# HYDROGEN IN MARITIME
## REGULATORY UPDATES AND MARKET UPDATES


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Sustainability strategy lead

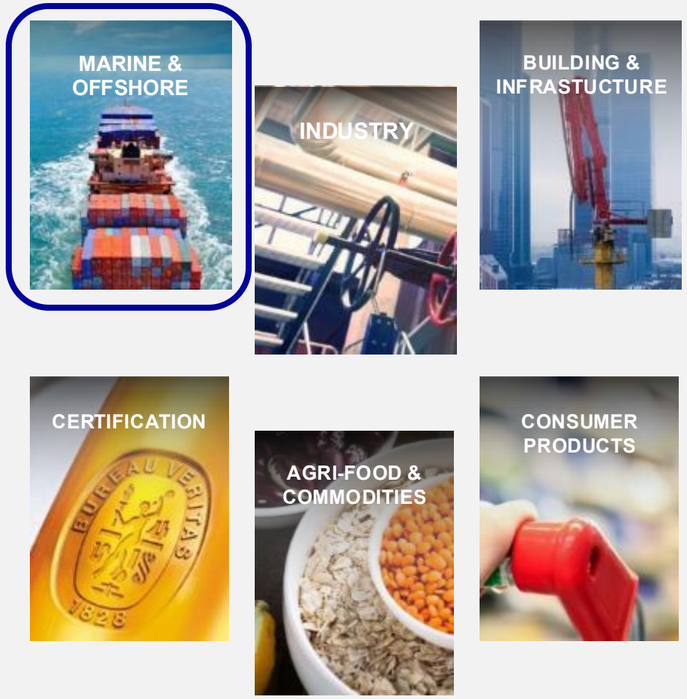
**Bureau Veritas Marine & Offshore**

# BUREAU VERITAS

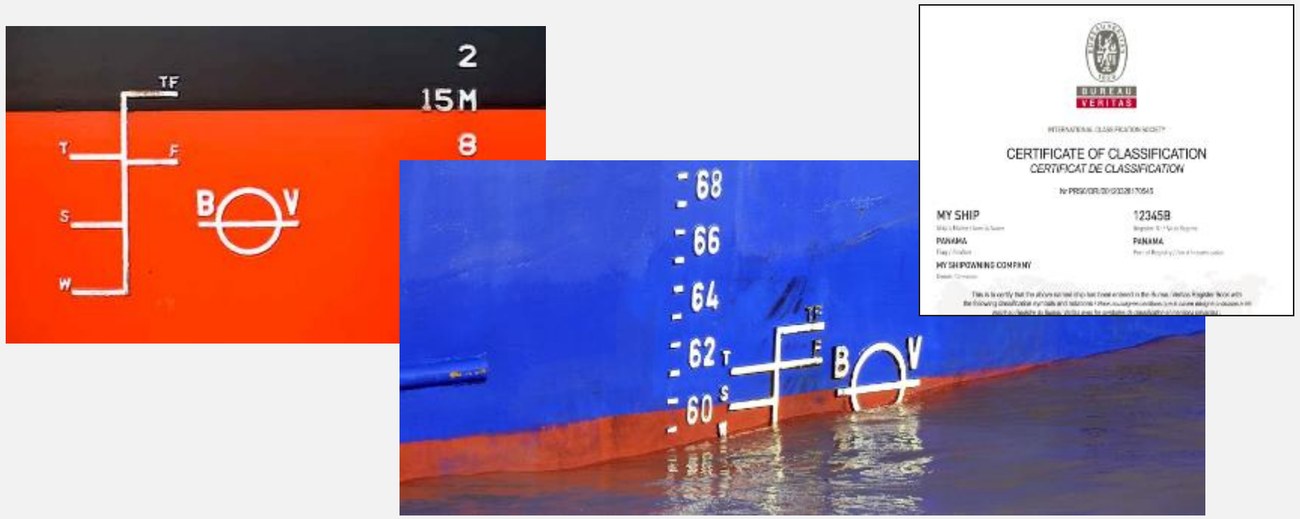
## Bureau Veritas

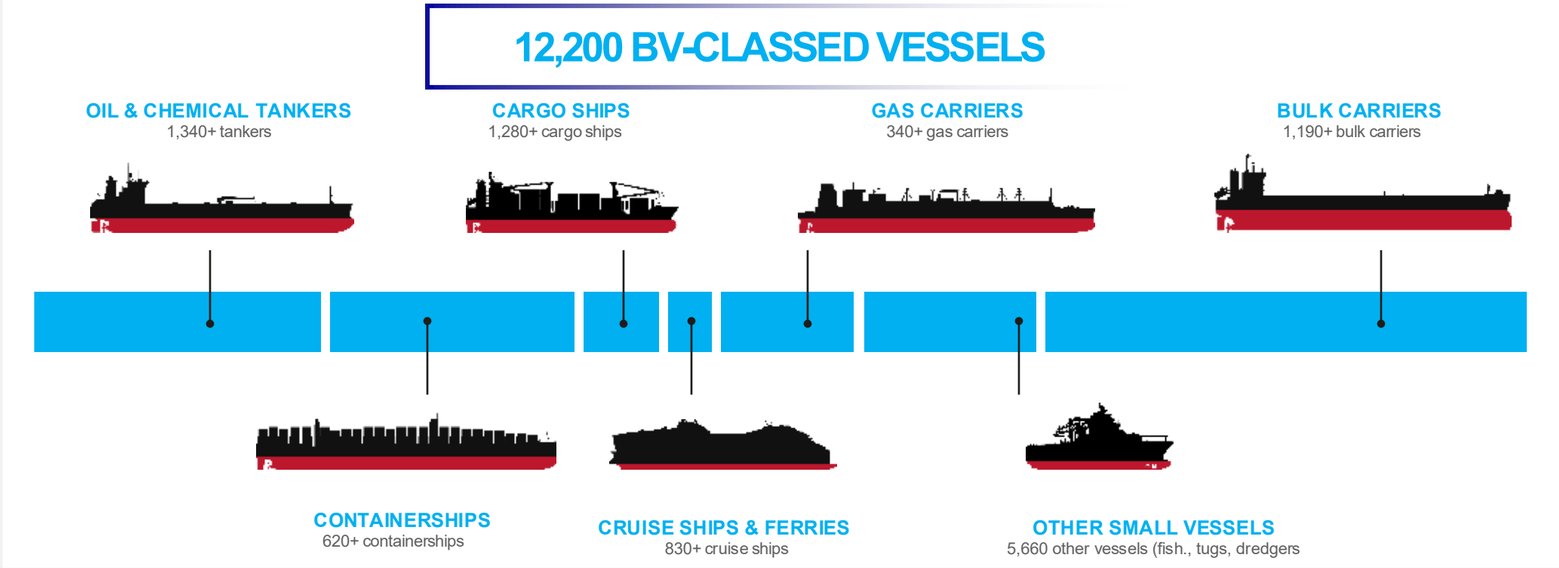
**Services in Testing, Inspection and Certification**

"*Contributing to transform the world we live in*"




## Bureau Veritas Marine & Offshore



# STAKEHOLDERS AND REGULATORY ENVIRONMENT

**FLAG STATE ("Country")**
**(the Flag the ship flies)**
**Represented at the IMO**

**PORT STATE**
**(where the ship will call during its voyage)**

**CLASS SOCIETY**
**(Third party verification)**
**Design, Building, Operation**

**COASTAL STATE**
**(where the ship is installed, if stationary)**

**SHIPOWNER**
**(SHIP)**

**BANK and INSURER (P&I, H&M)**
**(the « Finance » and the insurance)**

**CHARTERER**
**(the Client)**

## FLAG STATE

- Legal registration and nationality
- Regulatory responsibilities inc. ensuring compliance with maritime conventions on safety, environmental protection and crew-related ("**IMO Conventions**")
- **Focus : regulatory compliance**

## IMO (International Maritime Organization)

- UN Agency dedicated to maritime transport
- Develops and maintains maritime regulations : safety, environment protection
- Constituted of 176 Member States ("Flag State").

