GUIDANCE CHANGE NOTICE No.3

Part 1 Seagoing Ships

GUIDANCE FOR THE APPROVAL AND TYPE APPROVAL OF MATERIALS AND EQUIPMENT FOR MARINE USE

Volume W

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Foreword

This Guidance Change Notices (GCN) No. 3 provide amendment and corrigenda to the Guidance for The Approval and Type Approval of Materials and Equipment for Marine Use (Pt.1, Vol.W) 2022 edition along with effective date from which these changes are applicable.

Amendments to the preceding edition are marked by strikethrough, red color, and expanded text. These new additions and amendments are to be read in conjunction with the requirements given in the 2022 Edition of the Guidance.

The summary of current amendments for each section including the implementation date are indicated in *Table 1 - Amendments Incorporates in This Notice*.

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Any quires or comments concerning these Guidance are welcomed through communication with BKI Head Office.

Guidance Changes Notice No. 3 – April 2023

Table 1 – Amendments Incorporates in This Notice

These amendments will come into force as indicated in the Table.

Paragraph	Title/Subject	Status/Remark
Section 3 – Type Approval *The amendments are effective from 1 July 2023*		
J.	Crankcase Oil Mist Detection and Alarm Equipment	
J.1	Application	Added the purpose of type approval test acc. to IACS UR M67 Rev.2
J.2	Data to be submitted	Added reference data to be submitted for review/approval
J.3.1	–	Changed the reference
J.4.2	–	Removed into Table 3.12 in Environmental tests
J.4.3	–	Removed into Table 3.12 in Environmental tests
J.4.2	Test report	Added items to be included in the test result acc. to IACS UR M67 Rev.2
Table 3.12	Type tests of crankcase oil mist detection and alarm equipment	Added requirements for Test facilities, Environmental Tests, Functional tests, Detectors and alarm equipment to be tested, and Test method
U.	Cable Laying	
U.3.1	Prevention methods of flame spread through cable	Added the year of edition of the standard
U.3.2	Non-metallic cable bands	Deleted some words
Table 3.32	Approval test method and acceptance criteria for non-metallic cable bands	Replaced the old table with the new table that contains test types and test methods
Table 3.33	Type tests for cable trays/ protective casings made of plastics materials	Changed the surface resistivity value limit acc. to IACS Rec.73 Corr.1
V.	Automatic and Remote Control Systems	
Table 3.34	Environmental test items, testing conditions and methods, and criteria	Added equipment that may be exposed to higher vibration and requirements for Vibration test (no. 8) for equipment subject to increased vibration levels (IACS UR E10 Rev.6)
Table 3.34	Environmental test items, testing conditions and methods, and criteria	Deleted the requirements in Insulation resistance test (no.10) that already mentioned before
		Deleted one of test conditions for Electrostatic discharge immunity test (no.14) because of misplace
Y.	Fire Protection Materials	
Table 3.45	Fire test specimens of “A” and “B” class divisions	Added approval condition for “A-0” penetration
Y.4.4	Smoke and toxicity test	Revised the reference
Table 3.50	Smoke and toxicity test	Described the test specimen in detail
		Added new requirement for classification criteria of smoke
AS.	Air Anti-fouling systems	
AS.1	Application	Changed the title to be aligned with other sub-section
AS.1.1		Added new references for type approval basis
AS.1.2		Added paragraph that were previously from AS.3
AS.1.3		Added paragraph that were previously from AS.3

Paragraph	Title/Subject	Status/Remark
AS.3	Application	Deleted
AS.3	Data to be submitted	Renumbered, corrigenda and changed of product spesification
AS.4	Design requirements	Renumbered
AS.5	Requirements to production and quality control arrangement	Renumbered
AS.6	Type testing	Renumbered, changed the title and added new requirements for cybutryne content acc. to IMO Res. MEPC.331(76)
Table 3.91	Requirements for type testing of anti-fouling system	Changed the title and added new test requirements for cybutryne acc. to IMO Res. MEPC.331(76)
AS.7	Marking of product	Renumbered, changed the title and corrigenda

Section 3 Type Approval

J. Crankcase Oil Mist Detection ~~Arrangements~~ and Alarm Equipment

1. Application

The requirements in this sub section apply to tests and inspections for the type approval of crankcase oil mist detection ~~arrangements~~ and alarm equipment in accordance with the requirements of the Rules for Machinery Installations (Pt.1, Vol.III) Sec. 2.F.3.3.

The purpose of type testing crankcase oil mist detection and alarm equipment is :

1) To verify the functionality of the system
2) To verify the effectiveness of the oil mist detectors
3) To verify the accuracy of oil mist detectors
4) To verify the alarm set points
5) To verify time delays between oil mist leaving the source and alarm activation
6) To verify functional failure detection
7) To verify the influence of optical obscuration on detection

(IACS UR M67 3.1)

2. Data to be submitted

~~Drawings, detailed manufacturing data and test records~~ The following reference data are to be submitted to BKI in addition to those specified in A.2.

1) Description of oil mist detection equipment and system including alarms
2) Schematic layout of engine oil mist detection arrangements showing location of detectors/sensors and piping arrangements and dimensions
3) Maintenance and test manual which is to include the following information
   A) Intended use of equipment and its operation
   B) Functionality tests (to demonstrate that the equipment is operational and that any faults can be identified and corrective actions notified)
   C) Maintenance routines and spare parts recommendations
   D) Limit setting and instructions for safe limit levels
   E) Where necessary, details of configurations in which the equipment is and is not to be used

(IACS UR M67 12.2.1 - 12.2.4)

3. Design requirements

Oil mist detection arrangements are to be designed and fitted in accordance with the following requirements.

3.1 The oil mist detection arrangements are to be installed in accordance with the engine designer's and oil mist manufacturer's instructions and recommendations. Items and contents to be included in the instructions and recommendations are to comply with the requirements in the Rules for Machinery Installations (Pt.1, Vol.III) Sec. 2.F.~~4~~.3.3.11.

3.2 Alarms and shutdowns for the oil mist detection arrangements and the system arrangements are to be in accordance with the requirements in the Rules for Automations (Pt.1, Vol.VII) Sec. 2.C.

3.3 Where sequential oil mist detection arrangements are provided the sampling frequency and time is to be as short as reasonably practicable.

3.4 The oil mist detection arrangements are to provide an indication that any lenses fitted in the equipment and used in determination of the oil mist level have been partially obscured to a degree that will affect the reliability of the information and alarm indication.

3.5 The oil mist detection arrangements are to provide a alarm indication in the event of a foreseeable functional failure in the equipment and installation arrangements.

3.6 Where oil mist detection equipment includes the use of programmable electronic systems, the arrangements are to be in accordance with the requirements in the Rules for Automations (Pt.1, Vol.VII) Sec. 2.C.

3.7 Oil mist detection arrangements are to be capable of being tested on the test bed and onboard under engine at standstill and engine running at normal operating conditions.

4. Type tests

4.1 Approval tests are to comply with the requirements given in Table 3.12.

~~4.2 Panel of the oil mist detection arrangement is to be type tested in accordance with Table 3.34 of Sub-section V of the Guidance except that the test items are to be the functional tests, electrical power supply failure test, power supply variation test, dry heat test, damp heat test, vibration test, EMC test, insulation resistance test, high voltage test and static and dynamic inclinations, if moving parts are contained.~~

~~4.3 Detectors are to be type tested in accordance with Table 3.34 of Sub-section V. of the Guidance except that the test items are to be the functional tests, electrical power supply failure test, power supply variation test, dry heat test, damp heat test, vibration test, insulation resistance test, high voltage test and static and dynamic inclinations, if moving parts are contained.~~

~~4.4~~ 4.2 Test report

The test house is to provide a full report that includes the following information and documents:

1) Test specification
2) Details of devices tested
3) Results of tests

   To include a declaration by the manufacturer of the oil mist detector of its:

   A) Performance (mg/L)
   B) Accuracy, of oil mist concentration in air
   C) Precision, of oil mist concentration in air
   D) Range, of oil mist detector
   E) Resolution, of oil mist detector
   F) Response time, of oil mist detector
   G) Sensitivity, of oil mist detector
   H) Obscuration of sensor detection, declared as percentage of obscuration. (0% totally clean, 100% totally obscure)

I) Detector failure alarm

(IACS UR M67 11)

Table 3.12 Type tests of crankcase oil mist detection~~/monitoring~~ and alarm equipment ~~and systems~~

Kinds	Requirements
Test facilities	1) A full range of facilities for carrying out the environmental and functionality tests required by this sub section shall be available and be acceptable to BKI. 2) The test house that verifies the functionality of the equipment is to be equipped so that it can control, measure and record oil mist concentration levels in terms of mg/L to an accuracy of ± 10%. 3) When verifying the functionality, test houses are to consider the possible hazards associated with the generation of the oil mist required and take adequate precautions. It will be accepted the use of low toxicity, low hazard oils as used in other applications, provided it is demonstrated to have similar properties to SAE 40 monograde mineral oil specified.
Environmental tests	1) Panel of the oil mist detection arrangement is to be type tested in accordance with Table 3.34. However, the test items are to be electrical power supply failure test, power supply variation test, dry heat test, damp heat test, vibration test, EMC test, insulation resistance test, high voltage test and, static and dynamic inclinations (if moving parts are contained). 2) Detectors are to be type tested in accordance with Table 3.34. However, the test items are to be electrical power supply failure test, power supply variation test, dry heat test, damp heat test, vibration test, EMC test where susceptible, insulation resistance test, high voltage test and, static and dynamic inclinations.
~~Testing Methods~~ Functional tests	1) All tests to verify the functionality of crankcase oil mist detection and alarm equipment are to be carried out in accordance with 2) to 6) with an oil mist concentration in air, known in terms of mg/l to an accuracy of ±10%. ~~1)~~ 2) The concentration of oil mist in the test vessel is to be measured in the top and bottom of the vessel and is not to differ by more than 10 %. ~~2)~~ 3) The oil mist detection arrangements are to be capable of detecting oil mist in air concentrations of A) between 0 and 10 % of the lower explosive limit (LEL). B) between 0 and a percentage of weight of oil in air determined by the Manufacturer based on the sensor measurement method (e.g. obscuration or light scattering) that is acceptable to BKI taking into account the alarm level specified in 4). ~~(~~The LEL corresponds to an oil mist concentration of approximately 50 mg/l (13 % concentration of oil in air mixture, 4.1% weight of oil in air mixture). Refer to Fig 3.6~~)~~

Table 3.12 Type tests of crankcase oil mist detection and alarm equipment *(continued)*

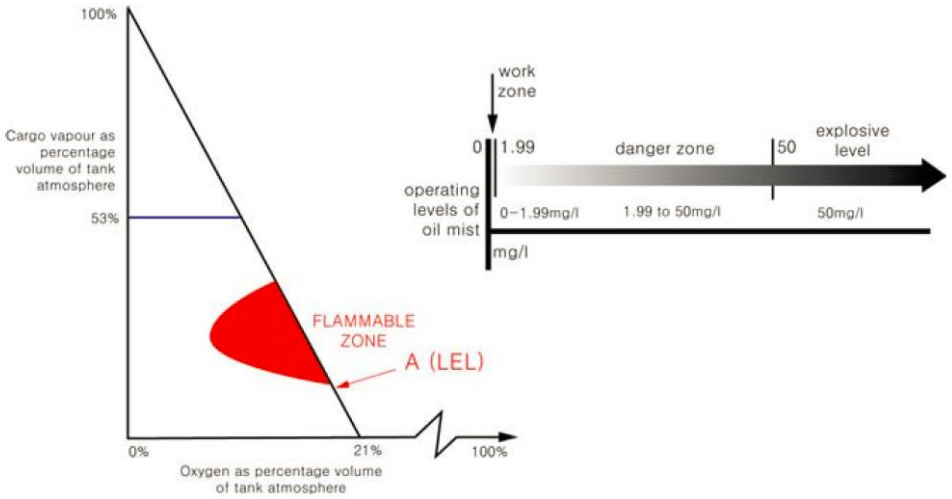
Kinds	Requirements
~~Testing Methods~~ Functional tests	 Fig 3.6 Explosion curve of oil-air mixture and operating levels of oil mist ~~3)~~ 4) The ~~operation of the~~ alarm ~~indicators~~ set point for oil mist concentration in air ~~are to be verified and are~~ is to provide an alarm at a maximum ~~setting~~ level corresponding to not more than 5 % of the LEL ~~corresponding to~~ or approximately 2,5 mg/L. ~~4) Two sets of oil mist detection arrangements are to be tested. One set is to be tested in the clean condition and the other in a condition that represents the maximum degree of lens obscuration that is stated as being acceptable by the manufacturer.~~ 5) Where alarm set points can be altered, the means of adjustment and indication of set points are to be verified against the equipment manufacturer's instructions. 6) The performance of the oil mist detector in mg/L is to be demonstrated. This is to include the range, resolution, sensitivity. ***Note:*** *Sensitivity of a measuring system: quotient of the change in an indication of a measuring system and the corresponding change in a value of a quantity being measured.* *Resolution: smallest change in a quantity being measured that causes a perceptible change in the corresponding indication.* 7) Where oil mist is drawn into a detector via piping arrangements, the time delay between the sample leaving the crankcase and operation of the alarm is to be determined for the longest and shortest lengths of pipes recommended by the manufacturer. The pipe arrangements are to be in accordance with the manufacturer's instructions/ recommendations. Piping is to be arranged to prevent pooling of oil condensate which may cause a blockage of the sampling pipe over time. 8) It is to be demonstrated that the openings of detector equipment does not become occluded or blocked under continuous splash and spray of engine lubricating oil, as may occur in the crankcase atmosphere. Testing is to be in accordance with arrangements proposed by the manufacturer and agreed by the classification society. The temperature, quantity and angle of impact of the oil to be used is to be declared and their selection justified by the manufacturer.

