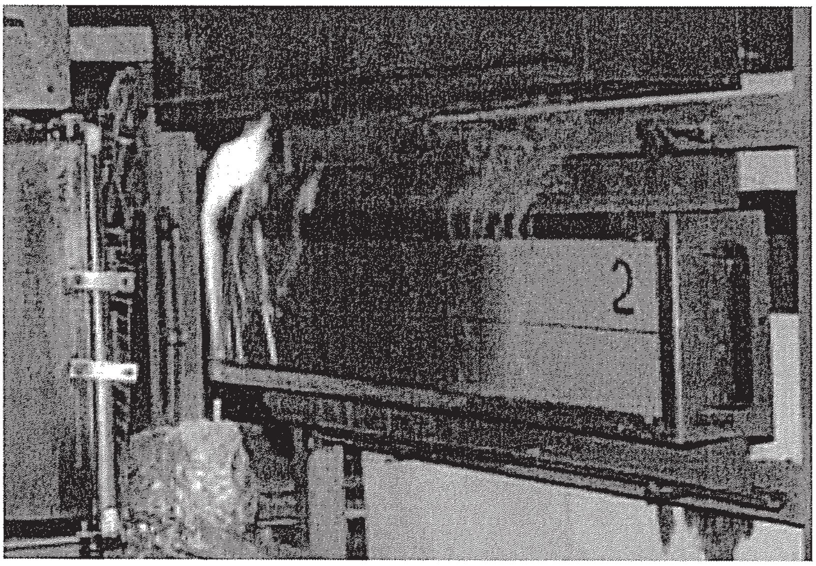


圖 2 — 自試樣一側的觀測

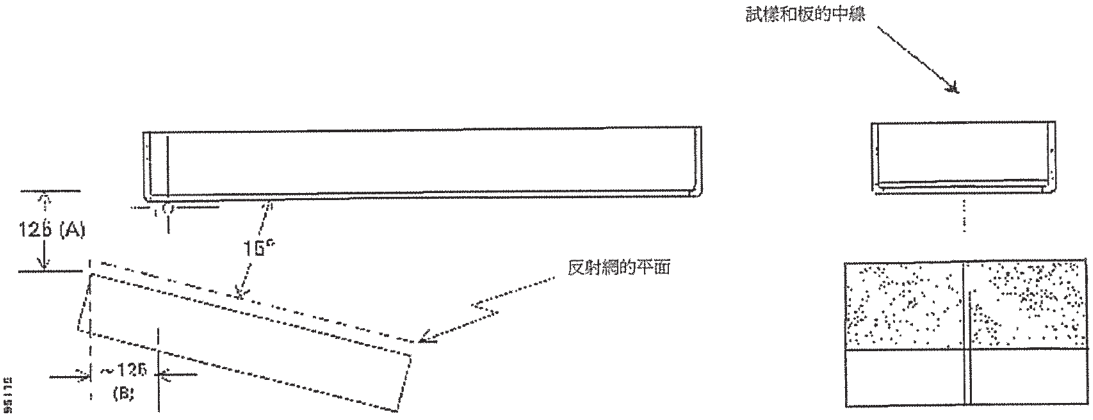


圖3 － 試樣－輻射板的佈置

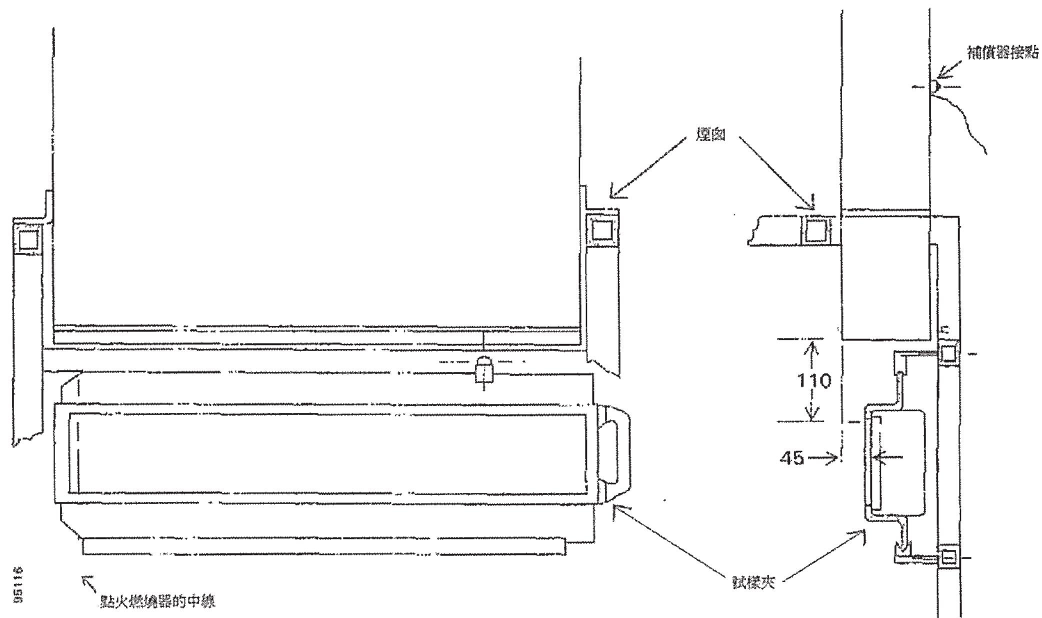
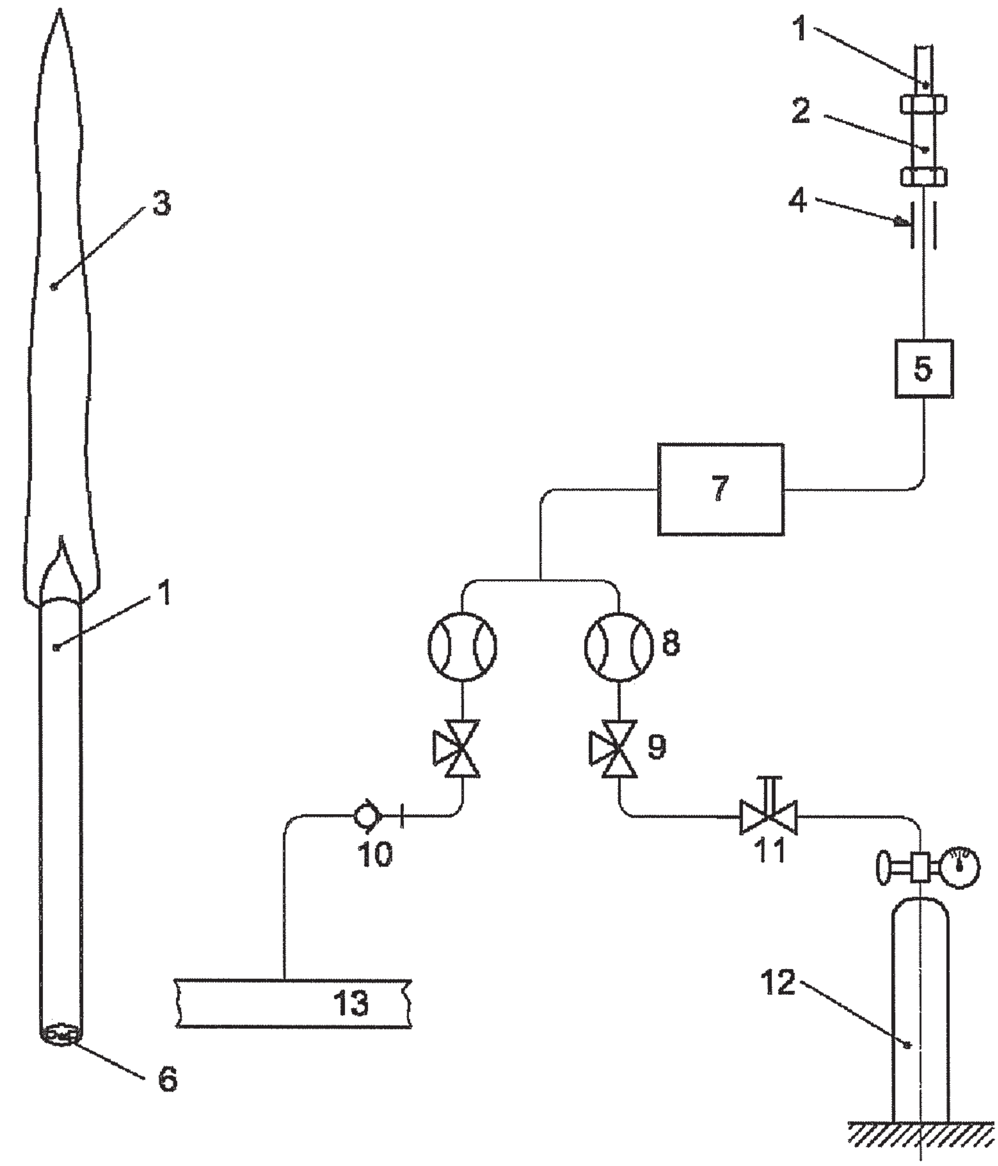


圖4 － 煙囪和試樣的位置



圖例

1 點火火焰燃燒器
2 連接器
3 (230±20)毫米長的火焰
4 燃燒器支架位置
5 阻焰器
6 (200±10)毫米長的雙孔磁管
7 減壓室
8 流量計
9 針閥
10 止回閥
11 開關閥
12 丙烷氣瓶
13 至板的空氣管線

圖5 — 點火燃燒器的細節和連接

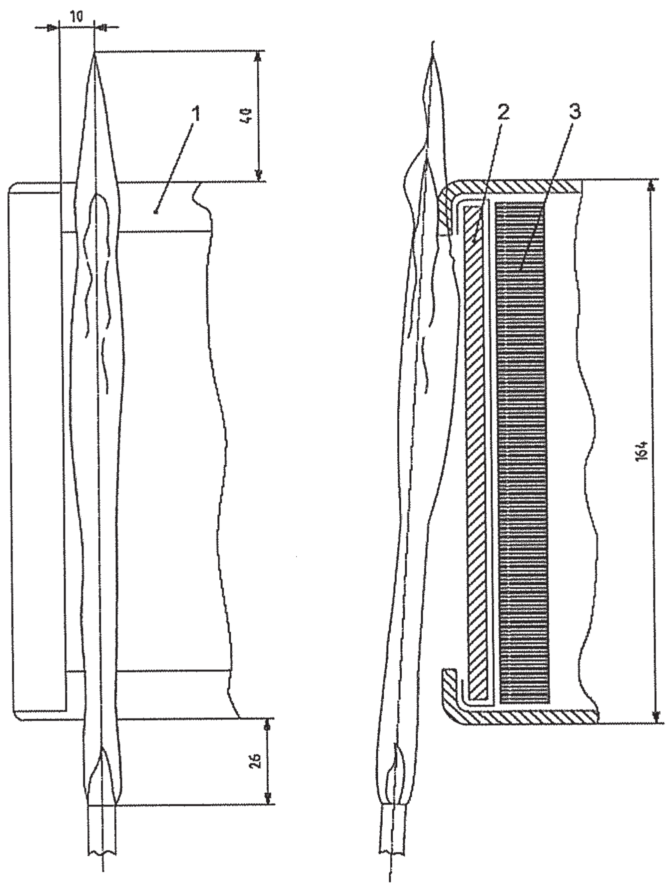


圖6 — 點火火焰的位置

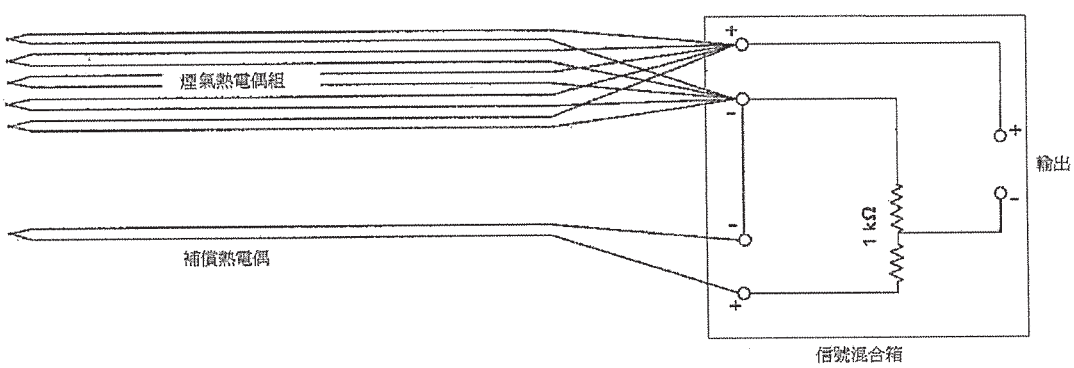


圖7 — 熱電偶電路示意圖

需要兩套熱電偶和導出電線。煙氣熱電偶組內電線尺寸和長度必須一樣，以確保適當信號平均。可在混合箱中通過導線的插座連接實現熱電偶的並聯。這樣可以在最短的時間內迅速拆除和查驗連續性和接地問題。不得使用冷接點但混合箱應有板輻射屏蔽。

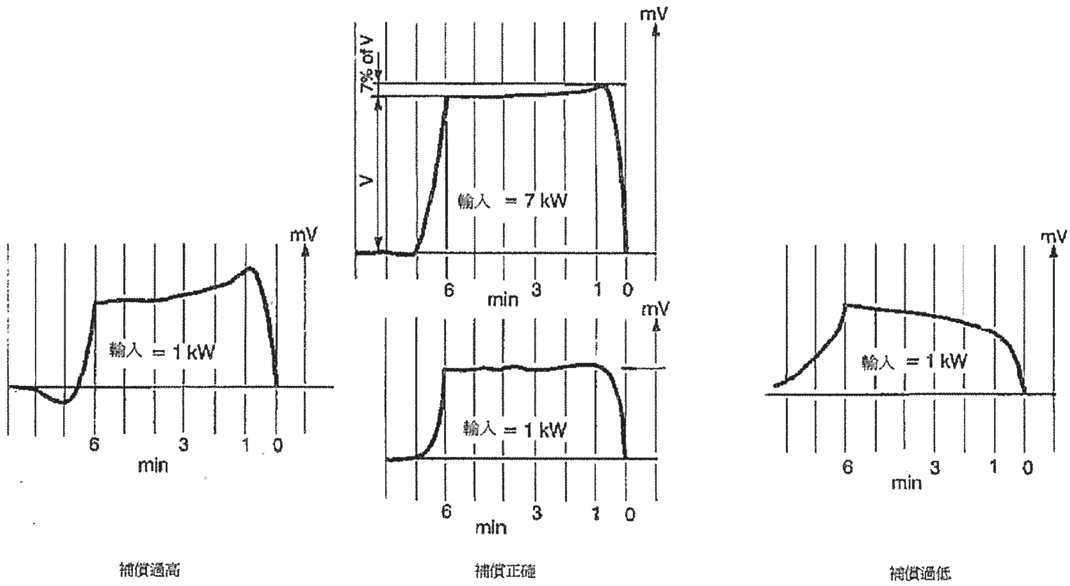


圖8 — 熱釋放信號對方形波熱脈衝的反應表現舉例

（四條曲線顯示了三種不同水平的反向反饋或補償水平的標示毫伏信號上升的例子。各儀器就時間而言的反應性能將因煙囪壁板厚度而不同。）

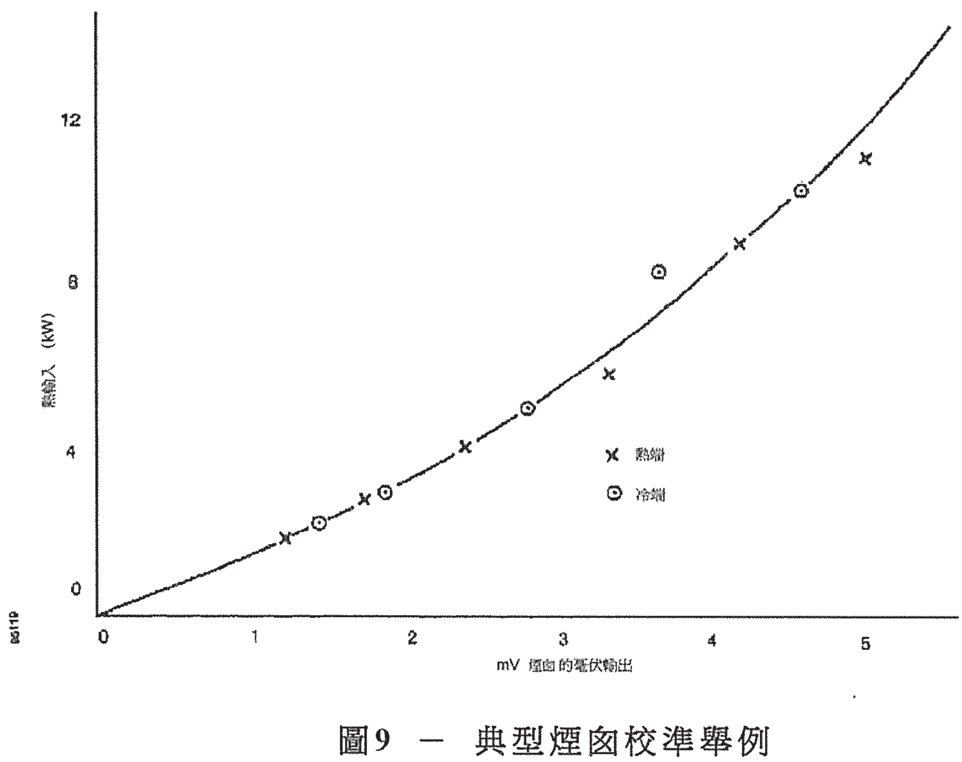


圖9 — 典型煙囪校準舉例

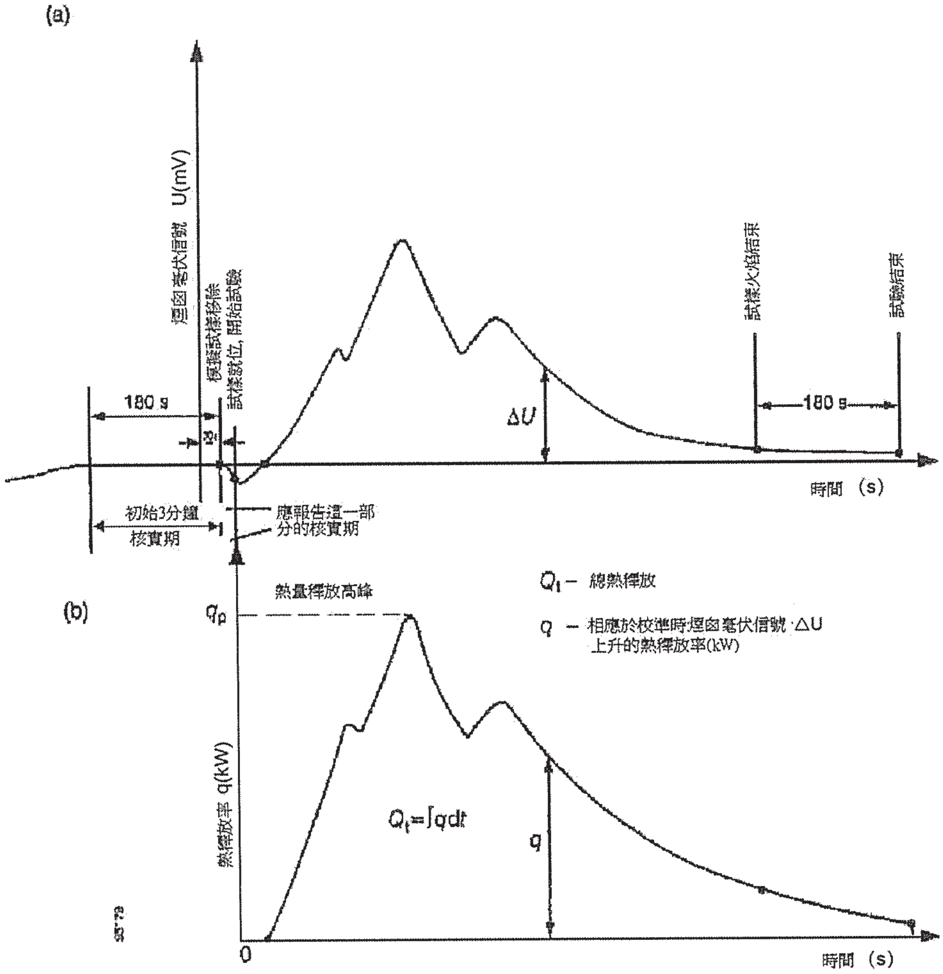
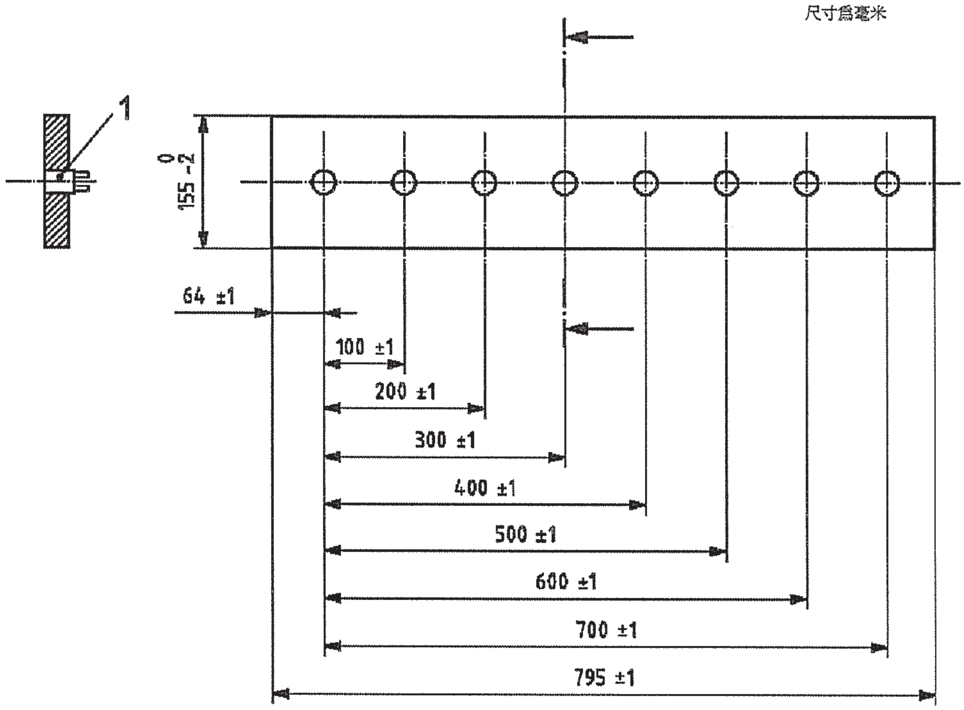


圖10　－　毫伏信號上升ΔU轉換為試樣熱釋放率舉例

（a）實驗中記錄的毫伏信號變化

（b）轉換為熱釋放率曲線的毫伏信號

尺寸爲毫米



圖例

1 緊密固定於25毫米直徑的孔中的熱通量計(如用於300毫米處的測量)

圖11 — 用於入射通量梯級校準的校準板

附錄3

對結果的解釋

對異常試樣表現的評定（見本部分第2.2段）

	異常表現	定級指導
1	閃燃，無穩定火焰	報告火焰和時間的最大進展，及閃燃是否在中線上。根據數據定級。
2	爆發性散裂，無閃燃或火焰	接受該材料通過實驗。
3	表面迅速閃燃，之後穩定火焰進展	報告兩種火焰前鋒的結果但根據兩個燃燒體的各四項試驗參數的最差表現定級。
4	試樣或貼面熔化並滴落，無火焰	報告試樣表現及試樣上的進展程度。
5	爆發性散裂，及試樣暴露部分火焰燃燒	報告該爆發，並根據無論是中線之上或之下的火焰進展定級。
6	試樣或貼面熔化，燃燒、及滴落	無論標準如何拒絕該材料。對於地板敷料，燃燒熔滴少於10滴者可以接受。
7	點燃火焰熄滅	報告發生的情況，放棄數據並重新實驗。
8	試樣解體，並從試樣夾中掉落	報告該表現，但根據有或無本部分附錄1第8.3.2段中的限制情況下的最差表現定級。
9	試樣、黏合劑或結合劑大量噴出可燃高溫分解氣體	報告：未定級為低播焰。
10	沿試樣邊緣仍留有小火焰	報告表現並在試樣暴露面上的火焰熄滅3分鐘後終止試驗。

附錄4

《消防試驗程序規則》第2和第5部分的試樣導則，

及這些產品的類型認可

（認可範圍和使用限制）

1 範圍

本附錄為本規則第2和第5部分選擇和製備表面材料試樣，包括選擇基底和背襯材料，提供了建議性導則。本附錄也為此類表面材料的類型認可條件提供了導則。

2 選擇試樣的基本原則

2.1 基本原則

為試驗選擇的試樣須對船上實際運作條件中的產品特性具有代表性。這意味着應選用預期會有最差結果的產品。試樣選擇應注重產品的厚度、顏色、有機成分、基底，及其組合。

2.2 試樣厚度

一般厚度為50毫米或以下的材料和複合物應使用其完整厚度進行試驗，適用時，用適當黏合劑將其附在基底上。對於一般厚度大於50毫米的材料和複合物，所需試樣應通過切削非暴露面將其厚度減至47毫米至50毫米（第5部分，附錄1，第7.2.2段）。

2.3 基底

表面材料和地板敷料的基底：材料和複合材料須使用其完整厚度、附在將要在實際應用中（適用時，使用黏合劑）附着的基底上進行試驗。該試樣須反映出船上的實際應用（第5部分，附錄1，第7.3.1段）。

2.4 複合物

組件應如附錄1第7.2段（尺寸）中所述。但是，如在製造組件中使用薄的材料或複合物，空氣間隙的存在和（或）任何底層構造的性質可能會對暴露面的可燃特性有顯著影響。對各底層構造的影響應有認識並小心確保對任何組件所獲得的試驗結果切合其實際應用（第5部分，附錄1，第7.4.1段）。

2.5 地板敷料試驗

2.5.1 如要求地板敷料具低播焰性，則所有各層均須符合第5部分的規定。如地板敷料為多層構造，主管機關可要求對地板敷料的各層或某些層的組合進行試驗。地板敷料的各層或數層的組合（即，試驗和認可僅適用於這一組合）須符合本部分的規定（第5部分，第4.2.3段）。

2.5.2 因此，多層地板敷料，如各層均符合第5部分（地板敷料標準）的規定，則可以接受；或者可進行對複合狀況的試驗。這樣，只要各個所用材料符合第5部分的規定，就有可能進行各層的替換。

2.6 試樣的不同顏色和有機成分

試樣的顏色和有機分通常對消防實驗的結果具有顯著影響。試樣的有機成分對於產品的燃燒特性是一個關鍵要素。應選用產品變化中具有最多有機成分的試樣。試樣的顏色也是關鍵，因為吸收輻射熱的較深的試樣顏色將極大地影響其可燃性。因此較深顏色試樣和較亮顏色試樣的試驗結果將是不一樣的。總之，如產品有不同顏色，則至少應選用具有最多有機成分和深顏色的試樣。

2.7 按照第2部分免除試驗

表面材料和甲板基層敷料如其總熱釋放（*Qt*）不大於0.2MJ及熱釋放率峰值（*Qp*）不大於1.0千瓦，（兩個數值均按照附件1第5部分確定），則被視為符合第2部分的要求而無需再做實驗（見附件2第2.2段）。

3 表面材料類型認可範圍

3.1 按照第2節所述試樣選擇基本原則，類型認可的範圍將按照試樣包括其基底或背襯材料的選擇，予以考慮。

3.2 表1顯示出試樣基底與表面材料類型認可範圍的關係。

表1 － 試樣基底和表面材料的類型認可
（認可範圍和使用限制）

在下表中：

第一欄：有待試驗的產品。

第二欄：基底。

第三欄：認可範圍和使用限制。

產品	試驗基底	產品船舶應用限制
漆和表面貼面	鋼 (例如，1毫米)	1 產品可在任何類似或更厚基底的金屬基礎上應用（金屬基礎如鋼、不鏽鋼或鋁合金）。 2 非金屬不燃材料上的應用未經認可。 3 酌情限制，確保產品已被試樣涵蓋（如厚度、黏合劑、有機成分、密度、顏色範圍）。 4 當產品將應用於已獲認可的地板敷料或甲板基層敷料時，對基礎材料將沒有限制。
	附錄1第3.5段中規定為模擬試樣的標準硅酸鈣板	1 產品可應用於任何不燃基底。 2 酌情限制，以確保產品已被試樣涵蓋（如厚度、黏合劑、有機成分、密度、顏色範圍）。
表面貼面	試驗時未使用基底（該產品具有足夠試驗厚度無需基底）	1 產品如不需任何黏合劑或可燃材料層，可應用於任何金屬基礎和不燃基礎。 2 酌情限制，以確保產品已被試樣涵蓋（如厚度、密度、材料構成、黏合劑和使用率、及顏色範圍）。 3 如應用於艙壁或天花板並使用黏合劑，則應要求帶有黏合劑進行組合試驗。
地板敷料和甲板基層敷料	厚鋼材（3毫米）	1 以所試驗的試樣顏色和有機成分為限。 2 可應用於任何低播焰性地板敷料、鋼材、或不燃材料之上。
	組合試驗（多層組合）	1 酌情限制，以確保產品已被試樣涵蓋（如厚度、密度、材料構成、黏合劑和使用率、及顏色範圍）。 2 該產品認可僅適用於此組合。 （如地板敷料為多層構造，主管機關可要求對地板敷料的各層或數層的組合進行試驗。）

4 第2和第5部分的試樣製備

按照第3段中所述試樣基底和表面材料類型認可範圍的關係，對試樣包括基底的選擇應給予認真考慮。本節對如何為本規則第2和第5部分製作試樣做出規定。

4.1 試樣

所選試樣須對產品具代表性。這意味着應選用預期會有最差結果的產品。

4.2 船上應用

試樣應按照第2.2段中規定的厚度進行試驗。應慮及產品在船上將附着的基底選用基底。

4.3 試驗的暴露面

對產品各不同暴露面均應進行試驗（第5部分，附錄1，第7.1.2段）。這意味着產品的各可暴露面；不指顏色。

4.4 試樣尺寸

4.4.1 對於第5部分：寬度150毫米至155毫米，長度795毫米至800毫米（第5部分，附錄1，第7.2.1段）。

4.4.2 對於第2部分：寬度75±1毫米，長度75±1毫米（第2部分，附錄1，第4.2.1段）。

4.5 試樣厚度

4.5.1 試樣應使用其完整厚度進行試驗(第5部分,附錄1,第7.2.2段)。

4.5.2 對於第5部分：最大50毫米（第5部分，附錄1，第7.2.2段）。

4.5.3 對於第2部分：最大25毫米（第2部分，附錄1，第4.2.3段）。

4.5.4 如產品厚度大於以上第4.5.2和第4.5.3段中所述，則應通過切削非暴露面以減至上述最大厚度而獲取試樣。

4.6 漆或表面材料的顏色變化

如產品有顏色變化，則應按照以下所述認真選擇對產品具有代表性的試樣。

4.6.1 ***有機成分***

當以上述4.5段中所示最大厚度應用時，認真選擇具有最大有機成分的產品，以此最大厚度應用的產品，被視為具有最大有機成分。

4.6.2 ***試樣的顏色***

應選擇黑色或深色。

4.6.3 ***關於試樣顏色和有機成分的優先順序***

當顏色最深的產品不是具有最多有機成分的產品時，主管機關或進行試驗的實驗室可就試樣作出決定。如一個黑色或深色試樣和一

個白色或淺色試樣的有機成分含量類似（相差在5%之內）則應選用黑色或深色試樣。否則，應選用具有最大有機成分的試樣。

4.6.4 *關於不同顏色和有機成分的信息*

要求進行類型認可的申請人或生產者應向主管機關或進行試驗的實驗室提交關於不同顏色和有機成分的信息。需要時，主管機關或進行試驗的實驗室可就試樣的選擇向申請人作出指示/提出建議。

4.6.5 *關於類型認可的注意事項*

認可時，如所試驗的試樣可被視為具有代表性的試樣（即 深顏色具有最大有機成分），則所有不同顏色的該產品也可得到認可。如對試樣的具體條件進行了試驗，則類型認可僅供與所試驗的條件相同或類似的產品使用。

4.7 基底

應選用產品在船上實際應用中所附着者為試樣的基底。用金屬基底進行的試驗被認為不同於用不燃基底進行的試驗（第5部分，第1.3段和第5部分，附錄1，第7.3段）。

4.8 基底厚度

應將實際應用中的基底最小厚度選做試樣，因為產品須就與所試驗的基底有類似或更高厚度（但基底要具有400kg/m^{3}或以上的密度）的基底上的應用獲得認可（第5部分，第1.3段和第5部分，附錄1，第7.3段）。

4.9 地板敷料的基底

4.9.1 甲板基層敷料和地板敷料應塗施於厚度為3±0.3毫米的鋼板上。

4.9.2 按照附件1第5部分定級為不易點燃的甲板基層敷料，被視為符合對地板敷料的要求（附件2第5.2段）。

4.10 複合材料（用於艙壁和天花板）

4.10.1 組合的尺寸應如同第5部分附錄1第7.2段中的規定。但是，如在組合製造中使用了薄的材料或複合物，空氣間隙的存在和（或）任何下層構造的性質對暴露面可燃特性會有顯著影響。對下層構造的影響應有認識並要小心確保對任何組合所獲得的實驗結果與其實際中的應用相切合。

4.10.2 對艙壁和天花板應用多層構造的產品時，應要求進行組合各層的表面可燃性試驗以證實這些下層構造的影響（第5部分，附錄1，第7.4.1段）。

4.11 對本規則附件1第3部分所述黏合劑的試驗

第5部分附錄1第3.5段中規定的、描述為模擬試樣的硅酸鈣板，應用作黏合劑的標準基底。

第6部分 — （空白）

第7部分 — 垂直懸掛的紡織品和薄膜試驗

1 適用

帷幔、簾幕和其他懸掛的紡織品，如要求具有不劣於質量為0.8kg/m^{2}的毛織品的阻止火焰蔓延性能，則須符合本部分的規定。

2 消防試驗程序

垂直懸掛的紡織品和薄膜須按照本部分附錄1中規定的消防實驗程序進行試驗和評定。

3 簾幕性能標準

3.1 經附錄1中的消防試驗顯示出具有任何下列特性的產品，須視為不適於用作在含有公約第II-2章有關規定中限定為有限失火風險的家具和裝飾的房間內使用的簾、幕、或自由懸掛的紡織產品：

.1 點火火焰表面應用試驗的10個或更多試樣中的任何試樣的後燃時間大於5秒（另見下列第3.2段）；

.2 點火火焰表面應用試驗的10個或更多試樣中的任何試樣，按照附錄2確定為燒透至任何邊緣（另見下列第3.2段）；

.3 引燃所試驗的10個或更多試樣中的任何試樣之下的棉絨（另見下列第3.2段）；

.4 經表面或邊緣點燃試驗的一批五份試樣中的任何試樣上觀測到的按照附錄2確定的平均碳化長度超過150毫米；及

.5 發生自點燃點漫延100毫米以上、有或無基礎織物碳化的表面閃燃（另見下述第3.2段）。

3.2 對紡織物試驗的試驗數據分析後，如發現經向或緯向剪切的或兩者的五個為一批的試樣，因所試驗的五個試樣中僅一個試樣性能不佳而未達到上述.1至.3和.5小段中規定的一項或多項標準，可允許對類似的一批試樣再進行一次完整試驗。第二批若未能達到標準中的任何一項，則須為拒絕使用該紡織品的依據。

4 補充要求

須使用最後成品（例如經染色處理後）進行試驗。如僅顏色不同，則無需進行新的實驗。但是，如基礎產品或處理程序有變，則須進行新的試驗。

5 試驗報告

試驗報告須包括本部分附錄1第7段中所含信息。

附錄1

垂直懸掛紡織品和薄膜阻焰測定消防試驗程序

警告 — 試驗人員的健康與安全

紡織品燃燒會產生影響試驗人員健康的煙氣和毒氣。在每次試驗後，須使用適當強制通風方法清除試驗區的煙、霧，並恢復所要求的試驗條件。

1 範圍

本附錄規定了判定主要用作垂直懸掛簾幕的紡織品和薄膜符合公約第II-2章有關條款中規定的阻止火焰蔓延要求的消防試驗程序。通常並非本身阻焰的紡織物，須經清潔或暴露程序處理並在此處理之前及之後均進行試驗。

2 定義

2.1 *後燃時間*係指點火源移開或熄滅後材料繼續有焰燃燒的時間。

2.2 *持續燃燒*係指後燃時間為5秒或以上。

2.3 *陰燃*係指材料停止有焰燃燒後或點火源移開後的繼續無焰熾燃。

2.4 *表面閃燃*係指在紡織物表面上的迅速閃燃火焰，主要涉及表面光絨並常令基礎紡織物仍處於基本無損狀態。

3 目的

本試驗方法對紡織物暴露於小點火源之下時阻止持續燃燒和火焰蔓延的能力提供信息。一種紡織物在本試驗中的表現並不一定表明它在暴露於與試驗中所用者有重大不同的條件下的阻止火焰蔓延的性能。

4 試驗設備

4.1 瓦斯燃燒器

須提供如圖1中所示的瓦斯燃燒器。其安裝須使燃燒器筒身的軸線能夠調定至三種固定位置中的每一個位置，即，垂直向上、水平或與水平成60°度角。燃燒器與紡織物所處的相對位置示於圖2中。圖3和圖4顯示出將燃燒器保持在此等位置上的支撐板。

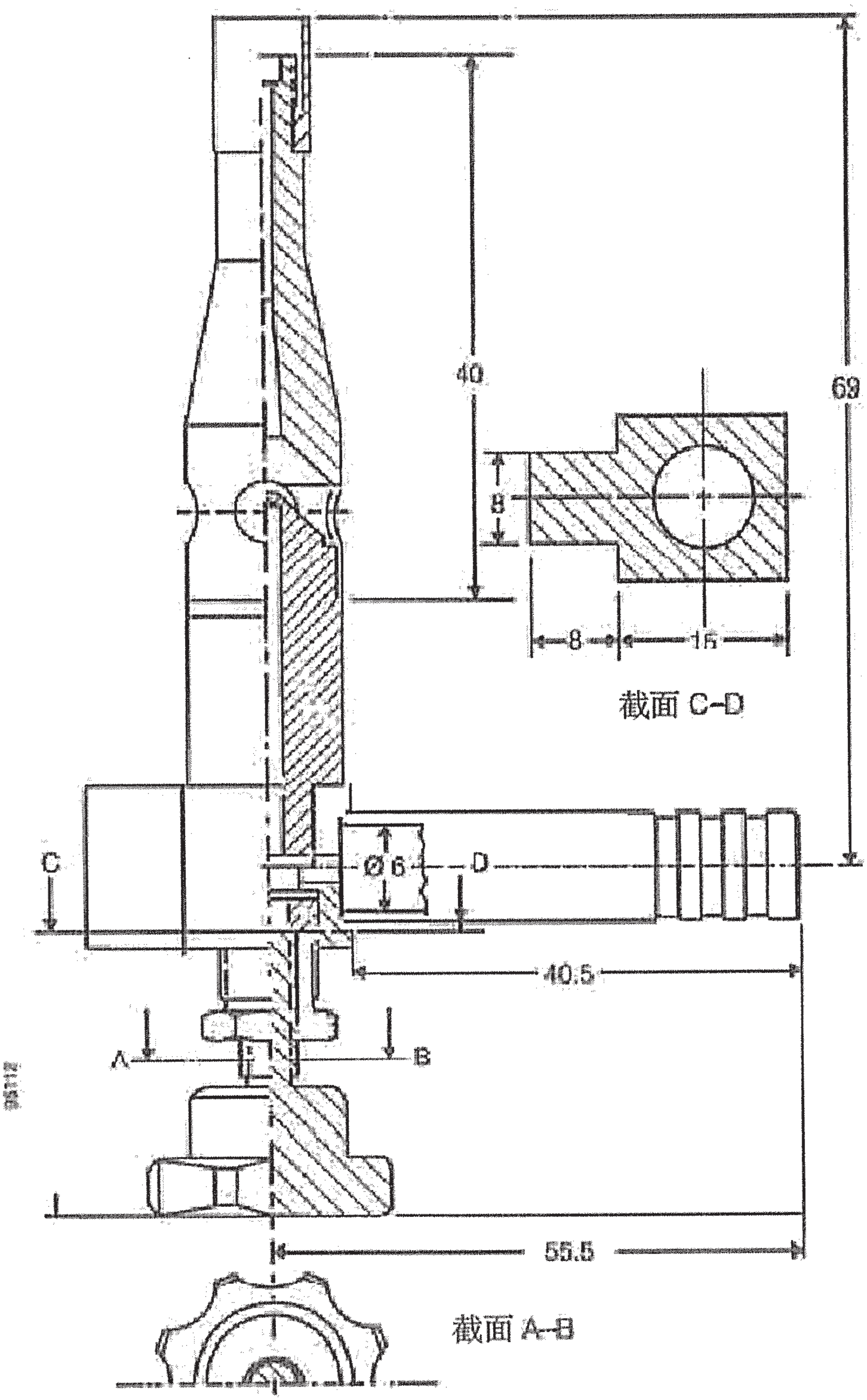


圖1 — 點火燃燒器

（根據：德國工業 — 標準（DIN）50 051類型 KBN）

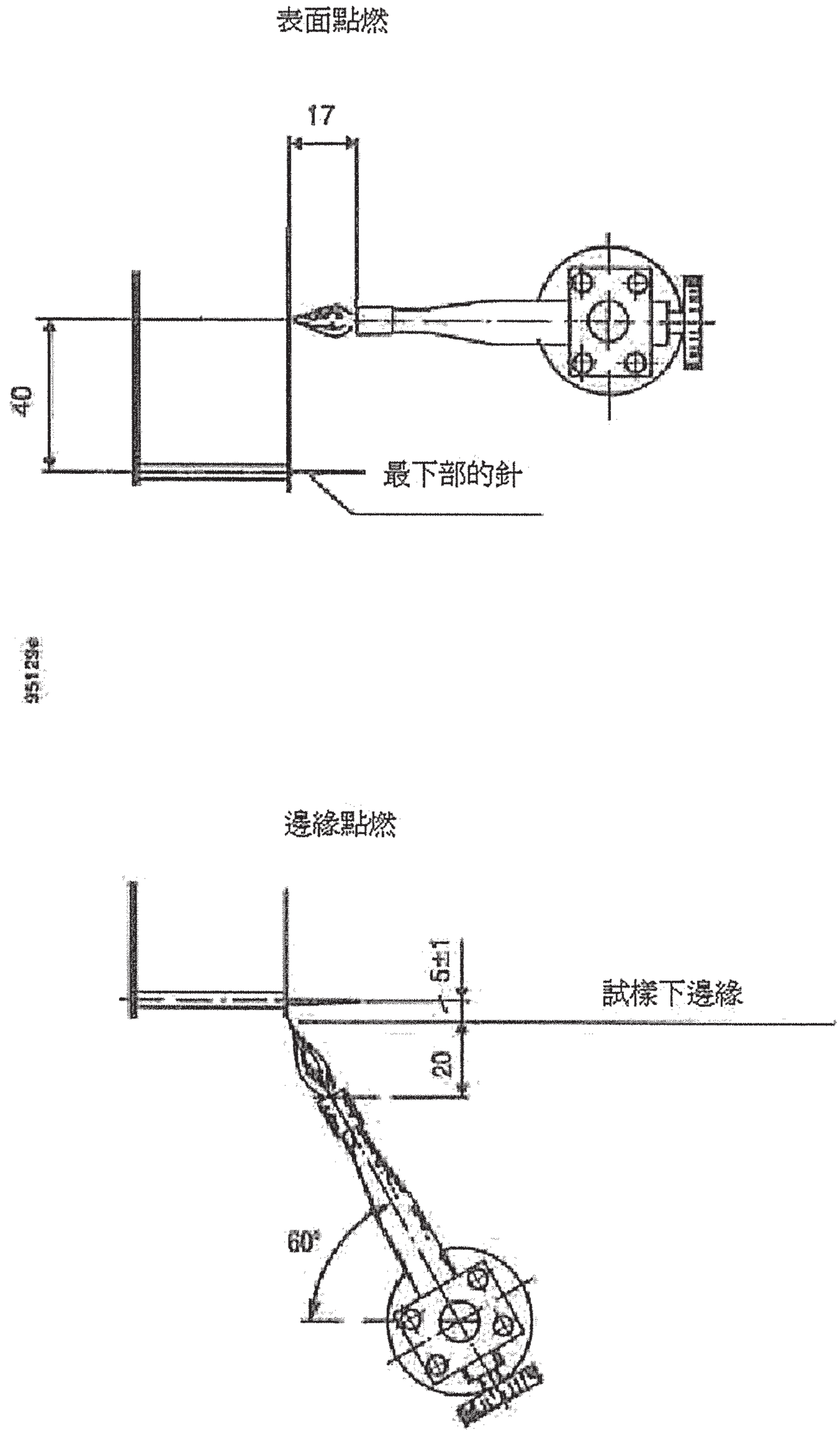


圖2 － 點火燃燒器：紡織物位置

4.2 燃料瓦斯

須使用純度至少為95%的商業級丙烷。

4.3 試樣夾

須提供一個用10毫米寬、2毫米厚的不鏽鋼製成的、長度為200±1毫米×寬度為150±1毫米的矩形試驗框架。用直徑為2±1毫米的不鏽鋼製成的、帶有間距樁的安裝銷釘須固定在試驗框架的各角及兩個長構件的中心點。圖3和圖4為試樣夾的圖解。

4.4 基礎支撐

試樣夾須通過兩個與其連接的垂直立柱支撐在一個剛性金屬基座上。該金屬基座並提供支撐以旋轉燃燒器底座將火焰移至與試樣接觸或自試樣移開。圖3和圖4為基礎支撐和底座的圖解。

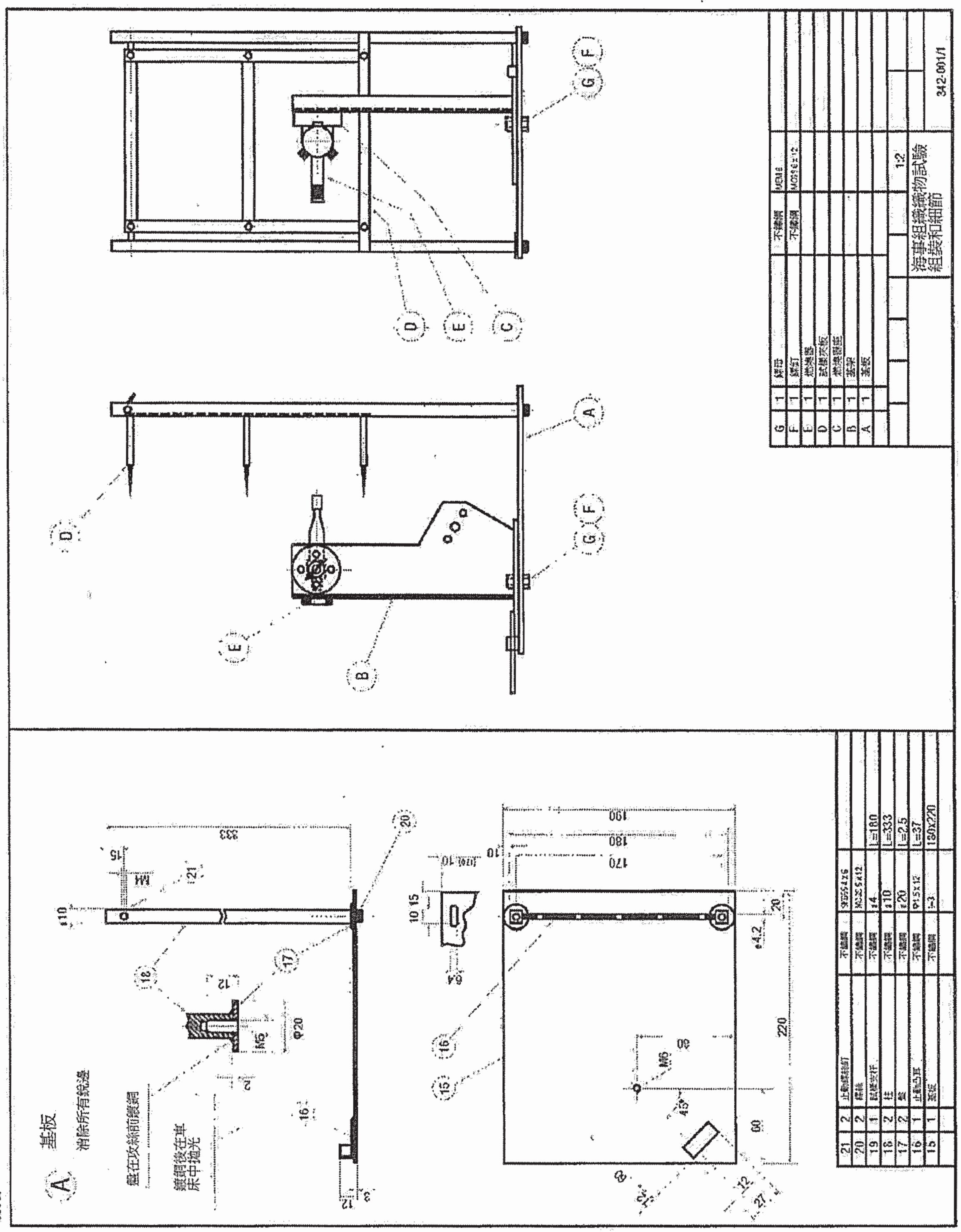


圖3 － 紡織物試驗：組合與細節

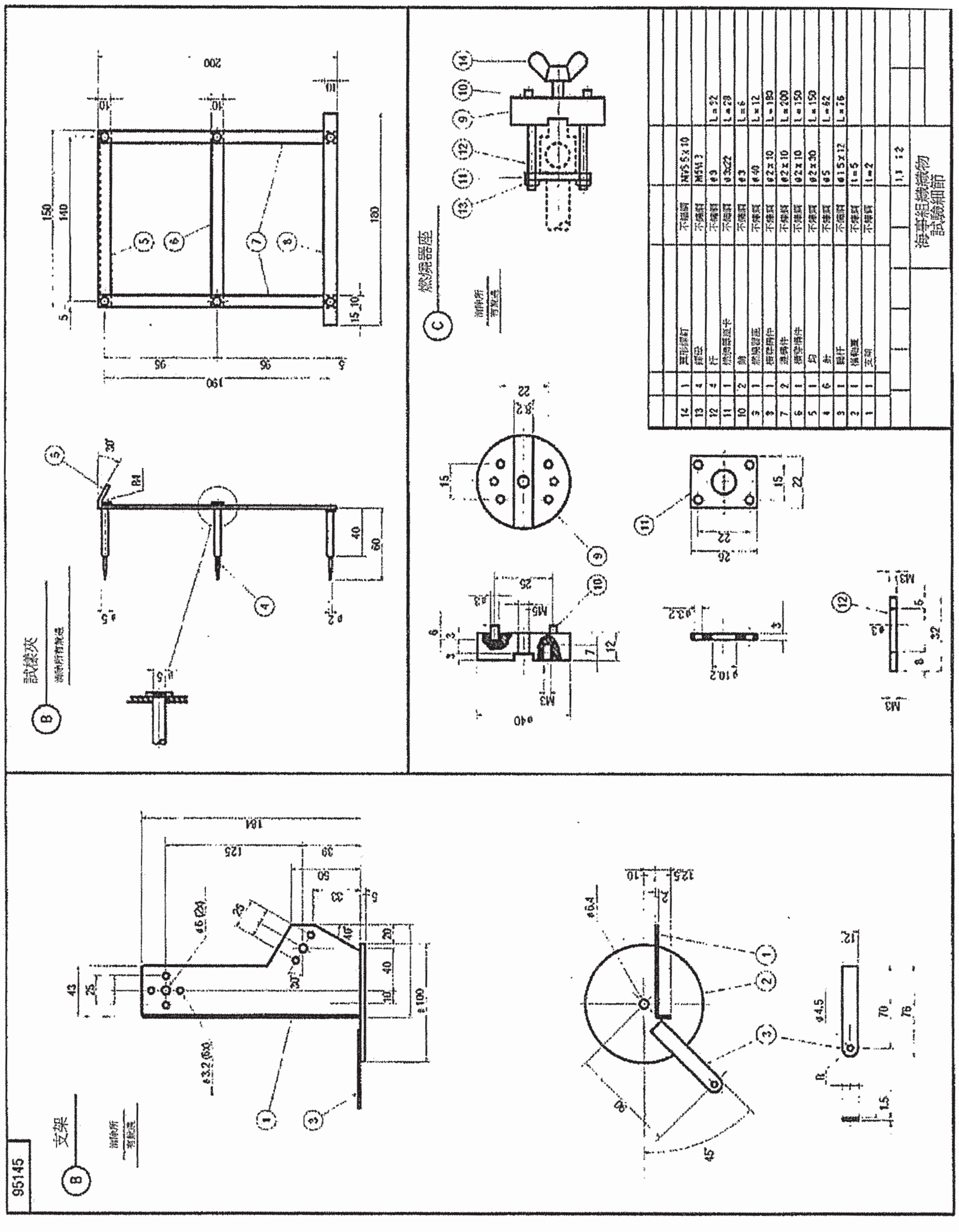


圖4 — 紡織物試驗：細節

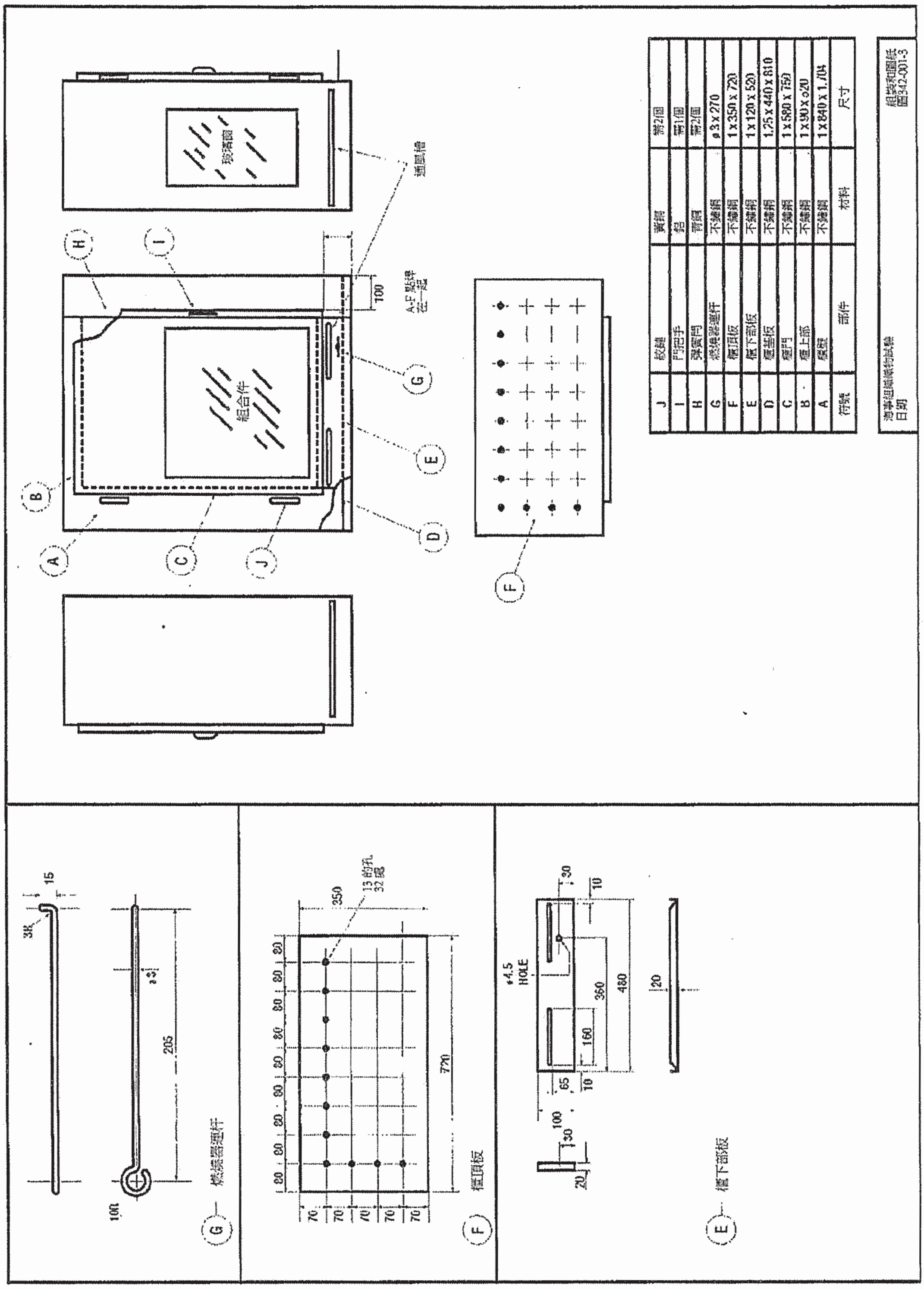


圖5 — 紡織物試驗：試驗圍罩

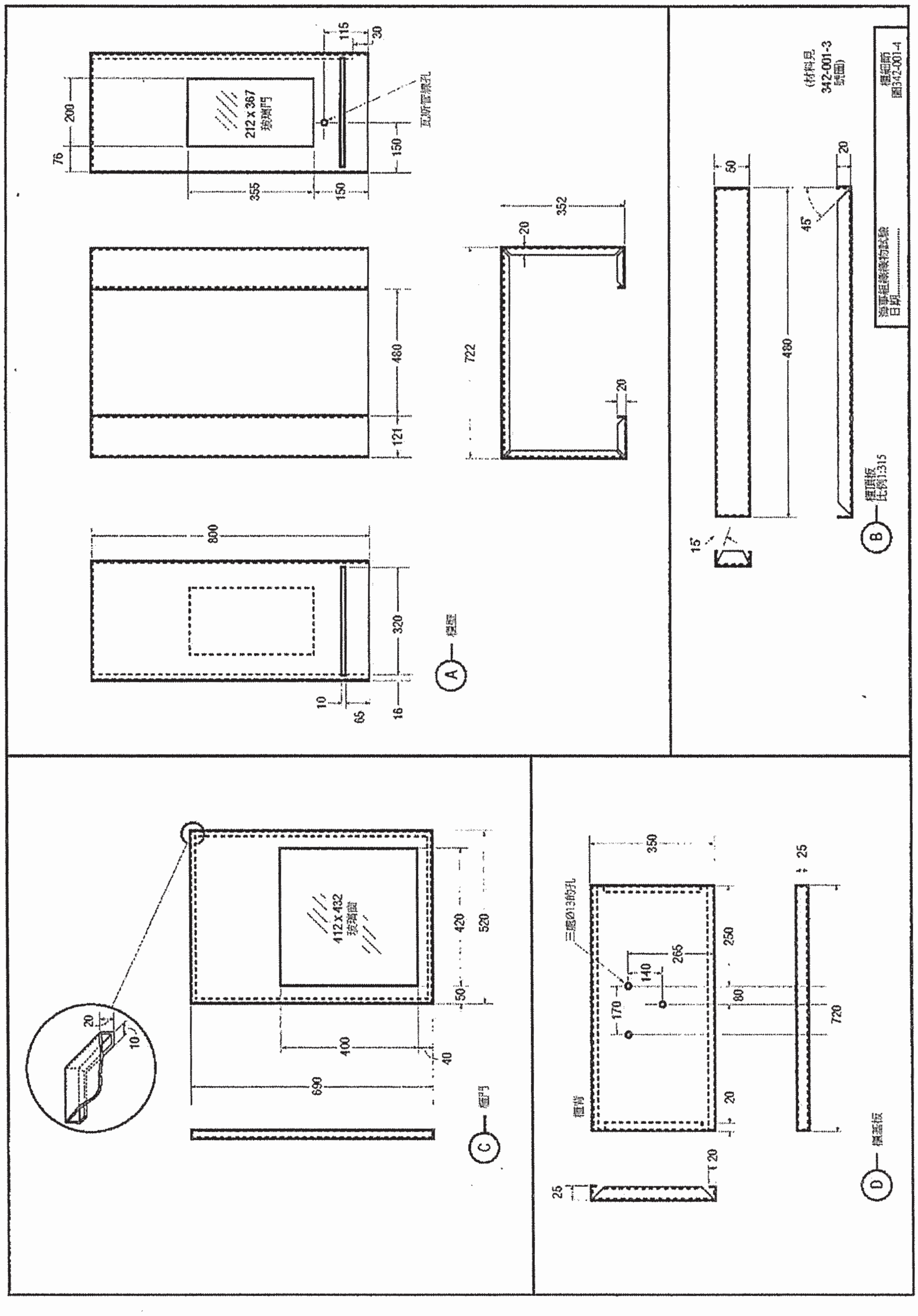


圖6 — 紡織物試驗：試驗圍罩

4.5 試驗圍罩

須提供一個0.5毫米至1毫米厚金屬薄板擋風圍罩，其尺寸約為700±25毫米寬x325±25毫米深x750±25毫米高。其頂部須設有32個對稱鑽出的直徑為13±1毫米的圓孔，其底部須每邊設有帶擋板的通風開口，對稱分佈，提供總計至少為32cm^{2}的自由通風面積。須建造一個700毫米x325毫米的正面，以容納一個主要為玻璃的保護門，並須將一個較小的側面建造成一個觀察面。亦須為瓦斯供給管路和燃燒器遙控定位杆提供一個開孔。圍罩的底板須用不燃隔熱材料覆蓋。內部漆成黑色。圖5和圖6為試驗圍罩的圖解。

5 試樣

5.1 製備

試樣須儘可能對所提供的材料具有代表性並須排除織邊。須至少剪切出10個尺寸為220毫米x170毫米的試樣，五個為經向，五個為緯向。如紡織物的兩面表面不同，須為有待試驗的兩個表面剪切出足夠試樣。須將每個試樣平置在實驗台上，用在框架銷釘位置處有約為5毫米直徑孔洞的220毫米x170毫米的模板，對試樣預作標記/預先打孔，以便將試樣安裝在框架上之後，確保可重複和可複製的試樣張力。

5.2 調理和暴露程序

試驗之前，須將試樣在20±5℃和65±5%相對濕度下調理至少24小時。如材料本身並不耐火焰，在認可當局同意下，可對至少另外10個試樣應用附錄3中詳細闡述的各種暴露程序中的一種。

5.3 安裝

每一試樣須自調整環境中取出，並，或者在3分鐘內進行試驗，或者置於密封容器內直至需要之時。紡織物須按每一試樣上預先標好的位置安裝在試驗框架的銷釘上（見第5.1段）。紡織物在銷釘上的位置須基本位於寬度的中心及，紡織物的下邊緣延伸至下銷釘之下5±1毫米。

6 試驗程序

6.1 點火火焰的預設定

須點燃瓦斯燃燒器並至少預熱2分鐘。之後須將燃料供應調整為：當燃燒器處於垂直位時 燃燒管尖端至可見火焰尖端的距離為40±2毫米。如願意，可使用瓦斯流量計作為實現燃燒器火焰長度調整可重複性的手段。

6.2 確定對特定紡織物的火焰應用方式

6.2.1 燃燒器的角度須調至水平位，其高度須固定為：當燃燒器就位時，其火焰將觸及紡織物在第一排銷釘水平之上40毫米處的中心點。之後須關閉圍罩門並將燃燒器移至其尖端距試樣表面17毫米的位置。

6.2.2 應用火焰5秒鐘之後移開。如未發生持續燃燒，則須將一個新試樣固定在試樣夾上並如前再次應用火焰但這次為15秒鐘。在更長的時限內未出現持續燃燒，就需要將燃燒器的位置調整至燃燒器的尖端位於紡織物底緣之下20毫米處，火焰觸及紡織物。

6.2.3 在此位置上對一個新試樣應用火焰5秒鐘，如未發生持續燃燒，則須插入另一個試樣並將火焰應用時間延長至15秒鐘。

6.2.4 試驗試樣所用點燃條件須為遵循以上所列試驗順序時首次出現持續燃燒的條件。如無持續燃燒，試樣須在顯示出最大碳化長度的條件下試驗。對經向和緯向試樣的火焰應用方法須使用上述點燃順序確定。

6.3 火焰試驗

使用對試驗中的試樣適用的燃燒器位置和火焰應用時間，對另外五個經向和緯向剪切的試樣如第6.2段所述進行試驗並記錄後燃時間。任何表面閃燃的跡象須加以記錄。如在試驗中觀察到陰燃，則須將試樣保持原位，直至陰燃停止。亦須測量碳化程度。如對紡織物損壞的準確界限有疑問，則須遵循附錄2中詳細闡述的程序。

6.4 火焰熔滴

為調查熱塑材料的燃燒熔滴是否能夠點燃設備基座上的可燃材料，須在試樣夾正下方的基座板上，鋪設10毫米厚的第3部分附錄1第7.9段中規定的棉絨。對任何棉絨燃着或陰燃須作出記錄。

