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Regulations Relevant at Aerodromes Utilising Hydrogen

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Disclaimer

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Executive Summary

This report has been commissioned from the Health and Safety Executive by the Civil Aviation Authority to aid aerodromes in their potential transition to hydrogen powered flight. It signposts regulations that would need to be considered by duty holders in ensuring safe installation and operation of hydrogen on sites, although it remains the duty holders' responsibility to ensure all relevant regulations are complied with. Where available, Approved Codes of Practice have also been indicated.

In addition, the report has collated many codes, standards and guidance related to equipment and activities that may be required as a result of the installation of hydrogen infrastructure.

Revision History

Version	Date	Author	Description of Changes
1.0	July 2026	Helen Brocklehurst	Initial release

Abbreviations

Abbreviations	
ACOP	Approved Code of Practice
ASTM	American Society for Testing and Materials
ATEX	Atmosphères Explosibles
BCGA	British Compressed Gas Association
BSI	British Standards Institute
CAA	Civil Aviation Authority
CDG	Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations
COMAH	Control of Major Hazard Regulations
COSHH	Control of Substances Hazardous to Health
DfE	Department for Economy
DSEAR	Dangerous Substances and Explosive Atmospheres Regulations
EIGA	European Industrial Gas Association
GH2	Gaseous hydrogen
HSE	Health and Safety Executive
HSENI	Health and Safety Executive for Northern Ireland
HSG	Health and Safety Guidance
HSWA	Health and Safety at Work Act
ICC	International Code Council
ISO	International Organisation for Standards
LH2	Liquid hydrogen
LOLER	Lifting Operations and Lifting Equipment Regulations
MAPP	Major Accident Prevention Policy
MHGLG	Ministry of Housing Community and Local Government
NASA	National Aeronautics and Space Administration
NFPA	National Fire Protection Association
PESR	Pressure Equipment Safety Regulations
PGS	Publicatiereeks Gevarlijke Stofen
PSSR	Pressure Systems Safety Regulations
PUWER	Provision and Use of Work Equipment Regulations
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations

Abbreviations	
SAE	Society of Automotive Engineers

Introduction

Objective

The objective of this work is to provide the Civil Aviation Authority (CAA) with an overview of UK Health and Safety regulations that need to be considered as aerodromes potentially transition to the use of hydrogen for aviation fuel.

Scope

An aircraft is not defined as a workplace in the context of Health and Safety legislation. The legislation listed in this report therefore applies solely to aerodrome-based activities, including ground handling operations and maintenance, and not to activities relating to the crew and passengers on the aircraft, which comes under the regulatory remit of the CAA. The Health and Safety Executive (HSE) and CAA have a long-standing history of collaboration managing the interface between regulatory boundaries which is formalised by an existing memorandum of understanding. The analysis has focussed solely on civil aerodromes, i.e. Ministry of Defence sites are not covered in this report. Only UK legislation for which the HSE is the enforcing body is included, except for Planning (Hazardous Substances) Regulations 2015, which are enforced by the Hazardous Substances Authority, (usually the local planning authority) for which HSE is a statutory consultee.

Other legislation, for example environmental, is not included. Worldwide legislation is out of scope, although references to some codes are included as they provide useful background information, although adhering to them does not guarantee legal compliance in the UK.

The legislation considered within this report does not represent an exhaustive list of legislation that may apply to workplace health and safety in aerodromes. Further information on health and safety legislation is available on HSE's website.

HSE keeps its regulatory framework under review and is engaging with industry as new technologies are developed to ensure the health and safety regime in Great Britain remains fit for purpose and enables innovation. It is expected that the standards will evolve as the technology to support the introduction of hydrogen at aerodromes matures.

It remains the responsibility of any individual operator to consider which regulations would apply to their specific circumstances and operations.

