

STRUCTURAL FIRE PROTECTION

FOREWORD

1. In the following four chapters, advice is given and comments are made about those regulations which prescribe the structural fire protective measures that have to be adopted on UK ships. The primary aims of these measures being to:

(a) restrict to the spread of fire and smoke within the accommodation spaces; and

(b) provide a sufficient degree of protection within accommodation and working spaces so as to enable the passengers and crew to evacuate the immediate area and if necessary reach the muster stations and then abandon ship, should the fire become unmanageable.

2. Experience has shown however that these aims can only be achieved successfully by paying strict attention to detail when designing the arrangements and installing the means of protection. In other words, it is essential to:

(a) pay close attention to the requirements of the individual regulations which in many cases are of a very detailed nature;

(b) have concise and accurate drawings of the proposed arrangements properly prepared and examined by competent personnel;

(c) use only those materials and fittings which have been correctly evaluated, which in many cases means physically fire tested;

(d) ensure that the materials and fittings used are correctly installed by competent personnel - i.e. precisely as stated in the approval documentation and or the manufacturer's literature, - and thereafter; and

(e) ensure that the means of protection are inspected and tested at regular intervals, not just at the time of statutory inspections, and that they are repaired or renewed promptly, whenever necessary.

3. Most of the foregoing points are addressed in Chapter 11. Then in Chapters 12, 13 and 14 advice is given and comments are made on those regulations relating to specific types and classes of ships. Finally, in Chapter 15, advice and comment is presented in respect of those regulations which prescribe the measures needed to provide suitable "means of escape" from the various compartments on different classes of ships.

CHAPTER 11

GENERAL ADVICE AND COMMENT

11.1 Submission of Structural Fire Protection Proposals

11.1.1 Documentary evidence - plans, specifications, brochures etc., dealing with the items listed in paragraph 11.1.2 to show how compliance with the various regulations is to be achieved, must be prepared by the shipowner, his agent or the shipbuilder. Such evidence should be in English or be provided with adequate translation in English, and metric units should be used for all measurements. Then when prepared, it should be submitted in the case of:

11.1.1.1 passenger ships of Classes I, II and II(A), to the Lead Surveyor conducting the survey of the ship, after which it should be forwarded together with any pertinent comments to Headquarters for final consideration; and

11.1.1.2 all other ships, to the Lead Surveyor conducting the survey of the ship. Reference to Headquarters will only be necessary if the inspecting surveyor requires advice on any aspect of the proposals presented.

11.1.2 Drawings and information to be submitted

The following drawings and information as stated below should be prepared as appropriate, and submitted for consideration and approval:

11.1.2.1 the name of the owners of the ship, its intended service, the date the keel was laid and when appropriate the date of conversion or of any major alterations, modifications or repairs (see also paragraph 1.4.3);

11.1.2.2 a general arrangement drawing, drawn to a scale of not less than 1:200; showing on the profile and on each deck of the ship the main zone bulkheads, the length of each zone and the clear height for vehicles in each special category space within each main horizontal zone;

11.1.2.3 a second general arrangement drawing, drawn to a scale of not less than 1:100 showing as applicable:

- (a) the method of fire protection which is to be adopted;
- (b) the purpose for which each compartment in the ship is to be used and its fire risk category number as denoted in L.S. Regulation 56, 74 or 91 as is applicable;
- (c) the arrangement of main vertical and horizontal zones;

- (d) the integrity and insulation standards (by use of a scheme of colour coding) of all 'A' class bulkheads and decks; 'B' Class bulkheads, decks and linings, the extent of any continuous 'B' Class ceilings and also the extent of 'C' Class bulkheads and linings;
- (e) details of the materials to be used to insulate the 'A' Class bulkheads and decks and those from which the 'B' Class bulkheads, and ceilings and linings are to be constructed;
- (f) the extent of any aluminium structure; and
- (g) the location of any draught stops.

(To avoid confusion the above drawings should indicate only the extent to which 'A' Class insulations are used i.e. insulations used for thermal or acoustic purposes should not be included. It should be noted that the use of an effective scheme of colour coding greatly facilitates the examination process.)

11.1.2.4 Plan of fire doors and shutters

A general arrangement drawing to a scale of not less than 1:200 showing the purpose for which each compartment in the ship is used and the position, type, dimensions and standard of each 'A' and 'B' Class door or shutter which is to be fitted on the ship and an indication of the doors provided with self-closing and central control releasing arrangements. The names of the manufacturers of the doors should also be indicated on the drawing.

11.1.2.5 Plan of 'A' and 'B' Class bulkheads and decks

A drawing showing the details of the construction of the 'A' Class bulkheads and decks, the material used to attach the insulation to the divisions, vapour barriers where fitted, the construction of 'B' Class bulkheads, ceilings and linings and the construction of draught stops.

11.1.2.6 Plan of mechanical ventilation arrangements

A general arrangement drawing to a scale not less than 1:100 showing the mechanical and natural ventilation systems fitted throughout the ship and the materials of their construction; the positions, types and sizes of the fans; the cross sectional dimensions of ducting passing through 'A' Class bulkheads and decks and 'B' Class bulkheads, decks and ceilings and where each change occurs in the size of the ducting; the dimensions of recirculating ducting and associated openings; the position and size of heating units; the position and method of operating each fire damper and the dimensions of the coaming in which it is fitted; the names of the manufacturers of fans, ducting, dampers and heating units; the positions of grease traps and details of access arrangements for cleaning; details of any fire extinguishing systems fitted in any ducting; and details of the methods of closing external openings. The

ventilation systems shown on the drawing should be coloured individually so that they may be readily identified.

11.1.2.7 Plan of electric cable and pipe penetrations

Drawings showing the arrangements for maintaining the integrity and insulation standards of 'A' Class bulkheads and decks and 'B' Class bulkheads, decks, ceilings and linings where penetrated by electric cables, pipes and electric lighting fittings and the construction of window and sidescuttle boxes which maintain the integrity of lining at the ship's side or deckhouse side.

11.1.2.8 Plan of protection in way of lifeboats and liferafts

A drawing to a scale of not less than 1:200 showing the extent of fire resisting glass fitted in windows overlooking lifeboat, liferaft and marine escape system stowage, embarkation and lowering positions. The drawing should incorporate port and starboard profiles of the ship showing the positions of davits, winches, operating platforms and indicating the embarkation deck or decks. Where the side of a superstructure or deckhouse slopes the drawing should also incorporate a section showing the stowage position of the lifeboats, liferafts and marine escape systems and their operating platform in relation to the side of the superstructure or deckhouse.

11.1.2.9 Plan of water sprinklers and detectors

A drawing to a scale of not less than 1:100 showing the arrangement and grouping of sprinkler heads and heat detectors or smoke detectors.

11.2 Definitions and Application of the Regulations (Regulation 1(2))

11.2.1 A' Class division

An 'A' Class division is a bulkhead or part of a deck constructed of steel or other 'equivalent material' and capable of preventing the passage of smoke and flame for a period not less than 60 minutes as defined in the regulations. Subject to any additional requirements for watertight or load-bearing structure, the minimum scantlings required for steel and aluminium alloy 'A' Class divisions should be derived from the tables and notes in paragraph 11.2.1.1 to 11.2.1.3 inclusive and should be insulated as indicated in paragraphs 11.2.1.4 to 11.2.1.8 inclusive.

11.2.1.1 Scantlings of steel 'A' Class divisions

Where wedges are used to stiffen 'A' Class bulkheads the spacing should not exceed 760mm.

Table showing the geometrical properties required when using steel stiffeners or beams spaced 760mm apart and without end connections.

Span of Stiffener or Beam	Plating Thickness	Geometrical Properties in conjunction with plating 610mm x thickness	
		Moment of Inertia (I)	Section Modulus (I/Y)
Metres	mm	cm ⁴	cm ³
2.4	4.0	87.5	12.0
2.7	4.5	130.0	17.0
3.0	5.0	175.0	22.0
3.3	5.5	237.5	27.0
3.6	6.0	305.0	32.0

(Note: The spacing of stiffeners or beams should not normally exceed 760mm. However, where stiffeners or beams are spaced other than 760mm apart their moment of inertia and section modulus should be increased or decreased in direct proportion to the distance apart.)

11.2.1.2 Scantlings of aluminium alloy 'A' Class divisions

Where 'A' Class divisions are constructed of aluminium alloy the aluminium structure should have the equivalent strength and stiffness to that of steel having the same length of unsupported span - see table.

Table giving the ratios to be used to obtain equivalent strength values when using aluminium alloys

Required Plating thickness of aluminium alloy	=	1.4 x thickness of steel plating
Required Inertia (I) of aluminium alloy stiffeners or beams	=	2.8 x inertia (I) of steel stiffeners or beams
Required Modulus (I/Y) of aluminium alloy stiffeners or beams	=	2.35 x Modulus (I/Y) of steel stiffeners or beams

11.2.1.3 Alternative scantlings

Proposals to use scantlings less than those derived from the foregoing tables should be referred to Headquarters.

11.2.1.4 Insulating aluminium alloy 'A' Class divisions

Aluminium alloy has a low melting point and its strength properties are severely diminished at elevated temperatures. 'A' Class divisions constructed of alloy have therefore to be protected against the effect of heat by the fitting of approved fire insulation to all surfaces which may be exposed to a fire. L.S. Regulation 52(2), 70 and 86(2) require that the insulation of 'A' Class divisions shall be such that the temperature of the aluminium alloy core does not rise more than 200°C above ambient temperature at any time during the

standard fire test of 60 minutes duration. This requirement applies to aluminium alloy 'A' Class divisions A-60, A-30, A-15 or A-0 standard. Such divisions should be insulated on both sides, except for decks which should be insulated at least on their underside. Where such divisions form the outer boundaries of the ship's hull, superstructures or deckhouses, only their inside surfaces need to be insulated. Flanges and webs of deep girders should be insulated as part of the structural core, even when they exceed the dimensions of the stiffeners included in the standard structural core of IMO Resolution A 754(18) on which the insulation was tested.

