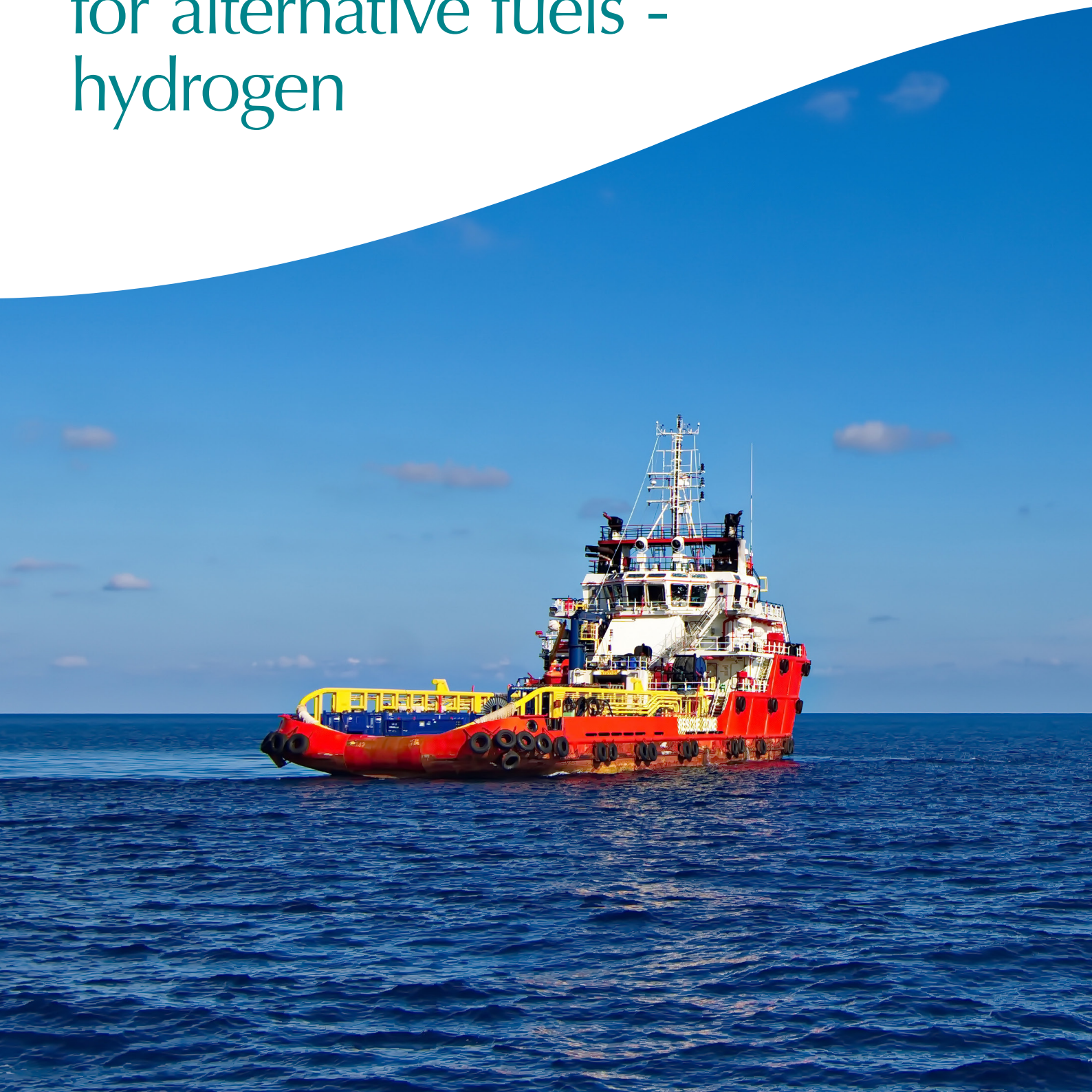
Maritime & Coastguard Agency

Safer lives, safer ships, cleaner seas

MCA customer process for alternative fuels - hydrogen



Overview

Hydrogen (H2) is a light, volatile, colourless, and extremely flammable gas. Due to the chemical composition of the fuel, hydrogen is considered a zero-carbon fuel with no carbon in the chemical molecule. It does have flammability and explosive issues which require special handling for storage and transport.