7 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗所確定的數據須作出明確區分：

.1 提及試驗係按照2010年消防試驗程序規則第7部分進行（另見.2小段）；

.2 任何與試驗方法的不同；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱和地址（如已知）；

.7 材料類型，即簾、幕、等等；

.8 所測試的產品名稱和（或）識別；

.9 描述取樣程序，如有關；

.10 描述所測試產品，酌情包括：

.1 每面積單位的質量；

.2 厚度；

.3 顏色和色調：如產品具有圖案，需描述代表性顏色；

.4 任何塗層的量和道數；

.5 阻燃處理方法和數量；

.6 產品用料，如毛、尼龍、滌綸、等等，及其構成比率；

.7 編織法的構成：如平紋、回紋、斜紋；

.8 密度（數量/英寸）：經向和緯向每英尺的線數；及

.9 紗支數；

.11 描述試樣，包括每面積單位的質量，厚度和尺寸，顏色，試驗的取向和所測試的面；

.12 樣品抵達日期；

.13 試樣調理細節，包括所用清洗和風化程序及所用洗滌劑的信息；

.14 試驗日期；

.15 試驗結果：

.1 所採取的火焰應用方式；

.2 火焰應用時限；

.3 後燃時間；

.4 碳化長度；

.5 熔滴點燃棉絨；及

.6 發生表面閃燃及其蔓延長度；

.16 試驗中所作的觀測；

.17 確定所試驗的材料是否滿足本部分第3段中的性能標準；

.18 聲明：

“試驗結果與一種產品的試驗用試樣在試驗的特定條件下的表現相關；實驗結果並不擬作為評定該產品使用中潛在失火風險的唯一標準。”。

附錄2

碳化或材料毀損長度測量

1 儀器

確定碳化或材料毀損長度須使用一個掛鈎和砝碼的組合。該組合的總計質量須如表1中所示。

表1 － 撕裂碳化織物的質量

所測試織物的質量（g/m^2）	用於撕裂織物的總計質量（g）
小於 200	100
200 － 600	200
大於 600	400

2 方法

試樣上的火焰和陰燃全部終止後，須立即測定碳化或材料毀損長度。碳化長度在本試驗中的定義為從試樣暴露於火焰下的一端至按照下列方式、經由碳化區域中心沿試樣長度所做撕裂的末端的距離：

.1 對樣品的最高和最大碳化穿透邊緣須作出檢查以確定是否因熱塑效應，試驗導致邊緣變厚。如發生邊緣變厚，須在冷卻後進行切割，僅切除碳化試樣變厚邊緣的最高部分即可；

.2 須將試樣沿其長度折疊並輕輕折過碳化長度的最大可見部分；

.3 須將掛鈎插入試樣碳化區域的一側，於相鄰外緣之內8毫米和底部之上8毫米處；及

.4 須用手指抓住試樣碳化區域的相對一側，並輕輕提起至承受砝碼重量時為止。試樣將經由碳化區域撕裂，直至達到織物強度足以承受其負荷之處為止。

附錄3

清洗和風化程序

1 一般考慮

任何擬在船上使用的紡織物均假定為或者業經永久性防火處理，或者用本身耐火的材料製成。本附錄所述程序擬能夠對此假定進行核實。

2 應用

2.1 這些程序應應用於紡織物。

2.2 各種紡織物應僅承受適用於其擬定用途的暴露程序，並在經過適當暴露周期後，應滿足第5段的耐火要求。

2.3 本附錄中所述加速暴露試驗應提供充足測試，能夠對紡織物使用壽命的（在其設計條件之下的）處理耐久性做出合理評估。

3 加速乾洗

3.1 經處理的紡織物應作為由可乾洗紡織物模擬片塊構成的荷載之一部分，在投幣運作的乾洗設備內乾洗。有效液比應為1：10或每千克紡織物10千克液體。

3.2 全氯乙烯溶劑（包括乳化劑和水在內的1%裝料系統）投幣運作設備應運行10至15分鐘包括滾籠乾燥在內的完整周期。在每一次乾洗周期結束時，從機器中取出荷載並逐件分開。

3.3 上述乾洗應重複至完成10次清洗和乾燥完整周期為止。

3.4 之後應從經過乾洗的紡織物上為試驗剪切試樣。

4 加速洗滌

4.1 一份經處理的紡織物試樣應在自動商用洗衣機中使用商用洗滌劑清洗，或按照生產者說明/建議的方法進行製備。

4.2 應遵循表1中概述的作業周期。

4.3 之後，試樣應於滚籠烘乾機中在80℃的溫度下乾燥。

4.4 上述程序應重複至完成10次清洗和乾燥完整周期為止。如該材料將有特殊用途，可要求進行更多次洗滌。

4.5 如紡織物洗滌說明係由生產者或加工者提供，則其說明應優先於上述模擬典型商業洗滌做法的程序加以遵循。

表1 － 加速洗滌作業周期[1]

運行	時間（分鐘）	溫度（℃）
1　皂液洗滌	6	55
2　皂液洗滌	6	70
3　皂液洗滌	6	70
4　漂白	8	70
5　漂清	2	70
6　漂清	2	70
7　漂清	2	70

運行	時間（分鐘）	溫度（℃）
8 漂清	2	55
9 上藍	3	40
10 脫水	3	40

(1) 此周期擬用於白色紡織物。對於有色紡織物，省去漂白和上藍作業並將皂液洗滌和漂清作業的溫度減少17℃。

5 加速水浸出

5.1 經處理的紡織物樣品應在室溫下完全浸沒於盛有自來水的容器中達72小時。該容器應具有液比為1：20的使用能力。

5.2 在浸沒期間，水應間隔24小時排空並再斟滿一次。

5.3 在浸沒期結束時，應從試驗容器中取出樣品並於滾籠烘乾機或烤爐內在70℃的溫度下乾燥。

6 加速風化

負責主管機關可要求採用使用氙氣燈的適當加速風化程序或者下述程序之一。

6.2 1號備選程序

6.2.1 設備：

.1 設備應由中心設有垂直碳弧的垂直金屬圓筒構成，並內裝試樣夾；

.2 桶的直徑應為：試樣夾面至碳弧中心的距離為375毫米；

.3 筒應安排為圍繞碳弧旋轉，轉速為每分鐘一圈；

.4 筒內應裝設噴水器並裝設水流量調節裝置；

.5 如使用直流電，垂直碳弧應為直徑13毫米固體電極類型，如使用交流電，則應為單核心電極。電極構成應一致；及

.6 電極應使用厚度為1.6毫米的透明石英玻璃球或具有同等吸收和傳導性能的圍罩環繞。

6.2.2 試驗設備的運作：

.1 試驗所用試樣應裝在筒內面對碳弧；

.2 該筒在試驗期間應以約每分鐘一圈的速度旋轉；

.3 噴水器應在每120分鐘的時段內以約0.0026m^3/min的流量向試樣噴水約18分鐘；

.4 碳弧應在13A直流電或17A，60Hz交流電下運作，碳弧電壓為140V；

.5 為確保燈的全部運作條件，電極應經常更新；及

.6 球罩應在取出電極時或每運作36小時清潔一次。

6.2.3 試驗周期：

.1 試樣應承受此暴露360小時；

.2 之後，應讓試樣在20℃至40℃的溫度下完全乾燥；及

.3 乾燥後，應對試樣進行火焰試驗。

6.3 2號備選程序

6.3.1 設備：

.1 設備應由一個安裝在垂直圓筒中心的垂直碳弧構成；

.2 圓筒內應安裝一個旋轉架，並使試樣面和碳弧中心之間的距離為475毫米；

.3 碳弧應為容納兩對碳電極而設計，上碳電極為22號，下碳電極為13號。但是每次僅應點燃一對碳電極之間的電弧；

.4 碳弧與試樣之間不應有任何過濾或圍罩；及

.5 噴嘴應安裝在圓筒內，並應使試樣在每一個120分鐘的時段內被噴濕約18分鐘。

6.3.2 試驗設備的運作：

.1 試驗所用試樣應安裝在旋轉架上，面對碳弧；

.2 旋轉架應以約每分鐘一圈的等速圍繞碳弧旋轉；

.3 碳弧應在跨弧60A和50V交流電，跨弧50A和60V直流電之下運作；及

.4 噴水嘴應在120分鐘的時段內以$0.0026m^3/min$的流量向試樣噴射約18分鐘。

6.3.3 試驗周期：

.1 試樣應承受此暴露100小時；

.2 之後應讓試樣在20℃至40℃的溫度下完全乾燥；及

.3 乾燥後，應對試樣進行火焰試驗。

第8部分 – 軟墊家具試驗

1 適用

要求具有耐火和阻止火焰蔓延特性的軟墊家具，須符合本部分的規定。

2 消防試驗程序

軟墊家具須按照本部分附錄1中規定的消防試驗程序進行試驗。

3 性能標準

3.1 悶燃香煙試驗

3.1.1 須如附錄1第7.2段中的規定，進行兩次悶燃香煙試驗。

3.1.2 如在一小時的時限內未觀測到漸進悶燃或火焰，或如香煙未能悶燃至其完整長度，則將香煙悶燃試驗結果記錄為通過，除非試驗物未能通過附錄1第7.4段中規定的最後檢驗。

3.2 火焰點火源試驗

3.2.1 須如附錄1第7.3段中的規定，進行兩次丙烷火焰點燃試驗。

3.2.2 如在此試驗中未觀測到火焰或漸進悶燃，將丙烷火焰點燃源試驗結果記錄為通過，除非試驗物未能通過附錄1第7.4段中規定的最後檢驗。

4 補充要求

須使用最終成品的試樣進行試驗（例如經染色處理）。如僅有顏色變化，則無需新的試驗，但是如基本產品或處理程序有變，則需要進行新的試驗。

5 試驗報告

試驗報告須包括附錄1第8段中所含信息。

附錄1

用吸煙材料對軟墊座位複合物進行點燃性消防試驗程序

警告 － 操作人員的健康與安全

總則

這些實驗具有相當風險，須採取防範措施。

圍罩

為了安全，試驗須在適當煙氣櫃中進行。如未配備此種櫥櫃，則須製造一個圍罩，使試驗者不會接觸到煙氣（見第7.1.1段）。

滅火器

須提供易及的樣品滅火手段，例如水桶、滅火毯、或滅火器。

1 範圍

此試驗程序規定出材料組合，如軟墊座位的面罩和填料，在軟墊座位使用中會意外接觸到悶燃香煙或燃着火柴時的點燃性評定方法。但不包括有意破壞造成的點燃。

2 定義

就本試驗程序而言，下列定義適用。

*漸進悶燃*係指自身（即獨立於點火源的）蔓延的無火焰放熱氧化。可或有或無伴隨白熾。

註： 實用中已發現在點火源影響下會碳化但不進一步蔓延（漸進）的材料與悶燃程度有發展和蔓延（漸進）的材料之間通常有明顯區別。

3 原理

原理為：對安排成以仿效的方式代表座位和座椅椅背（或座位或扶手）表面之間的接結合處的軟墊材料組合，應用兩種點火源，一種是悶燃香煙，另一種是熱輸出接近於燃着火柴的火焰源。

4 設備

4.1 試驗裝置

4.1.1 適當的試驗裝置示於圖1和圖2之中。它由兩個矩形框架鉸接在一起構成，並能夠互為直角鎖定。框架須用標定25毫米×3毫米的扁鋼條製成並須牢固地卡住置於框架頂緣之下6±1毫米的鋼板網平台。

註： 鋼板網的網眼大小並非關鍵，但已發現約為28毫米×6毫米的對角網眼尺寸適用。

4.1.2 背框架的內部寬度和高度須為450±2毫米×300±2毫米，底框架的寬度和深度須為450±2毫米×150±2毫米。沿鋼板網邊緣可使用標準護緣，以提供保護和更大的剛性。

4.1.3 框架的側面須延伸超出各框架的背部，以提供鉸接孔並形成後腿。鉸接杆須為標定10毫米直徑的鋼杆連續貫穿裝置的背部，其軸線超出各框架背部構件22.5±0.5毫米。

4.1.4 框架須能夠用穿過各對構件形成後腿的銷栓或銷釘鎖定成直角。前腿可穿過前角焊在底框架上。腿的高度須為：在底框架和支撐表面之間留有不小於50毫米的空隙。

4.1.5 試驗時，此裝置須置於圍罩之中（見第7.1.1段），試驗須在有充分空氣供應的基本無氣流的環境中進行。

4.2 悶燃香煙源

4.2.1 需要一支符合下列要求的無濾嘴香煙：

長度	70±4毫米
直徑	8±0.5毫米
質量	0.95±0.15克
悶燃率	11±4.0分鐘/50毫米

4.2.2 對於所用每批10支香煙中的一個樣品須如下進行悶燃率核實。在按照第5.1段調理過的香煙距點燃端5毫米和55毫米處做出標記。按照第7.2.1段所述將它點燃並將其非點燃端在無風空氣中水平插在一根水平金屬絲尖釘上，插入深度不大於13毫米。記錄下自5毫米標記悶燃至55毫米標記所用的時間。

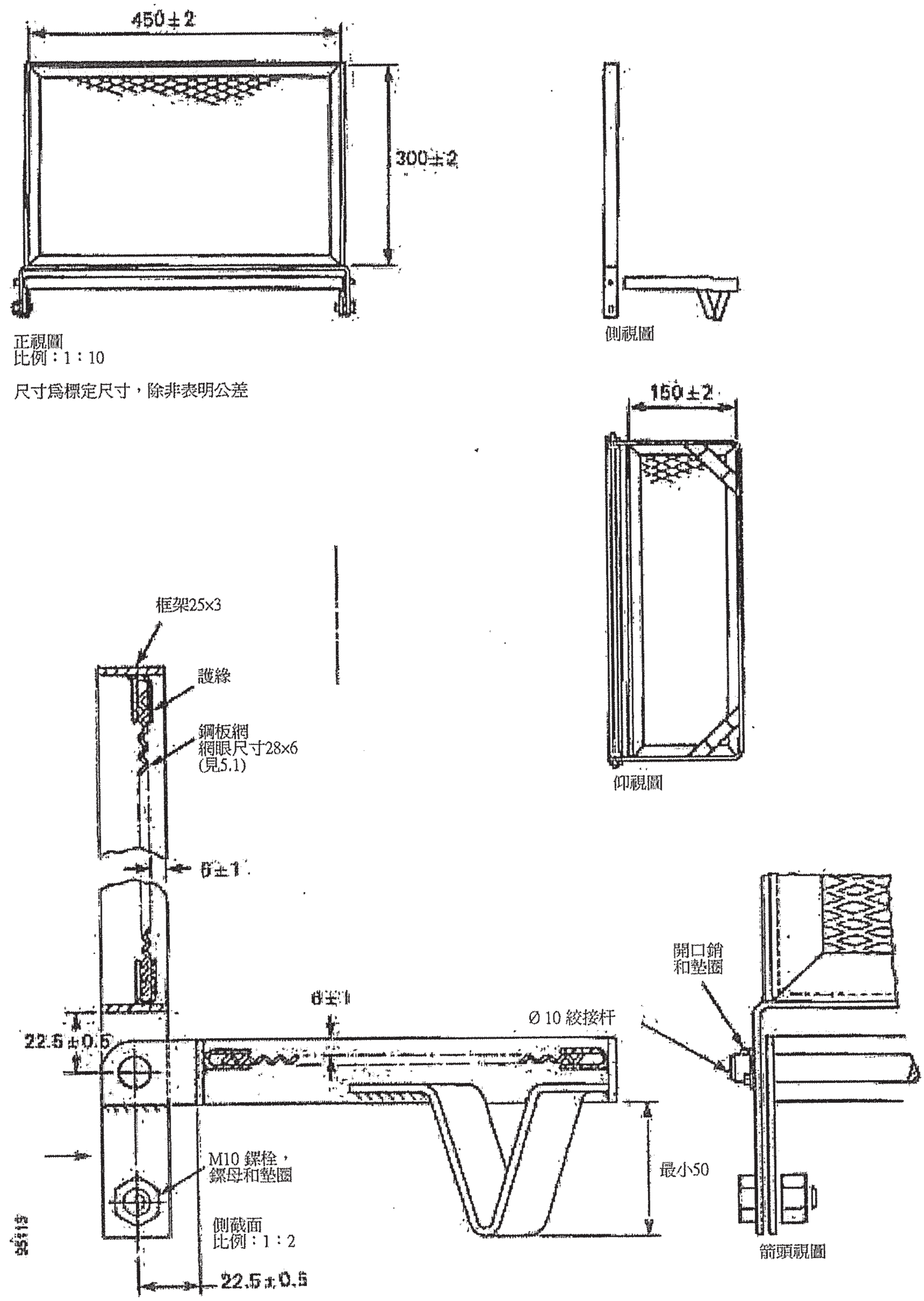


圖1 — 試驗裝置

(所有尺寸為毫米。所有部件為鋼製。)

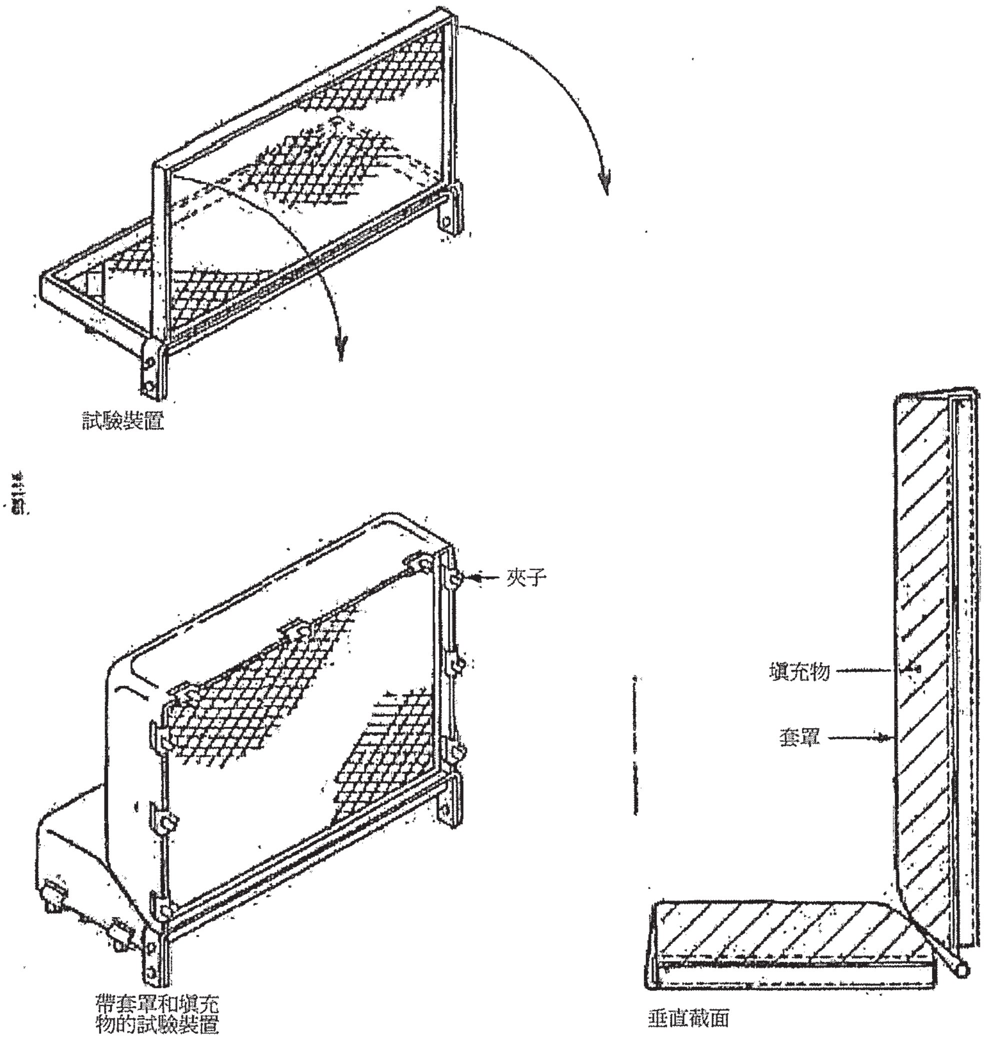


圖2 — 試驗裝置組合

4.3 丙烷火焰點火源

註： 此點火源設計為給出相當於一根燃着火柴的熱輸出。

該燃燒器為一根不鏽鋼管，其內部直徑為6.5±0.1毫米，外部直徑為8±0.1毫米，長度為200±5毫米。燃料須為純度95%的丙烷。燃料供應率：20℃時，6.38±0.25克/小時。

5 調理和試驗的大氣環境

5.1 調理

待試驗的材料和香煙須在臨試驗前在室內環境條件下調理72小時並之後在溫度為23±2℃及相對濕度為50±5%的大氣環境下調理至少16小時。

5.2 試驗

試驗環境須基本無風、溫度為20±5℃相對濕度為20%至70%。

6 試樣

6.1 總則

試樣須對最終組合中所用的面罩、填充物和任何其他成分具有代表性。

6.2 面罩材料和紡織物內襯

6.2.1 各試驗所需面罩的尺寸為800±10毫米×650±10毫米。長尺寸須與鑲邊平行剪切。面罩可用小塊材料製成，但所形成的接口不得位於可能受到試驗影響的區域之內100毫米處。

6.2.2 面罩須有三角形切口，兩側三角形的尖頂均須位於距末端325毫米處。當組裝到試驗裝置上時，切口的位置須為：任何堆疊的方位為沿背部組合向下並自鉸接處至底框架前部。這些切口的尺寸須大約為底邊50毫米、高110毫米。

6.2.3 如使用紡織物內襯，則其剪切須與面罩的尺寸和取向相同，以供在試驗裝置上安裝在面罩之下。

6.3 軟墊填充

6.3.1 每次試驗需要兩件，一件為450±5毫米×300±5毫米×75±2毫米厚，另一件450±5毫米×150±5毫米×75±2毫米厚。

6.3.2 一些靠墊組合會由數層構成，典型者可為毛氈、纖維填料或不同泡沫材料。在這些情況下，試驗物件須複製靠墊組合上部75毫米的部分。

6.3.3 如填充物厚度不足75毫米，試驗物件須通過在其之下增加另一層底部材料以增至所要求的厚度。

7 試驗程序

7.1 準備

7.1.1 所有試驗均須在構造適當的煙氣圍罩中進行，並須確保手邊有滅火手段（見警告部分）。

7.1.2 打開試驗裝置並將面罩材料及紡織物內襯（如有）穿向鉸接杆後。

7.1.3 將填充物試樣置於面罩紡織物及紡織物內襯（如有）之下位於框架凹進處，並用約20毫米的紡織物包裹框架內部。

7.1.4 用螺栓或銷釘將框架鎖定於直角，確保填充部件沒有錯位。

7.1.5 用夾子將紡織物在框架的頂、底和側面固定，確保紡織物牢固並張力均勻。

7.2 悶燃香煙試驗

7.2.1 點燃香煙（見第4.2段）並經香煙抽氣直至其尖端明亮紅熾。在此作業中，所耗香煙不得超過8毫米。

7.2.2 將悶燃香煙沿垂直和水平試驗物件的結合處放置，距最近邊緣、或以前香煙試驗留下的痕跡至少50毫米，同時開始計時。

7.2.3 觀測燃燒的進展，並記錄任何漸進悶燃的證據（見第2段）或內容物和（或）面罩有焰燃燒的證據。

> **註：** 可能不易發現悶燃，不斷觀測香煙周圍是否冒煙會容易些。通過一面鏡子下視上升的煙柱最易看到煙。

7.2.4 在放置香煙後的1小時之內，如在任何時候觀測到軟墊構件有漸進悶燃或火焰，熄滅試驗物件，並將香煙悶燃試驗結果記錄為失敗。

7.2.5 如在一小時內未觀測到漸進悶燃或火焰，或香煙未能悶燃至其完整長度，則須使用新的香煙在距任何以前試驗損壞不少於50毫米處，再次試驗。如再次試驗中未觀測到漸進悶燃或火焰，或如香煙未能悶燃至其完整長度，將香煙悶燃試驗結果記錄為通過，除非試驗物件未能通過第7.4段中規定的最後檢驗。否則，熄滅試驗物並將結果記錄為失敗。

註： 此再試驗可與首次試驗同時進行。

7.3 丙烷火焰試驗

7.3.1 點燃從燃燒管中冒出的丙烷，將瓦斯流調整到適當流率（見第4.3段）並讓火焰穩定至少2分鐘。

7.3.2 將燃燒管沿座位和後背之間的結合處軸線方向放置，火焰距最近邊緣、或以前試驗留下的任何痕跡至少50毫米，並同時開始計時。

7.3.3 令瓦斯燃燒20±1秒，之後將燃燒管從試驗物件小心移開而終止。

7.3.4 觀測內容物和（或）面罩有無火焰或漸進悶燃（見第2段）。對移開燃燒管後120秒鐘之內停止的火焰、殘熾、冒煙或悶燃忽略不計。

7.3.5 如觀測到軟墊成分有火焰或漸進悶燃，熄滅試驗物件。將丙烷火焰點燃試驗結果記錄為失敗。

7.3.6 如未觀測到火焰或漸進悶燃，如第7.3.2段所述，在新的位置重複試驗。如再次試驗中未觀測到火焰或漸進悶燃，將丙烷火焰點燃試驗結果記錄為通過，除非試驗物件未能通過第7.4段中規定的最後檢驗。否則，熄滅試驗物，並將結果記錄為失敗。

7.4 最後檢驗

已有從外部未發現漸進悶燃事例的報告。完成組合試驗計劃後，立即對該組合進行拆解並查驗其內部有無漸進悶燃。如有，則熄滅試驗物件並將相關試驗源的試驗結果記錄為失敗。為安全緣故，要確保所有悶燃均已終止後方可離開試驗裝置。

8 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗所確定的數據須作出明確區分：

.1 提及試驗係按照《2010年消防試驗程序規則》第8部分進行（另見.2小段）；

.2 任何與試驗方法的不同；

.3 試驗實驗室名稱和地址；

.4 試驗報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產商/供應商名稱和地址（如已知）；

.7 家具類型，如座位、沙發、辦公椅、等等；

.8 所試驗產品的名稱和（或）識別；

.9 取樣程序說明，如適用；

.10 所試驗產品的說明，酌情包括：

.1 紡織物：

.1 材料：如毛、尼龍、滌綸、等，及其構成比例；

.2 編織方法：如平紋、回紋、斜紋；

.3 密度（數量/英寸）： 經向和緯向的每英寸的線數；

.4 紗支數；

.5 紡織物的厚度，以毫米計；

.6 質量：每單位面積的重量（克/毫米^2)；

.7 顏色和色調：如產品有圖案，須描述代表性顏色；及

.8 阻火處理；

.2 填充物：

.1 材料（生產商名稱、種類名稱）；

.2 密度：每單位體積的重量（千克/米^3)及對於厚度難以準確測量的產品，平方密度（克/米^2)；及

.3 阻火處理（如有）；

.11 試樣說明，包括紡織物和填充物的尺寸和質量、紡織物的顏色和取向；

.12 樣品抵達日期；

.13 樣品調理細節，包括所用清洗和風化程序的類型及，如適用，所用洗滌劑的信息；

.14 試驗日期；

.15 試驗結果，包括：

.1 所用香煙尺寸和質量；

.2 所用香煙悶燃率；

.3 試樣量自點火源的損壞（燃燒和（或）碳化）程度；及

.4 發生漸進悶燃；

.16 試驗期間所做的觀測；

.17 確定所試驗的材料是否達到本部分第3段中的性能標準；

.18 聲明：

"試驗結果與產品試樣在試驗的特定條件下的表現相關，並不擬作為評定該產品使用中潛在失火風險的唯一標準。"。

附錄2

指導性說明

1 本試驗程序規定了在限定的條件下，軟墊材料組合點燃性的檢驗方法。這些材料的組合，擬大體上代表其在軟墊座位中的最終應用方式，點燃源為悶燃香煙及代表燃着火柴的火焰。

1.1 因此，對特定的面罩、填充物和內襯組合的潛在點燃性可加以評定並可制定關於吸煙材料引燃的規範。但是，卻有如下兩點重要局限：

.1 試驗僅與點燃性相關，任何失火風險控制還另外需要考慮到火的特性的其他方面，如火的發展速率，熱輸出、煙產生率和數量和毒氣的產生。理想的是，任何減少點燃性的努力不應對這些其他特性造成不利影響；及

.2 此試驗僅衡量用於軟墊座位中的材料組合的點燃性，並非某一包含這些材料的特定家具成品的點燃性。試驗僅對家具成品引燃表現給予顯示而並非保證。這一局限的出現，是因為家具設計特點會極大地影響其燃燒特性；因而對於一件家具，任何點燃性試驗將需要對具體實物而非對構成材料或模擬物進行。但是，可如第2和第3段所示，獲得有限的與某一擬定設計更為具體相關的點燃性信息。

2 此試驗程序規定了對材料組合的實驗室試驗，這將為家具成品的點燃性提供總體指導。如需要更加具體的信息、或在最終使用的關鍵區域，其原則可適用於完整成品或家具部件或經適當改變的試驗組合，一些實例給出如下。在這些情況下，附錄1第4.2和第4.3段中規定的點火源通常可應用於與實際使用中發生引燃風險處相應的位置。

例1： 如座椅座位和靠背之間有間隔，將點火源放置在實驗裝置夾角處則不適當。然而，將點火源置於水平和垂直表面中間的面向點燃，將更有意義。

例2： 實驗裝置可用以模擬垂直和水平表面的任何連接，所以如果椅臂和椅背構造不同，可分別與座位一起試驗。

例3： 將兩種不同紡織物面料在鉸接杆後面縫合或用訂書釘釘住，可模擬靠背和座位使用不同材料的座椅。

例4： 在最終設計中，如將在軟墊座位平台上放置活動坐墊，則在活動坐墊和周圍的軟墊之間產生更多香煙陷阱。這可通過用適當材料製作一個尺寸為500±5毫米×75±2毫米的活動坐墊放置在一般組合試驗安排的水平表面之上而加以檢驗。

3 應用此試驗原則的另一途徑是提供用於組合中的各種材料的信息。例如面罩材料提供防燃保護的能力可通過對其進行與一種已知易燃基底的組合試驗而得知；業已發現，密度約為22千克/米^{3}的標準非阻燃撓性聚酯泡沫材料適用。此類關於各個材料的信息並不排除對實際組合進行試驗的必要性，但可有助於縮減材料組合的數量並因而減少所需試驗的總體數量。

附錄3

罩面和填充材料獨立試驗指南

對各個材料的可選擇性單獨試驗

（罩面材料和填充材料）

1 罩面材料獨立試驗（罩面材料能力核查）

1.1 罩面材料應覆在非阻燃填充材料上進行試驗。如在其他阻燃填充材料之上試驗，則該罩面將僅在該具體填充材料上使用獲得認可。

1.2 在進行罩面材料獨立試驗之前，應對此試驗所用填充材料加以核查並證實是否為不符合本標準的非阻燃材料。這將通過以下第2段中所述填充材料獨立試驗加以證實。

2 填充材料獨立試驗（填充材料能力核查）

填充材料應在無罩面材料下進行試驗。如材料滿足本標準中的衡準，則可認為該材料將具有足以用作“軟墊家具”填充材料的性能，並亦可認為該材料不適於在上述罩面材料獨立試驗中用作標準非阻燃填充材料。

3 “軟墊家具”類型認可

3.1 罩面和填充組合可申請“軟墊家具”類型認可。但如兩種材料，罩面和填充材料，可滿足本標準中的衡準並且各個材料均具有充足試驗報告作為獨立試驗的證據，則對其實際組合無需另做實驗。

3.2 主管機關可以規定僅承認一種認可選擇。

第9部分 — 床上用品試驗

1 適用

床上用品如要求具有耐火和阻止火焰蔓延性能，則須符合本部分的要求。

2 消防試驗程序

床上用品須按照本部分附錄中規定的消防試驗程序進行試驗和評定。

3 性能標準

床上用品如表明無本附錄第10.1段中規定的漸進悶燃，或本附錄第10.2段中規定的有焰燃燒，則定級為不易點燃。

4 補充要求

須使用最終成品（如經染色處理）的試樣進行試驗。如僅有顏色變化，則無需新的試驗。但是，如基本產品或處理程序有變，則需進行新的試驗。

5 試驗報告

試驗報告須包括本附錄第11段中所述信息。

附 錄

床上用品點燃性消防試驗程序

引言

本方法中規定的試驗論及一個對產品暴露於悶燃香煙和相等於火柴火焰之下的典型潛在失火狀況的一個具體方面的簡單展示。單此實驗不能對例如暴露於更大火源的其他類型的意外，提供任何直接指導。但此類試驗可用於比較或確保具備被視為總體上與着火性能有關的某些特性。對此試驗中的性能不得附以任何其他意義。

安全警告

所有本試驗運用者需對下列警告給予注意：

為對健康保護採取適當防範措施，請所有從事消防試驗者注意，試樣燃燒中會釋放出有毒或有害氣體。

1 範圍

本方法規定了確定床上用品在小型悶燃和火焰點燃源之下的點燃性。

2 應用領域

2.1 本方法擬用於對床上用品如毛毯、棉被、床罩、枕頭和床墊、包括用在其他床墊之上的薄、輕褥墊的試驗。

2.2 下列物品須包括在床上用品之內：床幔、羽絨被、鴨絨被。

2.3 下列物品不得包括在床上用品之內：床單、枕套、床墊彈簧、床裙（防塵短帷）和床簾。

3 定義

3.1 *床墊*係指有外罩封裝的彈性材料（例如聚氨酯泡沫或輕型纖維材料）或襯墊材料與鋼製彈簧的組合（彈簧床墊）形式的產品。

3.2 *棉被和枕頭*係指有紡織物封裝的襯墊材料（絨/毛或紡織纖維）製品。

3.3 *褥墊套料*係指床墊內封裝彈性材料的紡織物。

3.4 *點燃性*係指對一種材料或產品被點燃發生焰燃或漸進悶燃的容易程度的測定。

3.5 *點火源*係指用於點燃可燃材料或產品的能源。

3.6 *焰燃*係指進行中的氣相燃燒，通常發出火光。

3.7 *悶燃*係指材料中發生的無火焰放熱反應，或有或無火光。

3.8 *漸進悶燃*係指點火源熄滅或移開後仍然繼續的悶燃。

4 取樣

試樣須對有待試驗的整個產品具代表性。如可能，取樣方式須使試樣亦可沿接縫及其交接處開始點燃。頂面暴露。如對那一面為頂面有疑問，則須對兩面均做實驗。這將需要另外四份試樣。

4.1 床墊

4.1.1 須有充足的材料足以製作至少四份尺寸為450毫米×350毫米的完整標定厚度的試樣。罩面須完全封裝床墊且無皺褶，並須在底面固定（如使用鋼針）。

4.1.2 對於具有可除去罩面的床墊的試驗，須有充足的材料足以製作至少八份尺寸為450毫米×350毫米的完整標定厚度的試樣，四份有罩面，四份無罩面。

4.2 枕頭

須有四份全尺寸的樣品。

4.3 除床墊和枕頭外

4.3.1 從每個樣品上須剪切下四份試樣，尺寸為450毫米×350毫米。

4.3.2 如產品包含鬆散填充材料，須對邊緣加以縫合。接口縫合最好在剪切試樣之前進行，以避免填充材料損失。

5 試驗方法

5.1 原理

將試樣水平放置在試驗裝置上進行試驗。點火源置於試樣頂部。使用悶燃或焰燃點火源確定點燃性。將一個在悶燃香煙上的可悶燃隔熱棉毛墊用作悶燃點火源，擬用以模擬床上用品中使用的可能會悶燃的材料。焰燃點火源為一個小型丙烷火焰。對試樣漸進悶燃或焰燃燃着進行觀測。

5.2 儀器與材料

試驗需要下列設備和材料：

.1 圖1中所示試樣支撐裝置。支架用角鐵製成，標定尺寸為25毫米×25毫米×3毫米。支架頂部為一個金屬網平台，網眼標定尺寸為100毫米×50毫米；

.2 礦物棉，標定密度為60千克/米^3，尺寸為450毫米×350毫米×50毫米；

.3 秒錶；

.4 試驗圍閉，或為容積大於20米^{3}的房間（含有充分氧氣供試驗用），或為具有空氣流通的較小圍閉。在裝置所在位置提供空氣流速為0.02米/秒至0.2米/秒的進氣和排氣系統供給充分氧氣且不干擾燃燒特性；

.5 點火源：順序使用的點火源為覆以棉毛墊的悶燃香煙及明火；

.6 香煙：試驗須使用符合下列規範的香煙：

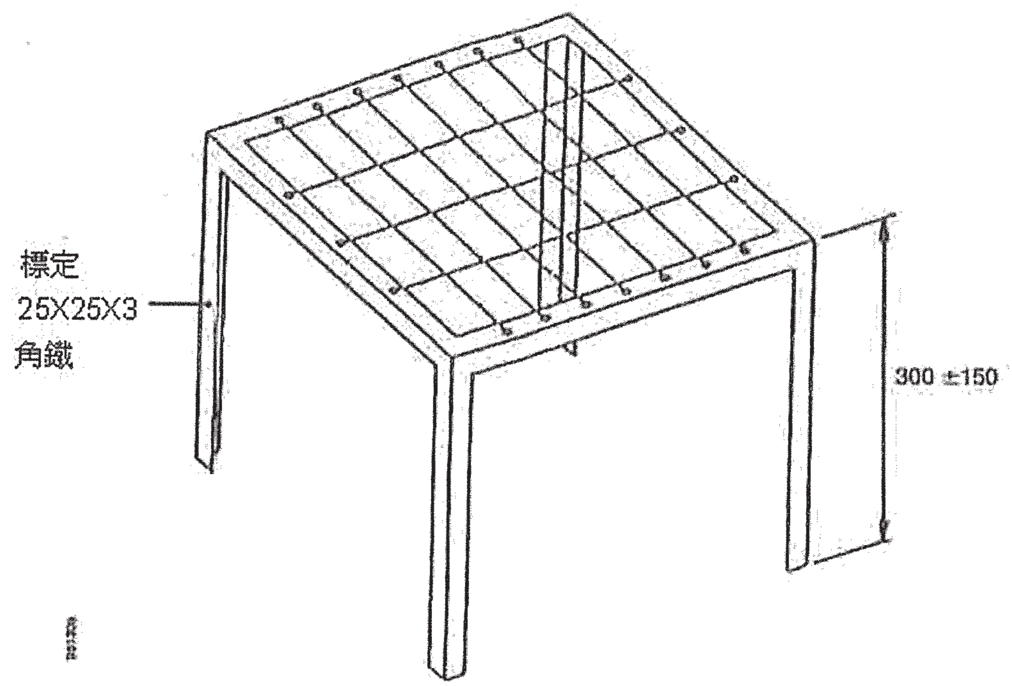
長度	70±4毫米
直徑	8±0.5毫米
質量	0.95±0.15克
悶燃率	11±4.0分鐘/50毫米

對於每盒20支香煙的悶燃率須作如下核實：

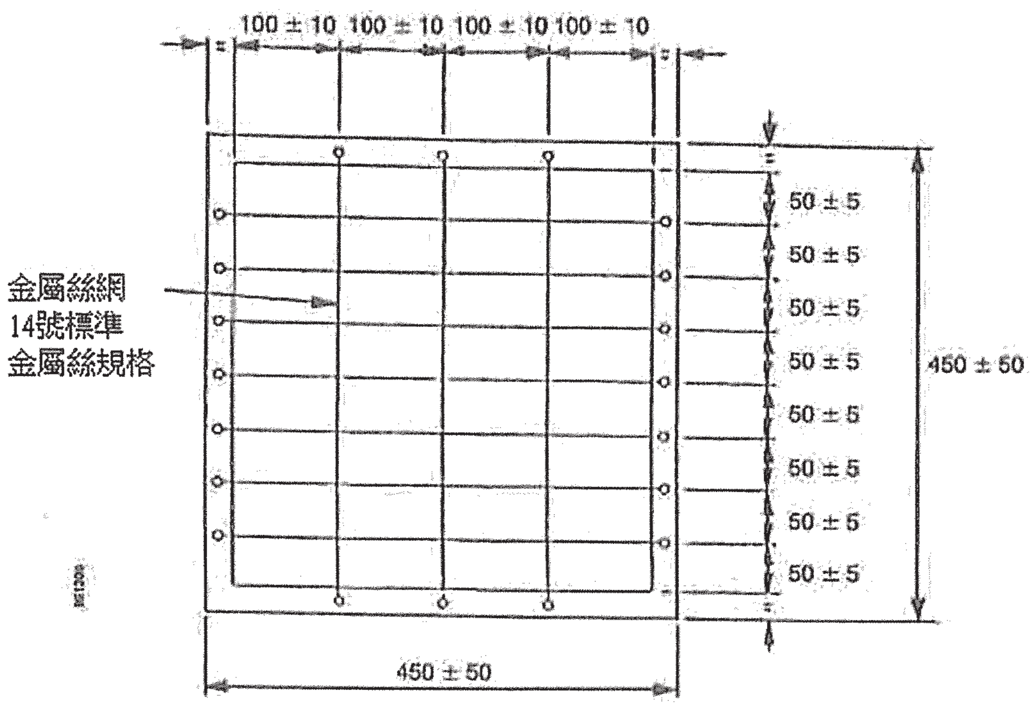
如以下第7段所述，對香煙進行調理。在一支香煙距一端5毫米和55毫米處做出標記。將該香煙在標有5毫米距離標記的一端點燃，經香煙抽氣直至觀測到明確紅熾，但不得超過5毫米標記，之後將香煙非點燃端水平插入一根金屬絲尖釘不超過13毫米。記錄自5毫米標記悶燃至55毫米標記的時間；

.7 棉毛墊：香煙須覆以一個棉毛墊，其標定尺寸為150毫米×150毫米×25毫米，重量為20±6.5克。棉毛須由新的未染色的軟纖維構成，無任何混合物或人造纖維，並須無線、葉和殼纖維末。外科用卷狀包裝為適於此用途的材料。從棉卷中展開一單層，厚度為25毫米至30毫米，剪成計劃尺寸大小，之後通過從頂部去除鬆散纖維減至正確質量和厚度；及

.8 火焰：燃燒器為一根不鏽鋼管，其內直徑為6.5±0.1毫米，外直徑為8±0.1毫米，長度為200±5毫米。燃料須為95%純度的丙烷氣體。20℃之下的燃料供給率：6.38 ±0.25克/小時。



(a) 展示出支腿的平台



(b) 金屬絲網平台的間隔

圖1 — 試驗裝置

6 準備試樣

毛毯、棉被、枕頭、薄輕褥墊或可除下罩面如作為阻焰物出售，則須經主管機關決定，按照以下所列者之一進行三次清洗處理之後，進行試驗：

.1 生產者說明書；

.2 ISO 6330標準中所述程序；或

.3 商業洗滌劑。

7 調理

有待試驗的材料、用作點火源的香煙及隔熱棉毛墊須在臨試驗前，於室內環境條件下調理72小時並之後在溫度為23±2℃，相對濕度為50±5%的大氣環境中調理至少16小時。

8 試驗程序

本試驗在室內基本無空氣氣流的環境中進行。室內溫度須為20±5℃，相對濕度20%至70%。床墊試樣直接置於試驗裝置上。毛毯、枕頭、棉被或薄、輕褥墊試樣置於鋪在試驗裝置上的礦物棉之上。點火源置於試樣頂部。從將點火源置於試樣頂部起開始計時。試驗期限為自將點火源置於試樣之上起1小時。

8.1 悶燃點火源試驗

點燃香煙並經香煙抽氣直至香煙明亮紅熾。在此作業中，香煙消耗不得少於5毫米亦不得多於8毫米。將香煙置於試樣上距最近邊緣或任何先前試驗所留痕跡至少100毫米之處。將棉毛墊置於香煙正中之上，並開始計時。觀測燃燒進展並記錄任何試樣漸進悶燃（見第10.1段）或焰燃（見第10.2段）的證據。使用棉毛墊覆蓋的香煙分別進行兩次試驗。在有針線縫紉的試樣上，一次試驗中將香煙沿縫線放置，另一次試驗中如有可能，將香煙在光面上放置。

8.2 火焰點火源試驗

點燃瓦斯並將瓦斯流量調校至第5.2.8段中所示流率。讓瓦斯流量穩定至少120秒鐘。將燃燒器水平置於試樣之上，距試樣的任何邊緣至少100毫米，並距任何先前試驗所留痕跡至少50毫米。試樣須在點燃火焰之下暴露20秒鐘。通過將燃燒器自試樣小心移開而終止暴露。觀測燃燒進展，並記錄任何試樣漸進悶燃（見第10.1段）或焰燃（見第10.2段）的證據。分別進行兩次試驗。在有針線縫紉的試樣上，一次試驗中將燃燒器沿縫線放置，另一次試驗中如有可能，將燃燒器在光面上放置。

9 試驗結果表達

9.1 所有時間觀測以分鐘和秒鐘表達，從試驗開始起算。試驗結果包括：

.1 在規定的試驗期限之內及剛結束之後的試樣表現；

.2 在規定的試驗期限之內及剛結束之後的火焰或可見數量的煙、熱或紅熾；及

.3 試驗結束後試樣的損壞，以毫米計。

9.2 各個單獨試驗所得結果須分別報告。

10 點燃性標準

10.1 漸進悶燃

就本試驗方法而言，所有以下.1至.5小段中所述表現均被視為漸進悶燃點燃：

.1 任何試樣在應用點火源1小時後產生外部可見數量的煙、熱、或紅熾；

.2 任何試樣顯示出逐步升級燃燒表現以致繼續試驗不再安全並須強制滅火；

.3 任何試樣在試驗期間悶燃至基本燒毀；

.4 任何試樣在試驗期間悶燃至其末端，即至試樣的任何一邊或完整厚度。但是，厚度為25毫米或以下的所有材料，如薄輕褥墊、棉被或毛毯等允許悶燃至試樣的完整厚度；及

.5 任何試樣在最終檢驗中，顯示出自棉毛墊邊緣和明火火焰點火源原位最近之處，在任何水平方向上的大於25毫米的除變色外的悶燃證據。

10.2 焰燃點燃

10.2.1 *床墊*

就本試驗方法而言，所有以下.1至.5小段中所述表現均被視為焰燃點燃：

.1 悶燃點火源引發任何焰燃；

.2 任何試樣在移除點火火焰後繼續焰燃150秒鐘以上；

.3 任何試樣顯示出逐步升級燃燒表現，以致繼續試驗不再安全並需強制滅火；

.4 任何試樣在移除點火火焰後150秒鐘之內燃燒至燒毀達66%以上；及

.5 任何試樣在試驗期間燃燒至其末端，即至試樣的任何一邊或完整厚度。

10.2.2 *毛毯、棉被、枕頭及薄輕褥墊*

就本試驗方法而言，所有以下.1至.5小段中所述表現均被視為焰燃點燃：

.1 悶燃點火源引發任何焰燃；

.2 任何試樣在移除點火火焰後繼續焰燃150秒鐘以上；

.3 任何試樣顯示出逐步升級燃燒表現，以致繼續試驗不再安全並需強制滅火；

.4 任何試樣在移除點火火焰後150秒鐘之內燃燒至燒毀達66%以上；及

.5 任何試樣在試驗期限內燒至試樣的任何一邊。

10.3 定級

床上用品如未顯示出第10.1和10.2段中規定的漸進悶燃點燃或焰燃點燃，則定級為不易點燃。

11 試驗報告

試驗報告須至少包括下列信息。對申請人提供的信息和試驗所確定的信息須做出明確區分。

.1 提及試驗係按照《2010年消防試驗程序規則》第9部分進行（另見.2小段）；

.2 與試驗方法的任何不同；

.3 試驗實驗室名稱與地址；

.4 試驗報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱與地址，如已知；

.7 材料種類，即床墊、毛毯、棉被、枕頭、薄輕褥墊或可卸下罩面等；

.8 所試驗產品的名稱和（或）識別號；

.9 取樣程序說明，如有關；

.10 對所試驗產品的說明，酌情包括：

.1 紡織物：

.1 材料：如毛、尼龍、滌綸等及其構成比例；

.2 編織構成：如平紋、回紋、斜紋；

.3 密度（數/英寸）：經向和緯向每英寸的線數；

.4 紗支數；

.5 紡織物厚度，以毫米計；

.6 質量：每單位面積重量（克/毫米^2）；

.7 顏色與色調：如產品有圖案，則須描述有代表性的顏色；及

.8 阻火處理；

.2 填充物：

.1 材料（生產者名稱，類別）；

.2 密度：每單位體積重量（千克/米^3）及厚度不易準確測量的產品的面積密度（克/米^2）；及

.3 阻火處理，如有；

.11 試樣說明包括紡織物和填充物的尺寸和質量，顏色，紡織物的取向；

.12 樣品抵達日期；

.13 試樣調理細節，包括所用清洗和風化程序類型及所用洗滌劑信息，如適用；

.14 試驗日期；

.15 試驗結果，包括：

.1 所用香煙的尺寸和質量；

.2 所用香煙的悶燃率；

.3 量自點火源的試樣損壞程度（燃燒和（或）碳化）；

.4 發生漸進悶燃；及

.5 發生焰燃點燃；

.16 試驗期間所做的觀測；

.17 確定所試驗的材料是否達到本部分第3段中的性能標準；

.18 聲明：

“試驗結果與產品試樣在特定試驗條件下的表現相關；並不擬作為評定產品使用中潛在失火風險的唯一標準。” 。

第10部分 － 高速船限火材料試驗

1 適用

高速船上所用材料如要求為限火材料，則須符合本部分的要求。

2 限火材料消防試驗程序與標準

2.1 總則

《1994年高速船規則》或《2000年高速船規則》的規定要求為限火材料的艙壁、牆壁和天花板襯板表面材料包括其支撐構件、家具、和其他結構或內部部件，須按照本部分附錄1中規定的消防試驗程序進行試驗和評定。

2.2 限火材料的定義

*限火材料*的定義在《2000年高速船規則》中界定。

2.3 艙壁、牆壁和天花板襯板表面材料包括其支撐構件

2.3.1 *試驗程序*

艙壁、牆壁和天花板襯板表面材料包括其支撐構件須按照本部分附錄1中所述ISO 9705標準進行試驗。艙壁、牆壁和天花板襯板須以其最終使用構成，並包括任何表面飾面材料進行試驗。

2.3.2 *標準*

艙壁、牆壁和天花板襯板表面材料包括其支撐構件，如按照本部分附錄1在20分鐘的試驗時間內，滿足下列六項衡準，則為合格“限火材料”：

.1 不包括點火源熱釋放率在內的時間平均熱釋放率不超過100千瓦；

.2 試驗期間任何一個30秒的時段內不包括點火源熱釋放率在內的最大平均熱釋放率不超過500千瓦；

.3 時間平均產煙率不超過1.4米^2/秒；

.4 試驗期間任何一個60秒的時段內最大平均產煙率不超過8.3米^2/秒；

.5 火焰傳播不得下延至試驗房間牆壁距地板0.5米，但點火源所處角落1.2米之內的區域除外；

.6 試樣燃燒熔滴或碎片不可落到點火源所處角落1.2米區域之外的試驗房間地板上。

2.3.3 *合格“限火材料”的其他應用*

經按照第2.3.1段中規定的方法試驗而按照第2.3.2段定為合格“限火材料”者，如與作為其實際最後應用的房間內襯所試驗的構型密切相似（即類似厚度和表面飾面），可用於家具或其他部件。

2.4 用於家具和其他部件的材料

2.4.1 ***試驗程序***

用於家具和其他部件的材料須如本部分附錄2中所述進行試驗（這並不包括須分別按照本附件第7至第9部分試驗的垂直懸掛的紡織品和薄膜，軟墊，或臥具）。

2.4.2 ***標準***

用於家具和其他部件的材料，如滿足下列四項衡準，則為合格“限火材料”：

.1 點燃時間大於20秒；

.2 30秒鐘滑動最大平均熱釋放率不超過60千瓦/米^2；

.3 總熱釋放率不超過20千焦耳/米^2；

.4 時間平均煙產生率不超過0.005米^2/秒。

3 試驗報告

試驗報告須包括附錄1第9段或附錄2第12段中的信息和按照以上第2段中規定的試驗標準做出的材料標定。

4 參照文件

ISO 9705，消防試驗－表面產品全尺寸房間試驗。

ISO 5660-1，對消防試驗的反應－熱釋放、產煙和質量損失率－第1部分：熱釋放率（錐形熱量計法）。

ISO 5660-2，對消防試驗的反應－熱釋放、產煙和質量損失率－第2部分：產煙率（動態測量）。

ISO 14697，對消防試驗的反應－建築和運輸產品基底選擇指南。

附錄 1

消防試驗程序－高速船艙壁、牆壁和天花板內襯表面材料包括其支撐結構全尺寸房間試驗

參照文件：ISO 9705，消防試驗 － 表面產品全尺寸房間試驗。

1 範圍

1.1 本試驗程序規定了在一個單一開敞門道的小房間的一角，在良好通風條件下開始着火的模擬試驗方法。

1.2 本方法擬用於使用特定點火源評定表面產品對火勢發展的影響。

1.3 本方法特別適於由於某些原因無法進行小規模實驗室試驗的產品，例如熱塑性材料、隔熱基底的影響、接頭、極不規則的表面。

1.4 本方法不擬用於評定產品的耐火性。

1.5 按照本附錄中規定的方法進行試驗為自點燃至跳火的着火早期階段提供數據。

2 參照規範

下列規範文件含有的規定，在本文中援引時構成本段的規定。

ISO 9705，消防試驗－表面產品全尺寸房間試驗。

ISO 13943，消防安全－詞彙。

3 定義

就本附錄而言，ISO 13943標準中給出的定義及下列定義適用。

3.1 *組件*係指材料和（或）複合物的構成，例如夾芯板。

註： 組件中可包括空氣間隙。

3.2 *複合物*係指多種在建築建造中視為分離實體材料的一種結合，例如有塗層或貼面的材料。

3.3 *暴露表面*係指產品承受試驗加熱狀況的表面。

3.4 *材料*係指一種基本單一物質或均一分佈的混合物，例如金屬、石頭、木材、混凝土、礦物纖維、聚合物。

3.5 *產品*係指需要獲得其信息的一種材料、複合物或組件。

3.6 *試樣*係指有待與任何基底或處理共同試驗的、有代表性的產品之一部分。

註： 試樣可包含空氣間隙。

3.7 *表面產品*係指建築中構成內牆和（或）天花板暴露表面的任何部分，例如鑲板、瓷磚、板、牆紙、噴塗或刷塗塗層。

4 原理

4.1 火勢蔓延到房間中遠離點火源的其他物體的潛勢，通過測量位於地板中心處的熱通量計上的總計入射熱通量進行評定。

4.2 火勢蔓延到原房間之外物體的潛勢，通過測量火總體熱釋放率進行評定。

4.3 毒性風險通過測量某些毒氣提供顯示。

4.4 能見度降低的風險通過測量擋光煙氣進行評估。

4.5 火勢發展用視覺圖像和（或）錄像記錄。

註： 如需進一步信息，可對該房間內的氣體溫度和門道進出質量流進行測量。

5 試驗儀器

5.1 總則

試驗儀器，包括試驗房間、點火源、火室內的熱通量儀錶、排風罩和排風管道、排風管道中的儀錶、氣體取樣和分析系統、光學煙氣測量系統和試樣安裝系統及其他必要外圍設備，須符合ISO 9705標準。試驗儀器的校準須按照ISO 9705標準進行。

5.2 點火源

標準點火源與ISO 9705標準附件A相符，即，10分鐘的100千瓦熱輸出並之後10分鐘的300千瓦熱輸出。總體試驗時間須為20分鐘。

5.3 試樣安裝

標準試樣構成與ISO 9705標準附件G相符，即，產品安裝在試驗房間的牆壁上和天花板上。產品須按照最終使用條件試驗，包括任何表面飾面材料或其他表面處理。

6 試樣準備

6.1 有待試驗的產品須儘可能按照與實際應用相同的方式安裝。

註： 在標準試樣構成中，用產品覆蓋三面牆壁和天花板。其他可用試樣構成選擇在ISO 9705標準附件G中給出。

6.2 如有待試驗的產品為板狀形式，須儘可能使用板的標定寬度、長度和厚度。

6.3 產品須：或者附在基底上，或者直接附在消防試驗房間內部。安裝工藝（例如，釘、膠、使用支撐系統）須儘可能與該產品所用的一致。安裝工藝須在報告中清楚闡明，如所用安裝工藝在試驗期間對試樣物理特性有改進時，尤其如此。

6.4 薄型表面材料、會溶化的熱塑產品、油漆和清漆須依照其最終使用，應用於下列基底上：

.1 乾密度為680±50千克/米^{3}的不燃纖維加強硅酸鹽板；

.2 乾密度為1,650±150千克/米^{3}的不燃板；

.3 在相對濕度為50±5%，溫度為23±2℃的大氣環境中調理後密度為680±50千克/米^{3}的粗紙板（顆粒板）；

.4 在相對濕度為50±5%，溫度為23±2℃的大氣環境中調理後密度為725±50千克/米^{3}的石膏板；及

.5 實際使用基底，如其熱性質顯著不同於第.1至.4小段中所述基底，例如鋼、礦物棉。

註： 第.1至.4小段中所述基底的適宜厚度為9至13毫米。

6.5 油漆和清漆須以用戶規定的應用率應用於第6.4段中所列基底之一之上。

6.6 除不吸濕者外，試樣須在相對濕度為50±5%，溫度為23±2℃的大氣中調理至平衡。具代表性的一塊樣品業已達到恆定質量則須視為達到平衡。

註1： 木基產品和會發生溶劑氣化的產品，會需要至少四周調理時間。

註2： 當間隔為24小時的連續兩次稱重作業之差不超過試驗部件質量的0.1%或0.1克，以大者為準，視為已達到恆定質量。

7 試驗

7.1 初始條件

7.1.1 消防試驗房間內和周圍區域的溫度自開始安裝試樣起直至試驗開始須為20±10℃。

註： 將試樣自調理中取出至試驗開始的時間間隔，須保持在最低限度。

7.1.2 距門道中心水平距離1米處測量的水平風速不得超過0.5米/秒。

7.1.3 燃燒器須與牆角接觸。燃燒器開口表面區域須乾淨。

註： 在產品與燃燒器所處角落相鄰的表面上標出0.3米×0.3米網格可有助於確定火焰延播範圍。

7.1.4 試驗前須對產品照相或錄像。

7.2 程序

7.2.1 啟動所有記錄和測量裝置並在點燃燃燒器之前至少進行2分鐘數據記錄。

7.2.2 在點燃燃燒器後10秒鐘內，將燃燒器調整至ISO 9705標準附件A中給出的輸出水平。連續調整排氣能力以收集所有燃燒產物。

7.2.3 對試驗須做照相和（或）錄像記錄。在所有照片記錄中均須出現時鐘，給出至最近1秒鐘的時間。

7.2.4 試驗期間，對下列觀測做出記錄，包括其發生時間：

.1 天花板點燃；

.2 火焰在牆壁和天花板表面上蔓延；

.3 燃燒器熱輸出變化；及

.4 火焰經門道出現。

7.2.5 如發生跳火或在20分鐘後，以先者為準，終止試驗。

註： 安全考慮可令試驗更早終止。

7.2.6 試驗後記下試樣損壞程度。

7.2.7 記錄任何其他異常表現。

8 分析與計算實驗結果

分析與計算須按照ISO 9705標準附件F，及下列方法進行：

.1 試驗開始和結束時的產煙率最大值須計算如下：計算平均值時，對於試驗的第一30秒鐘，亦使用點燃點火源之前的數值，即，零產煙率。對於試驗的最後30秒鐘，使用第20分鐘時測量的數值，將其賦予至第20分鐘零30秒鐘的數值，並計算平均值；

.2 試驗開始和結束時的最大熱釋放率須使用計算平均產煙率的相同原則進行計算；及

.3 產煙率和熱釋放率的時間平均值需使用尚未如上所述加以平均的實際測得值進行計算。

9 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和試驗確定的數據須做出明確區分：

.1 提及試驗係按照《2010年消防試驗程序規則》第10部分附錄1進行（另見.2小段）；

.2 任何與試驗方法的不同；

.3 試驗實驗室名稱和地址；

.4 試驗報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱和地址，如已知；

.7 材料類型，即，艙壁、牆壁或天花板內襯表面材料，並說明是否及如何包括支撐結構；

.8 所試驗產品的名稱和（或）識別；

.9 取樣程序說明，如相關；

.10 對所試驗產品的說明包括密度和（或）每單位面積的質量、厚度和尺寸、顏色、任何塗層的數量和道數，以及產品構造細節；

.11 對試樣的說明包括密度和（或）每單位面積的質量、厚度和尺寸、顏色、任何塗層的數量和道數，試驗的取向和承受試驗的面，及構造；

.12 試樣抵達日期；

.13 試樣調理細節；

.14 試驗日期；

.15 試驗結果（見ISO 9705標準附件F）：

.1 時間/地板中央處熱通量計的入射熱通量；

.2 時間/排氣管道中的體積流量；

.3 時間/熱釋放率；如燃燒器包括在內，燃燒器的時間/熱釋放率；

.4 時間/一氧化碳產生（在參照溫度和壓力下）；

.5 時間/二氧化碳產生（在參照溫度和壓力下）；

.6 時間/擋光煙氣產生（在實際煙道氣流溫度下）；

.7 火勢發展說明（照片）；及

.8 按照ISO 9705標準第10.2段校準的結果；

.16 材料定級；及

.17 聲明：

"試驗結果與產品試樣在特定試驗條件下的表現相關；並不擬作為評定產品使用中潛在失火風險的唯一標準。"。

10 其他參照

亦須參照ISO 9705標準的下列部分：

.1 附件A － 推薦點火源；

.2 附件B － 可選點火源；

.3 附件C － 試驗房間測量儀錶；

.4 附件D － 排氣系統設計；

.5 附件E － 排氣管道中的測量儀錶；

.6 附件F － 計算；

.7 附件G － 試樣構造；及

.8 附件H － 文獻。

附錄2

高速船家具和其他部件所用材料熱釋放、

產煙和質量損失率消防試驗程序

參照文件：ISO 5660-1，對消防試驗的反應 － 熱釋放、產煙和質量損失率 － 第1部分：熱釋放率（錐形熱量計法）；及ISO 5660-2，對消防試驗的反應 － 熱釋放、產煙和質量損失率 － 第2部分：產煙率（動態測量）。

1 範圍

本段規定了使用外部點火器對以水平取向暴露於受控輻射水平的試樣進行熱釋放率評定的方法。熱釋放率，通過測量從氧濃度中得出的耗氧量和產品燃燒流的流率而確定。在此試驗中，對點燃時間（持續焰燃）亦做測量。

2 參照規範

下列規範性文件包含的規定在本文中援引時，構成本附錄的規定。

ISO 291，塑料－調理和試驗的標準大氣環境。

ISO 554，調理和（或）試驗的標準大氣環境－規範。

ISO 5660-1，對消防試驗的反應－熱釋放、產煙和質量損失率－第1部分：熱釋放率（錐形熱量計法）。

ISO 5660-2，對消防試驗的反應－熱釋放、產煙和質量損失率－第2部分：產煙率（動態測量）。

ISO 13943，消防安全－詞彙。

ISO 14697，對消防試驗的反應－建築和運輸產品基底選擇指南。

3 術語與定義

就本附錄而言，ISO 13943標準中給出的術語與定義及下列術語與定義適用。

3.1 *基本平整表面*係指平面不規則不超過1毫米的表面。

3.2 *閃燃*係指試樣表面或表面之上出現歷時不足1秒鐘的火焰。

3.3 *點燃*係指第3.10段中定義的持續火焰的開始。

3.4 *輻射度*（於表面某一點之上的）係指表面上極小元素（包含該點和該元素面積）上的入射輻射通量之商數。

註： 在水平試樣取向上，對流加熱無足輕重。由於此原因，在ISO 5660標準的此部分中，通篇使用“輻射度”而未使用“熱通量”這一術語，因為這最佳地表明了基本上為輻射式熱交換。

3.5 *材料*係指一種單一物質或均勻散佈的混合物，如金屬、石頭、木材、礦物纖維和聚合物。

3.6 *取向*係指試驗中試樣暴露面的平面，無論垂直或水平面朝上。

3.7 *耗氧原理*係指燃燒時氧消耗和熱釋放之間的關係的比例數。

3.8 *產品*係指需獲取信息的材料、複合物或組合。

3.9 *試樣*係指產品擬與任何基底或處理一同試驗的具代表性的一部分。

註： 對於某些類型的產品，例如包含空氣間隙或接頭的產品，可能無法製備對其最終應用條件具代表性的試樣（見第7段）。

3.10 *持續焰燃*係指試樣表面或之上出現的歷時10秒鐘以上的火焰。

3.11 *短暫焰燃*係指試樣表面或之上出現的歷時1至10秒鐘的火焰。

4 符號

見ISO 5660-1標準，表1。

5 原理

5.1 本方法以通常燃燒淨熱值與燃燒需氧量成比例這一觀測經驗為基礎。其關係為每千克氧消耗釋放約13.1×10^3千焦的熱。試驗中，試樣在環境空氣條件下燃燒，在承受0至100千瓦/米^{2}範圍內的預定外部輻射的同時，對氧氣濃度和排氣流率進行測量。

5.2 本試驗方法用於評定試驗中的產品陷於着火之中時，可對放熱率做出的貢獻。這些特性在具代表性的小型試樣上確定。

6 儀器

6.1 試驗儀器，包括錐形輻射電熱器、帶有氣流測量儀錶的排氣系統、氣體取樣和分析系統、試樣夾和其他必要外圍設備，須與ISO 5660-1標準相符。試驗儀器校準須按照ISO 5660-1標準進行。