11.2.1.5 Boundaries and intersections of insulated 'A' Class divisions

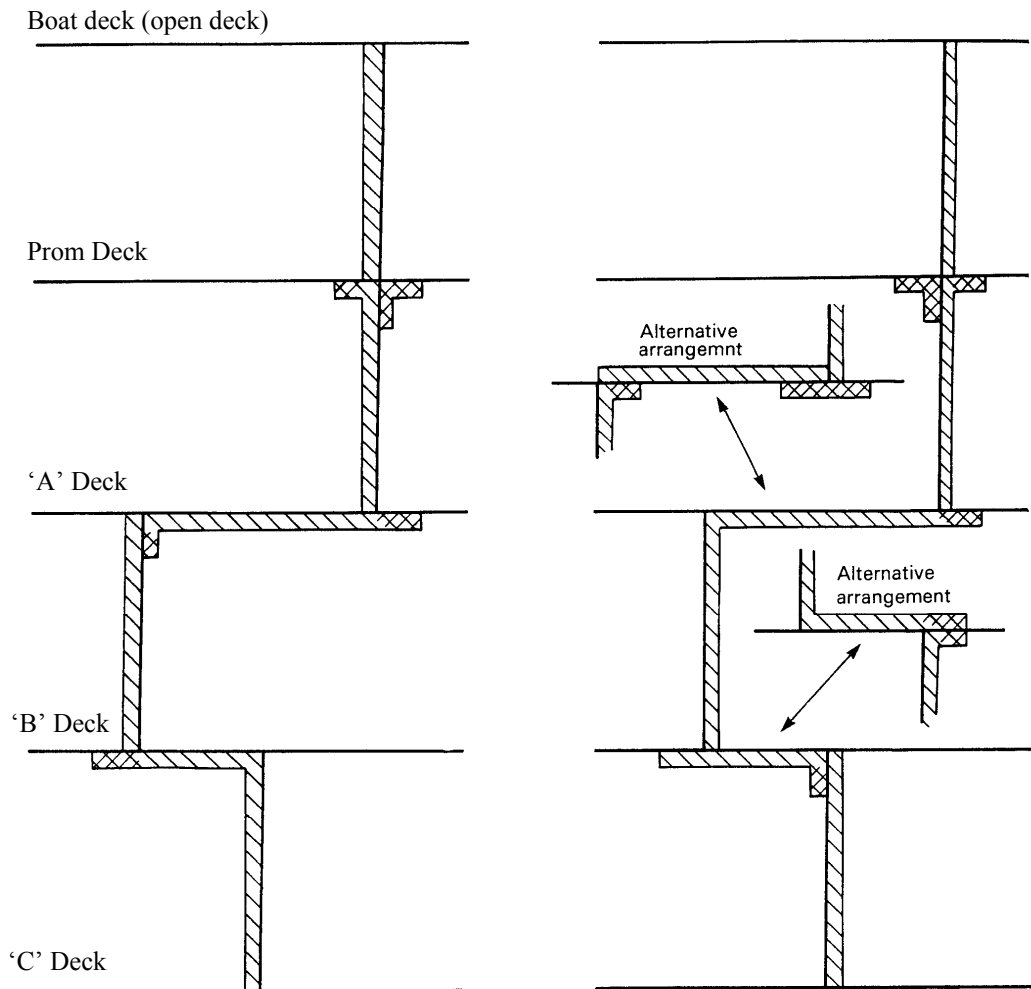
It is essential that the fire integrity and insulation standard of an insulated 'A' Class division is maintained at the boundaries of the division and where the division is abutted or intersected by other structural members. The method by which this should be achieved is by continuing the insulation along the boundaries and intersections for a distance of not less than 380mm in the case of steel structure and 450mm in the case of aluminium alloy structure. The thickness of the insulation used in the continuation ribands should be the same as that fitted over the plating of the division which is being insulated and not as that of the insulation fitted over the stiffeners and or beams. This should apply to all structure, except that referred to below, at which the division terminates or which abuts or intersects the division such as bulkheads or decks, ship's side or deckhouse side, webs or girders and beams or stiffeners. It may be necessary to fit ribands of insulation on the opposite side of the division to that on which the insulation is fitted. When a division is insulated by means of approved board or panels the continuation of the insulation may best be achieved by the use of an approved mineral wool insulation having a thickness corresponding to the same 'A' Class standard as that of the division which is being insulated. The continuation ribands may be omitted in the following instances:

- (a) on the underside of a weather deck abutting a bulkhead which is being insulated; and
- (b) on the upperside of a deck intersecting a bulkhead which is being insulated except when the bulkhead is a machinery casing.

(Figures 11.1, 11.2 and 11.3 illustrate typical examples of where continuation ribands of insulation are necessary.)

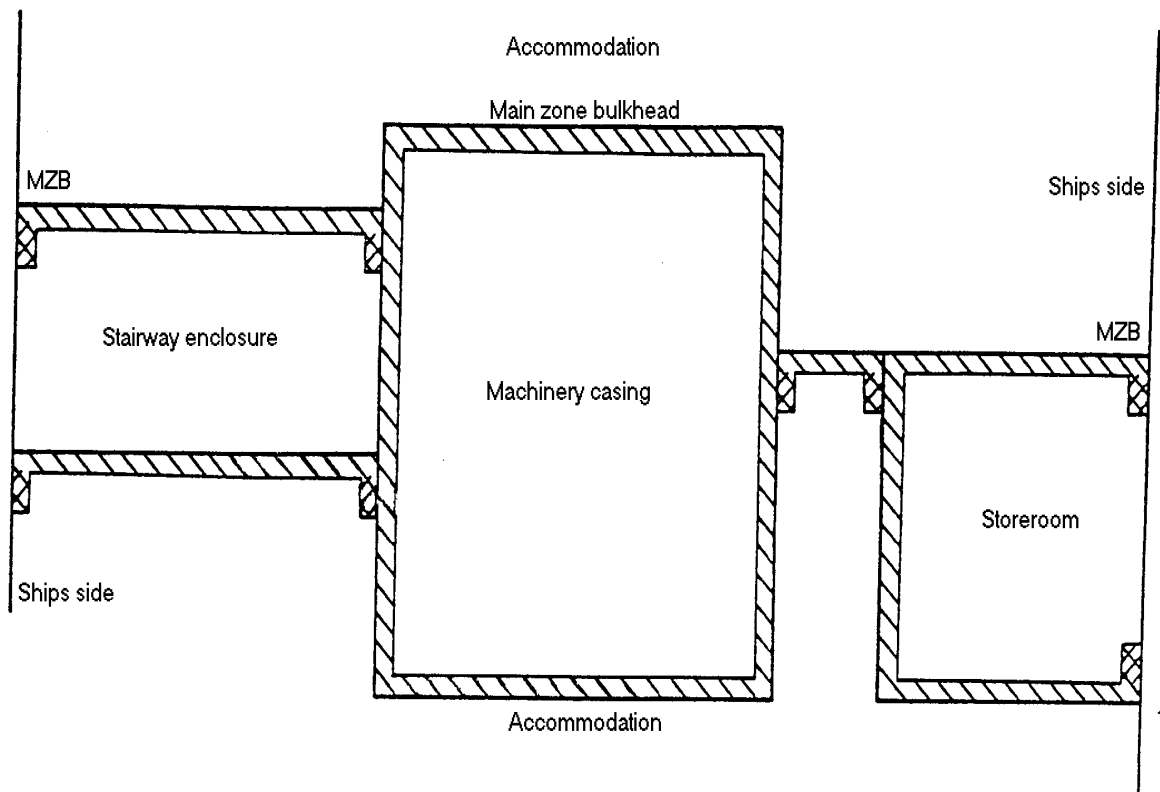
11.2.1.6 Insulations to be approved

Steel 'A' Class divisions A-60, A-30 or A-15 standard or aluminium alloy 'A' Class divisions A-60, A-30 or A-15 standard are required to be insulated with non-combustible materials which have been formally approved for that particular standard. The method of applying each such insulation to an 'A' Class division should be strictly in accordance with the conditions stated in the certificate of approval.



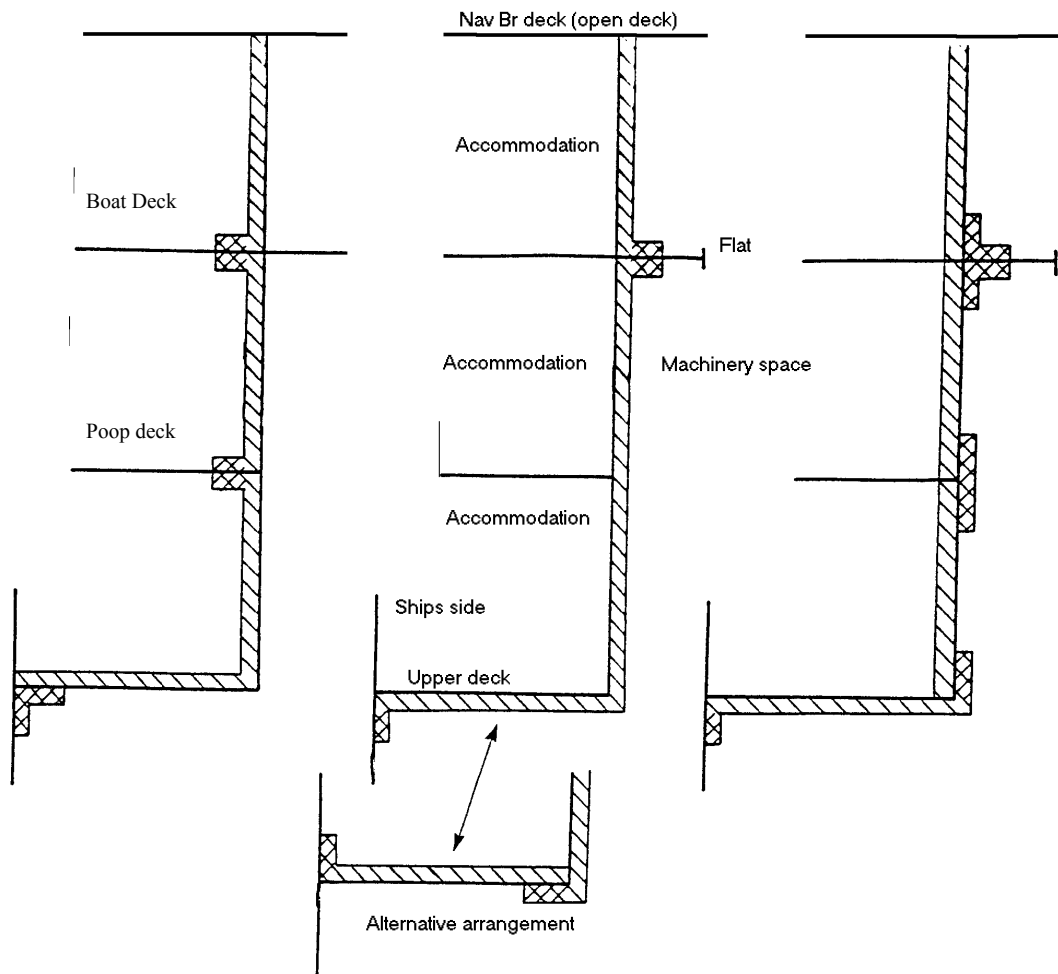
(The ribbands of insulation at boundaries and intersections are shown double hatched.)

Fig 11.1 Two Profiles of a typical Main Zone Bulkhead insulated on the fore and after sides.



(The ribands of insulation at boundaries and intersections are shown double hatched)

Fig 11.2 Plan view of a typical Main Zone Bulkhead in association with other 'A' Class bulkheads.



(The ribbands of insulation at boundaries and intersections are shown double-hatched.)

Fig 11.3 Three methods of insulating a typical machinery casing

11.2.1.7 *Non-combustibility of materials*

Non-combustible materials, whether certified as such or not, are not acceptable as insulants for 'A' Class divisions. They must be subject to the appropriate fire test.

11.2.1.8 *Limited usage of insulations*

Materials which have been accepted only as insulants for 'A' Class bulkheads should not be used as insulants for 'A' Class decks and vice versa.

11.2.2 'B' Class divisions - general comment

Every 'B' Class division, other than those constructed of steel or aluminium alloy must be constructed of materials (or panels) which have been approved and they

should be erected in accordance with the conditions stated on the approval certificates (see also paragraph 12.4.2).

11.2.2.1 Facings on 'B' Class division

The panels from which a 'B' Class division is constructed may be faced with a combustible material to the extent indicated in paragraphs 12.11, 13.11, 14.11 and 14.26.

11.2.2.2 Steel or aluminium alloy 'B' Class divisions

(a) Subject to any additional requirements for load-bearing structure, the minimum scantlings required for steel or aluminium alloy 'B' Class divisions should be the same as those for steel and aluminium alloy 'A' Class divisions as derived from the tables and notes in paragraphs 11.2.1.1 to 11.2.1.3 inclusive.

(b) L.S. Regulations 52(2), 70 and 86(2) require that the insulation of aluminium alloy 'B' Class divisions shall be such that the temperature of the aluminium alloy core does not rise more than 200°C above the ambient temperature at any time during a standard fire test of 30 minutes duration. This requirement applies to 'B' Class divisions of any standard i.e. B-15 or B-0.

(c) Steel 'B' Class divisions of B-15 standard should be insulated to the same standard as steel 'A' Class divisions of A-15 standards and aluminium alloy 'B' Class divisions of B-15 and B-0 should be insulated respectively to the same standards as aluminium alloy 'A' Class divisions of A-15 and A-0 standards as indicated in paragraph 11.2.1.6 unless an approval certificate has been issued for the appropriate 'B' Class standard.

