Global Requirements for the Fire Protection of Ships

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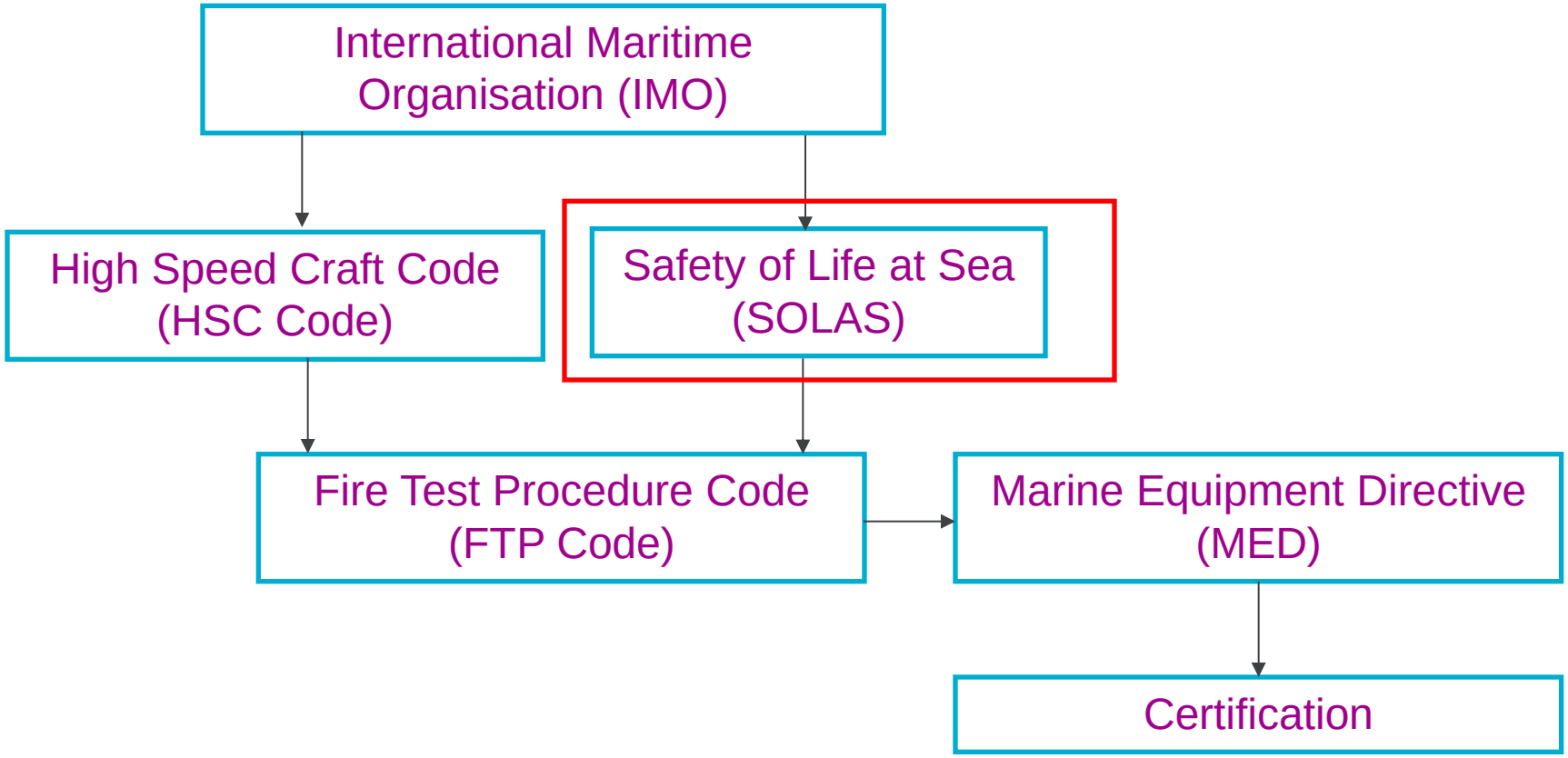
International Maritime Organisation (IMO)


International Maritime Organisation (IMO)
High Speed Craft Code (HSC Code)
Safety of Life at Sea (SOLAS)
Fire Test Procedure Code (FTP Code)
Marine Equipment Directive (MED)
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SOLAS - Safety of Life at Sea (1974)

- Sets standards that ships should be built to
- Defines the requirements for products on board ship
- First developed after the sinking of the Titanic but did not contain fire safety requirements
- SOLAS is the **only** International Marine legislation in existence and all other legislation, both National and European are secondary.