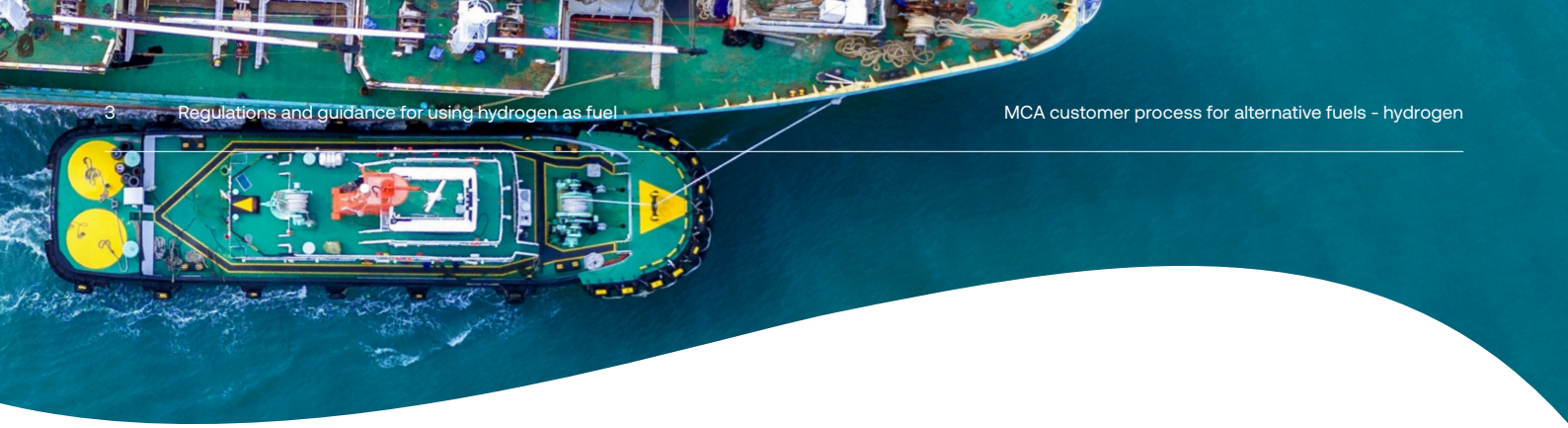
For vessels above 500GT, the Maritime and Coastguard Agency (MCA) works with operators and Classification Societies to regulate vessels using hydrogen as a marine fuel, under the International Maritime Organisation's (IMO) International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code). These are applicable through the use of the alternative design arrangement. The MCA is also currently developing interim guidelines for the use of Liquefied Hydrogen at the IMO. For vessels carrying hydrogen as cargo, they can utilise the IMO's International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk (IGC Code) interim guidelines. For smaller vessels using hydrogen as fuel, no prescriptive regulations currently exist and are considered on a case-by-case basis, guided by experts from MCA's Technical Operations, Regulation and Standards and Seafarer Technical Delivery teams.

Advantages of hydrogen as fuel

- Hydrogen is stored as either a compressed (at around 350 bar) or refrigerated (at around -253°C)
- It has the potential to be carbon-neutral when produced using renewable energy. Low emissions compared to existing marine fuels (when viewed on a life cycle basis).
- Can be used in existing marine diesel engines or fuel cells by carrying out appropriate modifications, which should be duly approved by the relevant Classification Society or Recognised Organisation
- Limited toxicity or environmental effects when compared to other fuels.
- Used in many other land-based applications such as cars and industrial applications.
- Naturally buoyant in air resulting in a quick dispersal in air upwards.

Challenges associated with using hydrogen as fuel

- Storage requirements can be hard to keep it refrigerated with high levels of boil-off.
- Material selection is important due to hydrogen embrittlement causing stresses and cracking.
- Low ignition energy can lead to explosions or jet flames from leaks. This results in increased structural protection around storage and pipes.
- Due to the molecule size, it is hard to stop small level of leaks from the system.
- Lower energy density compared to traditional fuels therefore requires significantly larger fuel tank capacity when compared to diesel. This can be a challenge especially for retrofit vessels.
- Most hydrogen today is 'grey' (produced using natural gas). These types of hydrogen are not sustainable as truly 'green fuels' due to their production methods and overall, from a 'well-to-wake' perspective, they can generate more emissions than fossil diesel. It is however anticipated that suppliers will move towards more sustainable production methods in the future.
- Hydrogen is currently more expensive compared to traditional fuel types.