11.2.3 'Continuous 'B' Class ceiling or lining'

11.2.3.1 A continuous 'B' Class ceiling should terminate at:

- (a) an 'A' Class bulkhead except that it should not penetrate the 'A' Class insulation;
- (b) the ship's side or deckhouse side;
- (c) a 'B' Class bulkhead of the same or higher standard, fitted deck to deck; or
- (d) a 'B' Class lining of the same of the same or higher standard, fitted deck to deck.

11.2.3.2 A continuous 'B' Class lining should be fitted deck to deck except that it may stop short of the deckhead at a continuous 'B' Class ceiling

extending each side of the lining. A continuous 'B' Class lining should terminate in a horizontal direction at:

- (a) an 'A' Class division, except that it should not penetrate the 'A' Class insulation;
- (b) the ship's side or deckhouse side; or
- (c) a 'B' Class bulkhead of the same or higher standard, extending each side of the lining.

11.2.4 'Modular cabins'

Modern construction techniques include the use of modular cabins. Whenever possible this type of construction should meet the requirements and intent of the regulations and these Instructions. In instances where this appears impracticable advice may be sought from Headquarters.

11.2.5 'Control stations'

11.2.5.1 Spaces in which the sprinkler pumps, drencher pumps and fire pumps are situated should not be regarded as control stations. Such spaces in passenger ships are categorised as 'auxiliary machinery spaces' and in cargo ships as 'other machinery spaces'. However in ships of 2,000 tons and over, other than passenger ships, the boundaries of the space containing the emergency fire pump should be insulated equivalent to that required for a control station in L.S. Regulation 74 or 91 as applicable.

11.2.5.2 A control room situated in a machinery space which does not contain the propulsion machinery and boilers should still be regarded as a control station even when the space contains pumps, purifiers etc. necessary for the operation of the propulsion machinery and boilers. Moreover, spaces containing batteries which are reserve power sources for radio installations, emergency generator starting or transitional emergency power supply, are control stations.

11.2.6 'Central control stations'

The communications systems referred to in the definition of 'central control station' do not include fire systems which are not required by the regulations.

11.2.7 'Equivalent material'

The definition of 'equivalent material' specifies that such a material is to be non-combustible and at present aluminium alloy is the only suitable material which complies with the definition.

11.2.8 'Non-combustible material'

Where non-combustible materials are required by the regulations, they should be of an approved type. Approval is not however required for metals or any inorganic materials which are recognised as being non-combustible e.g. steel aluminium, alloy, copper, glass, woven glass cloth, concrete, perlite, vermiculite, calcium silicate, ceramic products, natural stone etc., except when any such material is combined with a combustible material of any quantity in a product.

11.2.9 'Rooms containing furniture and furnishings of restricted fire risk'

11.2.9.1 For compliance with L.S. Regulation 1(2), surface floor coverings other than carpets and carpet underlays should comply with paragraph 11.16.2 and carpets and carpet underlays should comply with paragraph 11.16.3.

11.2.9.2 For compliance the upholstered parts of furniture are required to be tested in accordance with British Standard 5852: Part 1:79 and satisfy the cigarette and butane flame tests.

11.2.9.3 The requirements specified in the definition should apply to furniture and furnishings in private sanitary facilities situated in cabins containing furniture and furnishings of restricted fire risk.

11.2.10 Major repairs, alterations and modifications (L.S. Regulation 1(7)(a))

The regulations are required to apply to ships undergoing major repairs, alterations and modifications only within the parts of the ship in which the repairs alterations and modifications are made. However, the regulations should not apply to existing bulkheads, decks and ceilings, linings, materials or fittings within such parts provided they are unaffected by the repairs, alterations and modifications, (see also paragraph 1.4.3).

11.2.11 Asbestos - health hazards on ships undergoing repairs, modifications, and maintenance etc.

11.2.11.1 Dust generated by the stripping out of thermal or fire insulations containing asbestos presents a serious health hazard. Merchant Shipping Notice No. M.1428 gives a very comprehensive account of the dangers of exposures to asbestos dust and the precautions to be observed when maintenance or emergency repairs are being carried out which are liable to create asbestos dust. Reference should also be made to the 'Code of Safe Working Practices for Merchant Seamen'.

11.2.11.2 It should be assumed that asbestos particles are present in the dust on the upperside of ceilings situated below deckheads which have been insulated with sprayed asbestos insulation even when it is known that the insulation is faced with hard setting cement. The cement facing may have

deteriorated or been disturbed at some stage during the life of the ship exposing the insulation. It should be similarly assumed that asbestos particles are present in the dust behind linings in way bulkheads which have been insulated with sprayed asbestos insulation. Surveyors should exercise extreme caution when panels are removed from such ceilings and linings and when surveying the structure, insulation or equipment behind the ceilings or linings.

11.2.11.3 From time to time a surveyor may be involved in survey work on ships when asbestos-based insulating materials are being disturbed or stripped out. Where such work is being carried out the surveyor should take the full precautions set out in this paragraph.

11.2.11.4 Before boarding such a ship, he should obtain from the shipowner or shiprepairer an assurance that the appropriate safety standards and precautions i.e. as described in the Merchant Shipping Notice, are in operation or, if the ship is within the United Kingdom as required by the regulations of the Health and Safety Executive inspector, or his equivalent in the case of work being done abroad. If it is obvious that such standards and precautions are not being maintained, the surveyor should not proceed with his survey on board the ship until the situation has been rectified, and he should report the full facts to Headquarters.

11.2.11.5 Shipowners and shiprepairers should be persuaded to maintain the highest level of cleanliness of the ship at all times. High standards will only be maintained where the work is carefully planned and closely supervised by a responsible person who is properly trained and experienced in this work. It is important that all spaces on board the ship which are liable to be contaminated should be adequately monitored by the owner or ship repairer to establish the concentration of asbestos dust. Each space or group of spaces should be clearly indicated as high risk or low risk areas by means of easily observed notices.

11.2.11.6 High risk areas, which may be defined as areas which have a concentration of asbestos dust containing crocidolite (blue asbestos) in excess of 80 fibres/millilitre, require the wearing of positive pressure powered respirators, self contained breathing apparatus, compressed air-line breathing apparatus or fresh-air hose breathing apparatus. Such equipment is bulky and restrictive of movement and would prevent a wearer from carrying out most survey work. For this reason a surveyor is not expected to work in or pass through such areas.

11.2.11.7 Low risk areas may be defined as areas which have a concentration of asbestos dust containing crocidolite between 0.2 fibres/ml and 80 fibres/ml. For work in such areas, surveyor's should wear high efficiency dust respirators, fully protective disposable overalls and rubber boots. Approved equipment of this type will be provided by the MCA on application to Headquarters.

11.2.11.8 It is most important that the precautions taken aboard ship and ashore preclude the possibility of cross contamination by other personnel working aboard the ship who may not be observing the precautions recommended.

11.2.11.9 After leaving the ship a surveyor should discard contaminated overalls after vacuum cleaning in a properly equipped decontamination centre ashore and wash all parts of his body which have been exposed to dust before leaving the centre. After this stage he should not make contact with other personnel from the ship unless they too have worn full protective equipment and have passed through the same decontamination procedure.

11.2.11.10 Dust should be continuously removed by means of vacuum extractor appliances sited in the immediate vicinity of dust generating work. Such appliances should remove dust in collectors fitted with the necessary filters to avoid further spread of contamination. Sprayed asbestos insulation should be thoroughly wetted with water before being disturbed. Ventilation trunking should be sealed off before work is commenced and any dust is generated. The importance of this latter action cannot be over-stressed as the removal of dust from inside trunking can be difficult both to do and to ensure that it has been done thoroughly.

11.2.11.11 Before a ship which has been contaminated by asbestos during a lay-up for repairs or re-fitting is returned to service it is vital that all parts of the ship including ventilation systems and concealed spaces above ceilings and behind linings are thoroughly cleaned of dust to eliminate any subsequent hazard to passengers and crew. Cleaning should be done in a logical order. If ventilation trunking has been contaminated then running the system will probably remove most of the dust but in doing so will distribute it throughout the accommodation. If cleaning the ventilation trunking has become necessary by running the system then this should be preceded the cleaning of the spaces served by the system.

11.3 'A' Class Insulations

11.3.1 Bulkhead insulation - extent

11.3.1.1 An insulation for an 'A' Class bulkhead should cover the whole area of the division and adjacent structures as indicated in paragraph 11.2.1.5 except that it may terminate on top of the expanded metal or equivalent fitted over the insulation incorporated in an 'A' Class deck covering of the same or higher 'A' Class standard provided the 'A' Class deck insulation is fitted tightly to the bulkhead plating. However when an 'A' Class bulkhead is connected to the double bottom plating or bottom shell plating, the insulation should terminate 400mm above the double bottom or bottom shell in order to reduce the risk of the insulation absorbing any oil or water which may be on the double bottom or shell plating. The lower edge of the insulation should terminate at a flat bar welded to the bulkhead.

11.3.1.2 Any pipe penetrations situated in the bulkheads below the flat bar need not be insulated provided the penetrations are constructed in accordance with paragraph 11.4.

11.3.1.3 Any cable penetrations situated in the bulkheads below the flat bar need not be insulated except for those which are constructed of heat sensitive materials which should be insulated with approved materials fitted in accordance with the conditions specified in the approval certificate. The insulation should be protected by an oil and oil vapour barrier.

11.3.2 'A' Class deck insulation - extent

An insulation for an 'A' Class deck should cover the whole area of the division and adjacent structures as indicated in paragraph 11.2.1.5. It should not terminate at a ship's side lining or a bulkhead lining except that a ceiling which is the insulating medium for an 'A' Class deck may terminate at a lining fitted deck to deck which is the insulating medium for an 'A' Class bulkhead.

11.3.3 Mineral wool insulations

11.3.3.1 *General Comment*

For the purpose of these Instructions mineral wool insulations include ceramic fibre insulations. Mineral wool insulations should be stored in dry conditions before use and should be dry when attached to the ship's structure.

11.3.3.2 *Density*

The density of a mineral wool insulation is required to be within the range of $\pm 10\%$ of the density specified by the manufacturer. Surveyors should occasionally check from the mass and volume of several slabs or rolls that the density of an insulation lies within this range. A surveyor who finds that the density of an insulation is outside this range should contact Headquarters for advice on what further action should be taken.

11.3.3.3 *Securing insulations to steel structure*

Mineral wool insulations used for fire protection purposes should be secured mechanically to the steel structure by means of welded steel pins, normally spaced not more than 300mm apart, galvanised wire netting having a maximum mesh size of 25mm and spring steel washers, the steel pins being at least 12mm longer than the thickness of the insulation. As an alternative, surveyors, may accept the insulation being secured by means of welded steel pins bent at right angles over the galvanised wire netting, the spring washers being dispensed with provided that the pins are at least 40mm longer than the thickness of the insulation and pins in adjacent rows are bent over in opposite directions. On no account should the pins be bent in the same direction because this may result in the wire netting becoming detached from the

insulation. The pins should be bent over at the exposed surfaces of the insulation in order to maintain its thickness and prevent a 'quilted effect' occurring.

11.3.3.4 Securing insulations to aluminium alloy structure

Mineral wool insulations used for fire protection purposes must be secured mechanically to the aluminium alloy structure by means of stainless steel pins screwed into aluminium alloy bosses welded to the structure, normally spaced not more than 300mm apart, galvanised wire netting having a maximum mesh size of 25mm and spring steel washers, the stainless steel pins being at least 12mm longer than the thickness of the insulation. The steel pins should not be bent over at right angles as an alternative method of securing the insulation because the thread in the bosses may be damaged in the process of bending the pins.

11.3.3.5 The fitting of insulating materials

(a) When an insulating material is approved for structural fire protection purposes, the manner in which it should be fitted will normally be stated in the certificate of approval. It is therefore essential to ensure that all such materials are correctly fitted. Failure to do so could lead to very serious problems should a fire ever occur in the vicinity.