Significant Fires

Fires do still occur however they are infrequent. In Japan 2002 fire occurred on the Diamond Princess while it was being refitted – cause – arc lamps too close to combustible protective sheeting.

About a year ago in Norway, an engine room fire caused the death of 2 crew members

Fires in the last 3 years

Royal Caribbean
Grandeur of the Seas 2013
Carnival Dream 2013
Royal Caribbean
Allure Of The Seas Fire 2012
Azamara Quest Fire 2012
Bahamas Celebration 2011
Carnival Freedom Fire 2010
Carnival Imagination Fire 2010
Carnival Splendour Fire 11/2010
Carnival Splendour Fire 10/2010

Carnival Triumph 2013
Costa Allegra Fire 2012
Royal Caribbean
Independence Of The Seas 2011
Lisco Gloria Fire 2010
Nordlys Fire 2011
Ocean Star Pacific Fire 2011
Pearl Of Scandinavia Fire 2010
Queen Mary 2 Explosion 2010

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Significant Fires

The fire on the balconies on the Star Princess in March 2006 causing 1 death and 11 serious injuries resulted in legislation to control all external areas of a ship which had previously not been addressed

Significant Fires

Fires don’t just occur on passenger ships. This fire occurred off Dubai in 2008

SOLAS - Safety of Life at Sea (1974)

Chapter II-2 of SOLAS sets out all the requirements (in general terms) for fire protection, fire detection and extinction

- Part A – General
- Part B – Prevention of fire and explosion
- Part C – Suppression of fire
- Part D – Escape
- Part E – Operational requirements
- Part F – Alternative design arrangements
- Part G – Special requirements

SOLAS - Safety of Life at Sea (1974)

- Part A – General
- Part B – Prevention of fire and explosion
- Part C – Suppression of fire
- Part D – Escape
- Part E – Operational requirements
- Part F – Alternative design arrangements
- Part G – Special requirements

SOLAS II-2 Part A - General

Fire safety objectives and functional requirements

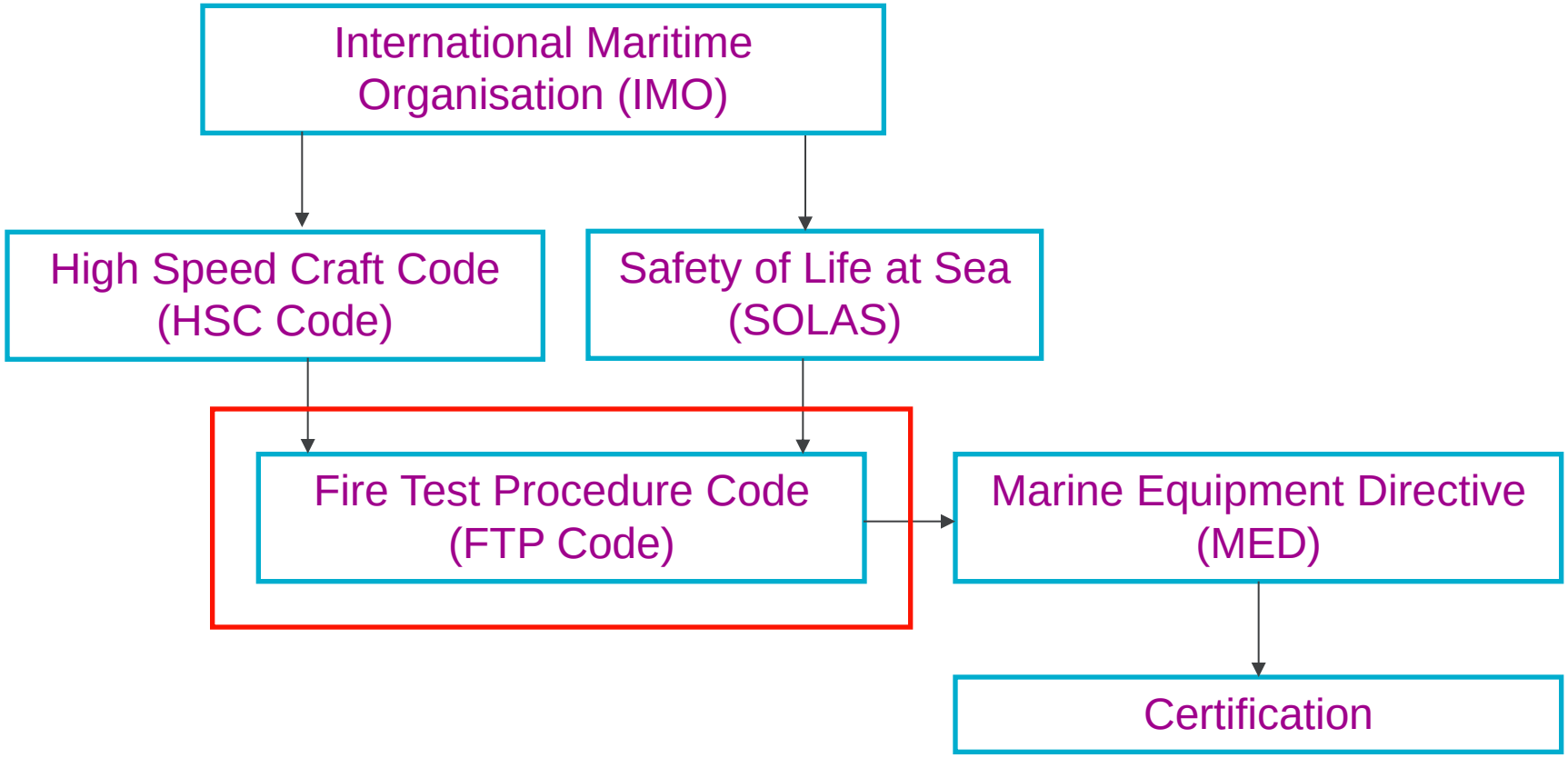
– This enables us to deviate from the prescriptive requirements of SOLAS and use alternative design solutions.

