History of SOLAS fire protection requirements

1914 and 1929 SOLAS Conventions

The first fire protection requirements for international shipping were developed as part of the 1914 SOLAS Convention, which was developed in response to the sinking of the Titanic in 1912. Although the 1914 SOLAS Convention was prevented from coming into force due to World War I, it did contain basic fire safety requirements which were later carried over to the 1929 SOLAS Convention.

1948 and 1960 SOLAS Conventions

After the adoption of the 1929 SOLAS Convention, many lessons were learned about the safety of shipping in general, including fire protection, which led to the adoption of the 1948 SOLAS Convention. In 1934, a fire aboard the passenger ship Morro Castle caused 134 casualties. The investigation of the Morro Castle fire, and the lessons learned from it, played a major part in the development of the non-combustible construction regulations which today form the basis of the fire safety regulations for passengers ships. In addition, many advances in maritime technology were made during World War II and subsequently incorporated into the 1948 SOLAS Convention. As a result, a greater emphasis was placed on fire safety aboard ships and this was demonstrated by the development of three new parts (parts D, E and F) being added to chapter II of the 1948 SOLAS Convention which were exclusively dedicated to fire safety. In addition, the SOLAS 1948 requirements applied to both passenger ships and cargo ships.

The 1948 SOLAS Convention established three methods of construction for passenger ships and basic fire protection requirements for cargo ships. The 1948 SOLAS Convention was eventually updated with the 1960 SOLAS Convention. The most significant change incorporated into the 1960 SOLAS Convention, related to fire safety, was the application of certain passenger ship fire safety requirements to cargo ships.

1974 SOLAS Convention

While the SOLAS conventions of 1914, 1929, 1948 and 1960 did contain fire safety requirements, they proved inadequate for passenger ships. In the 1960’s, a series of fires aboard international passengers ships highlighted many problems and, as a result, many changes were incorporated into the 1974 SOLAS Convention. In the 1974 Convention (which came into effect in 1980 and is still in force today, as amended) separated the fire requirements into a separate chapter: SOLAS chapter II (Construction) of the 1960 SOLAS Convention was divided into two new chapters: chapter II-1 on Construction - Structure, subdivision and stability, machinery and
The 1974 SOLAS required all new passenger ships to be built of non-combustible materials and to have either a fixed fire sprinkler system or fixed fire detection system installed. Requirements for cargo ships were also updated with special regulations for specific types of cargo ships such as tankers.

1981 revision

The 1981 Amendments, which entered into force on 1 September 1984, completely revised SOLAS chapter II-2. The amendments included the requirements of resolutions A.327(IX) Recommendation concerning fire safety requirements for cargo ships (Incorporated in MSC.1(XLV)) and A.372(X) Recommendation concerning fire safety requirements for passenger ships carrying not more than 36 passengers (Incorporated in MSC.1(XLV)), adopted in 1975 and 1977 respectively, provisions for halogenated hydrocarbon fire extinguishing systems and a new regulation 62 on inert gas systems.

1990 Scandinavian Star and the 1992 Fire Safety Amendments

In 1990, a fire aboard the Scandinavian Star passenger ship left 158 persons dead. The incident raised a number of issues relating to fire protection and evacuation.

In December 1992, IMO adopted a comprehensive set of fire safety amendments, applicable to both new and existing passenger ships. The amendments required the installation of the latest fire safety features applicable to any modern hotel such as automatic sprinkler and smoke detection systems, and the upgrading of fire safety bulkheads to non-combustible materials and improved methods for assisting escaping persons, such as use of low location lighting.

Also in 1992, the Sub-Committee on Fire Protection agreed to undertake a comprehensive revision of SOLAS chapter II-2 as it was felt that the adoption, over a number years, of various sets of amendments, made the chapter difficult to use and implement. Technological advancements and lessons learned from accidents, since the chapter’s last revision in 1981, required new provisions to be added and for existing requirements to be modified. However, the outcome of this eight year effort resulted in more than just a “user-friendly” amalgamation of the latest amendments, but an entirely new structure for SOLAS chapter II-2 which will better accommodate the way port and flag States and ship designers deal with fire safety issues in the future.