Table 3.12 Type tests of crankcase oil mist detection and alarm equipment *(continued)*

Kinds	Requirements
~~Testing Methods~~ Functional tests	9) Detector equipment may be exposed to water vapour from the crankcase atmosphere which may affect the sensitivity of the equipment and it is to be demonstrated that exposure to such conditions will not affect the functional operation of the detector equipment. Where exposure to water vapour and/or water condensation has been identified as a possible source of equipment malfunctioning, testing is to demonstrate that any mitigating arrangements such as heating are effective. Testing is to be in accordance with arrangements proposed by the manufacturer and agreed by BKI. 10) It is to be demonstrated that an indication is given where lenses fitted in the equipment and used in determination of the oil mist level have been partially obscured to a degree that will affect the reliability of the information and alarm indication.
~~Assessment~~	~~After completing the tests, the satisfactory operation of oil mist detection arrangements and the condition of all components should be ascertained.~~
Detectors and alarm equipment to be tested	1) The detectors and alarm equipment selected for the type testing are to be selected from the manufacturer's normal production line by the classification society witnessing the tests. 2) Two detectors are to be tested. One is to be tested in clean condition and the other in a condition representing the maximum level of lens obscuration specified by the manufacturer.
Test method	1) The ambient temperature in and around the test chamber is to be at 25 ± 10°C. 2) Oil mist is to be generated with suitable equipment using an SAE 40 monograde mineral oil or equivalent and supplied to a test chamber. The selection of the oil to be used is to take into consideration risks to health and safety, and the appropriate controls implemented. A low toxicity, low flammability oil of similar viscosity may be used as an alternative. The oil mist produced is to have an average (or arithmetic mean) droplet size not exceeding 5 µm. The oil droplet size is to be checked using the sedimentation method or an equivalent method to a relevant international or national standard. If the sedimentation method is chosen, the test chamber is to have a minimum height of 1 m and volume of not less than 1m3. 3) The oil mist concentrations used are to be ascertained by the gravimetric deterministic method or equivalent. Where an alternative technique is used its equivalence is to be demonstrated. (For this test, the gravimetric deterministic method is a process where the difference in weight of a 0,8 µm pore size membrane filter is ascertained from weighing the filter before and after drawing 1 litre of oil mist through the filter from the oil mist test chamber. The oil mist chamber is to be fitted with a recirculating fan.) 4) Samples of oil mist are to be taken at regular intervals and the results plotted against the oil mist detector output. The oil mist detector is to be located adjacent to where the oil mist samples are drawn off.

Table 3.12 Type tests of crankcase oil mist detection and alarm equipment *(continued)*

Kinds	Requirements
Test method	5) The results of a gravimetric analysis are considered invalid and are to be rejected if the resultant calibration curve has an increasing gradient with respect to the oil mist detection reading. This situation occurs when insufficient time has been allowed for the oil mist to become homogeneous. Single results that are more than 10% below the calibration curve are to be rejected. This situation occurs when the integrity of the filter unit has been compromised and not all of the oil is collected on the filter paper. 6) The filters require to be weighed to a precision of 0.1mg and the volume of air/oil mist sampled to 10ml. 7) Oil mist detection equipment is to be tested in the orientation (vertical, horizontal or inclined) in which it is intended to be installed on an engine or gear case as specified by the equipment manufacturer. 8) Where sensitivity levels can be adjusted, testing is to be carried out at the extreme and mid-point level settings.

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U. Cable Laying

3. Type tests

3.1 Prevention methods of flame spread through cable

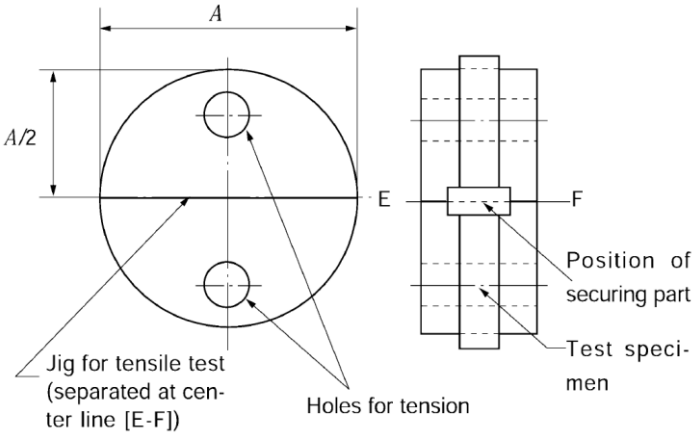
The type tests for prevention methods of flame spread through cable are to be carried out in accordance with IEC 60332-3-22:2018.

3.2 Non-metallic cable bands

The type tests for non-metallic cable bands are~~, according to the purpose and kind,~~ to be carried out in accordance with the requirements given in Table 3.32.

Table 3.32 Approval test method and acceptance criteria for non-metallic cable bands

~~Kind~~	~~Test item~~	~~Approval test method and acceptance criteria~~
~~Test specimens~~		~~The tests are to be done with the ten test specimens which were left in air for 30 minutes prior to tests, after conditioned at 20 ± 2°C and 50 ± 2% relative humidity for 24 hours.~~
~~Test method~~	~~Flame retardant test~~	~~(a) The test specimens are to be set upright in a test box of 1,200 ± 25 mm high, 300 ± 25 mm wide, 450 ± 25 mm deep, opened front face, nonmetallic bottom and other faces made of wire net and the distance from the lowest side of specimens to the bottom is to be adjusted to 50 mm.~~ ~~(b) The heating source from gas burner with tip of inner diameter 10 mm is to be blue flame of length of 100 mm and temperature of 800 ± 50°C.~~ ~~(c) The bottom of burner is to be at an angle of 45° against the specimens and the flame center is to be positioned at the height of 50 mm above the lowest side of specimen. The flame is to be applied for 60 seconds.~~ ~~(d) When the flame is removed, the flame ignited on the specimen is to be self-extinguished and the burnt trace is not to reach to the top of upper part as cleaned.~~

<table>
<tr>
<td>~~Test method~~</td>
<td>~~Mechanical property test before and after aging test~~</td>
<td>
~~(a) The tensile strength for ten test specimens is to be measured using the jig shown in Fig 3.11 before and after the aging test. The length of A described in the Figure is 30 mm for specimens of 200 mm length or less, and is chosen as appropriate for those of more than 200 mm length.~~


~~Fig 3.11 Attachment for Test Specimen of Cable Band~~
~~(b) The test specimens are to be placed at a temperature of 90 ± 2°C for 240 hours.~~
~~(c) The required tensile strength before and after aging test is shown in Table below.~~
<table>
<tr><td>~~Length of test specimen (mm)~~</td><td colspan="2">~~Min. tensile strength (N)~~</td></tr>
<tr><td></td><td>~~before aging test~~</td><td>~~after aging test~~</td></tr>
<tr><td>~~200 or below~~</td><td>~~250~~</td><td>~~188~~</td></tr>
<tr><td>~~over 200~~</td><td>~~500~~</td><td>~~375~~</td></tr>
</table>
</td>
</tr>
<tr>
<td>~~Test method~~</td>
<td>~~Bending test of low temperature~~</td>
<td>
~~(a) Effective length of specimen except securing part and end is to be tested.~~
~~(b) After the aging test in (b) of Mechanical property test before and after aging test above, the diameter of round bar which is not more than 5 times of thickness of test specimens and specimens are to be placed at temperature of -25 ± 2°C for four hours, and the test specimens are spirally rolled on the bar 5 times at the speed of one revolution per 5 seconds.~~
~~(c) When the test specimens rolled on the round bar are placed at room temperature, any crack is not to be allowed.~~
</td>
</tr>
</table>

No.	Item	Test method	Remarks
1	Installation test	IEC 62275, 9.2	
2	Minimum installation temperature test	IEC 62275, 9.3	except for metallic
3	Minimum operating temperature test	IEC 62275, 9.4	except for metallic
4	Loop tensile strength test for cable ties	IEC 62275, 9.5 and 9.6	
5	Mechanical strength test for fixing devices	IEC 62275, 9.7	
6	Contribution to fire	IEC 62275, 10	
7	Resistance to ultraviolet light	IEC 62275, 11.1	except for metallic
8	Resistance to corrosion	IEC 62275, 11.2	

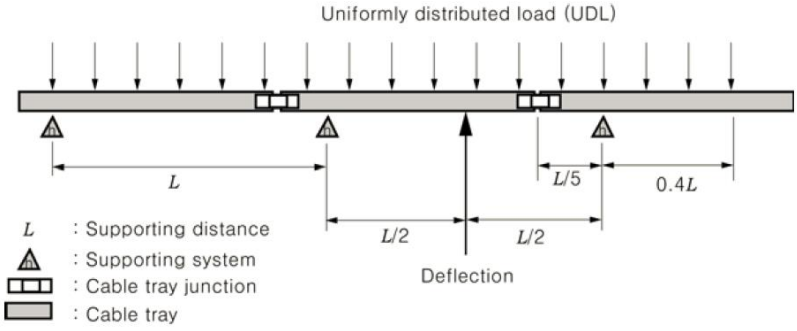
3.3 Non-metallic cable trays/protective casings

The type tests for cable trays/protective casings made of plastics materials are, according to the purpose and kind, to be carried out in accordance with the requirements given in Table 3.33.

Table 3.33 Type tests for cable trays/ protective casings made of plastics materials

<table>
<tr><th colspan="2">Test item</th><th>Approval test method and acceptance criteria</th></tr>
<tr><td colspan="2">Impact Resistance Test</td><td>The test should be performed according to IEC 60082-2-75:2014 using the pendulum hammer.
(a) The test should be carried out on samples of cable tray lengths or cable ladder lengths of 250 mm ± 5 mm long. Samples of ladder should consist of two side-members with one rung positioned centrally. Samples of mesh trays should be prepared in such a way that there will be a wire in the centre.
(b) Before the test, plastics components should be aged at a temperature of 90°C ± 2°C for 240 h continuously.
(c) The samples should be mounted on wooden fibreboard of thickness 20 mm ± 2 mm.
(d) The samples to be tested should be placed in a refrigerator, the temperature within which is maintained at the declared temperature below with a tolerance of ±2°C.
-25°C to 90°C for outdoor use
+ 5°C to 90°C for indoor use.
Consideration will be given to the use of plastics cable trays/protective casings in the cold environment where the ambient temperature is below -25°C provided the mechanical properties of the plastics can be maintained for the intended purpose and the installation location. In this particular instance, the cold bend and cold impact properties of the material should also be considered.
<table>
<tr><th>Approximate energy(J)</th><th>Mass of hammer (kg)</th><th>Fall height(mm)</th></tr>
<tr><td>10</td><td>5,0</td><td>200 ± 2</td></tr>
</table>
(e) After 2 h, the samples should, in turn, be removed from the refrigerator and immediately placed in the test apparatus.
(f) At 10 s ± 1s after removal of each sample from the refrigerator the hammer should be allowed to fall with impact energy, mass of the hammer and fall height as bellows:
(g) The impact should be applied to the base, or the rung, in the first sample, to one of the side members in the second sample, and to the other side member in the third sample. In each case, the impact should be applied to the centre of the face being tested.
(h) After the test, the samples should show no signs of disintegration and/or deformation that will impair the safety.</td></tr>
<tr><td rowspan="2">Safe Working Load (SWL) Test</td><td>application</td><td>Tests should be carried out for the smallest and largest sizes of cable trays lengths or cable ladder lengths, having the same material, joint and topological shape.</td></tr>
<tr><td>Test Tempera-ture</td><td>Cable trays/protective casings and joints should be tested at the declared temperatures according to (d) of impact resistance test above. Alternatively, tests can be carried out:
(a) at any temperature within the declared range if documentation is available which states that the relevant structural properties of the materials as used within the system do not differ by more than 5% of the average between the maximum and minimum property values, or,
(b) only at maximum temperature within the range, if documentation is available, which states that the relevant structural properties of the materials, as used within the system decrease when the temperature is increasing, or
(c) at maximum and minimum temperature only.</td></tr>
</table>