Defines the varying classes of fire boundary eg A-60, A30, B15

SOLAS II-2 - Part B – Prevention of fire and explosion

Fire growth potential

The use of non-combustible materials (FTP Code)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SOLAS II-2
Part B - Prevention of fire and explosion

Fire growth potential

The use of non-combustible materials (FTP Code)

Low flame spread characteristics (FTP Code)

Smoke generation and toxicity (FTP Code)

SOLAS II-2 Part C – Suppression of fire

Detection and alarm (FSS Code)

Control of smoke spread (FSS Code)

Fire fighting (FSS Code)

Containment of fire

- SOLAS defines and categorizes the various parts of a ship according to their fire risk
- The fire protection from space to space is then determined by this fire risk

SOLAS II-2 Part C – Suppression of fire

Spaces		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Control stations	(1)	B-0[a]	A-0	A-0	A-0	A-0	A-60	A-60	A-60	A-0	A-0	A-60	A-60	A-60	A-60
Stairways	(2)		A-0[a]	A-0	A-0	A-0	A-0	A-15	A-15	A-0[c]	A-0	A-15	A-30	A-15	A-30
Corridors	(3)			B-15	A-60	A-0	B-15	B-15	B-15	B-15	A-0	A-15	A-30	A-0	A-30
Evacuation stations and external escape routes	(4)					A-0	A-60[b,d]	A-60[b,d]	A-60[b,d]	A-0[d]	A-0	A-60[b]	A-60[b]	A-60[b]	A-60[b]
Open deck spaces	(5)						A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0	A-0
Accommodation spaces of minor fire risk	(6)						B-0	B-0	B-0	C	A-0	A-0	A-30	A-0	A-30
Accommodation spaces of moderate fire risk	(7)							B-0	B-0	C	A-0	A-15	A-60	A-15	A-60
Accommodation spaces of greater fire risk	(8)								B-0	C	A-0	A-30	A-60	A-15	A-60
Sanitary and similar spaces	(9)									C	A-0	A-0	A-0	A-0	A-0
Tanks, voids and auxiliary machinery spaces having little or no fire risk	(10)										A-0[a]	A-0	A-0	A-0	A-0
Auxiliary machinery spaces, cargo spaces, cargo and other oil tanks and similar spaces of moderate fire risk	(11)											A-0[a]	A-0	A-0	A-15
Machinery spaces and main galleys	(12)												A-0[a]	A-0	A-60
Store-rooms, workshops, pantries, etc.	(13)													A-0[a]	A-0
Other spaces in which flammable liquids are stowed	(14)														A-30

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SOLAS II-2 Part C – Suppression of fire

- The hull, superstructures, structural bulkheads, decks and deckhouses shall be constructed of steel or other equivalent material