(b) It is of particular importance to ensure that properly formed joints are made between the butts and seams of adjacent rolls or slabs of insulating material and that the insulation is always fitted tightly over the structure, especially the stiffeners, it is protecting. Furthermore when the insulation comprises two or more layers of material it is essential to ensure that the butts and seams of each layer are effectively staggered. All wire netting should also be fitted tightly across the face of the insulation on both the plating and stiffeners.

The central aim being to avoid the creation of air gaps, or to leave any of the structure which has to be protected, improperly insulated.

11.3.3.6 The effect of water in insulation

(a) Although water does not normally affect the insulating properties of 'A' Class mineral wool insulations it could seriously corrode the steel pins and galvanised wire netting which secure the insulations to the structure. Therefore surveyors should examine insulation which has been soaked with water and if there are any signs of deterioration in the pins and wire netting then the insulation should be removed, the pins renewed as necessary, the insulation replaced when dry if still in good condition or new insulation fitted, and new wire netting and spring steel washers fitted over the pins.

(b) Insulation fitted in boiler rooms should be examined regularly because similar deterioration may occur due to the high humidity in such spaces.

11.3.4 Board insulations

11.3.4.1 General comment

For the purpose of these Instructions board insulations include panels consisting of mineral wool insulations faced with steel sheets.

11.3.4.2 Density

The density of a board insulation or the core insulation in the case of a panel consisting of mineral wool insulations faced with steel sheets is required to be within the range of $\pm 10\%$ of the density specified by the manufacturer. Surveyors should occasionally check from the mass and volume of the boards or panels that the density of the board or insulation lies within this range. Any surveyor who finds that the density of a batch of boards or the insulation in a batch of panels is outside this range should contact Headquarters for advice on what further action should be taken.

11.3.4.3 The extent of insulation

(a) Each board insulation which has been approved as the insulating medium for 'A' Class bulkheads should be fitted deck to deck except that it may terminate on top of the insulating component of an 'A' Class deck covering as indicated in paragraph 11.3.1.

(b) In no case should the board insulation terminate on any other type of deck covering or any combustible surface material on an 'A' Class deck covering. Stopping a board insulation at ceiling level and insulating the bulkhead between the ceiling and deckhead with an 'A' Class mineral wool insulation should not be accepted without the prior agreement of Headquarters because the insulation standard of the bulkhead may not be maintained at the junction of the two insulations during a fire situation due to the distortion of the bulkhead.

11.3.4.4 Increasing the length of boards

If a tween deck height exceeds the length of an 'A' Class board insulation the length of the board may be increased by butt strapping an extension board of the same material to it, the joint between the boards being tight. Straps should be fitted in way of the joint on each side of the extended board and should be of steel having a length equal to the width of the board less any jointing profiles and a width and thickness of 75mm and 0.7mm respectively. The butt straps should be screwed and not through-bolted. The jointing profiles should be fitted deck to deck in such cases.

11.3.4.5 Care in erecting insulation

Care should be taken to ensure that the boards used as the insulating media for 'A' Class bulkheads are erected in accordance with the approved drawings and in particular that the correct thickness of boards and jointing profiles are used. The boards may be faced on their exposed and concealed surfaces with a combustible material having a Class 1 surface spread of flame rating as indicated in paragraphs 12.11, 13.11, 14.11 and 14.26.

11.3.4.6 Electrical fittings on 'A' Class linings

Lighting switches, power sockets and other electrical fittings and cables leading to such fittings may be surface mounted on the unconcealed side of linings which are the insulating media for 'A' Class bulkheads in order to ensure that the insulation standards of the bulkheads are not impaired. The cables may be uncovered or fitted in conduits or covered by omega profiles of steel or other materials having a Class 1 surface spread of flame rating.

11.3.4.7 Ceilings which are insulations for 'A' Class decks

Ceilings which have been accepted as the insulating media for 'A' Class decks should not be fitted closer to the deck plating than the distance used when the test sample was fire tested. The panels from which a ceiling is constructed may be faced on their exposed and concealed surfaces with a combustible material having a surface spread of flame rating in accordance with the appropriate regulation i.e.; L.S. Regulations 62, 80 & 97 and S.S. Regulation 43.

11.3.4.8 Access panels

Hinged panels may be fitted in an 'A' Class ceiling in order to provide access for the control and maintenance of fire dampers in ventilation ducting positioned above the ceiling provided that the integrity and insulation standard of the ceiling are not impaired, particularly when the ceiling incorporates an overlay of mineral wool insulation.

11.3.4.9 Penetration of ceilings

A ceiling which is the insulating medium for an 'A' Class deck should not be penetrated by bulkheads and linings which are 'B' Class or 'C' Class divisions or combustible divisions nor should it rely on support afforded by such bulkheads and linings. The ceiling should be supported in accordance with the approved drawing at the ships side, deckhouse side or 'A' Class bulkheads and also from the deckhead by steel hangers and/or on the flanges of the top channel profiles of bulkheads and linings, the profiles being supported by steel hangers from the deckhead. Such top channel profiles should be unperforated as indicated in paragraph 11.7.6.

11.3.5 Sprayed insulations

11.3.5.1 Preparation

The surfaces of the structure are to be prepared and coated in accordance with the manufacturer's instructions and any other conditions stated on the approval certificate for the insulation. The retention clips or pins should be welded to the structure before the application of any coating. The sprayed insulation should be applied by trained and skilled operators.

11.3.5.2 Density

The density of a sprayed insulation in its dried-out condition is required to be within the range of $\pm 15\%$ of the density specified by the manufacturer. It is very difficult to check the density of a sprayed insulation because it takes several weeks for it to achieve its dried-out condition and it cannot be known for certain when it has reached this condition. The density could then only be checked by removing a specific volume of insulation and weighing it and surveyors are not expected to resort to such measures. A crude method has been devised which enables a surveyor to check the density of an insulation immediately after it has been sprayed. Each manufacturer has indicated the number of bags of dry mix of the insulation which when mixed with water will cover a square metre of plating to the correct thickness at the specified density allowing for normal wastage. This coverage rate is stated in the approval certificate for the insulation. The number of bags of dry mix which should have been used to insulate the division can be obtained by dividing the area of the division by the manufacturers coverage rate and this can be compared with the number of bags of dry mix which have actually been used. When the stiffened side of a bulkhead or the deckhead is being insulated the area of each stiffener or beam should be obtained by multiplying its length by twice its depth. Some allowance may also need to be made for other structure such as stringers, brackets etc.

11.3.5.3 Thickness

The thickness of a sprayed insulation indicated in the approval certificate is a minimum thickness. Surveyors should use their discretion when checking the thickness of a sprayed insulation and may accept small areas in which the minimum thickness has not been achieved provided that the insulation in these areas is deficient by no more than 3mm and the thickness over the division is generally in excess of the minimum thickness.

11.3.6 Overdeck insulations (including deck coverings)

11.3.6.1 *Preparation*

The preparation of the deck plating and the method of laying an approved deck covering incorporating an 'A' Class overdeck insulation are specified in the approval certificate for the insulation.

11.3.6.2 *Bulkheads and linings fitted on overdeck insulations*

Linings which are the insulating media for 'A' Class bulkheads and bulkheads and linings which are 'B' Class or 'C' Class divisions or are combustible should not penetrate an 'A' Class overdeck insulation. In each case the bottom profile should be fitted to the top of the 'A' Class insulation as shown on the appropriate approved drawing. Any combustible surface covering on an 'A' Class insulation should not be laid under any bulkheads or linings except those which are combustible.

11.3.7 Intumescent materials

Intumescent materials are not acceptable to the MCA for use as 'A' Class insulations for any of the following reasons:

11.3.7.1 they may not be non-combustible;

11.3.7.2 they intumesce at temperatures in excess of the mean temperature limitation of 139°C. This temperature could be considerably exceeded before they became effective;

11.3.7.3 they produce smoke whilst intumescenting;

11.3.7.4 they may lose their intumescenting properties in spaces having high ambient temperatures such as machinery spaces or in low temperature fires;

11.3.7.5 there is no guarantee that the materials would intumesce at any stage during the life of a ship and there is no means of knowing if materials have lost their ability to intumesce;

11.3.7.6 they are unrecognisable from ordinary paints and coatings and any deteriorating material may be removed and inadvertently replaced by an ordinary paint or coating;

11.3.7.7 they may deteriorate unbeknowningly in concealed spaces; and

11.3.7.8 they may be affected by water or hydrocarbons.

11.4 Pipes Penetrating 'A' Class Divisions

11.4.1 Approved manufactured systems for pipe penetrations

11.4.1.1 Any approved manufactured system for pipe penetration may be used for pipes penetrating 'A' Class divisions subject to compliance with the conditions specified in the approval certificate.

11.4.1.2 Bends in pipes should be arranged sufficiently clear of a bulkhead or deck so as not to interfere with a pipe penetration (pipe penetration systems are normally tested only on straight pipes).

11.4.1.3 Alternatively the procedures outlined in the next paragraph may be adopted.

11.4.2 Alternative acceptable systems for pipe penetrations

11.4.2.1 *Penetration with pipes having a high melting point*

When the piping is of steel or any other material having a melting point of 1000°C or more, either (a) or (b) should apply.

(a) The pipe should be welded directly to the division or joined to a bulkhead or deck fitting of the same material which should be welded or bolted to the division as shown in figures 11.4 and 11.5. Where practicable in the case of an insulated division the bulkhead or deck fitting should be of sufficient length to ensure that bolted flanges are clear of the insulation which is to be continued along the fitting for a distance of 380mm from the division. When compression, push-in or similar joints are used the length of the portion of the piping or fitting which is welded or bolted to the division should not be less than 900mm with at least 400mm on the insulated side of an insulated division.