Regulations and guidance for using hydrogen as fuel

IMO is currently developing interim guidelines for using hydrogen as fuel and these should be used by owners/operators wishing to build new vessels or convert existing vessels to run on hydrogen. These are expected to be approved by 2026. This guidance should be used in conjunction with IMO's International Code of Safety for Ships using Gases or other Low-flashpoint Fuels (IGF Code). Until these are approved the use of the functional goals in the IGF code is still allowed to demonstrate safety.

As part of the requirements, the IGF Code requires that an Alternative Design Arrangement (ADA) is submitted to the Administration to be notified to the IMO. The ADA is a risk-based design process, catered for under SOLAS, which identifies the main hazards/risks associated with the operation and mitigates them to the satisfaction of the flag administration and other stakeholders. Full guidance on the ADA process is published in MSC Circular, MSC.1/Circ.1212, and should be closely followed by owners/operators prior to submission to the MCA as part of the plan approval process. The ADA process usually requires several iterations before final sign off, the number of iterations is very much dependant on the quality and thoroughness of the submission. Owners/operators are therefore encouraged to ensure submissions are of a high standard to minimise the number of iterations required to reach approval and final sign off. Repeat and similar designs that have already gone through the ADA process, are usually signed off in a much shorter timescale.

Ships below 500GT or not having to comply with the IGF code, can follow a similar process which is described in Marine Guidance Note 664 (MGN664). This is also a risk-based process and closely follows the ADA process already mentioned. The MCA is also working to develop requirements, for domestic vessels under 24m in length wishing to use hydrogen as fuel, as part of the 'The Workboat Code 3' and will be published in future editions of this Code.

Crew training requirements for alternative low flash point fuels are currently covered by the IGF training requirements under the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW) which includes hydrogen. The MCA is currently engaging with training providers to develop a weeklong hydrogen course for convention-sized vessels with initial courses expected to be launched in mid-2025. Basic training for the use of hydrogen as fuel will be introduced into the UK curriculum from September 2025, as part of the new syllabus developed under the Cadet Training and Modernisation (CT&M) programme. Longer term, through the IMO, training for alternative fuels, including hydrogen, will be included as part of the comprehensive review of the STCW, with a timeline expected to be 2030.

Following approval of the ADA/MGN664 and associated plans, the remainder of the process follows a conventional route through survey of the vessel, ensuring the installation is built in accordance with the approved plans, leading to final certification.

Delegated authority

As described in the previous section the process of certification is currently based around the ADA/MGN664 process, based on size of vessel.

If the vessel is to follow the ADA process, then a Recognised Organisation (RO) would usually be involved in this process. Depending on the level of involvement of the RO they might need to sign a Project Specific Agreement. This, and other specifics of any delegation, would be discussed in the initial meeting of the project. This level of delegation is highly dependent on the initiative risk of the project and the capabilities of the RO. The MCA would always retain the final approval for the project before issuing any exemption or equivalence.