6.2 測量產煙率的試驗儀器須與ISO 5660-2標準相符。

7 適於試驗的產品

7.1 表面特性

7.1.1 具備下列特性之一的產品，適於試驗：

.1 基本平整的暴露面；

.2 表面不規則性均勻分佈於暴露面上，但條件為：

.1 在具代表性的100毫米×100毫米的面積之內，至少50%的表面在沿暴露面最高點所取平面的10毫米深度以內，或

.2 對於含有深度超過10毫米的開裂、縫隙或孔洞的表面，這些開裂、縫隙或孔洞的寬度不得超過10毫米，及這些開裂、縫隙或孔洞在表面上的總體面積不得超過暴露表面具代表性的100毫米×100毫米區域的30%。

7.1.2 如暴露表面不符合第7.1.1.1或7.1.1.2段的要求，則該產品須以經修改的、儘可能符合本段中所給出要求的方式進行試驗。試驗報告須闡明該產品以經修改的方式進行試驗並對修改做出清楚描述。

7.2 不對稱產品

為此試驗提交的產品可具有不同表面，或兩面包含以不同方式佈置的不同材料的貼面。如在房間、空腔或空隙內使用中，兩面均可暴露，則兩面均須試驗。

7.3 短期燃燒材料

對於短期燃燒（3分鐘或以下）試樣，須間隔不超過2秒鐘測量熱釋放率。對於燃燒期較長者，可採用5秒鐘間隔。

7.4 複合試樣

複合試樣，只要按照第8.3段中的規定製備並以最終使用狀況的典型方式暴露，則適於試驗。

7.5 尺寸易變材料

7.5.1 因熱漲或變形致使其在點燃之前觸及火花塞，或在點燃後觸及錐形加熱器底部的樣品，須在錐形加熱器底板與試樣上表面之間間隔60毫米進行試驗。在此情況下，須將熱通量計置於錐形加熱器底板之下60毫米處對加熱器進行校準。必須強調的是，在此間隔下測量的點燃時間與在25毫米間隔下測量的點燃時間不可比較。

7.5.2 其他尺寸易變產品，如試驗期間捲曲或收縮的產品，須得到制約以避免過度移動。這須如下所述使用四條束縛金屬絲而實現。須使用直徑為1±0.1毫米，長度至少為350毫米的金屬絲。試樣須以標準方式如第8段所述加以製備。將一條金屬絲環繞試樣夾和定位框架組合，並與組合四條邊之一平行並距該邊約20毫米。將金屬絲的兩端擰在一起使金屬絲拉緊至緊貼定位框架。在試驗前將擰接處的多餘部分剪去。將其餘三條金屬絲以同樣的方式裝設在試樣夾和定位框架組合上，並與其餘三條邊平行。

8 試樣的構造和製備

8.1 試樣

8.1.1 試樣須對材料的最終應用具代表性，並包括任何表面加工。

8.1.2 如可燃隔熱材料受金屬外殼保護或可作為分離物識別，則該隔熱須無表面保護進行試驗。

8.1.3 所有試驗中均須使用樣品邊框。所有三次試驗均須將輻射水平設定為每平方米50千瓦。試驗須在暴露開始後20分鐘結束。試驗結束後，須繼續收集數據兩分鐘，以確保在計及部分儀錶延遲的時間漂移後具有完整試驗期數據。

8.1.4 在選定的50千瓦/米^{2}的輻射水平下，須對各不同暴露表面的三份試樣進行試驗。

8.1.5 試樣須對材料最終使用條件具代表性，包括任何表面加工並須為各邊尺寸為100±2毫米的方形。

8.1.6 正常厚度為50毫米或以下的產品，須以其完整厚度進行試驗。

8.1.7 對於正常厚度大於50毫米的產品，所需試樣須通過切削非暴露面將厚度減至50毫米而獲得。

8.1.8 從具有不規則表面的產品上切割試樣時，須將表面上的最高點安排在試樣的中央。

8.1.9 組合須酌情如第8.1.3段或8.1.4段的規定進行試驗。但是，若組合製造中使用了薄型材料或複合物，則任何下層構造的性質可對暴露面的點燃和燃燒特性有顯著影響。

8.1.10 對基礎層的影響須有瞭解，並小心確保對任何組合所獲得的試驗結果與其實際應用相切合。

8.1.11 產品如為通常附在明確限定的基底上的材料或複合物，則須與該基底一同試驗，並採用所建議的固定工藝，例如使用適當黏合劑黏合或機械固定。如無特定或明確限定的基底，則須按照ISO 14697標準選擇適當基底進行試驗。

8.1.12 薄於6毫米的產品須與對最終應用具代表性的基底一同試驗，使試樣的總體厚度達到6毫米或以上。

8.2 試樣的調理

8.2.1 試驗前，須按照ISO 554標準，在溫度為23±2℃和相對濕度為50±5%之下，將試樣調理至恆定質量。

8.2.2 當間隔24小時連續進行的兩次稱重作業之差不大於試驗物質量的0.1%或0.1克時，以大者為準，視為達到恆定質量。

8.2.3 對於達到平衡需要調理一周以上的材料如聚酰胺，可在按照ISO 291標準調理之後進行試驗。此期限不得少於一周，並須在試驗報告中闡明。

8.3 準備

8.3.1 ***包裹試樣***

8.3.1.1 經調理的試樣須用厚度為0.025至0.04毫米的單層鋁箔包裹，鋁箔光面面對試樣。鋁箔須事先切成覆蓋試樣底部和邊部並自試樣上表面延伸出3毫米或以上的尺寸。須將試樣置於鋁箔中央並對底部和邊部加以包裹。頂部表面以上的多餘鋁箔如必要須剪去，使其不致延伸至試樣頂部表面以上。邊角處的多餘鋁箔需沿邊角加以折疊以沿試樣頂表面形成密封。包裹後，經包裹的試樣須置於試樣夾中並用定位框架覆蓋。此程序完成後，不得有可見鋁箔。

8.3.1.2 對於柔軟試樣，可使用與待試驗試樣厚度相同的模擬試樣預定鋁箔形狀。

8.3.2 *試樣製備*

所有試樣須使用定位框架進行試驗。須採取下列步驟為試驗製備試樣：

.1 將定位框架面朝下置於平整表面上；

.2 將用鋁箔包裹的試樣暴露面朝下插入框架；

.3 將數層耐熔纖維毯（標定厚度13毫米，標定密度65千克/米^3）置於頂上直至一完整層，並不得多於兩層，延伸至框架邊緣之上；

.4 將試樣夾在耐熔纖維之上裝入框架並向下壓；及

.5 將定位框架緊固在試樣夾上。

9 試驗環境

試驗儀器須位於基本無風的環境之中，大氣條件為相對濕度在20%至80%之間及溫度在15℃至30℃之間。

10 試驗程序

10.1 通用防範措施

警告： 為採取適當健康保護措施，請所有參與試驗者注意試樣暴露期間會釋放出有毒或有害氣體的可能性。

本試驗程序涉及高溫和燃燒過程。因此，存在例如燒着或點燃無關物品或服裝的風險。試驗者插入或取下試樣須穿着保護手套。除帶有保護手套外，不得觸摸熱燙錐形加熱器和相關固定裝置。須注意不得觸及帶有可觀的10千伏勢能的火花點火器。須在試驗前核查試驗儀器排氣系統工作正常，並向具有充分能力的建築排氣系統排放。對於某些試樣受到輻射時劇烈噴出熔融高熱物質或鋒利碎片的可能性不可完全不予考慮及因此佩戴護目鏡至關重要。

10.2 初始準備

10.2.1 檢查二氧化碳捕集器和最後水分捕集器。必要時更換吸附劑。排空冷凝器分離槽中的積水。冷凝器正常運作溫度不得超過4℃。

如氣體取樣系統的任何捕集器或過濾器在檢查中曾經開啟，須（在取樣泵啟動下）核查氣體取樣系統有否泄漏，例如，通過與取樣氣體相同的流率和壓力，從儘可能靠近環形取樣器連接的氮氣源引入純氮氣。氧氣分析儀的讀數須為零。

10.2.2 調整錐形加熱器底板與試樣上表面之間的距離。

10.2.3 開啟錐形加熱器及排氣扇電源。氣體分析儀、稱重裝置和壓力傳感器的電源不得每日關閉。

10.2.4 將排氣流率設定為0.024±0.002米^3/秒。

10.2.5 進行ISO 9705標準第10.2段中規定的必要校準程序。在稱重裝置之上放置熱絕緣（例如帶有耐熔纖維毯或水冷輻射屏蔽的空試樣夾）。這在準備期間和試驗間隔期間就位以避免對稱重裝置熱傳遞過度。

10.3 程序

10.3.1 ***開始數據收集***

收集基線數據：掃描間隔為2秒鐘。

10.3.2 將輻射屏蔽插入就位。除去保護稱重裝置的熱絕緣。將按照第8.3段製備的試樣與試樣夾放置在稱重裝置上。輻射屏蔽在即將插入前須低於100℃。

10.3.3 按照所用屏蔽的類型，以正確順序如下所述插入火花塞並除去輻射屏蔽。

對於a）型屏蔽（見ISO 5660-1標準），移除屏蔽並開始試驗。在移除屏蔽的1秒鐘內插入並啟動點火器。

對於b）型屏蔽（見ISO 5660-1），在插入後10秒鐘內移除屏蔽並開始試驗。在移除屏蔽的1秒鐘內插入並啟動點火器。

10.3.4 記錄發生閃燃或短暫焰燃的時間。當出現持續焰燃時，記錄時間、關閉火花塞、並移除點火器。如火焰在關閉火花塞後熄滅，重新插入火花塞點火器並在5秒鐘內啟動火花塞，並在全部試驗完成之前不要移除火花塞。在試驗報告中對這些事件做出報告（見第12段）。

10.3.5 收集全部數據直至：

.1 持續焰燃22分鐘之後（該22分鐘包括20-分鐘試驗期和收集時間平移數據的另外2-分鐘後試驗期）；

.2 20分鐘已過且試樣未被點燃；

.3 XO_2在百萬分之100氧氣濃度內回復到實驗前數值達10分鐘；或

.4 試樣質量成為零，

以先發生者為準，但在任何情況下，最短試驗時間須為5分鐘。觀測並記錄樣品物理變化如熔化、膨脹和開裂。

10.3.6 取下試樣和試樣夾。將熱絕緣置於稱重裝置之上。

10.3.7 須對三份試樣進行試驗並如第12段所述作出報告。須對該三份試樣18秒鐘時的平均熱釋放率讀數進行比較。如任何平均讀數與三個讀數的計算平均值相差大於10%以上，則須對另外三份試樣進行試驗。在此情況下，須報告六份讀數的計算平均值。

註： 如試樣熔化足以溢出試樣夾，如發生爆發性散裂，或如試樣過度膨脹並觸及火花點火器或加熱器底板，則試驗數據有效性有限。

11 計算

11.1 點燃時間、熱釋放率和總體熱釋放須按照ISO 5660-1和ISO 5660-2標準進行測量和計算。

11.2 產煙率（SPR）和熱釋放率（HRR）的時間平均值須使用未經平均的實際測量值進行計算。

11.3 30秒鐘滑動熱釋放率（HRR30）和30秒鐘滑動產煙率（SPR30）須作為該時間之前和之後15秒鐘期間的平均值計算。對於第一個和最後一個30秒鐘的期間，以下所列適用：

.1 對於試驗的第一個30秒鐘，計算產煙率平均值時，亦使用點燃點火源之前的數值，即，零產煙率；及

.2 對於試驗的最後30秒鐘，使用20分鐘時的測量值，將其賦予直至20分鐘30秒的30秒鐘並計算平均值。

11.4 最大30秒鐘滑動產煙率（SPR30max）和最大30秒鐘滑動平均熱釋放率（HRR30max）須分別作為SPR30和HRR30的最大值獲取。

12 試驗報告

試驗報告須至少包含下列信息。對申請人提供的數據和試驗確定的數據須做出明確區分：

.1 提及試驗係按照《2010年消防試驗程序規則》第10部分附錄2進行（另見.2小段）；

.2 與試驗方法的任何不同；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 生產者/供應者名稱和地址，如已知；

.7 材料類型，即，家具部件、表面襯裡或飾面，等等；

.8 所試驗產品名稱和/或識別；

.9 取樣程序說明，如相關；

.10 所試驗產品說明，包括每單位面積的密度和（或）質量、厚度和尺寸、顏色、任何塗層的數量和道數、以及產品構造細節；

.11 對試樣的說明，包括每單位面積的密度和（或）質量、厚度和尺寸、顏色、任何塗層的數量和道數、試驗取向和承受試驗的面，及構造；

.12 樣品抵達日期；

.13 試樣調理細節；

.14 試驗日期；

.15 試驗條件：

.1 孔流率校準常數C（見ISO 5660-1標準）；

.2 輻射水平（50千瓦/米^2），及排氣系統流率，以米^3/秒表達；及

.3 在同樣條件下試驗的複製試樣數量（除測試試驗外，這須至少為三份）；

.16 試驗結果：

.1 各試樣點燃時間，以秒鐘表達；

.2 各試樣試驗時限，通常為20分鐘；

.3 對於每份試樣，以曲線圖顯示的、各試樣整個試驗所記錄的以千瓦/米^{2}表達的30秒鐘滑動平均熱釋放率，和以米^2/秒鐘表達的30秒鐘滑動平均產煙率；

.4 對於每份試樣，以千瓦/米^{2}表達的最大30秒鐘滑動平均熱釋放率和以米^2/秒鐘表達的最大30秒鐘滑動平均產煙率；

.5 各試樣以千焦/米^{2}表達的總體熱釋放；

.6 其他觀測，如短暫焰燃或閃燃；及

.7 試驗中遇到的困難，如有；

.17 材料定級；及

.18 聲明：

“試驗結果與產品試樣在特定試驗條件下的表現相關；並不擬作為評定產品使用中潛在失火風險的唯一標準。”。

13 其他參照

就本附錄2而言，對ISO 5660-1標準的下列章節亦須加以參照：

.1 附件A： 對操作者的解說及指導說明；

.2 附件B： 分辨率、精確度及偏置；

.3 附件C： 質量損失率及有效燃燒熱量；

.4 附件D： 垂直取向試驗；

.5 附件E： 工作熱通量計的校準；

.6 附件F： 帶有附加氣體分析的熱釋放計算；

.7 附件G： 試樣構造；及

.8 附件H： 文獻。

第11部分 － 高速船耐火分隔試驗

1 適用

高速船上所用構造如要求具有耐火特性，則須符合本部分的規定。此類構造包括耐火艙壁、甲板、天花板、襯板和門。

2 消防試驗程序

高速船的耐火分隔須按照本部分附錄中規定的消防試驗程序進行試驗和評定。

3 附加要求

3.1 耐火分隔中使用的材料須分別為按照本附件第1或第10部分核實的不燃或限火材料。

3.2 本附件第3部分亦適用於某些如窗、檔火板、管道貫穿和電纜穿越等構造。

3.3 如要求防火門控制系統在着火時能夠運作，則本附件第4部分亦適用。

3.4 如允許可燃貼面在耐火分隔中與不燃基底共用，則此等貼面的低播焰性（如要求）須按照本附件第5部分進行核實。

附 錄

高速船耐火分隔消防試驗程序

1 總則

1.1 根據《1994年或2000年高速船規則》的規定，用於高速船上的構造須具備令主管機關滿意並獲主管機關認可的耐火特性。在此，“耐火特性”係指構造在失火中具備分隔性能，對某個區域給予隔熱/保護、免受相鄰區域中失火影響的能力。此等構造係指耐火的艙壁、甲板、天花板、襯板和門。

1.1.1 中等火災耐火分隔的級別為“耐火30分隔”。

1.1.2 重大火災耐火分隔的級別為“耐火60分隔”。

1.2 級別須以，例如，“承重耐火60甲板”和“非承重耐火30艙壁”的形式表達，即，包括對分隔取向的限定並說明有關分隔是否被評定為承重或非承重。

1.3 耐火分隔的試驗和報告通常須符合本附件第3部分中給出的要求。需要額外解釋、調整和（或）補充要求者，在本部分中作出詳述。

1.4 試驗須進行的時間為：耐火30分隔至少30分鐘，或耐火60分隔至少60分鐘，或遵循《2000年高速船規則》所允許的中間消防保護時間。

1.5 下列隔熱和完整性性能標準須在級別時限內得到滿足（見上述第1.4段）：

.1 隔熱：非暴露面平均溫度上升不得超過140℃，及，非暴露面上的任何一個單獨熱電偶所記錄的溫度上升不得超過180℃；及

.2 完整性：

.1 非暴露面不得有焰燃；

.2 不得有點燃，即，棉毛墊焰燃或無焰熾燃；及

.3 不得有將隙規如第3部分附錄1第8.4.4段所述插入試樣任何縫隙的可能性。

1.6 在本附錄中，耐火分隔試驗分三部分敍述如下：

.1 非承重耐火分隔；

.2 本附件第3部分中預定為“A”級分隔的具有金屬構芯的承重耐火分隔；及

.3 其他承重耐火分隔。

2 非承重耐火分隔

非承重耐火分隔試驗所採用的方式須在相關和適當時，遵循本附件第3部分中對“B”級分隔的試驗要求。

3 本附件第3部分中預定為“A”級分隔的具有金屬構芯的承重耐火分隔

3.1 具有金屬構芯（鋼或鋁）的承重耐火分隔試驗所採用的方式須在相關和適當時，遵循本附件第3部分中對“A”級分隔的試驗要求。

3.2 如構芯為鋁製，則在其級別時限（見上述第1.4段）內的任何時候，構芯平均溫度上升不得超過其初始溫度以上200℃。

4 承重耐火分隔

4.1 其他承重耐火分隔試驗所採用的方式須在相關和適當時，遵循本附件第3部分中對“B”級分隔的試驗要求。

4.2 另外，此等承重分隔須承載所規定的靜負荷進行試驗，並須在其級別時限內（見上述第1.4段）保持其承重能力。

4.3 試樣的性質

4.3.1 試樣的構造、樹立和加強須如其典型實際應用。

4.3.2 對於垂直分隔（艙壁），試樣暴露部分的最小整體尺寸為2,440毫米寬及2,500毫米高，或，如其高度小於2,500毫米，則為其完整高度。

4.3.3 對於水平分隔（甲板），試樣暴露部分的最小整體尺寸為2,440毫米寬及3,040毫米長（跨距），或，如其長度小於3,040毫米，則為其完整長度。

4.4 試樣安裝

4.4.1 垂直試樣須僅在其頂部和底部加以支撐，並不得沿其垂直邊緣加以支撐。

4.4.2 水平試樣須僅在兩端加以支撐並不得沿其與跨度平行的邊緣加以支撐。

4.5 靜負荷

4.5.1 須儘實際可能均勻地沿垂直試樣的頂緣或水平試樣的表面應用下列負荷水平：

.1 艙壁： 7.0千牛/米；及

.2 甲板： 3.5千牛/米^2。

負荷應用可為液壓、機械壓力或使用重物。

4.5.2 加載設備須能夠對試驗構造酌情模擬負荷條件。加載設備並須：能夠在不改變其分佈的情況下，於負荷承載能力時限內，將試驗負荷維持為恆定值（要求值±5%之內）；不得對通過試樣的熱傳遞有任何顯著影響亦不得妨礙熱電偶絕緣墊的使用；不得干擾對表面溫度和（或）變形的測量並允許對非暴露面進行全面觀測。

4.5.3 對甲板而言，加載設備與試樣表面之間的接觸點總體面積不得超過水平試樣表面總體面積的10%。該設備須能夠追隨試樣的最大變形和變形率。對艙壁而言，加載設備須產生對艙壁整體寬度均勻施加的負荷。

4.5.4 試驗組件如包括承重部件如樑，則除其與試樣接觸面外，所有各面均須暴露於火爐，並不得置於距爐壁不到200毫米之處。

4.5.5 在實踐中，特別是在甲板上，可能難產生均勻負荷。在確定負荷分佈是否為第4.4.2段和第4.5.1段中規定的典型標準條件時，實驗室須對自由程度、最大剪力和彎曲力矩給予考慮。

4.5.6 可以採用與第4.4.2段和第4.5.1段不同的安裝方法和負荷條件。在此情況下，試驗條件和負荷分佈須為主管機關所接受者。

4.5.7 試驗報告須包括與均勻負荷和安裝近似的論證。報告須包括有關負荷重新分配的力、表面接觸和接觸點位置的說明。

4.5.8 施加試驗負荷須在開始加熱階段之前至少15分鐘進行。

4.6 變形

4.6.1 變形測量需使用運用機械、光學或電學技術的設備進行。試樣撓曲測量儀器所在位置須能夠在消防試驗期間提供撓曲量和撓曲率數據。

4.6.2 變形數據須在試驗時限期間以±2毫米的精度加以記錄。

4.6.3 對於艙壁，須對軸向收縮和水平撓曲進行測量。

4.6.4 對於甲板，須對垂向撓曲進行測量。

4.7 負荷承載能力性能標準

試樣如不再能夠支撐試驗負荷，則須視為不合格。支撐試驗負荷通過撓曲量和撓曲率兩者加以確定。由於在達到穩定條件之前會發生相對快速的撓曲，甲板撓曲率標準在撓曲超過L/30之前不做應用。就本部分而言，下列標準適用：

.1 艙壁：

.1 軸向收縮限制h/100毫米；及

.2 軸向收縮率限制3h/1,000毫米/分鐘，

其中：

h ＝ 初始高度（毫米）；及

.2 甲板：

.1 撓曲限制（L）^{2}/400d毫米；及

.2 撓曲率限制（L）^{2}/9,000d毫米/分鐘，

其中：

L ＝ 試樣淨跨度（毫米）；及

d ＝ 從結構剖面的設計壓縮區末端構造至設計張力區末端構造的距離（毫米）。

5 試驗報告

試驗報告須至少包括下列信息。對申請人提供的數據和經試驗確定的數據需做出明確區分：

.1 提及試驗係按照《2010年消防試驗程序規則》第11部分進行（另見以下.2小段）；

.2 任何與試驗方法的背離；

.3 試驗實驗室名稱和地址；

.4 報告日期和識別編號；

.5 申請人名稱和地址；

.6 所試驗產品的名稱和（或）識別；

.7 試樣和產品及構造中所用部件製造者名稱；

.8 產品類型，即艙壁、天花板、門、窗、管道貫穿、等等；

.9 依照第1.6段的試驗分類；

.10 試樣的結構細節，包括部件的說明、圖紙和主要的細節。須提供第2段中所要求的全部細節。報告中所包括的說明和圖紙須儘實際可行地以得自試樣檢驗的信息為根據。如報告中未包括全部和詳細的圖紙，則申請人的試樣圖紙須經實驗室認證，實驗室須至少保留一份經認證的圖

紙副本；在此情況下，報告中須引用申請人的圖紙並有表明圖紙核准方法的陳述；

.11 所用材料對試樣耐火性能有影響的所有特性，以及試驗實驗室確定的隔熱材料的厚度、密度和（適用時）水分和（或）有機成分；

.12 負荷應用方法及負荷數量，如適用；

.13 試樣抵達日期；

.14 試樣調理細節；

.15 試驗日期；

.16 試驗結果：

.1 有關固定於試樣上的所有熱電偶的位置信息，以及試驗期間得自各熱電偶的表列數據。另外可包括所獲數據的圖形描述。須包括一份圖紙清楚說明各熱電偶的位置，並相對於溫度－時間數據對各熱電偶加以標明；

.2 在與有關等級隔熱性能標準相應的時限結束時記錄的平均溫升和最大溫升及，適用時，構芯平均溫升，或，如因超出隔熱標準而終止試驗，超過各限定溫度的時間；

.3 試樣的最大變形。就門而言，門試樣中心的最大變形和門扇各角相對於門框的最大變形；

.17 試樣所達到的等級須以“承重耐火60分隔艙壁”的方式表達，即，包括對分隔取向的限定。在試驗報告中，結果須以下列方式在“等級”的標題下表達：“按本報告中所述而建造的艙壁，按照《2010年消防試驗程序規則》附件1第11部分，可被視為“承重耐火60分隔”級艙壁。”；

.18 試驗時在場的主管機關代表姓名。如主管機關要求試驗前事先通知，且其代表未曾目擊試驗，則須在報告中以下列方式對此做出記錄：

“……………………（主管機關名稱）已得知擬進行本報告中詳述的試驗，並認為無需派代表目擊試驗。”；及

.19 聲明：

“本試驗結果與產品試樣在特定試驗條件下的表現相關；不擬作為產品使用中潛在着火風險評估的唯一標準”。

附件2

不經試驗和（或）認可即可安裝的產品

總則

列於本附件中的產品或產品組別通常被視為具有以下所規定的消防安全特性並且可不按照及根據本規則中的具體消防試驗程序對產品的具體安全特性進行試驗及給予認可即可安裝。

以下段落，與附件1中規定出相應試驗要求的部分，編號相同。

1　　不燃材料

僅由玻璃、混凝土製成的產品、陶瓷產品、天然石頭、磚瓦部件、普通金屬和金屬合金通常被視為不燃並且不經試驗和認可即可安裝。

2　　在火中不產生過量煙和有毒產物的材料

2.1　不燃材料通常被視為符合附件1第2部分的要求而無需進一步試驗。

2.2　總體熱釋放（Q_t）不超過0.2MJ、熱釋放率峰值（Q_p）不超過1千瓦（兩個數值均按照附件1第5部分確定）的表面材料和甲板基層敷料通常被視為符合附件1第2部分的要求而無需進一步試驗。

2.3 對符合以上第2.2段中要求的產品免除按照ISO 1716標準進行試驗。預期這些產品滿足最大總熱值要求（例如，45MJ/米^2）而無需進一步試驗。

2.4 對於高速船，限火材料被視為符合附件1第2部分的要求而無需進一步試驗。

3 "A"、"B"和"F"級分隔

3.1 下列產品可不經試驗或認可而安裝：

等級	**產品說明**
"A-0"級 艙壁	鋼質艙壁，其尺寸不小於以下所列最小尺寸： － 板材厚度：4毫米 － 加強肋60毫米×60毫米×5毫米間距600毫米或等效結構
"A-0"級 甲板	鋼質甲板，其尺寸不小於以下所列最小尺寸： － 板材厚度：4毫米 － 加強肋95毫米×65毫米×7毫米間隔600毫米或等效結構。

3.2 儘管有以上第3.1段中的規定，“A”、“B”和“F”級分隔中所用、並要求具有某些其他特定特性（如，不燃性、低播焰性、等等）的材料須符合本規則附件1適當部分的要求。

4 防火門控制系統

（無條目）

5 低播焰性表面和甲板基層敷料

5.1 不燃材料被視為符合附件1第5部分的要求。但是，對於應用和固定方法（例如，膠）須給予適當考慮。

5.2 按照附件1第5部分定級為不易點燃的甲板基層敷料被視為符合地板敷料要求。

5.3 對於高速船，係合格限火材料的表面與材料，被視為符合附件1第5部分的要求而無需再做實驗。

6 垂直懸掛紡織品和薄膜

（無條目）

7 軟墊家具

（無條目）

8 床上用品

（無條目）

9 高速船限火材料

（無條目）

10 高速船耐火分隔

（無條目）

附件3

消防保護材料及所需認可試驗方法

表1 — 載運36名以上乘客的客船及高速船消防保護材料及所需認可試驗方法

試驗方法（消防試驗程序規則） 試樣（產品）	第1部分 不燃性	第2部分 煙與毒性	第3部分 A、B和F級分隔	第4部分 門系統	第5部分 表面易燃性	第7部分 帷簾或垂直懸掛的紡織品	第8部分 軟墊家具	第9部分 床上用品	第10部分 — ISO 9705 (MSC.40(64)和(MSC.90(71))	第10部分 — ISO 5660 (MSC.40(64)和MSC.90(71))	第11部分 — A.754(18) (對於《2000高速船規則》)	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則 適用條款
不燃材料	X													5.3.1.2.1
“A”級 艙壁	X		X											3.2.3， 9.2.2.3
“B”級 艙壁	X		X											3.4.1， 9.2.2.3
“C”級 艙壁	X												1	3.10， 9.2.2.3
“A”級 甲板	X		X											3.2.3， 9.2.2.3
“B”級 甲板	X		X											3.4.1， 9.2.2.3
“B”級 襯板	X		X											3.4.1， 9.2.2.3
“B”級 天花板	X		X											3.4.1， 9.2.2.3
“B”級 連續天花板	X		X											3.4.1， 9.2.2.3.3
“A”級 防火門	X		X											3.2.3， 9.4.1.1.2
“B”級 防火門	X		X											3.4.1， 9.4.1.2.1
“A”級 窗	X		X											3.2.3， 9.4.1.3.1

試驗方法（消防試驗程序規則） 試樣（產品）	第1部分 不燃性	第2部分 煙與毒性	第3部分 A、B和F級分隔	第4部分 門系統	第5部分 表面易燃性	第7部分 帷簾或垂直懸掛的紡織品	第8部分 軟墊家具	第9部分 床上用品	第10部分 — ISO 9705 (MSC.40(64)和(MSC.90(71)	第10部分 — ISO 5660 (MSC.40(64)和MSC.90(71)	第11部分 — A.754(18) (對於《2000高速船規則》)	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則 適用條款
“B”級 窗	X		X											3.2.3， 9.4.1.3.1
隔熱及隔音材料	X													5.3.1.1
部分艙壁	X												2	5.3.1.2.1
檔火板			X											9.7.1.2.1
電纜穿越			X											9.3.1
管道貫穿			X											9.3.1
防火門控制系統				X										9.4.1.1.4.15
通風管道	X													9.7.1.1
黏合劑（艙壁，甲板，門及其他分隔）					X									5.3.1.1
暴露油漆表面		X			X								3	5.3.2.4.1.1
暴露箔、紡織物或表面貼面		X			X							X	3	5.3.2.4.1.1
遮蔽處所油漆表面					X									5.3.2.4.1.2
遮蔽處所表面或地面上的箔、紡織物或貼面					X							X		5.3.2.4.1.2
天花板及襯板	X												2	5.3.1.2.1

試驗方法（消防試驗程序規則）／試樣（產品）	第1部分 不燃性	第2部分 煙與毒性	第3部分 A、B和F級分隔	第4部分 門系統	第5部分 表面易燃性	第7部分 帷簾或垂直懸掛的紡織品	第8部分 軟墊家具	第9部分 床上用品	第10部分 — ISO 9705 (MSC.40(64)和(MSC.90(71))	第10部分 — ISO 5660 (MSC.40(64)和MSC.90(71))	第11部分 — A.754(18) (對於《2000高速船規則》)	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則 適用條款
艙壁及天花板襯板表面		X			X								4	5.3.2.4.1.1
地面	X												2	5.3.1.2.1
擋風條	X												2	5.3.1.2.1， 8.4
室內暴露表面上的油漆、清漆和其他飾面		X			X									6.2
地面敷料		X			X3									5.3.2.4.1
可燃通風管道					X									9.7.1.1.1 氣體經管道傳輸
製冷服務系統隔熱材料					X									5.3.1.1 標準須經限定
防潮層					X									5.3.1.1
甲板基層敷料		X			X									4.4.4， 6.3
帷簾 — 垂直懸掛紡織品						X								3.40.3，9.2.2.3.2.2（6） 可慮及毒性及不透明性標準

試驗方法（消防試驗程序規則）／試樣（產品）	第1部分 不燃性	第2部分 煙與毒性	第3部分 A、B和F級分隔	第4部分 門系統	第5部分 表面易燃性	第7部分 帷簾或垂直懸掛的紡織品	第8部分 軟墊家具	第9部分 床上用品	第10部分 — ISO 9705 (MSC.40(64)和(MSC.90(71))	第10部分 — ISO 5660 (MSC.40(64)和MSC.90(71))	第11部分 — A.754(18) (對於《2000高速船規則》)	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則適用條款
軟墊家具							X							3.40.6，5.3.3，9.2.2.3.2.2（6）
床上用品								X						3.40.7，9.2.2.3.2.2（6）
限火分隔									X					HSC 7.4.3.1
限火天花板									X					HSC 7.4.3.1
限火襯板									X					HSC 7.4.3.1
限火箱框家具										X				HSC 7.4.3.3.1
限火獨立家具										X				HSC 7.4.3.3.1
限火隔熱及隔音材料										X				HSC 7.4.3.3.2
非承重耐火分隔											X			HSC 7.4.3.3.5
有金屬構芯的承重耐火分隔											X			HSC 7.2.1
無金屬構芯的承重耐火分隔											X			HSC 7.2.1

1 可使用低播焰性黏合劑。

2 貨物處所、郵件收發室、行李間和服務處所冷藏間內除外。

3 僅走廊和樓梯間。

4 起居處所和服務場所（除桑拿室外）和控制站內。

* 如要求最大總熱值小於45MJ/米^2。

表2－貨船消防保護材料及所需認可試驗方法（IC法）

試驗方法（消防試驗程序規則）／試樣（產品）	第1部分 不燃性	第2部分 煙與毒性	第3部分 A、B和F級分隔	第4部分 門系統	第5部分 表面易燃性	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則適用條款
不燃材料	X							5.3.1.2.2
“A”級 艙壁	X		X					3.2.3， 9.2.3
“B”級 艙壁	X		X					3.4.1， 9.2.3
“C”級 艙壁	X						1	3.10， 9.2.3
“A”級 甲板	X		X					3.2.3， 9.2.3
“B”級 甲板	X		X					3.4.1， 9.2.3
“B”級 襯板	X		X					3.4.1， 9.2.3
“B”級 天花板	X		X					3.4.1， 9.2.3
“B”級 連續天花板	X		X					3.4.1， 9.2.3.3
“A”級 防火門	X		X					3.2.3， 9.4.2.1
“B”級 防火門	X		X					3.4.1， 9.4.2.1
“A”級 窗	X		X					3.2.3， 4.5.2.3
隔熱及隔音材料	X							5.3.1.1
檔火板			X					9.7.1.2.1

試驗方法（消防試驗程序規則）／試樣（產品）	第1部分 不燃性	第2部分 煙與毒性	第3部分 A、B和F級分隔	第4部分 門系統	第5部分 表面易燃性	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則適用條款
電纜穿越			X					9.3.1
管道貫穿			X					9.3.1
通風管道	X		~~X~~					9.7.1.1
黏合劑（艙壁，甲板，門及其他分隔）					X			5.3.1.1
暴露油漆表面		X			X		3	5.3.2.4.2
暴露箔、紡織物或表面貼面		X			X	X	3	5.3.2.4.2
遮蔽處所油漆表面					X			5.3.2.4.2
遮蔽處所表面或地面上的箔、紡織物或貼面					X	X		5.3.2.4.2
天花板和襯板	X						2	5.3.1.2.1
天花板襯板表面		X			X		4	5.3.2.4.1.1
地面	X						2	5.3.1.2.1，
擋風條	X						2	5.3.1.2.1， 8.4
室內暴露面上的油漆、清漆及其他飾面		X						6.2
地板敷料		X			X		3	5.3.2.4.1

試驗方法（消防試驗程序規則）／試樣（產品）	第 1部分 不燃性	第 2部分 煙與毒性	第 3部分 A、B和F級分隔	第 4部分 門系統	第 5部分 表面易燃性	ISO 1716 潛熱能	備註	《安全公約》第II-2章及高速船規則適用條款
可燃通風管道					X			9.7.1.1.1
製冷服務系統隔熱材料					X			5.3.1.1
防潮層					X			5.3.1.1
甲板基層敷料		X			X			4.4.4， 6.3

1 可使用低播焰性黏合劑。

2 貨物處所、郵件收發室、行李間和服務處所冷藏間內除外。

3 僅走廊和樓梯間。

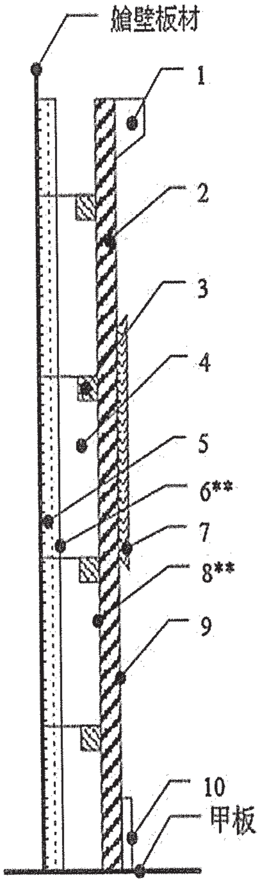
4 起居處所和服務場所（除桑拿室外）和控制站內。

附件4

對《安全公約》II-2章第5.3條和6.2條的解釋

（MSC/Circ.1120號通函）

表1 －第II-2/3.1 條中限定的客船起居處所艙壁上所用材料及其要求（第 5.3和 6.2條）



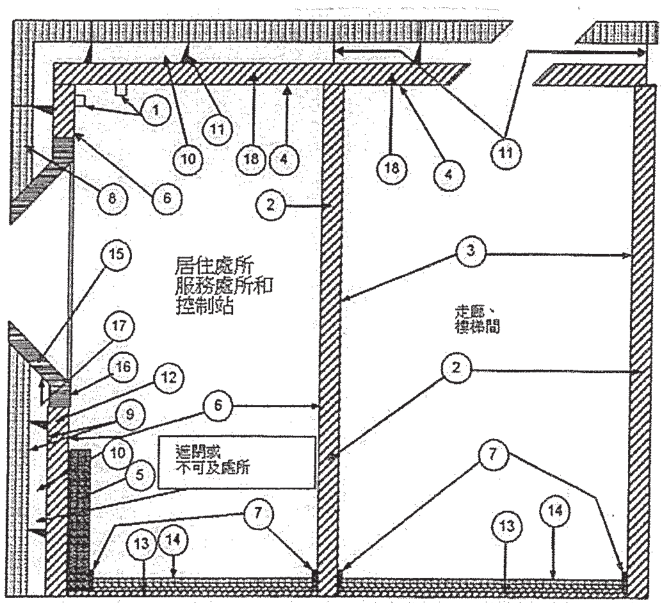
第II-2/3.1 條中限定的起居處所艙壁所用材料					
艙壁構件	《安全公約》II-2章中對構件的要求				
	不燃材料 （5.3.1.1） （5.3.1.2.1）	熱值 （5.3.2.2）	相等體積 （5.3.2.3）	低播焰性 （5.3.2.4）*	產生煙、有毒產物 （6.2）
	（A）	（B）	（C）	（D）	（E）
1 嵌條			X		
2 牆板（襯板）	X				
3 基礎及支撐	X				
4 擋風條	X				
5 絕緣物	X				
6 絕緣表面**				X （5.3.2.4.1.2）	
7 裝潢			X		
8 油漆表面**或紡織物或貼面**		– X		X （5.3.2.4.1.2） X （5.3.2.4.1.2）	
9 油漆表面或紡織物或貼面		– X	X X	X （5.3.2.4.1.1） X （5.3.2.4.1.1）	X X
10 壁腳板			X		

註：

* II-2/5.3.2.4.1.1條中所指走廊和樓梯間的暴露表面包括地板敷料。

** 如牆板按照II-2/9.2.2.3.3條為消防絕緣的構成部分，則這些部件須為不燃材料。

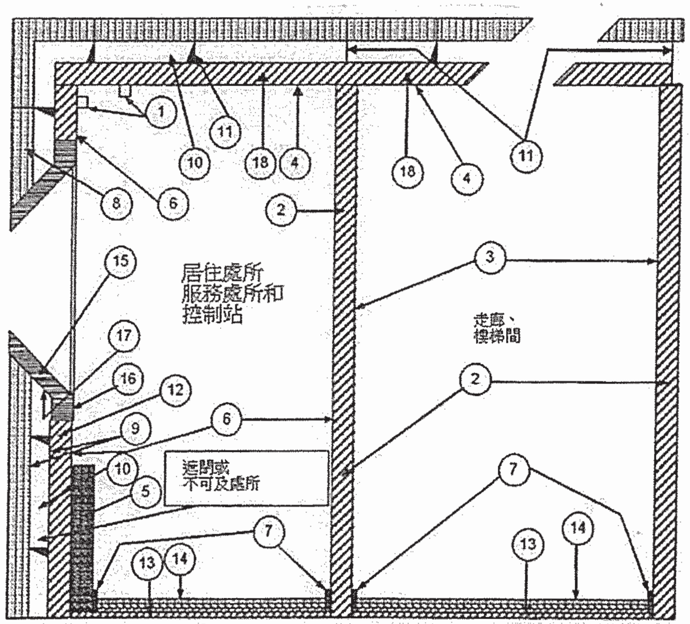
表2 － 第5.3和6.2條－第 II-2/3.1條中限定的貨船起居處所中所用材料（IC法）



		對構件的要求						
		A 不燃材料 （第5.3.1.2.2條）	*B* 不燃材料 （第5.3.1.1條）	*C* 低播焰性 （第5.3.2.4條）	*D* 相等體積 （第5.3.2條）	*E* 熱值 （第5.3.2條）	*F* 產煙 （第6條）	*G* 不易點燃 （第4.4和5條）
1	嵌條				$X^{3)}$			
2	牆板	$X^{4)}$						
3	油漆表面或貼面或紡織物或箔			X	X	X	$X^{5)}$	
4	油漆表面或貼面或紡織物或箔			X	$X^{3)}$	$X^{2)}$	$X^{5)}$	
5	裝璜板				$X^{3)}$			
6	油漆表面或貼面或紡織物或箔				$X^{3)}$	$X^{2)}$	$X^{5)}$	
7	牆腳板				$X^{3)}$			
8	絕緣物		$X^{1)}$					
9	遮閉或不可及處表面或油漆			X				
10	擋風條	$X^{4)}$						
11	基礎和支撐	$X^{4)}$		X				
12	襯板	$X^{4)}$						
13	初級甲板敷料第一層						X	X
14	地板飾面			$X^{6)}$			X	
15	窗鍾箱	$X^{4)}$						
16	窗鍾箱表面			$X^{3)}$	$X^{3)}$	$X^{2)}$	X	
17	窗鍾箱遮閉或不可及表面			X				
18	天花板面板	$X^{4)}$						

1) 製冷服務管道上所用防潮層（統一解釋SC102），如其表面具低播焰性（第5.3.1.1條），可為可燃材料
2) 如該材料安裝於居住和服務處所的不燃艙壁、天花板和襯板上（第5.3.2.2條）
3) 應用於以不燃艙壁、天花板和襯板為限界的居住和服務處所（第5.3.2.3條）
4) 僅在供居住和服務處所及控制站使用的走廊和樓梯間內（第5.3.1.2.2條）
5) 適用於油漆、清漆和其他飾面（第6.2條）
6) 僅在走廊或樓梯間內

表3 － 第5.3和6.2條 － 第II-2/3.1條中限定的貨船起居處所中所用材料（IIC－IIIC法）



		對構件的要求						
		A 不燃材料 (第5.3.1.2.2條)	B 不燃材料 (第5.3.1.1條)	C 低播焰性 (第5.3.2.4條)	D 相等體積 (第5.3.2條)	E 熱值 (第5.3.2條)	F 產煙 (第6條)	G 不易點燃 (第4.4.4和5條)
1	嵌條				X			
2	牆板	X						
3	油漆表面或貼面或紡織物或箔			X	X	X	X2)	
4	油漆表面或貼面或紡織物或箔			X	X	X	X2)	
5	裝璜板				X			
6	油漆表面或貼面或紡織物或箔				X	X	X2)	
7	牆腳板				X			
8	絕緣物		X1)					
9	遮閉或不可及處表面或油漆			X				
10	擋風條	X						
11	基礎和支撐	X		X				
12	襯板	X						
13	初級甲板敷料第一層						X3)	X
14	地板飾面			X3)			X	
15	窗鏈箱	X						
16	窗鏈箱表面			X	X	X	X	
17	窗鏈箱遮閉或不可及表面			X				
18	天花板面板	X						

1) 製冷服務管道上所用防潮層（統一解釋SC102），如其表面具低播焰性（第5.3.1.1條），可為可燃材料

2) 適用於油漆、清漆和其他飾面（第6.2條）

3) 僅走廊或樓梯間內

RESOLUTION MSC.307(88)
(adopted on 3 December 2010)

INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE)

THE MARITIME SAFETY COMMITTEE,

RECALLING article 28(b) of the Convention on the International Maritime Organization concerning the function of the Committee,

NOTING the International Code for Application of Fire Test Procedures (FTP Code) and chapter II-2 of the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, hereinafter referred to as "the Convention", which made the FTP Code mandatory under the Convention,

NOTING ALSO resolution MSC.57(67) by which it adopted amendments to chapter II-2 of the Convention to make the provisions of the International Code for Application of Fire Test Procedures (FTP Code) mandatory under the Convention for ships constructed on or after 1 July 1998,

NOTING FURTHER resolution MSC.97(73) by which it adopted the International Code of Safety for High-Speed Craft, 2000 (2000 HSC Code) providing for the application of fire test procedures for materials used in the construction of high-speed craft to which that Code applies, in accordance with the FTP Code,

RECOGNIZING that the continual development of materials for use in the construction of ships and improvement of marine safety standards since the adoption of the FTP Code necessitated the revision of the provisions of the fire test procedures in order to maintain the highest practical level of safety,

HAVING CONSIDERED, at its eighty-eighth session, the draft 2010 FTP Code which had been developed following a thorough revision of the FTP Code,

1. ADOPTS the International Code for Application of Fire Test Procedures, 2010 (2010 FTP Code), the text of which is set out in the Annex to the present resolution;

2. INVITES Contracting Governments to the Convention to note that the 2010 FTP Code will take effect on 1 July 2012 upon entry into force of the associated amendments to chapter II-2 of the Convention;

3. NOTES that under the amendments to chapter II-2 of the Convention, amendments to the 2010 FTP Code shall be adopted, brought into force and take effect in accordance with the provisions of Article VIII of the Convention, concerning the amendment procedure applicable to the annex to the Convention other than chapter I.

4. REQUESTS the Secretary-General of the Organization to transmit certified copies of the present resolution and the text of the 2010 FTP Code, contained in the Annex, to all Contracting Governments to the Convention;

5. FURTHER REQUESTS the Secretary-General of the Organization to transmit copies of the present resolution and the text of the Code contained in the Annex to all Members of the Organization which are not Contracting Governments to the SOLAS Convention.

ANNEX

INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE)

Contents

Appendix 3 – Thermal radiation test supplement to fire resistance test procedures for windows in "A", "B" and "F" class divisions

Appendix 4 – Continuous "B" class divisions

Part 4 Test for fire door control systems

Appendix – Fire test procedures for fire door control systems

Part 5 Test for surface flammability (Test for surface materials and primary deck coverings)

Appendix 1 – Fire test procedures for surface flammability of bulkhead, ceiling, deck finish materials and primary deck coverings

Appendix 2 – Technical information and calibration of the physical test equipment

Appendix 3 – Interpretation of results

Appendix 4 – Guidelines for the specimen of the FTP Code, parts 2 and 5, and the type approval of those products (Range of approval and restriction in use)

Part 6 (blank)

Part 7 Test for vertically supported textiles and films

Appendix 1 – Fire test procedures for determining the resistance to flame of vertically supported textiles and films

Appendix 2 – Measurement of length of char or material destruction

Appendix 3 – Cleaning and weathering procedures

Part 8 Test for upholstered furniture

Appendix 1 – Fire test procedures for the ignitability by smokers' materials of upholstered composites for seating

Appendix 2 – Guidance notes

Appendix 3 – Guide for independent test for cover and filling materials

Part 9 Test for bedding components

Appendix – Fire test procedures for ignitability of bedding components

Part 10 Test for fire-restricting materials for high-speed craft

Appendix 1 – Fire test procedures – Full-scale room test for surface materials on bulkheads, wall and ceiling linings, including their supporting structure, of high-speed craft

Appendix 2 – Fire test procedures for heat release, smoke production and mass loss rate for materials used for furniture and other components of high-speed craft

Part 11 Test for fire-resisting divisions of high-speed craft

Appendix – Fire test procedures for fire-resisting divisions of high-speed craft

Annex 2 **Products which may be installed without testing and/or approval**

Annex 3 **Fire protection materials and required approval test methods**

Table 1: Fire protection materials and required approval test methods for passenger ships carrying more than 36 passengers and high-speed craft

Table 2: Fire protection materials and required approval test methods for cargo ships (method IC)

Annex 4 **Interpretation of SOLAS chapter II-2, regulations 5.3 and 6.2 (MSC/Circ.1120)**

Table 1: Materials used on passenger ships for bulkheads of accommodation spaces as defined in regulation II-2/3.1 and its requirements (regulations 5.3 and 6.2)

Table 2: Regulations 5.3 and 6.2 – Materials used in accommodation spaces, as defined in regulation II-2/3.1, of cargo ships (method IC)

Table 3: Regulations 5.3 and 6.2 – Materials used in accommodation spaces, as defined in regulation II-2/3.1, of cargo ships (method IIC – IIIC)

INTERNATIONAL CODE FOR APPLICATION OF FIRE TEST PROCEDURES, 2010 (2010 FTP CODE)

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 International Convention for the Safety of Life at Sea, 1974, as amended.

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

2 APPLICATION

2.1 This Code is applicable for 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 made to the fire performance of a product only 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 *Administration* means the Government of the State whose flag the ship is entitled to fly.

3.2 *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.

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

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

3.5 *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.

3.6 *High-Speed Craft Code 1994 (1994 HSC Code)* means the International Code of Safety for High-Speed Craft adopted by the Maritime Safety Committee of the Organization by resolution MSC.36(63), as amended.

3.7 *High-Speed Craft Code 2000 (2000 HSC Code)* means the International Code of Safety for High-Speed Craft, 2000, adopted by the Maritime Safety Committee of the Organization by resolution MSC.97(73), as amended.

3.8 *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.

3.9 *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.

3.10 *Sustained flaming* means a presence of flames on or over any part of a specimen lasting 5 s or longer.

3.11 *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.

3.12 *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 (°C)

t is the time (min).

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 paragraph 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 based on standard ISO/IEC 17025.

4.3 Test reports

4.3.1 In general, the test reports shall be in accordance with standard ISO/IEC 17025.

4.3.2 The fire test procedures in annex 1 state the required contents of the test reports.

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

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 4.3.3).

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;

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

.6 for cases where an unsuccessful test had been conducted prior to the final approval test, a description of the modifications made to the test specimen that resulted in the successful test.

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

5.2 Type approval

5.2.1 Type approval certificates shall not be issued on the basis of test reports which are more than 5 years old when submitted to the Administration. If the approval depends on several test reports with different dates, the date of the oldest report governs. However, the Administration may renew a type approval of a product without retesting provided that the test report is not more than 15 years old and that no alteration of components or construction has been made to the product.

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 for 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 type approval certificates for surface materials shall state what substrate was applied for the test. The restriction of the base materials, which products would be applied on, shall be considered (see annex 1, part 5, appendix 4, paragraph 3);

.3 type approval certificates for surface materials shall state the specimen information such as the colour, organic contents and thickness of the products. The restriction of the products shall be considered by that information (see annex 1, part 5, appendix 4, paragraph 3);

.4 type approval certificates for "A", "B" and "F" class divisions shall state the detail information for the thickness and density of the insulation materials, how to fix the materials to the division, and how to insulate to the stiffener in ships. The restriction of the products shall be considered by that information;

.5 type approval certificates for non-combustible materials shall state the organic content;

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

.7 name and address of the manufacturer and applicant;

.8 fire test procedure(s) used in test(s);

.9 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);

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

.11 expiration date of the certificate;

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

.13 type approval certificates for windows shall state which side of the window was exposed to the heating condition during the test;

.14 the certificate shall include a reference to optional test(s) such as hose stream test and/or thermo radiation test; and

.15 information required in subparagraphs .2 to .5 may be specified in a manual/booklet of the product which shall be clearly referred to in the certificate.

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 to 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 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 TYPE APPROVALS ISSUED IN ACCORDANCE WITH THE PREVIOUS FTP CODE

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

8.2 The Administration may issue type approval certificates of products tested in accordance with the previous version of this Code , provided the tests were conducted no later than one year after entry into force of this Code. The purpose is to allow test laboratories a practical period of grace to obtain test equipment necessary to comply with this Code. Tests conducted later than one year after entry into force of this Code shall be conducted in accordance with the present version.

8.3 The Administration may renew a type approval of a product tested in accordance with the previous version of this Code without retesting, provided that the test report is not more than 15 years old and that no alteration of components or construction has been made to the product.

9 LIST OF REFERENCES

The following ISO and IEC standards are referred to in this Code. Wherever a reference is made to ISO or IEC standards, the year of publication shall be understood as specified below:

.1 ISO 834-1: 1999, Fire resistance tests – Elements of building construction – Part 1: General requirements;

.2 ISO 1182: 2010, Reaction to fire tests for building and transport products – Non-combustibility test;

.3 ISO 1716: 2010, Reaction to fire tests for building products – Determination of the heat of combustion;

.4 ISO 5658-2: 2006, Reaction to fire tests – Spread of Flame – Part 2: Lateral spread on building and transport products in vertical configuration;

.5 ISO 5659-2: 2006, Plastics, Smoke generation – Part 2: Determination of optical density by a single chamber test;

.6 ISO 5660-1: 2002, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method);

.7 ISO 5660-2: 2002, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 2: Smoke production rate (dynamic measurement);

.8 ISO 9705: 1993, Fire tests – Full-scale room test for surface products;

.9 ISO 13943: 2008, Fire safety – Vocabulary;

.10 ISO 14934-3: 2006, Fire tests – Calibration and use of heat flux meters – Part 3: Secondary calibration method;

.11 ISO/IEC 17025: 2005, General requirements for the competence of testing and calibration laboratories;

.12 ISO 19702: 2006, Toxicity testing of fire effluents – Guidance for analysis of gases and vapours in fire effluents using FTIR gas analysis;

.13 ISO 291: 2005; Plastics – Standard atmosphere for conditioning and testing;

.14 ISO 554: 1976; Standard atmosphere for conditioning and/or testing – Specifications;

.15 ISO 14697: 2007; Reaction to fire test – Guidance on the choice of substrates for building and transport products; and

.16 IEC 60584-1: 1995, Thermocouples – Part 1: reference tables.

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, the provisions in paragraphs 7 and 8.2 of 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 5 of annex 1, the reference shall be "IMO 2010 FTP Code parts 2 and 5".

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, refer to annex 2 to the Code.

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 paragraph 3, it shall be considered as "non-combustible" even if it consists of a mixture of inorganic and organic substances.

2 FIRE TEST PROCEDURES

The non-combustibility shall be verified in accordance with the test procedure in the appendix to this part (ISO 1182). However, the test exposure need not exceed 30 min duration.

3 ACCEPTANCE CRITERIA OF NON-COMBUSTIBILITY

Materials to be classified as non-combustible shall satisfy the following criteria:

.1 the average furnace thermocouple temperature rise as calculated in paragraphs 8.4 and 8.5 of the appendix does not exceed 30°C;

.2 the average specimen surface thermocouple temperature rise as calculated in paragraphs 8.4 and 8.5 of the appendix does not exceed 30°C;

.3 the average duration of sustained flaming as calculated in paragraph 8.3 of the appendix does not exceed 10 s; and

.4 the average mass loss as calculated in paragraph 8.2 of the appendix does not exceed 50%.

4 TEST REPORT

The test report shall include the information in paragraph 9 of the appendix and classification of the material according to the test criteria specified in paragraph 3 above.

5 REFERENCE DOCUMENT

ISO 1182, Reaction to fire tests for building and transport products – Non-combustibility test.

APPENDIX

FIRE TEST PROCEDURES FOR NON-COMBUSTIBILITY TEST

INTRODUCTION

This fire test is for identification of products which produce only a very limited amount of heat and flame when exposed to temperatures of approximately 750°C.

SAFETY WARNING

The attention of all persons concerned with managing and carrying out this test is drawn to the fact that fire testing may be hazardous and that there is a possibility that toxic and/or harmful smoke and gases may be evolved during the test. Operational hazards may also arise during the testing of specimens and the disposal of test residues.

An assessment of all potential hazards and risks to health shall be made and safety precautions shall be identified and provided. Written safety instructions shall be issued. Appropriate training shall be given to relevant personnel. Laboratory personnel shall ensure that they follow written safety instructions at all times.

1 SCOPE

1.1 This appendix specifies test procedures for determining the non-combustibility.

1.2 Information on the precision of the test method is given in annex A of standard ISO 1182.

2 NORMATIVE REFERENCES

The following normative documents contain provisions which constitute provisions of this appendix.

.1 ISO 1182, Reaction to fire tests for building and transport products – Non-combustibility test; and

.2 ISO 13943, Fire safety – Vocabulary.

3 TERMS AND DEFINITIONS

For the purpose of this appendix, the terms and definitions given in Fire safety – Vocabulary (ISO 13943), together with the following, apply:

3.1 *Homogeneous product* is a product, consisting of a single material, having uniform density and composition throughout the product.

3.2 *Loose fill material* is a material without any physical shape.

3.3 *Material* is a single basic substance or uniformly dispersed mixture of substances, e.g., metal, stone, timber, concrete, mineral wool with uniformly dispersed binder, polymers.

3.4 *Non-homogeneous product* is a product that does not satisfy the requirements of a homogeneous product. It is a product composed of more than one component, substantial and/or non-substantial.

3.5 *Product* is material, element or component about which information is required.

3.6 *Sustained flaming* shall be taken as the persistence of flames on, or over any part of, the visible part of the specimen lasting 5 s or longer.

3.7 Moisture content

3.7.1 The specimen for determining the moisture content and organic contents shall not be used for the non-combustibility test.

3.7.2 The moisture content (W_1-W_2) of each specimen shall be calculated using the following method, and indicate a percentage of the dry weight (W_2), and which information is required.

3.7.3 In the following, W_1, W_2 and W_3 are mean values of three weight measurements. W_1 shall be higher than 25 g. Three specimens of each material, taken in the width of the production's direction and measuring width x minimum 20 mm x thickness of the material, shall 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, cementations and similar materials shall be dried at a temperature of 55 ± 5°C to constant weight (W_2).

3.7.4 The moisture content (W_1-W_2) of each specimen shall be calculated as a percentage of the dry weight (W_2).

3.8 Organic content

3.8.1 The information of organic content is required. After the percentage moisture contents have been calculated as specified above, the three specimens shall be further heated in an oven at a temperature of 500 ± 20°C for 2 h and again weighed (W_3). The organic content (W_2-W_3) shall be calculated as a percentage of the dry weight (W_2).

3.8.2 The organic content of each material used in the test specimen shall be within ± 0.3% absolute of the value stated as the nominal organic content.

> **Note**: A bigger tolerance can be accepted as long as the tested specimen represents the upper limit of the tolerance. In this case, it shall be specified in the test report and in the type approval certificate.

4 TEST APPARATUS

The test apparatus including thermocouples, specimen holders and other necessary peripherals shall be in accordance with Reaction to fire tests for building and transport products – Non-combustibility test (ISO 1182). Calibration of the test apparatus shall be conducted in accordance with the ISO standard.

5 TEST SPECIMEN

5.1 General

5.1.1 The test specimen shall be taken from a sample which is sufficiently large to be representative of the product.

5.1.2 The test specimens shall be cylindrical and each shall have a diameter of 43 mm to 45 mm and a height of 50 ± 3 mm.

5.2 Preparation

5.2.1 If the thickness of the material is different from 50 ± 3 mm, specimens of the height of 50 ± 3 mm shall be made by using a sufficient number of layers of the material and/or by adjustment of the material thickness.

5.2.2 For non-homogeneous materials, the specimen of height of 50 ± 3 mm shall be constructed such that all layers are represented in the specimen in proportion to their presence, by volume, in the original specimen.

5.2.3 The layers shall occupy a horizontal position in the specimen holder and shall be held together firmly, without significant compression, by means of two fine steel wires, of maximum diameter 0.5 mm, to prevent air gaps between layers. The specimens of loose fill materials shall be representative in appearance, density, etc., as in use.

Note: When a specimen is composed of a number of layers, the overall density should be as close as possible to that of the product provided by the manufacturer.

5.3 Number

For homogeneous products, five specimens shall be made. For non-homogeneous products, 10 specimens shall be made.

6 CONDITIONING

The test specimens shall be dried in a ventilated oven maintained at 60 ± 5°C, for between 20 h and 24 h, and cooled to ambient temperature in a desiccator prior to testing. The mass of each specimen shall be determined to an accuracy of 0.01 g prior to test.

7 TEST PROCEDURE

7.1 Test environment

The apparatus shall not be exposed to draughts or any form of strong direct sunlight or artificial illumination which would adversely affect the observation of flaming inside the furnace. The room temperature shall not change by more than 5°C during a test.

7.2 Setting up procedure

7.2.1 *Specimen holder*

Remove the specimen holder and its support from the furnace.

7.2.2 *Thermocouple*

7.2.2.1 Furnace thermocouple

The furnace thermocouple shall be located with its hot junction 10 ± 0.5 mm from the furnace tube wall and at a height corresponding to the geometric centre of the furnace tube.

7.2.2.2 Specimen surface thermocouple

The specimen surface thermocouple shall be positioned so that its hot junction is in contact with the specimen at mid-height of the specimen at the start of the test and shall be located diametrically opposite the furnace thermocouple.

7.2.3 ***Electricity supply***

Connect the heating element of the furnace either to the voltage stabilizer, variable transformer and the electrical input monitor or the power controller. Automatic thermostatic control of the furnace shall not be used during testing.

Note 1: The heating element should normally draw a current of between 9 A and 10 A at approximately 100 V under steady state conditions. In order not to overload the winding, it is recommended that the maximum current does not exceed 11 A.

Note 2: A new furnace tube should be subjected to slow heating initially. A suitable procedure has been found to be to increase the furnace temperature in steps of approximately 200°C, allowing 2 h heating at each temperature.

7.2.4 ***Furnace stabilization***

Adjust the power input to the furnace so that the average furnace temperature, as indicated by the furnace thermocouple, is stabilized for at least 10 min at 750 ± 5°C. The drift (linear regression) shall not be more than 2°C during these 10 min and there shall be a maximum deviation from the average temperature of not more than 10°C in 10 min.

Note: An example of furnace temperature stabilization is given in annex D of standard ISO 1182.

7.3 Standard test procedure

7.3.1 Stabilize the furnace as described in paragraph 7.2.4. If the recorder used does not allow a real-time calculation, the temperature stabilization shall be checked afterwards. If the conditions specified in paragraph 7.2.4 were not satisfied, the test shall be repeated.

7.3.2 Before starting the test, ascertain that the whole equipment is in good working order, for example, that the stabilizer is clean, the specimen insertion device is working smoothly and the specimen holder exactly occupies the required position in the furnace.

7.3.3 Insert one specimen prepared and conditioned as specified in paragraph 6 into the specimen holder suspended on its support.

7.3.4 Place the specimen holder in the furnace in the position taking not more than 5 s for this operation. The position of the specimen shall be such that the geometric centre of the specimen is located rigidly at the geometric centre of the furnace during the test.

7.3.5 Start observation of flaming before the specimen is lowered into the furnace.

7.3.6 Start the timing device immediately following the insertion of the specimen into the furnace.

7.3.7 Record in intervals not longer than 1 s, throughout the test, the temperature measured by the furnace thermocouple and the specimen surface thermocouple.

7.3.8 Carry out the test for a period of 30 min.

7.3.9 After cooling the specimen to ambient temperature in a desiccator, weigh the specimen. Recover any char, ash or other debris which breaks off the specimen and falls down the tube, either during or following the test, and include this as a part of the unconsumed specimen.

7.3.10 For homogeneous products, test five specimens as described in paragraphs 7.3.1 to 7.3.9.

7.3.11 For non-homogeneous products, test five specimens oriented with one surface on the top of the test specimen as described in paragraphs 7.3.1 to 7.3.9. Repeat with the remaining five specimens oriented with that surface on the bottom.

7.4 Observations during test

7.4.1 Record the mass, in g, before and after the test for each specimen tested according to paragraph 7.3, and note any observations relating to the behaviour of the specimen during the test including during insertion into the apparatus.

7.4.2 Note the occurrence of any sustained flaming and record the duration of such flaming in seconds.

Note: Some specimens exhibit only a steady blue-coloured luminous gas zone; this shall not be considered as flaming but be noted under "observations during test" in the test report.

7.4.3 Record the following temperatures, in °C, as measured by the thermocouples:

.1 the initial furnace temperature, $T_{i(furnace)}$ which is the average temperature over the final 10 min of the stabilization period as defined in paragraph 7.2.4;

.2 the maximum furnace temperature $T_{m(furnace)}$ and the maximum specimen surface temperature $T_{m(surface)}$, which are the discrete values at maximum temperature anywhere over the entire test period; and

.3 the final furnace temperature $T_{f(furnace)}$ and the final specimen surface temperature $T_{f(surface)}$, which is the average temperature over the final 1 min of the test period as defined in paragraph 7.3.8.

8 EXPRESSION OF RESULTS

8.1 Calculation of averages

8.1.1 For homogeneous products, calculate the averages for paragraphs 8.2 (Mass loss) to 8.5 (Average temperature rise) for the five specimens.

8.1.2 For non-homogeneous products, calculate the averages for paragraphs 8.2 (Mass loss) to 8.5 (Average temperature rise) for each set of five specimens in the same orientation. The results for each orientation shall be presented separately, but they shall not be combined. Classification shall be based on the most onerous orientation such that all the averages for each set of five specimens shall meet the requirements in paragraph 3 of part 1.

8.2 Mass loss

8.2.1 Calculate and record the mass loss in percentage for each of the five specimens, expressed as a percentage of the initial mass of the specimen, measured as specified in paragraph 7.4.1.

8.2.2 Calculate the average mass loss in percentage, which is the average of mass loss of the five specimens.

8.3 Flaming

8.3.1 Calculate and record the total duration of sustained flaming, in seconds, for each of the five specimens measured as specified in paragraph 7.4.2.

8.3.2 Calculate the average duration of sustained flaming, which is the average of total duration of sustained flaming of the five specimens.