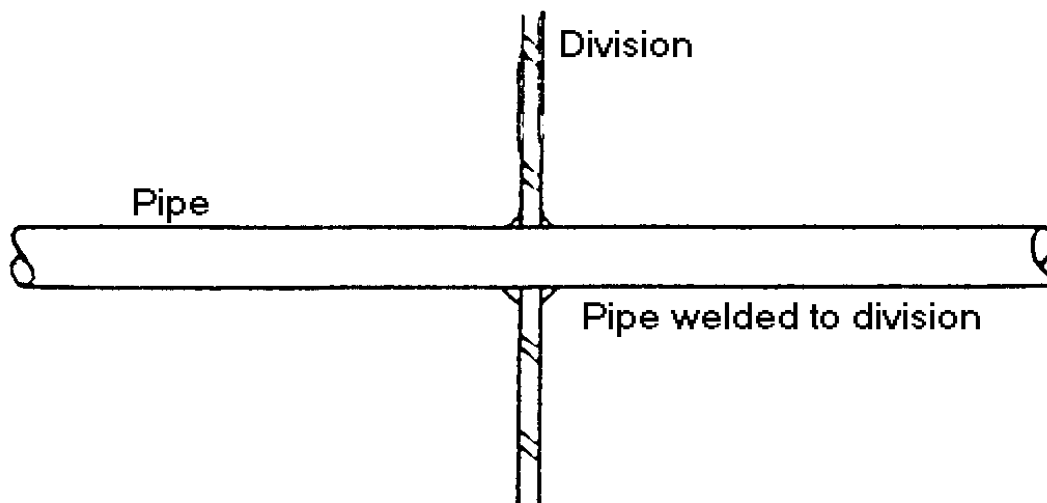


Fig 11.4

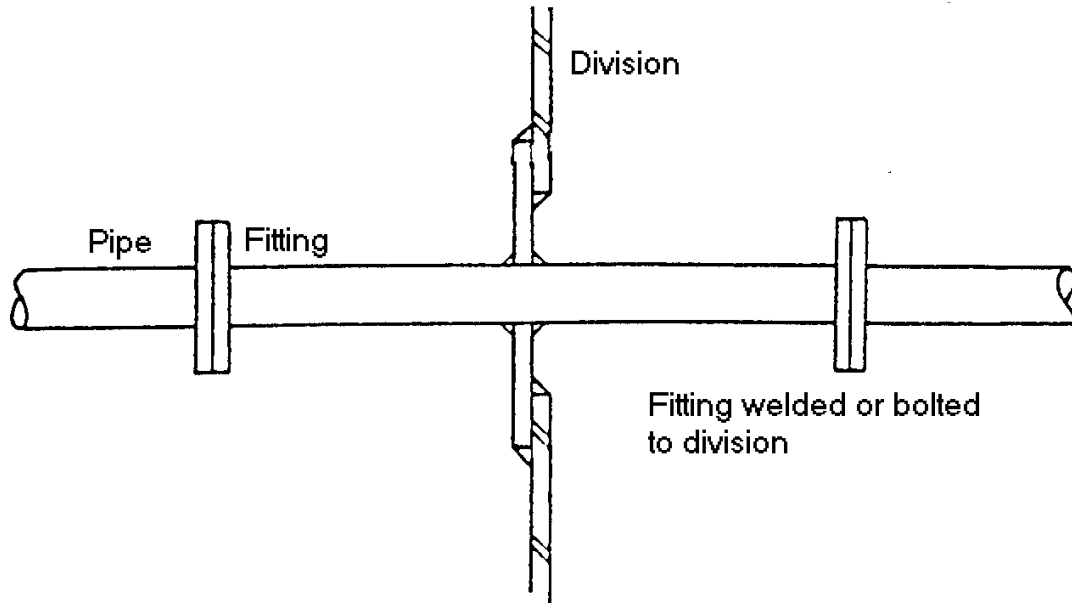


Fig 11.5

(b) When the pipe is not welded or bolted to the division as stated in sub-paragraph (a) then each pipe should be passed through a steel circular spigot, of 3mm minimum thickness and 400mm minimum length, which should be welded to the division. A nominal 20mm gap should be provided between the pipe and the spigot which should be packed tightly throughout its length with an approved A60 insulation and sealed at each end with a suitable flexible sealant. Where the outside diameter of the pipe is 150mm or more the spigot should not be less than 900mm in length. Compression, push-in or similar type of joints should not be positioned within the spigot and should not be less than 900mm apart. The spigot should be positioned such that at least 400mm of its length is on the insulated side of an insulated division. Figure 11.6 illustrates this sub-paragraph.

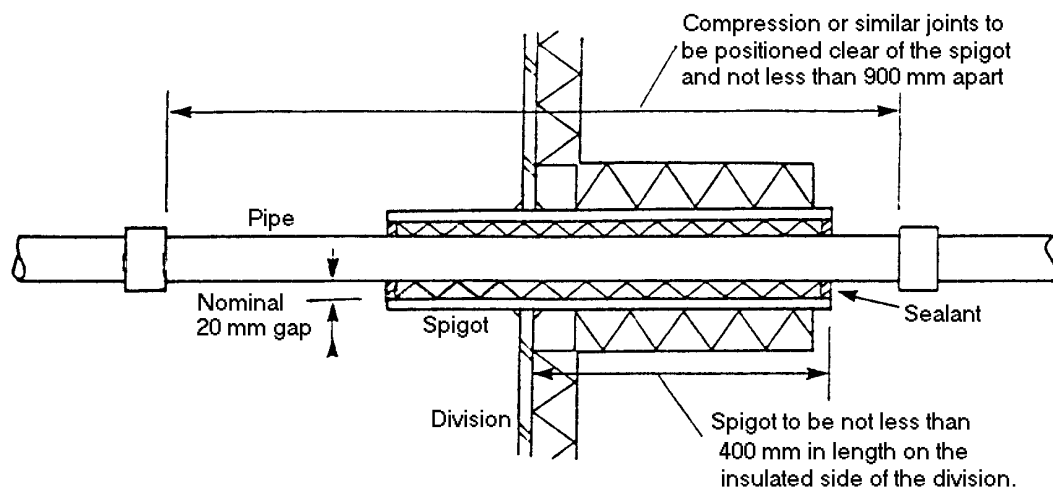


Fig 11.6

11.4.2.2 Penetration of 'A' Class divisions with pipes having low melting points.

When penetrations through 'A' Class divisions are made with piping having a melting point less than 1000°C then:

- (a) each pipe should be passed individually through a 900mm long steel circular spigot of 5mm minimum thickness which should be welded to the division. A nominal 20mm gap should be provided between the pipe and the spigot which should be packed tightly throughout its length with an approved A-60 insulation and sealed at each end with a suitable flexible sealant. There should be no joints in the pipe within the length of the spigot. The spigot should be positioned such that at least 400mm of its length is on the insulated side of an insulated division; and
- (b) pipes penetrating decks should be treated as indicated in subparagraph (a) except that when the piping extends vertically through more than one tweendeck, the vertical piping in alternate tweendecks should be of steel irrespective of whether or not the pipe is offset within its length.

11.4.3 Piping penetrating watertight 'A' Class divisions

11.4.3.1 The piping should be of steel or any other material having a melting point of 1000°C or more and should be welded directly to the division or joined to a bulkhead or deck fitting of the same material which should be welded or bolted to the division as indicated in paragraph 11.4.2.1.

11.4.3.2 Compression, push-in or similar joints should not be used in piping systems which penetrate watertight 'A' Class divisions.

11.4.4 The insulation of pipe penetrations

11.4.4.1 When the piping penetrations referred to in paragraphs 11.4.2 and 11.4.3 pass through insulated 'A' Class divisions the insulation on the plating of the division should be continued along the piping or spigot for a distance of not less than 380mm. Where a pipe has a bend close to the division the 380mm should be measured along the insides of the bend. The insulation should be secured effectively in place by wire netting and steel wire. See also paragraph 11.3.1.

11.4.4.2 See paragraph 12.7, 13.7, 14.7 and 14.22 of these Instructions which deal specifically with the regulations referring to openings in 'A' Class divisions.

11.5 Electric Cables Penetrating 'A' Class Divisions

11.5.1 Electric cables penetrating non-watertight 'A' Class divisions

11.5.1.1 Any approved manufactured cable transit may be used for electric cables penetrating non-watertight 'A' Class divisions subject to compliance with the conditions specified in the approval certificate. Alternatively the following procedures may be adopted.

11.5.1.2 The cables should be passed through steel spigots having a minimum length of 450mm and a minimum thickness of 3mm which should be welded to the divisions. The internal cross sectional area of the spigots should not exceed 0.05m². A nominal distance of 20mm should be maintained between the cables and between the cables and spigot. The space between the cable and between the cables and spigot should be packed tightly throughout the length of the spigot with an approved A-60 insulation and the ends of the spigot sealed with a suitable flexible sealant. When the division is insulated the spigot may project up to 400mm on the insulated side of the division but should not project more than 225mm on the uninsulated side of the division. The insulation on the division should be continued along the spigot and cables where applicable for a distance of not less than 380mm. The insulation should be secured effectively in place by wire netting and steel wire. When the division is uninsulated the spigot may project up to 400mm on either side of the division. Figure 11.7 illustrates this arrangement.

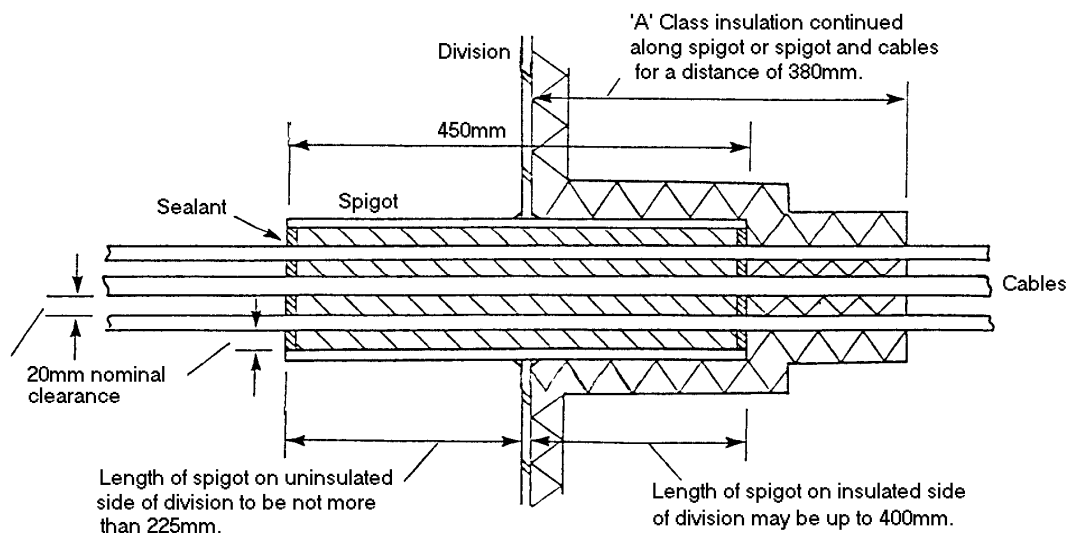


Fig 11.7

11.5.2 Electric cables penetrating watertight 'A' Class divisions

Electric cables which penetrate watertight 'A' Class divisions should only be passed through approved manufactured cable transits which have been approved for this purpose. Moreover, such penetrations should be located as high as practicable in order to reduce the risk of progressive flooding in the event of the compartment being breached.

11.5.3 Cable-tray hangers

Hangers used to support cable trays, suspended ceilings etc. and welded to deck beams or bulkhead frames should be insulated for a length of 380mm from the plating and to the same standard as the plating insulation. If the cross-sectional area of the hanger is less than 100 square millimetres this requirement may be waived.

11.6 'A' Class Doors and Shutters

11.6.1 General comment

11.6.1.1 *Doors and shutters*

- (a) Every door or shutter assembly which is used to close openings in 'A' Class bulkheads should be of an approved type and its construction and method of installation should be in accordance with the conditions specified in the approval certificate.
- (b) When a door or shutter is used to close an opening in an 'A' Class bulkhead constructed of aluminium alloy it should be fitted in a stiffened steel panel attached to the aluminium alloy bulkhead by 12mm diameter steel bolts spaced 300mm apart. The steel plate should extend 450mm beyond the sides and top of the frame of the door or shutter. The steel plate and bolts should be suitably isolated from the aluminium alloy to the satisfaction of the surveyor.
- (c) In no case should a primary deck covering or a surface floor covering be fitted under an 'A' Class door or shutter. The sill plate, sill channel or coaming, whichever is applicable, should be welded to the deck plating and such coverings stopped on each side of it.
- (d) Grilles or louvres should not be fitted in 'A' Class doors or shutters.

11.6.1.2 *Doors only*

- (a) A door should have the same or higher 'A' Class standard as the bulkhead in which it is fitted.
- (b) A window may be fitted in the upper half of an 'A' Class door provided that;

- (i) it is positioned no closer than 150mm to any edge of the door leaf;
- (ii) the window is of toughened safety glass and the window frame and glazing bar are of steel; and
- (iii) the door incorporating the window has been successfully fire tested.

11.6.1.3 Shutters only

In no case should a rolling shutter be fitted in an 'A' Class bulkhead other than a bulkhead of A-O standard. A rolling shutter should be capable of automatic closure after initial release and subsequently if the shutter is raised to approximately three quarters of the height of the clear opening.

11.6.1.4 Instructions to open

To avoid any doubts in an emergency, all sliding 'A' Class doors and drop-rolling 'A' Class shutters should be provided with the following notices to indicate how they are to be opened;

- (a) Sliding doors

The following notice should be painted on each side of the door leaf:

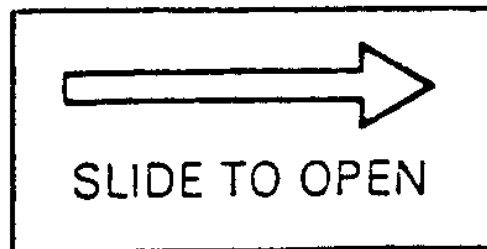


Fig 11.8

The notice should be painted in letters 100mm in height and positioned close to the door handle. The letters and arrow should be painted white on a green background.