Table 3.33 Type tests for cable trays/ protective casings made of plastics materials *(continued)*

Test item		Approval test method and acceptance criteria
Safe Working Load (SWL) Test	Test loads	All loads should be uniformly distributed (UDL) over the length and width of the samples as shown in Fig 3.12. The loads should be applied in such a way that a UDL is ensured even in the case of extreme deformation of the samples.  Fig 3.12 UDL applying method (IEC 61537: 2006)
	Load test	(a) To allow for settlement of the samples, a pre-load of 10% of the test load unless otherwise specified, should be applied and held for at least 5 min, after which the measurement apparatus should be calibrated to zero. (b) The load should then be gradually increased evenly longitudinally and transversely up to the test load continuously or when a continuous increase is impractical, the load may be increased by increments. These increments should not exceed about a quarter of the safe working load. The load increments should be distributed through the load plates longitudinally and transversely as evenly as is practical. (c) After loading, the deflection should be measured at the points specified to give a practical mid-span deflection. (refer to Fig 3.12) The samples should be left, and the deflections measured every 5 minutes until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings. The first set of readings measured at this point is the set of deflections measured at the test load. (d) The maximum deflection should not exceed L/100 where L is the distance between the supports. (refer to Fig 3.12) (e) When subject to the test load the samples, their joints and internal fixing devices, should show no damage or crack visible to normal view or corrected vision without magnification
	Breaking test	(a) The load should then be increased to 1,7 times the test load. (b) The samples should be left, and the deflections measured every 5 min until the difference between two consecutive sets of readings is less than 2 % with regard to the first set of the two consecutive sets of readings. (refer to Fig 3.5) (c) The samples should sustain the increased loading without collapsing. Buckling and deformation of the samples is permissible at this loading.
Flame Retardant Test		The cable trays/protective casings should be at least flame retardant. They should be tested in accordance with Table 3.43 of Y.4. of this Guidance.
Smoke and Toxicity Test		The cable tray/protective casings should be tested in accordance with Y.4.4 of this Guidance, or any international or national standard.
Resistivity Test		(a) Cable trays/protective casings passing through a hazardous area should be electrically conductive. The cable tray/protective casings should be tested in accordance with IEC 62631-3-1:2016 and IEC 62631-3-2:2015. (b) The volume resistivity level of the cable trays/protective casings and fittings should be below 10^5 ohm meter [Ωm] and the surface resistivity should be below ~~10^6~~ 10^8 ohm [Ω]. The resistance to earth from any point in these appliances should not exceed 10^6 ohm [Ω].

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V. Automatic and Remote Control Systems

4. Type test

4.1 Hardware

4.1.2 Test methods and criteria

1) After the drawings and documents submitted in accordance with the requirements in 2. have been examined, tests are to be carried out in accordance with the testing condition and method of Table 3.34 in the presence of BKI Surveyor, and they are to be proven to satisfy the criteria of Table 3.34.
2) Where tests which do not fully comply with the testing condition and method, and the criteria of Table 3.34, they may comply with a standard deemed appropriate by BKI such as IEC, Standard Nasional Indonesia (SNI) or other recognized standard.
3) In contrast to a complete performance test, a functional test is a simplified test sufficient to verify that the equipment under test (ETU) has not suffered any deterioration caused by the individual environmental tests.
4) In application to high voltage test of Table 3.34, if agreed by BKI, the test may be carried out by referring of Rules for Electrical Installations (Pt.1, Vol.IV) Sec.20.

Table 3.34 Environmental test items, testing conditions and methods, and criteria

No.	Test Item	Testing condition and method	Criteria
1	Visual inspection	Examine the external, structure, etc., of the equipment.	The equipment complies with the specifications.
2	Performance test	- Check the operation of the equipment. - Check the self-monitoring features if provided. - Check the specified protection against an access to the memory. - Check against the effect of un-erroneous use of control elements in the case of computer systems. - When the EUT is required to comply with an international performance standard, e.g. protection relays, verification of requirements in the standard are to be part of the performance testing required in this initial test and subsequent performance tests after environmental testing.	The equipment operates satisfactory.
3	Electrical power supply failure test	- Check the operation of the equipment when the electrical power supply is interrupted 3 times for 5 minutes. (interruption time is 30 seconds each time) - The time of 5 minutes may be exceeded if the equipment under test needs a longer time for start-up, e.g. booting sequence. For equipment which requires booting, one additional power supply interruption during booting to be performed - Check the possible corruption of programme or data held in programmable electronic systems (where applicable)	The equipment operates satisfactory without manual calibration after restoration of the electrical power supply.

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

<table>
<tr><th>No.</th><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>4</td><td>Electrical power supply variation test</td><td>- Check the operation of the equipment when the electrical power supply varies as shown in the following
AC supply
<table>
<tr><th>Combination</th><th>Voltage variation permanent (%)</th><th>Frequency variation permanent (%)</th></tr>
<tr><td>1</td><td>+6</td><td>+5</td></tr>
<tr><td>2</td><td>+6</td><td>-5</td></tr>
<tr><td>3</td><td>-10</td><td>-5</td></tr>
<tr><td>4</td><td>-10</td><td>+5</td></tr>
<tr><td></td><td>Voltage transient (%)</td><td>Frequency transient (%)</td></tr>
<tr><td></td><td>1,5 sec</td><td>5 sec</td></tr>
<tr><td>5</td><td>+20</td><td>+10</td></tr>
<tr><td>6</td><td>-20</td><td>-10</td></tr>
</table>
DC supply
<table>
<tr><td rowspan="3">For the equipment not related to a battery (%)</td><td>Voltage tolerance continuous</td><td>± 10</td></tr>
<tr><td>Voltage cyclic variation</td><td>5</td></tr>
<tr><td>Voltage ripple</td><td>10</td></tr>
<tr><td rowspan="2">For the equipment related to a battery (%)</td><td>For thr equipment connected to a battery during charging</td><td>-25 ~ +30</td></tr>
<tr><td>For the equipment not connected to a battery charging</td><td>-25 ~ +20</td></tr>
</table>
- Check the possible corruption of programme or data held in programmable electronic systems (where applicable)</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
<tr><td>5</td><td>Power supply variation test</td><td>Check the operation of the equipment when the pneumatic and the hydraulic power supplies are maintained continuously +20 % and -20 % of the working pressure for at least 15 minutes.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
<tr><td>6</td><td>Dry heat test</td><td>- The test shall be carried out at 25 ±2 °C in atmospheric temperature.
- The absolute humidity shall not exceed 20 g of water vapor per cubic meter of air (corresponding approximately to 50 % relative humidity at 35°C).
- Test A: The equipment is at an operating condition and apply the environmental condition of +70±2°C for 16 hours. And check the operation of the equipment during the last 1 hour at the test temperature and after recovery. Dry heat at 70 °C is to be carried out to automation, control and instrumentation equipment subject to high degree of heat, for example mounted in consoles, housings, etc. together with other heat dissipating power equipment. (see Fig. 3.13)
- Test B: For the equipment installed in air-conditioned spaces, the environmental condition of +55 ±2°C for 16 hours may be applied. Check the operation of the equipment during the last 1 hour at the test temperature and after recovery. Where the equipment is attached with other equipment in the console and housing, test A is to be performed. (see Fig 3.13)
- Detailed test methods are referred to Test Bb for non-heat dissipating equipment or Test Be for heat dissipating equipment of IEC 60068-2-2:2007.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
</table>

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

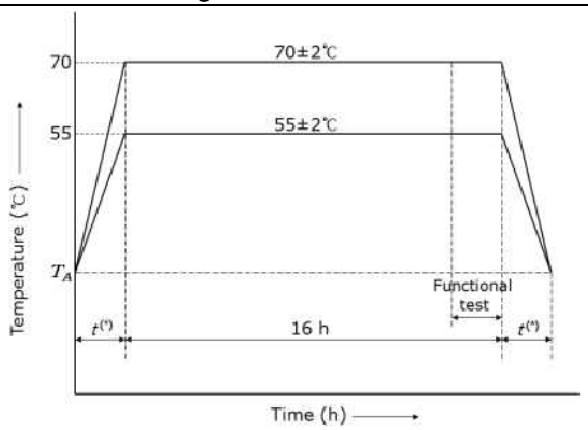
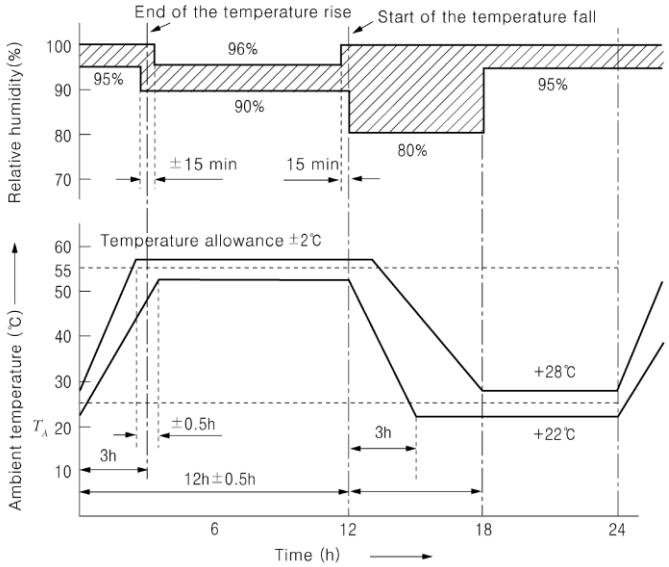
No.	Test Item	Testing condition and method	Criteria
6	Dry heat test	 Fig 3.13 Program of dry heat test ***Note*** *(*) Raising and lowering rate of temperature is to be within 1°C/min.(mean value for a period within 5 minutes)*	- No abnormality is observed. - The equipment operates satisfactory.
7	Damp heat test	- The test shall start with 25°C ± 3°C and at least 95% humidity. - The temperature in the chamber shall be continuously raised to 55 ±2 °C during 3h±30 min. During this period, the relative humidity shall be not less than 95 %, except during the last 15min when it shall be not less than 90 %. (see Fig 3.14) - The temperature shall then be maintained 55 ±2 °C until 12h ±30 min from the start of the cycle. During this period, the relative humidity shall be 93±3%, except for the first and last 15 min when it shall be between 90% and 100%.  Fig 3.14 Program of damp heat test - 2 cycles shall be carried out as shown in Fig 3.14. The equipment is kept under operating condition during complete 1st cycle and switched off during 2nd cycle except for the operation test. And check the operation of the equipment during the first 2 hours of the 1st cycle at the environmental condition, during the last 2 hours of 2nd cycle at the environmental condition and after recovery - Insulation resistance measurements are carried out before and after test. - Detailed test methods are referred to Test Db of IEC 60068-2-30:2005.	- No abnormality is observed. - The equipment operates satisfactory.

