

Annex B:
Fire Protection on containerships – Regulations review

Fire protection on containerships
– Regulation review
CARGOSAFE

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SECTION 1 INTRODUCTION

1 Scope

This document aims at giving an overview of fire protection requirements applicable onboard containerhips. Two types of requirements are summarized:

- Mandatory requirements as imposed by Flag Administrations – i.e. in general IMO SOLAS requirements
- Voluntary requirements as recently developed by Classification Societies in Additional Class notations

This document provides quick and simplified regulation review aiming at giving a broad picture of the applicable requirements. It is intentionally not fully detailed and exhaustive but includes extensive regulation references.

2 Reference documents

	Issuer	Ref.	Date	Title
[R1]	ABS		09/21	Guide for Fire-Fighting Systems for Cargo Areas of Container Carriers
[R2]	DNV		07/21	Rules for Classification – Ships - Pt 6, Ch 5, Sec 23 - Additional fire safety for container vessels - FCS
[R3]	BV	NR467	01/22	Rules for the Classification of Steel Ships – Pt F, Ch 11, Sec 30 -
[R4]	IMO	SOLAS	2020	International Convention for the Safety of Life at Sea 1974, as amended
[R5]	IMO	IMDG	2016	International Maritime Dangerous Goods (IMDG) Code
[R6]	IMO	MSC 103/21	25/05/21	Report of the Maritime Safety Committee on its 103rd session
[R7]	IMO	MSC/Cir c.608 rev.1	05/07/94	Interim Guidelines for Open-top Containerships
[R8]	IMO	SSE 8/10	26/11/21	Proposal for a road map amending SOLAS chapter II-2 to address firefighting capabilities on board container vessels Submitted by Bahamas, France, Germany, Marshall Islands, Norway, Singapore, IUMI, BIMCO and IACS
[R9]	IMO	SSE 8/10/1	24/12/21	Proposals for enhancing the capabilities of containerhips for early fire detection in cargo holds and on cargo deck Submitted by China
[R10]	IMO	SSE 8/10/2	26/11/21	Comments on document SSE 8/10 Submitted by Denmark
[R11]	IMO	SSE 8/10/3	07/01/22	Comments on document SSE 8/10 Submitted by Germany, Liberia, Panama, Philippines, ICS, IACS, P&I Clubs, ITF and WSC

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[R12]	IMO	MSC.1/ Circ.131 8 rev.1	25/05/ 2021	Revised guidelines for the maintenance and inspections of fixed carbon dioxide fire-extinguishing systems
[R13]	IMO	MSC 101/21/ 5	04/03/ 2019	WORK PROGRAMME - Proposal for a new output: Amendment to MSC.1/Circ.1318 to clarify the hydrostatic testing regime for high-pressure CO2 cylinders - Submitted by the United Kingdom

3 Abbreviations

ABA	Air Breathing Apparatus
ABS	American Bureau of Shipping
BV	Bureau Veritas
DNV	Det Norske Veritas
FSS Code	International Code for Fire and Safety Systems
IMDG Code	International Maritime Dangerous Goods Code
IMO	International Maritime Organisation
LR	Lloyds Register
SOLAS	International Convention for the Safety Of Life At Sea

SECTION 2 MANDATORY REQUIREMENTS

1 Summary

Fire protection standards for containerships are set by IMO SOLAS Chapter II-2, which applies to seagoing containerships engaged in international voyages. Since most containerships are intended to carry dangerous goods, it may be considered that the requirements for container cargo holds carrying dangerous goods are also applicable.

Then it can be noted that a number of fire safety measures are mandatory for enclosed container cargo holds, including:

- Container cargo holds are provided with a gas (usually CO₂) fixed fire-extinguishing system
- When intended to carry explosives, container cargo holds are provided with a fixed water-spray system intended for boundary cooling purposes. Such system is not provided in all cargo container holds
- Fixed fire detection is installed in container cargo holds. As a note, there is no specification on the type of detectors to be installed (fire, smoke or heat in line with FSS Code or smoke extraction system)
- Container cargo holds are ventilated through a dedicated ventilation system capable of providing 6 air changes per hour and electrical equipment installed in the holds is certified safe
- A-60 fire integrity is required between the container cargo hold and the engine room

For cargo area on weather decks however, limited fire safety measures are included in SOLAS, such as A60 fire integrity is required between the container area and the engine room. Additional requirements for water-based portable fire-fighting material have been introduced by resolution MSC.365(93) and are applicable only to containerships built on or after 01/01/2016:

- Water mist lance
- Mobile water monitors for containerships carrying five or more tiers of containers on the weather deck

