Rules for Classification and Construction

VI  Additional Rules and Guidelines

7  Guidelines for the Performance of Type Approvals

4  Test Requirements for Sealing Systems ofBulkhead and Deck Penetrations

Edition July 2015
The following Guidelines come into force on 1 January 2016.

Alterations to the preceding Edition are marked by beams at the text margin.

DNV GL SE

(Germanischer Lloyd SE has on 29 January 2014 changed its name to DNV GL SE. Any references in this document to Germanischer Lloyd or GL shall therefore also be a reference to DNV GL SE.)

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Annex B        Extract from IMO RESOLUTION MSC.307(88) (2010 FTP Code), Annex 1, Part 3 - Test for “A”, “B” and “F” class divisions, Appendix 2, A.IV – Cable Transits
Section 1  General Conditions

A  General

A.1  Scope and application

A.1.1  These Guidelines apply to the type approval of sealing systems intended to be used in cable and piping installations for penetrations through bulkhead and decks and other fire-protection constructions in accordance with SOLAS 74, Amendment 2013, Chapter II-2, Regel 9 and IMO RESOLUTION MSC.307(88) (2010 FTP Code), Annex 1, Part 3 - Test for “A”, “B” and “F” class divisions. Furthermore these Guidelines are applicable for approval of sealing systems with regard to water and gas tightness.

A.1.2  Type approval certificates shall not be issued on the basis of test reports which are more than 5 years old at the date of application for type approval. If the type approval depends on several test reports with different dates, the date of the oldest report governs. However, renewal of existing type approval certificates without retesting may be carried out provided that the test report is not more than 15 years old at the date of application for renewal and that no alteration of components or construction has been made to the product.

A.1.3  A Type Approval is not required if the pipe penetration is made of steel or equivalent material having a thickness of 3 mm or greater and a length of not less than 900 mm (preferably 450 mm on each side of the division), and no openings. Such penetrations shall be suitably insulated by extension of the insulation at the same level of the division.

A.2  Applicable Rules and Regulations

A.2.1  GL Rules for Machinery Installations (I-1-2), Section 11 and Electrical Installations (I-1-3), Section 12.

A.2.2  GL Guidelines for Procedure (VI-7-1).

B  Definitions

B.1  Sealing systems

Sealing systems generally consist of a metal frame respectively case or conduit sleeve, the sealing material (sealing compounds, packing modules or plugs) the insulation and additional auxiliary means possibly required.

B.2  Auxiliary means

Auxiliary means are materials used for packing the open ends of the penetration device (cable or pipe-exit openings). They serve the purpose of ensuring the tightness and minimum spacing between the cables/pipes and penetration casing required for filling the sealing compound.
B.3 Packing and plug systems

Packing and plug systems are modular systems. Packing systems consist of a compression frame, packing modules, anchorage and intermediate plates, and a terminal seal with compression screw. Plug systems normally consist of a conduit sleeve and a sealing plug for sealing of the conduit at both ends.

B.4 Sealing compound systems

Sealing compound systems are sealing systems realised by means of sealing compounds. They generally consist of the conduit sleeve, the auxiliary means for sealing the ends and maintaining the spacing and the sealing compound.

B.5 Sealing compounds

Sealing compounds are products which have a good flow capability, consisting of one or more components. When cured, the compound forms the sealing element of the sealing system.

B.6 Injection mouldings

Injection mouldings are products for sealing of spacing of pipe and cable penetrations.

B.7 Mould and/or sealing length

Mould and/or sealing length is the length of a cable and/or pipe penetration required to fulfil the requirements of this Regulation in view of fire resistance, water – and gas tightness.

C Documents to be submitted

The following documents are to be submitted to GL Head Office:

C.1 Application for Type Approval

C.2 Drawings and technical specifications of the sealing system components including material specification and service range

C.3 In case of sealing compounds, a Manufacturer’s declaration concerning the compatibility of the sealing system with the cables as described in Section 2, A.3.

