

SOLAS Chapter II-2, Regulation 10.10.4

**Fire Fighter Radios:**  
**An essential guide to understanding and implementing the  
latest technical requirements from IMO and EU**

**White Paper**  
2nd Edition

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## Abbreviations

SOLAS	Safety Of Life At Sea
UHF	Ultra-High Frequency
VHF	Very High Frequency
GMDSS	Global Maritime Distress & Safety System
DMO	Direct Mode Operation
TMO	Trunked Mode Operation
IMO	International Maritime Organization
CTCSS	Continuous Tone Coded Squelch System
PTT	Push-To-Talk
RSM	Remote Speaker Microphone
IEC	International Electrotechnical Commission
ATEX	ATmosphères EXplosibles

## 1. Preface

On November 30, 2012 the IMO Maritime Safety Committee adopted Resolution MSC.338(91) among which, SOLAS Chapter II-2 “Construction – Fire Protection , Fire Detection and Fire Extinction“ is of specific interest to firefighting process and technology.

This White Paper is focused on the above mentioned SOLAS Chapter II-2 and in particular Regulation 10 “Fire Fighting”, but issues from other parts of Chapters I, II and III are also taken into consideration when reflecting on Chapter II-2, Regulation 10.10.4 “firefighter’s communication”.

### 1.1. Purpose

The intention of this paper is to reflect on the SOLAS requirement for radio communication equipment for firefighters on board vessels, and inform about the impact of the latest IMO and EU decisions in relation to the technical requirement of the Fire Fighter radio.

This paper is not an interpretation of the requirement but rather a reflection on issues related to the implementation of the firefighter communication regulations introduced, and the developments in the requirements following the implementation of Resolution MSC.338(91), in which the text may require further clarification. In addition, this paper reflects on various issues which may be considered concerning the firefighter’s communication equipment – the “two-way portable radiotelephone apparatus”.

Since issuing of the first version of this paper, the IMO has in document MSC.1/Circ.1616 approved a unified interpretation in relation to the Ex requirements of fire fighter radios. Additionally, the EU has included the Fire Fighter radio in the Marine Equipment Directive 2014/90/EU Implementing regulation (EU) 2019/1397 item MED/5.20 requiring the radio to be wheel mark approved for use within the EU. Both decisions provide clarification in relation to the technical requirements of the Fire Fighter Radio.

## 2. SOLAS Chapter II-2, Regulation 10.10.4 - Fire fighter's communication

The wording in the SOLAS Chapter II-2, Regulation 10.10.4 is:

*For ships constructed on or after 1 July 2014, a minimum of two two-way portable radiotelephone apparatus for each fire party for firefighter's communication shall be carried on board. Those two two-way radiotelephone apparatus shall be of an explosion-proof type or intrinsically safe. Ships constructed before 1 July 2014 shall comply with the requirements of this paragraph not later than the first survey after 1 July 2018.*

In the following the expression "Two-way portable radiotelephone apparatus" shall be referred to as "fire-fighter radios".

SOLAS Chapter II-2, Regulation 10.10.4 shall be referred to as "**Regulation 10.10.4**"

**As stated above, the implementation period is over and all ships should now be equipped with fire fighter radios.**

### 2.1. Compliance

The Fire Fighter Radio is described in:

- SOLAS Chapter II-2, Regulation 10.10.4. (Resolution MSC.338(91))
- IMO MSC.1/Circ.1616
- EU Marine Equipment Directive 2014/90/EU Implementing regulation (EU) 2019/1397 item MED/5.20

The IMO requirements are enforced by the vessel's flag state. For vessels flying a flag from an EU member state, and for many vessels flying a flag of convenience, these requirements are for radio communication equipment administrated under the Marine Equipment Directive (MED).

By adding the Fire Fighter Radio in the MED as listed above, wheel marked radios can be installed from 3 October 2019 onwards. Until 3 October 2022 installations of radios approved based on the Radio Equipment Directive (RED) are still accepted, but from that date all new installations onboard EU flagged vessels are to be MED approved wheel marked radios.

