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**Development of a proposal for  
technical regulations on the use of  
hydrogen as fuel in inland navigation**

On behalf of

**Deutsches Maritimes Zentrum e.V.**





Founded in 2017, the Deutsche Maritime Zentrum e. V. (DMZ) is an independent, publicly funded, cross-industry think tank based in Hamburg. It focuses on future topics such as non-fossil fuels, emission-free propulsion systems, modern safety systems and autonomous shipping. The core is formed by questions of the design and implementation of research, development and innovation in the maritime sector. They serve to increase knowledge, to further develop the state of the art and to strengthen the international competitiveness of Germany as an industry location.

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In the summer of 2021, the German Maritime Center commissioned the company Lloyds Register EMEA to “develop a proposal for technical regulations on the use of hydrogen as a fuel in inland navigation”.

## Management Summary

With this study a proposal for technical regulations for inland vessels that are operated with hydrogen as an energy carrier was developed. This proposal is intended to complement the European standard laying down technical requirements for inland navigation vessels (ES-TRIN) and be compatible with the existing regulations for other fuels. The international working body responsible for these regulations is the European Committee for drawing up Standards in the field of Inland Navigation. At present the current regulations for inland navigation vessels using fuels with a flash point of 55°C or below deal only with LNG. This study analyses how technical regulations for inland navigation vessels would need to be supplemented so that compressed or cryogenic (low-temperature) hydrogen could be used as a fuel. In addition it is examined how the technical principles of this draft regulation can potentially be transferred to seagoing vessels.

An important goal of the European Union is to shift more inland waterway freight traffic to rivers and canals in the EU and there to emission-free ships. This transfer should take place at the same time as the reduction of greenhouse gases and other pollutants by 2050.

The energy transition is a complex and time-consuming process for inland shipping which can be understood as an existential challenge. Only when inland navigation makes the transition to climate-neutral propulsion political support will be given to the development of this sector. In order to be able to use regenerative or alternative fuels including hydrogen on inland vessels across Europe without special permits in individual cases the European standard laying down technical requirements for inland navigation vessels must be supplemented accordingly.

Regulations for liquefied natural gas as a fuel have already been developed for the European Committee for the Development of Standards in the Field of Inland Navigation<sup>1</sup> and published with the European Standard of Technical Regulations for Inland Waterways. Regulations for fuel cells and methanol are currently still being discussed within the European Committee and are to be published shortly. So far neither the European Committee nor the International Maritime Organization (IMO) have developed regulations for hydrogen as a fuel. The updated legal framework aims to enable the regular use of alternative fuels on board inland waterway vessels. There are already a number of projects in which the use of liquid, cryogenic and compressed gaseous hydrogen as a fuel for ships has been tested or is being tested. Numerous project results and documents have been published that consider the particular dangers of hydrogen.

This study analyses how the European standard for inland waterway vessels needs to be supplemented to allow compressed or cryogenic hydrogen to be used on inland waterway vessels. Standards and other regulations for the transport and use of hydrogen and recommendations within the framework of pilot applications that use hydrogen as a fuel in inland navigation were examined for their relevance. The result is presented qualitatively in a gap analysis. A structure was drawn up for the new regulations to be developed which includes the definition of the ship-side technical requirements for the bunkering and storage of cryogenic and pressurized hydrogen and proposals for regulatory implementation. The regulatory requirements for cryogenic or compressed hydrogen on inland waterway vessels were examined with regard to a transfer of technical principles regardless of the vessel type.

In addition to the ES-TRIN, the recommendations of the Central Commission for Navigation on the Rhine (CCNR), the regulations of the classification society Lloyd's Register, the European Agreement concerning the International Carriage of Dangerous Goods on Inland Waterways, standards regarding hydrogen and

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<sup>1</sup> European Standard laying down Technical Requirements for Inland Navigation Vessels (ES-TRIN), Edition 2021/1

recommendations of the International Maritime Organization have been evaluated to develop the new text of the rules. The result is shown graphically in a qualitative gap analysis. The regulations under consideration provide to a varying extent the basics on the properties of hydrogen, storage of hydrogen and hydrogen as a fuel.

This draft of the rule text describes the scope of application and lists the necessary definitions. General requirements are presented such as requirements for the arrangement on the ship and for the system design, for fire protection and for the electrical systems, as well as for the control, for the monitoring and for the safety systems. Requirements for the energy converters are not included in this proposal. The regulatory proposal forms the basis for further discussion for the temporary CESNI working group `CESNI/PT/FC`.

Furthermore the transferability of the concept to seagoing vessels was examined, the objectives and functional requirements of the IGF Code<sup>2</sup> were described and compared with the ES-TRIN. Specific requirements for the carriage of hydrogen based on the Interim Recommendations for Carriage of Liquefied Hydrogen in Bulk<sup>3</sup> are compared with the specific requirements of the regulatory proposal and are qualitatively assessed.

The study comes to the conclusion that the European standard of technical regulations for inland waterway vessels (based on the existing structure for fuels with a low flash point and taking into account the specific properties and hazards) can be supplemented by hydrogen and recommends its implementation.

The supplements could be implemented based on prescriptive requirements or goal-oriented requirements or a combination of both.

Based on the ES-TRIN a structure is suggested. This follows the current structure of the supplementary requirements for fuels with a low flash point of the ES-TRIN and can be considered as constructive. Due to the safety concept of the IGF Code and the concept of the ES-TRIN a transfer of these supplementary technical regulations to international maritime shipping or coastal shipping is only conceivable to a limited extent and can only take place with special consideration of the individual risk minimization measures. An individual assessment of the regulatory proposals with regard to the overarching goal(s), the functional requirements and their fulfilment is recommended. Additional specific measures beyond the outlined regulatory proposal are presented. Finally specific requirements that are not or only partially suitable are presented in the regulatory proposal for a transfer.

The proposed draft of supplementary technical regulations for inland navigation craft - using hydrogen as a fuel with a low flash point - will support and accelerate the transition to further climate-neutral propulsion systems in inland navigation. The use of hydrogen in inland navigation can contribute to achieving the goals agreed in the Paris Agreement and the Mannheim Declaration.

The study came to the conclusion that the draft of the rule text should be presented to the relevant expert groups of the European committee for the development of standards in the field of inland navigation followed by a further discussion of the content and detailed definition of the requirements.

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<sup>2</sup> IMO MSC.391(95) – Adoption of the International Code of Safety for Ships Using Gases or Other Low-Flashpoint Fuels (IGF Code), Adopted on 11 June 2015

<sup>3</sup> IMO MSC.420(97) – INTERIM RECOMMENDATIONS FOR CARRIAGE OF LIQUEFIED HYDROGEN IN BULK, Adopted on 25 November 2016



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