Health and Safety Regulation in the UK

HSE's Role

The Health and Safety Executive (HSE) [1] is Great Britain's national regulator, primarily responsible for enforcing workplace health and safety legislation, preventing work-related death, injury, and ill health.

HSE was established under the Health and Safety at Work etc. Act 1974 [2], and operates as an independent, non-departmental public body sponsored by the Department for Work and Pensions.

The Health and Safety Executive for Northern Ireland (HSENI) is the lead body responsible for promoting and enforcing health and safety at work standards in Northern Ireland. It is an executive non departmental public body sponsored by the Department for the Economy (DfE). HSE/ HSENI engage with industry sector through a variety of forums, and support information exchange between sectors.

The Health and Safety at Work etc. Act 1974

The Health and Safety at Work etc Act 1974 [2], also referred to as HASWA, HSWA or HSW, is the primary piece of legislation covering occupational health and safety in Great Britain. The Health and Safety Executive is responsible for enforcing the Act. From this point on we will refer to HSWA.

HSWA sets out the general duties which:

- employers have towards employees and members of the public
- employees have to themselves and to each other

The primary responsibility for managing risk to health and safety lies with the duty holders. A duty holder is the person or organisation that creates the risk. They are legally responsible for managing and controlling risks under health and safety law.

HSWA sets out what duty holders must achieve, but not how they should achieve it. This goal-setting approach gives duty holders discretion to put sensible and proportionate measures in place to protect people. This allows for creativity and improvements in protective measures and enables technological innovation and new working practices.

Where necessary, the law sets out specific requirements on duty holders, for example, in relation to certain work activities or substances with the potential for high risks for people and workers. More details on HSE's approach to regulation and enforcement can be found in on the HSE website [3].

Hydrogen Usage at an Aerodrome

This section outlines the planned hydrogen use at an aerodrome, obtained through a series of conversations with the CAA. This is therefore not specific to a given aerodrome or configuration, rather it covers the CAA's understanding of potential developments within the civil aviation landscape in the UK. It will also not cover the certification of hydrogen powered aircraft, including the airframe itself and its power source, whether gas turbine, fuel cell or other, which sits within the remit of the CAA. The approach to the selection of relevant regulations is also explained.

Aerodrome Operation Outline

The focus of this report is the regulations relevant to the operation of equipment required to operate with hydrogen on an aerodrome and not to its design or installation, although the responsibilities imposed by land use planning are included, for which HSE is a statutory consultee (see the section The Planning (Hazardous Substances) Regulations 2015 for more detail). It is not possible to define the specific equipment covered by the regulations considered in this report, as this will depend on the particular installation, rather this report signposts regulations that are likely to be relevant, based on the following understanding of potential aerodrome hydrogen-related activities.

- Hydrogen generation: aerodromes could choose to generate their own hydrogen on site.
- Hydrogen tankering: initial installations may rely on hydrogen tankers bringing the fuel to site.
- Hydrogen storage: significant quantities of hydrogen will be required, and this may be at pressure (>0.5 bar from a legislation perspective) and/or at cryogenic temperatures. This will be in addition to existing stores of jet fuel.
- Usage for ground-based transport; airports may use their hydrogen supplies to fuel their airside transport, including passenger buses and baggage transport.
- Aircraft refuelling and defueling; this will need to occur in parallel with kerosene refuelling activities.
- Incident management and reporting; sites will need processes to manage incidents related to hydrogen usage leading to actual or potential harm including risk management and incident reporting and ensuring lessons are learnt.

Equipment and Activities Associated with Hydrogen on Site

Based on activities required to support the use of hydrogen on an aerodrome listed above, the following equipment and activities have been identified as being subject to regulations in addition to the Health and Safety at Work Act (HSWA), which are covered in more detail in the section

Regulations.