C.4 Assembly and work instructions

C.5 Description of the quality management system or a copy of the Quality system certificate according to ISO 9000 standard as well as a copy of the recent external audit report.

C.6 Test plan according to Section 3

C.7 Drawings of the test divisions (deck and bulkhead) acc. to IMO Res. MSC.307(88) (2010 FTP Code) including specification of type and cross section of the cables, dimensions and material of the pipes and their supports, the dimensions of the conduit pipes (length, outer diameter and wall thickness), the sealing length and the insulation design. Furthermore a copy of the approved drawing of the division applicable for the fire tests. For the insulation material an inspection certificate (EN 10 204, 3.1 or equivalent) is to be provided by the manufacturer as well as a copy of existing approval certificates for the insulation.

In case that also the approval of the sealing system for water and gas tight bulkheads has been applied for, additional drawings of the test bench set up for the tests specified in Section 3 are to be submitted.

The fire tests shall be carried out at recognised test laboratories. Refer to IMO List of Recognised Test Laboratories.
C.8 Fire- and pressure test reports

C.8.1 Fire test reports issued by IMO recognised test laboratory including insulation drawings of the cable and/or pipe penetration as tested.

C.8.2 GL reserves the right to require further fire and pressure testing if deemed necessary.

C.8.3 Pressure tests shall be witnessed by GL surveyor and the test reports shall be stamped by the GL Surveyor.

C.9 A manufacturer’s declaration concerning asbestos-free compliance of all relevant components of the sealing system shall be submitted.

The concentration range is to be stated in a report as described in IMO Res.197(62).

C.10 All documentation shall be submitted in English or German language.

C.11 To facilitate a smooth and efficient approval process the documents shall be submitted electronically via GLOBE 1. In specific cases and following prior agreement with GL they can also be submitted in paper form.

1 Detailed information about digital data exchange with GLOBE can be found on GL’s website www.gl-group.com/globe.
Section 2 Requirements

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A General

A.1 Sealing systems shall not inadmissibly impair the strength, tightness and fire resistance of the hull structure. They must be of sufficient mechanical strength and be protected against corrosion.

A.2 With regard to the fire behaviour and water tightness, sealing systems must meet the requirements of Section 3.

Without proof of water tightness, sealing systems can only be used above the freeboard deck on cargo ships respectively bulkhead deck on passenger vessels.

Below these decks sealing systems without proof of water tightness are permitted within watertight compartments only.

Where proof of gas tightness is applied for, the relevant requirements set out in Section 3, D are to be observed.

A.3 Sealing systems, including the auxiliary means employed, must be compatible with the cables used, i.e. the cables shall not undergo any inadmissible changes affecting, for example, their swelling behaviour or causing embrittlement, corrosion sheath decomposition or premature ageing.

Parts of sealing systems coming into direct contact with the cables should be chemically approximately neutral (pH range: 6.5 – 8.5).

Where no special specifications are laid down for the cables, compatibility is to be ensured at least with regard to cables manufactured in accordance with the following standards:

Standards: IEC 92-350
           IEC 92-351
           IEC 92-353
           IEC 92-359
           IEC 92-376
           JIS 3410
           DIN 89158, 89159, 89160

A.4 The mechanical loads and temperatures occurring under operating conditions and temperatures shall not interfere with the tightness capability of the sealing system.

The suitability of the employed materials for production of sealing compounds, packing modules and sealing plugs for the specified maximal operating temperatures is to be proved.

A.5 Only complete systems including any auxiliary means possible necessary can be approved. Approval of individual components is not possible.
A.6 For installation of sealing systems, the manufacturer must issue clear instructions for assembly and workmanship.

B Compound and Injection Mouldings

B.1 Application and expansion behaviour
Sealing compounds shall remain flowable and workable for a sufficient period, and their expansion behaviour shall be as follows:
Minimum expansion after 24 hrs \( \geq 0.5\% \)
Maximum expansion after 28 days \( \leq 1\% \)

B.2 Curing time
Sealing compounds and or injection mouldings must set within 24 hrs, and within a period not exceeding 30 days shall be sufficiently cured to ensure that a constant weight is attained.
Sealing compounds and injection mouldings together with the auxiliary means used, must be so constructed that the curing of the compound within the stated period is ensured.