## CLASS SOCIETY

- Originally set up by Marine Insurers circa **1800's**
- Giving "Rating" to a ship for marine insurance
- Independent, non-governmental organization developing and maintaining technical standards on design and construction of ships.
- Can act in Delegation of Flag States (as "Recognized Organization")
- **Focus : technical safety**

HYDROGEN
AS FUEL

HYDROGEN
AS CARGO

FUEL CELL

# HYDROGEN TECHNOLOGY
# REGULATIONS DEVELOPMENT AND MAIN SAFETY CONSIDERATIONS

## UNDERSTAND HYDROGEN CHARACTERISTICS TO MITIGATE THE RISK BY DESIGN

- Eliminate potential ignition sources
- Ventilate as much as possible

## CONSIDER HYDROGEN COMPATIBILITY AT THE DIFFERENT OPERATING CONDITION FOR MATERIAL SELECTION

- Very low temperature and wide range of temperature are to be considered

## ARRANGE PIPING IN A WAY THAT REDUCE LEAKAGE AND ALLOW FOR EASY DETECTION

- Prefer butt-welded pipes

## CONTROL AND MONITORING IS KEY

## SPECIFIC SAFETY ASPECTS

- Compressed Hydrogen leakage at very high pressure
- Liquefied Hydrogen: Clogging, Oxygen stratification, boil-off management

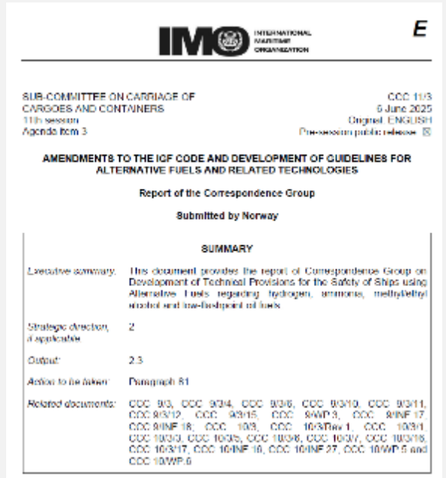
# HYDROGEN AS FUEL

## IMO
## Interim Guidelines
## to be adopted in May 2026

| | |
|---|---|
| Functional requirements, goals and principles (Ship design, construction and operation) | IGF Code Part A<br>- Detailed risk analysis<br>- Alternative design approach if no detailed requirements available in IGF Code |
| Detailed requirements related to Ship design, construction and operation | **Guideline under development**<br>Work initiated through Correspondence Group in **2022**<br>Draft finalized at CCC11 (Sept 2025)<br>To be approved by MSC 111 in 2026 (May) |
| Functional requirements and goals related to training | IGF Code Part D |
| Gas carriers and / or tankers using their cargo as fuel | Not addressed yet – IGC Code Ch 16 general principle |

**In Sept 2025, final discussions on:**

- Dedicated provisions for fuel separation rooms and tank connection spaces
- Separate requirements for Liquid $H_2$ and compressed $H_2$ containment systems
- Specific requirements for type C tanks (Liquid $H_2$) and type 4 composite cylinders (Compressed $H_2$)
- Adapts existing IGF requirements to hydrogen



IMO INTERNATIONAL MARITIME ORGANIZATION — E

SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS
11th session
Agenda item 3

CCC 11/3
6 June 2025
Original: ENGLISH
Pre-session public release:

**AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR ALTERNATIVE FUELS AND RELATED TECHNOLOGIES**

**Report of the Correspondence Group**

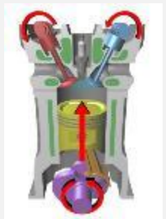
**Submitted by Norway**

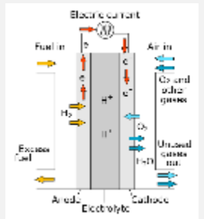
**SUMMARY**

| | |
|---|---|
| Executive summary: | This document provides the report of Correspondence Group on Development of Technical Provisions for the Safety of Ships using Alternative Fuels regarding hydrogen, ammonia, methylethyl alcohol and low-flashpoint oil fuels |
| Strategic direction, if applicable: | 2 |
| Output: | 2.3 |
| Action to be taken: | Paragraph 81 |
| Related documents: | CCC 8/3, CCC 8/3/4, CCC 8/3/5, CCC 8/3/10, CCC 8/3/11, CCC 8/3/12, CCC 8/3/15, CCC 8/WP.3, CCC 8/INF.17, CCC 8/INF.18, CCC 10/3, CCC 10/3/Rev.1, CCC 10/3/1, CCC 10/3/3, CCC 10/3/5, CCC 10/3/6, CCC 10/3/7, CCC 10/3/15, CCC 10/3/17, CCC 10/INF.16, CCC 10/INF.27, CCC 10/WP.5 and CCC 10/WP.6 |