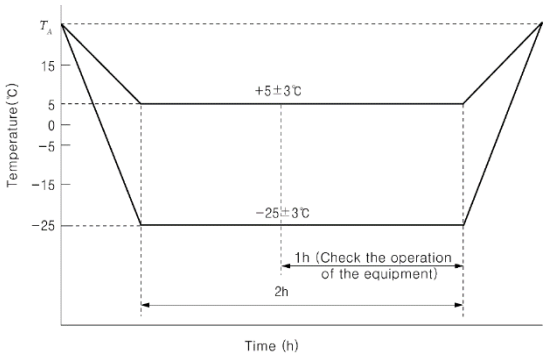
Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

<table>
<tr><th>No.</th><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>8</td><td>Vibration test</td><td>
- The equipment is at an operating condition and apply the sweeping of vibration specified in the following over the frequency range of 2(+3,-0) Hz ~ 100 Hz in order to find resonance points. (points of which amplification factor: (Q ≥ 2 are considered resonance points.)
<table>
<tr><th>Frequency</th><th>Amplitude or Acceleration</th></tr>
<tr><td>2 (+3, 0) ~ 13,2 Hz</td><td>Amplitude ± 1,0 mm</td></tr>
<tr><td>13,5 ~ 100 Hz</td><td>Acceleration ± 0,7 g</td></tr>
</table>
- When resonance points do not exist, apply the vibration of acceleration ±0,7 g at 30 Hz for 90 minutes as an endurance test.
- When resonance points exist, repeat the test with necessary provisions to avoid resonance or apply the vibration (same amplitude or acceleration of resonance point) at the resonance frequency for 90 minutes as an endurance test. However, where sweep test is to be carried out instead of the discrete frequency test and a number of resonant frequencies is detected close to each other, duration of the test is to be 120 min.
- Sweep over a restricted frequency range between 0,8 and 1,2 times the critical frequencies can be used where appropriate. Critical frequency is a frequency at which the equipment being tested may exhibit:
  - malfunction and/or performance deterioration
  - mechanical resonances and/or other response effects occur, e.g. chatter
- during the vibration test, functional tests are to be carried out;
- The test is carried out in three axis directions.
- It is recommended as guidance that Q does not exceed 5,
- For the equipment intended to be installed in severe vibration conditions such as diesel engines, air compressors, the vibration level specified in the following is applied.
<table>
<tr><th>Frequency</th><th>Amplitude or Acceleration</th></tr>
<tr><td>2 (+3, 0) ~ 25,0 Hz</td><td>Amplitude ± 1,6 mm</td></tr>
<tr><td>25,0 ~ 100 Hz</td><td>Acceleration ± 4,0 g</td></tr>
</table>
- More severe conditions may exist for example on exhaust manifolds or fuel oil injection systems of diesel engines ~~especially for medium and high speed engine~~. For equipment specified for increased vibration levels the vibration test is to be conducted at the agreed vibration level, frequency range and duration. Values may be required to be in these cases 40 Hz to 2000 Hz- acceleration ±10,0 g at 600 °C duration 90 minutes.
- Detailed test methods are referred to Test Fc of IEC 60068-2-6:2007.
</td><td>
- No abnormality is observed.
- The equipment operates satisfactory.
</td></tr>
</table>

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

<table>
<tr><th>No.</th><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>9</td><td>Inclination test</td><td>a) inclined to the vertical at an angle of at least 22,5°
b) inclined to at least 22,5° on the other side of the vertical and in the same plane as in (a),
c) inclined to the vertical at an angle of at least 22,5° in plane at right angles to that used in (a),
d) inclined to at least 22,5° on the other side of the vertical and in the same plane as in (c).
Note: The period of testing in each position should be sufficient to fully evaluate the behaviour of the equipment.
- Using the directions defined in a) to d) above, the equipment is to be rolled to an angle of 22,5° each side of the vertical with a period of 10 seconds.
- The test in each direction is to be carried out for not less than 15 minutes.
- On ships for the carriage of liquified gases and chemicals, the emergency power supply is to remain operational with the ship flooded up to a maximum final athwart ship inclination of 30°.
Note: These inclination tests are normally not required for equipment with no moving parts.
- Detailed test methods are referred to IEC 60092-504:2016.</td><td>- No abnormality is observed.
- The equipment operates satisfactory.</td></tr>
<tr><td>10</td><td>Insulation resistance test</td><td>- Measure the insulation resistance between current carrying parts and between current parts and earth when measured with the following application voltage.
<table><tr><th>Rated voltage : Un (V)</th><th>Test voltage (D.C Voltage) (V)</th></tr><tr><td>Un ≤ 65</td><td>2 x Un, min. 24</td></tr><tr><td>Un > 65</td><td>500</td></tr></table>- Measurements are carried out before and after; other series of environmental tests, damp heat test, cold test and salt mist test.
- For the equipment containing circuits in which the application of the test voltage is not desirable, the test voltage is applied after removing the circuits.
<s>- For high voltage equipment, reference is made to IACS UR E11.
- insulation resistance test is to be carried out before and after: damp heat test, cold test, salt mist test and high voltage test;
- between all phases and earth; and where appropriate, between the phases.</s>
Note: Certain components e.g. for EMC protection may be required to be disconnected for this test.</td><td>- The insulation resistance (MΩ) is not less than the value specified in the following.
<table><tr><th>Rated voltage</th><th>Before test</th><th>After test</th></tr><tr><td>Un ≤ 65</td><td>10</td><td>1,0</td></tr><tr><td>Un > 65</td><td>100</td><td>10</td></tr></table></td></tr>
<tr><td>11</td><td>High voltage test</td><td>- Apply the following test voltage, alternating of a frequency of 50 Hz or 60 Hz, between current carrying parts and between current-carrying parts connected and earth for 1 minute.
<table><tr><th>Rated voltage : Un (V)</th><th>Test voltage (V)</th></tr><tr><td>Un ≤ 65</td><td>2 x Un + 500</td></tr><tr><td>65 < Un ≤ 250</td><td>1500</td></tr><tr><td>250 < Un ≤ 500</td><td>2000</td></tr><tr><td>500 < Un ≤ 690</td><td>2500</td></tr></table>- For the equipment containing circuits in which the application of the test voltage is not desirable, the test voltage is applied after removing the circuits.</td><td></td></tr>
</table>

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

No.	Test Item	Testing condition and method	Criteria
12	Cold test	- The test shall be carried out at 25 ±10 °C in atmospheric temperature. - The equipment is switched off except for the operation test and apply the environmental condition of +5 ±3 °C for 2 hours. And check the operation of the equipment during the last hour at the test temperature and after recovery. - For the equipment installed in open decks, etc., the environmental condition of -25 ±3 °C is applied for 2 hours. - Insulation resistance measurements are carried out before and after cold test. - Detailed test methods are referred to test Ab or test Ad of IEC 60068-2-1:2007  Fig 3.15 Program of cold test	- No abnormality is observed. - The equipment operates satisfactory.

13	Salt mist test [2]	- The equipment is switched off except when its operation is checked. Apply four cycles of the environmental condition of spraying NaCl liquid (saline solution, 5 % NaCl, pH 6,5 ~ 7,2, 20 ±2 °C) for 2 hours and leaving for 7 days. Check the operation of the equipment during the 7th day of each cycle and after recovery.
		- Damp chamber conditions for storage are to be maintained as follows;
		  - Temp.: 40 °C ±2 °C
		  - Relative humidity: 93% +2% -3%
		The test is carried out according to the following procedure
		- Insulation resistance and functional test before test
		- Functional test on the 7th day of each cycle period
		- Insulation resistance and functional test: 4 to 6 hours after recovery
		- Detailed test methods are referred to Test kb of IEC 60068-2-52:2017.
			- No abnormality is observed.
			- The equipment operates satisfactory.

14	Electrostatic discharge immunity test.	- Check the operation of the equipment when the electrostatic discharge immunity test is carried out according to the following condition. Contact Discharge: 6 kV Air Discharge: 2 kV, 6 kV, 8 kV Interval between single discharge: 1 sec. No. Of Pulses: 10 per polarity - The test is to be confined to the points and surfaces that can normally be reached by the operator. - Detailed test methods are referred to Level 3 of IEC 61000-4-2:2008. ~~- If an equipment is intended to receive radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller), then the immunity limits at its communication frequency do not apply, subject to the provisions in Rules for Electrical Installations (Pt.1, Vol.IV) Sec. 10. E.2.~~	Performance Criterion B [2]

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

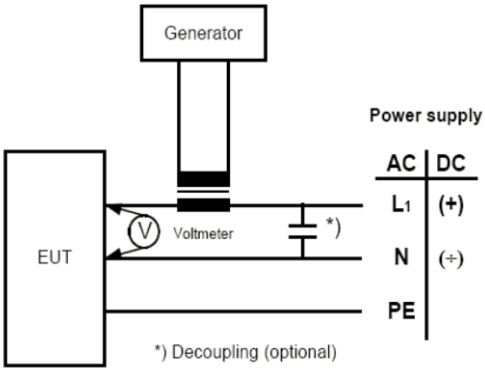
<table>
<tr><th>No.</th><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>15</td><td>Radiated radio frequency immunity test</td><td>- Check the operation of the equipment when the radiated radio frequency immunity test is carried out according to the following condition.
<table><tr><td>Frequency range</td><td>80 MHz ~ 2 GHz</td></tr><tr><td>Modulation</td><td>80 % AM at 1000 Hz</td></tr><tr><td>Field strength</td><td>10 V/m</td></tr><tr><td>Frequency sweep rate</td><td>≤ 1,5 x 10-3 decades/ sec.
(or 1 %/ 3 sec.)</td></tr></table>- If for tests of equipment an input signal with a modulation frequency of 1,000 Hz is necessary, a modulation frequency (80 % AM) of 400 Hz may be chosen.
- The test is to be confined to the appliances exposed to direct radiation by transmitters at their place of installation.
- If an equipment is intended to receive radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller), then the immunity limits at its communication frequency do not apply, subject to the requirements in Rules for Electrical Installations (Pt.1, Vol.IV) Sec.10, E.2.
- Detailed test methods are referred to Level 3 of IEC 61000-4-3:2020.</td><td>Performance Criterion A [3]</td></tr>
<tr><td>16</td><td>Conducted low frequency immunity test</td><td>- Check the operation of the equipment when the conducted low frequency immunity test is carried out according to the following condition. (values in round brackets are shown where the rated frequency of the equipment is 50 Hz)
 

Fig 3.16 Test set-up – conducted low frequency test
<table><tr><td>Frequency Range</td><td colspan="3">60 Hz ~ 12 kHz
(50 Hz~10 kHz)</td></tr><tr><td rowspan="4">Test Voltage</td><td rowspan="3">AC</td><td>10 % of supply voltage</td><td>60 Hz ~ 900 Hz
(50 Hz~750 Hz)</td></tr><tr><td>10 % to 1 % of supply voltage</td><td>900 Hz ~ 6 Hz
(750 Hz~5 kHz)</td></tr><tr><td>1 % of supply voltage</td><td>6 kHz ~ 12 kHz
(5 kHz~10 kHz)</td></tr><tr><td>DC</td><td>1 % of supply voltage
(at least 3 V)</td><td>50 Hz ~ 10 kHz</td></tr><tr><td rowspan="2">Maximum power</td><td>AC</td><td colspan="2">Min 3 V r.m.s, max 2 W.</td></tr><tr><td>DC</td><td colspan="2">max 2 W</td></tr></table>- In case of marine navigational and radiocommunication equipment and systems, this test can be exempted.</td><td>Performance Criterion A [3]</td></tr>
</table>

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

<table>
<tr><th>No.</th><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>17</td><td>Conducted high frequency immunity test</td><td>- Check the operation of the equipment when the conducted high frequency immunity test is carried out according to the following condition.
<table><tr><td>Frequency range</td><td>150 kHz ~ 80 MHz</td></tr><tr><td>Modulation</td><td>80 % AM at 1000 Hz</td></tr><tr><td>Amplitude</td><td>3 V rms [4]</td></tr><tr><td>Frequency sweep rate</td><td>≤ 1,5 x 10^{-3} decades/ sec.
(or 1 %/ 3 sec.)</td></tr></table>- If for tests of equipment an input signal with a modulation frequency of 1 kHz is necessary a modulation frequency (80 % AM) of 400 Hz should be chosen.
- Detailed test methods are referred to Level 2 of IEC 61000-4-6:2013.</td><td>Performance Criterion A [3]</td></tr>
<tr><td>18</td><td>Burst/Fast transient immunity test</td><td>- Check the operation of the equipment when the burst fast transient immunity test is carried out according to the following condition.
<table><tr><td>Single pulse time</td><td>5 ns (10 ~ 90% value)</td></tr><tr><td>Single pulse width</td><td>50 ns (50 % value)</td></tr><tr><td rowspan="2">Amplitude (peak)</td><td>Line on power supply port/ earth : 2 kV</td></tr><tr><td>Line/line on I/O data control and signal lines : 1 kV</td></tr><tr><td>Pulse period</td><td>300 ms</td></tr><tr><td>Burst duration</td><td>15 ms</td></tr><tr><td>Duration</td><td>5 min./polarity</td></tr></table>- Detailed test methods are referred to Level 3 of IEC 61000-4-4:2012.</td><td>Performance Criterion B [2]</td></tr>
<tr><td>19</td><td>Surge immunity test</td><td>- Check the operation of the equipment when the surge immunity test is carried out according to the following condition.
<table><tr><td colspan="3">Test applicable to AC and DC power ports</td></tr><tr><td rowspan="3">Open-circuit voltage</td><td>Pulse rise time</td><td>1,2 μs (10 ~ 90% value)</td></tr><tr><td>Pulse width</td><td>50 μs (50 % value)</td></tr><tr><td rowspan="2">Amplitude (peak)</td><td>Line/earth : 1 kV</td></tr><tr><td>Line/line : 0,5 kV</td></tr><tr><td rowspan="2">Short-circuit current</td><td>Pulse rise time</td><td>8 μs (front time)</td></tr><tr><td>Pulse width</td><td>20 μs (time to half value)</td></tr><tr><td colspan="2">Repetition rate</td><td>At least 1 pulse/min</td></tr><tr><td colspan="2">No. Of pulse</td><td>5 per polarity</td></tr></table>- Detailed test methods are referred to Level 2 of IEC 61000-4-5:2017.</td><td>Performance Criterion B [2]</td></tr>
</table>