For MED approval the radio is to be tested for compliance with the following dedicated maritime standards:

- For the marine environment IEC or EN 60945
- For EMC EN 301 843-1 and EN 301 843-2
- For UHF radio EN 300 720
- For VHF radio EN 301 178-1
- Ex compliance to ATEX directive 2014/34/EU

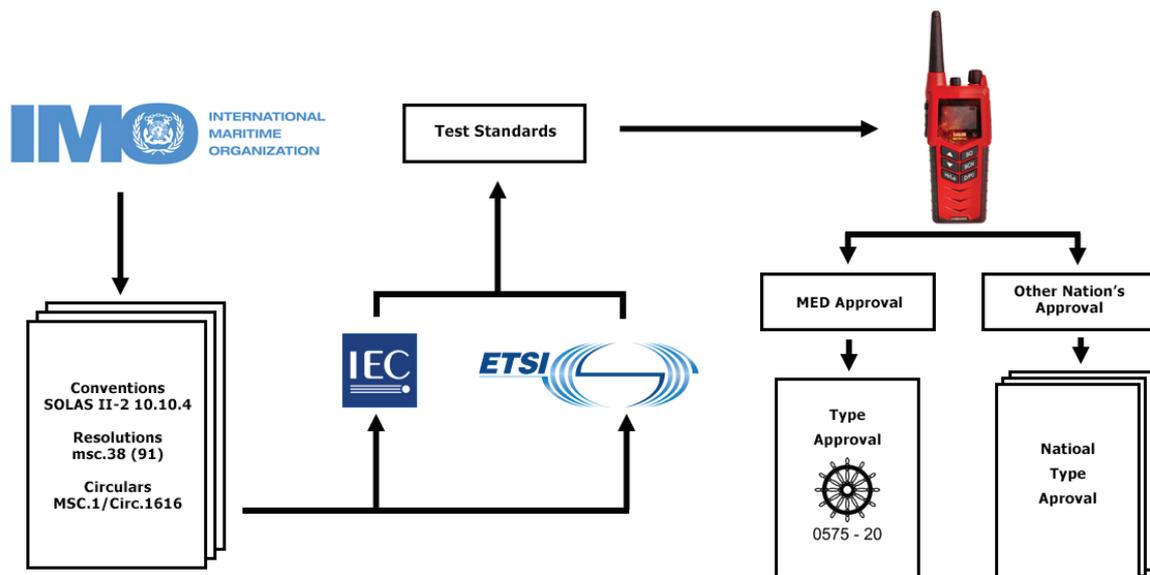


Figure 1: The regulatory process with relevant document references

In the RED directive the approval is based on three essential requirements covering safety of health, electromagnetic compatibility (EMC) and the efficient use of the frequency spectrum. In relation to EMC and efficient use of the radios spectrum, the dedicated maritime standards listed above also apply for RED approval.

IMO circular MSC.1/Circ.1616, which was published 26th June 2019 and enforced from that date, details requirements to the level of intrinsic safety for fire fighter radios. Based on this circular all fire fighter radios are to be in compliance with the Ex requirements for Zone 1 as defined in the IEC 60079-X series of standards. This equals a category 2G in the EU ATEX directive. In addition to this basic requirement, each vessel is to be accessed to make sure that the minimum requirements in respect to the apparatus group and temperature class are consistent with the most restrictive requirements for the hazardous area zone on-board which is accessible to the fire party.

## 2.2. Enforcement

The inspection and survey of ships, with regards to the enforcement of the provision of the regulations and granting of exemptions therefrom, is administrated by the flag state and carried out by officers of that Administration, but more often this is entrusted to the inspections and surveyors nominated for the purpose or to organizations recognized by the Administration.

The surveyor will carry out inspections and surveys requested by the appropriate flag state. If determined by the surveyor that the condition of the ship or its equipment does not correspond substantially with the particulars of the certificate in question, he shall immediately ensure that corrective actions are taken. In addition to the inspections required by the flag state, port states are able to perform inspections on their own initiative.

When applicable, the Government of both port state and flag state shall ensure that the ship is seaworthy and sail without danger to the ship, the environment, and persons on board.