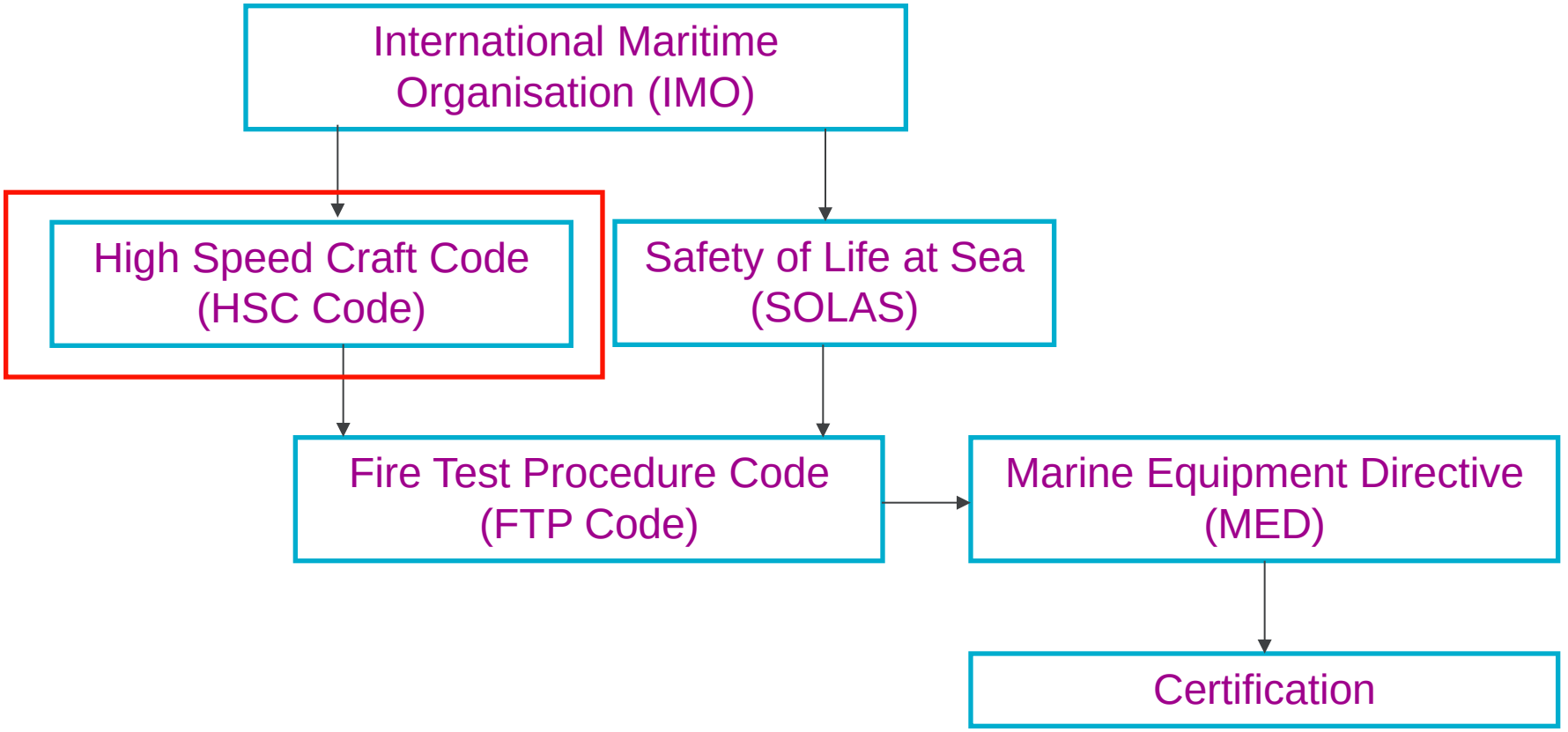
- *'Steel or other equivalent material'* means any non-combustible material which, by itself or due to insulation provided, has structural and integrity properties equivalent to steel at the end of the applicable exposure to the standard fire test (e.g. aluminium alloy with appropriate insulation).

SOLAS II-2 Part F - Alternative design arrangements

The purpose of this regulation is to provide a methodology for alternative design and arrangements for fire safety

Fire safety design and arrangements may deviate from the prescriptive requirements set out in parts B, C, D, E or G, provided that the design and arrangements meet the fire safety objectives and the functional requirements

When fire safety design or arrangements deviate from the prescriptive requirements of this chapter, fire engineering analysis, evaluation and approval of the alternative design and arrangements is carried out in accordance with this regulation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High Speed Craft Code (HSC Code)

Traditional shipping uses heavy metallic structures

Need for fast craft, to be built light weight

Constructed from FRPs or Aluminum etc

Structural elements are on longer Non Combustible

Constructed from Fire Restricting Materials and Divisions

High Speed Craft Code (HSC Code)