8.4 Temperature rise

Calculate and record the following temperature rise in °C for each of the five specimens recorded by the thermocouples as specified in paragraph 7.4.3:

.1 furnace temperature rise: $T_{r(furnace)} = T_{m(furnace)} - T_{f\ (furnace)}$; and

.2 specimen surface temperature rise: $T_{r(surface)} = T_{m(surface)} - T_{f\ (surface)}$.

8.5 Average temperature rise

Calculate the average furnace temperature rise $T_{ave\ r(furnace)}$ and the average specimen surface temperature rise $T_{ave\ r(surface)}$ from the values obtained by paragraph 8.4.

9 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with part 1 of the 2010 FTP Code (see also subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

.7 name and/or identification of the product tested;

.8 description of the sampling procedure, where relevant;

.9 description of the product tested including density, mass per unit area and thickness, together with details of the construction, moisture content and organic content of the product;

.10 description of the specimen including dimensions, orientations and construction;

.11 date of sample arrival;

.12 details of specimen conditioning;

.13 date of test;

.14 test results expressed in accordance with paragraph 8;

.15 observations made during the test;

.16 classification of the material; and

.17 the statement:

"The test results relate 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.".

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 PROCEDURES

2.1 General

Smoke generation tests shall be conducted in accordance with appendix 1, and the gas measuring method shall be in accordance with appendix 2 to this part, and additional test procedures as described in this part of the Code. To carry out the tests in accordance with this part, modifications of the arrangements and procedures of the ISO standard 5659-2 shall be made, if necessary for toxic gas measurement.

2.2 Test specimen

Preparation of test specimen shall be in accordance with the practice outlined in appendix 4 to part 5 of this Code. If the product has two faces and either face is likely to be exposed to a fire condition when in use, then both faces shall be evaluated.

2.3 Test results

2.3.1 The maximum specific optical density of smoke (*Ds max*) shall be obtained for each test in accordance with paragraph 9 of appendix 1 to this part.

2.3.2 When making toxicity measurements, the sampling of fumes shall be made during the testing of the second and the third specimen at each test condition, from the geometrical centre of the chamber at the time when the maximum specific optical density of smoke is reached. The concentration of each toxic gas shall be determined as parts per million (ppm) in the chamber volume.

2.4 Classification criteria

2.4.1 ***Smoke***

An average (*Dm*) of the maximum specific optical density of smoke (*Ds max*) of three tests at each test condition in paragraph 8.8.1 of appendix 1 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 coverings, the *Dm* shall not exceed 400 in any test condition;

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

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

2.4.2 *Toxicity*

The average value of the maximum value of the gas concentration measured at each test condition of paragraph 8.8.1 of appendix 1 shall not exceed the following limits:

CO	1,450 ppm	HBr	600 ppm
HC*l*	600 ppm	HCN	140 ppm
HF	600 ppm	SO_2	120 ppm (200 ppm for floor coverings)
NO_x	350 ppm		

3 ADDITIONAL REQUIREMENTS

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

4 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test.

.1 reference that the test was carried out in accordance with part 2 of the 2010 FTP Code (see also subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

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

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, together with details of the construction of the product;

.11 description of the specimen including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, orientations tested and face subject to the test, and construction;

.12 date of sample arrival;

.13 details of specimen conditioning;

.14 date of test;

.15 test conditions (see appendix 1, paragraph 8.8);

.16 test results:

.1 for the smoke test:

.1 *Ds max* for each test (paragraph 9 of the appendix 1); and

.2 *Dm* for each test conditions (paragraph 2.4.1 above); and

.2 for the toxicity tests, the values listed in paragraph 10 of appendix 2;

.17 observations made during the test; and

.18 classification of the material.

5 REFERENCE DOCUMENTS

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

ISO 13943, Fire safety – Vocabulary.

ISO 19702, Toxicity testing of fire effluents – Guidance for analysis of gases and vapours in fire effluents using FTIR gas analysis.

APPENDIX 1

FIRE TEST PROCEDURES FOR SMOKE GENERATION

Reference document: ISO 5659-2, Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test

Avoidance of danger to test operators

So that suitable precautions to safeguard health are taken, the attention of all concerned in fire tests is drawn to the fact that harmful gases are evolved in combustion of test specimens. Care must also be taken during cleaning operations on the smoke chamber to avoid inhalation of fumes or skin contact with smoke deposits.

Attention is drawn to the hazards arising from the hot radiator cone, and the use of a mains voltage electricity supply. A safety blow-out panel, as specified in paragraph 7.2.1.1 of standard ISO 5659-2, is essential for the protection of operators from the risk of explosion from sudden pressure surges.

1 SCOPE

1.1 This appendix specifies a method of measuring smoke production from the exposed surface of specimens of essentially flat materials, composites or assemblies not exceeding 25 mm in thickness, when placed in a horizontal orientation and subjected to specified levels of thermal irradiance in a closed cabinet with or without the application of a pilot flame. This method of test is applicable to all plastics and may also be used for the evaluation of other materials (e.g., rubbers, textile coverings, painted surfaces, wood and other materials).

1.2 Values of optical density determined by this test are specific to the specimen or assembly material in the form and thickness tested, and are not to be considered inherent, fundamental properties.

1.3 The test is intended primarily for use in research and development and fire safety engineering in buildings, trains, ships, etc., and not as a basis for ratings for building codes or other purposes. No basis is provided for predicting the density of smoke that may be generated by the materials upon exposure to heat and flame under other exposure conditions, nor has correlation been generally established with measurements derived from other test methods. The fact that this test procedure excludes the effect of irritants on the eye shall also be taken into account when applying the test results.

1.4 It is emphasized that smoke production from a material varies according to the irradiance level to which the specimen is exposed. In making use of the results of this method, it shall be borne in mind that the results are based on exposure to the specific irradiance levels of 25 kW/m^2 and 50 kW/m^2.

2 NORMATIVE REFERENCES

The following normative documents contain provisions which constitute provisions of this appendix:

.1 ISO 291, Plastics – Standard atmospheres for conditioning and testing;

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

.3 ISO 13943, Fire safety – Vocabulary.

3 TERMS AND DEFINITIONS

For the purposes of this appendix, the terms and definitions given in standard ISO 13943 and the following apply.

3.1 *Assembly* is fabrication of materials and/or composites, for example, sandwich panels. This may include an air gap.

3.2 *Composite* is a combination of materials which are generally recognized in building construction as discrete entities, for example, coated or laminated materials.

3.3 *Essentially flat surface* is a surface in which departure from a plane does not exceed ± 1 mm.

3.4 *Exposed surface* is that surface of the product subjected to the heating conditions of the test.

3.5 *Intumescent material* is a dimensionally unstable material, developing a carbonaceous expanded structure of thickness greater than 10 mm when exposed to a heat source during the test with the cone heater at 25 mm from the specimen.

3.6 *Irradiance (at a point on a surface)* is radiant flux incident on an infinitesimal element of the surface containing the point divided by the area of that element.

3.7 *Material* is a basic single substance or uniformly dispersed mixture, for example, metal, stone, timber, concrete, mineral fibre, polymers.

3.8 *Mass optical density (MOD)* is a measure of the degree of opacity of smoke in terms of the mass loss of the material under the conditions of the test.

3.9 *Optical density of smoke (D)* is a measure of the degree of opacity of smoke; the negative common logarithm of the relative transmission of light.

3.10 *Product* is a material, composite or assembly about which information is required.

3.11 *Specific optical density (Ds)* is optical density multiplied by a factor which is calculated by dividing the volume of the test chamber by the product of the exposed area of the specimen and the path length of the light beam (see paragraph 9.1.1).

3.12 *Specimen* is a representative piece of the product which is to be tested together with any substrate or treatment. This may include an air gap.

4 SPECIMEN CONSTRUCTION AND PREPARATION

4.1 Number of specimens

4.1.1 The test sample shall comprise a minimum of nine specimens if all three test conditions are to be tested: six specimens shall be tested at 25 kW/m^2 (three specimens with a pilot flame and three specimens without a pilot flame) and three specimens shall be tested at 50 kW/m^2 without a pilot flame.

4.1.2 An additional number of specimens as specified in paragraph 4.1.1 above shall be used for each face, in accordance with the requirements in paragraph 2.2 of part 2.

4.1.3 An additional nine specimens (i.e. three specimens per test mode) shall be held in reserve if required by the conditions specified in paragraph 8.8.2.

4.1.4 In case of intumescent materials, it is necessary to make a preliminary test with the cone heater at 50 mm from the specimen. Therefore, at least two additional specimens are required.

4.2 Size of specimens

4.2.1 The specimens shall be square, with sides measuring 75 ± 1 mm.

4.2.2 Materials of nominal thickness 25 mm or less shall be evaluated at their full thickness. For comparative testing, materials shall be evaluated at a thickness of 1 ± 0.1 mm. All materials consume oxygen when they burn in the chamber, and the smoke generation of some materials (especially rapid-burning or thick specimens) is influenced by the reduced oxygen concentration in the chamber. As far as possible, materials shall be tested in their end-use thickness.

4.2.3 Materials with a thickness greater than 25 mm shall be cut to give a specimen thickness between 24 mm and 25 mm, in such a way that the original (uncut) face can be evaluated.

4.2.4 Specimens of multi-layer materials with a thickness greater than 25 mm, consisting of core material(s) with facings of different materials, shall be prepared as specified in paragraph 4.2.3 (see also paragraph 4.3.2).

4.3 Specimen preparation

4.3.1 The specimen shall be representative of the material and shall be prepared in accordance with the procedures described in paragraphs 4.3.2 and 4.3.3. The specimens shall be cut, sawn, moulded or stamped from identical sample areas of the material, and records shall be kept of their thicknesses and, if required, their masses.

4.3.2 If flat sections of the same thickness and composition are tested in place of curved, moulded or speciality parts, this shall be stated in the test report. Any substrate or core materials for the specimens shall be the same as those used in practice.

4.3.3 When coating materials, including paint and adhesives are tested with the substrate or core as used in practice, specimens shall be prepared following normal practice, and in such cases the method of application of the coating, the number of coats and the type of substrate shall be included in the test report.

4.4 Wrapping of specimens

4.4.1 All specimens shall be covered across the back, along the edges and over the front surface periphery, leaving a central exposed specimen area of 65 mm x 65 mm, with a single sheet of aluminium foil (approximately 0.04 mm thick) with the dull side in contact with the specimen. Care shall be taken not to puncture the foil or to introduce unnecessary wrinkles during the wrapping operation. The foil shall be folded in such a way as to minimize losses of any melted material at the bottom of the specimen holder. After mounting the specimen in its holder, any excess foil along the front edges shall be trimmed off where appropriate.

4.4.2.1 Wrapped specimens of thickness up to 12.5 mm shall be backed with a sheet of non-combustible insulating board of oven-dry density 950 ± 100 kg/m^3 and nominal thickness 12.5 mm and a layer of low density (nominal 65 kg/m^3) refractory fibre blanket under the non-combustible board.

4.4.2.2 Wrapped specimens of thickness of more than 12.5 mm but less than 25 mm shall be backed with a layer of low-density (nominal 65 kg/m^3) refractory fibre blanket.

4.4.2.3 Wrapped specimens of thickness of 25 mm shall be tested without any backing board or refractory fibre blanket.

4.4.3 With resilient materials, each specimen in its aluminium foil wrapper shall be installed in the holder in such a way that the exposed surface lies flush with the inside face of the opening of the specimen holder. Materials with uneven exposed surfaces shall not protrude beyond the plane of the opening of the specimen holder.

4.4.4 When thin impermeable specimens, such as thermoplastic films, become inflated during the test due to gases trapped between the film and backing, they shall be maintained essentially flat by making two cuts of 20 mm long in parallel by 20 mm spacing in the centre in the film to act as vents.

4.5 Conditioning

4.5.1 Before preparing the specimens for test, they shall be conditioned to constant mass at 23 ± 2°C and 50 ± 5% relative humidity. Constant mass shall be considered to have been reached when two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1% of the mass of the test specimen or 0.1 g, whichever is the greater.

4.5.2 While in the conditioning chamber, specimens shall be supported in racks so that air has access to all surfaces.

Note 1: Forced-air movement in the conditioning chamber may be used to assist in accelerating the conditioning process.

Note 2: The results obtained from this method are sensitive to small differences in specimen conditioning. It is important therefore to ensure that the requirements in paragraph 4.5 are followed carefully.

5 APPARATUS AND ANCILLARY EQUIPMENT

The apparatus and ancillary equipment shall be in accordance with standard ISO 5659-2, Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test.

6 TEST ENVIRONMENT

6.1 The test apparatus shall be protected from direct sunlight, or any strong light source, to avoid the possibility of spurious light readings.

6.2 Adequate provision shall be made for removing potentially hazardous and objectionable smoke and gases from the area of operation, and other suitable precautions shall be taken to prevent exposure of the operator to them, particularly during the removal of specimens from the chamber or when cleaning the apparatus.

7 CALIBRATION PROCEDURES

Calibration of the test apparatus shall be carried out in accordance with standard ISO 5659-2, Plastics – Smoke generation – Part 2: Determination of optical density by a single-chamber test.

8 TEST PROCEDURES

8.1 Preparation of test chamber

8.1.1 Prepare the test chamber in accordance with the requirements of clause 9 of standard ISO 5659-2 with the cone set at 25 kW/m^2 or 50 kW/m^2. For intumescent materials the distance between the cone heater and the specimen shall be 50 mm and the pilot burner shall be positioned 15 mm down from the bottom edge of the cone heater.

8.1.2 If a test has just been completed, flush the test chamber with air until it is completely clear of smoke with the test chamber door closed and both exhaust and inlet vents open. Inspect the inside of the cabinet and clean the walls and the supporting framework if necessary (see paragraph 9.9 of standard ISO 5659-2). Clean the faces of the optical windows inside the chamber before each test. Allow the apparatus to stabilize until the chamber wall temperature is within the range 40 ± 5°C for tests with the radiator cone at 25 kW/m^2 or within the range 55 ± 5°C for tests with the radiator cone at 50 kW/m^2. Close the inlet valve.

8.1.3 For intumescent materials testing, the chamber wall temperature shall be within 50 ± 10°C for tests with the radiator cone at 25 kW/m^2 or within 60 ± 10°C for tests with the radiator cone at 50 kW/m^2.

Note: If the temperature is too high, the exhaust fan may be used to draw in cooler air from the laboratory.

8.2 Tests with pilot flame

For tests with the pilot flame, with the burner in its correct position, turn on the gas and air supplies and ignite the burner, check the flow rates and, if necessary, adjust the flow rates to ensure that the flame is as specified in paragraph 7.3.6 of standard ISO 5659-2.

8.3 Preparation of photometric system

Set the zero and then open the shutter to set the full-scale 100% transmission reading. Close the shutters again and check and reset the zero if necessary, using the most sensitive (0.1%) range. Recheck the 100% setting. Repeat the sequence of operations until accurate zero and 100% readings are obtained on the amplifier and recorder when the shutters are opened and closed.

8.4 Loading the specimen

8.4.1 Place a wrapped specimen, prepared in accordance with paragraphs 4.3 and 4.4. Place the holder and specimen on the supporting framework below the radiator cone. Remove the radiation shield from below the cone and simultaneously start the data recording system and close the inlet vent. The test chamber door and the inlet vent shall be closed immediately after the start of the test.

8.4.2 If preliminary tests indicate that the pilot flame is extinguished before the shield is removed, immediately relight the pilot burner and release the shield at the same time.

8.5 Recording of light transmission

8.5.1 Record the percentage light transmission and time continuously from the start of the test (i.e. when the radiation shield was removed). Switch the range of the photodetector amplifier system to the next decade when required, so that readings less than 10% of full-scale deflection are avoided.

8.5.2 If the light transmission falls below 0.01%, cover the observation window in the chamber door and withdraw the range-extension filter from the light path.

8.6 Observations

8.6.1 Note any particular burning characteristics of the specimen, such as delamination, intumescence, shrinkage, melting and collapse, and note the time from the start of the test at which the particular behaviour occurs, including the time of ignition and the duration of flaming. Also note the smoke characteristics, such as the colour and nature of the settled particulate matter.

Note 1: The smoke generation from some materials differs significantly depending on whether combustion occurs in a non-flaming or flaming mode (see standard ISO 5659-2). It is important, therefore, to record as much information as possible about the mode of combustion during each test.

Note 2: Coated and faced materials, including sheet laminates, tiles, fabrics and other materials secured to a substrate with an adhesive, and composite materials not attached to a substrate, can be subject to delamination, cracking, peeling or other types of separation affecting their smoke generation.

8.6.2 If the pilot flame is extinguished by gaseous effluent during a test and fails to re-ignite within 10 s, the gas supply to the pilot burner shall be immediately switched off (see paragraph 7.3.6 of standard ISO 5659-2).

8.6.3 If inflation of a thin specimen that has not been cut (see paragraph 4.4.4 above) has occurred, the results from that specimen shall be ignored and an extra cut specimen tested.

8.7 Termination of test

8.7.1 The initial test at each test condition in paragraph 8.8.1 shall last for 20 min to verify the possible existence of a second minimum transmittance value. If the minimum transmittance value is shown by the initial test to occur within the first 10 min, then subsequent tests for that test condition may have an exposure of 10 min. Otherwise, the tests shall last 20 min.

8.7.2 Extinguish the burner if the pilot flame has been used.

Note: The burner is extinguished in order to obviate the possibility of air mixing with combustion products present and causing an explosion.

8.7.3 Move the radiation shield below the cone.

8.7.4 Switch on the exhaust fan and, when the water manometer indicates a small negative pressure, open the inlet vent and continue exhausting until a maximum value of light transmission is recorded, with the appropriate range selected, and noted as the "clear beam" reading *Tc*, for use in correcting for deposits on the optical windows.

8.8 Repeat tests

8.8.1 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.

8.8.2 For each individual specimen, determine the percentage value of light transmission and from this calculate the appropriate specific optical density as given in paragraph 9.1. If the value of *Ds max* for any individual specimen differs from the average value for the set of three specimens of which it is part by more than 50% of that average for no apparent reason, test an additional set of three specimens from the same sample in the same mode and record the average of all six results obtained.

Note: Even in the same test condition, a specimen may burn with flaming and the others may not burn with flaming. This would be an apparent reason.

9 EXPRESSION OF RESULTS

9.1 Specific optical density *Ds*

9.1.1 For each specimen, produce a graph of light transmission against time and determine the minimum transmission *Tmin*. Convert *Tmin* to the maximum specific optical density *Ds max* by calculation to two significant figures using the following equation:

$$Ds\ max = 132 \log_{10} (100/Tmin)$$

where:

132 is a factor derived from *V/AL* for the test chamber,
V is the volume of the chamber,
A is the exposed area of the specimen,
L is the length of the light path.

Note: The transmission used in this equation is the measured transmission. For the first four decades this is the value recorded by the system. For the final two decades (where the range-extension filter is removed from the light path) the transmission must be calculated relative to the actual measuring range of 0.01% or 0.001%. For example, if the measuring range is set to 1% with the range-extension filter removed, then the actual measuring range is 0.01%. If the displayed transmission value is 0.523 then the actual measured transmission is 0.00523%.

9.1.2 If required, add, to each value of *Ds max* determined in paragraph 9.1.1, the correction factor C_f, which depends upon the use of the range-extension filter. The value of C_f is:

.1 zero:

.1 if the filter is in the light path at the time the transmission was recorded ($T \geq 0.01\%$); or

.2 if the photometric system is not equipped with a removable filter; or

.3 if the ND-2 filter is found to be of the correct optical density of 2; and

.2 as determined by the procedure described in paragraph 9.5 of ISO 5659-2, if the filter is moved out of the light path at the time it is measured ($T < 0.01\%$).

9.2 Clear-beam correction factor *D*c

For each specimen, record the value of the "clear beam" reading *T*c (see paragraph 8.7.4) to determine the correction factor *D*c. Calculate *D*c as for *Ds max* in paragraph 9.1.1. Do not record the correction factor *D*c if it is less than 5% of *Ds max*.

10 OTHER REFERENCES

"Calibration of heat flux meter", "Variability in the specific optical density of smoke measured in the single-chamber test" and "Determination of mass optical density (MOD)" should be referred to annexes A, B and C of standard ISO 5659-2.

APPENDIX 2

FIRE TEST PROCEDURES FOR TOXIC GAS GENERATION

1 SCOPE

1.1 This appendix specifies methods of measurement of gases developed in cumulative smoke/fire test, using Fourier transform infrared spectroscopy (FTIR). Particular attention is given to the gas sampling systems and conditions of gas measurement.

1.2 It should be noted that there are fire effluents other than gases, such as particles, smoke or vapours, which may be toxic and that some gases such as hydrogen halides may be trapped by moisture in sampling lines or by filters designed to remove only smoke particles.

1.3 Gas measurements by FTIR shall be carried out when the maximum smoke density is obtained. That time is determined by a smoke density measurement tests carried out in accordance with appendix 1.

2 NORMATIVE REFERENCES

The following normative documents contain provisions which constitute provisions of this appendix:

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

ISO 13943, Fire safety – Vocabulary.

ISO 19702, Toxicity testing of fire effluents – Analysis of gases and vapours in fire effluents using FTIR technology.

3 TERMS AND DEFINITIONS

For the purposes of this document, the terms and definitions given in standards ISO 13943 and ISO 19702 and the following apply.

3.1 *Maximum smoke density sampling time* (*DmST*) is the sampling time, expressed in seconds, used in toxicity tests correspondent to the time to reach the maximum specific optical density as per paragraph 2.4.1 of part 2.

3.2 *Sampling Response Period* (*SRP*) is the minimum time necessary during the sampling period to completely load the FTIR gas cell including the time to transfer the effluents flow from the smoke chamber into the cell.

4 PRINCIPLES

Fire effluents are sampled from a cumulative smoke chamber of a smoke test (appendix 1) at a single time point called Dm sampling time (DmST) which is pre-determined by the first smoke density test in appendix 1. This time represents the time where the smoke density reaches the maximum level during the standard 20 min test. Gas sampling shall be such that the sample represents the gas, the fire effluent, in quality and quantity, in the chamber, and that any effect of gas sampling systems (filters, probes, pipes, tubes and pumps) in minimized. It is recommended to minimize the travelling time and distance of fire effluent through the gas sampling system. A filtering system for fire effluent shall be installed within the gas sampling system to prevent smoke particles from entering into the gas analyser. FTIR shall be used to analyse the sampled gases.

5 GAS SAMPLING SYSTEM

Gas sampling system should consist of probe, heated gas sampling line, filter, valves and sampling pump.

6 GAS ANALYSIS TECHNIQUE

An FTIR system as described in standard ISO 19702 shall be used.

7 CALIBRATION

Calibration of the FTIR system shall be carried out for gases to be measured in accordance with standard ISO 19702.

8 TEST PROCEDURES

8.1 Operation before each test

8.1.1 Check the internal walls condition of the test chamber and eventually clean them removing all dirty layers and particles. The same operation shall be done on the surface of the internal probe for FTIR sampling.

8.1.2 The inlet of the probe shall be cleaned.

8.1.3 Keep the filter, gas sampling line and valves and gas cell at the temperature of 150°C to 180°C for at least 10 min prior to the test.

8.1.4 The wavelength resolution of the spectrometer shall be 4 cm^{-1} or better. Set the Mid-IR whole spectral region for collection between 650 cm^{-1} to 4,500 cm^{-1}.

8.1.5 Close the chamber door, and introduce the air in the chamber into the gas cell of FTIR. Wait for 1 min and record the background spectrum.

8.1.6 Turn the sampling valve to introduce the open air into the gas cell.

Note: It is recommended, before the start of any smoke test on that day, to carry out a dummy gas measurement where the ambient air in the smoke chamber is sampled and analysed by the normal test procedure, and to make sure that no gas is detected. It is also recommended that such a dummy gas measurement be carried out whenever a questionable gas measurement result is obtained. It is also recommended that this screening measurement be carried out after the smoke chamber is cleaned by volatile solvent.

8.2 Operation during a test

8.2.1 During the smoke density test specified in appendix 1, the sampling shall start by turning the sampling valve to introduce gas in the chamber into the sampling line, at *DmST* – (*SRP* x 0.5) (s).

8.2.2 Wait for a minimum period equal to SRP then collect the spectrum, stop the sampling from the chamber and turn the sampling valve to introduce open air side.

8.2.3 Continue the smoke density test until a 20 min period has elapsed. To verify the end of the test, ensure that the smoke density peak has already occurred.

8.2.4 At the end of the test, follow the end of the test procedures described in appendix 1.

8.2.5 If the smoke chamber pressure drops below the permitted minimum as specified in standard ISO 5659-2 by any phenomena of the combustion of the specimen, the gas inlet valve of the chamber will automatically open according to standard ISO 5659-2. If this happens, this shall be reported.

8.2.6 If the smoke chamber pressure exceeds the permitted maximum as specified in standard ISO 5659-2 by any phenomena of the combustion of the specimen, the gas release valve of the chamber will automatically open according to standard ISO 5659-2. If this happens, this shall be reported.

8.3 Repeat tests

In case an additional set of three smoke measurement tests are repeated in accordance with appendix 1, paragraph 8.8.2, in any of the test conditions in paragraph 8.8.1 of appendix 1, gas measurements shall be conducted at the second and third test of the second set of the tests in accordance with this appendix and the test results shall be reported in accordance with paragraph 10.

9 GAS ANALYSIS

9.1 FTIR gas analysis

FTIR gas analysis shall be carried out in accordance with standard ISO 19702.

9.2 Calculation of concentration correction for acid gases

9.2.1 Analysis of filtering materials used in the gas sampling line shall be carried out, and total acid gases trapped by the filtering materials (*Qa* (g)) shall be obtained.

9.2.2 The relative concentration shall be calculated based on the total gas volume (*Vs* (l)) passing through the filter for the gas sampling period:

$$Vs = Sfl \times St$$

where:

Sfl is the gas sampling flow rate (*l*/s),
St is the gas sampling time (s).

9.2.3 Relative volume of the gas (*Va* (*l*)) shall be calculated by:

$$Va = (Qa/PMa) \times Vm$$

where:

Vm is the molar volume at standard conditions,
PMa is the molar mass of the gas.

9.2.4 The concentration correction (Cca (ppm)) for an acid gas shall be obtained by:

$Cca = Va/Vs \times 10^6$

10 TEST RESULTS

The following test results shall be included in the test report:

.1 for each test:

.1 maximum gas concentration C (ppm) measured by FTIR for each gas listed in paragraph 2.4.2 of this part;

.2 gas concentration correction (Cca), if applicable;

.3 corrected maximum gas concentration ($C + Cca$), if applicable; and

.4 *DmST* and *SRP*;

.2 for each test condition (see paragraph 8.8.1 of appendix 1), the average value of the maximum value of the gas concentration measured and corrected, if applicable, at each test condition; and

.3 data regarding the test apparatus:

.1 the inner volume of the gas cell;

.2 the inner volume and the length of gas sampling line; and

.3 the capacity of the gas sampling pump.

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 PROCEDURES

The products shall be tested and evaluated in accordance with the fire test procedures specified in appendices 1 and 2 to this part. Appendix 2 contains test procedures for windows, fire dampers and pipe and duct penetrations in its appendices.

3 PERFORMANCE CRITERIA

3.1 Insulation

3.1.1 ***"A" class divisions, including "A" class doors***

The average unexposed-face temperature rise as determined in accordance with paragraph 8.4.1 of appendix 1 shall not be more than l40°C, and the temperature rise recorded by any of the individual unexposed-face thermocouples shall 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.

3.1.2 ***"B" and "F" class divisions, including "B" and "F" class doors***

The average unexposed-face temperature rise as determined in accordance with paragraph 8.4.1 of appendix 1 shall not be more than 140°C, and the temperature rise recorded by any of the individual unexposed-face thermocouples shall not be more than 225°C during the periods given below for each classification:

class "B-15"	15 min
class "B-0"	0 min
class "F-15"	15 min
class "F-0"	0 min.

3.2 Integrity

For all "A", "B" and "F" class divisions, including "A", "B" and "F" class doors, the following requirements shall be satisfied for the minimum test duration relevant to the classification (see paragraph 8.5 of appendix 1):

.1 flaming: there shall be no flaming on the unexposed face;

.2 cotton-wool pad: there shall be no ignition, i.e. flaming or glowing, of the cotton-wool pad when applied in accordance with paragraph 8.4.3 of appendix 1 or when used to assist evaluation of flaming (see paragraph 8.4.2 of appendix 1); and

.3 gap gauges: it shall not be possible to enter the gap gauges into any opening in the specimen in the manner described in paragraph 8.4.4 of appendix 1.

"A", "B" and "F" class doors are not required to be able to be opened or closed, during or after the specified test duration.

3.3 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 paragraph 7.7 of appendix 1 shall not rise more than 200°C above its initial temperature at any time during the minimum test duration relevant to the classification (see paragraph 8.5 of appendix 1). Where the structural core is of a material other than steel or aluminium alloy the Administration shall decide the rise in temperature which shall not be exceeded during the test duration.

3.4 Continuous "B" class ceilings and linings

Where ceilings or linings are required to be continuous "B" class ceilings or linings, they may be tested and evaluated in accordance with appendix 4 to this part.

3.5 Additional requirements

3.5.1 The specimen of the "A" and "B" class constructions shall be constructed from non-combustible materials. The following exceptions are permissible:

.1 adhesives and vapour barriers used in the construction of the specimen are not required to be non-combustible; however, they shall have low flame-spread characteristics;

.2 sealing materials used in penetration systems;

.3 seals for gas-, water- and weather-tight doors;

.4 seals for windows; and

.5 filling material within glazing systems.

Adhesives and sealing materials used in testing of penetration systems shall be used in the actual structure. Materials mentioned in paragraphs 3.5.1.3 to 3.5.1.5 may be installed in constructions of the specimen. Such inclusions shall be stated in the test report.

The material used in the test shall not be replaced by any other materials that have not been tested in accordance with this Code and/or accepted by the Administration.

3.5.2 ***Thermal radiation through windows***

3.5.2.1 Where thermal radiation through windows is required to be limited by an Administration, the window assembly may be tested and evaluated in accordance with appendix 3 to this part.

3.5.2.2 The cotton-wool pad need not be used on the unexposed face after the period relevant to the insulation classification of the product.

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.

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.

4.3 If an aluminium deck is tested with insulation installed below the deck, then the result will apply to decks which are bare on the top. Aluminium decks shall not be provided with deck coverings or insulation on the top unless tested with the deck covering or insulation included, to verify that the 200°C temperature of the aluminium is not exceeded.

5 TEST REPORT

The test report shall include the information contained in paragraph 9 of appendix 1.

6 REFERENCE DOCUMENTS

ISO 834-1 – Fire-resistance tests – Elements of building construction – Part 1: General requirements.

IEC 60584-1 – Thermocouples – Part 1 Reference tables.

APPENDIX 1

FIRE RESISTANCE TEST PROCEDURES FOR "A", "B" AND "F" CLASS DIVISIONS

1 GENERAL

1.1 Approval of constructions will be restricted to the orientation in which they have been tested; therefore, bulkheads, linings and doors shall be tested vertically mounted and decks and ceilings shall 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.

1.2 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.

1.3 In tests for "A" class bulkheads for "general application" it may be possible for approval to 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.

1.4 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.

1.5 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 shall be tested with the stiffeners on the unexposed side of the bulkhead, otherwise it shall be tested with the side with the thinnest thickness of insulation on the exposed face.

1.6 The thickness of insulation on the stiffeners need not be same as that of the steel plate.

1.7 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 shall 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 shall satisfy at least "B-0" classification.

1.8 When the insulation of an "A" class division is provided by membrane protection, the stiffeners of the structural core shall 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.

1.9 The dimensions of the structural cores of the test specimens given in paragraph 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.

1.10 "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.

1.11 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 shall not be applied to decks and vice versa.

1.12 The construction to be tested shall be, as far as possible, representative of that to be used on board ships, including the materials and method of assembly.

1.13 The designs of the specimens proposed in this appendix 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.

1.14 Doors, windows and other division penetrations intended to be installed in fire divisions made of material other than steel shall 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.

1.15 Constructions shall 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.

1.16 "B" class constructions shall be tested without finishes. For constructions where this is not possible, the finishes may be included in the "B" class test specimen, and shall be included in the non-combustibility test of the construction.

2 NATURE OF TEST SPECIMENS

2.1 "A" class bulkheads

2.1.1 *Dimensions*

2.1.1.1 The minimum overall 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 less than that given above, then the test specimen shall be of the maximum height to be used in practice.

2.1.1.2 The minimum bulkhead panel height shall be a standard height of the manufactured panel with a dimension of 2,400 mm.

2.1.1.3 The overall dimensions of the structural core shall 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 shall 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

2.1.1.4 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.

2.1.1.5 Any joints in the plating shall be fully welded, at least from one side.

2.1.1.6 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 shall be as illustrated in figure 3.

2.1.2 ***Design***

2.1.2.1 Where insulation is provided by panels (e.g., a "B" class lining), then the test specimen shall be such that at least one of the panels is of full width and this, or these, shall be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

2.1.2.2 The overall dimensions of the panel insulation system, including the perimeter details at all the edges, shall be 20 mm greater in each direction than the equivalent dimensions of the structural core.

2.1.2.3 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) shall be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the lining.

2.1.2.4 Where the insulation consists of blankets, the blankets shall be arranged so that not less than two transverse joints between blankets are included. The joints shall be located not less than 600 mm from the edges of the bulkhead.

2.1.3 ***Description***

2.1.3.1 The applicant shall 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 shall 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.

2.1.3.2 Where insulation is provided by panels, the manufacturer shall provide the information required in paragraphs 2.4.3 (bulkheads), 2.7.3 (linings) or 2.8.3 (ceilings). The distance between the steel bulkhead/deck and the insulating membrane shall be stated.

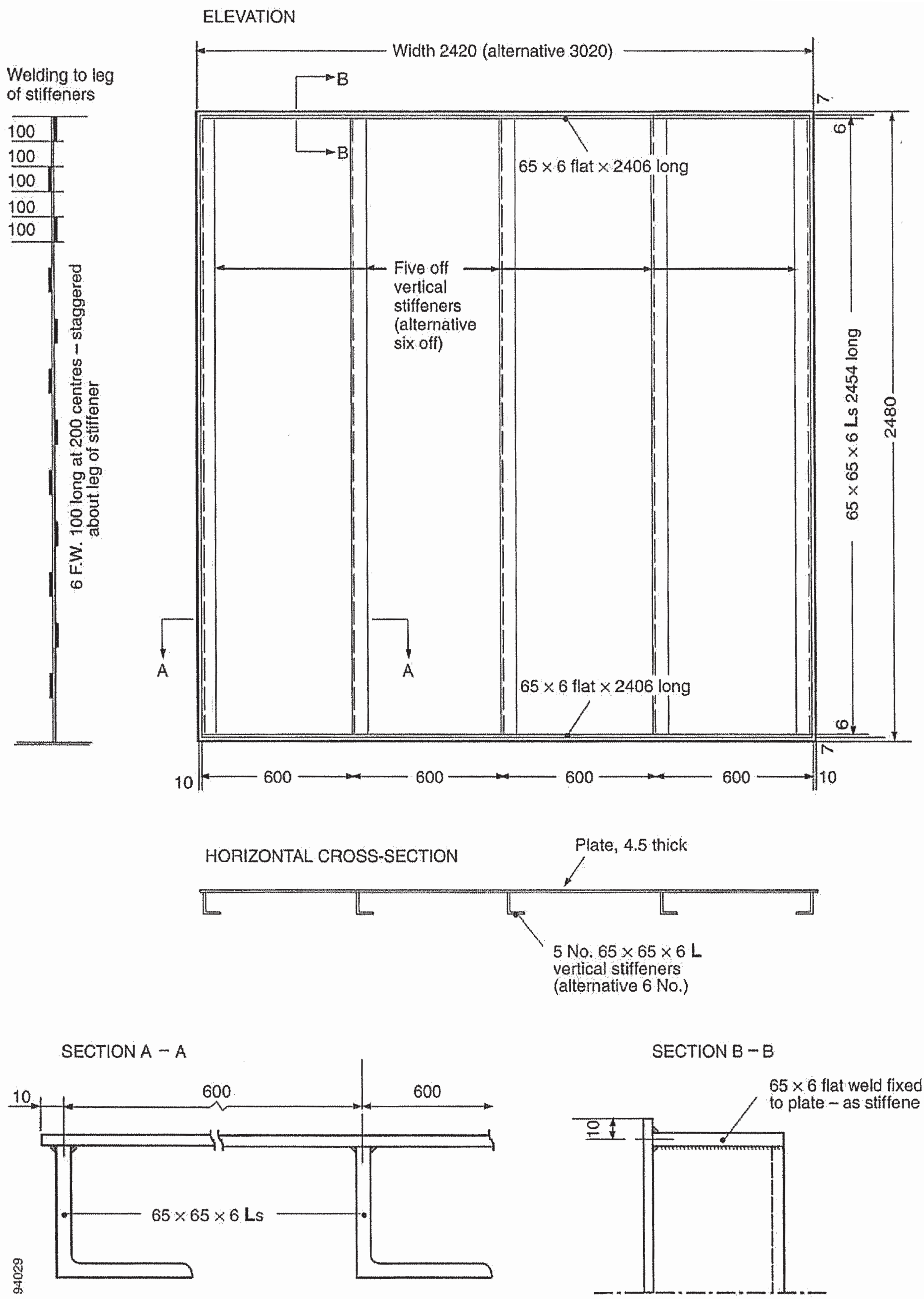


Figure 1 – Structural steel core for "A" class bulkhead and "B" class lining

2.2 "A" class decks

2.2.1 *Dimensions*

2.2.1.1 The minimum overall dimensions of the test specimen, including the perimeter details at all the edges, are 2,440 mm width and 3,040 mm length.

2.2.1.2 The overall dimensions of the structural core shall 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 shall be as follows:

– thickness of plating:	steel	4.5 ± 0.5 mm
	aluminium	6 ± 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

2.2.1.3 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.

2.2.1.4 Any joints in the plating shall be fully welded, at least from one side.

2.2.1.5 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 shall be as illustrated in figure 3.

2.2.2 *Design*

2.2.2.1 Where insulation is provided by panels (e.g., a "B" class ceiling), then the test specimen shall be designed such that at least one of the panels is of full width and this, or these, shall 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, shall be 20 mm greater in each direction than the equivalent dimensions of the structural core.

2.2.2.2 If the ceiling incorporates panels, the specimen shall 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 shall be positioned at a distance of approximately 600 mm from one of the shorter ends of the test specimen.

2.2.2.3 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) shall be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the ceiling.

2.2.2.4 Where the insulation consists of blankets, the blankets shall be arranged so that not less than two transverse joints between blankets are included. The joints shall be located not less than 600 mm from the edges of the deck.

2.2.3 *Description*

2.2.3.1 The applicant shall 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 shall 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.

2.2.3.2 Where insulation is provided by panels, the manufacturer shall provide the information required in paragraph 2.8.3 (ceilings). The distance between the steel deck and the insulating membrane shall be stated.

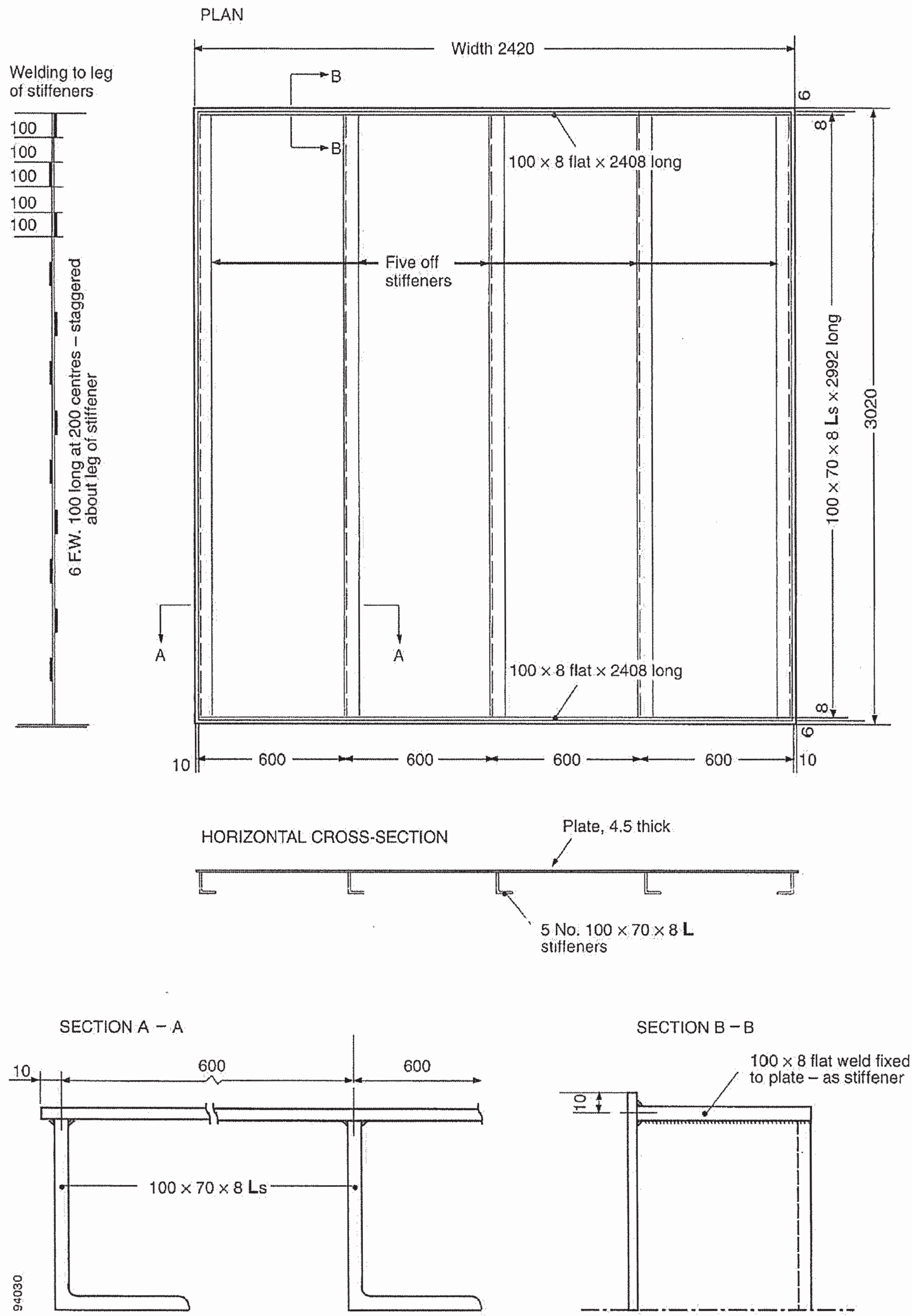


Figure 2 – Structural steel core for "A" class deck and "B" class ceiling

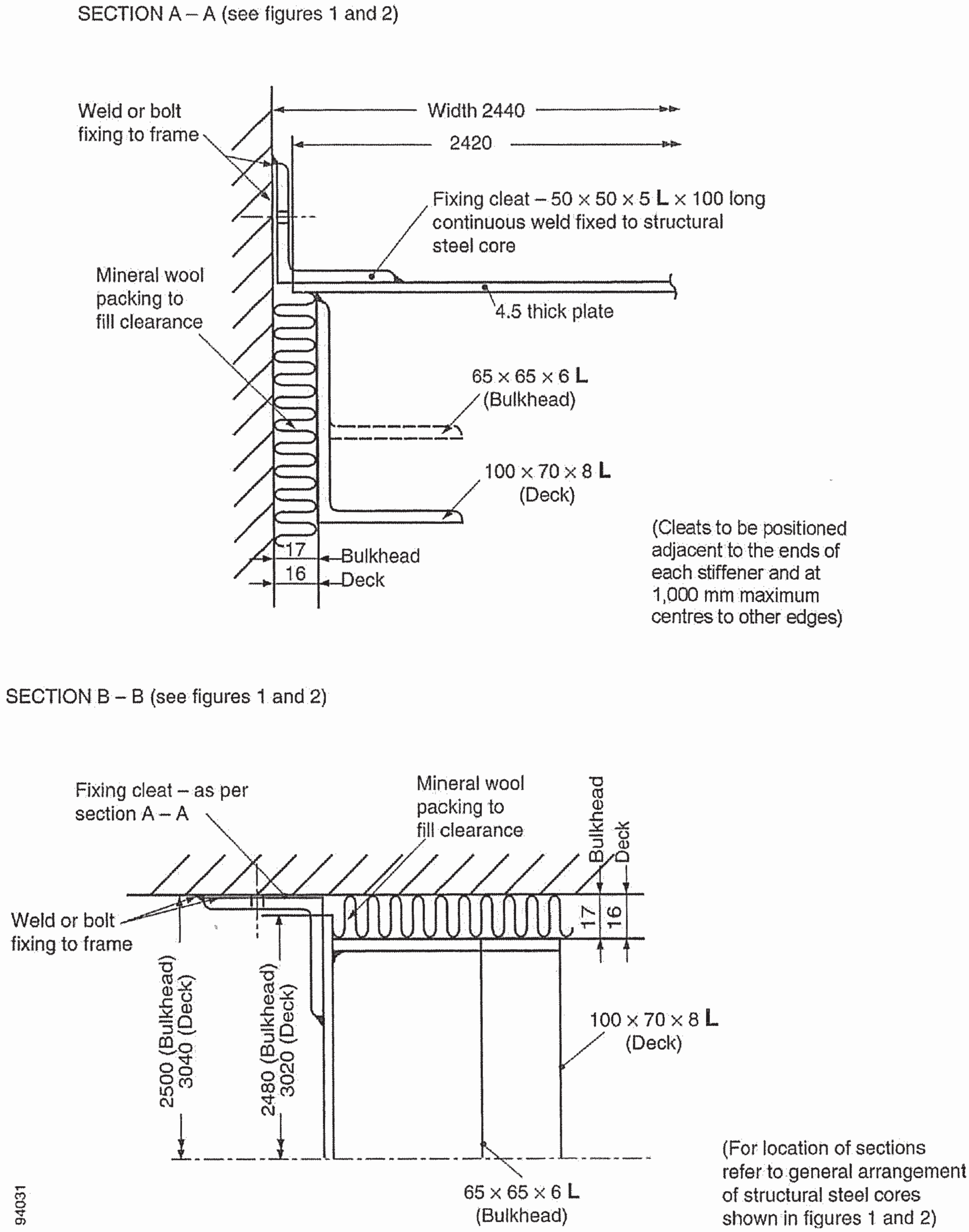


Figure 3 – Connection between restraint frame and structural steel core

2.3 "A" class doors

2.3.1 ***Dimensions***

The test specimen shall 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 paragraph 2.3.2.4 below).

2.3.2 ***Design***

2.3.2.1 The door leaf and frame shall be constructed of steel or other equivalent material and insulated as necessary to achieve the desired standard of insulation.

2.3.2.2 Door furniture such as hinges, locks, latches, shoot bolts, handles, etc., shall be constructed of materials having melting points of not less than 950°C unless it can be shown by the fire test that materials having melting points below 950°C do not adversely affect the performance of the door.

2.3.2.3 The door leaf and frame shall be mounted into a structural core constructed in accordance with paragraph 2.1.1.

2.3.2.4 An opening to accommodate the door assembly shall 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.

2.3.2.5 No additional stiffening shall be provided to the structural core unless provided as part of the door frame.

2.3.2.6 The method of fixing the door frame into the opening in the structural core shall be as used in practice. If the method of fixing the door frame in a test is made by bolts, the Administration may also accept welding as a method of fixing the door frame without further tests.

2.3.2.7 For doors mounted in a three-sided frame, the door shall be mounted with a bottom gap of between 12 mm and 25 mm between the bottom of the door and the test frame.

2.3.2.8 The structural core shall be mounted such that the stiffeners are on the unexposed face and the insulating system shall be on the exposed face.

2.3.2.9 The insulation system shall 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 shall be insulated to "A-60" standard. The insulation of the structural core shall not be extended beyond the outer web of the door frame.

2.3.2.10 The door shall 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.

2.3.2.11 A hinged door shall be tested with the door leaf opening away from the heating conditions unless the Administration deems otherwise.

2.3.2.12 For sliding doors it is not possible to state generally from which side the door shall 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.

2.3.2.13 Lift landing doors can be expected to be exposed to fire from the corridor side only, and they shall be exposed to fire test heating conditions from that side only.

2.3.2.14 Tests performed with double leaf doors will not be accepted as approval documentation for single leaf doors.

2.3.2.15 Double leaf doors should be tested with equally sized door leaves unless the door is intended to have unequally sized leaves.

2.3.3 ***Description***

The applicant shall 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 shall include dimensions and details of the following:

.1 the bulkhead;

.2 the door leaf and frame construction, including the clearances between the door leaf and the frame;

.3 the connection of the door frame to the bulkhead;

.4 the method of securing insulation and details of components used for this purpose (e.g., the type and rate of application of any adhesive); and

.5 fittings such as hinges, shoot bolts, latches, locks, etc.

2.4 "B" and "F" class bulkheads

2.4.1 ***Dimensions***

2.4.1.1 The minimum overall 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 that given above, then the test specimen shall be of the maximum height to be used in practice.

2.4.1.2 The minimum bulkhead panel height shall be a standard height of the manufactured panel with a dimension of 2,400 mm.

2.4.2 ***Design***

2.4.2.1 Where the construction incorporates panels, the specimen shall be constructed such that at least one of the panels is of full width and this, or these, shall be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

2.4.2.2 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) shall 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 shall 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 shall 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***

2.5.1.1 The minimum overall dimensions of the test specimen, including the perimeter details at all the edges, are 2,440 mm width and 3,040 mm length.

2.5.1.2 When the maximum dimensions in practice are less than that given above, the test specimen shall be of the maximum size to be used in practice and the tested width shall be reported.

2.5.2 ***Design***

Where the construction incorporates panels, the specimen shall be constructed such that at least one of the panels is of full width and this, or these, shall 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 shall 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 shall 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 shall incorporate the maximum size (in terms of both the width and the height) of the 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 paragraph 2.6.2.6).

2.6.2 ***Design***

2.6.2.1 Door furniture such as hinges, locks, latches, shoot bolts, handles, etc., shall 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 shall be mounted as appropriate into a "B" or "F" class bulkhead of compatible construction, thereby reflecting an actual end-use situation. The bulkhead shall have dimensions as prescribed in paragraph 2.4.1.

2.6.2.3 The bulkhead shall be of a construction approved by the Administration as having at least a similar classification to that required by the door, and approval shall be limited to the type of construction in which the door was tested.

2.6.2.4 The method of fixing the door frame to the bulkhead shall be as used in practice. If the method of fixing the door frame in a test is made by bolts, the Administration may also accept welding as a method of fixing the door frame without further tests.

2.6.2.5 For doors mounted in a three-sided frame, the door shall be mounted with a bottom gap of between 12 mm and 25 mm between the bottom of the door and the test frame.

2.6.2.6 The door shall 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.

2.6.2.7 The door shall 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.

2.6.2.8 A hinged door shall be tested with the door leaf opening away from the heating conditions unless the Administration deems otherwise.

2.6.2.9 For sliding doors it is not possible to state generally from which side the door shall 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.

2.6.2.10 For a door which incorporates a ventilation opening within its construction, the ventilation grille(s) shall be open at the commencement of the test.

2.6.3 ***Description***

The applicant shall 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 shall include dimensions and details as follows:

.1 the bulkhead;

.2 the door leaf and frame construction, including the clearances between the door leaf and the frame;

.3 the connection of the door frame to the bulkhead;

.4 the method of securing insulation and details of components used for this purpose (e.g., the type and rate of application of any adhesive); and

.5 fittings such as hinges, shoot bolts, latches, locks, handles, ventilation louvres, escape panels, etc.

2.7 "B" and "F" class linings

Linings shall be tested as bulkheads and they shall be exposed to the fire test heating conditions from the side intended to face the cabin.

2.7.1 ***Dimensions***

2.7.1.1 The minimum overall 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 that given above, then the test specimen shall be of the maximum height to be used in practice.

2.7.1.2 The minimum bulkhead panel height shall be a standard height of the manufactured panel with a dimension of 2,400 mm.

2.7.2 ***Design***

2.7.2.1 The lining shall be positioned alongside a structural core constructed in accordance with paragraph 2.1.1. The design of the lining shall be such that it facilitates its assembly with the limited access provided by the proximity of the structural core, i.e. it shall be mounted with the structural core in place.

Note: Viewing and access openings on an "A" class bulkhead may be provided for the determination of the integrity of the lining, and they should be located corresponding to joints of panels of the lining and away from thermocouples on an "A" class bulkhead. They should normally be sealed with mineral wool insulation slabs except when viewing or access to the lining is needed.

2.7.2.2 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.

2.7.2.3 The specimen shall be constructed such that at least one of the panels is of full width and this, or these, shall be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

2.7.2.4 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) shall 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 shall 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 shall 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***

2.8.1.1 The minimum overall dimensions of the test specimen, including the perimeter details at all the edges, are 2,440 mm width and 3,040 mm length.

2.8.1.2 When the maximum dimensions in practice are less than those given above then the test specimen shall be of the maximum size to be used in practice, and the tested width shall be reported.

2.8.2 ***Design***

2.8.2.1 The ceiling shall be positioned below a structural core constructed in accordance with paragraph 2.2.1. The design of the ceiling shall be such that it facilitates its assembly with the limited access provided by the proximity of the structural core, i.e. it shall be mounted with the structural core in place.

> **Note**: Viewing and access openings on an "A" class deck may be provided for the determination of the integrity of the ceiling, and they should be located corresponding to joints of panels of the ceiling and away from thermocouples on an "A" class deck. They should normally be sealed with mineral wool insulation slabs except when viewing or access to the ceiling is needed.

2.8.2.2 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.

2.8.2.3 If the ceiling incorporates panels, the specimen shall 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 shall be positioned at a distance of approximately 600 mm from one of the shorter ends of the test specimen.

2.8.2.4 The specimen shall be constructed such that at least one of the panels is of full width and this, or these, shall be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.

2.8.2.5 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) shall be performed on a specimen(s) with the units incorporated to ascertain their influence on the performance of the ceiling.

2.8.2.6 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.

2.8.3 ***Description***

The applicant shall 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 shall 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 all relevant details including, in particular, the components used for this purpose, joints, connections and air gaps.

3 MATERIALS FOR TEST SPECIMENS

3.1 Specifications

Prior to the test, the following information, if applicable, shall be submitted to the laboratory by the applicant for each of the materials used in the construction:

.1 the identification mark and trade name;

.2 principal details of composition;

.3 nominal thickness;

.4 nominal density (for compressible materials this shall be related to the nominal thickness);

.5 nominal equilibrium moisture content (at relative humidity of 50% and a temperature of 23°C);

.6 nominal organic content;

.7 specific heat at ambient temperature; and

.8 thermal conductivity at ambient temperature.

3.2 Control measurements

3.2.1 ***General***

3.2.1.1 The testing laboratory shall 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 shall 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 organic content.

3.2.1.2 The reference specimens for sprayed materials shall be made when the material is sprayed on the structural core and they shall be sprayed in a similar manner and in the same orientation.

3.2.1.3 The laboratory shall 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 paragraph 4.

3.2.1.4 For the determination of the thickness, the density and the moisture and/or organic content three specimens shall be used, and the value quoted as the mean of the three measurements.

3.2.2 ***Encapsulated materials***

3.2.2.1 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 shall be requested to provide the requisite samples of the material. In these cases it shall 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.

3.2.2.2 Notwithstanding the above, the laboratory shall 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 shall be repaired in a manner such that its performance in the fire test is not impaired.

3.2.3 ***Non-combustibility***

Where materials used in the construction of the specimen are required to be non-combustible, i.e. for "A" and "B" classes, evidence in the form of test reports in accordance with the test method in part 1 of this annex, and from a testing laboratory recognized by the Administration and independent of the manufacturer of the material shall be provided. These test reports shall indicate that the non-combustibility tests were conducted not more than 24 months prior to the date of the performance of the fire resistance test. If such reports cannot be provided then tests in accordance with part 1 of annex 1 to the Code shall be conducted. 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.

3.2.4 ***Low flame-spread characteristics***

3.2.4.1 Where materials used in the construction of the specimen are required to have low flame-spread characteristics, evidence in the form of test reports in accordance with part 5 of this annex, and from a testing laboratory recognized by the Administration and independent of the manufacturer of the material shall be provided. These test reports shall indicate that the low flame-spread tests were conducted not more than 24 months prior to the date of the performance of the fire resistance test. If such reports cannot be provided then tests in accordance with part 5 of this annex shall be conducted. When the material has a type approval certificate for low flame-spread characteristics valid at the performance of the fire resistance test, low flame-spread test reports may not be required.

3.2.4.2 Adhesives used in the construction of the specimen are not required to be non-combustible; however, they shall have low flame-spread characteristics.

3.2.5 ***Thickness***

3.2.5.1 The thickness of each material and combination of materials shall be ± 10% of the value stated as the nominal thickness when measured by using a suitable gauge or callipers.

3.2.5.2 The thickness of a sprayed insulation material shall be measured using a suitable probe at positions adjacent to each of the unexposed-face thermocouples.

3.2.6 ***Density***

3.2.6.1 The density of each material shall be determined from measurement of the weight and the dimensions.

3.2.6.2 The density of mineral wool or any similar compressible material shall be related to the nominal thickness and the density of each material used in the test specimen shall be ± 10% of the value stated as the nominal density.

3.2.7 ***Moisture content***

3.2.7.1 The moisture content (W_1-W_2) of each non-combustible material used in the specimen shall be calculated using the following method, and indicate a percentage of the dry weight (W_2), and which information is required.

3.2.7.2 In the following, W_1, W_2 and W_3 are mean values of three weight measurements. W_1 shall be higher than 25 g. Three specimens of each material, taken in the width of the production's direction and measuring width x minimum 20 mm x thickness of the material, shall 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, cementations and similar materials should be dried at a temperature of 55 ± 5°C to constant weight (W_2).

3.2.7.3 The moisture content (W_1-W_2) of each specimen shall be calculated as a percentage of the dry weight (W_2).

3.2.8 ***Organic content***

3.2.8.1 The information of organic content of non-combustible materials used in the specimen is required. After the percentage moisture contents have been calculated as specified in paragraph 3.2.7, the three specimens should be further heated in an oven at a temperature of 500 ± 20°C for 2 h and again weighed (W_3). The organic content (W_2-W_3) shall be calculated as a percentage of the dry weight (W_2).

Note: A bigger tolerance can be accepted as long as the tested specimen represents the upper limit of the tolerance. In this case, it should be specified in the test report and in the type approval certificate.

3.2.8.2 The organic content of each material used in the test specimen should be within ± 0.3% absolute of the value stated as the nominal organic content.

4 CONDITIONING OF THE TEST SPECIMENS

4.1 General

4.1.1 The test specimen should be protected against adverse environmental conditions until the time of the test. The test specimen shall not be tested until it has reached an equilibrium (constant weight), air-dry condition under the laboratory's normal ambient condition. The equilibrium condition shall be obtained according to paragraph 4.2 below.

4.1.2 Accelerated conditioning is permissible provided the method does not alter the properties of component materials. In general, high-temperature conditioning shall be below temperatures critical for the materials.

4.2 Verification

4.2.1 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 shall be so constructed as to represent the loss of water vapour from the specimen by having similar thicknesses and exposed faces. They shall have minimum linear dimensions of 300 mm by 300 mm and a minimum mass of 100 g. Constant weight shall 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.

4.2.2 Other reliable methods of verifying that the material has reached equilibrium moisture content may be used by the testing laboratory.

4.3 Encapsulated materials

4.3.1 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 shall be made with the applicant for the test to ensure that this is so.

4.3.2 When the test specimen, such as doors, incorporates encapsulated materials, the requirement relevant to equilibrium moisture in paragraph 4.2 shall apply.

5 MOUNTING OF THE TEST SPECIMENS

5.1 Restraint and support frames

5.1.1 All test specimens shall 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 shall have a density between 1,600 kg/m^3 and 2,400 kg/m^3. The concrete or masonry lining to a steel frame shall have a thickness of at least 50 mm.

5.1.2 The rigidity of the restraint frames shall 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 shall be conducted in the direction of the bulkhead or deck stiffeners, and the increase of the internal dimension shall not exceed 2 mm.

5.1.3 For frames which are to be used to evaluate "A" class divisions which incorporate "B" class ceilings or linings, the frames shall be provided with at least four viewing and access openings, notionally one to each quarter of the test specimen. These openings shall 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 shall 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

5.2.1 The structural core to an "A" class division shall 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.

5.2.2 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 shall 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, shall the perimeter edges be protected from direct exposure to the heating conditions.

5.3 "B" and "F" class divisions

5.3.1 For a "B" or "F" class bulkhead or lining, the specimen shall 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 shall 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 shall 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. If provision for movement at the edges of a bulkhead or lining is made for a particular construction in service, the specimen shall simulate these conditions.

5.3.2 For a "B" or "F" class ceiling, expansion of the ceiling members shall 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 shall 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

6.1.1 The laboratory shall verify the conformity of the test specimen with the drawings and method of assembly provided by the applicant (see paragraph 2), and any area of discrepancy shall be resolved prior to commencement of the test.

6.1.2 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 shall be clearly stated in the test report. The laboratory shall nevertheless ensure that it fully appreciates the design of the test specimen and shall 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 shall 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 shall 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 shall check the operability of the door by opening the door leaf by a distance of at least 300 mm. The door leaf shall then be closed, either automatically, if such a closing device is provided, or manually. The door may be latched for the test but shall not be locked, and no devices for latching or locking shall be included which are not normally incorporated in practice.

7 INSTRUMENTATION

7.1 General

7.1.1 *The furnace*

The instrumentation of the furnace and the instrumentation of the test specimen shall generally be in accordance with the standard ISO 834-1, Fire resistance tests – Elements of building construction – Part 1: General requirements; 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 Ambient temperature thermocouple

A thermocouple shall be used to indicate the ambient temperature within the laboratory in the vicinity of the test specimen both prior to and during the test period. The thermocouple shall be nominally of 3 mm diameter, mineral insulated, stainless steel type K. The measuring junction shall be protected from radiated heat and draught. The ambient temperature shall be monitored at a distance of between 1 m and 3 m horizontally away from the unexposed face of the test specimen.

7.3 Furnace temperature thermocouples

7.3.1 *Design*

7.3.1.1 The furnace thermocouples shall be plate thermometers, which comprise an assembly of a folded steel plate, a thermocouple fixed to it and containing insulation material as described in standard ISO 834-1.

7.3.1.2 The plate part shall be constructed from 150 ± 1 mm long by 100 ± 1 mm wide by 0.7 ± 0.1 mm thick nickel alloy sheet strips folded to the design as shown in figure 4.

7.3.1.3 The measuring junction shall consist of nickel chromium/nickel aluminium (type K) wire as defined in standard IEC 60584-1, contained within mineral insulation in a heat-resisting steel alloy sheath of nominal diameter 1 mm, the hot junctions being electrically insulated from the sheath. The thermocouple hot junction shall be fixed to the geometric centre of the plate in the position shown in figure 4 by a small steel strip made from the same material as the plate. The steel strip can be welded to the plate or may be screwed to it to facilitate replacement of the thermocouple. The strip shall be approximately 18 mm by 6 mm if it is spot welded to the plate, and nominally 25 mm by 6 mm if it is to be screwed to the plate. The screws shall be 2 mm in diameter.

7.3.1.4 The assembly of plate and thermocouple shall be fitted with a pad of inorganic insulation material nominally 97 ± 1 mm by 97 ± 1 mm by 10 ± 1 mm thick, density 280 ± 30 kg/m^3.

7.3.1.5 Before the plate thermometers are first used, the complete plate thermometer shall be aged by immersing in a pre-heated oven at 1,000°C for 1 h.

> **Note**: Exposure in a fire-resistance test furnace for 90 min under the standard temperature/time curve is considered to be an acceptable alternative to using an oven.

7.3.1.6 When a plate thermometer is used more than once, a log of its use shall be maintained indicating, for each use, the checks made and duration of use. The thermocouple and the insulation pad shall be replaced after 50 h exposure in the furnace.

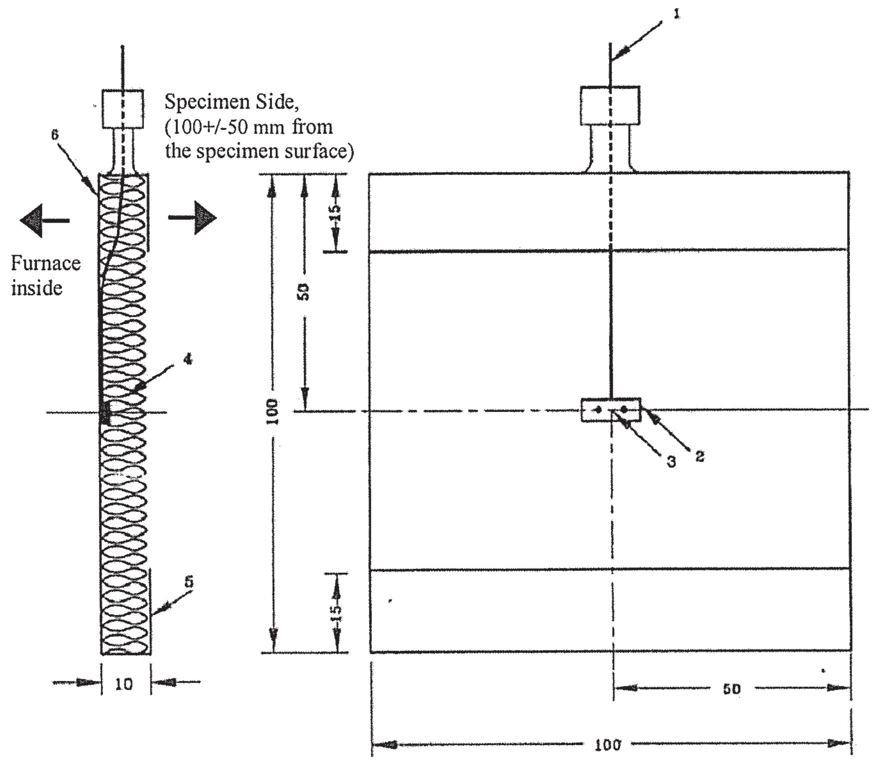
7.3.2 ***Number***

At least six furnace thermocouples shall be provided for the specimens given in paragraph 2. For specimens larger than those specified in paragraph 2, additional thermocouples shall be provided in the proportion of one per 1.5 m^2 of the specimen area. In case of a door assembly, specimen area refers to the entire bulkhead construction with the door fitted. This principle shall be used also for the other assemblies (e.g., windows, ducts and penetrations) installed in bulkheads or decks.