B.3 Water absorption
Cured sealing compounds respectively injection mouldings shall not be hygroscopic, and shall not crack, swell or dissolve under the action of water.

C Auxiliary Means
It has to be ensured by appropriate auxiliary means that a minimum spacing, as specified by the manufacturer and as tested, is maintained between individual cables/pipes, and between the cables/pipes and the casing of the penetration.
Auxiliary means must be proved in combination with the components used in the sealing system (e.g. sealing compound).
Auxiliary means shall not restrict the space for the sealing compound necessary for ensuring the tightness capability.
Auxiliary means shall be fire-retardant.
Examples of auxiliary means:
- packing material/insulating compounds
- putty
- intermediate layers of all kinds
- expansion elements

D Packing and Plug Systems
The following requirements are to be met:
- Packing and plug systems shall be simple to fit.
- Packing modules and plugs with suitably graded diameters matched to the ship's cable and outer pipe diameters shall be available.
- Packing modules must have sufficient elasticity to ensure durable sealing action.
- They must be water-resistant
• Plugs are to be marked with manufacturer's trade mark, type of material, type designation and size.
• Intermediate and anchor plates of non-magnetic materials must be used when laying single-core AC cables.

E Other Sealing Systems
Apart from the sealing compound, injection mould and packing systems referred to above, systems using foams or other materials may be employed for cable and pipe penetration systems, provided they comply with the requirements of this Section and 3.

F Testing and Approval of Pipe Penetrations and Cable Transits for Use in “A” Class Divisions
“A”-class pipe penetrations and cable transits that are
1. constructed without structural sleeves of minimum 3 mm thickness and minimum 60 mm length welded or bolted to the division; and/or
2. constructed with removable, soft or intumescent filling material;
are “those types of constructions which do not utilize conventional components of horizontal and vertical divisions” and are to be subject to additional testing and/or design criteria as described below.

Additional testing/design criteria
• Filling materials shall be adequately secured by bonded materials or mechanical means that cannot be removed without the use of tools in order to prevent damage by normal ship vibrations and pressures.
• The pipe penetration/cable transit shall not have any visible openings. It shall not be possible to manually penetrate any part of the penetration with a 6 mm gap gauge, as described in paragraph 7.10 of annex 1 to part 3 of the 2010 FTP Code.

Approval
Penetrations in structural divisions shall not impair the structural strength of the division. The structural make-up of the penetration is to be fully described so that its use and the need for additional stiffening for the division can be fully assessed.

1 IACS UI FTP6 (Feb 2013) - Interpretation of the IMO FTP Code 2010 Part 3 Appendix 1 item 1.13
IMO MSC.1/Circ.1488 (12 January 2015) - Interpretation of the IMO FTP Code 2010 Part 3 Appendix 1 item 1.13
Section 3  Test Requirements

A  General
The tests are to be carried out according to the International Code for Application of Fire Test Procedures

The test specimens are to be built under supervision of a GL surveyor in accordance with the installation
and processing instruction as well as approved insulating drawings of the manufacturer.

Alternatively, a confirmation of the test institute can be accepted, in which the consistency of the test
specimen to the approved insulation drawings as well as requirements of the 2010 FTP Code, Annex 1,
Part 3, Appendix 1 and Appendix 2 will be confirmed.

"A-0" cable transits and pipe penetrations shall not be approved without an "A-0" test although tested and
approved as "A-60".

If the cable transits and pipe penetrations are tested as "A-60" penetration, any insulation fitted (on the
cable transits resp. pipe penetrations itself and 200 mm around) will be required to be fitted also for "A-0".

Un insulated metallic pipes penetrating “A” or “B” class divisions shall be of materials having a melting
temperature which exceeds 950 °C for “A-0” and 850 °C for “B-0” class divisions (ref. SOLAS 74/78,
Reg.9.3 - vers.1 Jan. 2011).