## 2.3. Fire Party

According to Chapter II-2, regulation 10.10.2.1 all ships shall carry at least two firefighter's outfits.

According to Chapter II-2, regulation 10.10.2.2 an additional firefighter's outfit is required for passenger vessels depending on the design of the passenger vessel/cruise ship; i.e. length of passenger spaces, number of decks, number of vertical zones and number of passengers.

According to Chapter II-2, regulation 10.10.2.3 an additional two firefighter's outfits shall be provided on tankers.

The International Code for Fire Safety System (FSS Code), resolution MSC.98(73), Chapter 3, Regulation 2 "Firefighter's Outfit" defines and describes the scope of the firefighter outfit. This includes a type approved electric safety lamp, rubber boots, rigid helmet, explosion proof electrical safety lamps (for tankers), type approved lifeline, type approved breathing apparatus, etc.

The firefighter's outfit shall be kept ready for use in an easily accessible location.

The Firefighter's radios as required by Regulation 10.10.4, are required in addition to the above firefighters outfit and intended for the Fire Party.

Therefore, the total number of these radios to be carried on board will depend upon the number of fire parties detailed on the Muster List rather than the number of firefighter outfits.

Each Fire Party must have at least two of these dedicated radios as firefighters may need to use Direct Mode Operation (DMO) during fire-fighting operations or if the Fire Party consists of more crew members than the actual fire fighters, i.e. incident commander, the actual number of firefighter radios may vary from vessel to vessel as more than two radios may be required for each Fire Party.

The purpose of these firefighter radios is to provide a dedicated means of communication between a team of fire fighters entering the space, and the crew member located outside the space who is assigned to control this team.

### **3. Fire Fighter Radio**

The range of tests to document the performance of radio equipment required under SOLAS is based on international standards and therefore recognized by surveyors worldwide.

For radios where no dedicated standards exist it must be noted that it is the ship's responsibility to demonstrate that the radios are fit for purpose, i.e. that they are able to work within the environment to be expected in a fire scenario, that their operating range is sufficient and that they are safe.

#### **3.1. Standards**

When making new product-related requirements IMO normally develops a performance standard for each product. To date, IMO has not yet made a performance standard for the firefighter radio. This means the functional and technical requirements for these radios are based on the general requirements issued by IMO, ITU, and intrinsically safe national authorities who normally use the IEC 61097-X series of standards as a basis for this purpose.

For radios these performance standards normally cover environmental conditions, frequencies and modulations to be used, transmitter and receiver requirements, EMC, and HMI.

##### **3.1.1. Intrinsic Safety**

In relation to the IMO Unified Interpretation (UI) in MSC.1/Circ.1616 the Fire Fighter radios are to be approved for use in Zone 1 as defined in the IEC 60079 series of standards. In the ATEX directive Zone-1 is equal to category 2G.

In addition to the general Zone 1 requirement the UI also requires that the group and temperature class are consistent with the most restrictive requirements for the hazardous area zone on board which is accessible to the fire party.

In order for such equipment to meet the intrinsic safety requirements the radio telephone apparatus must be certified in accordance with relevant standards for equipment and protective systems intended for use in potentially explosive atmospheres, and maintained as such.

As an example, the EU commission has issued Directive 2014/34/EU (ATEX) which covers approval in relation to intrinsic safety. For a Fire Fighter radio the approval rating II 2G Ex ib IIB T4 will be appropriate for most ships, apart from those where a risk of hydrogen exists, which must have a rating of II 2G Ex ib IIC T4. For ships with only a low risk level in relation to intrinsic safety the temperature rating "T3" may be accepted instead of "T4" but the T4 rating will cover all types of vessels including tanker vessels.

##### **3.1.2. Environment**

In resolution A.694(17) IMO sets general environmental requirements for GMDSS and navigation systems. As no other environmental performance standards exist for on-board radios, the A.694(17) is the only relevant standard to use for fire fighter radios, when taking into consideration that they are to function under conditions which are similar or even worse than those under which the GMDSS radios are to work. The test standard related to resolution A.694(17) is the IEC/EN60945, which includes working temperature test, drop test, IP-grade test, to mention a few.