HSC Code adopted by Resolution MSC 36(63)

New FTP code replaces Resolution MSC 45(65) which used to provide fire test procedures for Fire Resisting Materials and Divisions for High Speed Craft

Test methods based on ISO 9705 and ISO 5660 for Materials

And ISO 834 for Divisions

SOLAS & the HSC Code

In support of SOLAS & the HSC Code there are a number of codes. Relevant to fire safety considerations is:

Fire Test Procedures Code (FTP Code)

Fire Test Procedures Code (FTP Code)

The FTP Code was implemented as a minimum standard for fire safety products in 1996

The FTP Code gives the testing procedure for the fire safety criteria that are required in SOLAS Chapter II-2, ie low flame spread or bulkheads and fire doors of A-60 class rating

The FTP Code has been revised and the new version came into effect on 1st July 2012

- There were changes to the test methods and also changes to the administrative rules
- The first major change to effect industry will be the rule that NO TEST EVIDENCE can be more than 15 YEARS OLD for Type Approvals.

Fire Test Procedures Code (FTP Code)

The FTP code provides international requirements for laboratory testing and type approval by detailing the following procedures:

Part 1 - Non-Combustibility Test
Part 2 - Smoke and Toxicity Test
Part 3 - Test for “A”, “B” and “F” Class Divisions
Part 4 - Test for Fire Door Control Systems
Part 5 - Test for Surface Flammability & Primary Deck Coverings
Part 6 - (Blank)
Part 7 - Test for Vertically Supported Textiles and Films
Part 8 - Test for Upholstered Furniture
Part 9 - Test for Bedding Components
Part 10 - Test for Fire-Restricting Materials for High-Speed Craft
Part 11 - Test for Fire-Resisting Divisions of High-Speed Craft

Part 1 – Non Combustibility Test

Based on ISO 1182:2010 “Reaction to fire tests for products - Non-combustibility test”

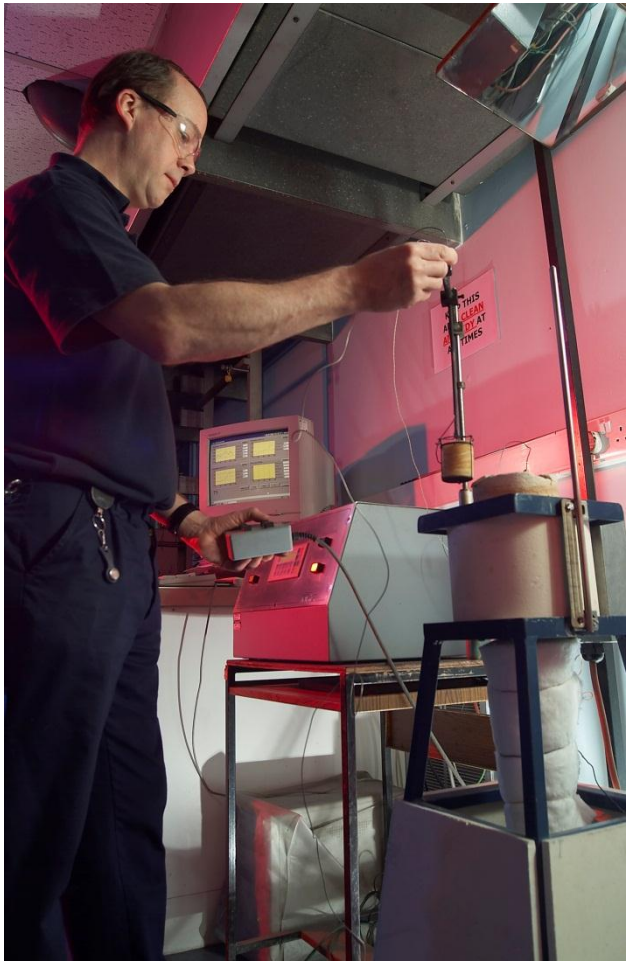
<u>Specific Criteria:</u>

Test of only 30 mins

Specimen temperature rise limited to 30°C

Duration of sustained flaming < 10s

Mass loss not to exceed 50%



Part 2 – Smoke and Toxicity Test

Procedure for smoke generation
Based on ISO 5659-2

Procedure for gas measuring based on ISO 19702

- Evaluation is “Fourier transform infrared spectroscopy” (FTIR)