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

<table>
<tr><th>No.</th><th>Test Item</th><th>Testing condition and method</th><th>Criteria</th></tr>
<tr><td>20</td><td>Radiated emission test</td><td>
- Radiated emission test is to be carried out according to the following.
For limits below 1000 MHz
<table>
<tr><td colspan="2">For equipment installed in the bridge and deck zone</td></tr>
<tr><td>Frequency range</td><td>Limits</td></tr>
<tr><td>150 kHz~ 300 kHz</td><td>80 ~ 52 dB µV / m</td></tr>
<tr><td>300 kHz ~ 30 MHz</td><td>52 ~ 34 dB µV / m</td></tr>
<tr><td>30 MHz ~ 1000 MHz</td><td>54 dB µV / m</td></tr>
<tr><td>156 MHz ~ 165 MHz</td><td>24 dB µV / m</td></tr>
<tr><td colspan="2">For equipment installed in the bridge in a zone other than bridge and deck zone</td></tr>
<tr><td>Frequency range</td><td>Limits</td></tr>
<tr><td>150 kHz~ 300 kHz</td><td>80 ~ 50 dB µV / m</td></tr>
<tr><td>30 MHz ~ 100 MHz</td><td>60 ~ 54 dB µV / m</td></tr>
<tr><td>100 MHz ~ 1000MHz</td><td>54 dB µV / m</td></tr>
<tr><td>156 MHz ~ 165 MHz</td><td>24 dB µV / m</td></tr>
</table>
For limits above 1000 MHz
<table>
<tr><td>Frequency range</td><td>Limits</td></tr>
<tr><td>1000 MHz ~ 6000MHz</td><td>54 dB µV / m</td></tr>
</table>
- Distance between equipment and antenna is to be 3 m.
- For the frequency band 156 MHz to 165 MHz the measurement shall be repeated with a receiver bandwidth of 9 kHz (as per IEC 60945:2002).
- Alternatively the radiation limit at a distance of 3 m from the enclosure port over the frequency 156 MHz to 165 MHz shall be 30 dB micro-V/m Peak (as per IEC 60945:2002)
- Equipment intended to transmit radio signals for the purpose of radio communication (e.g. wifi router, remote radio controller) may be exempted from limit, within its communication frequency range, subject to the provisions in Rules for Electrical Installations (Pt.1, Vol.IV) Sec. 10. E.2.
- Detailed test methods are referred to CISPR 16-2-3:2016, IEC 60945:2002 for 156-165 MHz
</td><td>Radiated emission is to be within limits in the table.</td></tr>
<tr><td>21</td><td>Conducted emission test</td><td>
- Conducted emission test is to be carried out according to the following.
<table>
<tr><td colspan="2">For equipment installed in the bridge and deck zone</td></tr>
<tr><td>Frequency range</td><td>Limits</td></tr>
<tr><td>10 kHz~ 150 kHz</td><td>96 ~ 50 dB µV / m</td></tr>
<tr><td>150 kHz ~ 350 kHz</td><td>60 ~ 50 dB µV / m</td></tr>
<tr><td>350 kHz ~ 30 MHz</td><td>50 dB µV / m</td></tr>
</table>
<table>
<tr><td colspan="2">For equipment installed in the bridge in a zone other than bridge and deck zone</td></tr>
<tr><td>Frequency range</td><td>Limits</td></tr>
<tr><td>10 kHz~ 150 kHz</td><td>120 ~ 69 dB µV / m</td></tr>
<tr><td>150 kHz ~ 500 kHz</td><td>79 dB µV / m</td></tr>
<tr><td>500 kHz ~ 30 MHz</td><td>73 dB µV / m</td></tr>
</table>
- Test applicable to AC and DC power ports
- Detailed test methods are referred to CISPR 16-2, 1
</td><td>Conducted emission is to be within limits in the table.</td></tr>
</table>

Table 3.34 Environmental test items, testing conditions and methods, and criteria *(continued)*

No.	Test Item	Testing condition and method	Criteria
22	Flame resistance test	- Flame resistance test is to be carried out according to the following condition. Flame application: 5 times 15 sec. each Interval between each application: 15 sec. or 1 time 30 sec. - The test is performed with the EUT or housing of the EUT applying needle-flame test method. - Detailed test methods are referred to IEC 60092-101:2018 or IEC 60695-11-5:2016	- The burnt out or damaged part of the specimen by not more than 60 mm long. - No flame, no incandescence or - In the event of a flame or incandescence being present, it shall extinguish itself within 30 s of the removal of the needle flame without full combustion of the test specimen. - Any dripping material shall extinguish itself in such a way as not to ignite a wrapping tissue. The drip height is 200 mm ± 5 mm.
23	Pressure test	- Apply the pneumatic or hydraulic pressure of 1,5 times the designed pressure.	No abnormality is observed.

Note:
1 Salt mist test is to be carried out for equipment installed in weather exposed areas.
2 Performance Criterion B: The Equipment Under Test is to continue to operate as intended after the tests. No degradation of performance or loss of function is allowed as defined in the technical specification published by the manufacturer.
During the test, degradation or loss of function or performance which is self-recoverable is however allowed but no change of actual operating state or stored data is allowed.
3 Performance Criterion A: The EUT is to continue to operate as intended during and after the test. No degradation of performance or loss of function is allowed as defined in the technical specification published by the manufacturer.
4 For equipment installed on the bridge and deck zone, the test levels shall be increased to 10 Vrms for spot frequencies in accordance with IEC 60945 at 2, 3, 4, 6.2, 8.2, 12.6, 16.5, 18.8, 22, 25 MHz.

---------- *end* ----------

Y. Fire Protection Materials

4. Test methods

4.2 Fire test of “A” and “B” class divisions

(refer to FTP Code, Annex 1, Part 3 and IMO Res. MSC 307(88))

4.2.1 General

1) The dimensions of the structural cores of the test specimens given in 4.2.2 below are intended for structural cores of stiffened flat plates of steel or aluminium alloy. BKI may require tests to be carried out on specimens having structural cores of materials other than steel or aluminium alloy if such materials are more representative of the construction to be used on board ships.

2) “A“ class divisions which consist of uninsulated steel bulkheads or decks of suitable scantlings and without openings can be deemed to satisfy the requirements for ”A-0“ class divisions, i.e. to satisfy the requirements for the passage of smoke and flame, without the need for testing. All other divisions, including “A-0“class divisions with a structural core of aluminium, are required to be tested.

3) Results obtained on an insulating material used in conjunction with an 'A' class division may be applied to constructions incorporating heavier scantling than those tested and providing the

orientation of the construction is the same, i.e. results from bulkhead tests are not to be applied to decks and vice versa.

4) Constructions are to be tested without paint or other superimposed finish, provided that where they are only produced with a superimposed finish, and subject to the agreement of BKI, they may be tested as produced. Such constructions may be required to be tested with a superimposed finish if such a finish is considered by BKI to have a detrimental effect on the performance of the construction in the test.

5) The construction to be tested are to be, as far as possible, representative of that to be used on board ships, including the materials and method of assembly.

6) Non-combustible materials used in the construction of the specimen are not to be more than 24 months old from the date of the performance of the fire resistance test. If not, tests are to be conducted specified in 4.1 above.

7) Adhesives used in A or B Class divisions should be low flame spread

8) The thickness of insulation on the stiffeners need not be same as that of the steel plate.

9) Doors, windows and other division penetrations intended to be installed in fire divisions made of material other than steel shall correspond to prototypes tested on a division made of such material.

10) “B” class constructions shall be tested without finished. For constructions where this is not possible, the finishes may be included in the "B" class test specimen, and shall be included in the non-combustibility test of the construction.

4.2.2 Nature of test specimens is to be as specified in Table 3.45.

---------- *end* ----------

Table 3.45 Fire test specimens of “A” and “B” class divisions

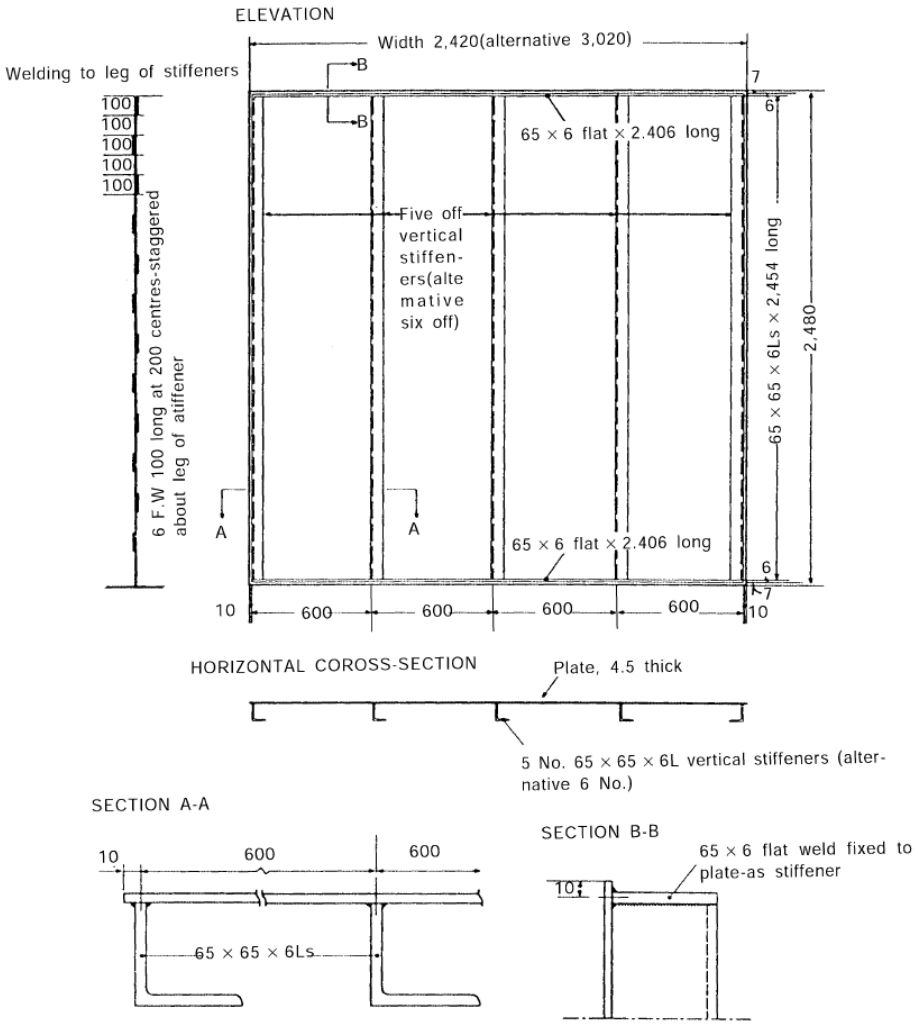
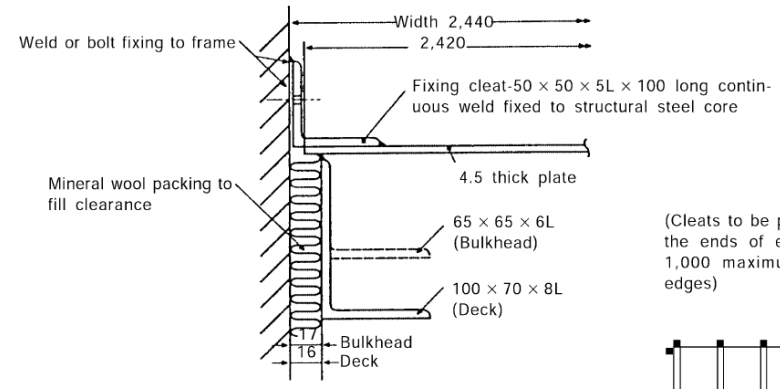
Kinds	Item	Requirements
“A“ class bulkheads	Dimensions	(1) The minimum overall dimensions of test specimen, including the perimeter details at the top, bottom and vertical edges, are 2440 mm width and 2500 mm height. (a) When the maximum overall height in practice is less than that given above, then the test specimen shall be of the maximum height to be used in practice. (b) The minimum bulkhead panel height shall be a standard height of the manufactured panel with a dimension of 2400 mm. (2) The overall dimensions of the structural core are to be 20 mm less in both the width and the height than the overall dimensions of the specimen, and the other dimensions of the structural core are to be as follows: (A) thickness of plating: - steel 4,5 ± 0,5 mm - aluminium 6,0 ± 0,5 mm (B) stiffeners spaced at 600 mm: - steel 65 ± 5 mm × 65 ± 5 mm × 6 ± 1mm - aluminium 100 ± 5 mm × 75 ± 5 mm × 9 ± 1 mm (3) The width of the structural core may be greater than the specified dimensions providing that the additional width is in increments of 600 mm to maintain the stiffener centres and the relationship between the stiffeners and the perimeter detail. (4) Any joints in the plating are to be full welded, at least from one side. The dimensions of the structural core and the details around the perimeter of the specimen are to be as illustrated in Fig 3.22 and Fig 3.23.  Fig 3.22 Structural steel core for "A" class bulkhead and "B" class lining