- Storage of significant quantities of hydrogen in addition to kerosene.
- Storage of pressurised gases.
- Electrolysis equipment.
- Electrical infrastructure to support electrolysis and hydrogen liquefication, battery charging and pumping activities.
- Venting or hydrogen recovery system.
- Cryogenic pumping equipment.
- Gaseous pumping equipment.
- Liquefaction equipment.
- Management of leakage and spills.
- Incident planning, management and reporting.
- Battery charging equipment.
- Loading of tankers with liquid hydrogen.

Regulations

In addition to the obligations under the HSWA, the activities involved in operating an aerodrome with hydrogen are expected to be covered by the UK regulations presented in this section. Duty holders are responsible for the selection of applicable regulation.

Twelve specific regulations have been identified that apply to the generation and use of hydrogen within an aerodrome. These specific regulations are introduced below, and an overview of the responsibilities provided.

Many of the regulations summarised in this section have a published Approved Code of Practice (ACOP) that contain advice on the practical application of the regulations. By following the advice within an ACOP, the legal requirement of the associated regulation will be complied with. It should be noted, however, that an ACOP guidance document is not legally binding, so alternate methods of compliance can be used. This document outlines the scope and general expectations required of an aerodrome under these regulations, but it is advised that each aerodrome becomes familiar with these regulations in full to ensure full compliance. The ACOP and standards that could aid in compliance with each regulation are included with the relevant regulation listed.

The regulations listed below cover the primary areas which will be relevant to the potential usage of hydrogen on an aerodrome, and compliance with these regulations is covered through the project specific processes being implemented (some of which are described in this document) as well as local health and safety processes/policies.

The Management of Health and Safety at Work Regulations 1999 (Regulation 3)

The Management Regulations [4] generally make more explicit what employers are required to do to manage health and safety under the Health and Safety at Work Act. Like the Act, they apply to every work activity.

The main requirement of The Management of Health and Safety at Work Regulations 1999 (Regulation 3) is to assess the risks that employees are exposed to while they are at work. For organisations with five or more employees, the risk assessment needs to be recorded. Five simple steps are followed.

1) Identify the hazards.
2) Decide who might be harmed and how.
3) Evaluate the risks & decide on precautions.
4) Record the significant findings
5) Review the assessment and update as necessary.

Further details can be found in HSE’s Managing for health and safety (HSG65) [5].

The Construction (Design and Management) Regulations 2015

The Construction (Design and Management) Regulations 2015 (CDM 2015) set out the legal framework for managing health, safety, and welfare on all UK construction projects.

Aerodrome operators may have duties under the Construction (Design and Management) Regulations 2015 [6]. The Regulations aim to make sure any construction project is safe to build, use and maintain and offers good value through the following steps.

- Sensibly plan the work so the risks involved are managed from start to finish.
- Have the right people for the right job at the right time.
- Cooperate and coordinate your work with others.
- Have the right information about the risks and how they are being managed.
- Communicate this information effectively to those who need to know.
- Consult and engage with workers about the risks and how they are being managed.

HSE has published Legal Series guidance that supports CDM 2015 and explains it in more detail [7].

Control of Major Accident Hazard (COMAH) Regulations 2015

The Control of Major Accident Hazards (COMAH) Regulations 2015 [8] are designed to ensure that businesses take all necessary measures to prevent major accidents involving dangerous substances and to limit the consequences to people and the environment of any major accidents which do occur.

Hazardous substances are defined, and sites containing these substances are separated into upper tier sites and lower tier sites, depending on the quantity of the substance. Hydrogen is included in the list of defined substances. For hydrogen, the lower tier threshold is 5 tonnes and the upper 50 tonnes, which applies to the total site inventory. The different tiers of sites are associated with different obligations for the business.

COMAH accounts for all dangerous substances used on the site in question, so sites containing multiple hazardous substances below the lower threshold may still fall within scope of the regulations. This is calculated using a fraction addition for similar hazardous substances (for example, all flammable substances would be added). For instance, the lower thresholds of hydrogen and kerosene are 5 tonnes and 2500 tonnes respectively. If a site has 4 tonnes of hydrogen and 2000 tonnes of kerosene present, the aggregation fraction to the respective lower threshold limit would be calculated as follows:

$$\frac{4}{5}+\frac{2000}{2500}=1.6$$

Where the aggregation is greater than 1, COMAH applies. Again, this applies to the total site inventory of all relevant hazardous substances.