CO	1450 ppm	NOx	350 ppm
HCl	600 ppm	HBr	600 ppm
HF	600 ppm	HCN	140 ppm
SO2	120 ppm (200 ppm for floor coverings)		

Part 3 - Test for “A”, “B” and “F” Class Divisions

Based on ISO 834

2.4m x 2.5m test specimen

(bulkhead) or 2.4 x 3m (deck)

Surface temperature rise average <140°, single thermocouple <180°

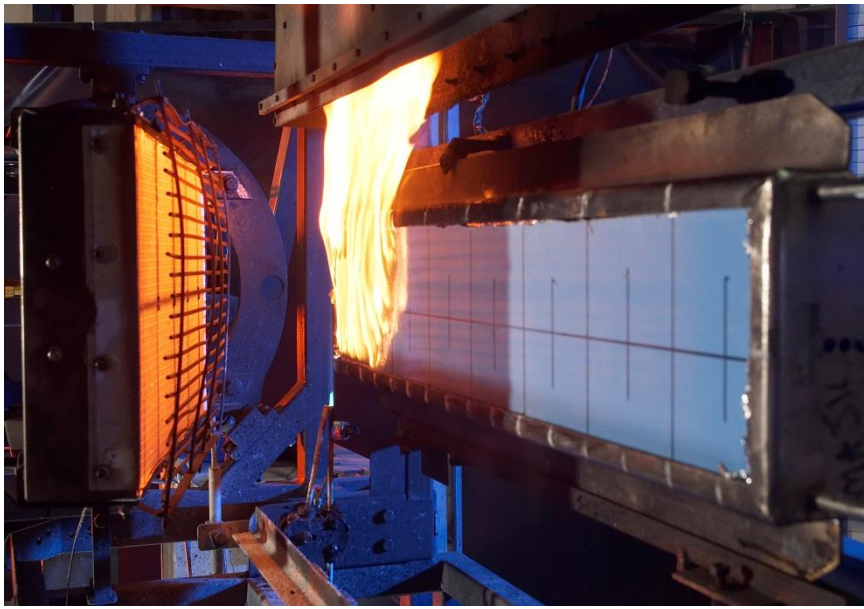
- Class “A-60” 60 min
- Class “ A or B-30” 30 min
- Class “A or B-15” 15 min

No surface flaming, no gaps (12 or 25mm)

No ignition of cotton-wool pad

Part 5 - Test for Surface Flammability & Primary Deck Coverings

Based on ISO 5658-2 “Reaction to fire tests - Spread of flame - Part 2: Lateral spread”



Critical flux at extinguishment
Heat for sustained burning
Total heat release
Peak heat release rate

<u>Requirements vary for:</u>
Bulkhead, wall and ceiling linings
Floor coverings
Primary deck

Part 7 -Test for Vertically Supported Textiles and Films

<u>Specific Criteria:</u>

After-flame time

Burn through criteria

Char length

Surface flash

Flaming drops

Part 8 - Test for Upholstered Furniture

- Smouldering cigarette test &
- Smouldering match equivalent

<u>Specific Criteria:</u>

No flaming

No progressive smouldering

Part 9 -
Test for Bedding Components

- Smouldering cigarette test &
- Smouldering match equivalent

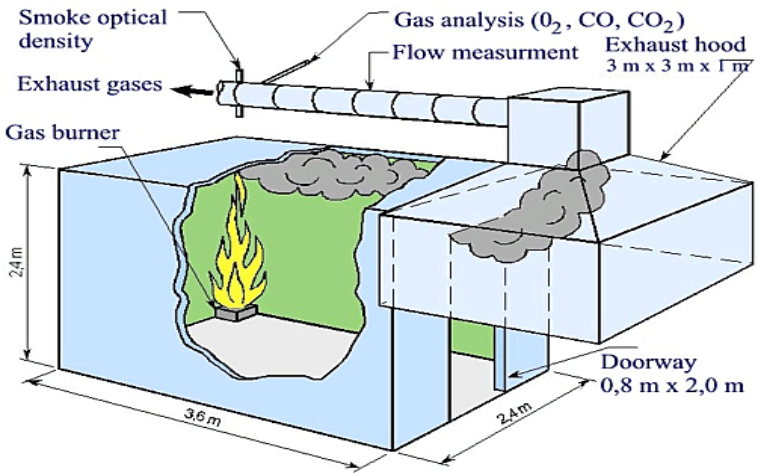
<u>Specific Criteria:</u>

No flaming after 150s

No progressive smouldering

No smoke generation after 1h

Part 10 - Test for Fire-Restricting Materials for High-Speed Craft (Annex 1)



Based on ISO 9705:1993

“Fire tests – Full-scale room test for surf

Specific Criteria:

Heat release

Smoke production.