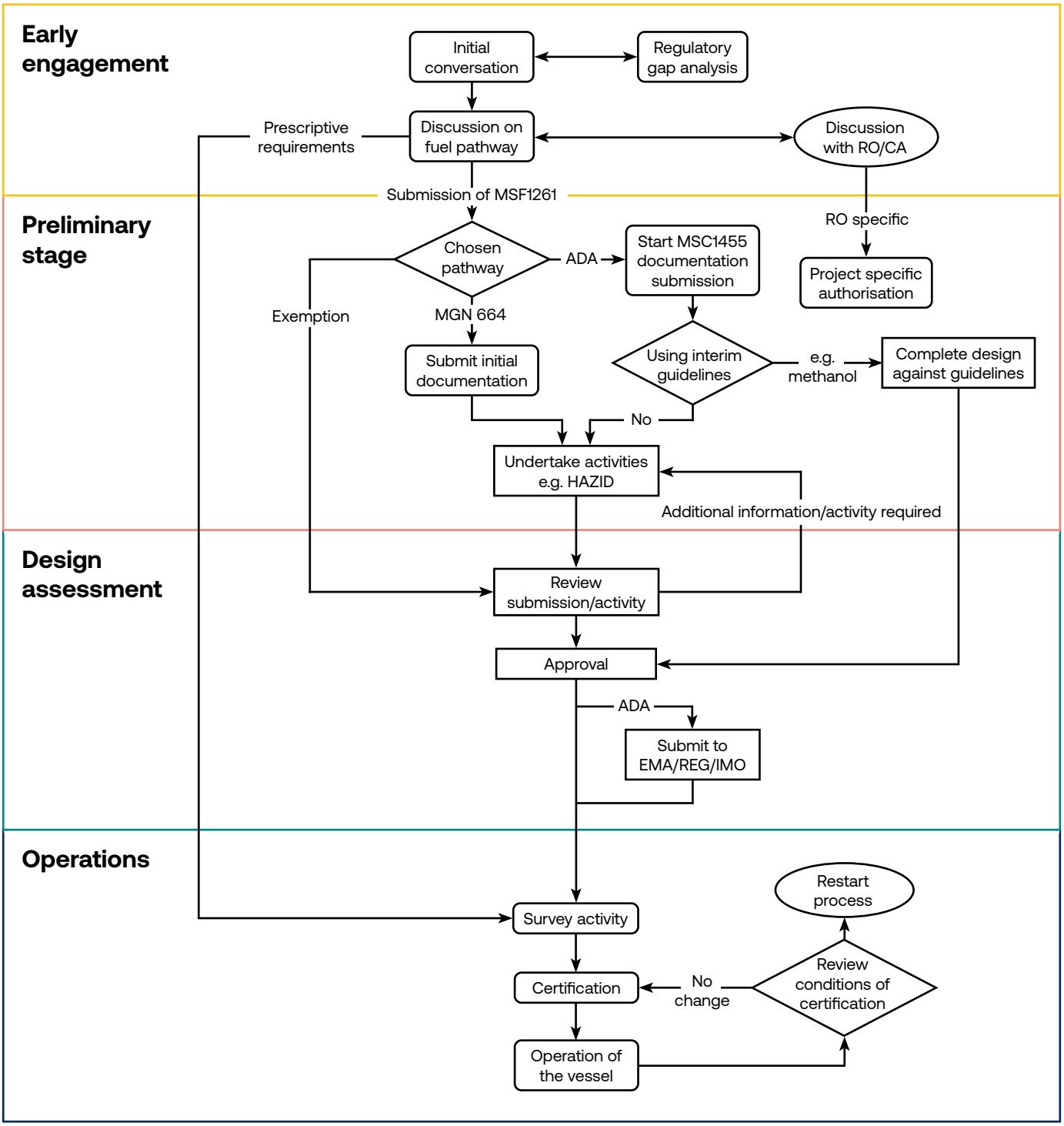
An indicative table of the activities undertaken and the responsibility is described in the table below.

Activity	Responsibility	Outcome Objective
Initial meeting.	Operator/MCA/Classification Society	Introducing the project and initial design. Discussion around approval process and timelines to reach certification.
Submission of plans including a gap analy-sis against the interim guidelines with any requests for exemptions, equivalencies supported by ADA and associated safety case/ engineering analysis.	Operator/Classification Society/ Specialist Marine Consultant	Demonstration of compliance against published standards, identifying gaps against those standards and, where required, provision of mitigation to support equivalent levels of safety.
Review and approval of the plans, exemptions, equivalents and ADA.	MCA	Approval allows design to be finalised and project to progress in ac-cordance with agreed requirements. This is an iterative process.
Seafarer qualifications and training.	Operator/MCA	Specific crew training requirements associated with the operation and use of hydrogen such as fuel handling will be identified.
Land based infrastructure, availability and quality of hydrogen.	Port Authorities/Health and Safety Executive (HSE)/Fuel Suppliers	Operators should consult the appropriate authorities to ensure adequate infrastructure, supply and quality of hydrogen exists for their areas of operation.

Timelines

Below is a diagram of the process described above with the different stages.

As can be seen much of the activity is related to activities being undertaken by the submitter. The MCA would review the outcomes of these activities within a maximum of 28 days. Due to this being a cyclic process the overall time for a project is mostly based on the quality of the application and the overall risk levels of the project. Once a project has had an initial meeting and started submissions with the MCA for a project, then better estimates for approval time can be provided.



Key contacts

Any existing customers wishing to build or convert a vessel to operate using hydrogen as fuel are encouraged, in the first instance, to contact their MCA Customer Service Manager who will be able to advise further on the process and where necessary set up a meeting with MCA subject matter leads to discuss the proposals in detail.

New customers or those without a Customer Service Manager should contact:

HQSurvey@mcga.gov.uk

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