The main requirements of COMAH are as follows.

- Notification of the competent authority when substance thresholds are met, or quantities of the hazardous substance are increased.
- The creation of a Major Accident Prevention Policy (MAPP).
- A Safety Management System (SMS) capable of implementing the MAPP.
- Information for the public and nearby sites that could be affected by an accident.

Upper tier sites must follow the lower tier requirements as well as a producing a detailed safety report, on-site emergency plan and to provide information to the local authorities for emergency planning. The following HSE documents, available on the HSE website, provide additional guidance.

- A guide to the Control of Major Accident Hazards Regulations (COMAH) 2015 (L111) [9].
- HSG190 – Preparing safety reports: Control of Major Accident Hazards Regulations 1999 (COMAH) [10].
- HSG 191 Emergency Planning for major accidents: Control of Major Accident Hazards Regulations 1999 (COMAH) [11].
- HSG 143 Designing and operating safe chemical reaction processes [12].

Dangerous Substances and Explosives Atmospheres Regulations (DSEAR) 2002

The Dangerous Substances and Explosive Atmospheres Regulations 2002 (DSEAR) implement the Directive 1999/92/EC, which covers ATEX 137/153, the ATEX Workplace Directive and ATEX 114, the ATEX Equipment Directive [13]. The intention is to protect people from the risk of fire, explosions, and the corrosion of metal in the workplace. This is achieved by placing responsibilities on employers and the self-employed to identify and control dangerous substances that can cause such events in their workplace.

A wide range of substances meet these criteria, and they can be found in many workplaces. Hydrogen is categorised as a flammable gas or liquid and, as such, falls within the scope of DSEAR. In addition, its storage at pressure, whether gaseous or liquid, brings the usage of hydrogen within DSEAR, along with any pressurised inert gases used for purging activities.

The duties under these regulations require employers to identify the dangerous substances, then control and mitigate the risk. The safest way to do this is to substitute the dangerous substance where practicable. An example of this is to carry out pressure tests using a non-flammable substance.

Where the risk cannot be eliminated, such as the use of hydrogen within an aerodrome, the following control measures must be implemented, in priority order as follows.

- Reduce the quantity to a minimum.
- Avoid or minimise a release.
- Control releases at the source.
- Prevent the formation of a dangerous atmosphere.
- Collect, contain and remove any releases to a safe area.
- Avoid ignition sources.
- Avoid adverse conditions that could lead to danger.
- Keep incompatible substances apart.

As well as these control measures, mitigation measures are also required to limit the impact of a potentially harmful event.

- Reduce the number of employees exposed.
- Provide explosion and corrosion resistant plant.
- Provide explosion suppression or relief equipment.
- Control or minimise the spread of fires or explosions.
- Provide suitable personal protective equipment.

Emergency procedures and training for employees on the dangerous substance, risk assessment and procedures are also required.

Aerodromes generating and using hydrogen will fall under the scope of DSEAR, so any installation will require a full DSEAR assessment once complete. Further information on DSEAR can be found on the HSE website [15] [16]. The ACOP for DSEAR (L138) [17] gives practical advice on how to comply with the law and is available on the HSE website.

Pressure Equipment Safety Regulations (PESR) 1999

The Pressure Equipment Safety (Amendment) Regulations 2015 (PESR) [18] apply to the design, manufacture and conformity assessment of pressure equipment with a maximum allowable pressure of greater that 0.5 bar (gauge) and as such will apply to the usage of hydrogen on an aerodrome.