(b) Drop-rolling shutters

The following notice should be painted on each side of the shutter curtain:

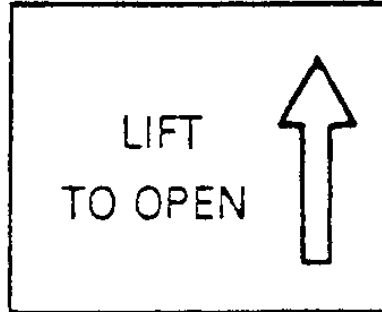


Fig 11.9

The notice should be painted in white letters 100mm in height on a green background and positioned close to the lifting handle.

11.6.1.5 'A' Class doors - gaskets

(a) Approved 'A' Class door assemblies are not designed to accommodate gaskets of any material in the bosom of the door frames or housing channels in order to make them gas tight and doors have been seriously damaged when this has been done in the past. Consequently under no circumstances should this be done. Each approved 'A' Class door assembly is considered to comply with the regulations without the necessity to fit gaskets.

(b) If it is necessary for any other purpose to fit gaskets to an 'A' Class door assembly they may be fitted to the door frame and bear on the surface of the door leaf as shown for a hinged door in figure 11.10. The gaskets should be of flame retardant neoprene or similar. It may be necessary at the bottom of the door to attach the gasket to the bottom edge of the door leaf and bear on the sill or coaming rather than the other way round because it would be vulnerable to damage in the latter situation. However it should be noted that the MCA is not prepared to take any responsibility with regard to the effectiveness of such gaskets where there is a pressure differential across the door.

11.6.1.6 'A' Class doors - identification plates

(a) Each door or shutter should be fitted with a thin metal identification plate which indicates clearly the manufacturers name, the 'A' Class standard of the door or shutter and the number of the approved drawing to which it has been manufactured or the manufacturers type designation or reference number (e.g. Smith + Co.; A30 grade; Ref Nos 123/A).

(b) The identification plate should be screwed or pop riveted to the vertical edge of the door (hinged side).

(c) In the case of a shutter the identification plate is to be screwed or pop riveted to the vertical flange of the bottom bar of the shutter or to the underside of its boxing.

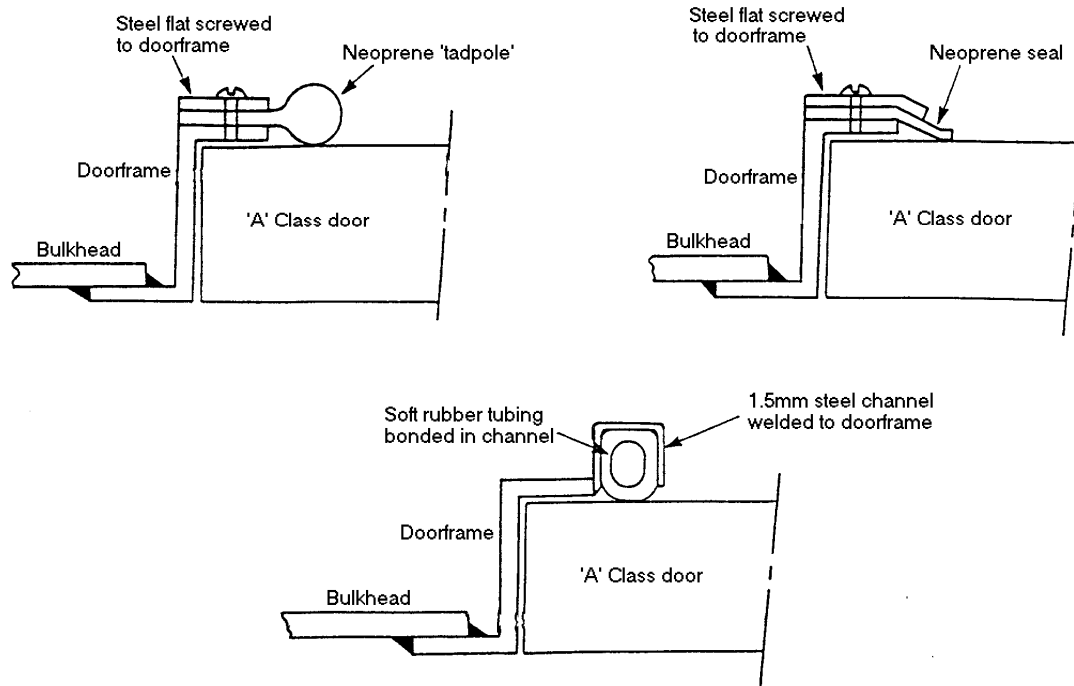


Fig 11.10 Acceptable seals for 'A' Class doors

11.6.1.7 Doors assemblies with coamings

The height of the door coaming may be increased or reduced from that shown on the approved drawing provided the construction of the door frame and its connection to the modified coaming is precisely the same as shown on the approved drawing.

11.6.1.8 Doors in spaces of high humidity

'A' Class doors which are fitted in the boundary bulkheads of boiler rooms, refrigerated machinery spaces and similar spaces having atmospheres of high humidity may be constructed of stainless steel instead of mild steel without the necessity to retest the doors provided that all other materials and details of construction are the same as shown on the appropriate approved drawings.

11.6.2 Doors - initial on-board survey

11.6.2.1 Each door or shutter should be inspected by a surveyor to verify as far as it can be determined that the door or shutter and its frame have been constructed in accordance with the drawing referred to on the identification

plate (see paragraph 11.6.1.6) and that the 'A' Class standard of the door or shutter is at least the same as that of the bulkhead in which it is fitted.

11.6.2.2 The surveyor should satisfy himself that the bulkhead has been faired and adequately stiffened around any opening in which a door or shutter is to be fitted in order to ensure that no stresses will be imposed on the door or shutter and its frame which may cause them to distort and become inoperable. It is not intended that the frame of a door or shutter should form any part of such stiffening.

11.6.2.3 The surveyor should examine each door or shutter after it has been fitted to verify that:

- (a) the door or shutter and its frame have been properly fitted in the bulkhead;
- (b) the clearances between the edges of the door or shutter and its frame have not been altered; and
- (c) the latches or shootbolts of a door or shutter (where applicable) are properly engaging the frame. The dimensions of the holes in a doorframe in which the top and bottom latches or shootbolts engage should be approximately 5mm greater than the dimensions of the latches or shootbolts in order to cater for minor movements of the door and its frame during service.

11.6.2.4 Opening and closing tests should be carried out on each door or shutter after the closing and speed retarding devices have been positioned so that they surveyor may be satisfied as far as is practicable that the door or shutter complies with the appropriate regulations. These tests may be carried out whilst the ship is in the upright condition. The opening force for doors and shutters required to be selfclosing should not exceed 110 N at 32° inclination from the vertical plane. This can be checked only approximately with the ship in the upright condition.

11.6.3 Doors - in service inspections and tests

11.6.3.1 *Inspections*

When an annual, intermediate or renewal survey is being carried out on a ship every 'A' Class door or shutter should be inspected to verify that the door or shutter and its frame and fittings are in good condition and that:

- (a) there is no distortion in the door or shutter and its frame which effects the efficiency of the door or shutter;
- (b) the latches or shootbolts or a door or shutter (where applicable) properly engage the frame and have not worn excessively;

- (c) the hinges of a door are not binding; and
- (d) the door or shutter (where applicable) is not catching the bulkhead, frame, sill plate or floor covering.

11.6.3.2 Tests

Opening and closing tests should be carried out on each door or shutter to prove to the surveyors satisfaction as far as is practicable, that the door or shutter still complies with the appropriate regulations. These tests may be carried out whilst the ship is in the upright condition, (note paragraph 11.6.2.4 above).

11.6.4 Electrical release arrangements for 'A' Class doors and shutters

11.6.4.1 General

- (a) Arrangements may be provided for fire doors or shutters to be held in the open position, by means of energised electro-magnets which may be controlled from a central control point, but they must also be capable of release at each door. Such devices should be arranged to 'fail-safe', i.e. they should cause the door to close in the event of their failure.
- (b) When the arrangements incorporate direct acting solenoids, they should be capable of exerting a pull which equates to at least half the weight of the door, plus that force required to overcome any self-closing mechanism, thus being capable of holding the door open under a possible rolling condition of up to at least 15° either way. Other retaining devices, e.g. solenoid controlled latches, should be capable of exerting a restraint equivalent to the above. When de-energised, the residual magnetism should not be so great as to impede the door from closing at inclinations of 3 1/2° either way.
- (c) Full details of the performance, construction and enclosure of the proposed solenoids should be submitted to Headquarters, together with the door manufacturer's assessment of the hold-on pull required for the type of door under consideration in the above mentioned conditions. The hold-on power of a solenoid should be established by tests, appreciating that a small reduction in air gap greatly reduces the hold-on power, and that cleanliness of the magnet faces is essential.
- (d) The solenoid coils should be rated for continuous operation.

11.6.4.2 Door control systems

- (a) It will be essential for the solenoids to release the doors when de-energised, from both the remote and local positions, and the solenoids must remain de-energised so that should the door thereafter be opened, it would not be retained in the open position.

(b) Grouping of release circuits should be so arranged that doors bounding, or lying in a main fire zone should normally be grouped together, and follow the same group nomenclature as the fire alarm indicators. Proposals for grouping should be forwarded to Headquarters for consideration at an early stage.

(c) Local switches, and the group release switches at the control station, should be of the 'on-off' or 'stay-put' type so that the solenoids remain de-energised when the switches are operated, until deliberately re-set after an emergency

(d) Where a door or shutter is permitted to have a local release switch on one side only it should be easily accessible and conspicuous to anyone passing through the door opening.

11.6.4.3 *Door indicators*

Where remote indication of door closure is required by the regulations, the sensing device for such purposes should activate only on the final movement of closure. Where large numbers of doors require remote indication then grouping of indicators may be accepted provided the doors in any such group are in reasonable proximity to each other.

11.6.5 Double swing doors

Double swing doors which often form the access to and from the kitchen in a restaurant are not acceptable as 'A' Class doors because they are not fitted with latches and their frames do not overlap the door leaves. Furthermore the door leaves of a double leaf swing door do not overlap each other.

11.6.6 Revolving doors

Revolving doors are not acceptable as 'A' Class doors because their leaves are capable of being 'feathered' and locked in the open position. They do not overlap the frame. Such doors should not be fitted in escape routes because they may inhibit escape particularly when in the revolving mode.

11.7 Construction of 'B' Class Divisions

11.7.1 Method of erecting the divisions

'B' Class bulkheads, ceilings and linings are required by the regulations to be constructed of approved non-combustible materials which have been fire tested as a bulkhead, ceiling or lining respectively and satisfied the appropriate 'B' Class standard. The methods of erecting each such division should be in accordance with the conditions indicated in the approval certificate (see also paragraph 12.4.2).

11.7.2 Increasing length of boards or panels

A 'B' Class bulkhead or lining may be required to be fitted deck to deck in a tween deck, the height of which exceeds the maximum length of the boards or panels from which the bulkhead or lining is to be constructed. In such cases the boards or panels may be increased in length by butt strapping extension boards or panels of the same material, provided the joints are tight fitting. Moreover the straps should be fitted in way of the joint on each side of an extended board or panel and should be of steel having a length equal to the width of the board or panel less any jointing profiles and a width and thickness of 75mm and 0.7mm respectively. The butt straps should be screwed and not through-bolted. The jointing profiles should be fitted deck to deck.

11.7.3 Termination of divisions

A 'B' Class division should not normally terminate at another 'B' Class division of lower standard, or 'C' Class division or a combustible division, but see paragraph 12.4.2.

11.7.4 Bottom profiles

The steel angle or channel profiles which support the bottom edges of the boards or panels from which a 'B' Class bulkhead or lining is constructed, should be welded to the deck plating or connected to the expanded metal or equivalent fitted over an 'A' Class deck covering by welding or steel fastenings. In no case should a 'B' Class bulkhead or lining penetrate an 'A' Class insulation incorporated in an approved deck covering. See also paragraph 11.3.6 for information relating to 'A' Class overdeck insulations.