2 SOLAS requirements - Detailed analysis

2.1 Container cargo hold fire protection as per SOLAS – New and old ships

Containerships are cargo ships in the sense of SOLAS and as such, SOLAS II-2 requires the following:

- Fire insulation
A0 fire integrity between container cargo holds and other spaces (A60 integrity with respect to control stations + A30 integrity required for a cargo hold located above a category A machinery space)

[SOLAS II-2/9.2.3]

- Ventilation
Independent ventilation system, protected when crossing other spaces with high fire risk

[SOLAS II-2/9.7]

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- Fire main
It should be possible to reach any part of the cargo hold (when empty) with two jets of water emanating from two different hydrants. Redundancy is required for the fire pumps

[SOLAS II-2/10.2]

- Fixed fire-extinguishing system
A fixed gas fire extinguishing system is required in enclosed cargo holds. CO₂ systems are generally provided on containerships.

[SOLAS II-2/10.7]

It is to be noted that IMO has developed specific inspection and maintenance guidelines for CO₂ systems. These guidelines have been updated in the recent years, following to concerns raised by UK related to insufficient testing of high pressure CO₂ cylinders.

[MSC.1/Circ.1318/Rev.1]

2.2 Container cargo holds allowed to carry dangerous goods

In addition, container ships are usually able to carry dangerous goods in containerized form. The packing and stowage of the dangerous goods has to comply with the requirements of the IMDG Code and in addition SOLAS II-2/19 – Carriage of Dangerous Goods applies to container cargo holds, requiring especially:

- Immediate availability of water supply for the fire main

[SOLAS II-2/19.3.1]

- Water-spray for boundary cooling when transporting dangerous goods classes 1.1 to 1.6

[SOLAS II-2/19.3.1]

- Fire detection

[SOLAS II-2/19.3.3]

- A60 insulation with respect to category A machinery spaces

[SOLAS II-2/19.3.8]

- Precautions with respect to the risk of explosive atmosphere:
 - Certified safe electrical equipment

[SOLAS II-2/19.3.2]

- Ventilation, 6 air changes per hour

[SOLAS II-2/9.3.4]

- Segregated bilge system

[SOLAS II-2/9.3.5]

2.3 Weather decks

It is to be noted that there are almost no requirements for weather decks where containers can be carried, except from SOLAS II-2/19 for the carriage of dangerous goods:

- Immediate availability of water supply for the fire main

[SOLAS II-2/19.3.1]

- Dedicated dry powder portable extinguishers

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[SOLAS II-2/19.3.7]

- A60 insulation with respect to category A machinery spaces

[SOLAS II-2/19.3.8]

2.4 Open-top container cargo holds

In the case of open-top container cargo holds, MSC.1/Circ.608 rev.1 - Interim Guidelines for Open-top Containerships recommends that open-top container cargo holds be protected by a fixed water-spray system, capable of spraying the outer vertical boundary of each container bay in an open cargo hold and of cooling the adjacent structure.

2.5 Recent evolutions – Requirements for recent containerhips (built on or after 01/01/2016)

SOLAS has been amended by MSC.365(93) on 22/05/2014, which has entered into force on **01/01/2016**. These amendments focus on the fire safety issues related to containers carried on an open deck. In addition to the requirements listed in 2.1 above, the following now applies for containerhips intended to carry five or more tiers of containers on or above the weather deck:

- Water-mist lance
Any ship carrying containers on the weather deck is required to be equipped with a water mist lance capable of penetrating a container

[SOLAS II-2/10.7.3.1]

- Mobile fire monitors
If carrying five or more tiers of containers on the weather deck, mobile water monitors are required

Ship breadth [m]	Number of mobile water monitors required
B < 30m	2
B ≥ 30m	4

These water monitors are intended to “create effective water barriers forward and aft of each container bay”. They need to be designed and tested according to MSC.1/Circ.1472 - Guidelines for the design, performance, testing and approval of mobile water monitors used for the protection of on-deck cargo areas of ships designed and constructed to carry five or more tiers of containers on or above the weather deck. Especially, it has to be demonstrated that they can reach the top tier of containers.

[SOLAS II-2/10.7.3.2]

In addition, a clear reference to MSC.1/Circ.608 rev.1 has been included in SOLAS II-2/10.1 by MSC.365(93) together with a mandatory requirement for “fire protection arrangements [...] for the purpose of containing a fire in the space or area of origin and cooling adjacent areas to prevent fire spread and structural damage.” For practical purposes, this makes the recommendation for a water-spray system in open-top container ships almost mandatory.