The results of fire tests with divisions made of steel are transferable on cable and pipe penetrations for
use through divisions made of aluminium. A separated fire test is not required.

Assumption for this is that the cable/pipe penetration is fully enclosed insulated with the same insulation
type and thickness as provided for the fire division.

In case of pipe penetrations, the medium pipe on the non fire rated side is to be provided with an insula-
ton of at least 450 mm length.

B  Fire Test

B.1  General requirements
Fire tests for divisions of Type "A", Type "B" and Type "F" are to be carried out according to Fire Test
Procedure Code (FTP Code), Annex 1, Part 3 Test for “A”, “B” and “F” class divisions.

The products, e.g. cable penetration systems shall be tested and evaluated in accordance with the fire
test procedure specified inIMO RESOLUTION MSC.307(88) (2010 FTP Code), Annex 1, Part 3, Appen-
dix 1 and Appendix 2

See also Annex A and B, Extract fromIMO RESOLUTION MSC.307(88) (2010 FTP Code), Annex 1, Part
3 - Test for “A”, “B” and “F” class divisions, Appendix 2, A.III – Pipe and Duct Penetrations and A.IV –
Cable Transits and further requirements specified in this Section.

The fire tests shall be carried out at recognised test laboratories. Refer to IMO List of Recognised Test
Laboratories.
B.2 Condition of test specimen

B.2.1 Deck and bulkheads

Divisions for testing of sealing systems intended to be approved for Type "A" deck and bulkheads are to be designed according to Section 2.1 and 2.2 of the IMO RESOLUTION MSC.307(88), Annex 1, Part 3, Appendix 1.

Type "B" and "F" bulkheads and decks are to be constructed in accordance with the requirements contained in 2.4 and/or 2.5 of the said IMO Regulation.

For bulkheads the insulated side is to be the side not exposed to the fire, and for decks the insulated side is to be the side exposed to the fire.

B.2.2 Test requirements for cable penetrations

B.2.2.1 Dimensions

The largest and smallest dimensions (width and height) of each type of cable penetration, for which approval is applied for, should be tested in horizontal and vertical position. In addition tests shall be conducted for the maximum and minimum fill based on the inside cross-sectional area at each transit. The distance between the adjacent cables shall be the minimum specified by the manufacturer, and the cables should be placed close to the centre of the transit.

B.2.2.2 Construction of test specimen

B.2.2.2.1 Sealing systems for use in Type "A" bulkheads and decks, see Annex B, Extract from IMO RESOLUTION MSC.307(88) (2010 FTP Code), Annex 1, Part 3 - Test for “A”, “B” and “F” class divisions, Appendix 2, A.IV – Cable Transits para. 2 and 3.

B.2.2.3 Grouping with cables of the test specimen

Different cable types and cross sections representative of those normally used on board ships should be chosen for the tests.

The following aspects should be observed:

- insulation material (e.g. EPR, XLPE, PVC)
- material of outer sheath (e.g. CR, PVC, SHF1 or SHF2)
- cross section and number of cores of each cable
- braided screen armouring

Test specimens should be furnished as listed in Table 3.1.

Where this is not possible, comparable cabling is to be agreed on with GL.

In the case of bulkhead penetrations the cables must be so positioned in the penetration that the large diameters are at the bottom, while the small diameters are at the top.

The ends of the cables introduced are to be sealed on the side not exposed to the fire, so that air or smoke will be prevented from passing through.

Following a conditioning period for sealing compounds of at least 30 days at room temperature, the penetrations to be tested will be subjected to the fire test.

B.2.3 Test requirements for pipe penetrations

The general construction of the test specimen for divisions of type "A" is specified in the IMO RESOLUTION MSC.307(88) (2010 FTP Code), Annex 1, Part 3 - Test for “A”, “B” and “F” class divisions, Appendix 2, A.III – Pipe and Duct Penetrations para. 2 and 3, see Annex A.