## BV Rules
## published in 2023, revised in 2025

| | |
|---|---|
| BV dedicated Rule note | **BV NR678**<br>Issued in Nov 2023<br>Updated in April 2025 |
| Development status | Application specificities to be specified in **Rules for Yachts** and **Ships less than 500 GT**<br>(NR500) and NR566) |
| Tanker using its cargo as fuel | |







**Machinery :**

**Internal Combustion Engine and Fuel Cell**

- **Risk assessment**
- **Arrangement onboard**
- **Control of atmosphere**
- **Materials compatibility (embrittlement)**
- **Bunkering Equipment**
- **Fuel Containment System**
- **Venting and Pressure Relief**
- **Hydrogen Piping**
- **Fire Protection**

# HYDROGEN AS CARGO

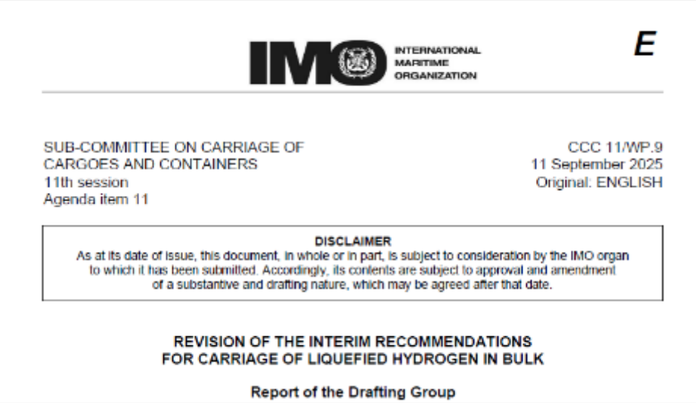
## IMO
### Revised Interim Recommendations to be adopted in May 2026

| | Liquid Hydrogen |
|---|---|
| Ship Safety | SOLAS |
| Cargo Safety | **IGC Code**<br>+ MSC.565(108) Part on membrane finalized at CCC11 (2025) |
| Bunkering Safety | No specific framework : same requirements as for a cargo transfer operation |

**Draft Amendments to Revised Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk**

for Adoption at IMO MSC 111 (May 2026)

- Part A: General requirements
- Part B: Independent cargo tanks using vacuum insulation
- Part C: Independent cargo tanks using insulation materials and hydrogen gas in inner insulation space
- New Part D: Membrane-type cargo tanks maintaining insulation spaces under vacuum respectfully



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SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS
11th session
Agenda item 11

CCC 11/WP.9
11 September 2025
Original: ENGLISH

DISCLAIMER
As at its date of issue, this document, in whole or in part, is subject to consideration by the IMO organ to which it has been submitted. Accordingly, its contents are subject to approval and amendment of a substantive and drafting nature, which may be agreed after that date.

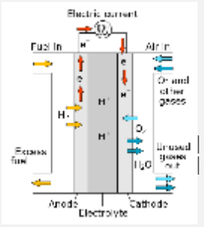
REVISION OF THE INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK

Report of the Drafting Group

## BV Rules
### published in 2023, revised in 2025

| | Liquid Hydrogen |
|---|---|
| Ship Safety | **BV Rules Steel Ships**<br>**NR467 Pt B & C** |
| Cargo Safety | **BV Rules Steel Ships Gas Carriers**<br>NR467 Pt D Ch 9 (July 2025) Based on IMO MSC.565(108) |
| Bunkering Safety especially Bunkering station & transfer system | **To be developed** |