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

<table>
<tr><th>Kinds</th><th>Item</th><th>Requirements</th></tr>
<tr><td rowspan="3">"A" class bulkheads</td><td rowspan="2">Dimensions</td><td>SECTION A-A (see Figs.3.22 and 3.24)
 

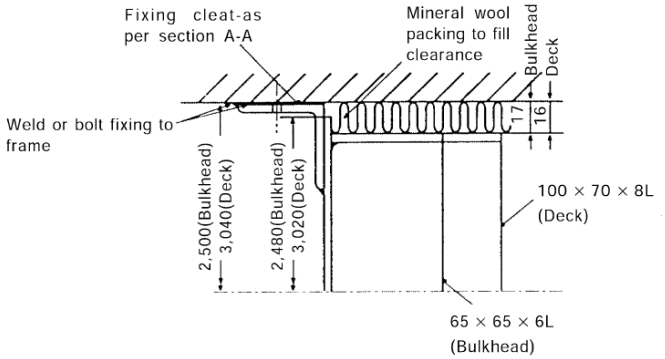
SECTION B-B (see Figs.3.22 and 3.24)
 

Fig 3.23 Connection between restraint frame and structural steel core</td></tr>
<tr><td>Construction</td><td>(1) Where insulation is provided by panels (e.g. a "B" class lining), then the test specimen is to be designed such that at least one of the panels is of full width and this, or these, are to be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.
(2) The overall dimensions of the panel insulation system, including the perimeter details at all the edges, are to be 20 mm greater in each direction than the equivalent dimensions of the structural core.</td></tr>
<tr><td>"A" class decks</td><td>Dimensions</td><td>(1) The minimum overall dimensions of test specimen, including the perimeter details at all the edges, are 2440 mm width and 3040 mm length.
(2) The overall dimensions of the structural core are to be 20 mm less in both the width and the length than the overall dimensions of the specimen, and the other dimensions of the structural core are to be as follows:
(A) thickness of plating:
- steel 4,5 ± 0,5 mm
- aluminium 6,0 ± 0,5 mm
(B) stiffeners spaced at 600 mm:
- steel 100 ± 5 mm × 70 ± 5 mm × 8 ± 1 mm
- aluminium 150 ± 5 mm × 100 ± 5 mm × 9 ± 1 mm
(3) The width of the structural core may be greater than the specified dimensions providing that the additional width is in increments of 600 mm to maintain the stiffener centres and the relationship between the stiffeners and the perimeter detail.
(4) Any joints in the plating are to be full welded, at least from one side.
The dimensions of the structural core and the details around the perimeter of the specimen are to be as illustrated in Fig 3.23 and Fig 3.24..</td></tr>
</table>

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

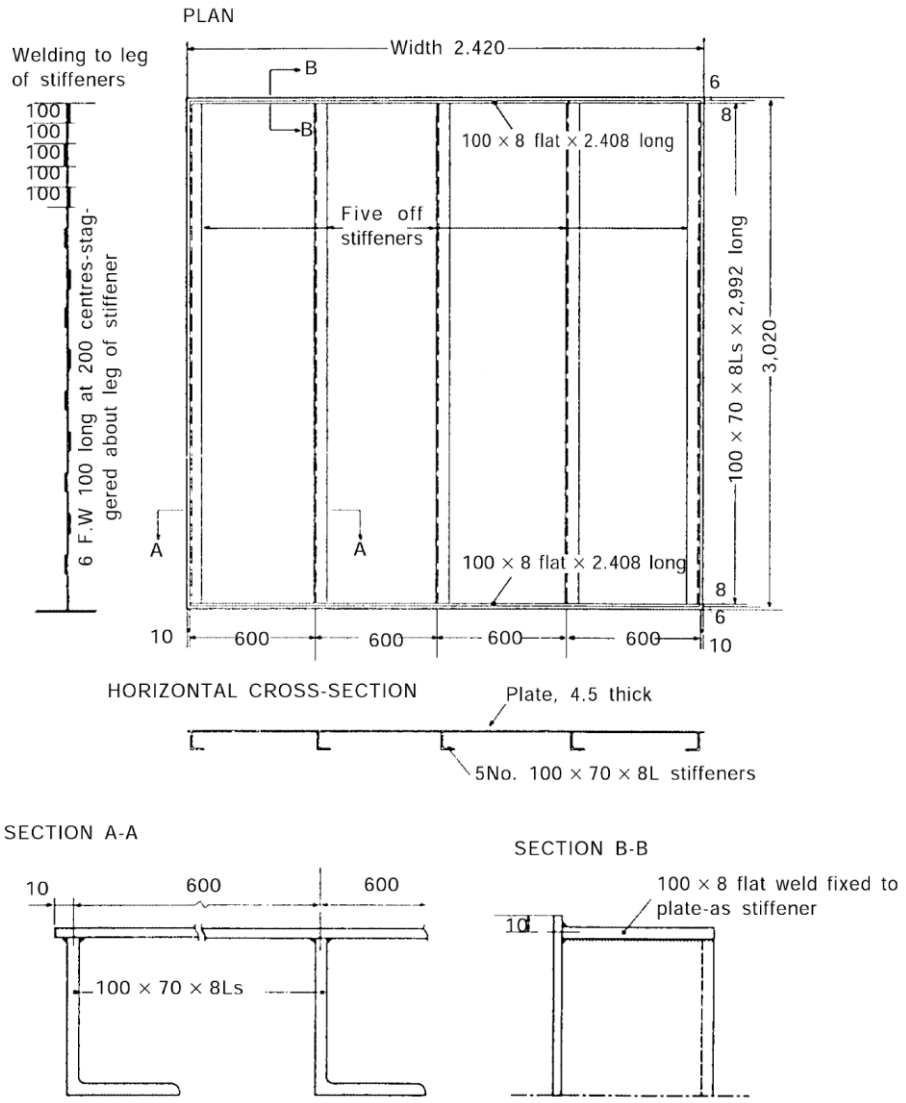
Kinds	Item	Requirements
"A" class decks	Dimensions	 Fig 3.24 Structural steel core for "A" class deck and "B" class ceiling
	Construction	(1) Where insulation is provided by panels (e.g. a "B" class ceiling), then the test specimen is to be designed such that at least one of the panels is of full width and this, or these, are to be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame. (2) The overall dimensions of the panel insulation system, including the perimeter details at all the edges, are to be 20 mm greater in each direction than the equivalent dimensions of the structural core.
"A" class doors	Dimensions	The test specimen is to incorporate the maximum size (in terms of both the width and the height) of door leaf of leaves for which approval is to be sought. The maximum size of a door which can be tested will be determined by the requirement to retain certain dimensions of the structural core. (1) Door furniture such as hinges, locks, latches, shoot bolts, handles, etc. are to be constructed of materials having melting points of not less than 950°C unless it can be shown by the fire test that materials having melting points below 950°C do not adversely affect the performance of the door.

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

Kinds	Item	Requirements
"A" class doors	Design	(2) The door leaf and frame are to be mounted as appropriate into a 'A' class bulkhead of compatible construction, thereby reflecting an actual end use situation. The bulkhead is to have dimension as specified in the dimension of 'A' class bulkhead above. The bulkhead is to be of a construction approved by BKI as having at least a similar classification to that required by the door. No additional stiffening shall be provided to the structurual core unless provided as part of the door frame. The method of fixing the door frame to the bulkhead is to be as used in practice. The door is to be positioned such that there is a minimum width of the bulkhead of 300 mm to each vertical side of the door and a minimum distance of 100 mm from the top edge of the bulkhead. If the method of fixing the door frame in a test is made by bolts, BKI may also accept welding as a method of fixing the door frame without further tests. (3) The door is to be positioned such that there is a minimum width of the bulkhead of 300 mm to each vertical side of the door and a minimum distance of 100 mm from the top edge of the bulkhead. If the method of fixing the door frame in a test is made by bolts, BKI may also accept welding as a method of fixing the door frame without further tests. (4) For doors mounted in a three-sided frame, the door shall be mounted with a bottom gap of between 12 mm and 25 mm between the bottom of the door and the test frame. (5) The door is to be mounted into the bulkhead such that the side expected to give the in ferior performance will be exposed to the heating condition of the test. A hinged door is to be tested with the door leaf opening away from the heating conditions unless BKI deems otherwise. For sliding doors, it is not possible to state generally from which side the door is to be tested to give the inferior performance. It will, therefore, be necessary to conduct two separate tests, one with the door mounted to the exposed face and one with the door mounted to the unexposed face of the bulkhead (6) For a door which incorporates a ventilation opening within its construction, the ventilation grille(s) is (are) to be open at the commencement of the test. Temperature measurements on such a door are not to be made over the face of the grille(s). (7) Lift landing doors can be expected to be exposed to fire from the corridor side only, and they shall be exposed to fire test heating conditions from that side only. (8) Tests performed with double leaf doors will not be accepted as approval documentation for single leaf doors. (9) Double leaf doors should be tested with equally sized door leaves unless the door is intended to have unequally sized leaves.
"B" class bulkheads	Dimensions	(1) The minimum overall dimensions of test specimen, including the perimeter details at the top, bottom and vertical edges, are 2440 mm width and 2500 mm height. When the maximum overall height in practice is to be less than given above, then the test specimen is to be of the maximum height to be used in practice. (2) The minimum bulkhead panel height shall be a standard height of the manufactured panel with a dimension of 2400 mm.
	Construction	Where the construction incorporates panels, the specimen is to be constructed such that at least one of the panels is of full width and this, or these, is to be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.
"B" class decks	Dimensions	The minimum overall dimensions of test specimen, including the perimeter details at all the edges, are 2440 mm width and 3040 mm length. When the maximum dimension in practice is to be less than given above, then the test specimen is to be of the maximum size to be used in practice.

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

Kinds	Item	Requirements
"B" class decks	Construction	Where the construction incorporates panels, the specimen is to be constructed such that at least one of the panels is of full width and this, or these, is to be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.
"B" class door	Dimensions	The test specimen is to incorporate the maximum size (in terms of both the width and the height) of door leaf of leaves for which approval is to be sought. The maximum size of a door which can be tested will be determined by the requirement to retain certain dimensions of the bulkhead.
	Design	(1) Door furniture such as hinges, locks, latches, shoot bolts, handles, etc. are to be constructed of materials having melting points of not less than 850°C unless it can be shown by the fire test that materials having melting points below 850°C do not adversely affect the performance of the door. (2) The door leaf and frame are to be mounted as appropriate into a 'B' class bulkhead of compatible construction, thereby reflecting an actual end use situation. The bulkhead is to have dimension as specified in the dimension of 'B' class bulkhead above. The bulkhead is to be of a construction approved by BKI as having at least a similar classification to that required by the door. The method of fixing the door frame to the bulkhead is to be as used in practice. (3) The bulkhead shall be of a construction approved by BKI as having at least a similar classification to that required by the door, and approval shall be limited to the type of construction in which the door was tested. (4) The method of fixing the door frame to the bulkhead shall be as used in practice. If the method of fixing the door frame in a test is made by bolts, BKI may also accept welding as a method of fixing the door frame without further tests. (5) For doors mounted in a three-sided frame, the door shall be mounted with a bottom gap of between 12 mm and 25 mm between the bottom of the door and the test frame. (6) The door is to be positioned such that there is a minimum width of the bulkhead of 300 mm to each vertical side of the door and a minimum distance of 100 mm from the top edge of the bulkhead. (7) The door is to be mounted into the bulkhead such that the side expected to give the inferior performance will be exposed to the heating condition of the test. A hinged door is to be tested with the door leaf opening away from the heating conditions unless BKI deems otherwise. For sliding doors, it is not possible to state generally from which side the door is to be tested to give the inferior performance. It will, therefore, be necessary to conduct two separate tests, one with the door mounted to the exposed face and one with the door mounted to the unexposed face of the bulkhead (8) For a door which incorporates a ventilation opening within its construction, the ventilation grille(s) is (are) to be open at the commencement of the test. Temperature measurements on such a door are not to be made over the face of the grille(s).
"B" class linings	Dimensions	(1) The minimum overall dimensions of test specimen, including the perimeter details at the top, bottom and vertical edges, are 2440 mm width and 2500 mm height. When the maximum overall height in practice is to be less than that given above, then the test specimen shall be of the maximum height to be used in practice. (2) The minimum bulkhead panel height shall be a standard height of the manufactured panel with a dimension of 2400 mm.
	Design	(1) The lining is to be positioned alongside a structural core constructed in accordance with the dimension of 'A' class bulkhead above. The design of the lining is to be such that it facilitates its assembly with the limited access provided by the proximity of the structural core, i.e. it is to be mounted with the structural core in place. (2) During a test on an "A" class bulkhead which utilizes membrane protection along its exposed side, e.g. a 'B' class lining, it is possible also to evaluate the