In addition to the general environmental performance standard A.694(17), the IMO resolution A.813(19) defines general requirements in relation to EMC for all electrical and electronic ships equipment. The test standard IEC/EN 60945 also points at this resolution.

It is worth noticing that the standards IEC/EN60945 defines a hand held radio as exposed equipment which has to function at extreme temperatures. To ensure reliable performance of the radio in a very cold environment and compliance with the standard a primary non-rechargeable battery is needed.

### 3.1.3. HMI

The IMO Fire Safety Code does not describe the design of the Fire Fighter Radio in this regard.

From a user point of view the firefighter radio should be designed for use with large gloves, the possibility of being worn underneath the firefighter suit, for smoke divers wearing breathing apparatus who must be able to connect to a breathing mask and for the Incident Commander who must be able to connect to the helmet headset.

In relation to the HMI, resolution A.694(17) and the related test standard IEC/EN60945 give general guidance in relation to the SOLAS requirements to the Human Machine Interface on the fire fighter radio.

Additionally, the performance standard for survival craft two-way VHF radio telephone apparatus MSC.149(77) gives some more detailed guidance for radios to be used under extreme conditions by persons in protective clothing.

### 3.1.4. Accessories

The firefighter outfit as well as the use of breathing apparatus sets high requirements for the design of radios and accessories to be fit for purpose during the fire-fighting operation.

Accessories for such radios have passed similar tests as the radio and are therefore tested and certified to have full functionality with the radio.

## 3.2. Frequency Band

Regulation 10.10.4 does not state what frequency band the firefighter radios should be working on. ITU however has specified which frequencies are to be used for on board purposes. For UHF this is specified in ITU-R M.1174-3, and for VHF the requirements are in ITU-R M.489-2 and Appendix 18 of the Radio Regulations.

To obtain the maximum coverage in confined areas on board a vessel, the use of the UHF is the most commonly used frequency band working in the range of 457 MHz to 467 MHz for maritime use.

## 3.3. UHF on Board Communication

Due to better propagation inside metal structures UHF frequencies are the most common for on board communication.

Using the firefighter radio on the same frequency as the daily on board UHF frequencies will provide the possibility of establishing communication between existing radios for on board communication and the firefighter radio.

Considerations should however be made on the programming of frequencies (channels) for all radios on board.

In DMO (Simplex) communication all radios working on the same frequency (channel) will have the functionality to send and receive on this channel. A dedicated channel should be reserved for the Fire Party for use only during fire-fighting operations in order to avoid disruptive interference from other radio communications on board not being part of the operation.

This will minimize the risk of interrupted communications between members of the Fire Party from other radios on board, but it will not prevent interference from other nearby vessels which may use the same frequency (channel) for daily operations.

To avoid interference from other nearby vessels the firefighter radio should be capable of having frequencies (channels) programmed with a Continuous Tone Coded Squelch System (CTCSS) which is an audio tone code programmed with the channel of the firefighter radio. Only radios with this code on this specific channel will be able to communicate.

Shifting the firefighter radio to any other channel without CTCSS will again open up the risk of interrupted communication from all other radios on board or nearby.

Using CTCSS is also known as Trunked Mode Operation (TMO) which is also needed when using radio repeaters i.e. for use in confined areas.

### 3.4. Storage

According to Chapter II-2, Regulation 10.2 firefighter's outfit shall be kept ready for use in an easily accessible location which is clearly marked.

Regulation 10.10.4 does not provide recommendations on the placement of firefighter radios.

As a fire on board a vessel can spread within minutes it is of paramount importance that there is easy access to the firefighter outfit and that equipment is ready to use. This is typically secured by placing it in permanently and clearly marked locations i.e. lockers on deck or in passageways.

Depending on the type or size of the vessel, more firefighter outfits may be required and these will then be stored in widely separated locations.

To prevent wasting valuable time spent collecting firefighter radios from a separate location, it is recommended that firefighter radios are stored together with firefighter's outfits to secure easy access and availability.