# FUEL CELL




## IMO
## Interim Guidelines published in 2022

| | |
|---|---|
| Functional requirements, goals and principles (Ship design, construction and operation) | **MSC.1/Circ.1647** Interim guidelines for the safety of ships using fuel cell power installations<br><br>Approved by MSC105 (04/2022) |
| Detailed requirements related to Ship design, construction and operation | |
| Functional requirements and goals related to training | |
| Gas carriers and/or tankers using their cargo as fuel | N/A |

**Will start review in Sept 2026**

## BV Rules
## revised in 2022

**Fuel Hydrogen (NR 678)**

- Supply logistics
- Bunkering
- Storage

**Power generation (NR 547)**

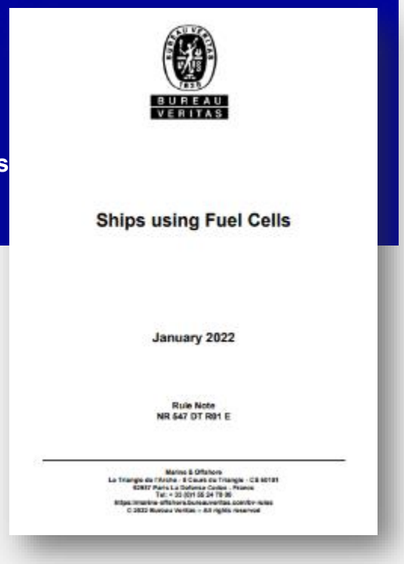
Fuel Reforming (optionnal) → Fuel Cell → ***Electrical and/or Thermal Energy***

**Power generation (NR 678)**

Internal Combustion Engine → ***Mechanical Power***

### Rules revised in **January 2022**

- **General**
- **Safety assessment**
- **Materials**
- **General arrangement**
- **Fuel cell power installation**
- **Fire safety**
- **Electrical systems**
- **Control, monitoring and safety systems**
- **Onboard testing**
- **Survey at works and certification**




## Message

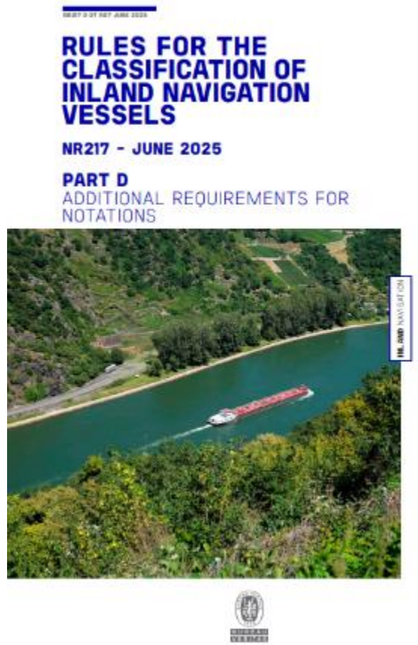
| | |
|---|---|
| Development status | **Update planned Q1 2026** |
| | Specificities for **Yachts** and **Less than 500 GT** |

# INLAND NAVIGATION : CESNI – ES-TRIN

| | | Hydrogen | Fuel Cells |
|---|---|---|---|
| ESTRIN | Functional requirements, goals and principles | **ES-TRIN 2021**<br>Chapter 30 and Annex 8<br>applicable to craft operating on fuels with a flashpoint equal to or lower than 55 °c | |
| | Detailed requirements related to Ship design, construction and operation | **ES-TRIN 2027**<br>**Annex 8**<br><br>Entry into Force<br>January 2028 | Annex 8 |
| BV Classification Rules | Additional service feature | To be developed, may may be covered by **LFPfuel** as needed | **Fuelcell** |
| | Rule reference | | **INLAND Rules**<br><br>**(NR217 Pt D, Ch 4)** |

**Color Code**

- In force
- Published
- Finalized, not published
- Not covered

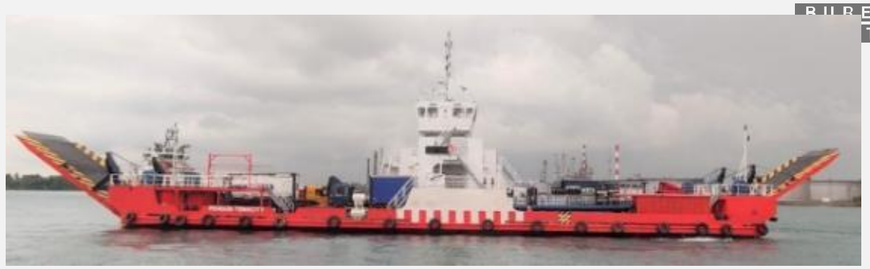


# SOME PROJECTS – FUEL CELL

Silver Nova, Royal Caribbean.
LNG fuel. [4 MW fuel cell.]