The objective of the PESR is to ensure that pressure equipment is safely designed and manufactured with regards to pressure hazards. Aerodromes are likely to utilise 3rd party vendors for the construction of pressure vessels, piping and accessories, consequently the primary section of interest in PESR relates to the testing and conformity of articles sourced from third parties so that the quality of items procured can be demonstrated. Relevant evidence of conformity, CE marks and instructions should be pursued from the manufacturer and retained by an aerodrome.

There may also be responsibilities under PESR if pressure equipment is imported from outside the UK: in this situation, aerodromes are required to be able to demonstrate that the equipment complies with UK law, including ensuring that the manufacturer conducts the relevant compliance testing certificates. Again, the documentation must be retained.

Pressure Systems Safety Regulations (PSSR) 2000

The Pressure Systems Safety Regulations 2000 (PSSR) [19] covers the safe design and use of pressure systems that operate above 0.5 bar (gauge). Both liquid and compressed hydrogen are considered a relevant fluid under these regulations and as such these regulations will apply to any aerodrome storing hydrogen.

The stated aim of PSSR is to prevent serious injury from the hazard of stored energy (pressure) resulting from the failure of a pressure system or one of its component parts. This is achieved by placing responsibilities on designers, manufacturers, owners and users of the pressure system. An aerodrome is likely to act primarily as a user or owner of equipment and as such will have responsibility under PSSR to maintain a written scheme of examination, carried out by a competent person.

An aerodrome generating and storing hydrogen at pressure will be within scope of PSSR.

The Safety of Pressure Systems (PSSR) ACOP (L122) [20] gives practical advice on how to comply with the law and is available on the HSE website. There is also guidance on how to assess the performance of pressure vessels operating at low pressure in HSG93 [21] on the HSE website along with information on transportable pressure equipment [22]. See also the section covering The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 for further information relating to the transportable pressure equipment.

Provision and Use of Work Equipment Regulations (PUWER) 1998

The Provision and Use of Work Equipment Regulations (PUWER) [23] aim to reduce the risk of accidents from unsuitable work equipment by placing responsibilities on employers to properly manage the equipment that their employees use.

Both “work equipment” and “use” has a broad definition and includes all tools and office equipment and any practical activity, including maintenance. It is, however, reasonable to use a risk-based approach to identify that equipment that poses a higher risk (e.g. equipment for use with hydrogen pumping rather than standard office equipment).

The general requirements of the regulation are to ensure that suitable work equipment is used for each specific task and to keep the equipment in good working order. This may include written inspection regimes, regular maintenance, or even compliance with other regulations such as PSSR. Due to the rigorous requirements within hazardous areas, hydrogen equipment including instrumentation, personal monitors and PPE should receive due care to ensure continued through-life suitability.

The Provision and Use of Work Equipment Regulations (PUWER) ACOP (L22) [24] gives practical advice on how to comply with the law and is available on the HSE website.

Lifting Operations and Lifting Equipment Regulations (LOLER) 1998

These Regulations (often abbreviated to LOLER) [25] place duties on people and companies who own, operate or have control over lifting equipment. This includes all businesses and organisations whose employees use lifting equipment, whether owned by them or not. In most cases, lifting equipment is also work equipment so the Provision and Use of Work Equipment Regulations (PUWER) will also apply (including inspection and maintenance). All lifting operations involving lifting equipment must be properly planned by a competent person, appropriately supervised and carried out in a safe manner.

LOLER also requires that all equipment used for lifting is fit for purpose, appropriate for the task, suitably marked and, in many cases, subject to statutory periodic 'thorough examination'. Records must be kept of all thorough examinations and any defects found must be reported to both the person responsible for the equipment and the relevant enforcing authority.

An Approved Code of Practice (L113) is available on the HSE website [26].

Control of Substances Hazardous to Health (COSHH) 2002

The Control of Substances Hazardous to Health (COSHH) regulations [27] aim to prevent or reduce peoples' exposure to hazardous substances. This is achieved by identifying the substances, then documenting and applying reasonable precautions to maintain exposure below given safe levels.