Firefighter radios might be marked or coloured to identify such radios from other on board portable radios to ensure that they are kept ready for use and that they are recognizable to the crew and surveyors.

To secure readiness of the firefighter radio, they may be placed in chargers providing constant charge to the radio battery. Since chargers are not explosion proof considerations must be made to place them outside hazardous areas.

Radio batteries will slowly be impaired when being constantly charged and although regular Fire Drills include checking of relevant communication equipment and also a read-out of battery status from the radio display, considerations should be made to have emergency primary back-up battery packs for instant use allowing recharging of the ordinary battery.

Emergency primary back-up batteries will shorten the time from the outbreak of a fire to the deployment of the Fire Party in case the radio battery for one or more firefighter radios is not usable (i.e. not charged)

Charging time for a radio battery of a portable radio which is fully discharged is typically between 4 to 5 hours.

Emergency primary batteries are non-rechargeable but will maintain their capacity for a period of 5 to 6 years if not activated before expiry.

Emergency batteries will typically provide power for the radio in a period of 6 to 8 hours.

### 3.5. Radio Accessories

Regulation 10.10.4 does not recommend the scope of possible accessories for the Firefighter Radio.

Being meant for use by the fire fighters in the Fire Party, firefighter radios must be capable of being used by crew wearing full fire fighter suits and full breathing apparatus/smoke diver equipment and the firefighters not involved in smoke diving wearing firefighter's outfit and helmets.

It should therefore be possible to connect relevant accessories to the firefighter radio in order to operate the radio in a safe and efficient way.

Typically an accessory kit for firefighters will consist of a PTT unit, or a Remote Speaker Microphone (RSM) and a headset.

All accessories need to be explosion proof and must be tested and approved to at least the same Ex specifications as the firefighter radio in order to fulfil the Ex certification of the radio. Additionally compatibility with the fire fighter radio is to be ensured as e.g. impedance in headsets etc. may vary from type to type and cause severe reduction in audio quality in case of mismatch between radio and accessory.

PTT's can be used by fire fighters as a connection between the helmet or smoke diver mask to activate the firefighter radio. It should be of ruggedized design as well as shaped for easy operation with heavy gloves or even when wearing under the firefighter suit, with the pressure of, for example, the elbow. It should be designed to prevent unintended activation by the fire fighter.

The PTT has no built in microphone or loudspeaker as these are placed in the fire fighter's mask or headset. When the PTT is connected to the firefighter radio the microphone and loudspeaker in the radio is disabled and all audio including possible channel readout is done in the mask or helmet unit.

A Remote Speaker Microphone (RSM) can be used by fire fighters not wearing smoke diving masks and it may or may not be used in connection with a headset. The RSM includes a Push-To-Talk button, a built in microphone and a built in loudspeaker as well as a connector for a headset.

When a headset is connected to the RSM the loudspeaker and microphone is disabled in the firefighter radio and audio is transferred to the headset with a boom microphone or skull microphone.

For some firefighter radios the change of channels will be confirmed in the headset by audio readout as the fire fighter may not have the option of seeing the channel selection button or display of the firefighter radio.

## 4. Conclusion

Safety and the preservation of life at sea should be the starting point for all businesses in the maritime industry. When a fire or explosion occurs at sea, the incident can be fast-moving and chaotic, with life and asset integrity at risk in worst case scenarios. Effective communication, enabled by firefighter radios, is key to effective management of every incident.

The SOLAS and EU requirements for firefighter radios have continue to evolve in line with industry-wide efforts to improve safety standards at sea. This is good news for the industry and especially those that work within it, but it also means that the compliance targets for ship owners and operators are constantly moving. All regulatory change requires comprehensive evaluation and, where necessary, further clarification should be given to the industry to ensure all new requirements are fully understood and can be efficiently applied at sea.

In this paper, we have aimed to provide the additional information the industry needs to meet the functional and technical requirements for the use of firefighter radios at sea, in line with new IMO and EU requirements. We will continue to scan the regulatory landscape in relation to radio communication at sea for firefighters, ensuring you are prepared for future changes and can make prudent decisions to prepare your vessels and crews.