Viking Neptune, Viking.
100 kW fuel cell.


MF Hydra, Norled. 2021
Liquid Hydrogen (4T, 56 $m^3$).
2x200 kW PEM fuel cell.



Penguin, Demonstraor. VINSSEN
60kW FC. Compressed $H_2$

San Xia Qing Zhou 1 Hao
(Three Gorges Hydrogen Boat 1)
500 kW Fuel cell.

Sea Change, 2023.
3 x 120 kW PEM fuel cell
242 kg, 250 bar.

Dredger “Hydromer”, 2024
200 kW PEM fuel cell
500 bar, 2 T.

World Europa, SOFC 150 kW
Demonstrator BloomEnergy

Zulu 06, PEM FC 2 x 200 kW.,
280 kg Hydrogen, 300 bar, 14 m3

Alba, 2 x 70 kW PEM fuel cell,
2024
350 bar, 75 kg.

Project NAVHYS
HORIZON EUROPE : 5 ME
$LH_2$ below deck
Ariane, BV, …

# FUEL CELL OEM AND BUREAU VERITAS

- PEM
- SOFC

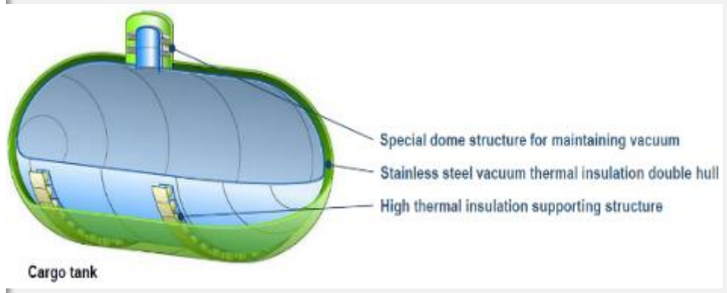
BUREAU VERITAS

- BALLARD
- Helion HYDROGEN POWER by ALSTOM
- Cummins + HYDROGENICS — SHIFT POWER | ENERGIZE YOUR WORLD
- Genevos EFFICIENT INNOVATIONS
- GENVIA
- EODev
- Bloomenergy
- PM Fuel Cells · Power Systems
- VINSSEN
- EKPO FUEL CELL TECHNOLOGIES
- TECO 2030
- NEXEYA A Hensoldt Company.
- Alma
- inocel Hydrogen powered solutions
- Air Liquide
- ADVENT
- DOOSAN

# PROJECTS TRANSPORTATION LIQUID $H_2$

## Limited experience in $LH_2$ transportation

- Currently, only **one vessel** ("*SUISO FRONTIER*") built by Kawasaki, Japan. **Delivered in 2021**. (not BV)
- Purpose : to test and prove transportation of bulk $LH_2$ by sea, this is a **pilot vessel**.
- Transport Liquid $H_2$ from Australia (Hastings) to Japan (Kobe). Hydrogen produced through gasification of brown coal with carbon capture and storage ("*blue*" $H_2$)
- $LH_2$ storage tank of **1,250m³** at -253°C, Type-C.
- Double-shell vacuum-insulated. Inter space supported by high strength glass fiber reinforced plastic.
- The vessel uses Diesel-Electric propulsion
- Note : Incident in Australia earlier this year (*Gas Combustion Unit*)




- **BV Projects :**
  - Approval-in-Principle (AIP) for large 150,000 m3 Liquefied $H_2$ carrier
  - AIP for 75,000 m3 Liquefied $H_2$ floating barge
  - AIP for 18,000 m3 Liquefied $H_2$ carrier
  - AIP for 230 m3 Liquefied $H_2$ tank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