The following conditions are to be considered in addition:

B.2.3.1 Pipe dimensions and pipe materials

At least the biggest and smallest size of the sealing system of each type of pipe penetration as well as the smallest and biggest pipe diameter for which a type approval is applied for is to be tested in horizontal (deck) and vertical (bulkhead) position.
In case of sealing systems for bundle tubes, a bundle tube with the minimum and maximum number of tubes of the range of application is to be used for the tests.

For approval of the sealing system for different pipe materials, every relevant pipe material is to be tested with the sealing system on principle. However, results of fire tests with materials with good thermal conductivity can be transmitted to materials with reduced thermal conductivity, i.e. test results on carbon steel pipes includes stainless steel where test results on copper pipes includes copper alloys and carbon steel.

In case of plastic pipes as well as composite pipes, proof is to be provided for every material type i.e. for PVC, PE, PP, ABS, FRP, etc.

The arrangement of the conduit pipes in deck test specimens shall include the different built-in situations occurring on board i.e. the conduit pipes are to be arranged alternatively centrically in the deck and flush with the deck.

The unprotected pipe length in the fire shall be at least 500 mm ± 50 mm. In case of insulations are necessary to pass the fire test, the pipes are to be prolonged accordingly.

C Water Tightness

Sealing systems in Type "A" bulkheads and decks, for which additionally to the proof of fire resistance the water tightness needs to be approved, must be so constructed that, with the test arrangement shown in Fig. 3.1 or Fig. 3.2, they are capable of withstanding a hydraulic test pressure conforming to the conditions stated below (for exception see Section 2, A.2). The specimen shall be tested for a period of at least 30 minutes under hydraulic pressure equal to or greater than that corresponding to the actual location in the damaged vessel in which the penetrations are to be installed, however, at least 1 bar. There should be no leakage through the prototype arrangement for the duration of the test. Subsequently, the penetration is exposed to a test pressure of 2.5 bar for a period of 30 minutes, during which a minimum leakage water quantity of 1 litre is permissible.

D Gas Tightness

Where proof of gas tightness is applied for, the following tests are to be performed:

Bulkhead and deck penetrations must be so constructed, that with the test arrangement shown in Fig. 3.1 or Fig. 3.2, they are capable of withstanding a pneumatic pressure test with air.

The test specimen will be exposed for 30 minutes to a test pressure of 30 mbar. During this time, no air shall leak from the non-pressurised side.

E Test Arrangement for Water- and Gas Tightness Tests

E.1 General

The sealing system is to be prepared in accordance with manufacturer's installation instruction. Test setup as specified in Fig. 3.1 and Fig. 3.2.

The length of the penetration is to be determined by the specification of the manufacturer.

After a conditioning time, for compounds of at least 30 days and in the case of packing and plug systems at least 24 hours, the sealing system is subjected to the tightness test.

The tests are to be witnessed by GL surveyor.

E.2 Selection of cables

Grouping with cables as specified in B.2.2.3 and Table 3.1.
E.3 Selection of pipes

At least the smallest and biggest pipe size shall be tested. In case of water and gas tightness should also be certified for plastic pipes, the tests are to be carried with tubes from thermoplastics (e.g. PVC pipe) and fibre glass reinforced material (FRP pipe).

Table 3.1 Example of the test occupation for cabling of bulkhead and deck penetrations for the fire test and for verifying water- and gas tightness

<table>
<thead>
<tr>
<th>Pos.</th>
<th>Group</th>
<th>Insulation</th>
<th>Sheath</th>
<th>Cable-Type</th>
<th>No. of Cores</th>
<th>Cross Section</th>
<th>Ø [mm]</th>
<th>Fläche [mm²]</th>
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<td>3 x 50 mm²</td>
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Group 1: Cables with thermoplast core insulation and sheaths
  1.1 Cables with braided or metal screen or armouring
  1.2 Cables without metal screen or armouring

Group 2: Cables with elastomere core insulation and sheaths
  2.1 Cables with braided or metal screen or armouring
  2.2 Cables without metal screen or armouring

Group 3: Cables with elastomere core insulation and thermoplast sheaths
  3.1 Cables with braided or metal screen or armouring
  3.2 Cables without metal screen or armouring