7.3.3 ***Positioning***

7.3.3.1 The thermocouples employed to measure the temperature of the furnace shall 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 shall be 100 mm from the face of the specimen and they shall be maintained at a distance of 50 mm to 150 mm during the test. The method of support shall 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 shall not be used. The plate thermometers shall not be located at positions within the furnace where they are subject to direct flame impingement.

7.3.3.2 The plate thermometer shall be orientated so that side A faces the back wall of the wall furnace and the floor of the horizontal furnace.



1 sheathed thermocouple with insulated hot junction
2 spot welded or screwed steel strip
3 hot junction of thermocouple
4 insulation material
5 nickel alloy strip (0,7 ± 0,1) mm thick
6 face 'A'

Figure 4 – Furnace thermocouple assembly

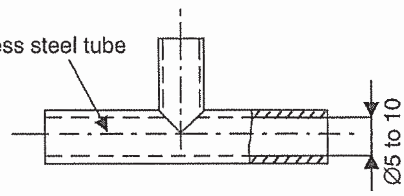
7.3.4 *Connection*

The thermocouple wire shall be either continuous to the recording instrument or suitable compensating wire shall be used with all junctions maintained as near as possible at ambient temperature conditions.

7.4 Furnace pressure sensors

The mean value of the furnace pressure shall 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

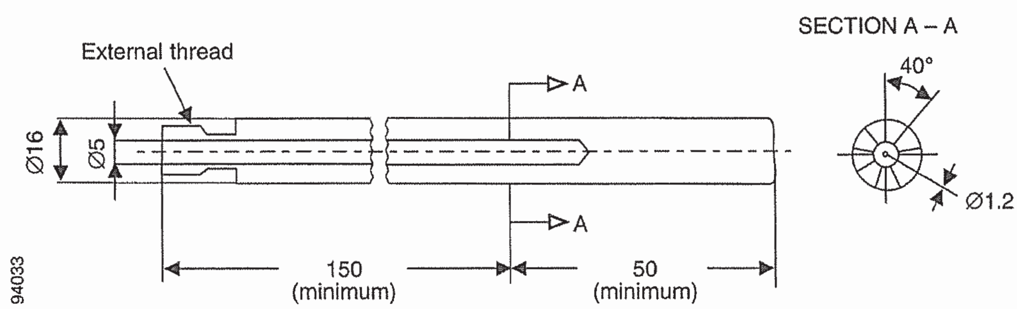


Figure 5 – Pressure-sensing heads

7.5 Unexposed-face temperature thermocouples

7.5.1 *Design*

The temperature of the unexposed surface shall be measured by means of disc thermocouples of the type shown in figure 6. Thermocouple wires, 0.5 mm in diameter, shall be soldered to a 0.2 mm thick by 12 mm diameter copper disc. Each thermocouple shall be covered with a 30 mm square x 2.0 ± 0.5 mm thick non-combustible insulating pad. The pad material shall have a density of 900 ± 100 kg/m^3.

7.5.2 *Connection*

Connection to the recording instrument shall be by wires of similar or appropriate compensating type.

7.5.3 *Preparation of surfaces to receive thermocouples*

7.5.3.1 Steel – Surface finishes shall be removed and the surface cleaned with a solvent. Loose rust and scale shall be removed by wire brush.

7.5.3.2 Irregular surfaces – A smooth surface, not greater than 2,500 mm^2, to provide adequate adhesive bond shall be made for each thermocouple by smoothing the existing surface with a suitable abrasive paper. The material removed shall be the minimum to provide an adequate bonding surface. Where the surface cannot be smoothed, fillings shall be used of minimum quantity to provide a suitable surface. The filling shall comprise a ceramic cement and when the filled surface is dry it shall be smoothed, if necessary, with abrasive paper.

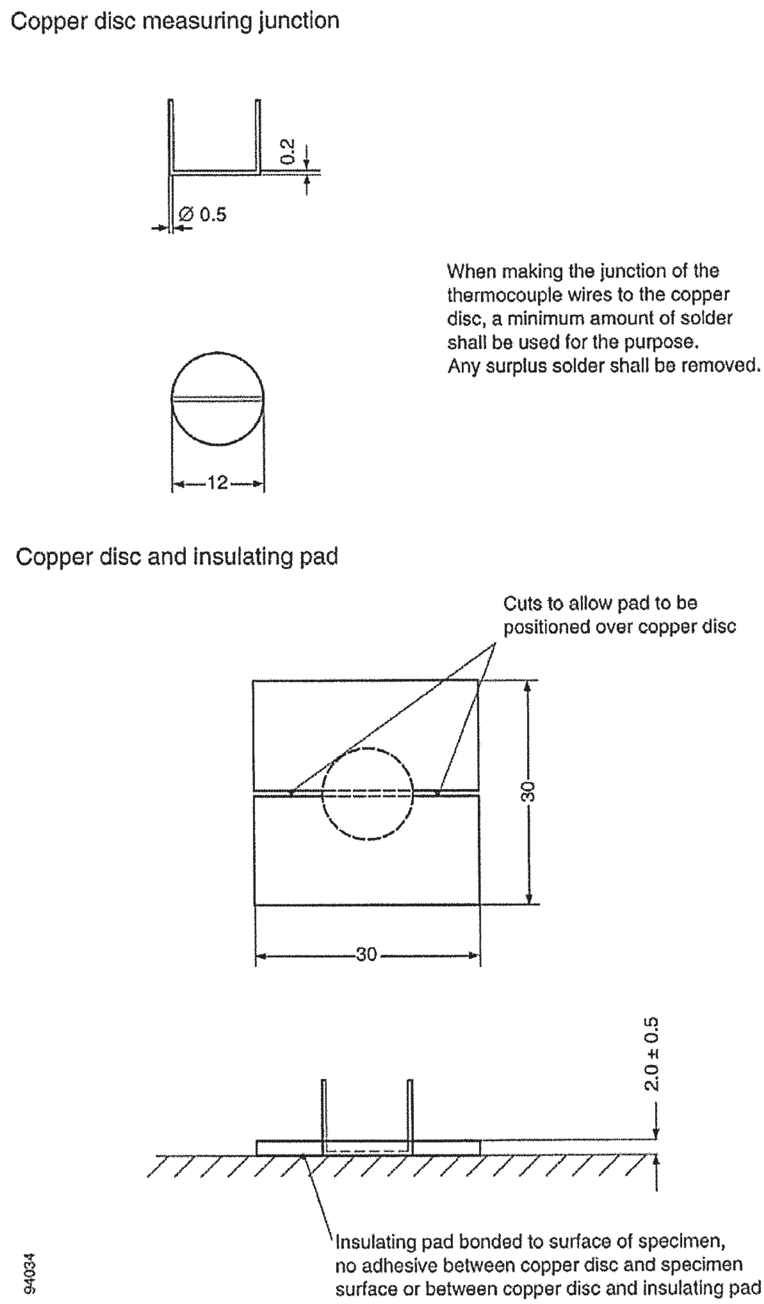


Figure 6 – Unexposed-surface thermocouple junction and insulating pad

7.5.4 *Fixing of thermocouples*

7.5.4.1 Steel – The insulating pad with the thermocouple fitted shall 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 shall 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 long 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 shall be replaced.

7.5.4.2 Mineral wool – The thermocouples with insulating pads fitted shall 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 shall 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.

7.5.4.3 Where gluing is not possible, pins, screws or clips which are only in contact with those parts of the pad which are not over the (copper) disc shall be used. (Example: U-shaped clips approximately 30 x 15 x 30 x 0.5 mm, which are in contact only with the extreme corners of the pad. Heat transfer to the copper disc is negligible.)

7.5.4.4 Mineral fibre spray – Thermocouples shall not be fitted until the insulation has reached a stable moisture condition. In all cases the bonding technique for steel shall be used and where a surface wire mesh is present the thermocouples shall be affixed to the insulation in such a way that the wire mesh aids retention.

7.5.4.5 Vermiculite/cement type spray – The technique specified for wet fibrous spray shall be employed.

7.5.4.6 Boards of fibrous or mineral aggregate composition – The bonding technique for steel shall be used.

7.5.4.7 In all cases of adhesive bonding, the adhesive shall be applied in a thin film sufficient to give an adequate bond and there shall 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".

7.5.4.8 For "A" and "B" class divisions the insulation performance of a construction shall 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 shall be removed locally over an area as small as possible to allow fixing of the thermocouples to the non-combustible part, e.g., a deck provided with overlaid non-combustible insulation (a floating floor) shall have any combustible top surface finish removed locally to the thermocouples to allow them to be fixed to the insulation material.

7.6 Positioning of thermocouples on the specimen

7.6.1 *"A" class divisions, excluding doors*

The surface temperatures on the unexposed face of the test specimen shall 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 placed 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 paragraph 7.6.1.3 above shall be used, one on each of two intersections;

.5 when a construction has two different types of joint detail, then two thermocouples shall 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 subparagraphs .4 to .6 above for measurements on bulkheads, e.g., over different joint types or over joint intersections, shall, where possible, be positioned in the upper half of the specimen.

7.6.2 *"B" and "F" class divisions, excluding doors*

The surface temperatures on the unexposed face of the test specimen shall 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 paragraphs 7.6.1.4 to 7.6.1.7 above.

7.6.3 *"A", "B" and "F" class doors*

The surface temperatures on the unexposed face of the test specimen shall 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 shall not be used for the purpose of classification of the test specimen, and if provided are for information only;

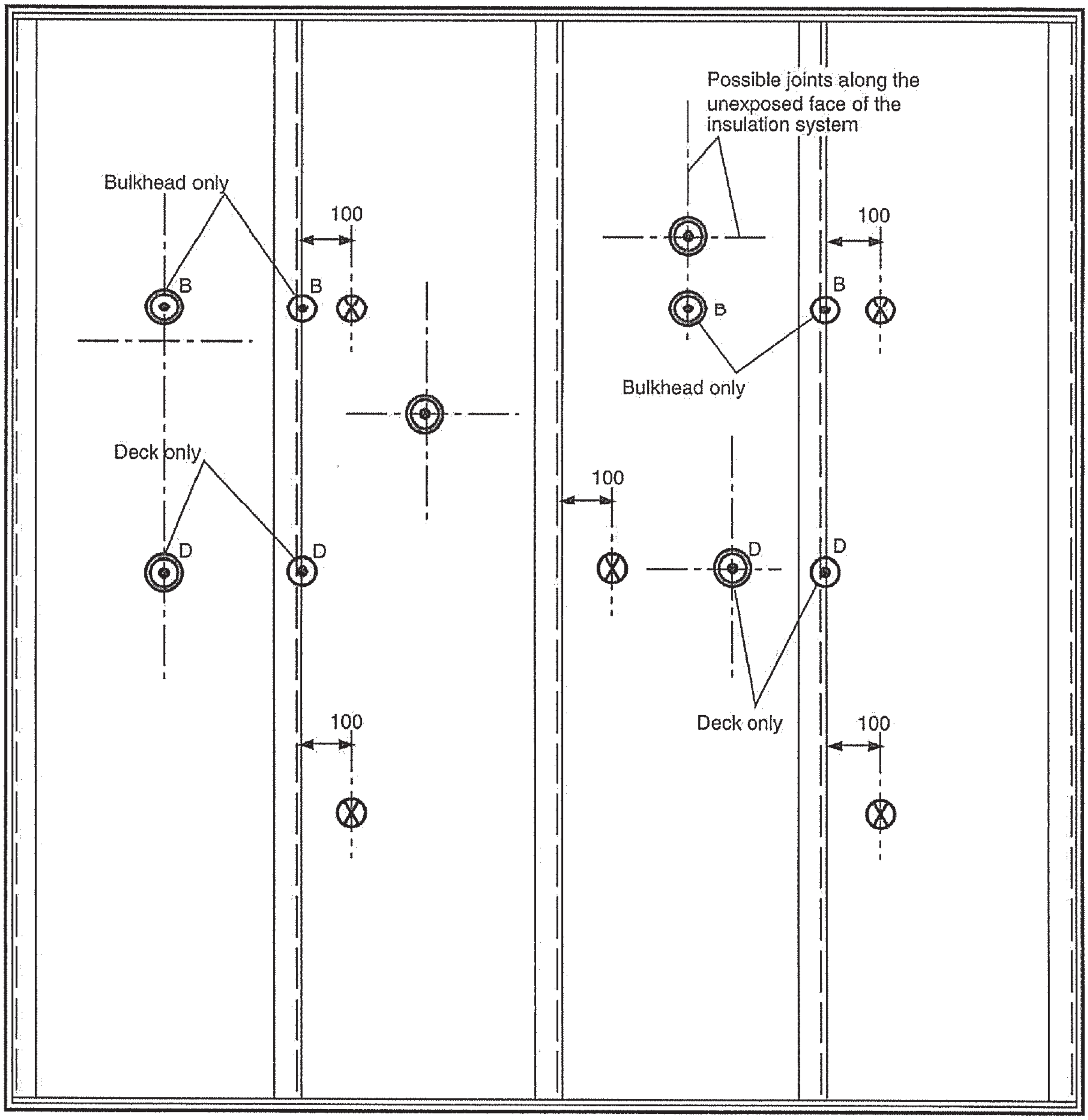
.4 the thermocouples specified in paragraphs 7.6.3.2 and 7.6.3.3 above shall, where possible, be positioned in the upper half of the specimen;

.5 additional thermocouples on the grille of a "B" class door are not to be placed over the perforated area and in a 100 mm wide zone around it;

.6 temperature measurements on a door which incorporates a ventilation opening within its construction shall not be made over the face of the ventilation grille(s);

.7 the door constructions, which incorporate a top panel, shall always be tested with thermocouples on the unexposed face of the top panel and on the joints and/or joining profiles at a level 125 mm above the top of the door leaf. Height of the top panel in the test specimen should be equal or greater than 225 mm; and

.8 when testing double-leaf door assemblies, the requirements shall be applied to each door leaf separately.



Thermocouples used for maximum temperature rise and in calculating average temperature rise.

Thermocouples used for maximum temperature rise.

Thermocouples used for maximum temperature rise (Not applicable if insulation system is without joints).

B: Thermocouples used for bulkhead tests only.

D: Thermocouples used for deck tests only.

Figure 7 – Position of unexposed-face thermocouples for "A" class division: insulated face to the laboratory

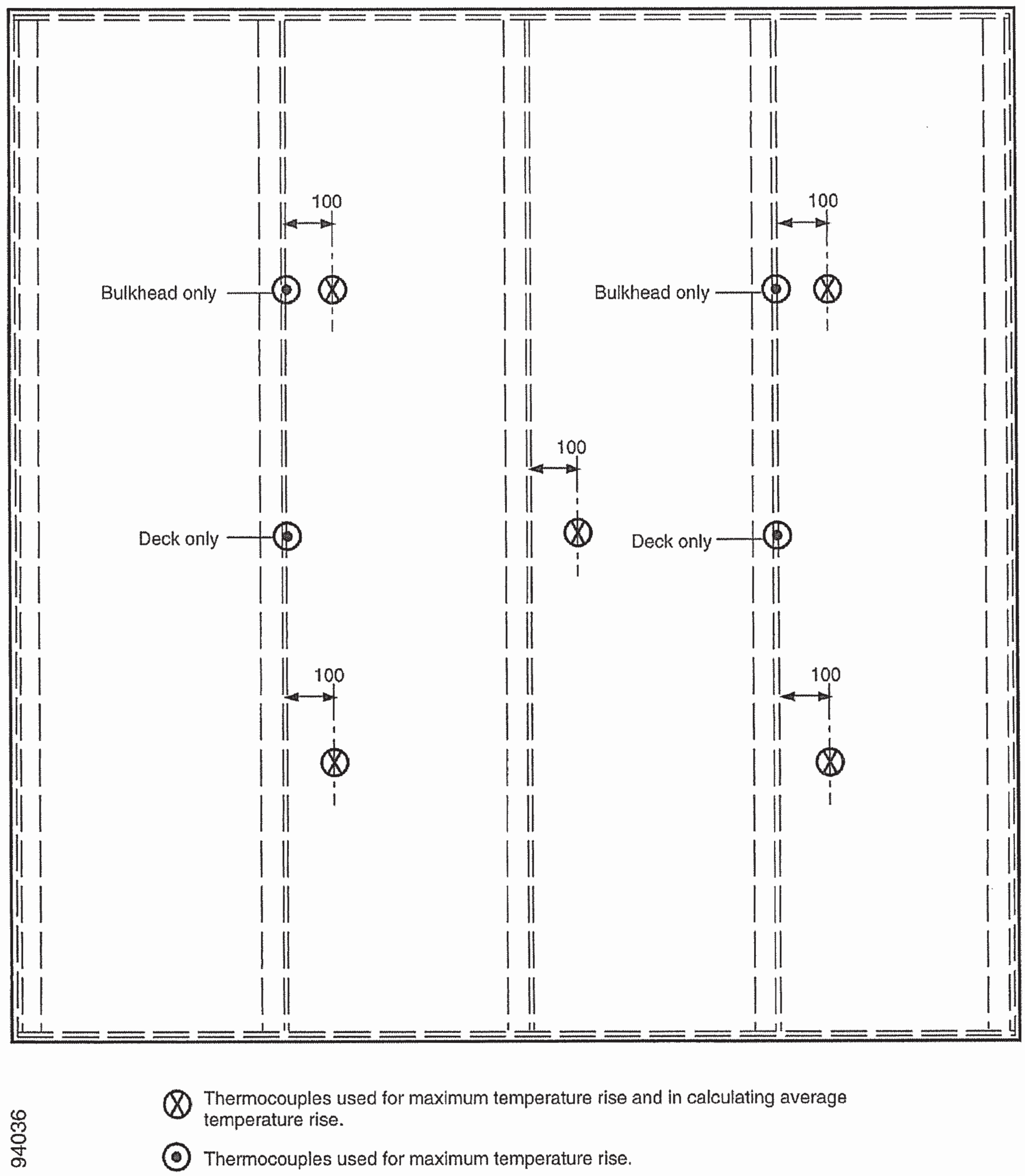


Figure 8 – Position of unexposed-face thermocouples for "A" class division: flat face of structural steel core to the laboratory

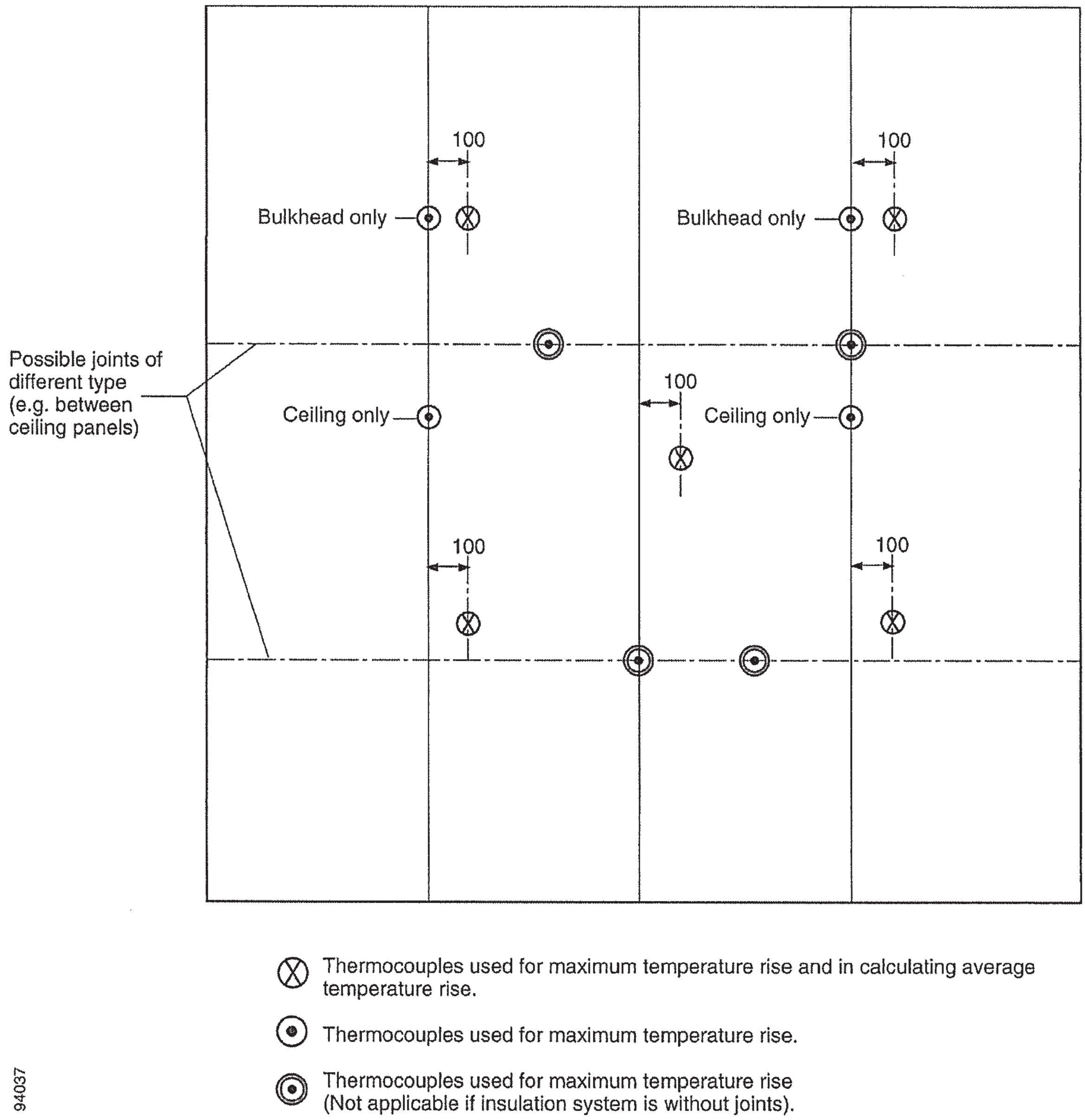


Figure 9 – Position of unexposed-face thermocouples for "B" and "F" class divisions

7.7 Structural core temperature thermocouples

7.7.1 When testing a specimen with a structural core other than steel, thermocouples shall be fixed to the core material in positions corresponding to the surface thermocouples mentioned in paragraph 7.6.1.1.

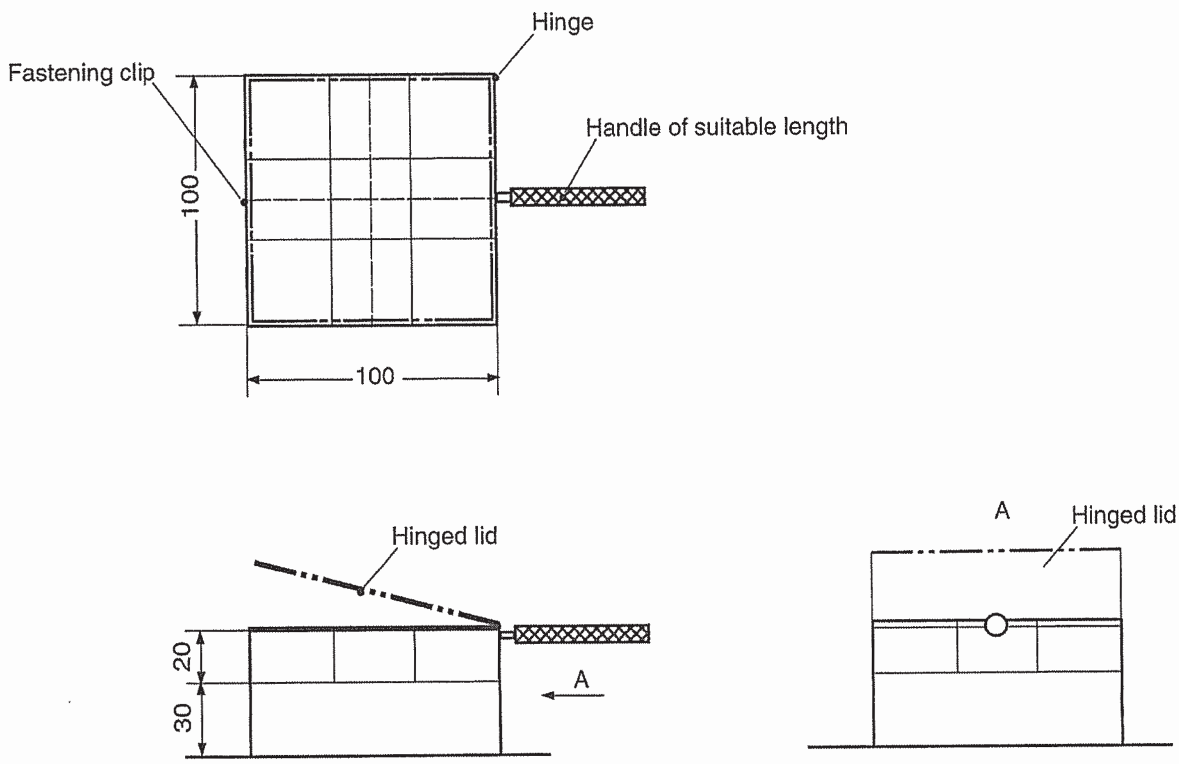
7.7.2 The thermocouples shall be fixed so that their hot junctions are attached to the appropriate positions by suitable means, including peening into the structural core. The wires shall be prevented from becoming hotter than the junction. The first 50 mm shall be in an isothermal plane.

7.8 Measuring and recording equipment for thermocouples

The measuring and recording equipment shall be capable of operating within the limits specified in standard ISO 834-1.

7.9 Cotton-wool pads

The cotton-wool pad employed in the measurement of integrity shall consist of new, undyed and soft cotton fibres, 20 mm thick x 100 mm square, and shall weigh between 3 g and 4 g. It shall be conditioned prior to use by drying in an oven at 100 ± 5°C for at least 30 min. After drying, it shall be allowed to cool to ambient temperature within a desiccator, where it may be stored until needed to be used. For use it shall be mounted in a wire frame, as shown in figure 10, provided with a handle.



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Material list:

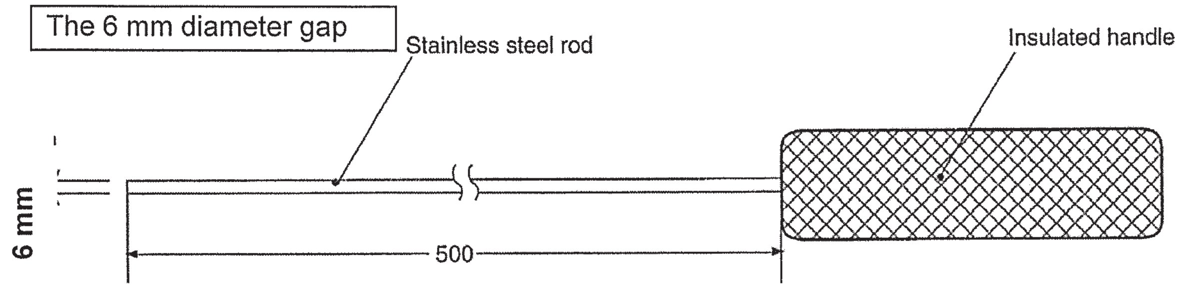
1. Main framework manufactured from ∅ 1.5 wire
2. Supporting wire ∅ 0.5 for cotton pad

Figure 10 – Cotton-wool pad holder

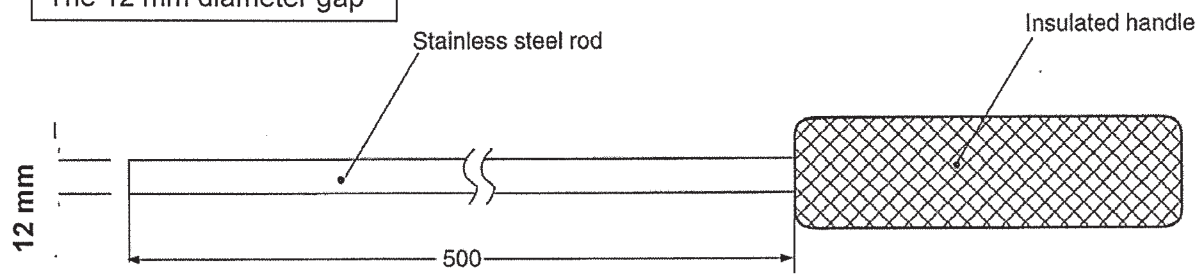
7.10 Gap gauges

Three types of gap gauge, as shown in figure 11, shall be available for the measurement of integrity. They shall be made of stainless steel of the diameter specified to an accuracy of ± 0.5 mm. They shall be provided with appropriate handles.

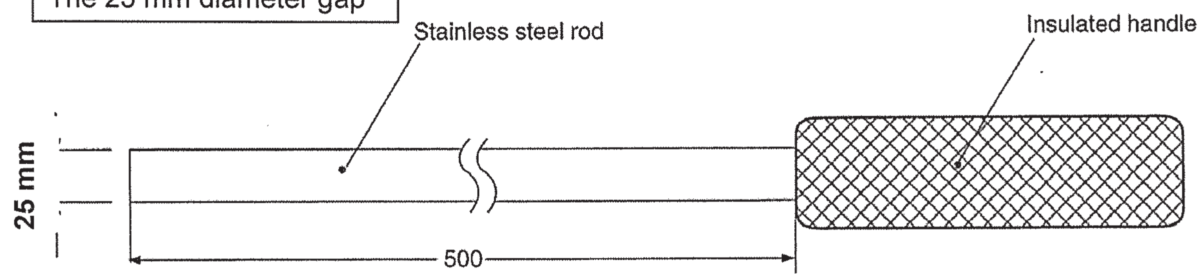
The 6 mm diameter gap



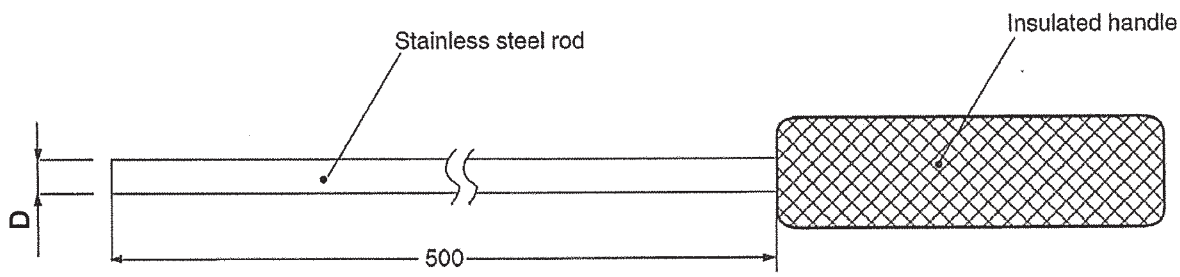
The 12 mm diameter gap



The 25 mm diameter gap



Three types of Gap gauges



No.	Gap gauge	Steel rod diameter (D) mm
1	ϕ6 mm	6 ± 0.5
2	ϕ12 mm	12 ± 0.5
3	ϕ25 mm	25 ± 0.5

Figure 11 – Gap gauges

8 METHOD OF TEST

8.1 General

The test shall be carried out generally in accordance with the standard ISO 834-1, except where amended by this section. The procedures given in the following sections are supplementary to, an elaboration of, or a deviation from the ISO requirements.

8.2 Commencement of test

8.2.1 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 the initial condition of the test specimen shall be noted.

8.2.2 At the time of the test, the initial average internal temperature and unexposed surface temperature of the specimen shall be from 10°C to 35°C and shall be within 5°C of the initial ambient temperature.

8.2.3 Prior to the commencement of the test the furnace temperature shall be less than 50°C. The commencement of the test shall be considered to be the moment when the programme to follow the standard heating curve has been initiated.

8.2.4 ***Ambient conditions***

The laboratory shall be virtually draught free during the test. The ambient temperature shall be from 10°C to 35°C at the commencement of the test and during the test the temperature shall not decrease more than 5°C or increase more than 20°C for all insulated separating elements while they are still satisfying the insulation criterion.

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 paragraph 7.3 shall be monitored and controlled such that it follows the relationship (i.e. the standard heating curve):

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

where:

T is the average furnace temperature (°C),
t is the time (min).

8.3.1.2 The following points are defined by the above relationship:

.1 at the end of the first 5 min 576°C;

.2 at the end of the first 10 min 679°C;

.3 at the end of the first 15 min 738°C;

.4 at the end of the first 30 min 841°C; and

.5 at the end of the first 60 min 945°C.

8.3.1.3 The percentage 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 shall be within:

± 15%	from t = 0 to 10	(1)
± (15-0.5(t-10))%	from t = 10 to 30	(2)
± (5-0.083(t-30))%	from t = 30 to 60	(3)
± 2.5%	from t = 60 and over	(4)

where:

$d = (A - As) \times 1/As \times 100$, and

A is the area under the actual average furnace time-temperature curve; and
As is the area under the standard time-temperature curve.

All areas shall be computed by the same method, i.e. by the summation of areas at intervals not exceeding 1 min.

8.3.1.4 At any time after the first 10 min of test, the temperature recorded by any thermocouple shall 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 shall be the nominal mean value, disregarding rapid fluctuations of pressure associated with turbulence, etc., and shall be established relative to the pressure outside the furnace at the same height. It shall be monitored and controlled continuously and by 5 min from the commencement of the test shall be achieved within ± 5 Pa and by 10 min from the commencement of the test shall be achieved and maintained within ± 3 Pa.

8.3.2.2 For vertically orientated specimens the furnace shall 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 shall not be greater than 20 Pa, and the height of the neutral pressure axis shall be adjusted accordingly.

8.3.2.3 For horizontally orientated specimens the furnace shall 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 shall 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 shall be done on an individual thermocouple-by-thermocouple basis. The average temperature rise on the unexposed surface shall 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 shall be calculated from the thermocouples specified in paragraph 7.6.1.1 only.

8.4.1.4 For "B" and "F" class divisions, excluding doors, the average temperature rise on the unexposed face of the specimen shall be calculated from the thermocouples specified in paragraph 7.6.2.1 only.

8.4.1.5 For "A", "B" and "F" class doors, the average temperature rise on the unexposed face of the specimen shall be calculated from the thermocouples specified in paragraph 7.6.3.1 only. For a double-leaf door, all ten thermocouples used on both door leaves shall 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, shall be recorded. In cases where it is difficult to identify whether or not there are flames then the cotton-wool pad shall 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 flaming under examination, for a period of 30 s, or until ignition (defined as glowing or flaming) 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 shall be used only once.

8.4.3.3 The cotton-wool pad need not be used on the unexposed face after the period relevant to the insulation classification of the product.

8.4.3.4 Where there are irregularities in the surface of the test specimen in the area of the opening, care shall 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.

8.4.3.5 The cotton-wool pad shall 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 shall be positioned in the flow of hot gases but shall 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.

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

.1 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

.2 whether the 25 mm gap gauge can be passed through the specimen such that the gauge projects into the furnace.

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 shall not be taken into account, e.g., small fastening across a construction joint that has opened up due to distortion.

8.4.4.3 If gaps in "A" or "B" class divisions are fully or partly sealed by intumescent materials, the gap gauge test shall be performed as if no intumescent material is present.

8.4.4.4 For doors mounted in a three-sided frame, the change of gap at the bottom of the door as measured by a horizontally-held gap gauge shall not increase by more than 12 mm along the bottom edge of the door. 12 mm gap gauge can be used for the purpose of examining the increase of such gap. The edges of the door above the horizontal plane along the bottom of the door should be checked in the same manner as the four-sided framed door.

Note: If the door is mounted with a 13 mm gap, the 25 mm gap gauge may be used to determine an unacceptable change in gap.

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, shall be recorded during the test. These deflections and displacements shall be measured with an accuracy of ± 2 mm.

8.4.6 ***General behaviour***

Observations shall be made of the general behaviour of the specimen during the course of the test and notes concerning the phenomena such as cracking, melting or softening of the materials, spalling or charring, etc., of materials of construction of the test specimen shall be made. If quantities of smoke are emitted from the unexposed face this shall 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 shall continue for a minimum of 60 min. However, when the specimen is of an "A" class division, with a structural steel core which is imperforate (e.g., without a 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 shall continue for a minimum of 30 min.

8.5.3 *Termination of the test*

The test may be terminated for one or more of the following reasons:

.1 safety of personnel or impending damage to equipment;

.2 attainment of selected criteria; or

.3 request of the sponsor.

The test may be continued after failure under subparagraph .2 above to obtain additional data.

9 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and the data determined by the test:

.1 reference that the test was carried out in accordance with part 3 of the 2010 FTP Code (see also subparagraph .2 below);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and/or identification of the product tested;

.7 the name of the manufacturer of the test specimen and of the products and components used in the construction;

.8 type of the product, e.g., bulkhead, ceiling, door, window, duct penetration, etc.;

.9 fire-resistant class of the test, e.g., "A" class, "B" class, "F" class;

.10 the constructional details of the test specimen, including description and drawing and principal details of components. All the details requested in paragraph 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 test specimen. When full and detailed drawings are not included in the report, then the applicant's drawing(s) of the test specimen 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;

.11 all 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 organic content of the insulation material(s) as determined by the test laboratory;

.12 date of the test specimen arrival;

.13 details of specimen conditioning;

.14 date of test;

.15 test results:

.1 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 shall be included which clearly illustrates the positions of the various thermocouples and identifies them relative to the temperature-time data;

.2 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 paragraph 3 of part 3) or, if the test is terminated due to the insulation criteria having been exceeded, the times at which limiting temperatures were exceeded; and

.3 the maximum deflection of the specimen. In case of doors, the maximum deflection at the centre of the door specimen and the maximum displacement of each corner of the door leaf relative to the door frame;

.16 the classification attained by the test specimen shall be expressed in the form of "class "A-60" deck", i.e. including the qualification on orientation of the division.

The result shall be presented in the test report in the following manner, which includes provision regarding non-combustibility, under the heading "Classification":

"A deck constructed as described in this report may be regarded as an "A-60" class deck according to part 3 of annex 1 to the FTP Code if all the materials comply with paragraph 3.5.1 of part 3 of annex 1 to the 2010 FTP Code.";

.17 the name of the representative of the Administration present at the test. If the Administration requires prior notification of test and a representative does not witness the test, 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."; and

.18 the statement:

"The test results relate 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 2

TESTING OF WINDOWS, FIRE DAMPERS, PIPE AND DUCT 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 shall be generally in accordance with the requirements given in appendix 1 to this part. Where additional interpretation, adaptations 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 this appendix, into specimens of smaller scale, all the tests of the components covered by this appendix shall be undertaken with those components installed in full-size dimensioned structural cores as specified in appendix 1.

A.I – WINDOWS

1 GENERAL

1.1 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 shall be tested within the appropriate door.

1.2 The approach adopted for testing windows shall generally follow the requirements for testing "A" class doors where relevant and appropriate.

2 NATURE OF TEST SPECIMENS

2.1 Dimensions

2.1.1 The test shall be conducted on the window of the maximum size (in terms of both the width and the height) for which approval is sought.

2.1.2 The test shall 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 shall, 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.

2.2 Design

2.2.1 The bulkhead which includes the window shall be insulated to class "A-60" on the stiffened face, which shall 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. 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, such as the window on front bulkhead of the tanker, or within bulkheads other than class "A-60".

2.2.2 The window shall be positioned within the bulkhead, shown in figure 1 of appendix 1, at that height which is intended for practical application. When this is not known, the window shall 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 "A-0", thermocouples shall be fixed to the window pane as specified for the leaf of a door. In addition, thermocouples shall 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 shall 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 shall 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) shall be used.

4.2 Cotton-wool pad and gap gauges

For windows which are to be of a classification "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 shall not be such as to allow the gap gauges to enter in the manner described in paragraph 8.4.4 of appendix 1.

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

5.2.1 The hose-stream test shall be applied to the exposed face of the specimen immediately, but at least within not more than 1.5 min following the termination of the heating period.

5.2.2 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 shall be 6 m from the centre and normal to the exposed face of the specimen.

5.2.3 The water pressure at the nozzle shall be 310 kPa when measured with the water flow in progress.

5.2.4 The duration of application of the hose stream to the surface of the specimen shall be 0.65 min for each square metre of the exposed area of the specimen. The stream shall 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

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) shall be used.

5.3.2 For the judgment of the maximum temperature rise on the unexposed face, all the thermocouples fixed to the face of the window pane(s), window frame, transoms and mullions shall be used.

5.3.3 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.

5.3.4 The window shall 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.

A.II – FIRE DAMPERS

1 GENERAL

1.1 "A" class divisions may have to be pierced for the passage of ventilation ducting, and arrangements shall be made to ensure that the effectiveness of the division in relation to the criterion for integrity, as specified in paragraph 3 of Part 3 , is not impaired. Provisions shall also be made to ensure that, shall a fire be initiated within, or gain access to, ventilation ductwork, such a fire does not pass through the division within the ductwork.

1.2 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 THE TEST SPECIMEN

2.1 Dimensions

The maximum sizes (in terms of both the width and the height, or the diameter) of each type of fire damper for which approval is sought shall be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the damper shall be constructed in accordance with paragraph 2.1 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is not exposed to the heating conditions of the test. A deck which includes the damper shall be constructed in accordance with paragraph 2.2 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is exposed to the heating conditions of the test.

2.2.2 Fire dampers shall be incorporated into or fixed to coamings or a spigot, which shall be welded or bolted into the structural core.

The length on the unexposed side = (450 mm or a needed insulation length for a damper under test) (Lunexp) + 50 mm.

The thickness of the coaming or spigot shall be as follows:

Width or diameter of the duct	Minimum thickness of coaming
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 less than 760 mm, the thickness of the coaming or spigot shall be obtained by interpolation

The coaming or spigot shall be insulated as shown in figure A1.

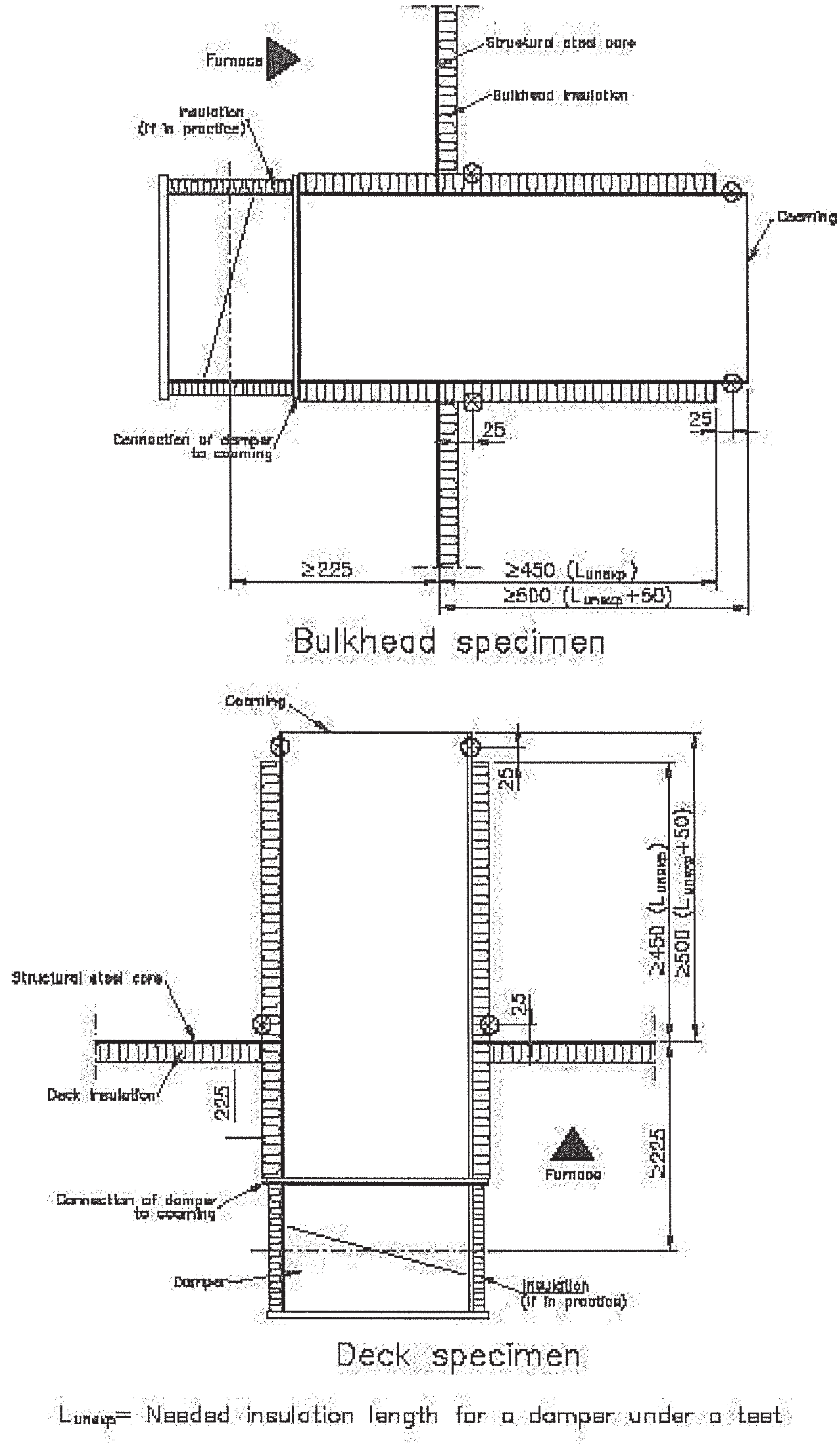


Figure A1 – Fire dampers: insulation on test specimens and position of unexposed-face thermocouples

2.2.3 The coamings or spigots (including insulation) shall be positioned only in the top half of a bulkhead. Where 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. These shall be no closer than 200 mm from the edges of a bulkhead or deck. Where more than one damper is to be tested simultaneously in a division, the distance between adjacent coamings or spigots (including insulation) shall not be less than 200 mm.

2.2.4 The fire dampers shall be positioned on the exposed face of the bulkhead or deck. The distance between the fire damper centre and the structural core shall be at least 225 mm.

The operative control of a damper is positioned on the exposed side of the division. When a damper is mounted in the bulkhead the fuse element should be situated at the lowest level of the damper as in practice.

2.2.5 Fire dampers which are operated automatically shall be in the open position at the start of the test and shall be closed by an automatic device. The damper shall be in the closed position within 2 min after the commencement of the test. If the fire damper fails to close after 2 min from the start of the test, the fire damper shall be deemed to have failed and the test shall be discontinued.

2.2.6 Fire dampers which are operated with a manual system shall be closed at the test time of 1 min.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

3.1.1 For each fire damper, two thermocouples where the width or diameter of a damper is not more than 200 mm and four thermocouples when that is over 200 mm shall be fixed to the unexposed face at each of the following locations:

.1 on the surface of the insulation provided to the coaming or spigot at a distance of 25 mm from the unexposed surface of the divisions; and

.2 on the surface of the coaming or spigot at a distance of 25 mm from where the coaming or spigot emerges from its insulation.

3.1.2 In the damper where the size exceeds 200 mm, four thermocouples, for each of the positions indicated in paragraphs 3.1.1.1 and 3.1.1.2, shall be fixed. One of the thermocouples shall be fixed at the centre of each side of the coaming or spigot.

3.1.3 In the damper where the size is not more than 200 mm, two thermocouples, for each of the positions indicated in paragraphs 3.1.1.1 and 3.1.1.2, shall be fixed. One of the thermocouples shall be fixed at the centre of opposing sides of the coaming or spigot and for dampers in bulkheads situated on the top and bottom surface of the coaming or spigot.

4 PERFORMANCE CRITERIA

4.1 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 shall not be such as to allow the gap gauges to enter in the manner described in paragraph 8.4.4 of appendix 1.

4.2 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.

4.3 If evaluation of insulation is required, the temperature rise at any point on the surface shall not exceed 180°C above the initial temperature. The average temperature rise shall not be used for this purpose.

A.III – PIPE AND DUCT PENETRATIONS

1 GENERAL

1.1 "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.

1.2 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.

1.3 This section refers from here on to pipe penetrations but may be read as equally applicable to duct penetrations.

2 NATURE OF THE TEST SPECIMEN

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 shall be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the pipe penetration shall be constructed in accordance with paragraph 2.1.1 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is not exposed to the heating conditions of the test. A deck which includes the pipe penetration shall be constructed in accordance with paragraph 2.2.1 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is exposed to the heating conditions of the test.

2.2.1.1 "A-0" class pipe penetrations are recommended to be performed in an uninsulated ("A-0") bulkhead/deck. If the pipe penetrations are tested as an "A-60" class penetration, any insulation fitted (on the penetration itself and 200 mm around) will be required to be fitted also for class "A-0".

2.2.1.2 "A-0" penetrations shall not be approved without an "A-0" test although tested and approved as "A-60".

2.2.2 The pipe penetrations shall be positioned only in the top half of a bulkhead but shall 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 shall not be less than 200 mm. Both measurements shall 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 shall 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 shall 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 shall 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 shall restrain it from movement during the test.

2.2.5 When the deck penetration is fitted on an exposed side or is fitted symmetrically, general application will be given. When the deck penetration is fitted on an unexposed side, the approval will limit the penetration to the tested orientation.

2.2.5.1 When the bulkhead penetration is fitted symmetrically, approval would be given for general application. For bulkhead penetrations with an exposed or unexposed fitted frame, one test for each fitting is required in order for obtaining approval for general application.

2.2.6 Sealing of pipe and duct penetrations: there shall be no visible openings before the start of the fire test.

2.2.6.1 In cases where a test specimen (deck) which includes the prototype penetration(s) is not mounted within a rigid restraint frame but is connected to the furnace roof by side wall coamings, the rigidity of the coamings is to be equivalent to that of a restraint frame and evaluated in accordance with paragraph 5.1 of appendix 1.

2.2.6.2 In cases where insulation is fitted to the test pipe(s), the distance(s) of 500 ± 50 mm required in paragraph 2.2.3 to which the pipe should project is to be taken from the end of the insulation as this is considered an integral part of the penetration(s) being tested and it is necessary that a length of unprotected pipe is exposed to the furnace.

2.2.6.3 In all cases, the support and fixing of the test pipe(s) is to be by a framework mounted from the restraint frame such that any movement of the bulkhead or deck relative to the pipe(s) will be experienced by the penetration(s) being tested.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

3.1.1 For each pipe penetration, two thermocouples shall be fixed on the unexposed face at each of the following locations:

.1 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;

.2 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

.3 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 the 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).

3.1.2 For pipe penetrations in bulkheads, for each of the positions indicated above, one of the thermocouples shall be fixed directly above the centre of the pipe and the other thermocouple shall be fixed directly below the centre of the pipe.

3.1.3 Additional thermocouples may be required to be fitted, dependent upon the complexity of the pipe penetration.

4 PERFORMANCE CRITERIA

4.1 General

4.1.1 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.

4.1.2 Duct penetrations shall meet both integrity and insulation criteria.

4.2 Insulation

Since the pipe penetration is a local weakness in the division it shall be capable of preventing a temperature rise exceeding I80°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 THE TEST SPECIMEN

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 shall be tested in both vertical and horizontal orientation.

2.2 Design

2.2.1 A bulkhead which includes the cable transit shall be constructed in accordance with paragraph 2.1.1 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is not exposed to the heating conditions of the test. A deck which includes the cable transit shall be constructed in accordance with paragraph 2.2.1 of appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is exposed to the heating conditions of the test.

2.2.1.1 "A-0" class cable transits are recommended to be performed in an uninsulated ("A-0") bulkhead/deck. If the cable transits are tested as "A-60" penetration, any insulation fitted on an exposed side (on the cable transits itself and 200 mm around) will be required to be fitted also for "A-0".

2.2.1.2 "A-0" cable transits shall not be approved without an "A-0" test although tested and approved as "A-60".

2.2.2 The cable transits shall be positioned only in the top half of a bulkhead but shall 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 shall not be less than 200 mm. Both measurements shall 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 shall 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 shall project 500 ± 50 mm beyond the transit on the exposed side of the division and 500 ± 50 mm on the unexposed side.

2.2.4.1 Each cable shall 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 cables shall restrain them from movement during the test.

2.2.5 Cable transits shall be fitted to the bulkhead or deck in accordance with the manufacturer's specifications. The cables and sealing compounds or blocks shall be incorporated into the transits with the bulkhead and deck panels placed respectively in vertical and horizontal positions. Any insulation shall be applied to the cables and transits with the panels in the same respective positions.

2.2.6 The transit(s) shall 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 shall 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.

2.2.6.1 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 Tests shall be conducted for the maximum and minimum fill based on the inside cross-sectional area at each transit. The distance between the adjacent cables shall be the minimum specified by the manufacturer, and the cables should be placed close to the centre of the transit.

2.2.8 When the deck cable transit is fitted on an exposed side or is fitted symmetrically, general application will be given. When the deck cable transit is fitted on the unexposed side, the approval will limit the penetration to the tested orientation.

2.2.8.1 When the bulkhead cable transit is fitted symmetrically, approval would be given for general application. For bulkhead cable transit with exposed or unexposed fitted frame, one test for each fitting is required in order for obtaining approval for general application.

2.2.9 Sealing of cable transits shall have no visible openings before the start of the fire test.

3 INSTRUMENTATION

3.1 Positioning of thermocouples on the specimen

3.1.1 For each uninsulated cable transit, thermocouples shall be fixed on the unexposed face at each of the following locations:

.1 at two positions on the surface of the frame, box or coaming at a distance of 25 mm from the unexposed surface of the division. When the penetration does not extend a minimum of 25 mm beyond the bulkhead or deck plate on the unexposed side of the assembly, these thermocouples shall be placed at the end of the frame, box or coaming;

.2 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. If there is insufficient area to affix the thermocouples as described, one or both may be placed within a distance of 25 mm from a cable; and

.3 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 shall be treated as a single cable. In case of horizontal cables, the thermocouples shall be mounted on the uppermost surface of the cables. These thermocouples may be excluded if the diameters of the cables are too small to effectively affix the thermocouples to the cables. This shall be at the discretion of the Administration.

3.1.2 For those thermocouples placed on the outer perimeter of the frame, box or coaming, one thermocouple shall be fixed on each of two opposite faces, which in the case of bulkheads shall be the top and bottom faces.

3.1.3 For each partially insulated or fully insulated cable transit, thermocouples shall be fixed on the unexposed face at equivalent positions to those specified for an uninsulated transit as illustrated in figure A2.

3.1.4 Additional thermocouples may be required to be fixed, dependent upon the complexity of the cable transit.

3.1.5 When fixing thermocouples to the unexposed surface of the cables, the copper disc and the insulating pad shall be formed over the surface to provide good contact with the surface of the cable. The copper disc and the pad shall 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 shall not provide any significant heat-sink effect to the unexposed face of the thermocouple.

4 PERFORMANCE CRITERIA

4.1 General

Cable transits shall meet both integrity and insulation criteria.

4.2 Insulation

Since the cable transit is a local weakness in the division, the temperature rise at any point on the surface shall not exceed 180°C above the initial temperature. The average temperature rise shall not be used for this purpose.

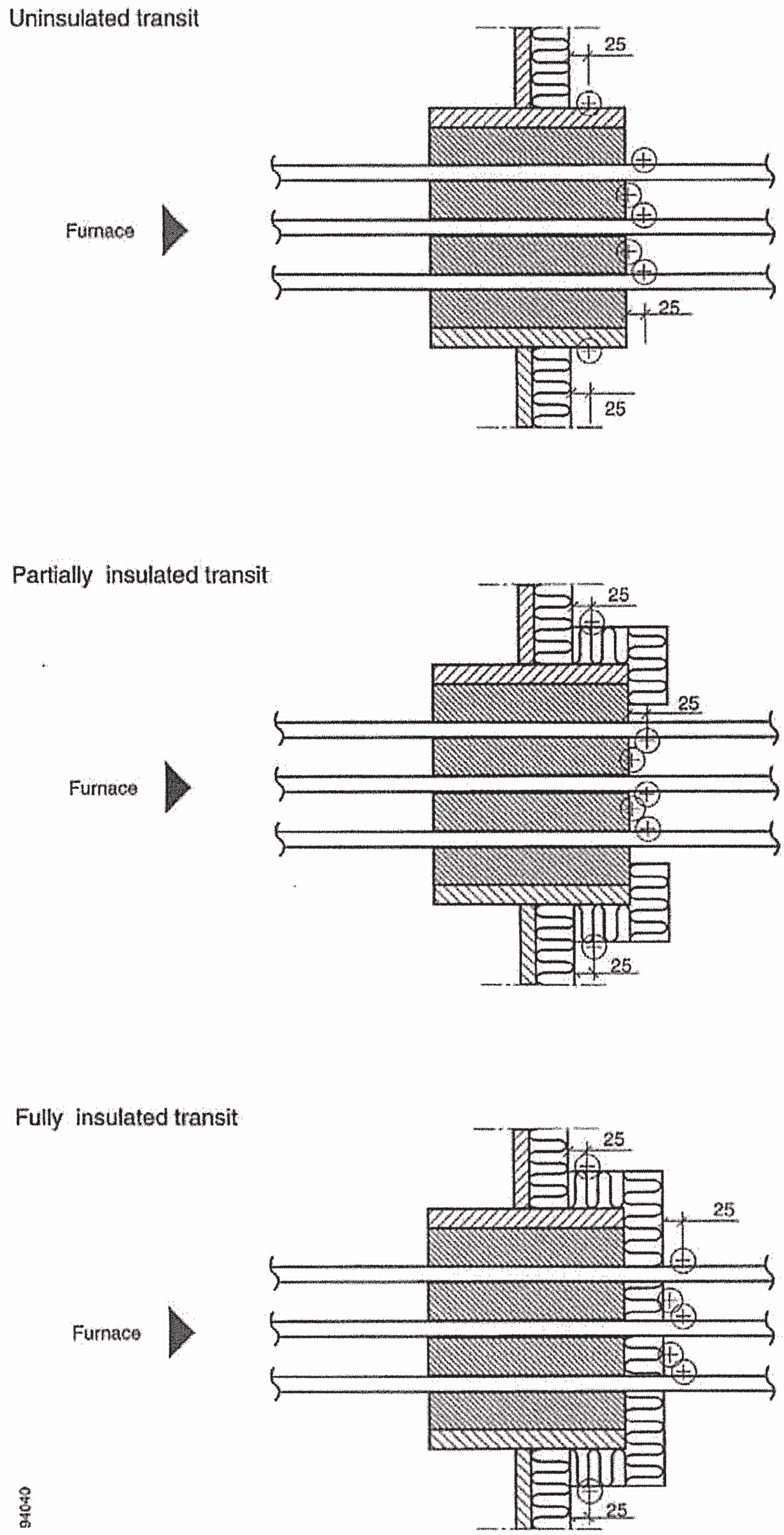


Figure A2 – Cable transits: position of unexposed-face thermocouples
(shown for bulkhead)

APPENDIX 3

THERMAL RADIATION TEST SUPPLEMENT TO FIRE RESISTANCE TEST PROCEDURES 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 PROCEDURES

2.1 The window shall be tested in accordance with appendix 2 of this part 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.

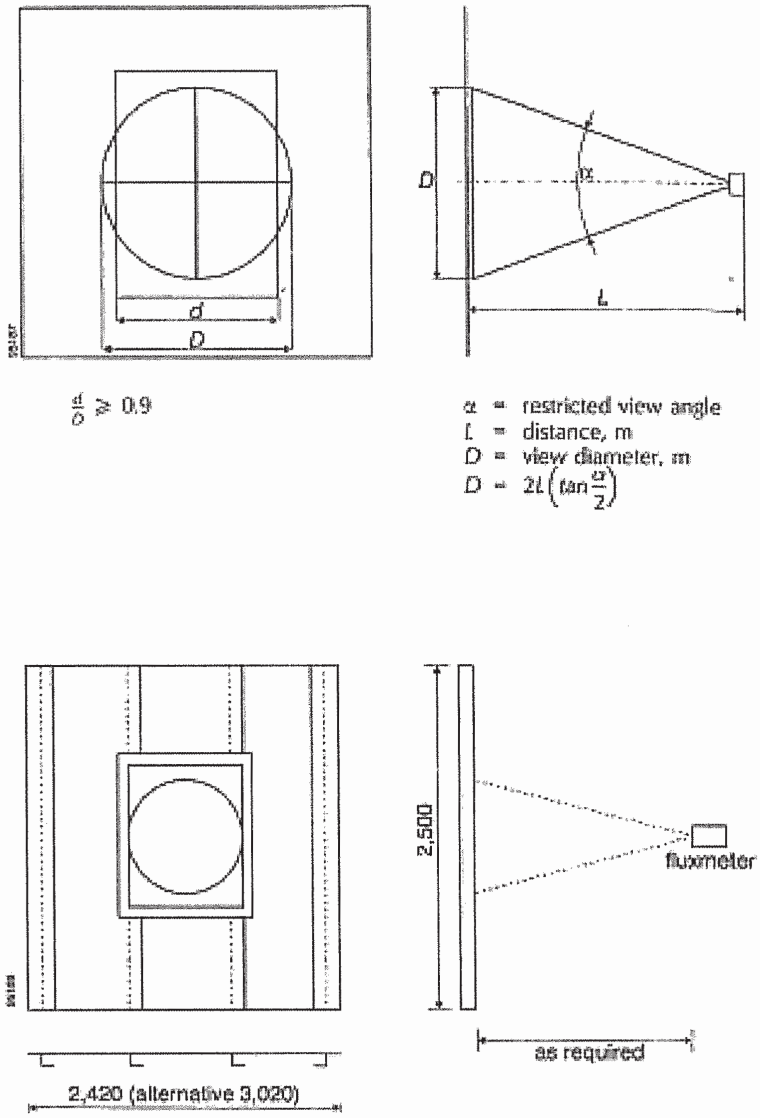
3 ADDITIONAL INSTRUMENTATION

3.1 Additional instrumentation consists of a restricted-view total-heat flux meter calibrated with the restricted view to indicate incident heat flux. The flux meter shall be water-cooled and capable of measuring heat flux 0 kW/m^2 to 60 kW/m^2. The flux meter should be calibrated at least once a year against a standard device.

3.2 The flux meter should be placed perpendicular to the centre of the window being tested, and in a position such that the centre of the flux meter's view coincides with the centre of the window (see figure). The flux meter should be located at a distance greater than 0.5 m from the window, such that the view of the flux meter just includes part of the frame. However, the flux meter should not be located more than 2.5 m from the window. The dimension of the boundary and window frame seen by the flux meter, which remains outside the window, should not exceed 10% of the total width seen by the flux meter on the surface of the sample. It should be calculated on the basis of restricted view angle of the flux meter 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 flux meter is needed.

3.4 For oblong windows whose greater dimension is more than 1.57 times the smaller dimension, additional flux meters should be provided. The distance of the flux meters from the window should be adjusted such that the flux meters' view covers at least 50% of the window. However, the flux meters should not be located less than 0.5 m nor more than 2.5 m from the window.



Figure

4 PERFORMANCE 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 table 1 below.

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 min	56.5
"A-15"	15 min 60 min	2.34 8
"A-30"	30 min 60 min	2.34 6.4
"A-60"	60 min	2.34
"B-0"	30 min	36.9
"B-15"	15 min 30 min	2.34 4.3

APPENDIX 4

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 PROCEDURES AND EVALUATION

2.1 The linings, ceilings and constructions should be evaluated in accordance with this part using the arrangements described below.

2.2 The ceilings should be tested in accordance with paragraph 2.8 of the appendix 1 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 appendix 1 of this part 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 this part to be a "B" ("B-0" or "B-15", as applicable on basis of the lining test) class lining may be considered as forming a "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 as forming a "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. Part 5 of this annex is applicable to adhesives used in connection with a fire door control system.

APPENDIX

FIRE TEST PROCEDURES 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 (pneumatic, 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 specified in appendix 1 of part 3 of this Code.

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

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 per paragraph 4 of appendix 1 to part 3) with an ambient atmosphere of 50% relative humidity at 23°C.