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

Kinds	Item	Requirements
"B" class linings	Design	performance of the lining with a view to classification providing that the necessary thermocouples are attached to the lining and proving that the necessary integrity measurements are made. (3) The specimen is to be constructed such that at least one of the panels is of full width and this, or these, is to be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.
"B" class ceilings	Dimensions	(1) The minimum overall dimensions of test specimen, including the perimeter details at the top, bottom and vertical edges, are 2440 mm width and 3040 mm length. (2) When the maximum dimensions in practice are less than those given above then the test specimen shall be of the maximum size to be used in practice, and the tested width shall be reported.
	Design	(1) The ceiling is to be positioned below a structural core constructed in accordance with the dimension of 'A' class deck above. (2) The design of the ceiling is to be such that it facilitates its assembly with the limited access provided by the proximity of the structural core, i.e. it is to be mounted with the structural core in place. (3) During a test on an "A" class deck which utilizes membrane protection along its underside, e.g. a 'B' class ceiling, it is possible also to evaluate the performance of the ceiling with a view to classification providing that the necessary thermocouples are attached to the ceiling and proving that the necessary integrity measurements are made. (4) If the ceiling incorporates panels, the specimen is to include example of both the lateral and longitudinal joints between the panels. (5) If the specimen is to simulate a ceiling where the maximum length of the panels is greater than the length of the specimen, then a joint is to be positioned at a distance of approximately 600 mm from one of the shorter ends of the test specimen. (6) The specimen is to be constructed such that at least one of the panels is of full width and this, or these, is to be positioned such that both its/their longitudinal edges are jointed to an adjacent panel and are not secured to the restraint frame.
Windows	General	Window is taken to include windows, side scuttles and any other glazed opening provided for light transmission or vision purposes in "A" class bulkheads. Windows in "A" class doors are considered to be part of the door and they are to be tested within the appropriate door.
	Dimensions	(1) The test is to be conducted on the window of the maximum size (in terms of both the width and the height) for which approval is sought. (2) The test shall be conducted on a window of the maximum size (in terms of both the height and the width) and the type of the glass pane and/or the minimum thickness of the glass pane or panes/and gaps, if appropriate, for which approval is sought. Test results obtained on this configuration shall, by analogy, allow approval of windows of the same type, with lesser dimensions in terms of height and width and with the same or greater thickness.
	Design	The bulkhead which includes the window is to be insulated to class 'A-60' on the stiffened face, which is to be the face exposed to the heating conditions of the test. There may be special applications of windows where BKI considers it appropriate to test the window with the insulation of the bulkhead to the unexposed face of the structural core, or within bulkheads other than class 'A-60'. The window is to be positioned within the bulkhead, shown in Fig 3.23, at that height which is intended for practical application. When this is not known, the window is to be positioned with the top of its frame as close as possible, but not closer than 300 mm, to the top of the bulkhead.

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

<table>
<tr><th>Kinds</th><th>Item</th><th>Requirements</th></tr>
<tr><td rowspan="2">Fire Dampers</td><td>Dimensions</td><td>The maximum sizes (in terms of both the width and the height, or the diameter) of each type of fire damper for which approval is sought are to be tested in both vertical and horizontal orientation.</td></tr>
<tr><td>Design</td><td>(1) A bulkhead which includes the damper is to be constructed in accordance with the dimension of 'A' class bulkhead above and is to be insulated to class "A-60" on the stiffened face, which is to be the face which is not exposed to the heating conditions of the test. A deck which includes the damper is to be constructed in accordance with (B) (a) above and is to be insulated to lass "A-60" on the stiffened face, which is to be the face which is exposed to the heating conditions of the test.
(2) Fire dampers are to be incorporated into or fixed to coaming or spigots, which are to be welded or bolted into the structural core.
The length on the unexposed side = (450 mm or a needed insulation length for a damper under test) (L_{unexp}) + 50 mm.
The thickness of the coaming or spigot shall be as follows :
<table>
<tr><th>Width* or diameter of the duct</th><th>Minimum thickness of coaming or spigot</th></tr>
<tr><td>Up to and including 300 mm</td><td>3 mm</td></tr>
<tr><td>760 mm and over</td><td>3 mm</td></tr>
</table>
* Width means the greater of the two cross-sectional dimensions.
For widths or diameters of ducts in excess of 300 mm but less than 760 mm, the thickness of the coaming or spigot is to be obtained by interpolation. The coaming or spigot are to be insulated as shown in Fig 3.25.
(3) The coamings or spigots (including insulation) are to be positioned only in the top half of a bulkhead but are to be no closer than 200 mm from the edges of a bulkhead or a deck. Where more than one damper is to be tested simultaneously in a division, the separation between adjacent coamings or spigots (including insulation) are not to be less than 200 mm. When more than one damper is included in a bulkhead, the top edges of all dampers are to be, as far as possible, at the same height.
(4) The fire dampers are to be positioned on the exposed face of the bulkhead or deck, at a distance of at least 225 mm from the structural core, with their operative controls also on that side of the division. When a damper is mounted in the bulkhead the fuse element should be situated at the lowest level of the damper as in practice.
(5) Fire dampers which are operated automatically shall be in the open position at the start of the test and shall be closed by an automatic device. The damper shall be in the closed position within 2 min after the commencement of the test. If the fire damper shall be deemed to have failed and the test shall be discontinued.</td></tr>
</table>

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

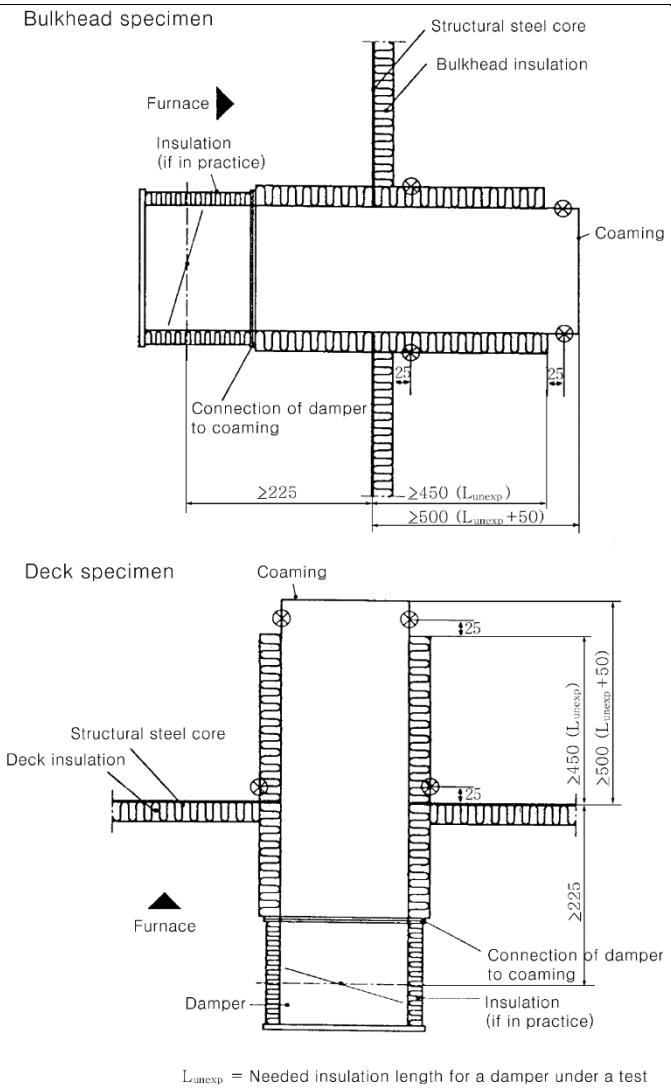
Kinds	Item	Requirements
Fire Dampers	Design	 Fig 3.25 Fire dampers: insulation on test specimens and position of unexposed-face thermocouples (6) Fire dampers which are operated with a manual system shall be closed at the test time of 1 min.

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

Kinds	Item	Requirements
Pipe and duct penetrations	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 are to be tested in both vertical and horizontal orientation.
	Design	(1) A bulkhead which includes the pipe penetration is to be constructed in accordance with ~~(A) (a)~~ "A" class bulkheads above and is to be insulated to class "A-60" on the stiffened face, which is to be the face which is not exposed to the heating conditions of the test. A deck which includes the pipe penetration is to be constructed in accordance with the dimension of "A" class deck above and is to be insulated to class "A-60" on the stiffened face, which is to be the face which is exposed to the heating conditions of the test. (a) "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 penetrations, any insulation fitted (on the penetration itself and 200 mm around) will be required to be fitted also for class "A-0". (b) "A-0" penetrations shall not be approved without an "A-0" test although tested and approved as "A-60". (2) The pipe penetrations are to be positioned only in the top half of a bulkhead but are not to 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 is not to be less than 200 mm. Both measurements are to relate to the distance to the nearest part of the penetration system, including any insulation which is part of the system. (3) Each pipe passing through a penetration is to 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 is to 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. (4) Each pipe is to 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 are to restrain it from movement during the test. (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. 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. (6) Sealing of pipe and duct penetrations: there shall be no visible openings before the start of the fire test.

Table 3.45 Fire test specimens of "A" and "B" class divisions *(continued)*

Kinds	Item	Requirements
Cable transits	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 are to be tested in both vertical and horizontal orientation.
	Design	(1) A bulkhead which includes the cable transit is to be constructed in accordance with the dimension of 'A' class bulkhead above and is to be insulated to class "A-60" on the stiffened face, which is to be the face which is not exposed to the heating conditions of the test. A deck which includes the cable transit is to be constructed in accordance with the dimension of 'A' class deck above and is to be insulated to class 'A-60' on the stiffened face, which is to be the face which is exposed to the heating conditions of the test. (a) "A-0"class cable transits are recommended to be performed in an uninsulated ("A-0") bulkhead/deck. If the cable transits are tested as an "A-60" class penetrations, any insulation fitted (on the cable transits itself and 200 mm around) will be required to be fitted also for class "A-0". (2) The cable transits are to be positioned only in the top half of a bulkhead but are not to 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 penetrations is not to be less than 200 mm. Both measurements are to relate to the distance to the nearest part of the penetration system, including any insulation which is part of the system. (3) Notwithstanding the above, the distance between transits is to be sufficient to ensure that the transits do not influence each other during the test, except that this requirement does not apply to mulitransits which are intended to be positioned adjacent to one another. (4) The cables are to project 500 ± 50 mm beyond the transit on the exposed side of the division and 500 ± 50 mm on the unexposed side. 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. (5) Cable transits shall be fitted to the bulkhead or deck in accordance with the manufacturer's specifications. The cables and sealing compounds or blocks shall be incorporated into the transits with the bulkhead and deck panels places respectively in vertical and horizontal positions. Any insulation shall be applied to the cables and transits with the panels in the same respective positions. (6) The transit(s) is to 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 is to provide an assembly which represents a practical situation which may be found on ships. 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. (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. (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. 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. (9) Sealing of cable transits shall have no visible opening before the start of the fire test.

Table 3.45 Fire test specimens of “A” and “B” class divisions *(continued)*

Kinds	Item	Requirements
Continuous “B“ class divisions	Continuous 'B' class ceilings	The ceilings are to be tested in accordance with “B” class ceilings above except that the ceiling is to be mounted on the horizontal furnace so that at least 150 mm high “B” class bulkheads are mounted on the furnace and the ceiling is fixed to these partial bulkheads by using the joining method as is intended to be used in practice. Such ceilings and the joining methods are to be evaluated as required for ceilings in accordance with “B” class ceilings above and accordingly they are to be classified as “continuous “B” class ceilings”.
	Continuous “B” class linings	A lining which has been evaluated in accordance with “B“ class linings above to be a “B” (“B-0”, “B-15”, as applicable on basis of the lining test) class lining may be considered forming 'continuous “B” (“B-0” or “B-15”, as applicable) class lining' in conjunction with a 'continuous “B” (“B-0' or ”B-15“, as applicable) class ceiling' and with the joining method used in the test without further testing the lining.
	Continuous “B” class construction	An enclosed construction installed on an “A” class deck and formed by 'continuous “B” (“B-0” or “B-15”, as applicable) class lining' and 'continuous “B” (“B-0” or “B-15”, as applicable) class ceiling' is to be considered forming 'continuous 'B' class construction”.

4.4 Smoke and toxicity test

Smoke and toxicity test are to comply with the requirements specified in Table 3.50 (refer to FTP Code, Annex 1, Part 2 ~~and Part 5, Annex 4~~).

