



INTERNATIONAL CONFERENCE ON  
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GENERAL APPROACH AND PHILOSOPHY OF A CODE FOR THE  
CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING  
LIQUEFIED OR COMPRESSED GASES IN BULK

1. Historical Background

In 1967, in response to a request by the United States, the Maritime Safety Committee established a Sub-Committee on Ship Design and Equipment. The Sub-Committee's terms of reference were:

"... to consider the construction and equipment of ships carrying bulk cargoes of dangerous chemical substances other than petroleum and similar flammable products normally carried in tankers, and to recommend suitable design criteria, construction standards, and other safety measures to minimize the risk involved in loading, carrying and discharging such cargoes.

In carrying out this task, the Sub-Committee will consider:

- (i) the hazards of each product with respect to the ship itself and its crew as well as the hazards to the neighbourhood;
- (ii) special hazards affecting the design or adaptation of the ship, such as specific gravity and the pressure and temperature at which the cargo is carried; and
- (iii) the influence of these hazards on the design, construction or adaptation of the ships carrying the goods in question."

To carry out this task, it was decided to complete first the requirements for liquids having a vapour pressure not exceeding  $2.8 \text{ kp/cm}^2$  (40 psia) at a temperature of  $37.8^\circ\text{C}$  ( $100^\circ\text{F}$ ).

In February 1971 the Sub-Committee forwarded a proposed Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk to the Maritime Safety Committee for consideration, thereby completing the first phase of the work programme. This Code was adopted by the Assembly as Resolution A.212(VII).

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An ad hoc working group subsequently began development of a Code for ships carrying liquefied and compressed gases. It was agreed that this Code should be separate and distinct from the Bulk Chemical Code, but similar in scope and format.

It was also agreed that sufficient detail should be included in the Code to permit any Administration to assess the risks associated with the carriage of a product.

During development of the Code, it was noted that certain areas of the Code, namely cargo containment, cargo piping and materials and welding for low temperatures were already under consideration by the International Association of Classification Societies (IACS). IACS accepted an invitation to co-operate in the development of those portions of the Code covering the above subjects.

## 2. Products to be included

The list of products to be covered by the Code has not yet been finalized. Attachment B lists the products which are presently under consideration for inclusion.

## 3. Ship Survival and Cargo Containment

In developing the Code, a prime consideration has been the possibility of a cargo release causing hazard over a wide area. While most gases do not present a water pollution hazard, other potential hazards such as flammability, toxicity and low temperature call for special attention to cargo containment under both normal and emergency conditions.

Accordingly in developing the Code, ship arrangements are specified which provide a level of protection commensurate with these hazards both for personnel on the ship and the populace in general. It is the aim, so far as practical considerations permit, to achieve a high level of safety by specifying criteria for ship survivability after damage, tank location, and cargo containment standards for each particular cargo.

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For the most dangerous gases, such as chlorine, it is considered that the ship should provide maximum survival and containment features including an ability to survive a major collision or stranding and still remain afloat without release of cargo. For gases whose release in the event of collision or stranding would present a minimal hazard, it is felt that minimum requirements for survivability and cargo containment may be provided. For gases whose hazards are between these two extremes, intermediate requirements will be specified.

In the case of liquefied natural gas, it is felt that the vessel should at least be capable of sustaining a stranding or minor side damage without release of cargo and without loss of its ability to navigate. In a more serious collision, loss of cargo will occur, but the vessel's hydrostatic parameters should provide for a stated condition of survival.

#### 4. Additional considerations

In addition to developing design and construction standards, other considerations may be appropriate for the safe carriage of these products. Among these considerations will be:

- (a) the adequate number and standard of qualification of officers and crew;
- (b) the provisions of standby control, manoeuvring and navigational equipment;
- (c) the implementation of cargo handling operational controls.

Furthermore it is envisaged that the level of safety achieved by ship construction and other shipboard features could be supplemented by any administration wishing to apply additional (e.g. navigational) restrictions in a particular port area, based on the problems associated with that port.

#### 5. Outline of the Code

An outline of the various parts of the Code together with a description of each part is included as attachment A.

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ATTACHMENT A

PRESENT OUTLINE OF A PROPOSED CODE FOR THE CONSTRUCTION AND EQUIPMENT  
OF SHIPS CARRYING LIQUEFIED OR COMPRESSED GASES IN BULK

Note: The chapter contents set out below are at various stages of development and may be amended in the light of further work on this subject.

Chapter I - General

The hazards considered by the Code are presented, including various fire, health, air pollution, water pollution, reactivity and low temperature transportation considerations. The requirements for equivalent materials, equipment etc. to those required by the Code are described, including a provision that an Administration accepting a substitute material should communicate full details to IMCO for circulation to participating governments.

Requirements for certification by Administrations include provisions for periodic re-inspection.

Chapter II - Physical Protection and Navigational Aids for Ships

This chapter sets forth damage standards as they relate to ship survivability and cargo release. A range of ship types is under consideration with varying degrees of survival capability and cargo tank location requirements. For example, for the most hazardous cargoes, protection would be provided against collision damage up to one-fifth of the beam and stranding damage up to a height of one-fifteenth of the beam (or 2m if less).

The Code considers that a vessel survives if, after suffering the stipulated damage, an equilibrium point is reached where progressive down-flooding cannot take place and the vessel still possesses certain stipulated reserve stability. The final angles of heel under discussion are in excess of those stipulated by the Load Line Convention.

