GUIDELINES

COMPETENCE REQUIREMENT FOR THE OPERATION OF CRAFT USING **GASEOUS HYDROGEN AS A FUEL**

November 2026



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CESNI

European Committee for drawing up Standards in the field of Inland Navigation

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PART I
INTRODUCTION

1. Objectives and addressees

The CESNI Working group on professional qualifications drew up guidelines for competences for the operation of craft using gaseous hydrogen as a fuel. At this stage, only compressed hydrogen (gaseous form) is addressed.

The guidelines are intended to address first the training institutes and schools that train students in new technologies. They can also address craft owners, who are responsible for ensuring that the crew is trained in new technologies. They can also serve a useful source of information for insurance companies, which insure the crew against work-related accidents and are therefore likely to set requirements for crew members.

2. Methodology

To work out the guidelines, experts identified the following main risks linked to the operation of craft using hydrogen as a fuel:

- **High flammability and high explosivity**: a simple match with a small quantity of hydrogen may generate an explosion. The risk of fire and explosion is higher than with methanol for example, especially in enclosed spaces or inadequately ventilated areas.
- **Electrostatic risk**: equipment that handles or transports hydrogen can accumulate electrostatic charges. These charges can discharge suddenly, creating sparks that can trigger an explosion if the gas is present in sufficient concentration.
- **Important risk of leaks**: the molecule of gaseous hydrogen (H_2) is small and can leak more easily. Hydrogen is *colourless, odourless and non-toxic* so it cannot be identified without a dedicated detector. In slow combustion, the flaming leak is almost invisible.
- **Acoustic risk:** the noise generated by a hydrogen leak is very significant, due to the size of the molecules, of the immense pressure under which it is stocked (350 bar) and the speed of leak. For example, a hydrogen leak at a pressure of 200 bars can easily reach 140 decibels.
- **Material embrittlement** (steel, piping, components) can cause damage to the vessel structure and components. It creates new specific needs for maintenance.
- **Use of rack of bottles of compressed hydrogen**: their handling can cause damage and requires therefore specific knowledge.

Other elements have been considered during the elaboration of the guidelines:

- An application-oriented and coherent approach has been applied for this guideline. It is intentionally formulated in an open manner to enable the examination commissions of the Member States to adapt the content of examinations to the latest legal and technical framework.

PART II
COMPETENCE TABLE FOR THE OPERATION OF CRAFT USING GASEOUS HYDROGEN AS A FUEL

1. The specialised person shall be able to identify the characteristics of compressed hydrogen and ensure safe handling

The specialised person shall be able to:

COLUMN 1 COMPETENCE	COLUMN 2 KNOWLEDGE AND SKILLS
1. identify possible hazards of compressed hydrogen;	1. Knowledge of physical and chemical properties of both, hydrogen in its natural form and as a compressed gas. 2. Knowledge of possible hazards of compressed hydrogen (such as high flammability, pressurized gas, embrittlement, …). 3. Knowledge of measures to mitigate risks presented by compressed hydrogen and its storage. 4. Ability to raise awareness of other crew members regarding the properties and possible hazards of compressed hydrogen.
2. ensure safe handling of compressed hydrogen and related equipment.	1. Knowledge of storage systems for compressed hydrogen. 2. Knowledge of issues that can arise on a compressed hydrogen storage systems component. 3. Knowledge of emergency procedures. 4. Knowledge of safe bunkering procedures. 5. Ability to implement and monitor safe working procedures. 6. Ability to take appropriate actions in case of a leakage of compressed hydrogen.

2. The specialised person shall be able to ensure compliance with legislation regarding the use of compressed hydrogen as a fuel.

The specialised person shall be able to:

COLUMN 1 COMPETENCE	COLUMN 2 KNOWLEDGE AND SKILLS
1. identify hydrogen-relevant regulations and ensure compliance with it.	1. Knowledge of relevant technical standards. 2. Knowledge of relevant police regulations. 3. Knowledge of relevant health and safety regulations. 4. Ability to instruct and monitor crew member operations in order to ensure compliance with relevant regulations.

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