11.7.5 Deck coverings

Primary or surface deck coverings which are combustible should not be laid under 'B' Class bulkheads or linings.

11.7.6 Top profiles

11.7.6.1 The top edges of the boards or panels from which a 'B' Class bulkhead or lining is constructed should be housed in steel channel profiles with a gap between the top edges of the boards or panels and the inside of the webs of the channels in order to prevent the boards or panels being affected by any movement in the ships structure due to pitching and rolling and reduce the effects of vibration and structure-borne noise.

11.7.6.2 The channel profiles supporting the top edges of the boards or panels should be welded to either:

- (a) the deckhead;

(b) the bottom edges of the beams, the gaps between the beams being plated-in or filled-in using the same boards or panels from which the bulkhead or lining is constructed;

(c) the bottom edge of a continuous steel curtain plate having a minimum thickness of 3mm. When the depth of a curtain plate exceeds 450mm its lower edge should be flanged and it should be stiffened to the satisfaction of the surveyor. When the bulkhead or lining is of B-15 standard the curtain plate should be insulated on one side with an 'A' Class mineral wool insulation of A-15 standard attached to the curtain plate by means of welded steel pins, wire netting and spring steel washers; or

(d) steel hangers welded to the deckhead of rectangular section 3mm x width of top profile and fitted at 1000mm centres approximately, or some equivalent arrangement. When the distance between the top channel profile and the deckhead is in excess of 500mm, the surveyor should consider whether or not it is necessary to increase the scantlings of the steel hangers in order to maintain the stability of the bulkhead or lining particularly in a direction at right angles to the division. The hangers may be omitted in the case of a lining which terminates at a continuous 'B' Class ceiling provided that the top channel profile of the lining is welded to the steel stringer and flats which connect the ceiling to the ships side or deckhouse side and 'A' Class bulkheads respectively as shown on the approved drawing for the ceiling panels.

11.7.6.3 In no case should the top channel profile be laid directly on top of the boards or panels from which a 'B' Class bulkhead or lining is constructed i.e. without an air gap.

11.7.6.4 When a shipbuilder wishes to construct a 'B' Class bulkhead or lining by erecting the boards or panels before the steel hangers and channel profile, the gap between the top edge of the boards or panels and the inside of the profile should be maintained by bonding strips of 'A' Class mineral wool insulation to the top edge of the boards or panels at approximately 600mm spacing before fitting the top channel profile. The strips of insulation should be bonded in place with their fibres positioned vertically and their length should be 100mm, their width equal to that of the boards or panels and their depth equal to the gap above the top edge of the boards or panels as indicated on the approved drawing.

11.7.6.5 The top channel profiles of 'B' Class bulkheads should be unperforated when they support ceilings which are the insulating media for 'A' Class decks of A-60 standard except for holes which are permitted for the passage of electrical cables.

11.7.7 Combustible inserts

Combustible inserts which are designed to reduce noise and/or vibration should only be used in the construction of 'B' Class divisions as follows:

11.7.7.1 in the top and bottom profiles housing the boards or panels which form 'B' Class bulkheads or linings provided that the inserts do not exceed 1.5mm in thickness; and

11.7.7.2 in association with particular boards or panels, when they have been incorporated in a fire test specimen and the test has shown they have no effect on the fire performance of the division constructed of the boards or panels.

11.7.8 Access panels

Hinged panels may be fitted in a 'B' Class ceiling or lining in order to provide access for the control and maintenance of fire dampers in ventilation ducting positioned behind the ceiling or lining provided that the integrity and insulation standards of the ceiling or lining are not impaired particularly in the case of a ceiling overlaid with a mineral wool insulation. Each panel should be provided with a bolt or catch to keep it in the closed position except that bayonet type catches should not be used.

11.7.9 Lighting fittings

Lighting fittings should preferably be surface mounted on a 'B' Class ceiling but when a fitting penetrates the ceiling it should be of steel or covered by a steel box and fastened effectively to the ceiling in order to maintain the integrity of the ceiling. When the ceiling is of B-15 standard the steel light fitting or steel cover should be covered by a mineral wool insulation which has been approved for A-15 standard, the insulation being effectively secured to the fitting or cover. Alternatively the light fitting may be boxed-in using a 'B' Class material having a thickness appropriate to B-15 standard.

11.7.10 Electric cables inside boards, panels or jointing profiles

Electric cables should not be fitted in ducts arranged in boards or panels from which 'B' Class bulkheads or linings are constructed or in the jointing profiles unless a bulkhead incorporating cables and switches has been successfully fire tested. Only cables from switches and/or power sockets situated on the same side of a bulkhead or lining should be led through a duct or profile.

11.8 Pipes Penetrating 'B' Class Divisions

11.8.1 Penetrations with pipes having high melting points

When pipes of steel or any other material having a melting point of 1000°C or more pass through a 'B' Class division they should be fitted with collars made from the same material as that of the division. The collars should be fitted on one side of the division only and adequately screwed to the division. The collars should be a tight fit around the pipes in order to maintain the integrity of the division. When compression, push-in or similar joints are used the length of the portion of the pipe which is collared to the division should not be less than 900mm in order to ensure that the integrity of the division is not impaired if there is movement in the pipe and a joint separates adjacent to the division.

11.8.2 Penetrations with pipes having low melting points

11.8.2.1 When pipes of any material having a melting point of less than 1000°C pass through a 'B' Class division they should be fitted individually in a steel circular spigot having a minimum thickness of 1.5mm. Each spigot should be a close fit in the hole in the division and should have a welded steel collar which is to be screwed to the division. A nominal 20mm gap should be provided between the pipe and the spigot which should be packed tightly throughout its length with an approved A-60 insulation and sealed at each end with a suitable flexible sealant. The length of the spigots should be as follows:

O/D of pipe	Minimum length of spigot
50mm or less	400mm
150mm or more	900mm

11.8.2.2 Lengths of spigots for intermediate diameters of pipe should be obtained by interpolation. When a spigot is fitted in a 'B' Class division of B-15 standard it should be positioned such that at least 400mm of its length is on one side of the division. Compression, push-in or similar type of joints should not be positioned within the spigot and should not be less than 900mm apart.

11.8.3 Support and insulation of pipes penetrating 'B' Class divisions

11.8.3.1 The pipes referred to in paragraphs 11.8.1 and 11.8.2 should be supported from the deckhead or other structure to the satisfaction of the surveyor.

11.8.3.2 When a pipe penetrates a 'B' Class division of B-15 standard the pipe or spigot where applicable should be insulated for a distance of 380mm from the division with an approved A-15 insulation. Where a pipe has a bend close to the division the 380mm should be measured along the inside of

the bend. The insulation should be effectively secured by wire netting and steel wire.

11.8.3.3 See paragraphs 12.8, 13.8, 14.8 and 14.23 of these Instructions which deal specifically with the regulations referring to openings in 'B' Class divisions.

11.9 Cables Penetrating 'B' Class Divisions

11.9.1 Electric cables in conduit penetrating 'B' Class divisions

Where up to three in number of cables for lighting and power in cabins and similar spaces penetrate 'B' Class divisions they may be fitted in steel conduit having a minimum length of 400mm and of such an internal diameter as to provide a close fit round the cables. The conduit should be passed through a hole in the division having the same diameter as the outside diameter of the conduit. The ends of the conduit should be glanded or sealed with a suitable flexible sealant except that the sealant need not be applied to the end of a conduit which is inside a switch or socket.

11.9.2 Electric cables in transits penetrating 'B' Class divisions

Where cables other than those referred to in paragraph 11.9.1 penetrate a 'B' Class division they may be passed through transits having a minimum length of 300mm and constructed from steel of 1.5mm thickness, 'B' Class bulkhead material or double steel spiroducting. The internal cross sectional area of the transits should not exceed 0.05m². The transits should be a close fit in the holes in the divisions and should be attached to the divisions by screwed steel angle or plate collars such that the integrity of the divisions are not impaired. A nominal distance of 20mm should be maintained between the cables and the cables and a transit. The space between the cables and between the cables and the transit should be packed tightly throughout the length of the transit with an approved A-60 insulation and the ends of the transit sealed with a suitable flexible sealant. Transits constructed of steel or spiroducting which are fitted in 'B' Class divisions of B-15 standard should be insulated for a distance of 380mm from the division with an approved A-15 insulation. The insulation should be effectively secured by wire netting and steel wire.

11.10 'B' Class Doors

11.10.1 General comment

Every door assembly which is used to close openings in 'B' Class bulkheads should be of an approved type and its construction and method of installation should be in accordance with the conditions specified in the approval certificate.

11.10.2 Attachment of door to bulkhead

A doorframe of a 'B' Class door assembly should not be screwed or bolted to 'B' Class bulkheads constructed of board type materials because the expansion of the steel frame could cause serious cracking in boards during a fire situation which could result in an integrity failure of the bulkhead.

11.10.3 Ventilation openings in doors

11.10.3.1 The 0.05m² total net area limitation for openings in and/or under 'B' Class doors is applicable to single and double leaf doors. In the case of the double leaf door the limitation should apply to the whole door and not to each leaf individually.

11.10.3.2 When a door is fitted with an escape panel the ventilation opening should be incorporated in it.

11.10.3.3 In addition to a ventilation grille being capable of manual closure from each side of the door it may be closed by means of a spring activated by the melting of a fusible link or similar. In no case should the automatic means be accepted without the manual means of closure.

11.10.4 Escape panels in doors

11.10.4.1 It is generally considered that escape panels in 'B' Class doors are unnecessary. However they may be fitted if an owner requires them. In such cases the panels should be constructed in accordance with any details shown on the approved drawings, provided they do not exceed 410mm x 410mm in size. A ventilation opening, when fitted, should be incorporated in the escape panel. Where no details of an escape panel are given the door manufacturer should be requested to submit details of the construction to Headquarters for consideration before use.

11.10.4.2 Escape panels should only be capable of being operated from that side of the door from which a person needs to escape and should be of such a design as to preserve the integrity and insulation standard of the door and prevent any unlawful entry into a space.

11.10.4.3 Escape panels should be marked with the words 'ESCAPE PANEL - KICK OUT' in white letters on a green background.

11.10.5 Locks in doors

11.10.5.1 Every 'B' Class door fitted in a cabin bulkhead should be capable, when locked, of being opened manually from the cabin side other than by means of the key or key card.

11.10.5.2 Any 'B' Class door, other than a cabin door, which is fitted to an opening forming part of an escape route should not be capable of being

locked shut, except that when such a door is required to be locked shut by the owner for security reasons keys should be provided on each side of the door in glass fronted boxes fitted close to the door.

11.10.5.3 Alternatively a door which is unlocked in the escape direction may be 'access controlled' subject to suitable safeguards. Digital locks for which the access code is known to appropriate crew members, may be accepted on such doors. (See also paragraph 15.2.12).

11.10.5.4 Paragraphs 12.8, 13.8, 14.8 and 14.23 of these Instructions which deal specifically with the regulations referring to openings in 'B' Class divisions, should be noted.

11.10.6 Self closing doors

Doors which are required to self close, should close and latch after opening wide enough to allow the passage of at least one adult, with the ship in an upright condition.

11.10.7 Inspection of doors

Latches of 'B' Class hinged doors should be examined regularly for wear and they should be replaced if shown likely to cause an integrity failure in a fire following minor distortion of either the frame or leaf. Door leaves should be examined for damage at the securing points of self closing doors.

11.11 Construction of 'C' Class Divisions

11.11.1 Construction

11.11.1.1 Although the MCA does not require approval certificates for 'C' Class divisions they should always be constructed of approved non-combustible materials except that combustible materials may be used to the extent referred to in paragraph 12.11.2. Profiles used in the construction of 'C' Class divisions should be of steel or aluminium alloy. The divisions may be faced with approved combustible materials as permitted by L.S. Regulations 62, 80 and 97 or S.S. Regulation 43 whichever is applicable.