In particular, the existing chapter had many vague phrases such as “to the satisfaction of the Administration” or “a means shall be provided”. In fact, there were over 200 such phrases used
throughout the chapter. In addition, the existing chapter had no support structure to accommodate novel designs and features and there was little focus on the human element, an issue which is now receiving a great deal of attention given that 80% maritime casualties are attributed to human factors.

1996 amendments and International Code for Application of Fire Test Procedures (FTP Code)

The 1996 amendments to SOLAS chapter II-2 - which entered into force in 1998 - included changes to the general introduction, Part B (fire safety measures for passenger ships), Part C (fire safety measures for cargo ships) and Part D (fire safety measures for tankers).

A new International Code for the Application of Fire Test Procedures was also developed and made mandatory on 1 July 1998. The Code is for use by Administrations when approving products for installation in ships flying their flag.

The FTP Code provides international requirements for laboratory testing, type approval and fire test procedures for the:

- non-combustibility test;
- smoke and toxicity test;
- test for "A", "B" and "F" class divisions;
- test for fire door control systems;
- test for surface flammability;
- test for primary deck coverings;
- test for vertically supported textiles and films;
- test for upholstered furniture; and
- test for bedding components.

2000 amendments - revised chapter II-2

In December 2000, IMO adopted a completely revised SOLAS chapter II-2, which entered into force on 1 July 2002.

The new structure focuses on the "fire scenario process" rather than on ship type, as the previous SOLAS chapter II-2 was structured. Thus, the regulations start with prevention, detection, and suppression following all the way through to escape. In addition, to make the revised SOLAS chapter II-2 more user-friendly, specific system-related technical requirements have been moved to the new International Fire Safety Systems Code and each regulation has a purpose statement and functional requirements to assist port and flag States.

The revised SOLAS chapter II-2 has a new part E that deals exclusively with human element matters such as training, drills and maintenance issues and a new part F that sets out a methodology for approving alternative (or novel) designs and arrangements.

Some of the original technical provisions were transferred from the Convention to the International Fire Safety Systems (FSS) Code, and many others are spelled out in greater detail in the Code. The main reason behind having a separate Code was to separate carriage and other statutory requirements, which clearly belong in the Convention and are meant for the Administration, from purely technical provisions, which are better suited for the Code and may be applied in a more user-friendly manner by equipment manufacturers, systems engineers, etc. The purpose of the FSS Code is therefore to provide international standards for fire safety systems required by revised SOLAS chapter II-2, under which it is made mandatory. The FSS Code consists of 15 chapters, each addressing specific systems and arrangements, except for chapter I which contains a several definitions and also general requirements for approval of alternative designs and toxic extinguishing media.

Application of Chapter II-2 to existing ships

The new chapter II-2 applies to ships constructed on or after 1 July 2002. However, the chapter also applies to ships built before that date as indicated below:

- All ships which undergo repairs, alterations, modifications and outfitting related thereto shall continue to comply with at least the requirements previously applicable to these ships. Such ships, if constructed before 1 July 2002, shall, as a rule, comply with the requirements for ships constructed on or after that date to at least the same extent as they did before undergoing such repairs, alterations, modifications or outfitting. (Regulation 1.3.1)

- Repairs, alterations and modifications which substantially alter the dimensions of a ship or the passenger accommodation spaces, or substantially increase a ship’s service life and outfitting related thereto shall meet the requirements for ships constructed on or after 1 July 2002 in so far as the Administration deems reasonable and practicable. (Regulation 1.3.2)

- Combination carriers constructed before, on or after 1 July 2002 shall not carry cargoes other than oil unless all cargo spaces are empty of oil and gas-freed or unless the arrangements provided in each case have been be approved by the Administration taking into account the guidelines developed by the Organization (Guidelines for inert gas systems (MSC/Circ.353), as amended by MSC/Circ.387.) (Regulation 1.6.5)