It is recognised that comparatively minor damage may in some cases result in a larger angle of heel than that likely to be caused by the maximum damage specified in the damage assumptions. Consideration is therefore being given to navigation of the vessel at angles of heel greater than the maximum specified for normal machinery operation.

### Chapter III - Ship Arrangements

The degree of segregation of cargo hold spaces from each other and from other parts of the vessel is described. It is required that cargo piping systems be segregated from other ship systems and should enter tanks directly from the open deck.

Accommodation spaces must be located outside the cargo tank area. There are restrictions on the positioning of doors leading directly from accommodation spaces and non-fixed portlights in relation to the cargo tank and cargo handling areas.

Cargo pump and compressor rooms may not be situated below the weather deck and must be within the cargo tank area.

Cargo tanks and potentially gas dangerous spaces are required to have access suitable for personnel wearing protective clothing and equipment. Means of detecting and removing water or leaked cargo from hold spaces are described.

### Chapter IV - Cargo Containment

This chapter defines requirements for the various types of cargo tanks (integral, membrane, independent, etc.) and containment systems. Design, materials, fabrication and inspection criteria are specified together with initial and in-service test procedures.

### Chapter V - Cargo Handling System

Requirements for arrangement, materials of construction and fabrication of cargo handling systems are set forth, taking into consideration corrosivity, pressure, temperature, flammability and toxicity. The design and testing of cargo hose is also covered.

### Chapter VI - Materials of Construction

This chapter gives the requirements for plates, sections, pipes, forgings, castings and weldments used in the construction of cargo tanks, cargo process tanks, cargo and process piping, secondary barriers, and contiguous hull structures.

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#### Chapter VII - Cargo Temperature Control

This chapter addresses the equipment and arrangements necessary for containment when the cargo is carried at a pressure below that corresponding to the ambient temperature. Means are discussed of preventing boil-off by cargo refrigeration, and of handling boil-off gas by re-liquefaction, or by combustion in boilers, engines and similar equipment.

#### Chapter VIII - Cargo Vent Systems

Requirements are given for pressure relief systems serving cargo tanks, spaces surrounding cargo tanks, and cargo piping and include the capacity and arrangement of relief valves.

#### Chapter IX - Tank Environmental Control

This chapter discusses the requirements for:

- (a) control of the atmosphere in containment spaces and void spaces;
- (b) inerting the cargo tanks and piping systems when empty; and
- (c) inerting the vapour space of a loaded cargo tank.

#### Chapter X - Electrical Arrangements

This chapter defines the hazardous zones created by the products and the class of electrical equipment including instrumentation required in such hazardous zones. Specifically addressed are requirements for cargo pumprooms, cargo compressor rooms and electric motor rooms.

#### Chapter XI - Fire Protection and Extinguishing

Requirements for fire protection and extinguishing for gas carriers include fire protection arrangements in cargo handling spaces, and provide for sea water extinguishing systems and water spray systems in the cargo tank area. A dry powder extinguishing system is specified to fight small flammable gas fires, recognising that extinction of a major gas fire would not be possible unless the source of gas is secured. Finally, requirements for fireman's protective clothing and outfit are detailed.

Chapter XII - Mechanical Ventilation in Cargo Tank Area

This chapter covers spaces normally entered during cargo handling operations and spaces not normally entered. Location of intakes and exhausts, number of air changes and materials of construction for fans are also covered.

Chapter XIII - Instrumentation (Gauging, Vapour Detection, etc.)

Requirements are given for cargo tank level indicators and alarms, pressure gauges and temperature indicators in cargo systems and vapour detection equipment.

Chapter XIV - Personnel Protection

This chapter discusses requirements for protective clothing, gas masks and breathing apparatus, first aid and resuscitation equipment, decontamination showers and eye wash facilities and personnel rescue equipment.

Chapter XV - Tank Filling Limits

Filling limits are specified in order to prevent a tank becoming liquid full by thermal expansion after loading.

Chapter XVI - Use of Cargo as Fuel

This chapter describes the conditions under which LNG boil-off gas may be used as a fuel. The necessary arrangements of piping, valves and gas detecting equipment for safe delivery of the gas to the machinery spaces is specified, as are the necessary ventilation systems to ensure no accumulation of hazardous vapours.

Chapter XVII - Special Requirements

Chapter XVIII - Operating Requirements

Chapter XIX - Summary of Minimum Requirements

These chapters will be developed when the earlier chapters reach a more advanced stage.

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ATTACHMENT B

PRODUCTS UNDER CONSIDERATION FOR INCLUSION IN THE CODE  
FOR GAS CARRIERS

Acetaldehyde  
Anhydrous ammonia  
Butadiene  
Butane  
Butane/Propane mixture (LPG)  
Butylenes  
1-Butene  
2-Butene-cis  
2-Butene-trans  
Isobutylene  
Chlorine  
Dinethylanine  
Ethylchloride  
Ethane  
Ethylene  
Ethylene oxide  
Methane  
Methyl bromide  
Methylchloride  
Propane  
Propylene  
Vinyl chloride  
Hydrogen chloride  
Hydrogen fluoride  
Nitrogen  
Oxygen  
Refrigerant gases  
(Halogenated Hydrocarbon)

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