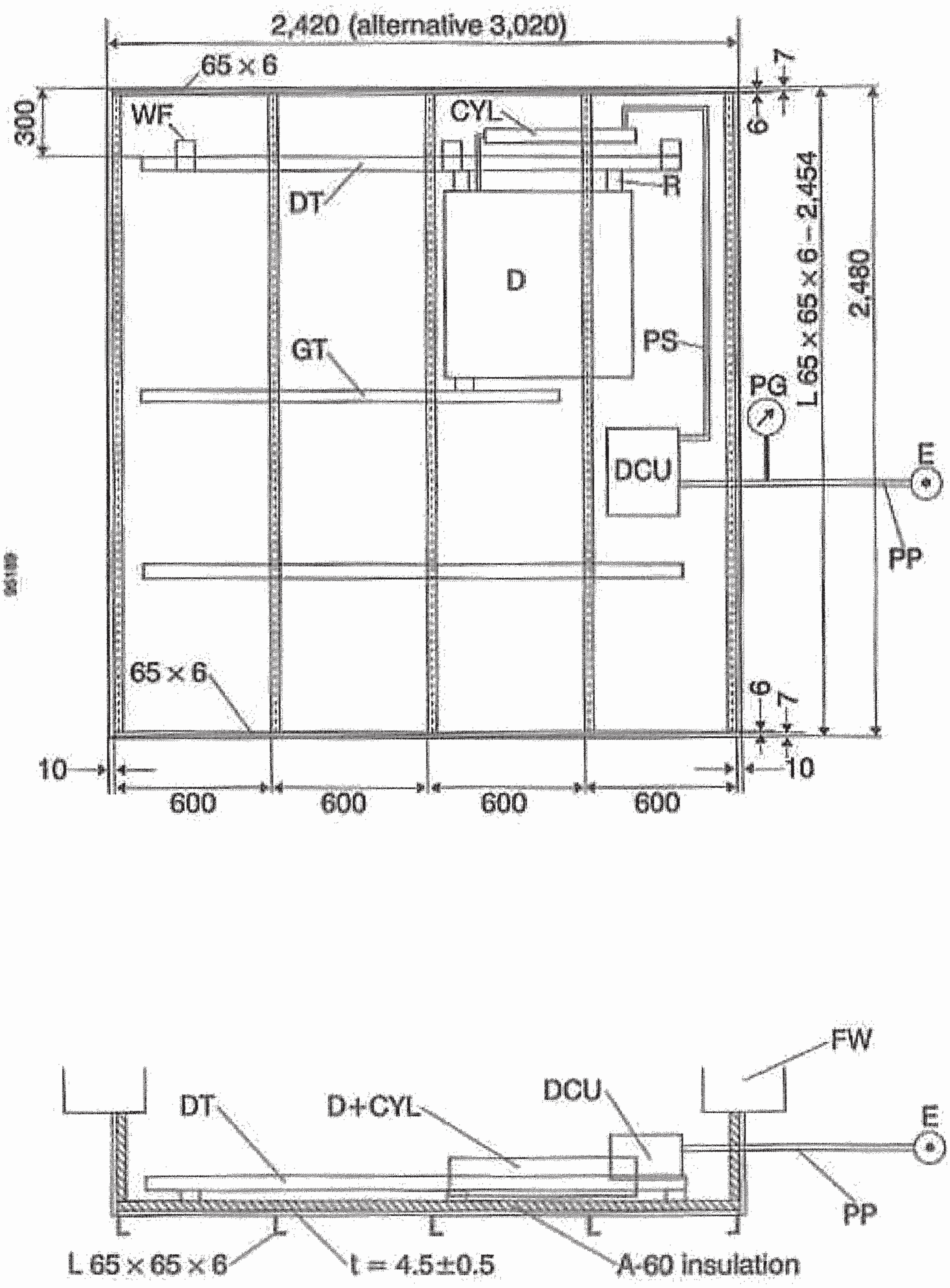
4.3 Accelerated conditioning is permissible provided the method does not alter the properties of component materials. High-temperature conditioning shall be below temperatures critical for the materials.

5 MOUNTING

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 appendix 1 of part 3 of this Code.

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.



D = door model, DCU = door control unit, DT = door track, WF = weld fastening, GT = guide track, CYL = door cylinder, R = supporting roller, PS = piping systems, PG = pressure gauge, PP = pressure pipe, E = Energy, FW = furnace wall.

Figure 1 – Structural core for fitting the prototype fire control systems

6 EXAMINATION

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 paragraph 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 paragraph 7 of appendix 1 to part 3 of this Code.

8 TEST PROCEDURE

8.1 Commencement of test

8.1.1 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.

8.1.2 At the time of the test, the initial average internal temperature shall be 20 ± 10°C and shall be within 5°C of the initial ambient temperature.

8.1.3 Prior to the test, the door shall be at open position. At the start of the test, the door control system shall show its capability to close the door.

8.1.4 The door control system shall be installed in a representative way with all its units and be powered for the entire test period.

8.2 Furnace control

The furnace control shall be in accordance with paragraph 8.3 of appendix 1 to part 3 of this Code.

8.3 Temperatures, duration of testing and actions during test

8.3.1 The average furnace temperature shall be increased and stabilized at 200 ± 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 up to 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 the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and the data determined by the test.

.1 reference that the test was carried out in accordance with part 4 of the 2010 FTP Code (see also subparagraph .2 below);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and/or identification of the prototype control system tested;

.7 the name of the manufacturer of the prototype control system and of the products and components used in the construction;

.8 the constructional details of the prototype control system, including description and drawings and principal details of components. All the details requested in paragraph 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;

.9 all the properties of materials used that have a bearing on the fire performance of the prototype control system together with measurements thickness, density and, where applicable, the moisture and/or organic content of the insulation material(s) as determined by the test laboratory;

.10 date of the test specimen arrival;

.11 details of specimen conditioning;

.12 date of test;

.13 test results:

.1 information concerning the location of the pressure gauges or other devices together with tabulated data obtained during the test;

.2 observations of significant behaviour of the prototype control system during test and photographs, if any; and

.3 a statement that the prototype fire door control system has passed the test and complies with the classification criteria;

.14 the classification attained by the test specimen should be expressed in the form of "Door control system", i.e. including the qualification on orientation of the division.

The result shall be presented in the test report in the following manner, which includes a proviso regarding non-combustibility, under the heading "Classification":

"A fire door control system constructed as described in this report may be regarded as a Fire door control system according to part 4 in annex 1 to the 2010 FTP Code."; and

.15 the name of the representative of the Administration present at the test. If the Administration requires prior notification of the test and a representative does not witness the test, 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.".

PART 5 – TEST FOR SURFACE FLAMMABILITY (TEST FOR SURFACE MATERIALS AND PRIMARY DECK COVERINGS)

1 APPLICATION

1.1 Where a product is required to have a surface with low flame-spread characteristics, the product shall comply with this part.

1.2 Where the primary deck coverings are required to be not readily ignitable, they shall comply with this part.

1.3 Where a product of surface material is approved based on a test of a specimen applied on a non-combustible and non-metallic substrate, that product shall be approved for application to any non-combustible and non-metallic substrate with similar or higher density (similar density may be defined as a density equal to or greater than 0.75 times 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 shall be approved for application to any metallic base of similar or higher thickness (similar thickness is obtained as a thickness equal to or greater than 0.75 times the thickness of metallic substrate used during testing).

2 FIRE TEST PROCEDURE

2.1 The surface materials and primary deck coverings shall be tested and evaluated in accordance with the test procedure specified in appendix 1 to this part. The test may be terminated after 40 min.

2.2 During fire tests for bulkhead, ceiling and deck finish materials and primary deck coverings, there are those specimens which exhibit various phenomena which cause difficulties in classification of the materials. Appendix 3 to this part provides guidance on the uniform interpretation of such results.

2.3 For preparation of the test specimen, refer to appendix 4 to this part, which provides guidelines for the specimen of the FTP Code, parts 2 and 5, and the type approval of those products (Range of approval and restriction in use).

3 PERFORMANCE CRITERIA

3.1 Surface flammability criteria

Materials having average values for all of the surface flammability criteria that comply with the values as listed in table 1, are considered to meet the requirement for low flame-spread in compliance with the relevant regulations in chapter II-2 of the Convention.

3.2 Burning droplets during the test

Materials for bulkhead, wall and ceiling linings and primary deck coverings shall not produce burning droplets during the test. The burning droplets shall be considered as a reject material regardless of the surface flammability criteria. For floor coverings, no more than 10 burning drops are acceptable.

Table 1 – Surface flammability criteria

	Bulkhead, wall and ceiling linings	Floor coverings	Primary deck coverings
CFE (kW/m^2)	≥ 20.0	≥ 7.0	≥ 7.0
Qsb (MJ/m^2)	≥ 1.5	≥ 0.25	≥ 0.25
Qt (MJ)	≤ 0.7	≤ 2.0	≤ 2.0
Qp (kW)	≤ 4.0	≤ 10.0	≤ 10.0
Burning droplets	Not produced	No more than 10 burning drops	Not produced

Where:

CFE = Critical flux at extinguishment
Qsb = Heat for sustained burning
Qt = Total heat release
Qp = Peak heat release rate

Note: *Qsb* means an average of heat for sustained burning, as defined in paragraph 9.3 of appendix 1.

4 ADDITIONAL REQUIREMENTS

4.1 Surface materials for bulkheads and ceilings and similar exposed surfaces

In case that the requirement of maximum gross calorific value (e.g., 45 MJ/m^2) applies for a product, the test method specified in the standard ISO 1716 shall be used for determining the gross calorific value.

4.2 Floor coverings and primary deck coverings

4.2.1 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".

4.2.2 When 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 (i.e. no other layer applied on it), it shall be considered as the "floor covering", and shall comply with the requirements of "floor covering".

4.2.3 Where a floor covering is required to be low flame-spread, all layers shall comply with this part. 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.

4.2.4 Primer or similar thin film of paint on deck plating need not comply with the above requirements.

4.3 Combustible ventilation ducts

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 of this part 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.

4.4 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 of this part shall be applied for such exposed surfaces.

4.5 Adhesives used for "A", "B" and "F" class divisions

Adhesives used for "A", "B" and "F" class divisions are required to be of material which has low flame-spread characteristics. The surface flammability test procedure and acceptance criteria for linings and ceilings, according to appendix 1 to this part, shall apply to the adhesive as the exposed surface. The calcium silicate board described as a dummy specimen specified in paragraph 3.5 of appendix 1 to this part shall be used as a standard substrate for adhesives.

5 TEST REPORT

The test report shall include the information contained in paragraph 10 of appendix 1.

6 REFERENCE DOCUMENTS

ISO 5658-2, Reaction to fire tests – Spread of Flame – Part 2: Lateral spread on building and transport products in vertical configuration.

ISO 13943, Fire safety – Vocabulary.

ISO 14934-3, Fire tests – Calibration and use of heat flux meters – Part 3: Secondary calibration method.

APPENDIX 1

FIRE TEST PROCEDURES FOR SURFACE FLAMMABILITY OF BULKHEAD, CEILING, DECK FINISH MATERIALS AND PRIMARY DECK COVERINGS

WARNING

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 shall be taken to avoid accidental ignitions of this type.

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 shall be taken to avoid any extended exposure to these fumes.

1 SCOPE

This appendix specifies a procedure for measuring fire characteristics of bulkhead, ceiling, deck finish materials and primary deck coverings as a basis for characterizing their flammability and thus their suitability for use in marine construction.

2 NORMATIVE REFERENCES

The following normative documents contain provisions which constitute provisions of this appendix:

.1 ISO 13943, Fire safety – Vocabulary; and

.2 ISO 5658-2, Reaction to fire tests – Spread of Flame – Part 2: Lateral spread on building and transport products in vertical configuration.

3 DEFINITIONS

For the purposes of this appendix 1, the terms and definitions given in standards ISO 13943 and ISO 5658-2 and the following apply.

3.1 *Backing board* is a non-combustible board with the same width and length as the test specimen and 12.5 ± 3 mm thick and having the density of 950 ± 100 kg/m^3, used to back the specimen.

3.2 C*alibration board* is a dummy specimen as defined by figure 11 of appendix 2, intended only for use in calibration of heat flux gradient along with specimen.

3.3 *Compensating thermocouple* is 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.

3.4 *Critical flux at extinguishment* is an incident heat flux level at the surface of a specimen at the point along its horizontal centreline where the flame ceases to advance and may subsequently go out.

Note: The heat flux value reported is based on interpolations of measurements with a non-combustible calibration board.

3.5 *Dummy specimen* is a specimen used for standardizing the operating condition of the equipment. It shall be a non-combustible board (for example, calcium silicate board) of oven-dry density of 950 ± 100 kg/m^3 and shall measure from 795 mm to 800 mm long, from 150 mm to 155 mm wide and 25 ± 2 mm thick.

3.6 *Fume stack* is 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.

3.7 *Heat for ignition* is 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.

3.8 *Heat release of specimen* is the observed heat release under the variable flux field imposed on the specimen and measured as defined by the test method.

3.9 *Heat for sustained burning* is the product of time from the start of exposure of a specimen to the arrival of the flame front at a specified position and the incident flux corresponding to that position measured on a non-combustible calibration board. This shall be calculated for each station starting at the 150 mm station, but it shall not be calculated for a given station unless the flame propagates more than halfway to the next station as viewed along the centreline of the specimen.

3.10 *Reverberatory wires* is 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.

3.11 *Viewing rakes* is 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

4.1 This test provides methods for evaluating flammability characteristics of 155 mm x 800 mm specimens in vertical orientation.

4.2 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

The test apparatus, except the equipment for measurement of heat release (i.e. fume stack and thermocouples for it), is specified in standard ISO 5658-2. A detailed description of the facility and apparatus required for conduct of this test is included in appendix 2 to this part. 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 of appendix 2. 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, a pilot burner, 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 flux meters, 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 shall be performed as described in appendix 2. These adjustments and calibrations shall be performed following initial installation of the apparatus and at other times as the need arises.

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 shall be confirmed by monthly tests, or at more frequent intervals if this is found necessary (see paragraphs 4.3 and 4.6 of appendix 2).

6.2 Daily verification

As a means of assuring continued proper adjustment of the apparatus, the following tests shall 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***

6.2.1.1 Adjust the propane gas and air flow rates to about 0.4 *l*/min and 1 *l*/min, respectively, to provide a flame length of 230 ± 20 mm in the vertical orientation. When viewed in a darkened room, the flame shall extend about 40 mm above the vertical specimen holder (see figure 6 of appendix 2). Record the flow rates of propane and air to the pilot burner.

6.2.1.2 Adjust the impingement zone of the flame onto the dummy specimen by moving the burner tube towards or away from the plane of the exposed surface of the dummy specimen. Rotate the pilot burner tube in its holder until the flame impinges over the top half of the exposed specimen height.

6.2.1.3 The pilot flame shall be checked and, if necessary, adjusted in the way stated above every day. The nature of some specimens may make this necessary to be done more frequently.

6.2.2 ***Stack gas thermocouples***

The stack gas thermocouples shall 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 shall 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 shall 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

6.3.1 A dummy specimen shall 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 flux meter positioned at 350 mm from the exposed hot end of a dummy specimen as defined in paragraph 3.5 (see paragraph 4.3.2 of appendix 2).

6.3.2 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 the panel operating level even when tests are in progress. Both signals shall remain essentially constant for 3 min prior to the test. The observed operating level of either the radiation pyrometer or the heat flux meter shall correspond, within 2%, to the similar required level specified in table 1 of appendix 2 and referred to in the calibration procedure mentioned in paragraph 6.1 above.

7 SPECIMENS

7.1 Number required

7.1.1 ***Specimens required***

At least six specimens shall be provided for each different exposed surface.

7.1.2 ***Required number for the test***

Three specimens shall be tested for each different exposed surface of the product evaluated and applied. Condition of retest is described in paragraph 8.3.

7.2 Dimensions

7.2.1 The specimens shall measure from 150 mm to 155 mm wide and from 795 mm to 800 mm long, and shall be representative of the product.

7.2.2 Specimen thickness: materials and composites of normal thickness 50 mm or less shall be tested using their full thickness. For materials and composites of normal thickness greater than 50 mm, the required specimens shall be obtained by cutting away the unexposed face to reduce the thickness between 47 mm and 50 mm.

7.3 Substrate

7.3.1 ***Substrate of surface material and floor coverings***

Materials and composite materials shall 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. The test specimen shall reflect actual application.

7.3.2 ***Substrate of primary deck covering***

The specimens shall be applied to a steel plate having a thickness of 3 ± 0.3 mm. The specimens shall have a nominal thickness; the components and construction of the primary deck covering shall reflect actual application.

7.4 Composite materials

7.4.1 Assembly shall be as specified in paragraph 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 shall be recognized and care taken to ensure that the test result obtained on any assembly is relevant to its use in practice.

7.4.2 Vapour barriers used in conjunction with insulation shall be tested without any other components that will shield the barrier being tested from the radiant panel. The substrate of the specimen shall reflect actual application on ships.

7.5 Metallic facings

If a bright metallic faced specimen is to be tested, it shall be tested as it is.

7.6 Marking specimens

A line shall be marked centrally down the length of the face to be tested of each specimen. Caution shall be exercised to avoid the use of a line which would influence specimen performance.

7.7 Conditioning of specimens

Before test, the specimens shall be conditioned to constant moisture content, at a temperature of 23 ± 2°C, and a relative humidity of 50 ± 5%. Constant moisture content is considered to be reached when, following two successive weighing operations, carried out at an interval of 24 h, 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 and 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 shall 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 shall be backed by a cool backing board. When mounting non-rigid specimens in the holder, shims shall be placed between the 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 shall be mounted in position facing the radiant panel. The equipment fume exhaust system shall be started.

8.1.3 The radiant panel is operated to realize the test conditions as specified in paragraph 6.3. Start the millivolt recorder recording the output signal of the stack thermocouples, as well as the signal from the total radiation pyrometer or heat flux meter positioned as described in paragraph 6.3.1.2.

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 3 min 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 shall 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 shall 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, shall be recorded throughout the test and continued until test termination.

8.1.7 Throughout the conduct of the test, no change shall be made in the fuel supply rate to the radiant panel to compensate for variations in its operating level.

8.2 Duration of test

8.2.1 The test shall 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; or

.2 3 min have passed since all flaming from the specimen ceased or 10 min exposure, whichever is longer.

8.2.2 Operations in paragraphs 8.1.1 to 8.1.7 shall be repeated for two additional specimens (see paragraph 8.3).

8.3 Conditions of retest

8.3.1 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 shall 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 shall also require further equipment stabilization and retest.

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, shall be tested and the data secured reported separately.

8.3.3 The following procedures shall be taken in relation to the behaviour of the specimen during the test:

.1 if the pilot flame extinguishes: report occurrence and reject data and repeat test; or

.2 if the specimen breaks up and falls out of the specimen holder, report the behaviour, but classify on basis of worst performance with and without specimen restraint in paragraph 8.3.2.

8.4 Observations

In addition to the recording of the experimental data, observations shall be made and recorded on the behaviour of the specimen including but not limited to flashing, unstable flame front, sparks, glowing, charring, melting, flaming drips, disintegration of the specimen, fissures, fusion, changes in form.

9 DERIVED FIRE CHARACTERISTICS

Experimental results shall be reported in terms of the thermal baseline of the output from the thermocouple circuit and measurements of incident heat flux measured with a dummy specimen in place. The results shall not be adjusted to compensate for changes in the thermal output of the radiant panel and the pilot flame during the conduct of the test. The following data shall be derived from the test results.

9.1 Heat for ignition

As defined in paragraph 3.7.

9.2 Heat for sustained burning

A list of the values of this characteristic as defined in paragraph 3.9.

9.3 Average heat for sustained burning

9.3.1 An average of the values for the characteristic defined in paragraph 3.9 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.

9.3.2 For each specimen where the flame front does not reach the 175 mm position, the heat of sustained burning is not defined. If the heat of sustained burning is not defined for one specimen, *Qsb* is calculated using the data from the other two specimens. If the heat of sustained burning is not defined for two specimens, *Qsb* is calculated using the data from the third specimen. If the heat of sustained burning is not defined for all three specimens, *Qsb* is undefined and the criterion of *Qsb* is deemed to have been met.

9.4 Critical flux at extinguishment

A list of the values of this characteristic for the specimens tested and the average of these values (see paragraph 3.4).

9.5 Heat release of the specimen

Both a heat release time curve and a listing of the peak and total integrated heat release shall be secured from the experimental data. They shall be corrected for the non-linearity of the heat release calibration curve. The curve of the millivolt signal from the stack thermocouples shall 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 shall be set at the level of the initial steady state just prior to test of the specimen involved (see figure 10 of appendix 2).

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 10 of appendix 2).

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 10 of appendix 2).

10 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with part 5 of the annex to the 2010 FTP Code (also see subparagraph .2 below);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

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

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, together with details of the construction of the product;

.11 description of the specimen including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, orientations tested and face subject to the test, and construction;

.12 date of sample arrival;

.13 details of specimen conditioning;

.14 date of test;

.15 test results:

  .1 duration of each test;

  .2 derived fire characteristics as described in paragraph 9; and

  .3 observations recorded in accordance with paragraph 8.4; and

.16 determination on whether the tested material meets the performance criteria in paragraphs 3 and 4 of this part.

APPENDIX 2

TECHNICAL INFORMATION AND CALIBRATION OF THE PHYSICAL TEST EQUIPMENT

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 and 2 show photographs of the equipment as assembled, ready for test. The test apparatus, except the equipment for measurement of heat release (i.e. fume stack and thermocouples for it), is specified in standard ISO 5658-2.

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. Requirements are summarized below:

.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; and

.2 the gas used may be either natural gas, methane or propane-butane. 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 shall 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;

.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; and

.7 a dummy specimen as defined in paragraph 3.5 of appendix 1 to this part shall 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 a 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 flux meters

2.2.1 It is desirable to have at least three heat flux meters 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.

2.2.2 The heat flux meters shall be calibrated in accordance with standard ISO 14934-3, Fire tests – Calibration and use of heat flux meters – Part 3: Secondary calibration method. Two of these should be retained as a laboratory reference standard. They should have been calibrated to an accuracy of within ± 5%.

2.2.3 The target sensing of 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 heat flux meter. If heat flux meters 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 heat flux meter body. The end of the sleeve and the exposed surface of the heat flux meter 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 or flux meter 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 μV or less.

3 SPACE FOR CONDUCTING TESTS

3.1 Special room

A special room should be provided for the 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 grille 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 1 m 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 midlength 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 adjustment 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 heat flux meter (see paragraph 2.2 above) mounted in a special dummy specimen (see figure 11).

4.1.2 Between consecutive tests, the operating level should be monitored either by use of a heat flux meter mounted in a dummy specimen as defined in paragraph 3.5 of appendix 1 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 heat flux meter. 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 paragraph 2.1).

4.2 Mechanical alignment

4.2.1 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 3.

4.2.2 These relationships can be achieved by appropriate use of shims between the panel and its mounting bracket, adjustment of 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.

4.2.3 The fume stack for heat release measurements should be mechanically mounted on the specimen support frame in the position shown in figure 4.

4.2.4 The method of mounting should ensure the relative positions shown and 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

4.3.1 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.

4.3.2 With a water-cooled heat flux meter mounted in the calibration board, the measured incident heat flux on the specimen should correspond to the values shown in table 1. Compliance with this 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 heat flux meter 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 table 1. 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.

4.3.3 Water cooling of the heat flux meter 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 heat flux meter 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 heat flux meter 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 heat flux meter. In some cases repairs and recalibration are possible.

4.3.4 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 heat flux meter mounted in a dummy specimen, as defined in paragraph 3.5 of appendix 1 – (Definitions), at the 350 mm position. If the latter method is used, the assembly of dummy specimen and heat flux meter 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 heat flux meters. 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

4.5.1 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 7.

4.5.2 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 8 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 1 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 2 min.

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 7 kW should show not more than approximately 7% overshoot shortly after application of the calibration flame (see figure 8).

4.6 Fume stack calibration

With the adjustment described in paragraph 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 paragraph 4.4. The flow rate of methane gas of at least 95% purity should be varied over the range of about 0.004 m^3/min to 0.02 m^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 9. 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 radiant panel subassembly 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.

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 a larger diameter may correct the problem.

5.5 The four panel support brackets should be fastened to the radiant panel at the 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 hole 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 spirit level to ensure that it also lies in a vertical plane.

5.10 The specimen frame with specimen support rails on the side and bottom positions and the pilot burner holder 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 125 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° 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° 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 stop screw, the spacing between the panel and specimen support frames should be adjusted to make dimension B (see figure 3) equal to approximately 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 each side to maintain the angular relationship called for in adjustments in paragraphs 5.11 and 5.12.

5.16 The nuts supporting the specimen holder side guide rail should be adjusted to ensure that dimension A (see figure 3) 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 to ensure that the 45 mm stack position dimension, as shown in figure 4, is maintained. Another way of adjustment to dimension A is through changes in the number of washers mentioned in paragraph 5.6.

5.17 If necessary, the procedure described in paragraph 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 incident heat 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 agree with the typical values within 5%. Calibration data at other positions should agree with typical values within 10%.

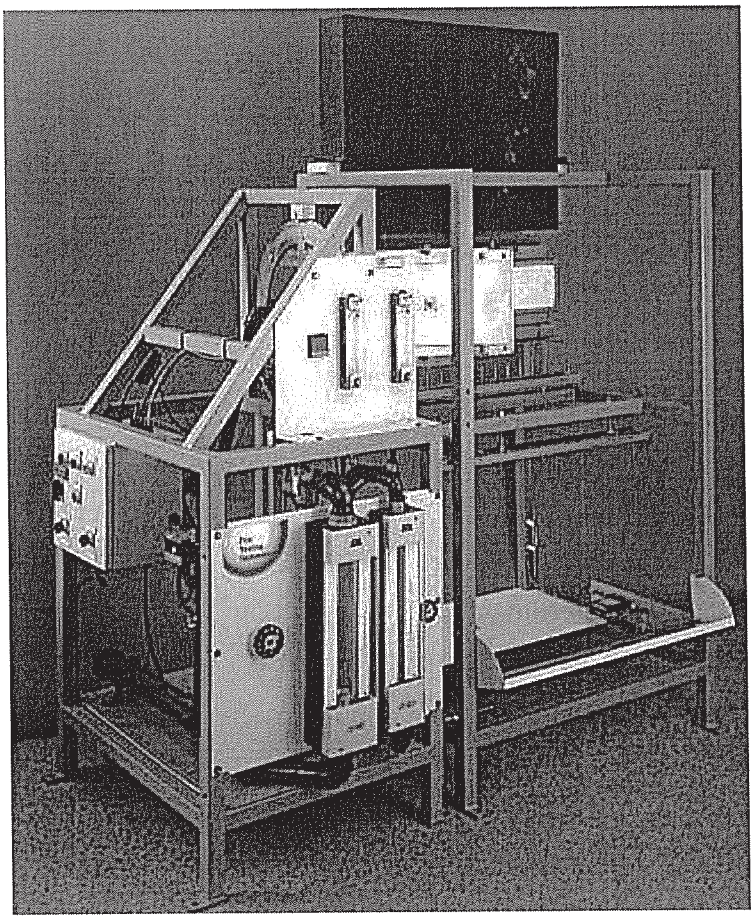


Figure 1 – General view of the apparatus

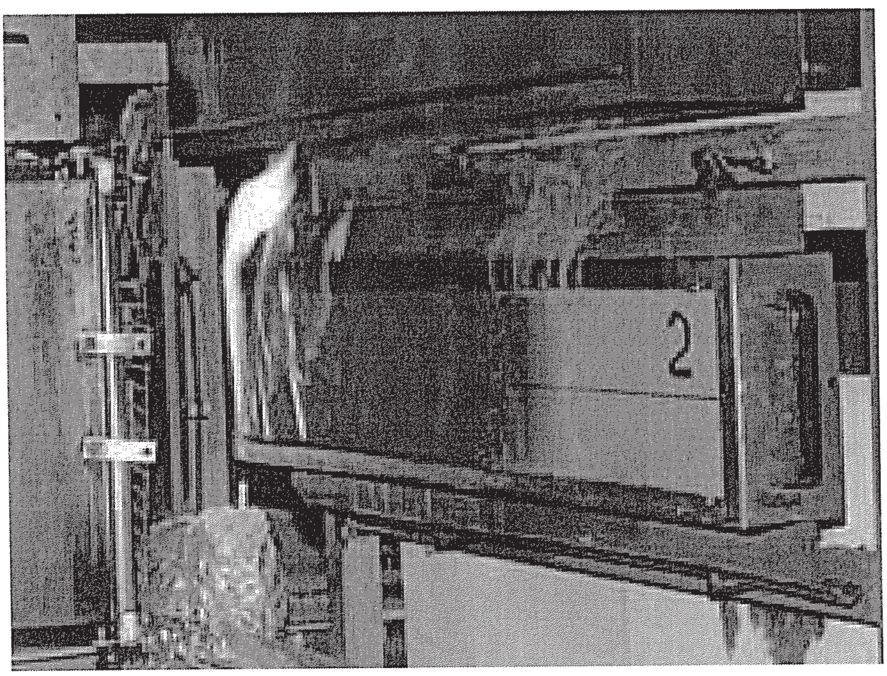


Figure 2 – View from specimen

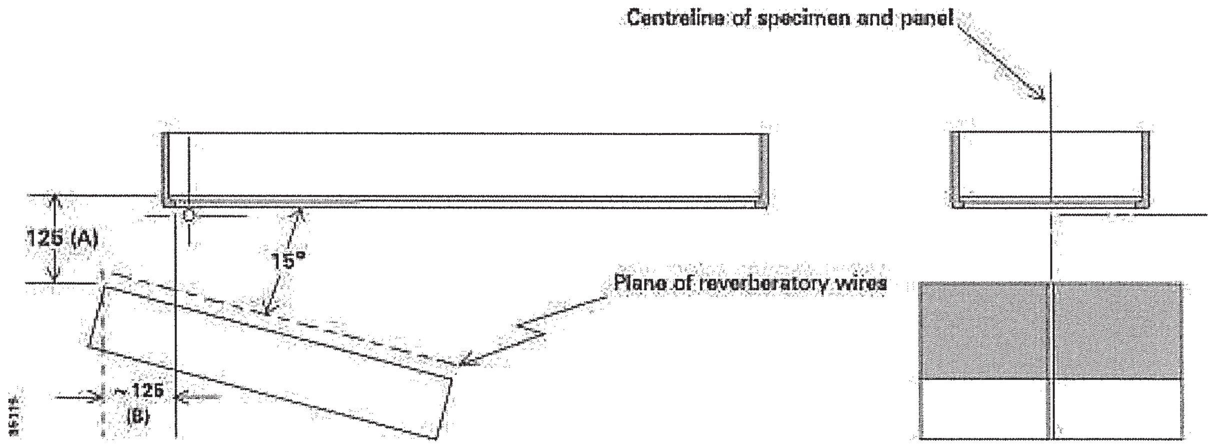


Figure 3 – Specimen – panel arrangement

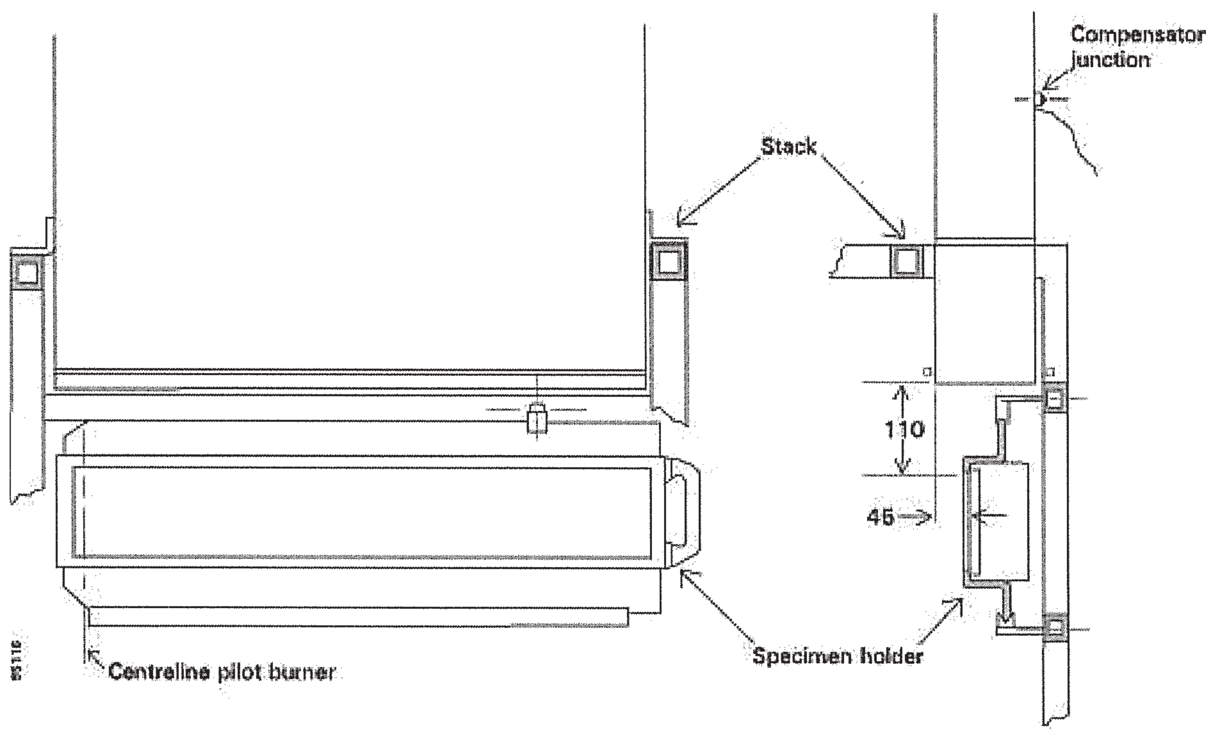
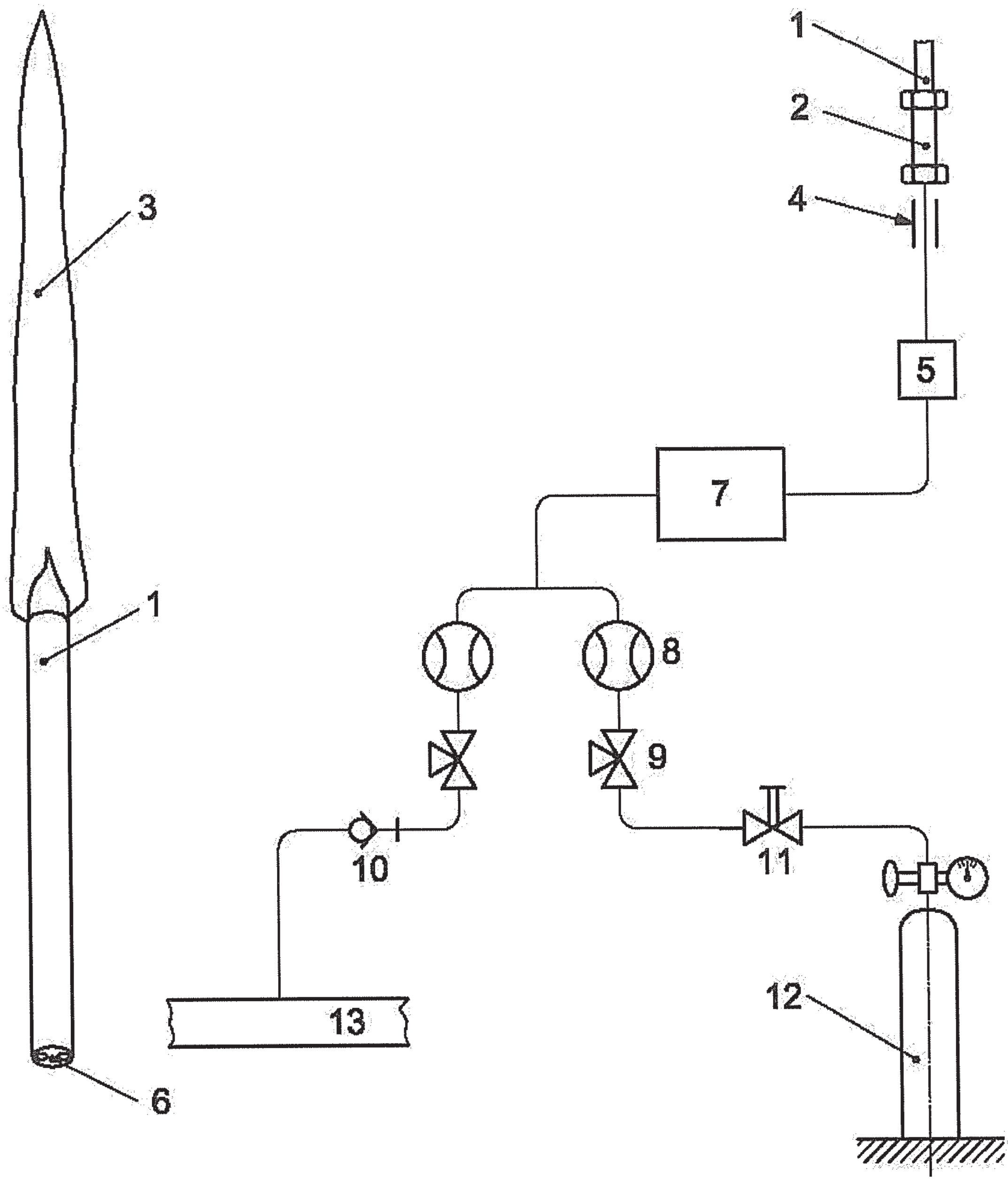


Figure 4 – Position of stack and specimen



Key

1 pilot flame burner
2 connector
3 flame (230 ± 20) mm long
4 location of burner support
5 flame arrester
6 twin-bore porcelain tube (200 ± 10) mm long
7 pressure damping chamber
8 flow meter
9 needle valve
10 non-return valve
11 on-off valve
12 propane gas cylinder
13 air line to panel

Figure 5 – Pilot burner details and connections

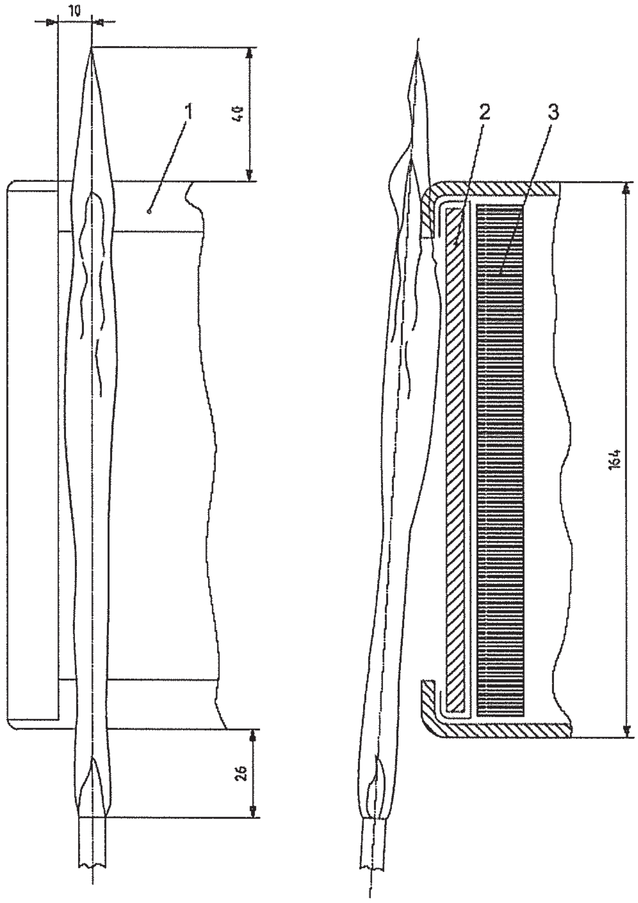


Figure 6 – Position of pilot flame

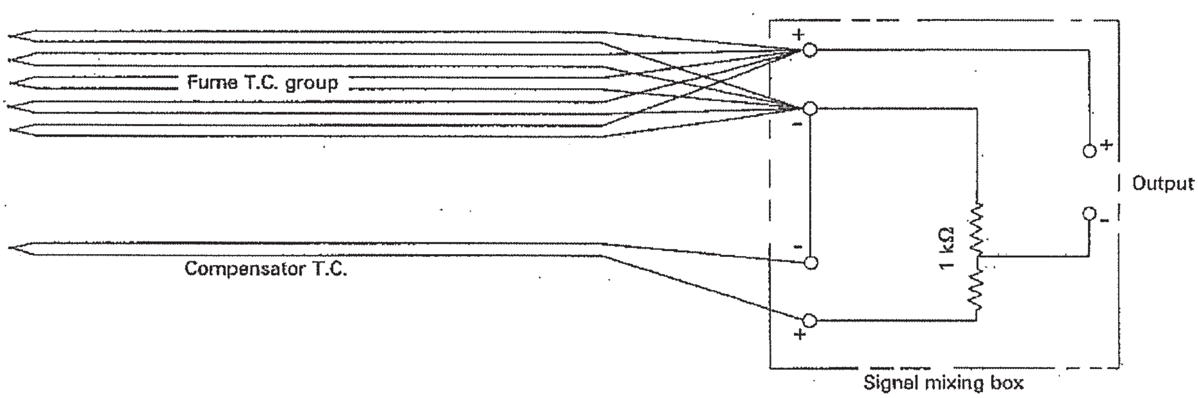


Figure 7 – Diagrammatic sketch of thermocouple circuit

Two sets of thermocouples (T.C.) 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 shielded from panel radiation.

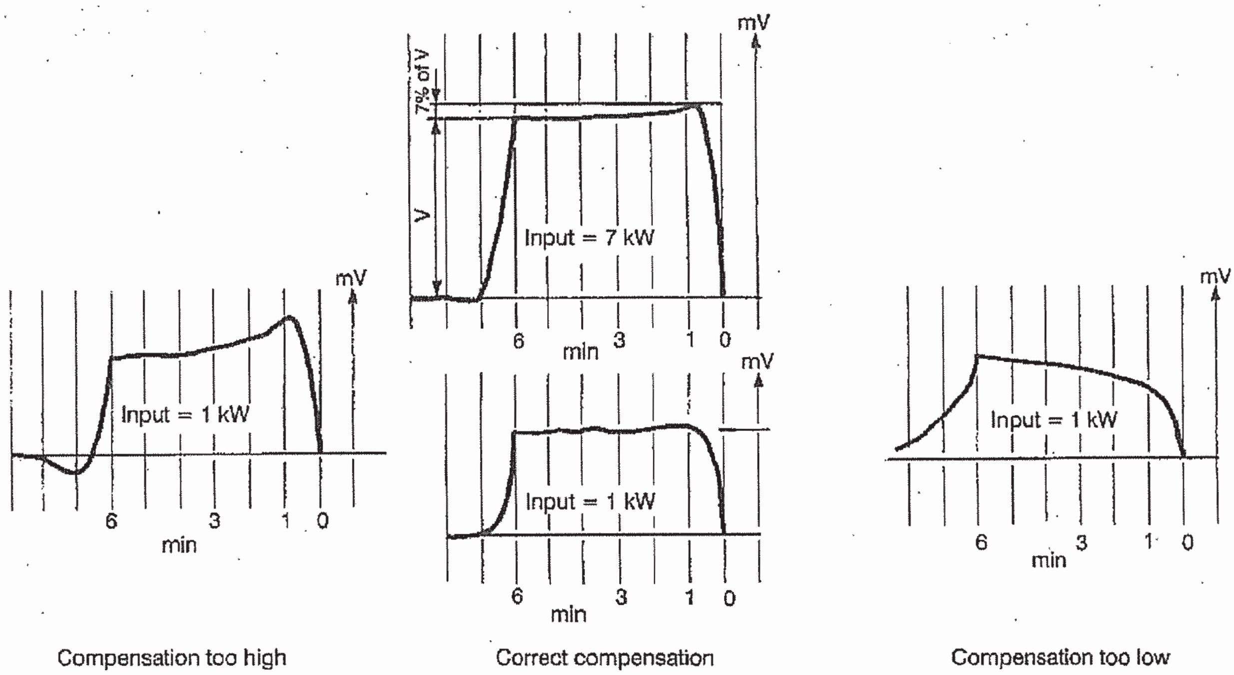


Figure 8 – An example of response behaviour of heat release signal to a square wave thermal pulse

(The four curves show examples of changes in the indicated mV signal rise for three different levels of inverse feedback or compensation level. Response performance in terms of time would be different in each apparatus due to the thickness of wall panel of the stack.)

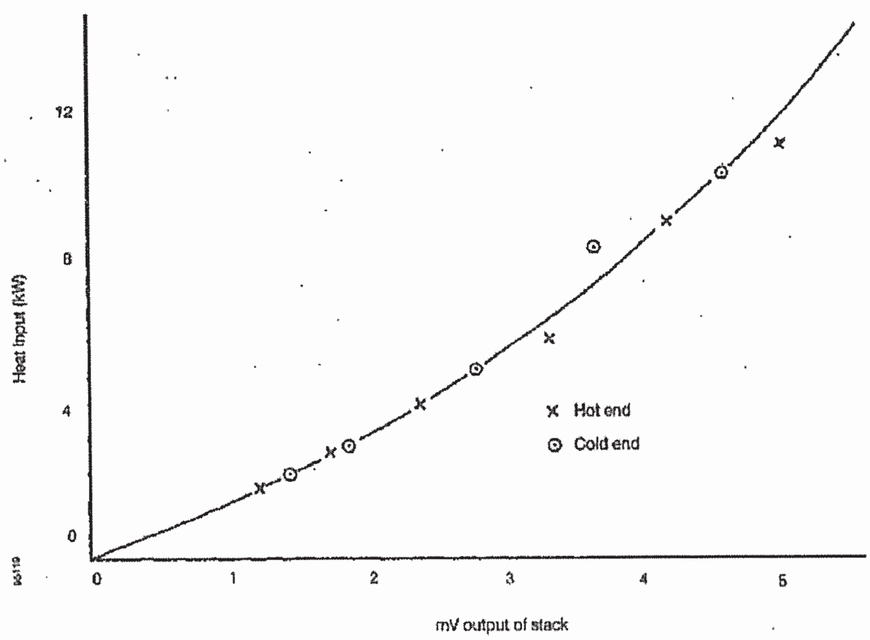


Figure 9 – Example of a typical stack calibration

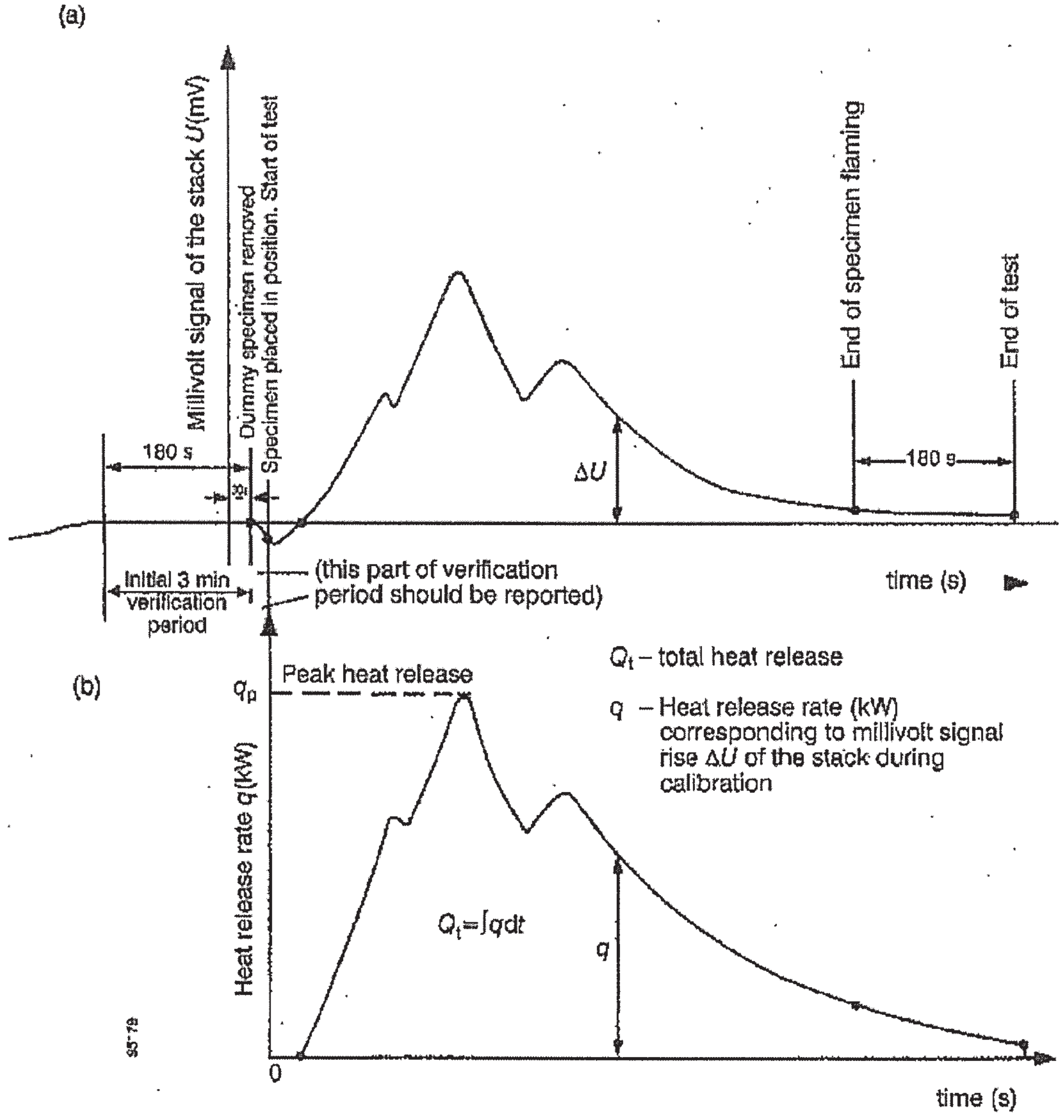
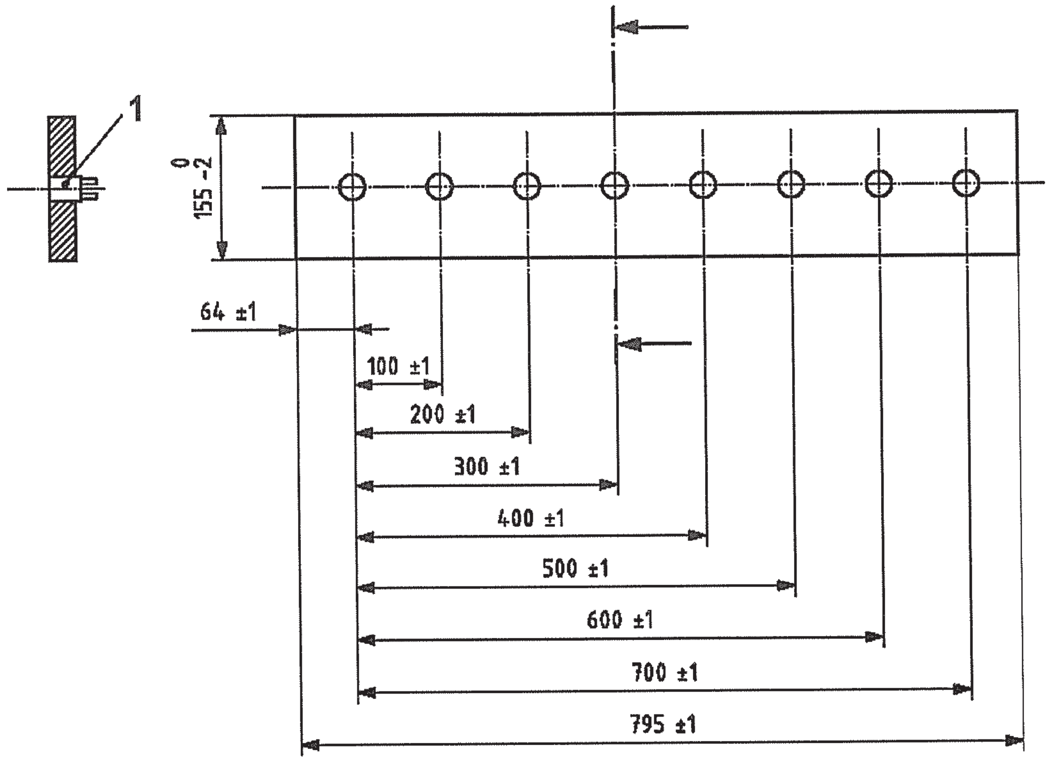


Figure 10 – Example of conversion of the millivolt signal rise ΔU to heat release rate of the specimen

(a) millivolt signal change recorded during test
(b) millivolt signal converted to heat release rate curve

Dimensions in millimetres



Key

1 heat-flux meter fitting closely in 25 mm diameter hole (such as for measurement at 300 mm)

Figure 11 – Calibration board for incident heat flux gradient calibration

APPENDIX 3

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 centreline. 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 centreline.
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	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 appendix 1 to this part.
9	Substantial jetting combustible pyrolysis gases from specimen, adhesive or bonding agents	Report that it is not classified as low flame-spread.
10	Small flame remaining along the edge of specimen	Report behaviour and terminate the test 3 min after flaming on exposed surface of specimen ceased.

APPENDIX 4

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

1 SCOPE

This appendix provides recommended guidelines for the selection and preparation of the specimen for surface materials for parts 2 and 5 of this Code, including the selection of substrates or backing materials. This appendix 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 representative of the characteristics of the product in actual operating conditions in ships. It means that the product which would be expected to have the worst result should be selected. Specimen selection should be concerned with thickness, colour, organic content, substrate of the product, and its combination of a product.

2.2 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. 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 between 47 mm and 50 mm (part 5, appendix 1, paragraph 7.2.2).

2.3 Substrate

Substrate of surface material and floor coverings: Materials and composites materials shall be tested using their full thickness, attaching them to the substrate to which they will be attached in practice when using an adhesive, if appropriate. The test specimen shall reflect actual application on ships (part 5, appendix 1, paragraph 7.3.1).

2.4 Composites

Assembly should be as specified in paragraph 7.2 (Dimensions) of appendix 1. 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 (part 5, appendix 1, paragraph 7.4.1).

2.5 Test for floor covering

2.5.1 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 separate layer, 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 (part 5, paragraph 4.2.3).

2.5.2 Therefore, multilayered floor coverings, such that each layer complies with part 5 (criteria for floor covering), are accepted; or a test of composite condition may be done. This makes it possible to interchange the layers as long as each material used complies with part 5.

2.6 Colour variation and organic contents of the specimen

Usually the influence of the colour and organic content of the specimen have a significant effect on the result of a fire test. The organic content of the specimen is a key factor of the combustion characteristic of the product. The 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, at least, the maximum organic content and the dark colour specimen within the product variation should be selected if the product has colour variation.

2.7 Exemption of the test in accordance with part 2

Surface materials and primary deck coverings with both the total heat release (*Qt*) of not more than 0.2 MJ and the peak heat release rate (*Qp*) of not more than 1.0 kW (both values determined in accordance with part 5 of annex 1) are considered to comply with the requirements of part 2 without further testing (see paragraph 2.2 of annex 2).

3 RANGE OF TYPE APPROVAL OF SURFACE MATERIALS

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

3.2 Table 1 shows the relationships of the specimen substrate and the range of type approval of surface materials.

Table 1 – Specimen substrate and the type approval of surface materials (Range of approval and restriction in use)

In the following table:

First column: product to be tested.
Second column: substrate.
Third column: range of approval and restriction in use.

Products	Test substrate	Limitation of product application for ships
Paints and surface veneer	Steel (e.g., 1 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). 2 It is not approved to apply to non-metallic non-combustible materials. 3 Limitation, as appropriate, to ensure that the product is covered by the test specimen (such as thickness, adhesive, organic content, density, range of colours). 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.
	Standard calcium silicate board, described as a dummy specimen, specified in paragraph 3.5 of appendix 1	1 Products can be applied to any non-combustible substrate. 2 Limitation, as appropriate, to ensure that the product is covered by the test specimen (such as thickness, adhesive, organic content, density, range of colours).
Surface veneer	No substrate used at the test (The 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, as appropriate, to ensure that the product is covered by the test specimen (such as thickness, density, material composition, adhesive and application rate, and range of colours). 3 When the products are to be applied to bulkheads or ceilings by using adhesive, a combination test with adhesive should be required.
Floor covering and primary deck coverings	Thick steel (3 mm)	1 Limitation by the specimen colour and organic contents that was tested. 2 May be applied over any low flame-spread floor covering, steel, or non-combustible material.
	Combination test (combination of layers)	1 Limitation, as appropriate, to ensure that the product is covered by the test specimen (such as thickness, density, material composition, adhesive and application rate, and range of colours). 2 The approval of 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.)

4 PREPARATION OF TEST SPECIMEN FOR PARTS 2 AND 5

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

4.1 Test specimen

The test specimen shall be selected as 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

The specimen should be tested using the thickness specified in paragraph 2.2. The substrate should be selected taking into consideration the substrates to which they will be attached in ships.

4.3 Exposed surface at the test

Each different exposed surface of the product should be tested (part 5, appendix 1, paragraph 7.1.2). This means each side of the product that may be exposed; it does not refer to colour.

4.4 Specimen size

4.4.1 For part 5: width 150 mm to 155 mm, length 795 mm to 800 mm (part 5, appendix 1, paragraph 7.2.1).

4.4.2 For part 2: width 75 ± 1 mm, length 75 ± 1 mm (part 2, appendix 1, paragraph 4.2.1).

4.5 Specimen thickness

4.5.1 The specimens should be tested using their full thickness (part 5, appendix 1, paragraph 7.2.2).

4.5.2 For part 5: maximum 50 mm (part 5, appendix 1, paragraph 7.2.2).

4.5.3 For part 2: maximum 25 mm (part 2, appendix 1, paragraph 4.2.3).

4.5.4 If the product thickness is greater than in paragraphs 4.5.2 and 4.5.3 above, the specimens should be obtained by cutting away the unexposed face to reduce to the above maximum thickness.

4.6 Colour variation of the paints or surface materials

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

4.6.1 *Organic content*

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

4.6.2 ***Colour of the specimen***

Black or a dark colour should be selected.

4.6.3 ***Order of priority regarding specimen colour and organic content***

When the product of the darkest colour is different from the product with the maximum organic content, the Administration or the testing laboratory may decide on the specimen. If the amount of organic content between a black or dark specimen and a white or brightly-coloured specimen are similar (difference is within 5%), the black or dark specimen should be chosen. Otherwise, the specimen with the maximum organic content should be selected.

4.6.4 ***Information on colour variation and its organic content***

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

4.6.5 ***Attention regarding the type approval issued***

When approving, if the specimen tested can be considered as a representative specimen (i.e. dark in 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 a similar conditioned product as tested.

4.7 Substrate

The substrate of the specimen should be selected as they are attached in actual ships. The test with metallic substrate is thought to be different from the test with non-combustible substrate (part 5, paragraph 1.3 and part 5, appendix 1, paragraph 7.3).

4.8 Thickness of the substrate

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 a similar or higher thickness of the substrate that was tested provided that the substrate has a density of 400 kg/m^3 or greater (part 5, paragraph 1.3 and part 5, appendix 1, paragraph 7.3).

4.9 Substrate of floor coverings

4.9.1 Primary deck coverings and floor coverings should be applied to a steel plate thickness of 3 ± 0.3 mm.

4.9.2 Primary deck coverings, classified as not readily ignitable in accordance with part 5 of annex 1, are considered to comply with the requirements for floor coverings (annex 2, paragraph 5.2).

4.10 Composite materials (for bulkheads and ceilings)

4.10.1 Assembly should be as specified in paragraph 7.2 of appendix 1 to part 5 (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.

4.10.2 When the product that has a multilayer construction would be applied to bulkheads and ceilings, the surface flammability test of the combination of each layer should be required to confirm the influence of these underlying constructions (part 5, appendix 1, paragraph 7.4.1).

4.11 Test of adhesives described in part 3 of annex 1 to this Code

The calcium silicate board described as a dummy specimen, specified in paragraph 3.5 of appendix 1 to part 5, should be used as a standard substrate for adhesives.

PART 6 – (BLANK)

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 PROCEDURES

The vertically supported textiles and films shall be tested and evaluated in accordance with the fire test procedure specified in appendix 1 of this part.

3 PERFORMANCE CRITERIA FOR CURTAINS AND DRAPES

3.1 Products which show any of the following characteristics obtained by the fire test in appendix 1, shall be considered unsuitable for use as curtains, draperies, or free-hanging fabric product for use in rooms containing furniture and furnishings of restricted fire risk as defined in the relevant regulations of chapter II-2 of the Convention:

.1 an after-flame time greater than 5 s for any of the 10 or more specimens tested with a surface application of the pilot flame (see also paragraph 3.2 below);

.2 burn through, as determined by appendix 2, to any edge of any of the 10 or more specimens tested with a surface application of the pilot flame (see also paragraph 3.2 below);

.3 ignition of cotton wool below the specimen in any of the 10 or more specimens tested (see also paragraph 3.2 below);

.4 an average char length, as determined by appendix 2, in excess of 150 mm observed in any of the batches of five specimens tested by either surface or edge ignition; and

.5 the occurrence of a surface flash propagating more than 100 mm from the point of ignition with or without charring of the base fabric (see also paragraph 3.2 below).

3.2 If, following analysis of the experimental data from tests of a fabric, it is found that either or both of the batches of five specimens cut in both warp and weft directions fail to meet one or more of the criteria specified in subparagraphs .1 to .3 and .5 above because of poor performance of only one of the five specimens tested, one complete retest of a similar batch is permitted. Failure of the second batch to meet any of the criteria shall provide the basis for rejection of the fabric for use.

4 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.

5 TEST REPORT

The test report shall include the information contained in paragraph 7 of appendix 1 to this part.

APPENDIX 1

FIRE TEST PROCEDURES FOR DETERMINING THE RESISTANCE TO FLAME OF VERTICALLY SUPPORTED TEXTILES AND FILMS

WARNING – HEALTH AND SAFETY OF TEST OPERATORS

Burning of textiles may produce smoke and toxic gases which can affect the health of operators. The testing area shall be cleared of smoke and fumes by suitable means of forced ventilation after each test, then restored to the required testing conditions.

1 SCOPE

This appendix specifies a fire test procedure for qualifying textiles and films used primarily as vertically hanging curtains and draperies, as meeting the requirements for the resistance to propagation of flame specified in the relevant regulations of chapter II-2 of the Convention. Fabrics, which are not inherently flame resistant, shall be exposed to cleaning or exposure procedures and tested both before and after such treatment.

2 DEFINITIONS

2.1 *After-flame time* is the time during which the material continues to flame after the ignition source has been removed or extinguished.

2.2 *Sustained ignition* means the case where after-flame time is 5 s or more.

2.3 *Afterglow* means persistence of glowing of a material after cessation of flaming or after the ignition source has been removed.

2.4 *Surface flash* means a rapid flash of a flame across the surface of the fabric primarily involving the surface pile finish and often leaving the base fabric in an essentially undamaged condition.

3 PURPOSE

The test method provides information on the ability of a fabric to resist sustained ignition and flame propagation when exposed to a small igniting flame. The performance of a fabric in this test does not necessarily indicate its resistance to flame propagation when exposed to conditions substantially different from those used in the test.

4 TEST APPARATUS

4.1 Gas burner

A gas burner shall be provided as illustrated in figure 1. This shall be so mounted that the axis of the burner barrel is capable of adjustment to each of three fixed positions, *viz*., vertically upwards, horizontal or at an angle of 60° to the horizontal. The positions assumed by the burner with respect to the fabric are illustrated in figure 2. Figures 3 and 4 show the burner supporting plate which keeps the burner in such positions.