11.11.1.2 Shipbuilders and shipowners should be advised that the use of glass in 'C' Class bulkheads or partitions should be kept to a minimum because of the hazards which could be created if such bulkheads or partitions were to collapse or shatter during a fire or other emergency situation.

11.11.1.3 'C' Class bulkheads or linings and their method of attachment on Ro-Ro passenger ships must be capable of supporting the handrail and other loadings specified in L.S. Regulation 68(9)(iv) and 10(b). This should be checked on installation.

11.11.2 'A' Class overdeck insulations (over 'C' Class divisions)

A 'C' Class bulkhead or lining should not penetrate an 'A' Class overdeck insulation incorporated in an approved deck covering. The bottom profile of the bulkhead or lining should be attached to the expanded metal or equivalent fitted over the insulation by means of welding or steel fastenings whichever is applicable as shown on the approved drawing for the 'A' Class deck covering.

11.11.3 Deck coverings (under 'C' Class divisions)

Primary or surface deck coverings which are combustible should not be laid under 'C' Class bulkheads or linings.

11.12 Window and Sidescuttle Boxes

11.12.1 Linings at the ships side, deck side or end in way of windows or side scuttle openings should be boxed in. The boxes should generally be of the same material and thickness as the adjacent lining, except that where this is a B-0 or 'C' Class division, sheet steel may be used.

11.12.2 The construction of the boxes should be similar to that of the lining as shown on the approved drawing relating to the boards or panels used and to the satisfaction of the surveyor.

11.12.3 Notwithstanding the above comments when the structure is of steel the non-combustible boxes may be dispensed with in:

- (a) a space not exceeding 6 m in length measured along the lining at the ships side or deckhouse side; or
- (b) a space of any length containing furniture and furnishings of restricted fire risk;

provided that in either case the bulkheads and ceilings bounding the space are carried to the ships side or deckhouse side. Draught stops should be fitted when spaces behind the linings exceed 14 m in length.

11.12.4 GRP window or sidescuttle boxes may be fitted in addition to, but not instead of, the non-combustible boxes and in the case of a passenger ship the GRP boxes should be included in the total volume of combustible facings, mouldings etc. referred to in L.S. Regulations 62(2).

11.12.5 However GRP window and sidescuttle boxes should not be fitted on tankers around windows and sidescuttles in the exterior boundaries of superstructures and deckhouses referred to in L.S. Regulation 88(1).

11.13 Fire Dampers

11.13.1 Manual control of dampers

11.13.1.1 Manual control of a fire damper is required to be by means of a handle connected directly or linked to the spindle of the damper blade and is to be independent of and capable of overriding any automatic means of control.

11.13.1.2 Manual closing may be achieved by mechanical means of release or by remote operation of the fire damper by means of a fail-safe electrical switch or pneumatic release (spring loaded, etc.), on both sides of the division. **[unified text]**

11.13.2 Automatic closure of dampers

11.13.2.1 When a fire damper is required to be closed automatically, the means of operation shall be situated inside the coaming or spigot such that it can be activated by hot gases passing through the ventilation ducting. The MCA is prepared to accept any additional means of operating the damper automatically, subject to compliance with paragraph 11.13.1.

11.13.2.2 The means of operation shall be activated at temperatures within the range of 68°C to 79°C inclusive except that in exhaust ducts serving spaces with high ambient temperatures such as galleys and drying rooms the temperature at which the means of operation is activated may be increased to not more than 30°C above the maximum deckhead temperature.

11.13.2.3 When the means of operating a fire damper automatically is a spring and fusible link, the link is required to be capable of being released manually from outside the duct by withdrawing the pin over which the link is hooked except that any other effective means of release would be considered.

11.13.2.4 A pneumatic system must be such that the fire damper closes on release of the air or failure of any one of the components in the system. Air pressure must not be used to close the damper.

11.13.3 Manual operation of dampers from both sides of a division

11.13.3.1 In order to satisfy the requirements to operate a fire damper from both sides of a bulkhead or deck as indicated in the regulations, a damper may be fitted on each side of the division within the coaming or spigot, the dampers being operated independently of each other. Only one of the two dampers need be capable of being closed automatically when automatic operation is required by the regulations.

11.13.3.2 Alternatively a single manual or automatic damper may be fitted on one side of the bulkhead or deck, arranged for local manual operation, and in addition for manual operation from the blind side of such a division using a suitable linkage. The instructions of this section should be complied with at both operating positions.

11.13.4 Open/closed indicator (on damper)

Each damper is required by the regulations to be fitted with a visible indicator to show whether the damper is in the open or closed position. The method of indication should be clear and permanently attached.

11.13.5 Components clear of coaming

The manual and automatic controls, indicator, access panels and any other component should be sufficiently clear of the coaming to enable the coaming to be properly insulated.

11.13.6 Damper controls clear of obstructions

Surveyors should ensure that the manual and automatic controls of a damper are clear of the division, the insulation on the division or any other obstruction when the damper is in the open and closed positions.

11.13.7 Operating position of damper

The fire dampers should be easily accessible. Where they are placed behind ceilings or linings, these latter should be provided with an inspection door on which a plate reporting the presence of a fire damper and its identification number should be fitted. Such a plate and the identification number should also be placed on any remote control. **[unified text]**

11.13.8 Ducts passing through 'A' Class divisions

The attention of surveyors is also drawn to paragraph 12.9, 13.9, 14.9 and 14.24 of these Instructions which deal with regulations referring specifically to the fitting of fire dampers in ventilation ducts passing through 'A' Class divisions and ventilation systems in general.

11.14 Laminates, Veneers, Paints and Other Surface Finishes

Plastic laminates, veneers, paints and other surface finishes which are applied to surfaces required by the regulations to have a Class 1 or 2 surface spread of flame rating, should be of approved types and be applied/fitted in accordance with the conditions stated on their approval certificates.

11.15 Windows and Sidescuttles

11.15.1 In internal bulkheads

Proposals to fit glazed openings in internal 'A' or 'B' Class bulkheads, together with particulars of the glass, framing arrangements and any test reports which are available, should be submitted to Headquarters for consideration.

11.15.2 In way of lifeboat, liferaft, marine escape system positions and external escape routes

The fire rated glass required to be fitted in windows facing life saving appliances, external escape routes and in windows situated below such spaces should be of an approved type and be fitted in accordance with the conditions stated in the certificate of approval.

11.16 Deck Coverings

11.16.1 Primary deck coverings

11.16.1.1 Each primary deck covering which is to be used in accommodation spaces, service spaces and control stations as indicated in paragraphs 12.11.5, 13.11.5, 14.11.2 and 14.26 should be of an approved type.

11.16.1.2 See paragraph 11.3.6 for information relating to approved deck coverings incorporating 'A' Class overdeck insulations.

11.16.2 Surface floor coverings other than carpets or carpet underlays

11.16.2.1 Each surface floor covering which is to be used in rooms containing furniture and furnishings of restricted fire risk, or in corridors and stairway enclosures should be of an approved type having low flame spread properties.

11.16.2.2 See paragraph 11.3.6 and paragraphs 12.11.1, 13.11.1, 14.11.3 and 14.26 for further information relating to surface deck coverings.

11.16.3 Carpets and carpet underlays

11.16.3.1 Each carpet and carpet underlay which is to be used in a room containing furniture and furnishings of restricted fire risk, or in corridors and stairway enclosures should be of an approved type having low flame spread properties.

11.16.3.2 See paragraph 11.3.6 and paragraphs 11.2.8, 12.11.1, 13.11.1, 14.11.1 and 14.26 for further information relating to carpets or carpet underlays.

11.17 Organic Foams, Cork and Other Highly Flammable and/or Toxic Materials.

11.17.1 General comment

11.17.1.1 Serious fires have occurred on British ships (and in UK coal mines) as a result of polyurethane foams having been unwittingly ignited.

11.17.1.2 Moreover fire tests conducted some years ago by the UK Safety in Mines Inspectorate and by a UK shipowner showed that serious dangers can exist when any type of polyurethane foam (including those classified as self-extinguishing) is exposed to fire or intense heat. These dangers can be summarised as:

- (a) extremely rapid spread of flame across the surface of the material, the speed often being in excess of 30 metres per minute;
- (b) very high temperature in the order of 1000°C, can be generated during the initial stage of burning; and
- (c) the emission of large quantities of highly toxic gases and smoke.

11.17.1.3 The risk of a rapid conflagration is greatest when foam is ignited in conditions where the heat generated cannot escape, where an air supply for combustion exists or could be induced by the starting of a fire, or with some types of foam when the vapours produced by heating cannot be readily dispersed. Typical examples could occur in an insulated cargo space or a ventilation duct. The risks entailed at sub-paragraph (c) above, are such as to render fire-fighting operations extremely hazardous.

11.17.1.4 Furthermore although the foregoing statements are made as a direct result of investigations concerning polyurethane foams, the MCA was advised that some or all of these dangers can exist when almost any organic foam material (e.g. polystyrene or expanded ebonite) is subjected to fire or intense heat. Clearly, it is necessary to exercise great caution whenever the use of organic foams is being contemplated.

11.17.2 Recommendations as to the use of organic foams

11.17.2.1 As indicated by L.S. Regulations 62(3)(a), 80(4)(a) and 97 most insulating materials fitted within the accommodation and machinery spaces are required to be non-combustible. For those limited areas where organic foams may be used, advice will be found in paragraphs 12.11.6.4, 13.11.6, 14.11.9.3 and 14.26.

11.17.2.2 Where the use of organic foams is contemplated e.g. as an insulant for a cargo space then it is strongly recommended that only those products which have been fire tested and assessed be used. The principle should always be, to use only those insulants which are known to have low properties of fire propagation and smoke generation.

11.17.2.3 Where organic foams are to be used in the cargo spaces of merchant ships the insulant should be completely covered with a suitable protective facing. This facing should be preferably non-combustible and able to withstand everyday wear and tear and the flexing of the ship's structure without fracture.

11.17.3 Measures to be taken when organic foams are to be used

It is recommended that the following measures are adopted when organic foams are to be used.

11.17.3.1 General precautions against the dangers of fire

Whilst the organic foam materials are being fitted:

- (a) a competent fireman should be in attendance;
- (b) efficient fire fighting equipment including a primed water hose with jet nozzle, and rescue equipment consisting of breathing apparatus, lifelines and stretchers, should be readily available;
- (c) effective and adequate means of escape from the compartment concerned should be arranged;
- (d) where fire protection facings are required they should be applied to the foam surface as soon as possible having regard to the curing time of the foam; and
- (e) a person should be delegated to collect and remove all organic foam waste material at frequent intervals. Clouds of foam dust are potentially very dangerous.

11.17.3.2 Application of the Foam

As the application of most organic foam materials can give rise to both toxic and fire risk, it is recommended that the guidance of HM Factory Inspectorate and the suppliers of the basic materials should always be sought prior to spraying or other methods of applying the foam.

11.17.3.3 Warning notices

As particular danger could exist whilst a ship is under construction or repair it is considered essential to display warning notices prominently in permanent positions inside any compartment insulated with organic foam material and also on the external surfaces of such a compartment, stressing the need to exercise great caution whenever welding or burning operations are contemplated in the vicinity. The organic foam material should be removed locally from the repair area before heat is applied.

11.17.3.4 Regular inspection

Once organic foam materials and their associated protective facings have been installed in a ship they should become items of regular inspection.

11.17.4 Organic foams in furniture

Organic foams should not be used in the construction of furniture other than in upholstered parts and mattresses. It is recommended that Combustion Modified High Resilient (CMHR) foams are used in the upholstered parts of furniture and mattresses on United Kingdom registered ships but, in any case, the upholstered parts of furniture in rooms on passenger ships containing 'furniture and furnishings of restricted fire risk' should comply with paragraph 11.2.8.