Group 4: Cables with halogen-free materials
  4.1 Cables with halogen-free elastomerics
  4.2 Cables with halogen-free thermoplastic compounds
Section 3 Test Requirements

**Fig. 3.1** Arrangement for testing water tightness and gas tightness of a sealing compound system

**Fig. 3.2** Arrangement for testing water tightness and gas tightness of a packing system
A.1 General

A.1.1 "A" class divisions may have to be provided with apertures to allow them to be penetrated by service pipes and ducts, and it is necessary to reinstate the insulation and/or integrity performance of the division at the position where it has been penetrated.

A.1.2 Administrations may have different requirements relating to the need to classify pipe and/or duct penetrations, e.g., related to the pipes' diameter and their direct attachment or not to the structural core.

A.1.3 This Section refers from here on to pipe penetrations but may be read as equally applicable to duct penetrations.

A.2 Nature of the test specimen

A.2.1 Dimensions

The maximum and minimum sizes (in terms of both the width and the height, or diameter) of each type of pipe penetration for which approval is sought shall be tested in both vertical and horizontal orientation.

A.2.2 Design

A.2.2.1 A bulkhead which includes the pipe penetration shall be constructed in accordance with paragraph 2.1.1 of Appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is not exposed to the heating conditions of the test. A deck which includes the pipe penetration shall be constructed in accordance with paragraph 2.2.1 of Appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is exposed to the heating conditions of the test.

A.2.2.1.1 "A-0" class pipe penetrations are recommended to be performed in an uninsulated ("A-0") bulkhead/deck. If the pipe penetrations are tested as an "A-60" class penetration, any insulation fitted (on the penetration itself and 200 mm around) will be required to be fitted also for class "A-0".

A.2.2.1.2 "A-0" penetrations shall not be approved without an "A-0" test although tested and approved as "A-60".

A.2.2.2 The pipe penetrations shall be positioned only in the top half of a bulkhead but shall not be closer than 200 mm from the edges of a bulkhead or a deck. Where more than one pipe penetration is to be tested simultaneously in a division, the separation between adjacent penetrations shall not be less than 200 mm. Both measurements shall relate to the distance to the nearest part of the penetration system, including any insulation which is part of the system.

A.2.2.3 Each pipe passing through a penetration shall project 500 ± 50 mm beyond the exposed end of the penetration and 500 ± 50 mm beyond the unexposed end of the penetration. The exposed end of the pipe shall be blanked off, using an appropriate methodology to ensure that any fire penetration into the pipe does not occur via the end of the pipe in advance of it occurring through the exposed perimeter of the pipe.
A.2.2.4 Each pipe shall be firmly supported and fixed independent of the bulkhead or deck on the unexposed side of the test specimen, e.g., by a framework mounted from the restraint frame. The support and fixing of the pipe shall restrain it from movement during the test.

A.2.2.5 When the deck penetration is fitted on an exposed side or is fitted symmetrically, general application will be given. When the deck penetration is fitted on an unexposed side, the approval will limit the penetration to the tested orientation.

A.2.2.5.1 When the bulkhead penetration is fitted symmetrically, approval would be given for general application. For bulkhead penetrations with an exposed or unexposed fitted frame, one test for each fitting is required in order for obtaining approval for general application.

A.2.2.6 Sealing of pipe and duct penetrations: there shall be no visible openings before the start of the fire test.

A.2.2.6.1 In cases where a test specimen (deck) which includes the prototype penetration(s) is not mounted within a rigid restraint frame but is connected to the furnace roof by side wall coamings, the rigidity of the coamings is to be equivalent to that of a restraint frame and evaluated in accordance with paragraph 5.1 of Appendix 1.

A.2.2.6.2 In cases where insulation is fitted to the test pipe(s), the distance(s) of 500 ± 50 mm required in paragraph 2.2.3 to which the pipe should project is to be taken from the end of the insulation as this is considered an integral part of the penetration(s) being tested and it is necessary that a length of unprotected pipe is exposed to the furnace.