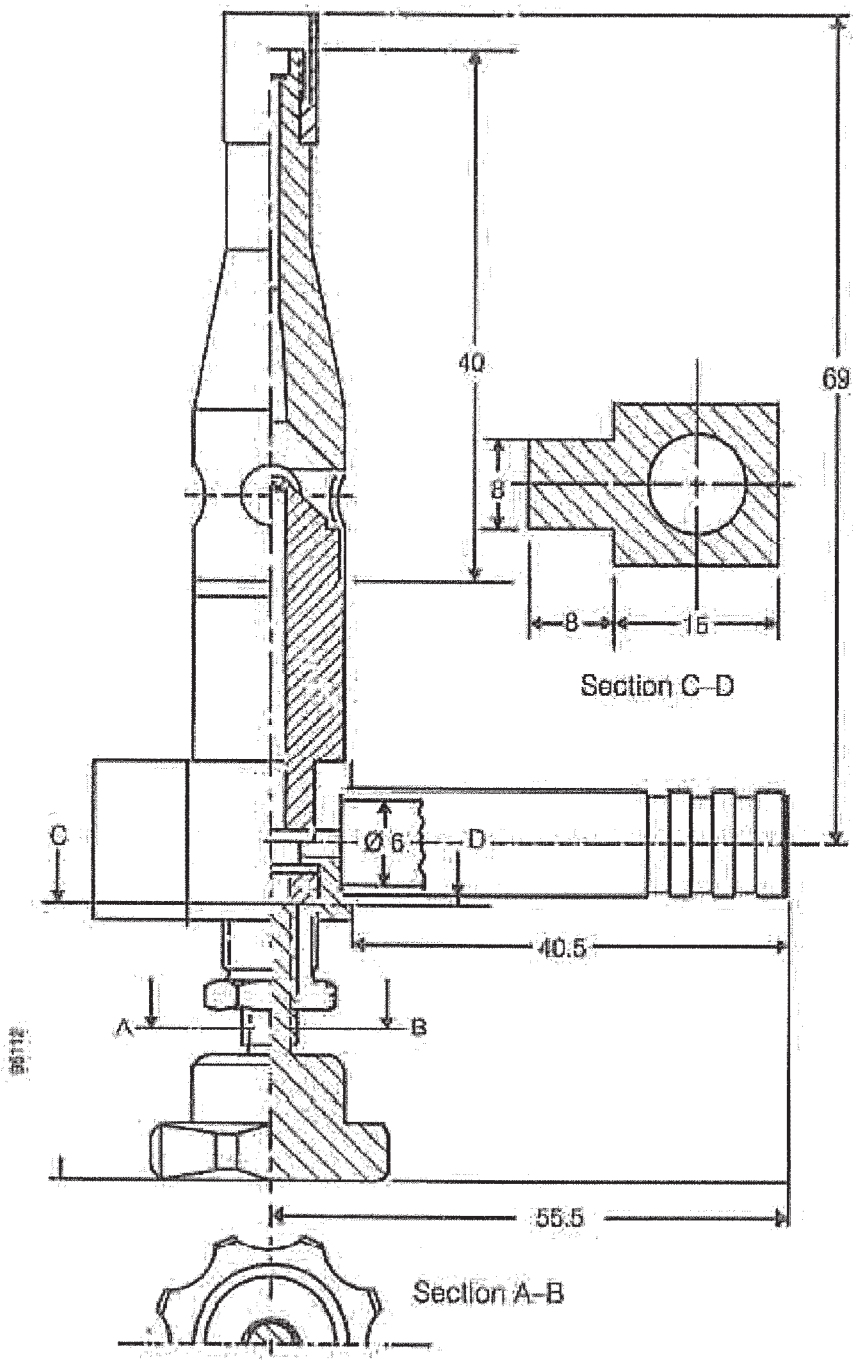


Figure 1 – Ignition burner
(according to Deutsche Industrie – Norm (DIN)50 051 type KBN)

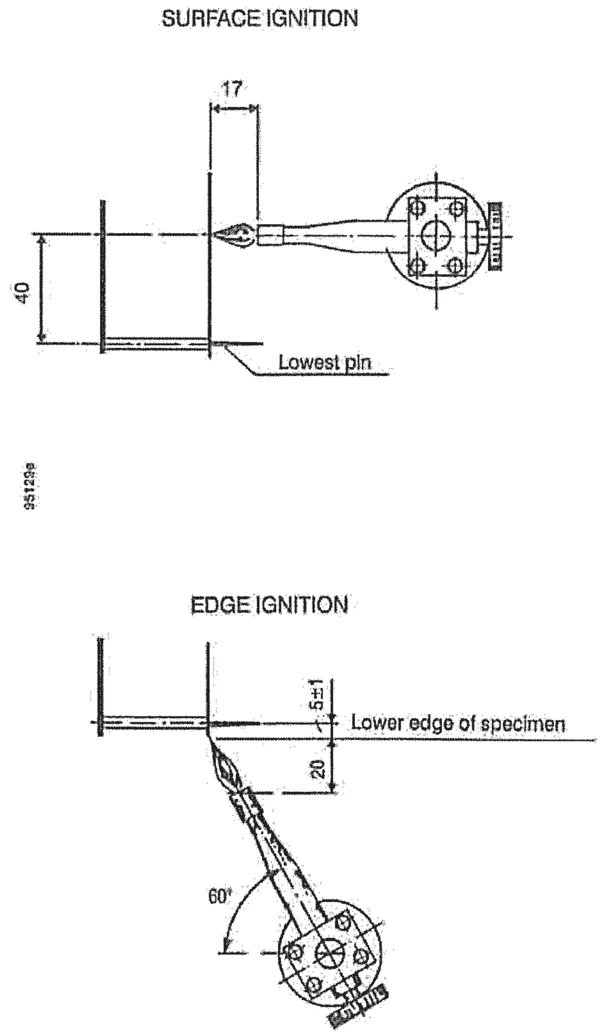


Figure 2 – Ignition burner: fabric positions

4.2 Fuel gas

Commercial grade propane of at least 95% purity shall be used.

4.3 Specimen holder

A rectangular test frame, 200 ± 1 mm long x 150 ± 1 mm wide shall be provided, constructed of stainless steel, 10 mm wide by 2 mm thick. Mounting pins incorporating distance stubs constructed of stainless steel 2 ± 1 mm diameter shall be fixed at each corner of the test frame and at the centre of both long members. Figures 3 and 4 illustrate the specimen holder.

4.4 Base support

The specimen holder shall be supported over a rigid metal base by means of two vertical uprights to which the specimen holder is attached. The metal base also provides a support for pivoting the burner pedestal to move the burner flame into contact with or away from the specimen. Figures 3 and 4 illustrate the base support and the pedestal.

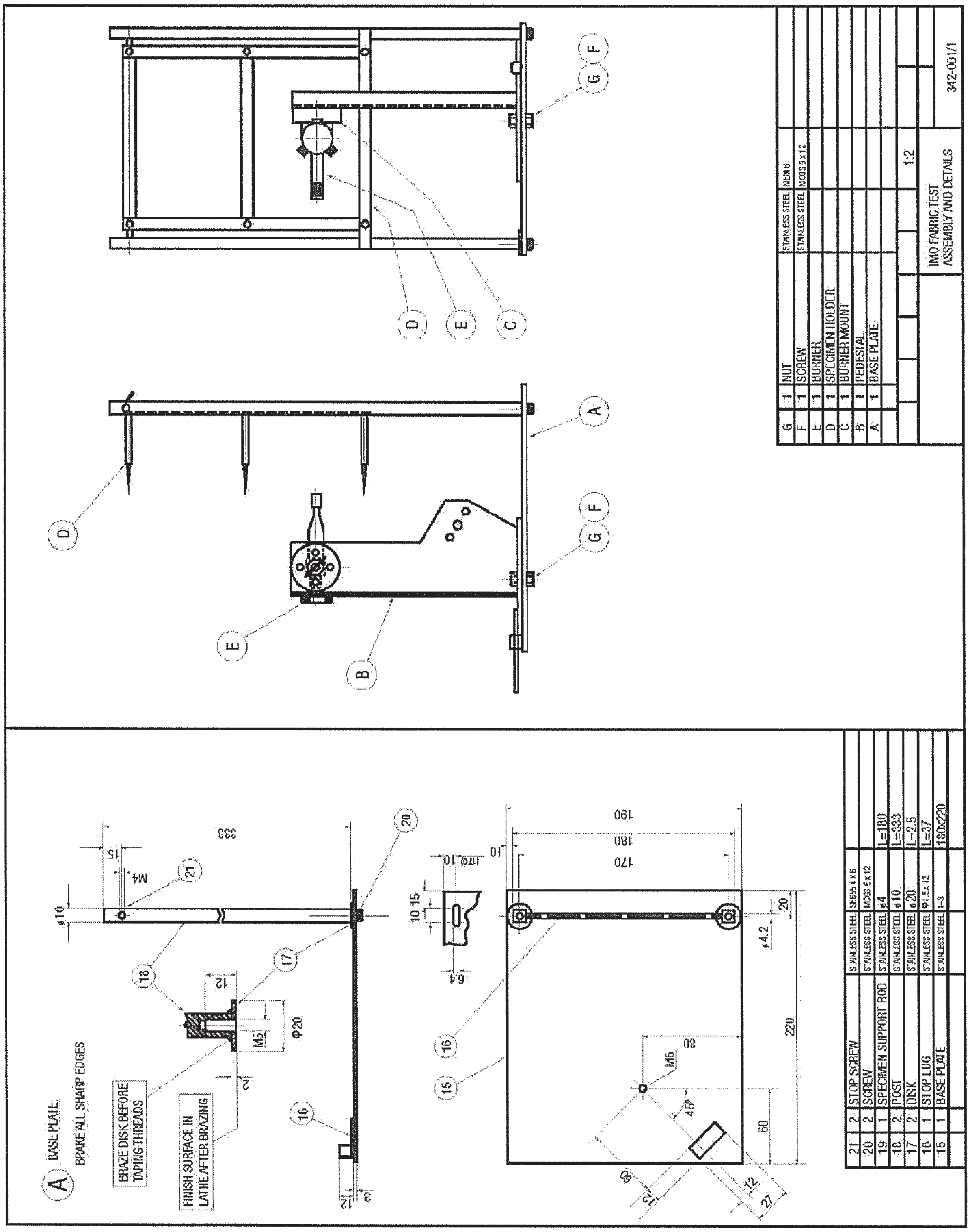


Figure 3 – Fabric test: assembly and details

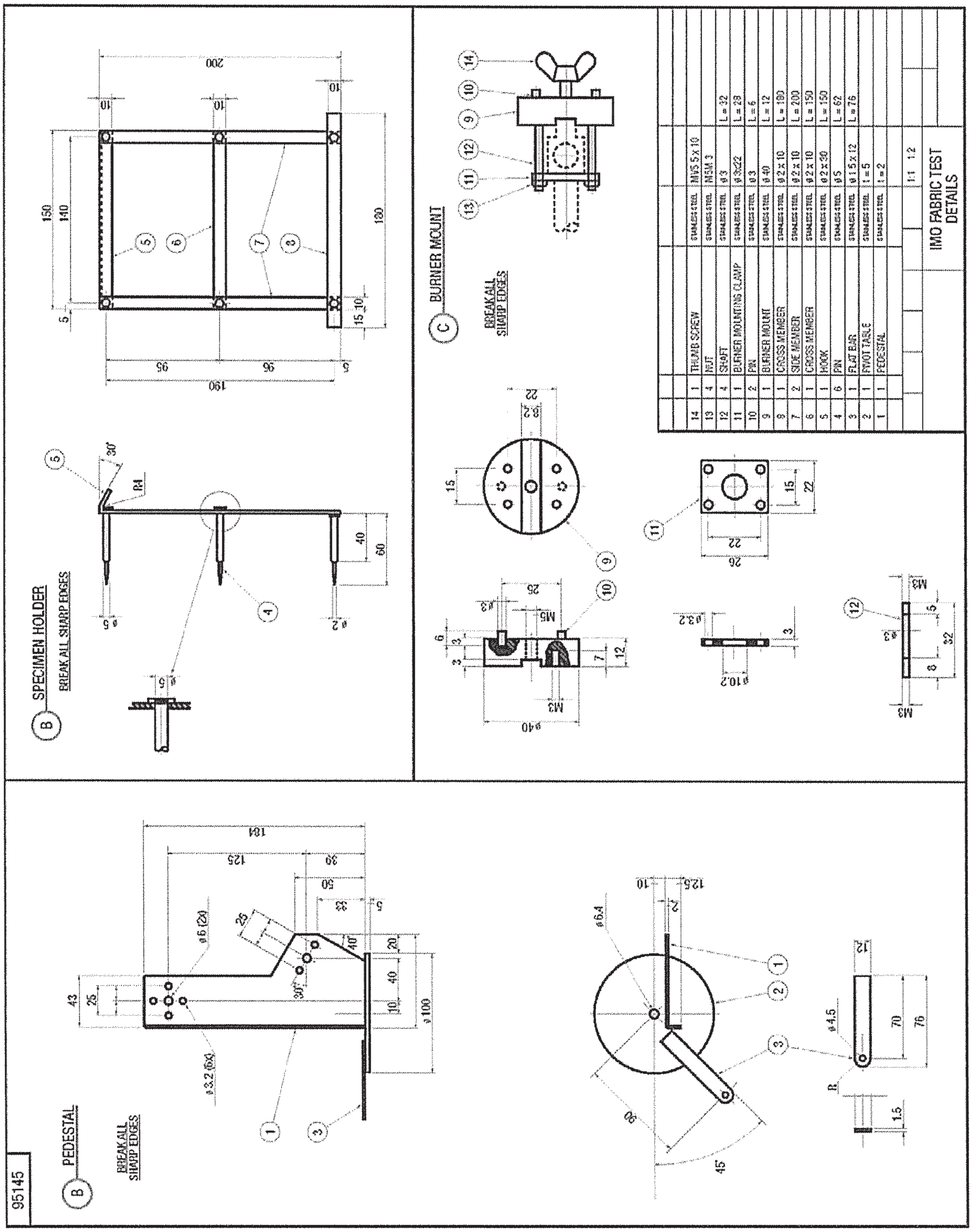


Figure 4 – Fabric test: details

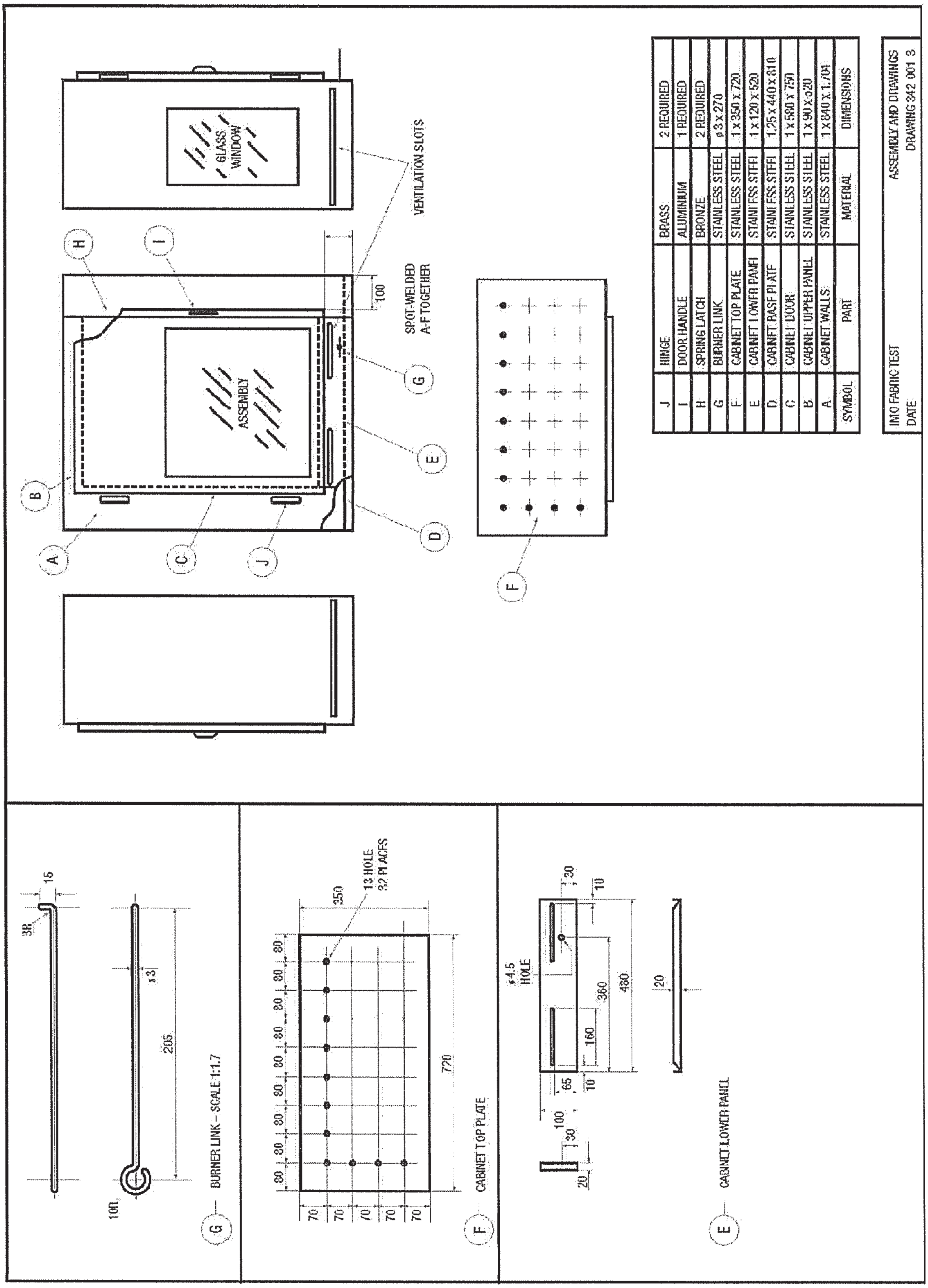


Figure 5 – Fabric test: test enclosure

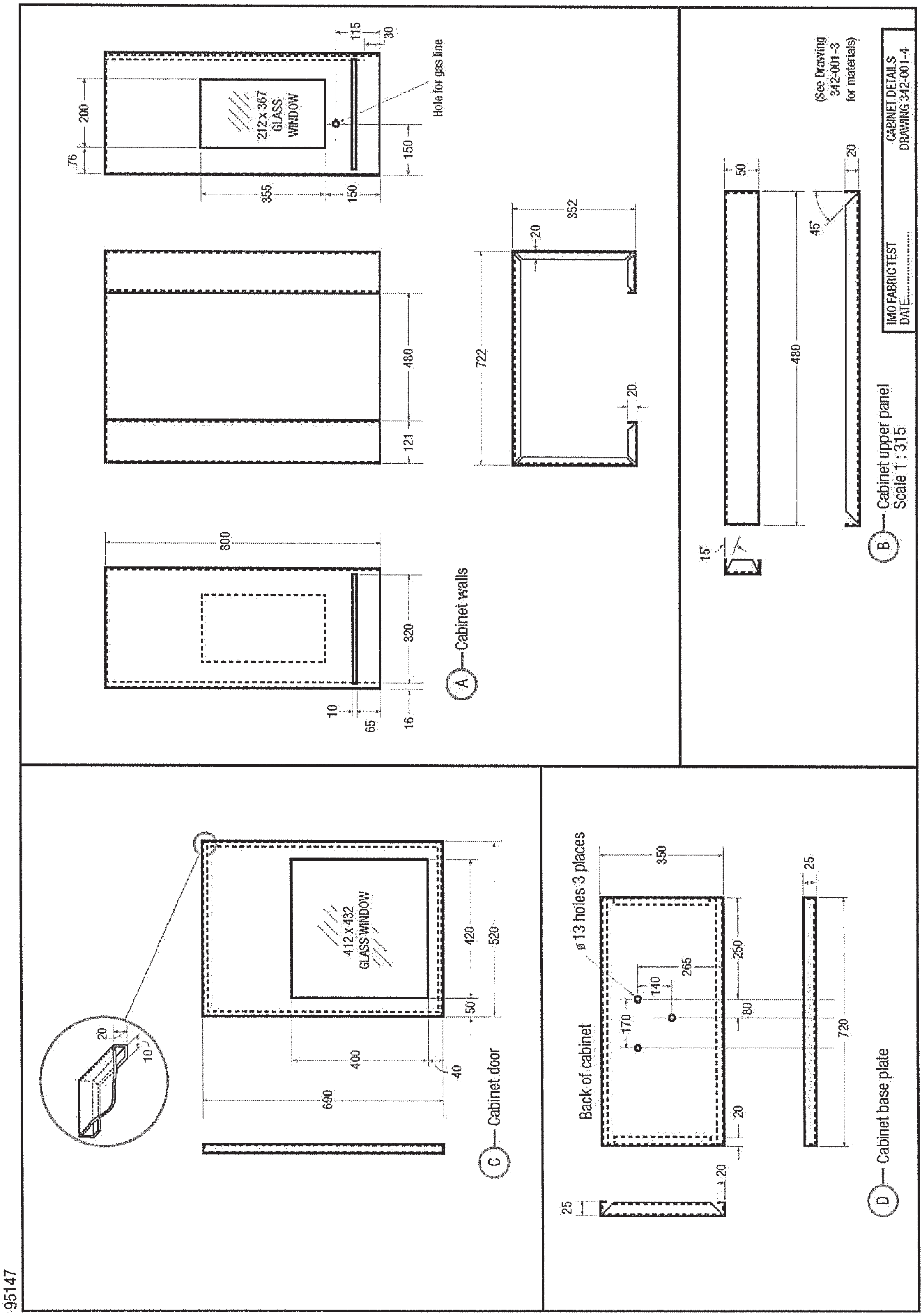


Figure 6 – Fabric test: test enclosure

4.5 Test enclosure

A 0.5 mm to 1 mm thick sheet metal draught-shielding enclosure shall be provided, measuring roughly 700 ± 25 mm wide x 325 ± 25 mm deep x 750 ± 25 mm high. The roof shall be provided with 32 circular holes, each 13 ± 1 mm in diameter, symmetrically drilled, and baffled vent openings shall be provided at the base of each side giving at least 32 cm^2 of free vent area, symmetrically distributed. One 700 mm x 325 mm face shall be constructed to accommodate a closure door mainly of glass, and one smaller side shall also be constructed as a vision panel. A hole shall also be provided for the gas feed tube and remotely-controlled burner positioning rod. The floor of the enclosure shall be covered with a non-combustible insulating material. The interior shall be painted black. Figures 5 and 6 illustrate the test enclosure.

5 TEST SPECIMENS

5.1 Preparation

The specimens shall be as representative as possible of the material provided and shall exclude selvages. At least 10 specimens shall be cut, each measuring 220 mm x 170 mm, five in the direction of the warp, five in the direction of the weft. Where the fabric has differing surfaces on the two sides enough samples shall be cut for both surfaces to be tested. Using a template 220 mm x 170 mm, with holes approximately of 5 mm diameter located on the template at the position of the pins on the frame, each specimen shall be laid flat on a bench and premarked/punctured, to ensure a repeatable and reproducible tension of the specimen, after mounting on the frame.

5.2 Conditioning and exposure procedures

The specimens shall be conditioned at 20 ± 5°C and 65 ± 5% relative humidity for not less than 24 h before test. If the material is not inherently flameproof, one of the exposure procedures detailed in appendix 3 may, at the discretion of the approving authority, be applied to at least 10 further specimens.

5.3 Mounting

Each specimen shall be removed from the conditioning atmosphere and either tested within 3 min or placed in a sealed container until required. The fabric shall be mounted on the pins of the test frame in the locations previously marked on each fabric (see paragraph 5.1). The location of the fabric on the pins shall be such that it is roughly centred in the width direction and the lower edge of the fabric extends 5 ± 1 mm below the lower pin.

6 TEST PROCEDURE

6.1 Presetting of the igniting flame

The gas burner shall be ignited and preheated for at least 2 min. The fuel supply shall then be adjusted so that, when the burner is in the vertical position, the distance between the tip of the burner tube and the visible tip of the flame is 40 ± 2 mm. If desired a gas flow meter may be used as a means of achieving reproducibility in adjusting the burner flame length.

6.2 Determining the mode of flame application for a given fabric

6.2.1 The angle of the burner shall be adjusted to the horizontal position and the height fixed so that the flame, when the burner is in position, will impinge on the fabric at a central point, 40 mm above the level of the first row of pins. The door to the enclosure shall then be closed and the burner moved into a position such that the burner tip is 17 mm from the face of the specimen.

6.2.2 The flame shall be applied for 5 s and then removed. If no sustained ignition occurs a new specimen shall be fixed to the holder and the flame applied as before but in this case for 15 s. Failure to achieve sustained ignition at the longer duration requires the position of the burner to be adjusted to a position such that the tip of the burner lies 20 mm below the bottom edge of the fabric, the flame impinging on it.

6.2.3 The flame shall be applied in this position to a new specimen for 5 s and if no sustained ignition occurs another specimen shall be inserted and the time of flame application shall be extended to l5 s.

6.2.4 The ignition condition to be used for testing the specimens shall be that at which sustained ignition is first achieved when the order of tests listed above is followed. In the absence of sustained ignition the specimens shall be tested under conditions showing the greatest char length. The method of flame application for warp and weft specimens shall be determined using the ignition sequence given above.

6.3 Flame test

Using the burner position and flame application time found to be appropriate for the specimens under test, a further five specimens cut in both warp and weft directions shall be tested as described in paragraph 6.2 and the after-flame times noted. Any evidence of surface flash shall be noted. If afterglow is observed to occur during a test, the specimen shall be allowed to remain in place until all glowing has ceased. The extent of char is also measured. Where doubt exists as to the precise limit of damaged fabric, the procedure detailed in appendix 2 shall be followed.

6.4 Flaming drops

To investigate if burning drops of thermoplastic materials are capable of igniting combustible materials on the base of the apparatus, cotton wool as specified in part 3, appendix 1, paragraph 7.9, shall be laid to a depth of 10 mm over the base plate, immediately below the specimen holder. Note shall be made of any ignition or glowing of the cotton wool.

7 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with part 7 of the 2010 FTP Code (see subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

.7 type of the material, i.e. curtain, drape, etc.;

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including, as applicable:

.1 mass per unit area;

.2 thickness;

.3 colour and tone: if the product has a pattern, the representative colour shall be described;

.4 quantity and number of any coating;

.5 method and quantity of fire retardant treatment;

.6 materials of the product such as wool, nylon, polyester, etc., and its composite ratio;

.7 composition of weave: such as plain, weave, twilled;

.8 density (number/inch): the number of threads per inch in both warp and weft; and

.9 yarn number count;

.11 description of the specimen including mass per unit area, thickness and dimensions, colour, orientations tested and face subject to the test;

.12 date of sample arrival;

.13 details of specimen conditioning including type of cleaning and weathering procedures used and information of the detergent used;

.14 date of test;

.15 test results:

.1 mode of flame application used;

.2 duration of flame application;

.3 after-flame time;

.4 length of char;

.5 ignition of cotton wool from drops; and

.6 occurrence of surface flash and its propagation length;

.16 observations made during the test;

.17 determination whether the tested material meets the performance criteria in paragraph 3 of this part; and

.18 the statement:

"The test results relate 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 2

MEASUREMENT OF LENGTH OF CHAR OR MATERIAL DESTRUCTION

1 APPARATUS

A hook and weight assembly shall be used to determine the length of char or destruction of the specimen. The combined mass of the assembly shall be as indicated in table 1.

Table 1 – Mass to tear charred fabric

Mass of fabric being tested (g/m^2)	Total mass used to tear fabric (g)
smaller than 200	100
200 – 600	200
greater than 600	400

2 METHOD

After all flaming and afterglow on the specimen have ceased, the length of char or material destruction shall be determined immediately. The length of char in this test is defined as the distance from the end of the specimen which was exposed to the flame to the end of a tear made lengthwise in the specimen through the centre of the charred area in the following manner:

.1 the edge of the highest or greatest char penetration of the sample shall be inspected to determine if as a result of thermoplastic behaviour a thickening of the edge has developed as a result of the test. If this has occurred a cut shall be made, after cooling, only sufficiently deep to cut through the highest portion of this thickened edge of the charred specimen;

.2 the specimen shall be folded parallel to its length and lightly creased through the maximum visible portion of the charred length;

.3 the hook shall be inserted in the specimen, on one side of the charred area, 8 mm in from the adjacent outside edge and 8 mm up from the bottom; and

.4 the specimen shall then be grasped with the fingers on the opposite side of the charred area, and raised gently until it supports the weight. The specimen will tear through the charred area until fabric strong enough to carry the load is reached.

APPENDIX 3

CLEANING AND WEATHERING PROCEDURES

1 GENERAL CONSIDERATIONS

It is assumed that any fabric intended for marine use will either have been subjected to a permanent fire-retardant treatment or have been made from inherently flame-resistant materials. This appendix describes procedures intended to permit verification of this assumption.

2 APPLICATION

2.1 These procedures should be applied to fabrics.

2.2 Each fabric should be subjected to only those exposure procedures which are applicable to its intended use. It should meet the flame-resistance requirements of paragraph 5 after passing through the appropriate exposure cycles.

2.3 Accelerated exposure tests described in this appendix should provide sufficient testing to permit a reasonable appraisal of the durability of the treatment (under the conditions for which it was designed) for the useful life of the fabric.

3 ACCELERATED DRY-CLEANING

3.1 The treated fabric should be dry-cleaned in a coin-operated dry-cleaning apparatus as part of a load made up with dummy pieces of dry-cleanable fabrics. The effective liquor ratio should be 1:10 or 10 kg of liquid per kilogram of fabric.

3.2 The coin-operated apparatus with perchloroethylene solvent (about 1% charge system involving an emulsifying agent and water) should run for the full 10- to 15-minute cycle which includes tumble-drying. At the end of each dry-cleaning cycle, remove the load from the unit and separate the pieces.

3.3 The above dry-cleaning should be repeated until 10 full cycles of cleaning and drying have been completed.

3.4 Test specimens should then be cut from the dry-cleaned fabric for testing.

4 ACCELERATED LAUNDERING

4.1 A specimen of the treated fabric should be washed in an automatic commercial washing machine using the commercial detergent, or the preparation of the test specimen should be carried out according with the instructions/recommended method given by the manufacturer.

4.2 The operating cycle outlined in table 1 should be followed.

4.3 The specimen should then be dried in a tumble dryer at a temperature of 80°C.

4.4 The above procedure should be repeated until 10 full cycles of washing and drying have been completed. If the material is to be subjected to a special use, more laundering may be required.

4.5 Where instructions for laundering a fabric are supplied by the manufacturer or finisher, those instructions should be followed in preference to the above procedure which simulates a typical commercial laundering practice.

Table 1 – Operating cycle for accelerated laundering (1)

Operation	Time (min)	Temperature (°C)
1 Sudsing	6	55
2 Sudsing	6	70
3 Sudsing	6	70
4 Bleaching	8	70
5 Rinsing	2	70
6 Rinsing	2	70
7 Rinsing	2	70
8 Rinsing	2	55
9 Blueing	3	40
10 Hydroextraction	3	40

(1) This cycle is intended for white fabrics. For coloured fabrics, the bleaching and blueing operations are omitted and the temperature of the "sudsing" and "rinsing" operations is reduced by 17°C.

5 ACCELERATED WATER LEACHING

5.1 A sample of the treated fabric should be totally submerged in a vessel containing tap water at room temperature for a period of 72 h. The vessel should be capable of use with a liquor ratio of 1:20.

5.2 The water should be drained from the tank and replenished at 24-hour intervals during the immersion period.

5.3 At the conclusion of the immersion period, the sample should be removed from the test vessel and dried in a tumble dryer or oven at a temperature of about 70°C.

6 ACCELERATED WEATHERING

Either a suitable accelerated weathering procedure using a xenon lamp or one of the following described procedures may be called for by the responsible Administration.

6.2 Alternative procedure No.1

6.2.1 Apparatus:

.1 the apparatus should consist of a vertical metal cylinder fitted with a vertical carbon arc at its centre and having a specimen holder mounted within;

.2 the diameter of the cylinder should be such that the distance to the face of the specimen holder from the centre of the carbon arc is 375 mm;

.3 the cylinder should be arranged to rotate about the arc at a rate of approximately one revolution per minute;

.4 a water spray should be provided within the cylinder and fitted with means to regulate the amount of water discharged;

.5 the vertical carbon arc should be either 13 mm diameter solid electrode type, if operating on direct current, or a single-cored electrode, if operating on alternating current. The electrodes should be of uniform composition; and

.6 the arc should be surrounded by a clear globe of quartz glass, 1.6 mm thick, or other enclosure having equivalent absorbing and transmitting properties.

6.2.2 Operation of the test equipment:

.1 the specimens for test should be mounted on the inside of the cylinder facing the arc;

.2 the cylinder should rotate at approximately one revolution per minute for the duration of the test;

.3 the water spray should discharge about 0.0026 m^3/min on to the specimens for about 18 min during each 120-minute period;

.4 the arc should operate on 13 A direct current or 17 A, 60 Hz alternating current, with voltage at the arc of 140 V;

.5 the electrodes should be renewed at intervals sufficiently frequent to ensure full operative conditions of the lamp; and

.6 the globe should be cleaned when the electrodes are removed or at least once in each 36 h of operation.

6.2.3 Test cycle:

.1 specimens should be subjected to this exposure for 360 h;

.2 specimens should then be allowed to dry thoroughly at a temperature of between 20°C and 40°C; and

.3 after drying, the specimens should proceed through the flame test.

6.3 Alternative procedure No.2

6.3.1 Apparatus:

.1 the apparatus should consist of a vertical carbon arc mounted at the centre of a vertical cylinder;

.2 a rotating rack should be mounted on the inside of the cylinder such that the distance from the face of the specimen to the centre of the arc is 475 mm;

.3 the arc should be designed to accommodate two pairs of carbon electrodes No.22 upper electrodes and No.13 lower electrodes. However, the arc should burn between only one pair of electrodes at a time;

.4 no filters or enclosures should be used between the arcs and the specimens; and

.5 spray nozzles should be mounted in the cylinder so that the specimens should be exposed to wetting for about 18 min during each 120-minute period.

6.3.2 Operation of test equipment:

.1 the specimens for test should be mounted on the rotating rack, facing the arc;

.2 the rack should rotate about the arc at a uniform speed of about one revolution per minute;

.3 the arc should operate on 60 A and 50 V across the arc for alternating current or 50 A and 60 V across the arc for direct current; and

.4 water-spray nozzles should discharge about 0.0026 m^3/min on to the specimens for about 18 min during each 120-minute period.

6.3.3 Test cycle:

.1 specimens should be subjected to this exposure for 100 h;

.2 they should then be allowed to dry thoroughly at a temperature of between 20°C and 40°C; and

.3 after drying, the specimens should proceed through the flame test.

PART 8 – TEST FOR UPHOLSTERED FURNITURE

1 APPLICATION

Where upholstered furniture is required to have qualities of resistance to the ignition and propagation of flame, the upholstered furniture shall comply with this part.

2 FIRE TEST PROCEDURES

The upholstered furniture shall be tested and evaluated in accordance with the fire test procedure specified in appendix 1 to this part.

3 PERFORMANCE CRITERIA

3.1 Smouldering cigarette test

3.1.1 Two smouldering cigarette tests are required, as specified in paragraph 7.2 of appendix 1.

3.1.2 If progressive smouldering or flaming is not observed within a one-hour period, or if the cigarette fails to smoulder its complete length, record a pass result for the smouldering cigarette test unless the test piece fails the final examination, as specified in paragraph 7.4 of appendix 1.

3.2 Flame ignition source test

3.2.1 Two propane flame ignition tests are required, as specified in paragraph 7.3 of appendix 1.

3.2.2 If flaming or progressive smouldering is not observed in this test, record a pass result for the propane flame ignition source test unless the test piece fails the final examination, as specified in paragraph 7.4 of appendix 1.

4 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.

5 TEST REPORT

The test report shall include the information contained in paragraph 8 of appendix 1.

APPENDIX 1

FIRE TEST PROCEDURES FOR THE IGNITABILITY BY SMOKERS' MATERIALS OF UPHOLSTERED COMPOSITES FOR SEATING

WARNING – HEALTH AND SAFETY OF OPERATORS

General

There is a considerable risk with these tests and precautions must be taken.

Enclosure

For safety, the tests shall be conducted in a suitable fume cupboard. If such a cupboard is not available, an enclosure shall be constructed so that the tester is not exposed to the fumes (see paragraph 7.1.1).

Extinguishers

Accessible means of extinguishing the samples shall be provided, for example a bucket of water, a fire blanket, or fire extinguisher.

1 SCOPE

This test procedure prescribes methods for assessing the ignitability of material combinations, e.g., covers and filling used in upholstered seating when subjected to either a smouldering cigarette or a lighted match as might be applied accidentally in the use of upholstered seats. It does not cover ignition caused by deliberate acts of vandalism.

2 DEFINITION

For the purposes of this test procedure, the following definition applies.

Progressive smouldering means an exothermic oxidation not accompanied by flaming which is self-propagating, i.e. independent of the ignition source. It may or may not be accompanied by incandescence.

> **Note**: In practice it has been found that there is usually a clear distinction between materials which may char under the influence of the ignition source but which do not propagate further (non-progressive) and those where smouldering develops in extent and spreads (progressive).

3 PRINCIPLE

The principle is to subject an assembly of upholstery materials arranged to represent, in stylized form, the joint between the seat and back (or seat and arm) surfaces of a chair to two sources of ignition, one being a smouldering cigarette, and the other a flaming source approximating to the calorific output of a burning match.

4 APPARATUS

4.1 Test rig

4.1.1 A suitable test rig is illustrated in figures 1 and 2. It shall consist of two rectangular frames hinged together and capable of being locked at right angles to each other.

The frames shall be made from nominal 25 mm x 3 mm steel flat bar and shall securely hold expanded steel platforms set 6 ± 1 mm below the top edge of the frames.

> **Note**: The size of the mesh of the expanded steel is not critical, but a mesh size across the diagonals of approximately 28 mm x 6 mm has been found to be suitable.

4.1.2 The internal width and height of the back frame shall be 450 ± 2 mm x 300 ± 2 mm and the width and depth of the base frame 450 ± 2 mm x 150 ± 2 mm. A standard edging section may be used around the expanded steel to give protection and greater rigidity.

4.1.3 The sides of the frame shall extend beyond the back of each frame to provide for the hinge holes and to form the back legs. The hinge rod shall be of nominal 10 mm diameter steel, continuous across the back of the rig, and its axis 22.5 ± 0.5 mm beyond the back member of each frame.

4.1.4 The frames shall be lockable at right angles by a bolt or pin through each of the pairs of members forming the back legs. The front legs may be welded across the front corners of the base frame. The height of the legs shall be such as to leave a gap not less than 50 mm high between the base frame and the supporting surface.

4.1.5 For the tests, the rig shall be sited within the enclosure (see paragraph 7.1.1) and the testing shall be performed in a substantially draught-free environment permitting an adequate supply of air.

4.2 Smouldering cigarette source

4.2.1 An untipped cigarette, complying with the following requirements, is needed:

length	70 ± 4 mm
diameter	8 ± 0.5 mm
mass	0.95 ± 0.15 g
smouldering rate	11 ± 4.0 min/50 mm

4.2.2 The smouldering rate shall be verified, as follows, on one sample from each batch of 10 cigarettes used. Mark the cigarette, conditioned as described in paragraph 5.1, at 5 mm and 55 mm from the end to be lit. Light it as described in paragraph 7.2.1 and impale it horizontally in draught-free air on a horizontal wire spike inserted not more than 13 mm into the unlit end. Record the time taken to smoulder from the 5 mm mark to the 55 mm mark.

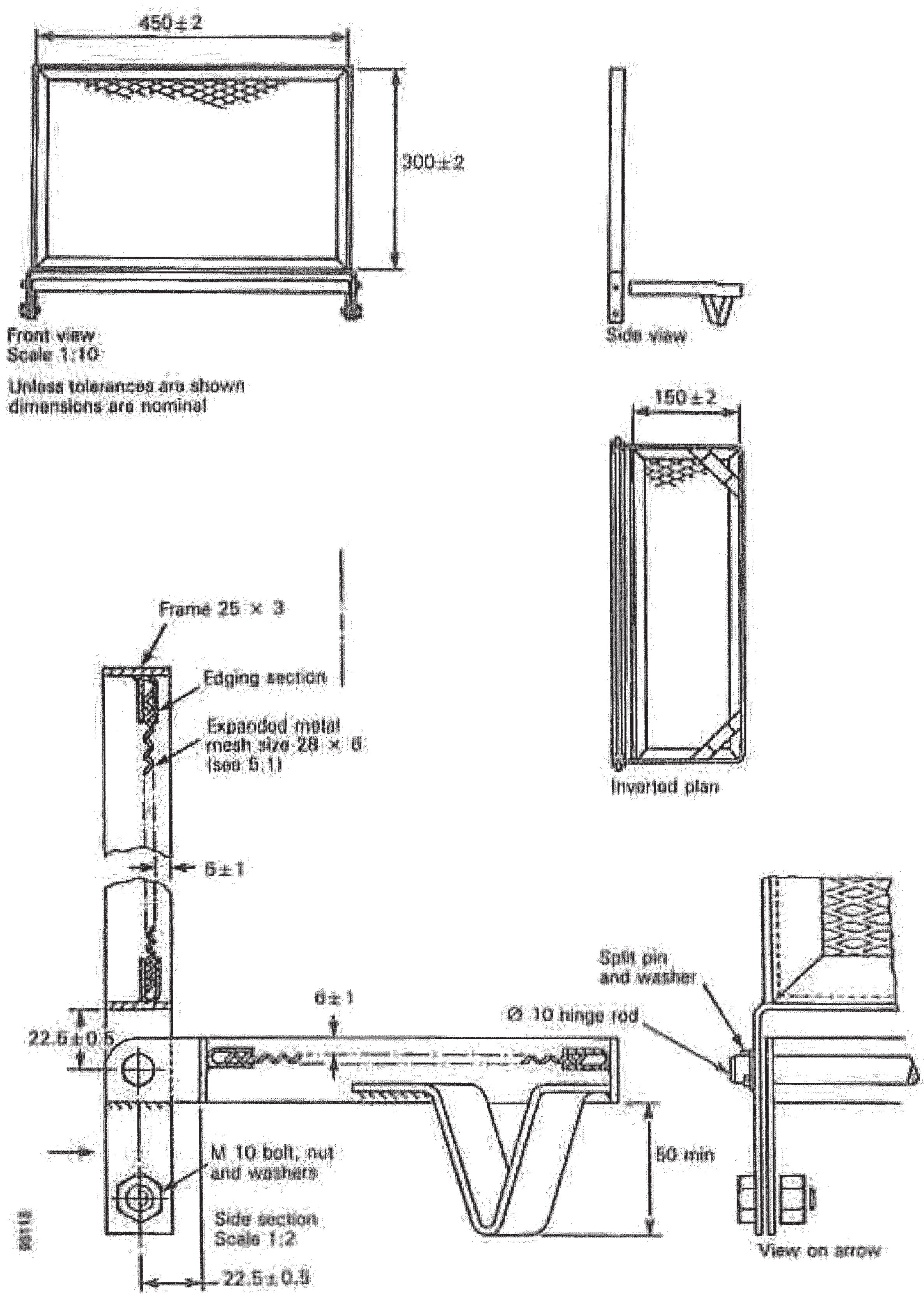


Figure 1 – Test rig

(All dimensions are in millimetres. All parts are of steel.)

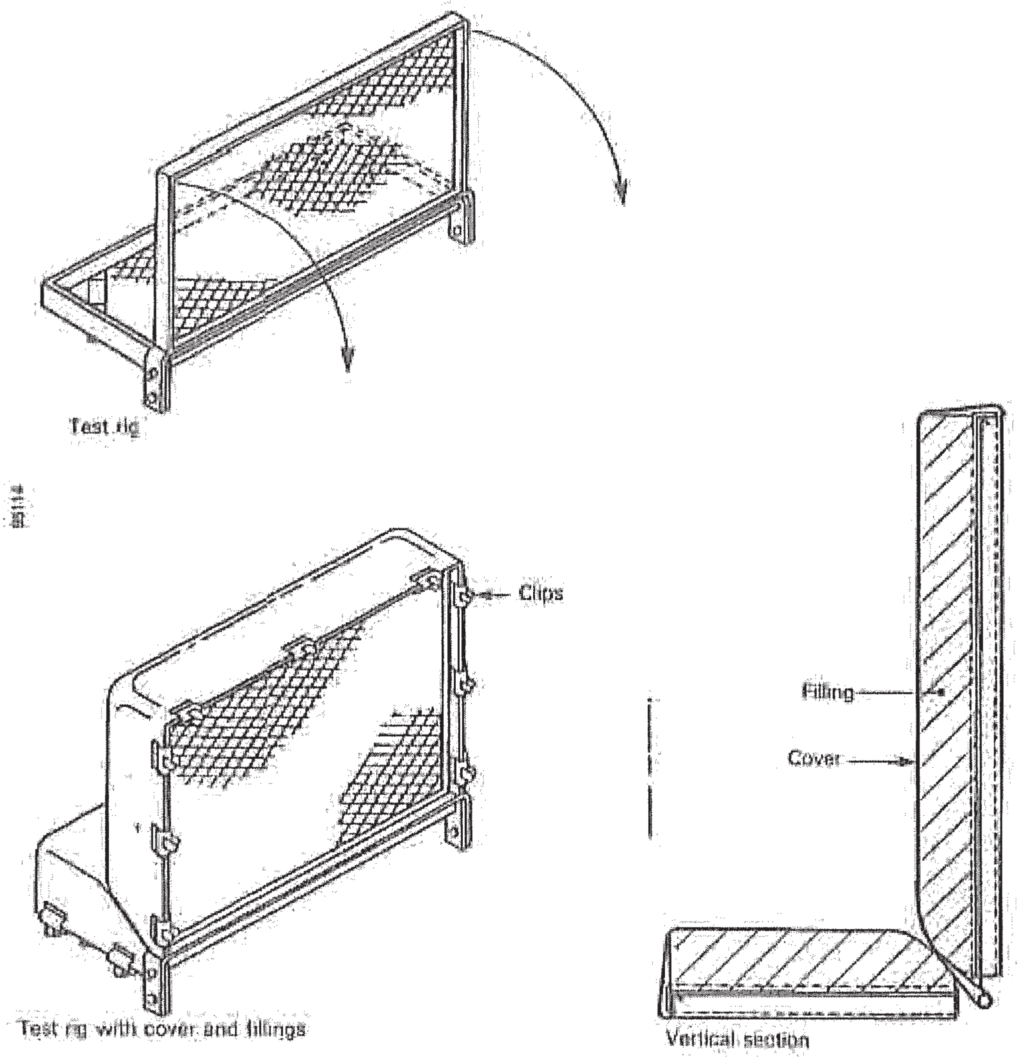


Figure 2 – Test rig assembly

4.3 Propane flame ignition source

Note: This source has been designed to give a calorific output approximating to that of a burning match.

The burner is a tube of stainless steel with internal diameter 6.5 ± 0.1 mm, outside diameter 8 ± 0.1 mm and length 200 ± 5 mm. The fuel shall be propane gas of 95% purity. Fuel supply rate: 6.38 ± 0.25 g/hour at 20°C.

5 ATMOSPHERE FOR CONDITIONING AND TESTING

5.1 Conditioning

The materials to be tested and the cigarettes shall be conditioned immediately before the test for 72 h in indoor ambient conditions and then for at least 16 h in an atmosphere having a temperature of 23 ± 2°C and a relative humidity of 50 ± 5%.

5.2 Testing

For testing, a substantially draught-free environment, having a temperature of 20 ± 5°C and a relative humidity of 20% to 70%, shall be used.

6 TEST PIECES

6.1 General

The test piece materials shall be representative of the cover, filling and any other components to be used in the final assembly.

6.2 Cover material and fabric interliner

6.2.1 The cover size needed for each test is 800 ± 10 mm x 650 ± 10 mm. The long dimension shall be cut parallel to the selvage. The cover may be constructed from smaller pieces of material provided that the resulting seams are not located within 100 mm of the area likely to be affected by the test.

6.2.2 The cover shall have triangular cut-outs, so that the peaks of the triangle are placed 325 mm from one end on both sides. The cut-outs shall be so positioned that when assembled on the test rig the lie of any pile is down the back assembly and from the hinge to the front of the base frame. The size of these cut-outs shall be approximately 50 mm base and 110 mm high.

6.2.3 Where a fabric interliner is used, it shall be cut to the same dimensions and in the same orientation as the cover for fitting to the test rig under the cover.

6.3 Upholstery filling

6.3.1 Two pieces, one 450 ± 5 mm x 300 ± 5 mm x 75 ± 2 mm thick, and the other 450 ± 5 mm x 150 ± 5 mm x 75 ± 2 mm thick are required for each test.

6.3.2 Some cushioning assemblies may consist of several layers that may be typically felt, wadding or different foams. In these cases the test pieces shall reproduce the upper 75 mm of the cushioning assembly.

6.3.3 Where the filling is less than 75 mm thick, the test piece shall be built up to the required thickness by adding to the underside a further layer of the bottom material.

7 TEST PROCEDURE

7.1 Preparation

7.1.1 All tests shall be carried out in a suitably-constructed fume enclosure, and ensure that the means of extinguishment are close at hand (see Warning section).

7.1.2 Open out the test rig and thread the covering fabric and, if any, the fabric interliner behind the hinge bar.

7.1.3 Place the filling pieces under the covering fabric and, if any, the fabric interliner locating the filling pieces in the frame recesses, and allowing approximately 20 mm of fabric to wrap round the inside of the frames.

7.1.4 Lock the frames at right angles using the bolts or pins ensuring that the filling components are not displaced.

7.1.5 Fasten the fabric over the top, bottom and sides of the frame using clips and ensure that the fabric or fabrics are secured and under even tension.

7.2 Smouldering cigarette test

7.2.1 Light a cigarette (see paragraph 4.2) and draw air through it until the tip glows brightly. Not more than 8 mm of the cigarette shall be consumed in this operation.

7.2.2 Place the smouldering cigarette in position along the junction between the vertical and horizontal test pieces, allowing at least 50 mm from the nearest side edge, or from any marks left by any previous test to the cigarette, and simultaneously start the clock.

7.2.3 Observe the progress of combustion, and record any evidence of progressive smouldering (see paragraph 2) or flaming in the interior and/or cover.

> **Note**: The detection of smouldering may be difficult and is made easier if a watch is kept for smoke emerging at points at a distance from the cigarette. Smoke is most easily viewed by looking down a rising column by means of a mirror.

7.2.4 If progressive smouldering or flaming of the upholstery components is observed at any time within 1 h of the placement of the cigarette, extinguish the test piece and record a fail result for the smouldering cigarette test.

7.2.5 If progressive smouldering or flaming is not observed within the one-hour period, or if the cigarette fails to smoulder its complete length, repeat the test with a new cigarette placed in a fresh position not less than 50 mm from any previous test damage. If progressive smouldering or flaming is not observed in this retest, or if the cigarette fails to smoulder its complete length, record a pass result for the smouldering cigarette test unless the test piece fails the final examination specified in paragraph 7.4. Otherwise, extinguish the test piece and record a fail result.

> **Note**: This repeat test may run concurrently with the first test.

7.3 Propane flame test

7.3.1 Light the propane emerging from the burner tube, adjust the gas flow to the appropriate rate (see paragraph 4.3) and allow the flame to stabilize for at least 2 min.

7.3.2 Position the burner tube axially along the junction between the seat and back so that the flame is not less than 50 mm from the nearest side edge, or from any marks left by any previous test, and simultaneously start the clock.

7.3.3 Allow the gas to burn for a period of 20 ± 1 s, and then terminate by carefully removing the burner tube from the test pieces.

7.3.4 Observe for flaming or progressive smouldering (see paragraph 2) in the interior and/or cover. Disregard flames, afterglow, smoking or smouldering that cease within 120 s of the removal of the burner tube.

7.3.5 If flaming or progressive smouldering of the upholstery components is observed, extinguish the test piece. Record a fail result for the propane flame ignition source test.

7.3.6 If flaming or progressive smouldering is not observed, repeat the test at a fresh position, as described in paragraph 7.3.2. If flaming or progressive smouldering is not observed in this retest, record a pass result for the propane flame ignition source test unless the test piece fails the final examination specified in paragraph 7.4. Otherwise extinguish the test piece and record a fail result.

7.4 Final examination

Cases of progressive smouldering undetected from the outside have been reported. Immediately after completion of the test programme on the assembly, dismantle and examine it internally for progressive smouldering. If this is present, extinguish the test piece and record a fail result for the relevant test source. For safety reasons, ensure that all smouldering has ceased before the rig is left unattended.

8 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with part 8 of the 2010 FTP Code (see also subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

.7 type of the furniture, e.g., seat, sofa, office chair, etc;

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including, as applicable:

  .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 threads per inch in both warp and weft;

    .4 yarn number count;

.5 thickness of the fabric in mm;

.6 mass: weigh per unit area (g/mm^2);

.7 colour and tone: if the product has a pattern, the representative colour shall be described; and

.8 fire retardant treatment;

.2 fillings:

.1 material (name of the manufacturer, type designation);

.2 density: weight per unit volume (kg/m^3) and for products where thickness is difficult to measure exactly square density (g/m^2); and

.3 fire retardant treatment, if any;

.11 description of the specimen including dimensions and mass of the fabric and the fillings, colour, orientation of the fabric;

.12 date of sample arrival;

.13 details of specimen conditioning including type of cleaning and weathering procedures used and information of the detergent used, if applicable;

.14 date of test;

.15 test results including:

.1 dimensions and mass of cigarette used;

.2 smouldering rate of the cigarette used;

.3 extent of damage (burning and/or char) of specimen measured from the ignition source; and

.4 occurrence of progressive smouldering;

.16 observations made during the test;

.17 determination whether the tested material meets the performance criteria in paragraph 3 of this part; and

.18 the statement:

"The test results relate 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 2

GUIDANCE NOTES

1 This test procedure prescribes methods for examining the ignitability, in defined circumstances, of an assembly of upholstery materials. These materials are combined together in a way intended to be generally representative of their end use in upholstered seating, and the ignition sources are a smouldering cigarette and a flame representing a burning match.

1.1 Thus, the potential ignitability of a particular cover, filling and interliner in combination can be assessed and this will allow the development of specifications concerned with ignition by smokers' materials. However, there are two important limitations, as follows:

.1 the tests are concerned only with ignitability, and any controls of fire hazard have to consider, in addition, other aspects of fire performance such as rate of fire development, heat output, rate and quantity of smoke production and toxic gas evolution. Ideally, any attempts to reduce ignitability ought not to affect these other properties adversely; and

.2 the tests only measure the ignitability of a combination of materials used in upholstered seating and not of a particular finished item of furniture incorporating these materials. They give an indication of, but cannot guarantee, the ignition behaviour of the finished item of furniture. This limitation occurs because design features of the furniture can greatly affect its fire properties; any ignitability tests of a piece of furniture would therefore need to be carried out on the actual item and not on component materials or mock-ups. However, limited information on ignitability more specifically related to an intended design may be obtained, as indicated in paragraphs 2 and 3.

2 This test procedure prescribes laboratory tests for an assembly of materials which will give general guidance on the ignitability of finished furniture. Where more specific information is required, or in critical areas of end use, the principles may be applied to complete items or components of furniture or to suitably modified test assemblies, some examples of which are given below. In such cases the sources of ignition described in paragraphs 4.2 and 4.3 of appendix 1 may be applied at positions which, as a general rule, correspond to those where the hazard of ignition occurs in use.

Example 1: If a chair were to have a gap between the seat and back cushions, the placement of ignition sources in the angle of the test apparatus would be inappropriate. Instead, face ignition, where the sources are placed at the centre of the horizontal and vertical surfaces, would be more meaningful.

Example 2: The test apparatus may be used to model the junction of any vertical and horizontal surfaces so that both arm and back constructions, if different, may be tested separately in conjunction with the seat.

Example 3: The use of different materials in a back and seat of a chair may be reproduced in the test, two different cover fabrics being joined by sewing or staples behind the hinge bar.

Example 4: If, in the final design, a loose cushion is to be placed on an upholstered seat platform, additional cigarette traps are produced between the loose cushion and the surrounding upholstery. This may be examined by constructing a loose cushion of the appropriate materials measuring 500 ± 5 mm x 75 ± 2 mm to be placed on top of the horizontal surface of the normally assembled test arrangement.

3 Another way in which this test principle might be used is to give information about individual materials to be used in a combination. For example, the ability of a cover material to provide protection against ignition can be indicated by testing it in combination with a substrate of known flammability; standard non-flame-retardant flexible polyester foam with a density of about 22 kg/m^3 has been found to be suitable. Such information about the individual materials does not eliminate the need to test the actual combination, but it can help in the short-listing of material combinations and so reduce the overall amount of testing required.

APPENDIX 3

GUIDE FOR INDEPENDENT TEST FOR COVER AND FILLING MATERIALS

SEPARATE OPTIONAL TESTS FOR EACH MATERIAL (COVER MATERIAL AND FILLING MATERIAL)

1 Independent test for cover material (check the ability of the cover material)

1.1 The cover material should be tested on non-flame-retardant filling material. If tested on other flame-retardant filling materials, the cover will be approved for use on that specific filling material only.

1.2 Before carrying out the independent test for cover material, the filling material used for this test should be checked and confirmed whether it would be non-flame-retardant material, which would not satisfy the criteria of this standard. This would be confirmed by the independent test for the filling material described in paragraph 2 below.

2 Independent test for the filling material (check the ability of the filling material)

The test for the filling material should be done without the cover material. If the material satisfies the criteria of this standard, it would be considered that such material would have sufficient performance as a filling material for "upholstered furniture", and it would also be considered that such material is not suitable as a standard non-flame-retardant filling material for a stand-alone test for cover material, described above.

3 Type approval for "upholstered furniture"

3.1 Type approval for "upholstered furniture" might be applied by the combination of the covering and filling. But if both materials, cover and filling material, could pass the criteria of this standard and have sufficient test reports for each individual material as evidence of the independent test, an additional test for the actual combination would not be required.

3.2 The Administration may specify that they will only recognize one of the options for their approval.

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 PROCEDURES

The bedding components shall be tested and evaluated in accordance with the fire test procedure specified in the appendix to this part.

3 PERFORMANCE CRITERIA

The bedding component is classified as not readily ignitable if it shows no progressive smouldering ignition as specified in paragraph 10.1 of the appendix or flaming ignition as specified in paragraph 10.2 of the appendix.

4 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 basic product or the treatment procedure changes, a new test is required.

5 TEST REPORT

The test report shall include the information described in paragraph 11 of the appendix.

APPENDIX

FIRE TEST PROCEDURES FOR IGNITABILITY OF BEDDING COMPONENTS

INTRODUCTION

The test specified in this method deals with a simple presentation of a particular aspect of the potential fire situation typified by smouldering cigarettes and a match equivalent flame exposure to the product. The test alone cannot provide any direct guidance on behaviour or safety in other types of accidents, like exposure to larger sources of flames. A test of this type may, however, be used to make comparisons or to ensure the existence of a certain characteristic considered to have a bearing on fire performance in general. No other significance shall be attached to performance in this test.

SAFETY WARNING

The attention of all users of the test is drawn to the following warning:

> In order that suitable precautions may be taken to safeguard health, the attention of all engaged with fire testing is drawn to the fact that toxic or harmful gases may be released during combustion of test specimens.

1 SCOPE

The method specifies a procedure to determine the ignitability of bedding components with small smouldering and flaming sources of ignition.

2 FIELD OF APPLICATION

2.1 The method is intended for testing bedding components such as blankets, quilts, bedspreads, pillows and mattresses, including thin, light mattresses used on top of other mattresses.

2.2 The following items shall be included in bedding components: bed drapes, duvets, comforters.

2.3 The following items shall not be included in bedding components: sheets, pillow cases, box springs, valances (dust ruffles), and bed curtains.

3 DEFINITIONS

3.1 *Mattress* is a product in the form of a resilient material (for instance, polyurethane foam or light fibre fill) or of padding materials in combination with steel springs (spring mattress), enveloped by a cover.

3.2 *Quilt* and *pillow* are products of padding materials (down/feather or textile fibre) enveloped by a textile fabric.

3.3 *Ticking* is a fabric enveloping the resilient material in a mattress.

3.4 *Ignitability* is a measure of the ease with which a material or a product can be ignited so as to flame or progressively smoulder.

3.5 *Ignition source* is a source of energy which is used to ignite combustible materials or products.

3.6 *Flaming* is undergoing combustion in the gaseous phase, usually with emission of light.

3.7 *Smouldering* is an exothermic reaction taking place in a material without flaming, with or without emission of light.

3.8 *Progressive smouldering* is smouldering which continues after the ignition source is extinguished or removed.

4 SAMPLING

The specimens shall be representative of the whole product to be tested. If possible, the specimens shall be taken in such a way that ignition can also be started along seams and their intersections. The top side is exposed. Where there is doubt as to which side is the top side, the test shall be carried out on both sides. Four additional specimens are then needed.

4.1 Mattresses

4.1.1 Sufficient material shall be available for making at least four specimens with dimensions 450 mm x 350 mm in full nominal thickness. The cover shall envelop the mattress completely without wrinkles and shall be secured underneath (for instance, with steel pins).

4.1.2 For testing of mattresses with removable covers, sufficient material shall be available for the making of at least eight specimens, four with and four without the mattress cover, with dimensions 450 mm x 350 mm in full nominal thickness.

4.2 Pillows

Four samples in full size shall be available.

4.3 Other than mattresses and pillows

4.3.1 Four specimens each of size 450 mm x 350 mm shall be cut from each sample.

4.3.2 If the product contains loose filling material, the edges shall be sewn. It is advisable to sew the seams before cutting the specimens in order to avoid loss of filling material.

5 TEST METHOD

5.1 Principle

The test is carried out with the specimen placed in a horizontal position on a test rig. The ignition source is placed on top of the specimen. The determination of the ignitability is carried out using smouldering and flaming ignition sources. A smoulderable insulation of cotton-wool pad on a smouldering cigarette is used as a smouldering ignition source, which is intended to simulate possible smoulderable materials used in bedding. The flaming ignition source is a small propane flame. The ignition of the specimen in progressive smouldering or flaming is observed.

5.2 Apparatus and material

The following equipment and material are necessary for the test:

.1 the test rig for support of the specimen is shown in figure 1. The stand is made of angle iron with nominal dimensions 25 mm x 25 mm x 3 mm. On top of the stand is a platform of wire mesh with openings of nominal dimensions 100 mm x 50 mm;

.2 mineral wool with a nominal density of 60 kg/m^3 and with dimensions 450 mm x 350 mm x 50 mm;

.3 stop clock;

.4 test enclosure, being either a room with a volume greater than 20 m^3 (which contains adequate oxygen for testing), or a smaller enclosure with a through flow of air. Inlet and extraction systems providing air speed of 0.02 m/s to 0.2 m/s in the locality of the rig provide adequate oxygen without disturbing the burning behaviour;

.5 ignition sources: the sequent ignition sources used are a smouldering cigarette covered with a cotton-wool pad and an open flame;

.6 cigarettes: for the tests, cigarettes with the following specifications shall be used:

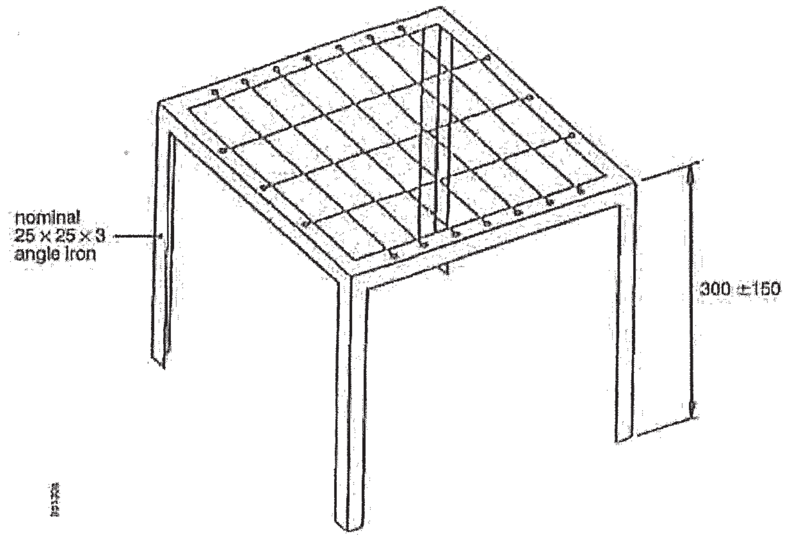
length	70 ± 4 mm
diameter	8 ± 0.5 mm
mass	0.95 ± 0.15 g
smouldering rate	11 ± 4.0 min/50 mm

The smouldering rate shall be verified for every carton of 20 cigarettes as follows:

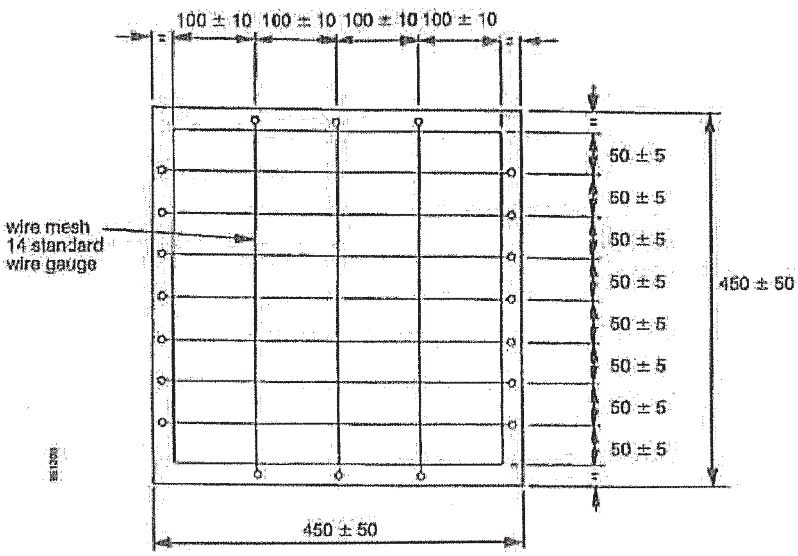
The cigarettes are conditioned as described below under paragraph 7. One cigarette is marked at distances 5 mm and 55 mm from one end. The cigarette is ignited at the end with the 5 mm distance marking, and the air is drawn through the cigarette until a clear glow is observed, but not further than on to the 5 mm marking, thereafter the cigarette is impaled horizontally on a wire spike inserted not more than 13 mm into the unlit end. The time is recorded for the smouldering from the 5 mm to the 55 mm marks;

.7 cotton-wool pad: the cigarette shall be covered with a pad of cotton wool of nominal dimensions 150 mm x 150 mm x 25 mm and of weight 20 ± 6.5 g. The cotton wool shall consist of new, undyed and soft fibres without any admixtures or artificial fibres, and it shall be free from thread, leaf and shell fibre dusts. A suitable material for this purpose is packaged in the form of rolls for surgical use. The piece shall be unwrapped from the roll as a single layer 25 mm to 30 mm thick, cut to plan size, then reduced to the correct mass and thickness by removal of loose fibres from the top; and

.8 flame: the burner is a tube of stainless steel with internal diameter 6.5 ± 0.1 mm, outside diameter 8 ± 0.1 mm and length 200 ± 5 mm. The fuel shall be propane gas of 95% purity. Fuel supply rate: 6.38 ± 0.25 g/hour at 20°C.



(a) Platform showing extended legs



(b) Spacing of wire mesh platform

Figure 1 – Test rig

6 PREPARATION OF SPECIMEN

If the blankets, quilts, pillows, thin light mattresses or removable covers are sold as flame retardant, they shall be tested after three cleaning treatments carried out according to one of the following as determined by the Administration:

.1 instructions given by the manufacturer;

.2 a procedure described in standard ISO 6330; or

.3 the commercial detergent.