- In cargo pump rooms in tankers, temperature sensing devices for bulkhead shaft glands, bearings and pump casings shall be fitted; all pump-rooms shall be provided with bilge level monitoring devices together with appropriately located alarms; and a system for continuous monitoring of the concentration of hydrocarbon gases shall be fitted on all tankers constructed before 1 July 2002 by the date of the first scheduled dry-docking after 1 July 2002, but not later than 1 July 2005. (Regulation 1.6.7)
• **Emergency escape breathing devices (EEBD)** - All existing ships must have these fitted not later than the date of the first survey after 1 July 2002 as follows: all ships shall carry at least two emergency escape breathing devices within accommodation spaces; in passenger ships, at least two emergency escape breathing devices shall be carried in each main vertical zone; in passenger ships carrying more than 36 passengers, two emergency escape breathing devices, in addition to those required above, shall be carried in each main vertical zone. (Regulations 13.3.4.2 to 13.3.4.5 - certain exemptions apply - see regulation 13.3.4.5). On all ships, within the machinery spaces, emergency escape breathing devices shall be situated ready for use at easily visible places, which can be reached quickly and easily at any time in the event of fire. The location of emergency escape breathing devices must take into account the layout of the machinery space and the number of persons normally working in the spaces. The number and location of EEBDs must be indicated in the fire control plan and they must comply with the Fire Safety Systems Code (regulation 13.4.3, which refers to the Guidelines for the performance, location, use and care of emergency escape breathing devices (MSC/Circ.849).)

• **Part E Operational requirements** - All existing ships must comply with Part E (except regulations 16.3.2.2 and 16.3.2.3 - relating to inert gas systems, as appropriate) not later than the date of the first survey after 1 July 2002. Part E includes regulation 14 on Operational readiness and maintenance; regulation 15 on Instructions, onboard training and drills; and regulation 16 on Operations.

• **For new installations only on existing ships**: Fire-extinguishing systems using Halon 1211, 1301, and 2402 and perfluorocarbons are prohibited for new installations. (Regulation 10.4.1.3).

• **Deep-fat cooking equipment** - for new installations on existing ships, the fire extinguishing systems for deep-fat cooking equipment must comply with regulation 10.6.4, including the requirement for an automatic or manual extinguishing system; a primary and backup thermostat with an alarm; arrangements for automatically shutting off the electrical power upon activation of the extinguishing system; an alarm for indicating operation of the extinguishing system in the galley where the equipment is installed; and controls for manual operation of the extinguishing system which are clearly labelled for ready use by the crew. (The regulation refers to the recommendations by the International Organization for Standardization, in particular, Publication ISO 15371:2000 on Fire-extinguishing systems for protection of galley deep-fat cooking equipment.)

• **Passenger ships of 2,000 gross tonnage and above** must comply not later than 1 October 2005 with regulations for fixed local application fire-fighting systems (regulation 10.5.6). The regulation requires certain machinery spaces above 500 m³ in volume to be protected by an approved type of fixed water-based or equivalent local application fire-
fighting system. The regulation refers to Guidelines for the approval of fixed water-based local application fire-fighting systems for use in category A machinery spaces (MSC/Circ.913). Fixed local application fire-fighting systems are to protect areas such as the following without the necessity of engine shutdown, personnel evacuation, or sealing of the spaces: the fire hazard portions of internal combustion machinery used for the ship’s main propulsion and power generation; boiler fronts; the fire hazard portions of incinerators; and purifiers for heated fuel oil.

THE INTERNATIONAL FIRE SAFETY SYSTEMS (FSS) CODE

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Fire test laboratories
IMO issues annually a circular containing a list of laboratories recognized by Administrations, which are able to conduct fire tests in accordance with the provisions of the International Code for Application of Fire Test Procedures (FTP Code).

Halon banking and reception facilities
IMO annually issues a circular containing a list of halon banking and reception facilities, to facilitate the deposit of decommissioned halons or the purchase of recycled halons.