2.6 Future evolutions

Further to a number of large containership fires in the recent years resulting in significant human and material losses, IMO, pushed by several member states and marine insurers, has opened a new work output during MSC.103 in May 2021.

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The work output focuses on the "Development of amendments to SOLAS chapter II-2 and the FSS Code concerning detection and control of fires in cargo holds and on the cargo deck of containerhips" and falls in the remit of the Ship System and Equipment subcommittee. The purpose is to amend regulations in SOLAS chapter II-2 and the FSS Code to enhance provisions for early fire detection and effective control of fires in containerized cargoes stowed on and under deck of containerhips.

The work is intended to be completed in 2025, and the amendments to be developed should enter into force on 1 January 2028, provided that they were adopted before 1 July 2026.

[MSC.103/21 §18.6 to 18.9]

4 papers have been submitted in view of discussion at SSE8 in March 2022 and outline:

- The need for a global, FSA-type approach. The present study, CARGOSAFE is already announced in this perspective.

[SSE 8/10 [R8] and SSE 8/10/3 [R11]]

- A number of SOLAS regulations that need to be enhanced in order to reach their goal on board containerhips are pointed out, especially
 - o SOLAS II-2/4 – Probability of ignition
 - o SOLAS II-2/5 – Fire growth potential
 - o SOLAS II-2/7 – Detection and alarm
 - o SOLAS II-2/8 – Control of smoke spread
 - o SOLAS II-2/10 – Fire-fighting (targeting both manual fire-fighting equipment and fixed fire-fighting installations)
 - o SOLAS II-2/19 – Dangerous goods

[SSE 8/10 [R8]]

- 2 possible measures targeting portable equipment on board
 - o portable infrared thermal imagers and portable infrared thermometers

[SSE 8/10/1 [R9]]

- o testing and approval guidelines for water-mist lances, including an option for “water mist lance extending devices” (i.e. hydropen-type solutions). It is to be noted that the proposed testing standard

[SSE 8/10/2 [R10]]

SECTION 3 VOLUNTARY CLASS NOTATIONS

1 Scope

This section summarizes and compares the requirements of Additional Class notations developed by various Class Societies and dedicated to enhancing fire protection on board containerhips.

It is to be kept in mind that such requirements apply only when the notation is specified by the shipowner.

2 Considered additional Class Notations¹

Class Society	Additional Class notation	Brief description
BV [[R3]]	ECFP-1	Portable equipment and arrangements improving the ability to manage a container cargo fire and that may be considered as retrofit for an existing ship
	ECFP-2	Equipment, systems and arrangements improving the ability to manage a container cargo fire and which constitute an extensive set of mitigation measures which are deemed effective and available with standard technologies ECFP-2 includes all requirements of ECFP-1
	ECFP-3	equipment, systems and arrangements improving the ability to manage a container cargo fire and which include measures that are deemed relevant using innovative technologies ECFP-3 includes all requirements of ECFP-2
ABS [[R1]]	FOC, FOC-R	Enhanced container deck firefighting capabilities Increased number of mobile water monitors as compared to SOLAS requirements
	FOC+, FOC-R+	Fixed water-spray system protecting the hatch covers
	CCH	Specific cooling arrangements air monitoring, and other arrangements intended to protect crew within the accommodations, service spaces, machinery spaces and other normally manned locations from the heat as well as smoke that may be created during a cargo fire. Mainly: <ul style="list-style-type: none"> - Accommodation block ventilation design, control and monitoring

¹ No additional class notation dedicated to fire protection on containerhips has been found in LR Rules.

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Class Society	Additional Class notation	Brief description
		- Auto-protection water-spray system for the accommodation block
	FBC	installation of fire protection arrangements and capabilities within the container holds Mainly: <ul style="list-style-type: none"> - Cargo fire control station - Fire detection in cargo holds including temperature monitoring - Water-spray system in holds
	CHF	Specific arrangements to flood individual container holds
DNV ² [[R2]]	FCS(HA)	Hazard identification assessment of container fires
	FCS(C)	Additional fire protection in cargo area
	FCS(FD), FCS(FD+)	Enhanced fire detection systems for container cargo areas FD+ = container identification
	FCS(FF)	Enhanced fire-fighting systems for container cargo areas
	FCS(HF)	Fire-fighting by container hold flooding for container cargo areas

3 Analysis of mitigation measures

The following table gives a broad overview of the mitigation measures considered in the identified additional Class notations. It is not intended as a detailed gap analysis between different notations, so that similar mitigation measures are grouped into one single line whereas discrepancies may exist in the detailed requirements associated with each system.

² Additional class notations FCS(A), FCS(M) and FCS(M-P) are not detailed here because they include measures mainly aimed at managing a fire originating in the accommodation block.