Hydrogen gas typically has a relatively simple COSHH assessment as the primary hazard (flammability) is controlled through DSEAR. At high concentrations, however, hydrogen can be an asphyxiant, and duty holders will need to assess the risk dependent on their installation, i.e. is a potential leak uncontained or contained and if contained are there regions for potential accumulation and whether or not there is ventilation in the zone. Duty holders should also consider any inert gases that may be in use within the hydrogen facilities and their potential for asphyxiation.

The Control of Substances Hazardous to Health (COSHH) ACOP (L5) [28] gives practical advice on how to comply with the law and is available on the HSE website, as is HSG 97 A step by step guide to COSHH assessment [29].

Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 2013

The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) [30] is the law that requires employers, and other persons in charge of work premises to report and keep records of all the following.

- Work-related fatalities.

- Work-related injuries diagnosed cases of reportable occupational diseases.
- Certain dangerous occurrences (incidents with the potential to cause harm).

Not all accidents need to be reported – a RIDDOR report is only required when the following criteria are met.

- The accident is work-relate.
- It results in an injury of a type which is reportable.

Schedule 2 of RIDDOR details the different dangerous occurrences which are reportable, and subject to the operation of an aerodrome the following could be relevant, noting that this is not an exhaustive list of reportable occurrences.

- Lifting equipment: *The collapse, overturning or failure of any load-bearing part of any lifting equipment, other than an accessory for lifting.*
- Pressure systems: *The failure of any closed vessel, its protective devices or of any associated pipework (other than a pipeline) forming part of a pressure system as defined by regulation 2(1) of the Pressure Systems Safety Regulations 2000, where that failure could cause the death of any person.*
- Electrical incidents causing explosion or fire: *Any explosion or fire caused by an electrical short circuit or overload (including those resulting from accidental damage to the electrical plant) which either results in the stoppage of the plant involved for more than 24 hours; or causes a significant risk of death.*
- Explosion or fire: *Any unintentional explosion or fire in any plant or premises which results in the stoppage of that plant, or the suspension of normal work in those premises, for more than 24 hours.*
- Hazardous escapes of substances: *The unintentional release or escape of any substance which could cause personal injury to any person other than through the combustion of flammable liquids or gases.*
- Release of flammable liquids and gases: *The sudden, unintentional and uncontrolled release:*
  - *inside a building*
    - *of 100 kilograms or more of a flammable liquid; or*
    - *of 10 kilograms or more of a flammable liquid at a temperature above its normal boiling point; or*
    - *of 10 kilograms or more of a flammable gas; or*
  - *in the open air, of 500 kilograms or more of a flammable liquid or gas.*

HSG 245 Investigating accidents and incidents; A workbook for employers, unions, safety representatives and safety professionals [31] provides additional information.

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009

The Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 (CDG) [34] implement the UNECE “Agreement concerning the International Carriage of Dangerous Goods by Road” (ADR) in Great Britain. There is separate legislation in Northern Ireland.

CDG sets out requirements for the transport by road of goods classed as dangerous, along with the design, testing, and use of pressure equipment. It also defines four GB Competent Authorities to carry out regulatory and policy activities in relation to CDG: HSE, the Department for Transport, the Ministry of Defence, and the Office of Nuclear Regulation.

This legislation relates to transport in publicly accessible locations, that is it does not apply to fuel tankers based solely airside on an airport.

The Planning (Hazardous Substances) Regulations 2015

In addition to the Health and Safety Regulations listed above, The Planning (Hazardous Substances) Regulations 2015 [35] would also apply to total site inventory of hydrogen of 2 tonnes or above. These regulations are the responsibility of Ministry of Housing Community and Local Government (MHCLG).