7 CONDITIONING

The materials to be tested, the cigarettes used as ignition sources and the insulating cotton-wool pads shall be conditioned immediately before testing for 72 h in indoor ambient conditions and then for at least 16 h in an atmosphere having a temperature of 23 ± 2°C and 50 ± 5% relative humidity.

8 TEST PROCEDURES

The test is carried out indoors, in an environment essentially free of air currents. The room temperature shall be 20 ± 5°C and 20 to 70% relative humidity. The mattress specimen is placed directly on the test rig. The blanket, pillow, quilt or thin, light mattress specimen is placed on the mineral wool which is laid on the test rig. The ignition source is placed on top of the specimen. The time is measured from the moment the ignition source is placed on the specimen. The test duration is 1 h from the moment the ignition source is placed on the specimen.

8.1 Testing with smouldering ignition sources

The cigarette is lighted and air is drawn through the cigarette until it glows brightly. Not less than 5 mm and not more than 8 mm of the cigarette shall be consumed in this operation. The cigarette is placed on the specimen at a distance of at least 100 mm from the nearest edge of the specimen or from marks left by any previous test. The cotton-wool pad is placed centrally on the cigarette, and the clock is started. The progress of combustion is observed and any evidence of progressive smouldering ignition (see paragraph 10.1) or of flaming ignition (see paragraph 10.2) of the specimen is recorded. Two separate tests are carried out with the cigarette covered with the cotton-wool pad. On specimens with stitching, one test is carried out with the cigarette placed along a stitching, and one test is carried out with the cigarette placed on a smooth surface if possible.

8.2 Testing with flame as ignition source

The gas is ignited and the gas flow adjusted to the rate indicated in paragraph 5.2.8. The flow is allowed to stabilize for at least 120 s. The burner is placed horizontally on the specimen at a distance of at least 100 mm from any edge of the specimen and not less than 50 mm from any marks left from previous tests. The specimen shall be exposed to the ignition flame for 20 s. The exposure is terminated by carefully removing the burner from the specimen. The progress of combustion is observed and any evidence of progressive smouldering ignition (see paragraph 10.1) or of flaming ignition (see paragraph 10.2) of the specimen is recorded. Two separate tests are carried out. On specimens with stitching, one test is carried out with the burner placed along a stitching, and one test is carried out with the burner placed on a smooth surface if possible.

9 EXPRESSION OF TEST RESULTS

9.1 All time observations are expressed in minutes and seconds elapsed from the start of the test. The test results include:

.1 the behaviour of the specimen during and immediately after the specified test period;

.2 flames or detectable amounts of smoke, heat or glowing during and immediately after the specified test period; and

.3 damages to the specimen after the test is finished, measured in millimetres.

9.2 The results obtained from each individual test shall be reported separately.

10 CRITERIA FOR IGNITABILITY

10.1 Progressive smouldering

For the purpose of this test method, all the types of behaviour described below in subparagraphs .1 to .5 are considered to be progressive smouldering ignition:

.1 any test specimen that produces externally detectable amounts of smoke, heat or glowing after a period of 1 h following the application of the ignition source;

.2 any test specimen that displays escalating combustion behaviour so that it is unsafe to continue the test and requires forcible extinction;

.3 any test specimen that smoulders until it is essentially consumed within the duration of the test;

.4 any test specimen that smoulders to the extremities of the specimen, *viz.* to either side or to the full thickness of the specimen, within the duration of the test. However, all materials having a thickness of 25 mm or less, such as thin, light mattresses, quilts or blankets are allowed to smoulder to the full thickness of the specimen; and

.5 any test specimen that, on final examination, shows evidence of smouldering other than discoloration more than 25 mm in any horizontal direction from the nearest part of the original position of the edge of the cotton-wool pad and open flame ignition source.

10.2 Flaming ignition

10.2.1 ***Mattresses***

For the purpose of this test method, all the types of behaviour described below in subparagraphs .1 to .5 are considered to be flaming ignition:

.1 the occurrence of any flames initiated by a smouldering ignition source;

.2 any test specimen that continues to flame for more than 150 s after removal of the igniting flame;

.3 any test specimen that displays escalating combustion behaviour, so that it is unsafe to continue the test and requires forcible extinction;

.4 any test specimen that burns until more than 66% consumed within 150 s after removal of the igniting flame; and

.5 any test specimen that burns to the extremities of the specimen, *viz.* to either side or to the full thickness of the specimen, within the duration of the test.

10.2.2 ***Blankets, quilts, pillows and thin, light mattresses***

For the purpose of this test method, all the types of behaviour described below in subparagraphs .1 to .5 are considered to be flaming ignition:

.1 the occurrence of any flames initiated by a smouldering ignition source;

.2 any test specimen that continues to flame for more than 150 s after removal of the igniting flame;

.3 any test specimen that displays escalating combustion behaviour, so that it is unsafe to continue the test and requires forcible extinction;

.4 any test specimen that burns until more than 66% consumed within 150 s after removal of the igniting flame; and

.5 any test specimen that burns to either side of the specimen within the duration of the test.

10.3 Classification

The bedding component is classified as not readily ignitable if it shows no progressive smouldering ignition or flaming ignition as specified in paragraphs 10.1 and 10.2.

11 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with part 9 of the 2010 FTP Code (see also subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

.7 type of the material, i.e. mattress, blankets, quilts, pillows, thin, light mattresses or removable covers, etc.;

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including, as applicable:

.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 threads per inch in both warp and weft;

.4 yarn number count;

.5 thickness of the fabric in mm;

.6 mass: weight per unit area (g/mm^2);

.7 colour and tone: if the product has a pattern, the representative colour shall be described; and

.8 fire-retardant treatment;

.2 fillings:

.1 material (name of the manufacturer, type designation);

.2 density: weight per unit volume (kg/m^3) and for products where thickness is difficult to measure exactly, square density (g/m^2); and

.3 fire-retardant treatment, if any;

.11 description of the specimen including dimensions and mass of the fabric and the fillings, colour, orientation of the fabric;

.12 date of sample arrival;

.13 details of specimen conditioning including type of cleaning and weathering procedures used and information of the detergent used, if applicable;

.14 date of test;

.15 test results including:

.1 dimensions and mass of cigarette used;

.2 smouldering rate of the cigarette used;

.3 extent of damage (burning and/or char) of specimen measured from the ignition source;

.4 occurrence of progressive smouldering; and

.5 occurrence of flaming ignition;

.16 observations made during the test;

.17 determination whether the tested material meets the performance criteria in paragraph 3 of this part; and

.18 the statement:

"The test results relate 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.".

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 AND CRITERIA FOR FIRE-RESTRICTING MATERIALS

2.1 General

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 by the provisions of the 1994 HSC Code or 2000 HSC Code shall be tested and evaluated in accordance with the fire test procedures specified in appendix 1 to this part.

2.2 Definition of fire-restricting materials

Fire-restricting materials is as defined in the 2000 HSC Code.

2.3 Surface materials on bulkheads, wall and ceiling linings, including their supporting structure

2.3.1 ***Test procedures***

Surface materials on bulkheads, wall and ceiling linings, including their supporting structure shall be tested to standard ISO 9705 as described in appendix 1 to this part. Bulkheads, wall and ceiling linings shall be tested in their end-use configuration, including any surface finish materials.

2.3.2 ***Criteria***

Surface materials on bulkheads, wall and ceiling linings including their supporting structure are qualified as "fire-restricting material" if, during the testing time of 20 min according to appendix 1 to this part, the following six criteria are met:

.1 the time average of heat release rate (HRR) excluding the HRR from the ignition source does not exceed 100 kW;

.2 the maximum HRR excluding the HRR from the ignition source does not exceed 500 kW averaged over any 30 s period of time during the test;

.3 the time average of the smoke production rate does not exceed 1.4 m^2/s;

.4 the maximum value of the smoke production rate does not exceed 8.3 m^2/s averaged over any period of 60 s during the test;

.5 flame spread shall not reach any further down the walls of the test room than 0.5 m from the floor excluding the area which is within 1.2 m from the corner where the ignition source is located; and

.6 no flaming drops or debris of the test specimen may reach the floor of the test room outside the area which is within 1.2 m from the corner where the ignition source is located.

2.3.3 *Other usage of the materials qualified as "fire-restricting materials"*

Materials which are qualified as "fire-restricting materials" by paragraph 2.3.2 using the test method described in paragraph 2.3.1 may be used for furniture or other components if the material closely represents the configuration tested as a room lining in its actual end use (i.e. similar thickness and surface finish).

2.4 Materials used for furniture and other components

2.4.1 *Test procedures*

Materials used for furniture and other components shall be tested as described in appendix 2 to this part (this does not include vertically supported textiles and films, upholstery, or bedding which shall be tested in accordance with parts 7 to 9, respectively, of this annex).

2.4.2 *Criteria*

Materials used for furniture and other components are qualified as "fire-restricting material" if the following four criteria are fulfilled:

.1 the time to ignition (TIG) is greater than 20 s;

.2 the maximum 30-second sliding average heat release rate (HRR30,max) does not exceed 60 kW/m^2;

.3 the total heat release (THR) does not exceed 20 MJ/m^2;

.4 the time average smoke production rate (SPRavg) does not exceed 0.005 m^2/s.

3 TEST REPORT

The test report shall include the information in paragraph 9 of appendix 1 or paragraph 12 of appendix 2 and designation of the material according to the test criteria specified in paragraph 2 above.

4 REFERENCE DOCUMENTS

ISO 9705, Fire tests – Full-scale room test for surface products.

ISO 5660-1, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method).

ISO 5660-2, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 2: Smoke production rate (dynamic measurement).

ISO 14697, Reaction to fire tests – Guidance on the choice of substrates for building and transport products.

APPENDIX 1

FIRE TEST PROCEDURES – FULL-SCALE ROOM TEST FOR SURFACE MATERIALS ON BULKHEADS, WALL AND CEILING LININGS, INCLUDING THEIR SUPPORTING STRUCTURE, OF HIGH-SPEED CRAFT

Reference document: ISO 9705, Fire tests – Full-scale room test for surface products.

1 SCOPE

1.1 This test procedure specifies a test method that simulates a fire that under well-ventilated conditions starts in a corner of a small room with a single open doorway.

1.2 The method is intended to evaluate the contribution to fire growth provided by a surface product using a specified ignition source.

1.3 The method is especially suitable for products that for some reason cannot be tested in a small laboratory scale, for example thermoplastic materials, the effect of an insulating substrate, joints, surfaces with great irregularity.

1.4 The method is not intended to evaluate the fire resistance of a product.

1.5 A test performed in accordance with the method specified in this appendix provides data for the early stages of a fire from ignition up to flashover.

2 NORMATIVE REFERENCE

The following normative documents contain provisions that when referenced in this text, constitute provisions of this paragraph.

ISO 9705, Fire tests – Full-scale room test for surface products.

ISO 13943, Fire safety – Vocabulary.

3 DEFINITIONS

For the purposes of this appendix, the definitions given in standard IS0 13943 and the following definitions apply.

3.1 *Assembly* is a fabrication of materials and/or composites, for example, sandwich panels.

Note: An assembly may include an air gap.

3.2 *Composite* is a combination of materials which are generally recognized in building construction as discrete entities, for example, coated or laminated materials.

3.3 *Exposed surface* is that surface of the product subjected to the heating conditions of the test.

3.4 *Material* is a basic single substance or uniformly dispersed mixture, for example, metal, stone, timber, concrete, mineral fibre, polymers.

3.5 *Product* is a material, composite or assembly about which information is required.

3.6 *Specimen* is a representative piece of the product which is to be tested together with any substrate or treatment.

Note: The specimen may include an air gap.

3.7 *Surface product* is any part of a building that constitutes an exposed surface on the interior walls and/or the ceiling such as panels, tiles, boards, wallpapers, sprayed or brushed coatings.

4 PRINCIPLE

4.1 The potential for fire spread to other objects in the room, remote from the ignition source, is evaluated by measurements of the total heat flux incident on a heat flux meter located on the centre of the floor.

4.2 The potential for fire spread to objects outside the room of origin is evaluated by the measurement of the total rate of heat release of the fire.

4.3 An indication of the toxic hazard is provided by the measurement of certain toxic gases.

4.4 The hazard of reduced visibility is estimated by the measurement of production of light-obscuring smoke.

4.5 The fire growth is visually graphic and/or video recording.

Note: If further information is required, measurements of the gas temperature in the room and the mass flow in and out the doorway may be performed.

5 TEST APPARATUS

5.1 General

The test apparatus including test room, ignition source, heat flux instrumentation in the fire room, hood and exhaust duct, instrumentation in the exhaust duct, gas sampling and analysis system, optical smoke measurement system and specimen mounting system and other necessary peripherals shall be in accordance with standard ISO 9705. Calibration of the test apparatus shall be conducted in accordance with standard ISO 9705.

5.2 Ignition source

The standard ignition source is according to annex A of standard ISO 9705, i.e. 100 kW heat output for 10 min and thereafter 300 kW heat output for another 10 min. The total testing time shall be 20 min.

5.3 Specimen mounting

Standard specimen configuration is according to annex G to standard ISO 9705, i.e. the product is mounted both on the walls and ceiling of the test room. The product shall be tested complying to end-use conditions, including any surface finish materials or other surface treatments.

6 PREPARATION OF TEST SPECIMENS

6.1 The product to be tested shall, as far as possible, be mounted in the same way as in practical use.

Note: In the standard specimen configuration, three walls and the ceiling are covered with the product. Alternative specimen configurations are given in annex G to standard ISO 9705.

6.2 In cases where the product to be tested is in board form, the normal width, length and thickness of the boards shall be used as far as possible.

6.3 The product shall be attached either to a substrate or directly to the interior of the fire test room. The mounting technique (for example, nailing, gluing, using a support system) shall, as far as possible, conform to that used for the product. The mounting technique shall be clearly stated in the report, particularly if the mounting technique used improves the physical behaviour of the specimen during the test.

6.4 Thin surface materials, thermoplastic products that melt, paints and varnishes shall, depending on their end use, be applied to one of the following substrates:

.1 non-combustible fibre-reinforced silicate board having a dry density of 680 ± 50 kg/m^3;

.2 non-combustible board having a dry density of 1,650 ± 150 kg/m^3;

.3 chipboard (particle board) having a density of 680 ± 50 kg/m^3 after conditioning in an atmosphere of 50 ± 5% relative humidity at a temperature of 23 ± 2°C;

.4 gypsum board having a density of 725 ± 50 kg/m^3 after conditioning in an atmosphere of 50 ± 5% relative humidity at a temperature of 23 ± 2°C; and

.5 the actual substrate if its thermal properties differ significantly from those of substrates described in subparagraphs .1 to .4, for example, steel, mineral wool.

Note: A suitable thickness for substrates described in subparagraphs .1 to .4 is 9 mm to 13 mm.

6.5 Paints and varnishes shall be applied to one of the substrates listed in paragraph 6.4 at the application rate specified by the client.

6.6 Unless non-hygroscopic, specimens shall be conditioned to equilibrium in an atmosphere of 50 ± 5% relative humidity at a temperature of 23 ± 2°C. Equilibrium shall be deemed to be reached when a representative piece of the specimen has achieved constant mass.

Note 1: For wood-based products and products where vaporization of solvents can occur, a conditioning time of at least four weeks can be required.

Note 2: Constant mass is considered to be reached when two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1% of the mass of the test piece or 0.1 g, whichever is the greater.

7 TESTING

7.1 Initial conditions

7.1.1 The temperature in the fire test room and the surrounding area from the start of the installation of specimens until the start of the test shall be 20 ± 10°C.

> **Note:** The time between the removal of the specimens from conditioning and the start of the test shall be kept to a minimum.

7.1.2 The horizontal wind speed measured at a horizontal distance of 1 m from the centre of the doorway shall not exceed 0.5 m/s.

7.1.3 The burner shall be in contact with the corner wall. The surface area of the burner opening shall be clean.

> **Note:** Marking the product with a grid of 0.3 m x 0.3 m on those surfaces adjacent to the corner where the burner is located can help in determining the extent of flame spread.

7.1.4 The product shall be photographed or video-filmed before testing.

7.2 Procedure

7.2.1 Start all recording and measuring devices and record data for at least 2 min prior to the burner being ignited.

7.2.2 Adjust the burner to the output level given in annex A of standard ISO 9705, within 10 s of ignition of the burner. Continuously adjust the exhaust capacity so that all of the combustion products are collected.

7.2.3 A photographic and/or video recording of the test shall be made. A clock shall appear in all photographic records, giving time to the nearest 1 s.

7.2.4 During the test, record the following observations, including the time when they occur:

.1 ignition of the ceiling;

.2 flame spread on wall and ceiling surfaces;

.3 change of the heat output from the burner; and

.4 flames emerging through the doorway.

7.2.5 End the test if flashover occurs or after 20 min, whichever occurs first.

> **Note:** Safety considerations can dictate an earlier termination.

7.2.6 Note the extent of damage of the product after the test.

7.2.7 Record any other unusual behaviour.

8 ANALYSIS AND CALCULATION OF THE TEST RESULTS

Analysis and calculation shall be conducted in accordance with annex F to standard ISO 9705, and the following methods:

.1 the maximum values of smoke production rate at the start and the end of the test shall be calculated as follows: for the first 30 s of testing, use also the values prior to ignition of the ignition source, i.e. zero rate of smoke production, when calculating average. For the last 30 s of testing, use the measured value at 20 min, assign that to another 30 s up to 20 min and 30 s and calculate the average;

.2 the maximum heat release rate (HRR) shall be calculated at the start and the end of the test using the same principles as for averaging the smoke production rate; and

.3 the time averages of smoke production rate and HRR shall be calculated using actual measured values that are not already averaged as described above.

9 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with appendix 1 of part 10 of the 2010 FTP Code (see also subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

.7 type of the material, i.e. surface material on bulkheads, wall or ceiling linings, and description whether and how it includes supporting structure;

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, together with details of the construction of the product;

.11 description of the specimen including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, orientations tested and face subject to the test, and construction;

.12 date of specimen arrival;

.13 details of specimen conditioning;

.14 date of test;

.15 test results (see annex F to standard ISO 9705):

- .1 time/heat flux incident on the meter at the centre of the floor;
- .2 time/volume flow in the exhaust duct;
- .3 time/rate of heat release; and if the burner is included, time/heat release from the burner;
- .4 time/production of carbon monoxide at reference temperature and pressure;
- .5 time/production of carbon dioxide at reference temperature and pressure;
- .6 time/production of light-obscuring smoke at actual duct flow temperature;
- .7 description of the fire development (photographs); and
- .8 calibration results according to paragraph 10.2 of standard ISO 9705;

.16 classification of the material; and

.17 the statement:

"The test results relate 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.".

10 OTHER REFERENCES

The following parts of standard ISO 9705 shall also be referred to:

.1 annex A – Recommended ignition sources;

.2 annex B – Alternative ignition sources;

.3 annex C – Instrumentation of test room;

.4 annex D – Design of exhaust system;

.5 annex E – Instrumentation in exhaust duct;

.6 annex F – Calculation;

.7 annex G – Specimen configurations; and

.8 annex H – Bibliography.

APPENDIX 2

FIRE TEST PROCEDURES FOR HEAT RELEASE, SMOKE PRODUCTION AND MASS LOSS RATE FOR MATERIALS USED FOR FURNITURE AND OTHER COMPONENTS OF HIGH-SPEED CRAFT

Reference documents: ISO 5660-1, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method); and ISO5660-2, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 2: Smoke production rate (dynamic measurement).

1 SCOPE

This paragraph specifies a method for assessing the heat release rate of a specimen exposed in the horizontal orientation to controlled levels of irradiance with an external igniter. The heat release rate is determined by measurement of the oxygen consumption derived from the oxygen concentration and the flow rate in the combustion product stream. The time to ignition (sustained flaming) is also measured in this test.

2 NORMATIVE REFERENCES

The following normative documents contain provisions that, when referenced in this text, constitute provisions of this appendix.

ISO 291, Plastics – Standard atmospheres for conditioning and testing.

ISO 554, Standard atmospheres for conditioning and/or testing – Specifications.

ISO 5660-1, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 1: Heat release rate (cone calorimeter method).

ISO 5660-2, Reaction-to-fire tests – Heat release, smoke production and mass loss rate – Part 2: Smoke production rate (dynamic measurement).

ISO 13943, Fire safety – Vocabulary.

ISO 14697, Reaction to fire tests – Guidance on the choice of substrates for building and transport products.

3 TERMS AND DEFINITIONS

For the purposes of this appendix, the terms and definitions given in standard ISO 13943 and the following apply.

3.1 *Essentially flat surface* is a surface whose irregularity from a plane does not exceed 1 mm.

3.2 *Flashing* is an existence of flame on or over the surface of the specimen for periods of less than 1 s.

3.3 *Ignition* is an onset of sustained flaming as defined in paragraph 3.10.

3.4 *Irradiance* (at a point on a surface) is a quotient of the radiant flux incident on an infinitesimal element of surface containing the point and the area of that element.

Note: Convective heating is negligible in the horizontal specimen orientation. For this reason, the term "irradiance" is used instead of "heat flux" throughout this part of standard ISO 5660 as it best indicates the essentially radiative mode of heat transfer.

3.5 *Material* is a single substance or uniformly dispersed mixture, such as metal, stone, timber, concrete, mineral fibre and polymers.

3.6 *Orientation* is a plane in which the exposed face of the specimen is located during testing, with either the vertical or horizontal face upwards.

3.7 *Oxygen consumption principle* is proportional to the relation between the mass of oxygen consumed during combustion and the heat released.

3.8 *Product* is a material, composite or assembly about which information is required.

3.9 *Specimen* is a representative piece of the product which is to be tested together with any substrate or treatment.

Note: For certain types of product, for example products that contain an air gap or joints, it may not be possible to prepare specimens that are representative of the end-use conditions (see paragraph 7).

3.10 *Sustained flaming* is the existence of flame on or over the surface of the specimen for periods of over 10 s.

3.11 *Transitory flaming* is the existence of flame on or over the surface of the specimen for periods of between 1 s and 10 s.

4 SYMBOL

See table 1 of standard ISO 5660-1.

5 PRINCIPLE

5.1 This test method is based on the observation that, generally, the net heat of combustion is proportional to the amount of oxygen required for combustion. The relation is that approximately 13.1 x 10^3 kJ of heat are released per kilogram of oxygen consumed. Specimens in the test are burned under ambient air conditions, while being subjected to a predetermined external irradiance within the range of 0 to 100 kW/m^2 and measurements are made of oxygen concentrations and exhaust gas flow rates.

5.2 The test method is used to assess the contribution that the product under test can make to the rate of evolution of heat during its involvement in fire. These properties are determined on small representative specimens.

6 APPARATUS

6.1 The test apparatus, including cone-shaped radiant electrical heater, exhaust gas system with flow measuring instrumentation, gas sampling and analysing system, specimen holder and other necessary peripherals, shall be in accordance with standard ISO 5660-1. Calibration of the test apparatus shall be conducted in accordance with standard ISO 5660-1.

6.2 The test apparatus for measuring smoke production rate shall be in accordance with standard ISO 5660-2.

7 SUITABILITY OF A PRODUCT FOR TESTING

7.1 Surface characteristics

7.1.1 A product having one of the following properties is suitable for testing:

.1 an essentially flat exposed surface;

.2 a surface irregularity which is evenly distributed over the exposed surface provided that:

.1 at least 50% of the surface of a representative 100 mm x 100 mm area lies within a depth of 10 mm from a plane taken across the highest points on the exposed surface, or

.2 for surfaces containing cracks, fissures or holes which depth exceeds 10 mm, the width of the cracks, fissures or holes shall not exceed 10 mm, and the total area of such cracks, fissures or holes at the surface shall not exceed 30% of a representative 100 mm x 100 mm area of the exposed surface.

7.1.2 When an exposed surface does not meet the requirements of paragraph 7.1.1.1 or 7.1.1.2, the product shall be tested in a modified form complying as nearly as possible with the requirements given in this paragraph. The test report shall state that the product has been tested in a modified form, and clearly describe the modification.

7.2 Asymmetrical products

A product submitted for this test can have faces which differ, or can contain laminations of different materials arranged in a different order in relation to the two faces. If either of the faces can be exposed in use within a room, cavity or void, then both faces shall be tested.

7.3 Materials of short burning time

For specimens of short burning time (3 min or less), the heat release rate measurements shall be taken at not more than 2 s intervals. For longer burning times, 5 s intervals may be used.

7.4 Composite specimens

Composite specimens are suitable for testing, provided that they are prepared as specified in paragraph 8.3 and are exposed in a manner typical of end-use conditions.

7.5 Dimensionally unstable materials

7.5.1 Samples that intumesce or deform so that they contact the spark plug prior to ignition, or the underside of the cone heater after ignition, shall be tested with the separation of 60 mm between the base plate of the cone heater and the upper surface of the specimen. In this case the heater calibration shall be performed with the heat flux meter positioned 60 mm below the cone heater base plate. It must be stressed that the time to ignition measured with this separation is not comparable to that measured with the separation of 25 mm.

7.5.2 Other dimensionally unstable products, for example products that warp or shrink during testing, shall be restrained against excessive movement. This shall be accomplished with four tie wires, as described below. Metal wires of 1 ± 0.1 mm diameter, and at least 350 mm long, shall be used. The specimen shall be prepared in the standard way as described in paragraph 8. A tie wire is then looped around the specimen holder and retainer frame assembly, so that it is parallel to and approximately 20 mm away from one of the four sides of the assembly. The ends of the wire are twisted together such that the wire is pulled firmly against the retainer frame. Excess wire is trimmed from the twisted section before testing. The three remaining wires shall be fitted around the specimen holder and retainer frame assembly in a similar manner, parallel to the three remaining sides.

8 SPECIMEN CONSTRUCTION AND PREPARATION

8.1 Specimens

8.1.1 The specimen shall be representative of the end-use conditions of the material, including any surface finishes.

8.1.2 In the case of combustible insulation materials that are protected by metallic skins or identifiable as a separate item, the insulation shall be tested without the surface protection.

8.1.3 A sample edge frame shall be used in all tests. The irradiance level shall be set at 50 kW/m^2 for all three tests. The test shall be terminated when 20 min have elapsed since the start of exposure. Data shall be collected for an additional 2 min after the end of a test to ensure that data are available for the entire test duration after time-shifting to account for delay times of part of the instrumentation.

8.1.4 Three specimens shall be tested at 50 kW/m^2 level of irradiance selected and for each different exposed surface.

8.1.5 The specimens shall be representative of the end-use conditions of the material, including any surface finishes and shall be square with sides measuring 100 ± 2 mm.

8.1.6 Products with a normal thickness of 50 mm or less shall be tested using their full thickness.

8.1.7 For products with a normal thickness greater than 50 mm, the requisite specimens shall be obtained by cutting away the unexposed face to reduce the thickness to 50 mm.

8.1.8 When cutting specimens from products with irregular surfaces, the highest point on the surface shall be arranged to occur at the centre of the specimen.

8.1.9 Assemblies shall be tested as specified in paragraph 8.1.3 or 8.1.4, as appropriate. However, where thin materials or composites are used in the fabrication of an assembly, the nature of any underlying construction can significantly affect the ignition and burning characteristics of the exposed surface.

8.1.10 The influence of the underlying layers shall be understood and care taken to ensure that the test result obtained on any assembly is relevant to its use in practice.

8.1.11 When the product is a material or composite which would normally be attached to a well-defined substrate, it shall be tested in conjunction with that substrate using the recommended fixing technique, for example, bonded with the appropriate adhesive or mechanically fixed. In the absence of a unique or well-defined substrate, an appropriate substrate for testing shall be selected in accordance with standard ISO 14697.

8.1.12 Products that are thinner than 6 mm shall be tested with a substrate representative of end-use conditions, such that the total specimen thickness is 6 mm or more.

8.2 Conditioning of specimens

8.2.1 Before the test, specimens shall be conditioned to constant mass at a temperature of 23 ± 2°C and a relative humidity of 50 ± 5% in accordance with standard ISO 554.

8.2.2 Constant mass is considered to be reached when two successive weighing operations, carried out at an interval of 24 h, do not differ by more than 0.1% of the mass of the test piece or 0.1 g, whichever is the greater.

8.2.3 Materials such as polyamides, which require more than one week in conditioning to reach equilibrium, may be tested after conditioning in accordance with standard ISO 291. This period shall be not less than one week, and shall be described in the test report.

8.3 Preparation

8.3.1 ***Specimen wrapping***

8.3.1.1 A conditioned specimen shall be wrapped in a single layer of aluminium foil, of 0.025 mm to 0.04 mm thickness, with the shiny side towards the specimen. The aluminium foil shall be pre-cut to a size to cover the bottom and sides of the specimen and extend 3 mm or more beyond the upper surface of the specimen. The specimen shall be placed in the middle of the foil and the bottom and sides shall be wrapped. The excess foil above the top surface shall be cut if necessary so that it does not extend more than above the top surface of the specimen. The excess foil at the corners shall be folded around the corners to form a seal around the top surface of the specimen. After wrapping, the wrapped specimen shall be placed in the specimen holder and covered by a retainer frame. No aluminium foil shall be visible after the procedure is completed.

8.3.1.2 For soft specimens, a dummy specimen having the same thickness as the specimen to be tested may be used to pre-shape the aluminium foil.

8.3.2 ***Specimen preparation***

All specimens shall be tested with the retainer frame. The following steps shall be taken to prepare a specimen for testing:

.1 put the retainer frame on a flat surface facing downwards;

.2 insert the foil-wrapped specimen into the frame with the exposed surface facing downwards;

.3 put layers of refractory fibre blanket (nominal thickness 13 mm, nominal density 65 kg/m^3) on top until at least one full layer, and not more than two layers, extend above the rim of the frame;

.4 fit the specimen holder into the frame on top of the refractory fibre and press down; and

.5 secure the retainer frame to the specimen holder.

9 TEST ENVIRONMENT

The apparatus shall be located in an essentially draught-free environment in an atmosphere of relative humidity of between 20% and 80% and temperature of between 15°C and 30°C.

10 TEST PROCEDURES

10.1 General precautions

Warning: So that suitable precautions are taken to safeguard health, the attention of all concerned in fire tests is drawn to the possibility that toxic or harmful gases can be evolved during exposure of test specimens.

The test procedures involve high temperatures and combustion processes. Therefore, hazards can exist such as burns or the ignition of extraneous objects or clothing. The operator shall use protective gloves for insertion and removal of test specimens. Neither the cone heater nor the associated fixtures shall be touched while hot, except with the use of protective gloves. Care shall be taken never to touch the spark igniter which carries a substantial potential 10 kV. The exhaust system of the apparatus shall be checked for proper operation before testing and shall discharge into a building exhaust system with adequate capacity. The possibility of the violent ejection of molten hot material or sharp fragments from some kinds of specimens when irradiated cannot totally be discounted and it is therefore essential that eye protection be worn.

10.2 Initial preparation

10.2.1 Check the CO_2 trap and the final moisture trap. Replace the sorbent if necessary. Drain any accumulated water in the cold trap separation chamber. The normal operating temperature of the cold trap shall not exceed 4°C.

If any of the traps or filters in the gas sampling system line have been opened during the check, the gas sampling system shall be checked for leaks (with the sample pump on), e.g., by introducing pure nitrogen, at the same flow rate and pressure as for the sample gases, from a nitrogen source connected as close as possible to the ring sampler. The oxygen analyser shall then read zero.

10.2.2 Adjust the distance between the base plate of the cone heater and the upper surface of the specimen.

10.2.3 Turn on power to the cone heater and the exhaust fan. Power to the gas analysers, weighing device and pressure transducer shall not be turned off on a daily basis.

10.2.4 Set an exhaust flow rate of 0.024 ± 0.002 m^3/s.

10.2.5 Perform the required calibration procedures specified in paragraph 10.2 of standard ISO 9705. Put a thermal barrier on top of the weighing device (for example, an empty specimen holder with refractory fibre blanket or water-cooled radiation shield). This is to be in place during warm-up and between tests to avoid excessive heat transmission to the weighing device.

10.3 Procedure

10.3.1 ***Start data collection***

Collection of baseline data: the scanning interval shall be 2 s.

10.3.2 Insert the radiation shield in position. Remove the thermal barrier protecting the weighing device. Place the specimen holder and specimen, prepared according to paragraph 8.3, on the weighing device. The radiation shield shall be cooler than 100°C, immediately prior to the insertion.

10.3.3 Insert the spark plug and remove the radiation shield in the correct sequence according to the type of shield that is used, as described below.

For type a) shields (see standard ISO 5660-1), remove the shield and start the test. Within 1 s of removing the shield, insert and power the igniter.

For type b) shields (see standard ISO 5660-1), remove the shield within 10 s after the insertion and start the test. Within 1 s of removing the shield, insert and power the igniter.

10.3.4 Record the times when flashing or transitory flaming occurs. When sustained flaming occurs, record the time, turn off the spark, and remove the spark igniter. If the flame extinguishes after turning off the spark, re-insert the spark igniter and turn on the spark within 5 s, and do not remove the spark until the entire test is completed. Report these events in the test report (paragraph 12).

10.3.5 Collect all data until:

.1 22 min after the time to sustained flaming (the 22 min consist of a 20-min test period and an additional 2-min post-test period to collect data that will be time-shifted);

.2 20 min have elapsed and the specimen has not ignited;

.3 XO_2 returns to the pre-test value within 100 parts per million of oxygen concentration for 10 min; or

.4 the mass of the specimen becomes zero,

whichever occurs first, but in any case, minimum test duration shall be 5 min. Observe and record physical changes to the sample such as melting, swelling and cracking.

10.3.6 Remove specimen and specimen holder. Put a thermal barrier on top of the weighing device.

10.3.7 Three specimens shall be tested and reported as described in paragraph 12. The 18 s mean heat release readings shall be compared for the three specimens. If any of these mean readings differ by more than 10% from the arithmetic mean of the three readings, then a further set of three specimens shall be tested. In such cases, the arithmetic mean of the set of six readings shall be reported.

Note: The test data have limited validity if the specimen melts sufficiently to overflow the specimen holder, if explosive spalling occurs, or if the specimen swells excessively and touches the spark igniter or the heater base plate.

11 CALCULATION

11.1 Time to ignition, heat release rate and total heat release shall be measured and calculated in accordance with standards ISO 5660-1and ISO 5660-2.

11.2 The time averages of smoke production rate (SPR) and heat release rate (HRR) shall be calculated using actual measured values that are not already averaged.

11.3 The 30-second sliding average heat release rate (HRR30) and smoke production rate (SPR30) shall be calculated as the average value during between 15 s before and 15 s after the time. For the first and last 30 s duration, the follows apply:

.1 for the first 30 s of testing, use also the values prior to ignition of the ignition source, i.e. zero rate of smoke production, when calculating average; and

.2 for the last 30 s of testing, use the measured value at 20 min, assign that to another 30 s up to 20 min and 30 s and calculate the average.

11.4 The maximum of 30-second sliding smoke production rate (SPR30max) and the maximum of 30-second sliding average heat release rate (HRR30max) shall be obtained as the maximum of SPR30 and HRR30 respectively.

12 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and data determined by the test:

.1 reference that the test was carried out in accordance with appendix 2 to part 10 of the 2010 FTP Code (see also subparagraph .2);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and address of the manufacturer/supplier, if known;

.7 type of the material, i.e. furniture component, surface linings or finishes, etc.;

.8 name and/or identification of the product tested;

.9 description of the sampling procedure, where relevant;

.10 description of the product tested including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, together with details of the construction of the product;

.11 description of the specimen including density and/or mass per unit area, thickness and dimensions, colour, quantity and number of any coating, orientations tested and face subject to the test, and construction;

.12 date of sample arrival;

.13 details of specimen conditioning;

.14 date of test;

.15 test conditions:

.1 orifice flow rate calibration constant *C* (see standard ISO 5660-1);

.2 irradiance level (50 kW/m^2), and exhaust system flow rate expressed in m^3/s; and

.3 number of replicate specimens tested under the same conditions (this shall be a minimum of three, except for exploratory testing);

.16 test results:

.1 time to ignition of each specimen, expressed in seconds;

.2 test duration of each specimen, usually 20 min;

.3 for each specimen, 30-second sliding average heat release (HRR30) expressed in kW/m^2 and 30-second sliding average smoke production (SPR30) expressed in m^2/s, represented as a curve, recorded for the entire test of each specimen;

.4 for each specimen, the maximum in 30-second sliding average heat release rate (HRR30max) expressed in kW/m^2 and the maximum in 30-second sliding average smoke production rate (SPR30max) expressed in m^2/s;

.5 the total heat release expressed in kJ/m^2 of each specimen;

.6 additional observations, such as transitory flaming or flashing; and

.7 difficulties encountered in testing, if any;

.17 classification of the material; and

.18 the statement:

"The test results relate 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.".

13 OTHER REFERENCES

The following parts of standard ISO 5660-1 shall be also referred to for the purpose of this appendix 2:

.1 annex A: Commentary and guidance notes for operators;

.2 annex B: Resolution, precision and bias;

.3 annex C: Mass loss rate and effective heat of combustion;

.4 annex D: Testing in the vertical orientation;

.5 annex E: Calibration of the working heat flux meter;

.6 annex F: Calculation of heat release with additional gas analysis;

.7 annex G: Specimen configurations; and

.8 annex H: Bibliography.

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 the appendix to this part.

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 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.

APPENDIX

FIRE TEST PROCEDURES FOR FIRE-RESISTING DIVISIONS OF HIGH-SPEED CRAFT

1 GENERAL

1.1 Under the provisions of the 1994 HSC Code or 2000 HSC Code, constructions for use in high-speed craft shall have fire-resisting properties to the satisfaction of, and be approved by, the Administration. In this context "fire-resisting property" is the ability of the construction to insulate/protect an area from the influence of a fire in an adjoining area by having separating performance during a fire. Such constructions are fire-resisting bulkheads, decks, ceilings, linings and doors.

1.1.1 Fire-resisting divisions for moderate fire hazard are classified as "fire-resisting divisions 30".

1.1.2 Fire-resisting divisions for major fire hazard are classified as "fire-resisting divisions 60".

1.2 The classification shall be expressed in the form of, for example, "Load bearing fire-resisting deck 60" and "Non-load bearing fire-resisting bulkhead 30", i.e. including the qualification on orientation of the division together with a statement if the division in question is evaluated as load bearing or as non-load bearing.

1.3 Testing of fire-resisting divisions and reporting shall generally be in accordance with the requirements given in part 3 of this annex. Where additional interpretation, adaptations and/or supplementary requirements may be necessary, these are detailed in this part.

1.4 The test shall continue for a minimum of 30 min for fire-resisting divisions 30, or 60 min for fire-resisting divisions 60, or for an intermediate fire protection time when allowed in accordance with the 2000 HSC Code.

1.5 The following performance criteria for insulation and integrity shall be fulfilled within the classification period (see paragraph 1.4 above):

.1 insulation: the average unexposed face temperature rise shall not be more than 140°C, and the temperature rise recorded by any of the individual unexposed face thermocouple shall not be more than 180°C; and

.2 integrity:

.1 there shall be no flaming on the unexposed face;

.2 there shall be no ignition, i.e. flaming or glowing, of the cotton-wool pad; and

.3 it shall not be possible to enter the gap gauges as described in paragraph 8.4.4 of appendix 1 to part 3 into any opening in the specimen.

1.6 In this appendix, testing of fire-resisting divisions is described in three separate parts, as follows:

.1 non-load bearing fire-resisting divisions;

.2 load bearing fire-resisting divisions having a structural metal core as presupposed in part 3 of this annex for "A" class divisions; and

.3 other load bearing fire-resisting divisions.

2 NON-LOAD BEARING FIRE-RESISTING DIVISIONS

The approach adopted for testing of fire-resisting divisions which are non-load bearing shall follow the requirements for testing "B" class divisions in part 3 of this annex where relevant and appropriate.

3 LOAD BEARING FIRE-RESISTING DIVISIONS HAVING A STRUCTURAL METAL CORE AS PRESUPPOSED IN PART 3 OF THIS ANNEX FOR "A" CLASS DIVISIONS

3.1 The approach adopted for testing of load-bearing fire-resisting divisions having a structural metal core (steel or aluminium) shall follow the requirements for testing "A" class divisions in part 3 of this annex, where relevant and appropriate.

3.2 If the structural core is of aluminium, the average temperature of the structural core shall not rise more than 200°C above its initial temperature at any time within the classification period (see paragraph 1.4 above).

4 LOAD BEARING FIRE-RESISTING DIVISIONS

4.1 The approach adopted for testing of other load bearing fire-resisting divisions shall follow the requirements for testing "B" class divisions in part 3 of this annex where relevant and appropriate.

4.2 In addition, such load bearing divisions shall be tested with the prescribed static load and they shall maintain their load bearing ability within the classification period (see paragraph 1.4 above).

4.3 Nature of test specimen

4.3.1 The construction, erection and stiffening of the test specimen shall be typical of the use in practice.

4.3.2 For vertical divisions (bulkheads), the minimum overall dimensions for the exposed part of the test specimen are 2,440 mm width and 2,500 mm height, or full height if the height is smaller than 2,500 mm.

4.3.3 For horizontal divisions (decks), the minimum overall dimensions for the exposed part of the test specimen are 2,440 mm width and 3,040 mm length (span), or full length if the length is smaller than 3,040 mm.

4.4 Mounting of test specimen

4.4.1 A vertical test specimen shall be simply supported at the top and the bottom and shall not be supported along its vertical edges.

4.4.2 A horizontal test specimen shall be simply supported at the two ends and shall not be supported along its edges parallel to the span.

4.5 Static load

4.5.1 The following levels of loading shall be applied uniformly, as far as practicable, along the top edge of the vertical specimen or surface of the horizontal specimen:

.1 bulkheads: 7.0 kN/m of the width; and

.2 decks: 3.5 kN/m2 of the area.

The load may be applied hydraulically, mechanically or by the use of weights.

4.5.2 The loading equipment shall be able to simulate the conditions of loading, as appropriate, for the test construction. The loading equipment shall also be capable of maintaining the test load at a constant value (to within ± 5% of the required value) without changing its distribution for the duration of the load-bearing capacity period; it shall not significantly influence the heat transfer through the specimen nor impede the use of the thermocouple insulating pads; it shall not interfere with the measurement of surface temperature and/or deformation and shall permit general observation of the unexposed face.

4.5.3 For decks, the total area of the contact points between the loading equipment and the test specimen surface shall not exceed 10% of the total area of the surface of a horizontal test specimen. The equipment shall be capable of following the maximum deformation and the rate of deformation of the test specimen. For bulkheads, the loading equipment has to produce a load uniformly applied to the total width of the bulkhead.

4.5.4 If the tested assembly includes load bearing elements such as beams, they shall be exposed to the furnace on all faces except for the face in contact with the specimen and shall not be placed at less than 200 mm from the furnace walls.

4.5.5 In practice, it may be difficult to produce a uniform load, especially on decks. When determining a load distribution that is representative of the standard conditions described in paragraphs 4.4.2 and 4.5.1, the laboratory shall consider the degrees of freedom, maximum shear force and bending moment.

4.5.6 Mounting methods and loading conditions different to those in paragraphs 4.4.2 and 4.5.1 may be used. In that case, the test conditions and load distribution shall be acceptable to the Administration.

4.5.7 The test report shall include justifications of approximations to uniform load and mounting. The report shall include a description of load repartition in terms of force, surface of contact and position of these contacts.

4.5.8 The test load shall be applied at least 15 min before the commencement of the heating period.

4.6 Deformation

4.6.1 Deformation measurements shall be made using equipment employing mechanical, optical or electrical techniques. Instrumentation for the measurement of deflection of the test specimen shall be located so as to provide data in terms of the amount and rate of deflection during the fire test.

4.6.2 The deformation data shall be recorded to an accuracy of ± 2 mm during the testing period.

4.6.3 For a bulkhead, measurement shall be made of the axial contraction and of the horizontal deflection.

4.6.4 For a deck, measurement shall be made of the vertical deflection.

4.7 Performance criteria for load bearing ability

The test specimen shall be deemed to have failed if it is no longer able to support the test load. Support of the test load is determined by both the amount and the rate of deflection. Since relatively rapid deflections can occur until stable conditions are reached, the rate of deflection criteria of decks is not applied until a deflection of L/30 has been exceeded. For the purposes of this part, the following criteria apply:

.1 bulkheads:

.1 limiting axial contraction of h/100 mm; and

.2 limiting rate of axial contraction of 3 h/1,000 mm/min,

where:

h = the initial height (mm); and

.2 decks:

.1 limiting deflecting of $(L)^2/400$ d mm; and

.2 limiting rate of deflection of $(L)^2/9{,}000$ d mm/min,

where:

L = the clear span of the specimen (mm); and

d = the distance from the extreme fibre of the design compression zone to the extreme fibre of the design tension zone of the structural section (mm).

5 TEST REPORT

The test report shall include the following information as a minimum. A clear distinction shall be made between the data provided by the sponsor and the data determined by the test:

.1 reference that the test was carried out in accordance with part 11 of the 2010 FTP Code (see also subparagraph .2 below);

.2 any deviations from the test method;

.3 name and address of the testing laboratory;

.4 date and identification number of the report;

.5 name and address of the sponsor;

.6 name and/or identification of the product tested;

.7 the name of the manufacturer of the test specimen and of the products and components used in the construction;

.8 type of the product, e.g., bulkhead, ceiling, door, window, duct penetration, etc.;

.9 classification of test per paragraph 1.6;

.10 the constructional details of the test specimen, including description and drawing and principal details of components. All the details requested in paragraph 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 test specimen. When full and detailed drawings are not included in the report, then the applicant's drawing(s) of the test specimen 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;

.11 all 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 organic content of the insulation material(s) as determined by the test laboratory;

.12 method of applying load and quantity of the load, if applicable;

.13 date of the test specimen arrival;

.14 details of specimen conditioning;

.15 date of test;

.16 test results:

.1 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 shall be included which clearly illustrates the positions of the various thermocouples and identifies them relative to the temperature-time data;

.2 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 or, if the test is terminated due to the insulation criteria having been exceeded, the times at which limiting temperatures were exceeded; and

.3 the maximum deflection of the specimen. In case of doors, the maximum deflection at the centre of the door specimen and the maximum displacement of each corner of the door leaf relative to the door frame;

.17 the classification attained by the test specimen shall be expressed in the form of "load-bearing fire-resisting divisions 60 bulkhead", i.e. including the qualification on orientation of the division. The result shall be presented in the test report in the following manner under the heading "Classification": "A bulkhead constructed as described in this report may be regarded as an "load-bearing fire-resisting divisions 60" class bulkhead according to part 11 of annex 1 to the 2010 FTP Code.";

.18 the name of the representative of the Administration present at the test. If the Administration requires prior notification of test and a representative does not witness the test, 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."; and

.19 the statement:

"The test results relate 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.".

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 the 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 as 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 kW (both values determined in accordance with part 5 of annex 1) are considered to comply with the requirements of part 2 of annex 1 without further testing.

2.3 Materials meeting the provisions in paragraph 2.2 above are exempted from testing in accordance to standard ISO 1716. They will be expected to satisfy a requirement of maximum gross calorific value (e.g., 45 MJ/m^2) without further testing.

2.4 For high-speed craft, fire-restricting materials are considered to comply with the requirements of part 2 of annex 1 without further testing.

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 mm x 60 mm 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 95 mm x 65 mm x 7 mm spaced at 600 mm or structural equivalent.

3.2 Notwithstanding the provisions in paragraph 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 to this Code.

4 Fire door control systems
(no entries)

5 Low flame-spread surfaces and primary deck coverings

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 5 of annex 1 are considered to comply with the requirements for floor coverings.

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.

6 Vertically supported textiles and films
(no entries)

7 Upholstered furniture
(no entries)

8 Bedding components
(no entries)

9 Fire-restricting materials for high-speed craft
(no entries)

10 Fire-resisting divisions of high-speed craft
(no entries)

ANNEX 3

FIRE PROTECTION MATERIALS AND REQUIRED APPROVAL TEST METHODS

Table 1 – Fire protection materials and required approval test methods for passenger ships carrying more than 36 passengers and high-speed craft

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke and toxicity	Part 3 A, B and F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 7 Curtains or Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) and MSC.90(71))	Part 10 – ISO 5660 (MSC.40(64) and MSC.90(71))	Part 11 – A.754(18) (for 2000 HSC Code)	ISO 1716 Calorific potential	Remarks/ Notes	Applicable regulation SOLAS chapter II-2 and HSC Code
Non-combustibility materials	X													5.3.1.2.1
"A" class bulkhead	X		X											3.2.3, 9.2.2.3
"B" class bulkhead	X		X											3.4.1, 9.2.2.3
"C" class bulkhead	X												1	3.10, 9.2.2.3
"A" class deck	X		X											3.2.3, 9.2.2.3
"B" class deck	X		X											3.4.1, 9.2.2.3
"B" class lining	X		X											3.4.1, 9.2.2.3
"B" class ceilings	X		X											3.4.1, 9.2.2.3
"B" class continuous ceilings	X		X											3.4.1, 9.2.2.3.3
"A" class fire door	X		X											3.2.3, 9.4.1.1.2
"B" class fire door	X		X											3.4.1, 9.4.1.2.1
"A" class windows	X		X											3.2.3, 9.4.1.3.1
"B" class windows	X		X											3.2.3, 9.4.1.3.1
Thermal and acoustic insulation materials	X													5.3.1.1
Partial bulkheads	X												2	5.3.1.2.1

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke and toxicity	Part 3 A, B and F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 7 Curtains or Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) and MSC.90(71))	Part 10 – ISO 5660 (MSC.40(64) and MSC.90(71))	Part 11 – A.754(18) (for 2000 HSC Code)	ISO 1716 Calorific potential	Remarks/ Notes	Applicable regulation SOLAS chapter II-2 and HSC Code
Fire damper			X											9.7.1.2.1
Cable transit			X											9.3.1
Pipe penetration			X											9.3.1
Fire Door Control System				X										9.4.1.1.4.15
Ventilation ducts	X													9.7.1.1
Adhesive (bulkhead, deck, door and other division)					X									5.3.1.1
Exposed painted surfaces		X			X								3	5.3.2.4.1.1
Exposed foil, fabric or surface veneers		X			X							X	3	5.3.2.4.1.1
Painted surfaces in concealed spaces					X									5.3.2.4.1.2
Foil, fabric or veneer on surfaces or grounds in concealed spaces					X							X		5.3.2.4.1.2
Ceilings and linings	X												2	5.3.1.2.1
Surfaces of bulkhead and ceiling linings		X			X								4	5.3.2.4.1.1
Grounds	X												2	5.3.1.2.1
Draught stops	X												2	5.3.1.2.1, 8.4
Paints, varnishes and other finishes on exposed interior surfaces		X			X									6.2
Floor coverings		X			X3									5.3.2.4.1
Combustible ventilation ducts					X									9.7.1.1.1 Gases are transported by ducts

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke and toxicity	Part 3 A, B and F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 7 Curtains or Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) and MSC.90(71)	Part 10 – ISO 5660 (MSC.40(64) and MSC.90(71)	Part 11 – A.754(18) (for 2000 HSC Code)	ISO 1716 Calorific potential	Remarks/ Notes	Applicable regulation SOLAS chapter II-2 and HSC Code
Insulation materials for cold service systems					X									5.3.1.1 Criteria have to be defined
Vapour barriers					X									5.3.1.1
Primary deck coverings		X			X									4.4.4, 6.3
Curtain – Vertically supported textiles						X								3.40.3, 9.2.2.3.2.2 (6) Toxicity and Opacity criteria can be taken into account
Upholstered furniture							X							3.40.6, 5.3.3, 9.2.2.3.2.2 (6)
Bedding components								X						3.40.7, 9.2.2.3.2.2 (6)
Fire restricting divisions									X					HSC 7.4.3.1
Fire restricting ceilings									X					HSC 7.4.3.1
Fire restricting linings									X					HSC 7.4.3.1
Fire restricting case furniture										X				HSC 7.4.3.3.1
Fire restricting free-standing furniture										X				HSC 7.4.3.3.1
Fire restricting thermal and acoustic insulation material										X				HSC 7.4.3.3.2
Non-load bearing fire-resisting divisions											X			HSC 7.4.3.3.5

Test method (FTP Code) / Specimen (Products)	Part 1 Non-combustibility	Part 2 Smoke and toxicity	Part 3 A, B and F class divisions	Part 4 Door systems	Part 5 Surface flammability	Part 7 Curtains or Vertically supported textiles	Part 8 Upholstered furniture	Part 9 Bedding components	Part 10 – ISO 9705 (MSC.40(64) and MSC.90(71))	Part 10 – ISO 5660 (MSC.40(64) and MSC.90(71))	Part 11 – A.754(18) (for 2000 HSC Code)	ISO 1716 Calorific potential	Remarks/ Notes	Applicable regulation SOLAS chapter II-2 and HSC Code
Load bearing fire-resisting divisions, with metal core											X			HSC 7.2.1
Load bearing fire-resistant divisions, without metal core											X			HSC 7.2.1

1 Low flame-spread adhesives may be used.
2 Except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces.
3 Corridors and stairway enclosures only.
4 In accommodation and service spaces (except saunas) and control stations.
* In case of the maximum gross calorific value less than 45 MJ/m^2 was required.

Table 2 – Fire protection materials and required approval test methods for cargo ships (method IC)

Test method (FTP Code) / Specimen (Products)	Part 1 Non combustibility	Part 2 Smoke and toxicity	Part 3 A, B and F class divisions	Part 4 Door systems	Part 5 Surface flammability	ISO 1716 Calorific potential	Remarks/ Note	Applicable regulation SOLAS chapter II-2 and HSC Code
Non-combustible materials	X							5.3.1.2.2
"A" class bulkheads	X		X					3.2.3, 9.2.3
"B" class bulkheads	X		X					3.4.1, 9.2.3
"C" class bulkheads	X						1	3.10, 9.2.3
"A" class decks	X		X					3.2.3, 9.2.3
"B" class decks	X		X					3.4.1, 9.2.3
"B" class linings	X		X					3.4.1, 9.2.3
"B" class ceilings	X		X					3.4.1, 9.2.3
"B" class continuous ceilings	X		X					3.4.1, 9.2.3.3
"A" class fire doors	X		X					3.2.3, 9.4.2.1
"B" class fire doors	X		X					3.4.1, 9.4.2.1
"A" class windows	X		X					3.2.3, 4.5.2.3
Thermal and acoustic insulation materials	X							5.3.1.1
Fire dampers			X					9.7.1.2.1
Cable transits			X					9.3.1
Pipe penetrations			X					9.3.1
Ventilation ducts	X		~~X~~					9.7.1.1
Adhesives (bulkhead, deck, door and other division)					X			5.3.1.1
Exposed painted surfaces		X			X		3	5.3.2.4.2
Exposed foil, fabric or surface veneers		X			X	X	3	5.3.2.4.2
Painted surfaces in concealed spaces					X			5.3.2.4.2

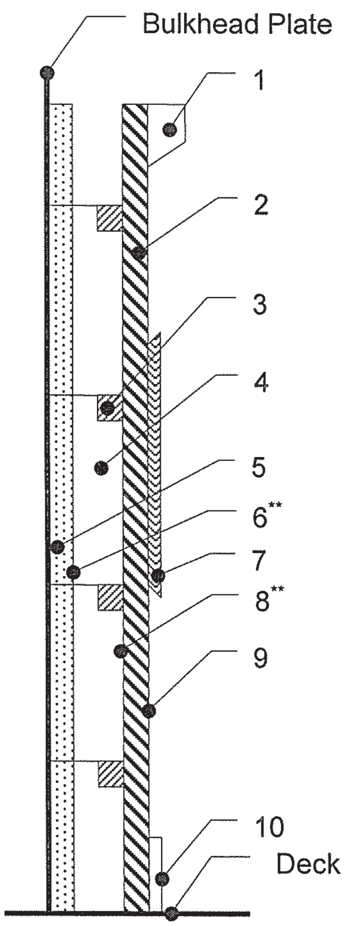
Test method (FTP Code) / Specimen (Products)	Part 1 Non combustibility	Part 2 Smoke and toxicity	Part 3 A, B and F class divisions	Part 4 Door systems	Part 5 Surface flammability	ISO 1716 Calorific potential	Remarks/ Note	Applicable regulation SOLAS chapter II-2 and HSC Code
Foil, fabric or veneer on surfaces or grounds in concealed spaces					X	X		5.3.2.4.2
Ceilings and linings	X						2	5.3.1.2.1
Surfaces of ceiling linings		X			X		4	5.3.2.4.1.1
Grounds	X						2	5.3.1.2.1,
Draught stops	X						2	5.3.1.2.1, 8.4
Paints, varnishes and other finishes on exposed interior surfaces		X						6.2
Floor coverings		X			X		3	5.3.2.4.1
Combustible ventilation ducts					X			9.7.1.1.1
Insulation materials for cold service systems					X			5.3.1.1
Vapour barriers					X			5.3.1.1
Primary deck coverings		X			X			4.4.4, 6.3

1 Low flame-spread adhesives may be used.
2 Except in cargo spaces, mail rooms, baggage rooms and refrigerated compartments of service spaces.
3 Corridors and stairway enclosures only.
4 In accommodation and service spaces (except saunas) and control stations.

ANNEX 4

INTERPRETATION OF SOLAS, CHAPTER II-2, REGULATIONS 5.3 AND 6.2 (MSC/Circ.1120)

Table 1 – Materials used on passenger ships for bulkheads of accommodation spaces as defined in regulation II-2/3.1 and its requirements (regulations 5.3 and 6.2)



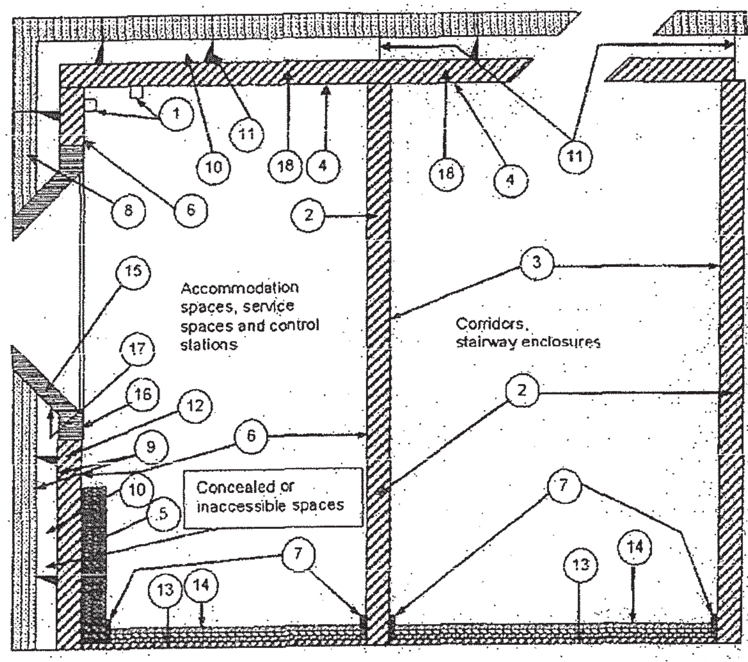
Materials used for bulkheads of accommodation spaces as defined in regulation II-2/3.1					
Bulkhead components	Requirements in SOLAS chapter II-2 for components				
	Non-combustible material (5.3.1.1) (5.3.1.2.1)	Calorific value (5.3.2.2)	Equivalent volume (5.3.2.3)	Low flame-spread (5.3.2.4)*	Smoke production, toxic products (6.2)
	(A)	(B)	(C)	(D)	(E)
1 moulding			X		
2 wall panel (lining)	X				
3 grounds and supports	X				
4 draft stops	X				
5 insulation	X				
6 insulation surface**				X (5.3.2.4.1.2)	
7 decoration			X		
8 painted surface** or fabric or veneer**		– X		X (5.3.2.4.1.2) X (5.3.2.4.1.2)	
9 painted surface or fabric or veneer		– X	X X	X (5.3.2.4.1.1) X (5.3.2.4.1.1)	X X
10 skirting board			X		

Notes:

* Exposed surfaces of corridors and stairway enclosures referred to in regulation II-2/5.3.2.4.1.1 include floor coverings.

** Where the wall panel is an integral part of the fire insulation in accordance with regulation II-2/9.2.2.3.3, these components are to be of non-combustible material.

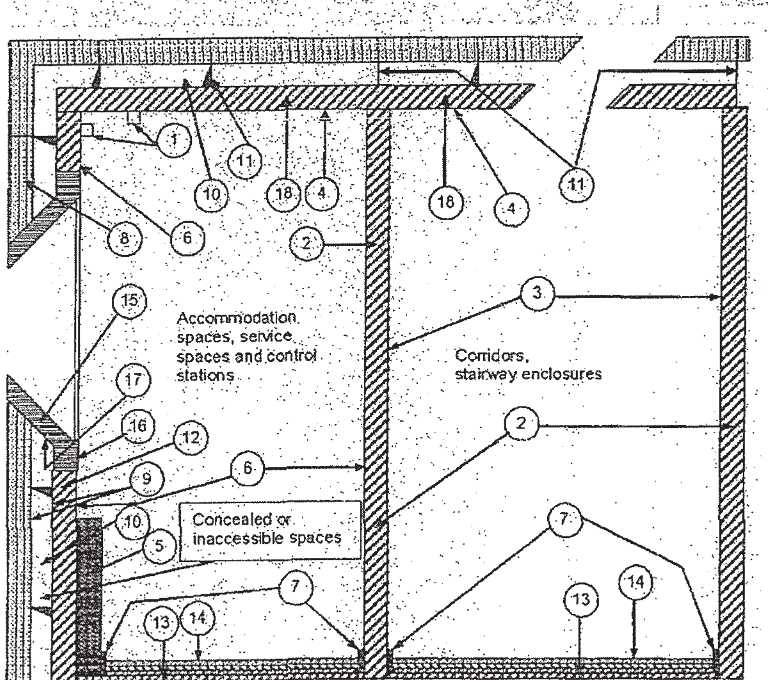
Table 2 – Regulations 5.3 and 6.2 – Materials used in accommodation spaces, as defined in regulation II-2/3.1, of cargo ships (method IC)



		Requirements for components						
		A *Non-combustible material (regulation 5.3.1.2.2)*	*B* *Non-combustible material (regulation 5.3.1.1)*	*C* *Low flame spread (regulation 5.3.2.4)*	*D* *Equivalent volume (regulation 5.3.2)*	*E* *Calorific value (regulation 5.3.2)*	*F* *Smoke production (regulation 6)*	*G* *Not readily ignited (regulation 4.4.4 and 6)*
1	Moulding				X3)			
2	Panel	X4)						
3	Painted surfaces or Veneer or Fabric or Foils			X	X	X	X5)	
4	Painted surfaces or Veneer or Fabric or Foils			X	X3)	X2)	X5)	
5	Decorative panel				X3)			
6	Painted surfaces or Veneer or Fabric or Foils				X3)	X2)	X5)	
7	Skirting board				X3)			
8	Insulation		X1)					
9	Surfaces and paints in concealed or inaccessible spaces			X				
10	Draught stops	X4)						
11	Grounds and supports	X4)		X				
12	Lining	X4)						
13	Primary deck covering 1st layer						X	X
14	Floor finishing			X6)			X	
15	Window box	X4)						
16	Window box surface			X3)	X3)	X2)	X	
17	Window box surface in concealed or inaccessible spaces			X				
18	Ceiling panel	X4)						

1) Vapour barriers used on pipes for cold services (see UI SC102) may be of combustible materials providing that their surface has low flame spread characteristics (regulation 5.3.1.1)
2) Where the material is fitted on non-combustible bulkheads, ceiling on lining in accommodation and service spaces (regulation 5.3.2.2)
3) To be applied to those accommodation and service spaces bounded by non-combustible bulkheads, ceiling and linings (regulation 5.3.2.3)
4) Only in corridors and stairway enclosures serving accommodation and service spaces and control stations (regulation 5.3.1.2.2)
5) Applicable to paints, varnishes and other finishes (regulation 6.2)
6) Only in corridors and stairway enclosures

Table 3 – Regulations 5.3 and 6.2 – Materials used in accommodation spaces, as defined in regulation II-2/3.1, of cargo ships (method IIC – IIIC)



		Requirements for components,						
		A Non-combustible material (regulation 5.3.1.2.2)	B Non-combustible material (regulation 5.3.1.1)	C Low flame spread (regulation 5.3.2.4)	D Equivalent volume (regulation 5.3.2)	E Calorific value (regulation 5.3.2)	F Smoke production (regulation 6)	G Not readily ignited (regulation 4.4.4 and 6)
1	Moulding				X			
2	Panel	X						
3	Painted surfaces or Veneer or Fabric or Foils			X	X	X	X2)	
4	Painted surfaces or Veneer or Fabric or Foils			X	X	X	X2)	
5	Decorative panel				X			
6	Painted surfaces or Veneer or Fabric or Foils				X	X	X2)	
7	Skirting board				X			
8	Insulation		X1)					
9	Surfaces and paints in concealed or inaccessible spaces			X				
10	Draught stops	X						
11	Grounds and supports	X		X				
12	Lining	X						
13	Primary deck covering first layer						X3)	X
14	Floor finishing			X3)			X	
15	Window box	X						
16	Window box surface			X	X	X	X	
17	Window box surface in concealed or inaccessible spaces			X				
18	Ceiling panel	X						

1) Vapour barriers used on pipes for cold services (see UI SC102) may be of combustible materials providing that their surface has low flame spread characteristics (regulation 5.3.1.1)

2) Applicable to paints, varnishes and other finishes (regulation 6.2)

3) Only in corridors and stairway enclosures