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Fire protection chain step	Mitigation measure	BV	ABS	DNV
General	HazId			FCS(HA)
Fire management	Centralized control station	ECFP-2, ECFP-3	FBC	
Detection	Fire detection system in cargo holds	ECFP-2, ECFP-3	FBC	FCS(C)
	Enhanced smoke detection / monitoring in cargo holds			FCS(FD)
	Fire detection system in cargo hold with fire seat location / temperature monitoring	ECFP-3	FBC	FCS(FD+)
	Fire detection on weather deck	ECFP-3		FCS(FD), FCS(FD+)
Manual fire-fighting	Water-mist lances	ECFP-1, ECFP-3	ECFP-2, FOC, FOC-R, FOC+, FOC-R+ FBC: 2 lances	FCS(C): 2 lances
	Portable fire-fighting devices for stacked containers	ECFP-1, ECFP-3 ¹	ECFP-2,	
	Increased number of fire-fighter's outfits	ECFP-1, ECFP-2, ECFP-3: 6 outfits	FBC: 8 outfits + portable infrared thermometers	FCS(C): 8 outfits
	Increased number of spare charges for ABA	ECFP-1, ECFP-2: 2 spare charges ECFP-3: 4 spare charges	FOC, FOC-R, FOC+, FOC-R+: 4 spare charges	
	Thermal imaging camera	ECFP-1, ECFP-2, ECFP-3: 1 camera	FBC: 2 cameras	
	Compressed air system for breathing apparatus	ECFP-1, ECFP-3	ECFP-2, FBC	
	Ring type fire main + capacity to feed 4 hydrants	ECFP-2, ECFP-3 ²	FOC, FOC-R, FOC+, FOC-R+	
	Increased number of mobile water monitors		FOC, FOC-R, FOC+, FOC-R+	

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Fire protection chain step	Mitigation measure	BV	ABS	DNV
Fixed fire-fighting	Fixed water monitors covering the on-deck cargo stowage area	ECFP-2, ECFP-3		FCS(FF)
	Water-spray system below hatch covers	ECFP-2, ECFP-3	FOC+, FOC-R+ FBC ³	FCS(FF)
	Flooding system for cargo holds	ECFP-2, ECFP-3	CHF	FCS(HF)
Containment (protection of the superstructure block)	Water-spray system for the protection of the superstructure block	ECFP-2, ECFP-3	CCH	
	Water curtain on container lashing bridges			FCS(FF)
	Quick-closing devices and centralized controls for the ventilation of the cargo holds	ECFP-2, ECFP-3		
	A-60 fire insulation between superstructure block and container cargo holds / stowage area		CCH, FBC ⁴	
	Redundant air inlets for the ventilation of the superstructure block	ECFP-2, ECFP-3	CCH	
	Air monitoring system for the superstructure block		CCH	
Evacuation	Dedicated sheltered assembly space		CCH	

¹ Capability to reach a higher height is required for ECFP-3

² Fire main required to be under permanent pressure for ECFP-2 and ECFP-3

³ FBC describes a water-spray system where the nozzles are distributed over the whole height of the cargo hold bulkheads

⁴ FBC requires A-60 fire insulation between cargo holds and heated FO tanks, machinery, service or accommodation spaces

SECTION 4 DANGEROUS GOODS ONBOARD MANAGEMENT

1 Introduction

This section provides a brief overview of regulations or standards applicable to the management of dangerous goods before and during transportation onboard containerhips.

2 IMDG Code

SOLAS Ch.VII covers the carriage of dangerous goods and makes IMO IMDG Code mandatory when such goods are carried in packaged form – as opposed to carriage in bulk onboard ships dedicated to one type of dangerous good. IMO International Maritime Dangerous Goods Code (IMDG Code) contains requirements for:

- The packaging and storage of dangerous goods inside containers: Shippers are responsible for compliance with these requirements and it is to be noted that limited control is usually performed in this respect
- Dangerous good categorization and declaration when registering a slot on a containerhip
- Onboard stowage of containers declared to contain dangerous goods, which are to be applied by the shipowner or ship manager when preparing the stowage plan based on the information transmitted by the shippers. IMDG Rules apply to:
 - o Container location: depending on the type of dangerous goods contained in the containers , they may be allowed on deck only or in certain cargo holds (provided with specific equipment as required by SOLAS II-2/19) only
 - o Container segregation: depending on the contents of two containers, minimum distances or separations may be required between 2 containers containing different kinds of dangerous goods, when the goods are known to be incompatible or likely to cause an accident if stored close-by