Part 10 - Test for Fire-Restricting Materials for High-Speed Craft (Annex 2)

Based on ISO 5660 “Reaction to-fire tests -- Heat release, smoke production and mass loss rate -- Part 1: Heat release rate (cone calorimeter method) - Part 2: Smoke production rate (dynamic measurement)

<u>Specific Criteria</u>

Heat release

Smoke production.

Part 11 - Test for Fire-Resisting Divisions of High-Speed Craft

IMO developed but based on ISO 834

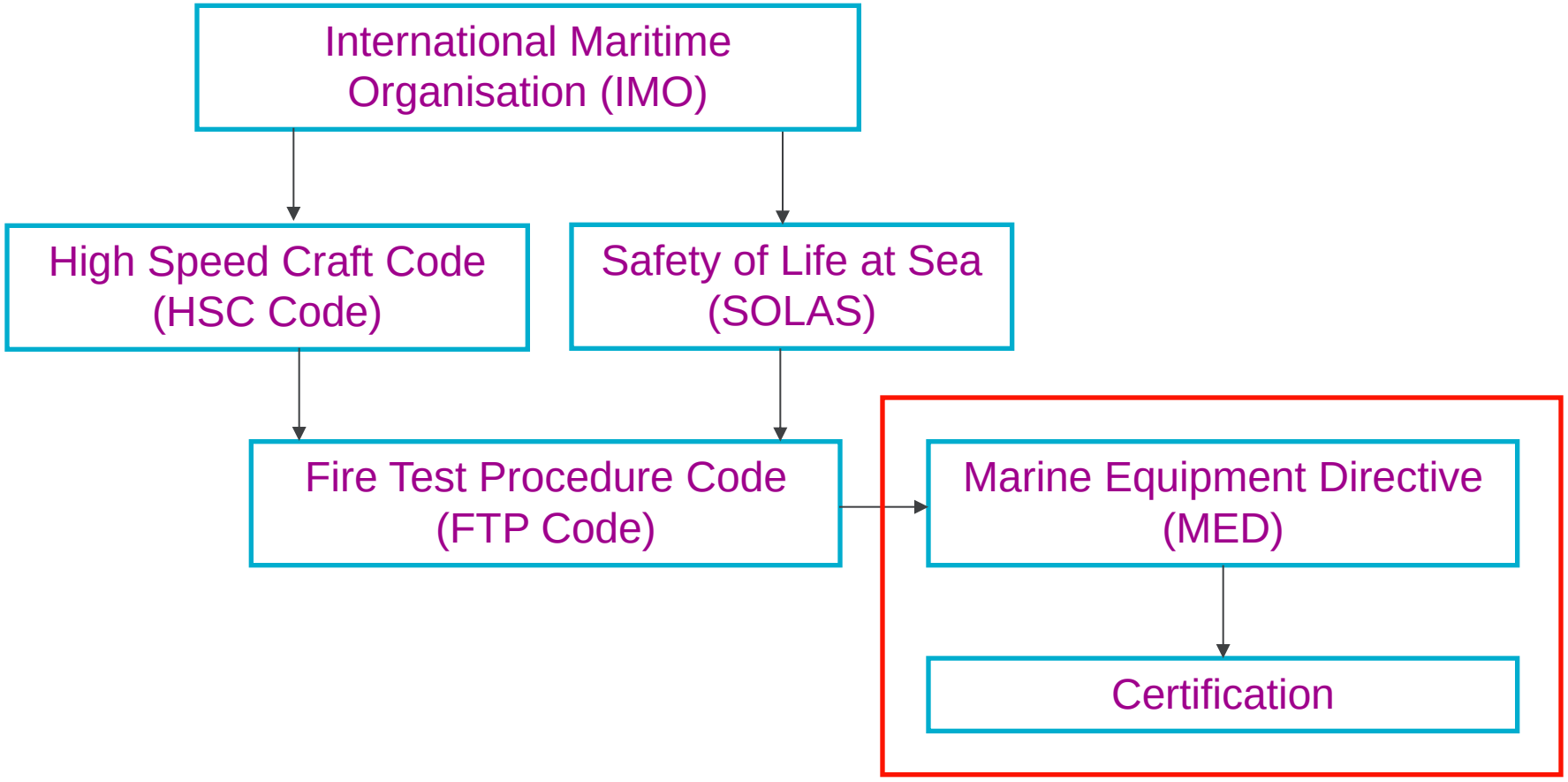
Specific Criteria: Same as Part 3 –

Test for “A”, “B” & “F” Class Divisions

Additional load applied with deflection criteria

- Bulkheads 7.0 kN/m of the width
- Decks 3.5kN/m² of the area

Aluminium core not allowed >200°C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All product placed on board any ship sailing in international waters must be Type Approved.