A.2.2.6.3 In all cases, the support and fixing of the test pipe(s) is to be by a framework mounted from the restraint frame such that any movement of the bulkhead or deck relative to the pipe(s) will be experienced by the penetration(s) being tested.

A.3 Instrumentation

A.3.1 Positioning of thermocouples on the specimen

A.3.1.1 For each pipe penetration, two thermocouples shall be fixed on the unexposed face at each of the following locations:

.1 on the surface of the pipe at a distance of 25 mm from the centre of the thermocouples to the position where the pipe emerges from the penetration seal;

.2 on the pipe penetration at a distance of 25 mm from the centre of the thermocouples to the face of the insulation on the unexposed side of the test specimen; and

.3 on the surface of any insulation or filling material used between the pipe and any coaming or spigot fixed to the division (provided that the gap between the pipe or any such coaming or spigot is greater than 30 mm), or on the surface of any collar or shroud used between the pipe and the division (e.g., vapour barrier).

A.3.1.2 For pipe penetrations in bulkheads, for each of the positions indicated above, one of the thermocouples shall be fixed directly above the centre of the pipe and the other thermocouple shall be fixed directly below the centre of the pipe.

A.3.1.3 Additional thermocouples may be required to be fitted, dependent upon the complexity of the pipe penetration.

A.4 Performance criteria

A.4.1 General

A.4.1.1 The performance of pipe penetrations may be related to their ability to satisfy both the insulation and the integrity criteria or may be related only to the requirements for integrity, depending on the requirements of the Administration.

A.4.1.2 Duct penetrations shall meet both integrity and insulation criteria.
A.4.2 Insulation

Since the pipe penetration is a local weakness in the division it shall be capable of preventing a temperature rise exceeding 180 °C above the initial temperature. The average temperature rise is not relevant.
A.1 General
"A" class divisions may have to be provided with apertures to allow them to be penetrated by cables, and it is necessary to reinstate the insulation and integrity performance of the division at the position where it has been penetrated. A cable transit consists of a metal frame, box or coaming, a sealant system or material and the cables, and it may be uninsulated, partially insulated or fully insulated.

A.2 Nature of the test specimen

A.2.1 Dimensions

The maximum and minimum sizes (in terms of both the height and the width) of each type of cable transit for which approval is sought shall be tested in both vertical and horizontal orientation.

A.2.2 Design

A.2.2.1 A bulkhead which includes the cable transit shall be constructed in accordance with paragraph 2.1.1 of Appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is not exposed to the heating conditions of the test. A deck which includes the cable transit shall be constructed in accordance with paragraph 2.2.1 of Appendix 1 and shall be insulated to class "A-60" on the stiffened face, which shall be the face which is exposed to the heating conditions of the test.

A.2.2.1.1 "A-0" class cable transits are recommended to be performed in an uninsulated ("A-0") bulkhead/deck. If the cable transits are tested as "A-60" penetration, any insulation fitted on an exposed side (on the cable transits itself and 200 mm around) will be required to be fitted also for "A-0".

A.2.2.1.2 "A-0" cable transits shall not be approved without an "A-0" test although tested and approved as "A-60".

A.2.2.2 The cable transits shall be positioned only in the top half of a bulkhead but shall not be closer than 200 mm from the edges of a bulkhead or a deck. Where more than one cable transit is to be tested simultaneously in a division, the separation between adjacent transits shall not be less than 200 mm. Both measurements shall relate to the distance to the nearest part of the transit system, including any insulation which is part of the system.

A.2.2.3 Notwithstanding the above, the distance between transits shall be sufficient to ensure that the transits do not influence each other during the test, except that this requirement does not apply to multi-transits which are intended to be positioned adjacent to one another.

A.2.2.4 The cables shall project 500 ± 50 mm beyond the transit on the exposed side of the division and 500 ± 50 mm on the unexposed side.

A.2.2.5 Each cable shall be firmly supported and fixed independent of the bulkhead or deck on the unexposed side of the test specimen, e.g., by a framework mounted from the restraint frame. The support and fixing of the cables shall restrain them from movement during the test.