Table 3.50 Smoke and toxicity test

Item		Test method
Application		Where a material is required not to be capable of producing excessive quantities of smoke and toxic products or not to give rise to toxic hazards at evaluated temperatures, the material is to comply with the requirements below.
Test specimen		~~Preparation of test specimen is to be in accordance with the practice outlined in IMO FTP Code, Annex 1, Part 5, Appendix 4.~~ (A) Number of specimens (a) The test sample shall comprise a minimum of nine specimens if all three test conditions are to be tested. (b) If the product has two faces and either face is likely to be exposed to a fire condition when in use, then both faces shall be evaluated. An additional number of specimens specified in (a) above shall be used for each face. (c) An additional set of three specimens per test conditions shall be held in reserve, where repeat test is required. (d) In case of intumescent materials, it is necessary to make a preliminary test with the cone heater at 50 mm from the specimen. Therefore, at least two additional specimens are required. (B) Size of specimens (a) The specimens shall be square, with sides measuring 75±1mm. (b) Materials of nominal thickness 25 mm or less shall be evaluated at their full thickness. For comparative testing, materials shall be evaluated at a thickness of 1±0,1 mm. As far as possible, materials shall be tested in their end-use thickness. (c) Materials with a thickness greater than 25 mm shall be cut to give a specimen thickness between 25 mm. (d) Specimens of multi-layer materials with a thickness greater than 25 mm, consisting of core material(s) with facings of different materials, shall be prepared as specified in (c). (C) Requirements other than those specified in test specimen of 4.4 may refer to the requirements of 4.3.
Test conditions		Irradiance to the specimen during the test shall be kept constant. Three specimens are to be tested under each of the following conditions: (A) irradiance of 25 Kw / m^2 in the presence of pilot flame; (B) irradiance of 25 Kw / m^2 in the absence of pilot flame; and (C) irradiance of 50 Kw / m^2 in the absence of pilot flame;
Duration of tests	Smoke	The initial test at each test condition shall last for 20 min. to verify the possible existence of a second minimum transmittance value. If the minimum transmittance value is shown by the initial test to occur within the first 10 min. then subsequent tests for that test condition may have an exposure of 10 min. Otherwise, the tests shall last 20 min.
	Toxicity	Continue the smoke density test until a 20 min. period has elapsed.

Table 3.50 Smoke and toxicity test *(continued)*

Item		Test method
Classification criteria	Smoke	(A) An average *(D_m)* of the maximum of specific optical density of smoke *(D_{smax})* of three tests at each test condition is to be calculated. - for materials used as surface of bulkheads, linings or ceilings, the D_m is not to exceed 200 in any test condition; - for materials used as primary deck covering, the D_m is not to exceed 400 in any test condition; - for materials used as floor covering, the D_m is not to exceed 500 in any test condition; and - for plastic pipes and electric cables, the D_m is not to exceed 400 in any test condition. (B) If the value of Ds max for any individual specimen differs from the average value for the set of three specimens of which it is part by more than 50% of that average for no apparent reason, test an additional set of three specimens from the same sample in the same mode and record the average of all six results obtained.
	Toxicity	The average value of the maximum value of the gas concentration measured at each test condition is not to exceed the follow limits: - CO 1450 ppm - HBr 600 ppm - HCl 600ppm - HCN 140 ppm - HF 600 ppm - SO2 120 ppm (200 ppm for floor coverings) - NOx 350 ppm
Additional requirements		Paints, floor coverings, primary deck coverings, varnishes and other finishes used on exposed interior surfaces are also to be applicable to the above 4.3, Surface flammability test
Others		Details of test for smoke and toxicity test not specially mentioned in 4.4 are to comply with FTP Code, Annex 1, Part 2.

---------- *end* ----------

AS. Anti-fouling systems

1. ~~Introduction~~ Application

1.1 The procedures and requirements described in this ~~Guidance~~ sub-section are applicable for obtaining the BKI's type approval certificate based on requirements in:

- IMO AFS Convention: International Convention on the Control of Harmful Anti-Fouling Systems on Ships (2001)
- IMO Resolution MEPC.104(49): Guidelines for brief sampling of anti-fouling systems on ships (2003) and Appendix - Possible methods for brief sampling and analysis of anti-fouling systems on ships (2003)
- IMO Resolution MEPC. 195(61): Guidelines for Survey and Certification of Anti-Fouling Systems on Ships (2010)
- IMO Resolution MEPC. 208(62): Guidelines for Inspection of Anti-Fouling Systems on Ships (2011)
- IMO Resolution MEPC.331(76): Amendments to the International Convention on the control of harmful anti-fouling systems on ships, 2001, adopted 17 June 2021
- ISO 9001: Quality management systems - Requirements

1.2 A type approval certificate in accordance with this Guidance will confirm compliance with the requirements in the regulations as specified in 1.1. The type approval certificate will not confirm compliance with requirements in other parts of the rules. In case additional requirements in other parts of the rules shall be covered by the type approval certificate, this shall be specified in the application for type approval and will be stated in the type approval certificate.

1.3 The BKI's Rules do not require that anti-fouling systems shall be type approved, and type approval in accordance with this Guidance is therefore voluntary for anti-fouling systems to be applied on classed vessels.

2. Scope

This Guidance gives a description of the procedures and requirements related to documentation, design and type testing applicable for type approval of anti-fouling systems.

The type approval comprises the anti-fouling system in liquid condition and in the condition when applied in full compliance with the manufacturer's recommendations (see 3). Quality control during surface preparation and/or application of the anti-fouling system is, however, not included in the type approval.

The BKI's type approval certificate will cover one grade of the actual product with the possibility to include variants. For an anti-fouling system this means:

- grade: full anti-fouling system, including one or more coats (as per system definition)
- variants: e.g. color variants or thinned variants.

A BKI type approval certificate is normally limited to one manufacturer at one production site.

~~3. Application~~

~~A type approval certificate in accordance with this Guidance will confirm compliance with the requirements in the regulations as specified in 1. The type approval certificate will not confirm compliance with requirements in other parts of the rules. In case additional requirements in other parts of the rules shall be covered by the type approval certificate, this shall be specified in the application for type approval and will be stated in the type approval certificate.~~

~~The BKI's rules do not require that anti-fouling systems shall be type approved, and type approval in accordance with this Guidance is therefore voluntary for anti-fouling systems to be applied on classed vessels.~~

4 3. ~~Documentation~~ Data to be submitted

For type approval of anti-fouling systems the following additional documentation shall be submitted by the manufacturer ~~at initial type approval, and updated at renewal (general requirements for documentation is given~~ in addition to those specified in A.2.3~~)~~. The documentation shall be submitted as electronic files. The manufacturer shall keep one (1) copy of type approval documentation in their own file. The documentation that forms the basis for the type approval shall be easily available for the BKI's surveyors at the type approval applicant's premises.

Please number documentation according to below list to facilitate review:

1) ~~t~~Type designation, i.e. product name (grade) with list of variants to be included in and stated on the type approval certificate
2) ~~p~~Product description (product ID number, number and type of components, colour, consistence, etc.)

3) ~~f~~Field of application and special limitations of the product

4) ~~p~~Product specification ~~or technical data sheet, materials safety data sheet,~~ with relevant information such as:

- trade name of the anti-fouling system
- type of anti-fouling system, e.g. organotin-free self-polishing type, organotin-free ablative, organotin-free conventional, ~~"non-stick" (silicone)~~ biocide-free silicon type paint, etc.
- documentation that the organotin, if present, is harmless to organic life, i.e. does not act as a biocide
- binder type
- active ingredients with their Chemical Abstract Service Registry Number(s) (CAS-number)
- packaging, storage
- solids content, thinners
- viscosity
- flash point
- service temperatures
- any other operational limitations
- safety and health data
- requirements for surface preparation
- application temperature range
- air humidity limitations
- application methods, equipment
- curing times versus temperatures
- dry film thickness per coat, and total number of coats
- repair or re-coating instructions.

~~5) description of fabrication[1]~~

5) Technical data sheet (TDS) and materials safety data sheet (MSDS) for all variants

6) ~~description of quality control arrangement including copies of the relevant certificates with issue number and/or date (e.g. quality management system certification)[2]~~ Manufacturer's quality control test procedure according a standard recognised by the Society (if applicable).

7) ~~t~~Test results with references to standards, methods etc. and relevant calibration certificates for equipment used in type tests (if applicable)

8) ~~i~~Information regarding marking of the product or package[2]

~~9) in-service experience, if available~~

~~10) witnessed type test results shall be submitted when completed.~~

~~5~~ 4. Design requirements

The anti-fouling system shall comply with the relevant requirements of this Guidance and the following publication:

~~[1] Will be verified by initial assessment prior to the issuance of the type approval certificate.~~

– IMO AFS Convention: International Convention on the Control of Harmful Anti-Fouling Systems on Ships (2001).

~~6~~ 5. Requirements to production and quality control arrangement

The manufacturer should have a quality system that meets ISO 9001 standards, or equivalent. If this quality standard is not fulfilled, the extent of type testing and assessments will be specially considered.

The quality control arrangement in production shall be checked with respect to:

– control of incoming materials
– scope of quality control, i.e. proof that test methods, test quantity and test equipment complies to the applicable standard (e.g ISO or other equivalent standards)
– traceability and marking system
– production records
– storage condition and procedure

The manufacturer shall check the production for either:

– content of total tin by analysis (ICP, AAS, XRF or similar), or
– content of organotin by raw material certificates or by analysis (GCMS or similar) and make a log for the analysis. This log shall be made available to the BKI during assessment.

~~7~~ 6. ~~Laboratory~~ Type ~~T~~testing

A condition for type approval is that total tin and cybutryne are ~~is~~ less than 0,25% and 0,10% by weight in dry film, mixed and cured if plural components, respectively, as determined by laboratory tests as described in Table 3.91.

If the total tin content is tested to be higher than 0,25% by weight in dry film (mixed and cured if plural components), additional laboratory testing as described in Table 3.92 is required. Type approval certificate may be issued only provided that the tin or organotin compound present does not act as a biocide (TBT is a common organotin compound normally acting as a biocide).

One dry sample is sufficient for carrying out the tests (alternatively one wet sample), and may be collected and treated as follows:

– make a dry sample by applying some paint on a plastic sheet or similar, size about 10 × 10 cm
– let it dry for two days or more at 20°C or higher and cover it with some soft plastic material
– the paint shall be taken from a well-mixed paint container in the presence of the BKI's surveyor
– alternatively, a wet sample of about 100 ml may be collected, from the same paint container, in a tin can or bottle.

Table 3.91 Requirements for type testing of anti-fouling system ~~- tin content only~~

Property	Test method [1]	Number and selection of specimens	Acceptance criteria	Minimum level of verification	Frequency of verification
Total tin (Sn) [2]	Inductively coupled plasma (ICP), atomic absorption (AAS), X-ray fluorescence (XRF), or similar	Minimum one representative sample	Maximum 0,25 % by weight tin (Sn) [2] in dry film (mixed and cured if plural components)	BKI Assessment	Initial, Renewal [3]
Cybutryne	Gas chromatography-mass spectroscopy (GCMS), or similar	Minimum one representative sample	Maximum 0,10% by weight	BKI Assessment	Initial, Renewal [3]

[1] Other test methods may be agreed upon with BKI prior to testing.
[2] If tin is identified or present in higher level than 0,25% by weight total tin, the product must be tested as per Table 3.92.
[3] Required testing at renewal will be considered and decided upon for each anti-fouling system.

Table 3.92 Requirements for type testing of anti-fouling system - if tin content too high

Property	Test method [1]	Number and selection of specimens	Acceptance criteria	Minimum level of verification	Frequency of verification
Tin (Sn) [3]	Gas chromatography-mass spectroscopy (GCMS), or similar	Minimum one representative sample	Action criterion maximum 0,25% by weight of TBT [4] calculated as tin (Sn) [3] in dry film (mixed and cured if plural components)	BKI Assessment	Initial, Renewal [2]

[1] Other methods may be agreed upon with BKI prior to testing.
[2] Required testing at renewal will be considered and decided upon for each anti-fouling system.
[3] If TBT is identified/present in higher level than 0,25% by weight, it must be documented that the TBT or organotin compound present is harmless to aquatic life, i.e. does not act as a biocide.
[4] A common organotin compound normally acting as a biocide is TBT, tributyltinoxide.

~~8~~ 7. ~~Requirements for m~~Marking of product

The ~~package~~ anti-fouling systems approved by BKI shall be marked. The marking shall at least include the following information:

- manufacturer's name and/or logo
- manufacturer's production address
- type designation
- type of ~~A~~anti-~~F~~fouling ~~S~~system used, see 4, if relevant
- storage instruction
- production date
- batch number
- quality guarantee period, if any

The marking shall be carried out in such a way that it is visible, legible and indelible. The marking of product shall enable traceability to the type approval certificate.

---------- *end* ----------