The Marine Equipment Directive (MED)
(96/98/EC as amended)

Marine Equipment Directive 96/98/EC as amended

Equipment covered by the Directive:

- Life Saving Appliances
- Marine Pollution Prevention
- **Fire Protection**
- Navigation Equipment
- Radio Communication Equipment

Marine Equipment Directive

Certification Framework (not setting standards)

SOLAS determines International fire safety requirements which are implemented by all Flag States

MED is Europe ensuring that there is consistency in manner of implementation

MED is also to ensure quality and consistency of products

Use of Notified Bodies to witness tests and issue certificates

Marine Equipment Directive

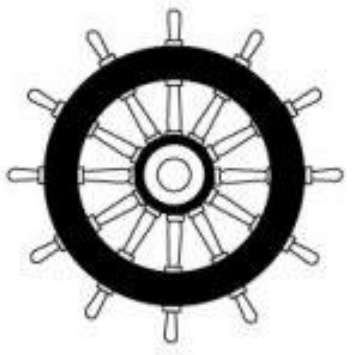
Has Mark of Conformity - The Wheelmark

Policed by the Flag States of EU

Came into force on 1 January 1999

Mandatory for all EC registered ships on 1 January 2001

There have been 10 amendments to date and so we are now beginning a rewrite of the directive.



Marine Equipment Directive - The Modules

There are 4 different modules which are relevant to Fire Protection:

Module B
Type Examination

+

Module D
Production Quality Assurance

or

Module E
Operation of Quality System

or

Module F
No QS, continual surveillance by Notified Body

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Module B

Formally Type Approval

Procedure by which Notified Body Ascertains and Attests that a specimen of the product meets the provisions of the MED

Notified Body either tests or witnesses tests and produces a certificate, stating compliance with SOLAS and the IMO FTP Code

Module D and E

Quality modules to ensure consistency in production

Linked to ISO 9001 certification (where control is through each stage of the manufacturing process)

Manufacturer must operate approved quality system which itself is subject to periodic surveillance

Quality system must apply to the production process, final product inspection and quality control testing (module D) or simply final product inspection and quality control testing (module E)

Module F

Used when the product manufacturer does not operate a standardised quality assurance procedure.

The Notified Body must conduct appropriate inspections and examinations in order to certify the conformity of the product. according to a statistical procedure. (More attune to USCG practices)

North America – United States Coast Guard

In 2005, a Mutual Recognition Agreement (MRA) was signed between the EU and US Coastguard which essentially means that products tested in an approved IMO laboratory and approved by an EU Notified Body are accepted without further assessment or testing for use on US registered ships and visa versa for USCG certificated products.

Documentation to Accompany Product

Type Examination Certificate (Module B)

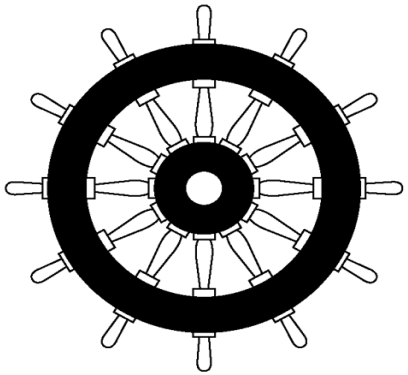
Certificate of Conformity (Module D, E or F)

Manufacturers own Declaration of Conformity

The ‘Wheel Mark’

CONFORMITY MARK

Affixed to products in compliance with the MED



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Carries Notified Bodies Identification Number

Also carries last 2 digits of year of manufacture

Approved Marine Products

There is a European database for all marine approved products which is used by Flag States, Shipyards, Naval Architects etc all around the world.

www.mared.org

The database links to the USCG database which together provides the worlds biggest reference to marine approved products.

Regulatory Summary

International Maritime Organisation (IMO)	Facilitates international discussions for its members to set standards
Safety of Life at Sea (SOLAS)	International Convention setting fire safety levels for ships
Fire Test Procedure Code (FTP Code)	Gives the tests to meet the SOLAS requirements
Marine Equipment Directive (MED)	An EU certification framework for the equipment/products