A.2.2.6 Cable transits shall be fitted to the bulkhead or deck in accordance with the manufacturer's specifications. The cables and sealing compounds or blocks shall be incorporated into the transits with
the bulkhead and deck panels placed respectively in vertical and horizontal positions. Any insulation shall be applied to the cables and transits with the panels in the same respective positions.

A.2.2.6 The transit(s) shall be tested incorporating a range of different types of cables (e.g., in terms of number and type of conductor, type of sheathing, type of insulation material, size) and shall provide an assembly which represents a practical situation which may be found on ships. An individual Administration may have its own specification for a "standard" configuration of penetrating cables which it may use as a basis of its approvals.

A.2.2.6.1 The test results obtained from a given configuration are generally valid for the tested types of cables of size equal to or smaller than tested.

A.2.2.7 Tests shall be conducted for the maximum and minimum fill based on the inside cross-sectional area at each transit. The distance between the adjacent cables shall be the minimum specified by the manufacturer, and the cables should be placed close to the centre of the transit.

A.2.2.8 When the deck cable transit is fitted on an exposed side or is fitted symmetrically, general application will be given. When the deck cable transit is fitted on the unexposed side, the approval will limit the penetration to the tested orientation.

A.2.2.8.1 When the bulkhead cable transit is fitted symmetrically, approval would be given for general application. For bulkhead cable transit with exposed or unexposed fitted frame, one test for each fitting is required in order for obtaining approval for general application.

A.2.2.9 Sealing of cable transits shall have no visible openings before the start of the fire test.

A.3 Instrumentation

A.3.1 Positioning of thermocouples on the specimen

A.3.1.1 For each uninsulated cable transit, thermocouples shall be fixed on the unexposed face at each of the following locations:

1. at two positions on the surface of the frame, box or coaming at a distance of 25 mm from the unexposed surface of the division. When the penetration does not extend a minimum of 25 mm beyond the bulkhead or deck plate on the unexposed side of the assembly, these thermocouples shall be placed at the end of the frame, box or coaming;

2. at two positions at the end of the transit, on the face of the sealant system or material at a distance of 25 mm from a cable. If there is insufficient area to affix the thermocouples as described, one or both may be placed within a distance of 25 mm from a cable; and

3. on the surface of each type of cable included in the cable transit, at a distance of 25 mm from the face of the sealant system or material. In case of a group or bunch of cables, the group shall be treated as a single cable. In case of horizontal cables, the thermocouples shall be mounted on the uppermost surface of the cables. These thermocouples may be excluded if the diameters of the cables are too small to effectively affix the thermocouples to the cables. This shall be at the discretion of the Administration.

A.3.1.2 For those thermocouples placed on the outer perimeter of the frame, box or coaming, one thermocouple shall be fixed on each of two opposite faces, which in the case of bulkheads shall be the top and bottom faces.

A.3.1.3 For each partially insulated or fully insulated cable transit, thermocouples shall be fixed on the unexposed face at equivalent positions to those specified for an uninsulated transit as illustrated in figure 13.

A.3.1.4 Additional thermocouples may be required to be fixed, dependent upon the complexity of the cable transit.

A.3.1.5 When fixing thermocouples to the unexposed surface of the cables, the copper disc and the insulating pad shall be formed over the surface to provide good contact with the surface of the cable. The copper disc and the pad shall be retained in position by some mechanical means, e.g., wiring or spring
clips, such that they do not become detached during the test. The mechanical retention shall not provide any significant heat-sink effect to the unexposed face of the thermocouple.

A.4 Performance criteria

A.4.1 General

Cable transits shall meet both integrity and insulation criteria.

A.4.2 Insulation

Since the cable transit is a local weakness in the division, the temperature rise at any point on the surface shall not exceed 180 °C above the initial temperature. The average temperature rise shall not be used for this purpose.
Fig. B.1  Cable transits: position of unexposed-face thermocouples (shown for bulkhead)