Prior to the installation greater than 2 tonnes of hydrogen total site inventory, the duty holder must obtain permission from the Hazardous Substances Authority, normally designated as the local planning authority. This legislation is not enforced by HSE, however HSE is a statutory consultee, and provides signposting to the relevant authority and template application forms on its website [35]. To mitigate the risk of a major accident at an industrial site causing damage to the local area, developments that involve hazardous substances above a threshold level will require approval from the local planning authority. The approving authority will consult HSE to review the safety of the proposed site. The threshold for hydrogen (including both gaseous and liquid forms) is 2 tonnes, so the quantity that will be stored onsite will dictate whether HSE will review the planning application for safety.

There is an advice web app and a commercial consultancy contact address on HSE website [37].

Codes and Standards

Many codes and standards have been identified and reviewed as being potentially relevant to Aerodromes planning to utilise hydrogen. Searches have covered the following range of organisations.

- American Society for Testing and Materials (ASTM), one of the world's largest international standards developing organisations [38].
- British Compressed Gases Association (BCGA), a trade association that produces Codes of Practice, Guidance notes and Technical Papers [39].
- British Standards Institute (BSI), the UK national standards body [40].
- The Energy Institute, the chartered professional membership body for people who work across the world of energy.
- European Industrial Gases Association (EIGA), a technical and safety orientated organisation that represents the majority of European and companies producing and distributing industrial gases [42].
- International Code Council (ICC), a global source of model codes and standards related to buildings [43].
- National Aeronautics and Space Administration (NASA) [44].
- National Fire Protection Association (NFPA), a US-based nonprofit organisation dedicating to reducing loss from fire, electrical and related hazards [45].
- Publicatiereeks Gevarlijke Stofen (PGS) [46] manages Hazardous Substances Publication and is housed at the Netherlands Standardization Institute (NEN).
- Society of Automotive Engineers (SAE) [47], a world leading authority in mobility standards development.
- US Department of Labor [48].

They have been grouped in the following way:

- General safety standards relating to the safe use of gaseous and liquid hydrogen.
- Information related to cryogenic storage.
    - General.
    - Static vessels.
    - Transportable vessels.
- Gaseous storage.
- Fuelling.
- Sampling.
- Electrolysis.

Which of the codes listed are relevant will depend on the specific details of the infrastructure and equipment on a given site. The search has focussed on standards related to hydrogen generation, storage, and operation of hydrogen systems, and not to the design and manufacture of hydrogen related equipment or standard test methods. Standards relating to hydrogen fuel cell manufacture, use and testing were also out of scope for this document, as fuel cells for aircraft propulsion will be certified via the CAA. In addition, this list will not be exhaustive, and organisations are responsible for ensuring that all relevant aspects of a given installation are covered. The codes are presented in alphabetical/ numerical order, so the order does not represent the relative relevance of the codes.

Standards related to the design and manufacture of components have been identified, to aid an aerodrome in building its ability to be an informed customer during the tendering, design and installation of hydrogen related facilities.

In addition to the standards listed below, attention is also directed to the following websites which signpost to hydrogen related information.

- Hydrogen Safety Access to safety information on hydrogen | Hydrogen Safety Ecosystem, https://www.h2safety.info/
- Hydrogen tools Home | H2tools | Hydrogen Tools, https://h2tools.org/

General Gaseous and Liquid Hydrogen Safety and Standards

Publisher	Document Number	Title	Publication Date	Brief Description
ASTM	ASTM D7265-23	Standard specification for hydrogen thermophysical property tables	30/01/2024	Gives standard thermophysical property tables for normal gaseous hydrogen between 50-500K and to 500MPA, as given by the National Institute of Standards and Technology (NIST) standard reference computer code Refprop.
BCGA	BCGA CP 46	The storage of cryogenic flammable fluids	04/08/2025	This provides best practice relevant to UK regulations, for storage systems of cryogenic flammable fluids, including liquid hydrogen. It also contains the separation distances for such a system in the Layout and Plant Design Requirements section as well as other requirements, such as grounding resistances, security, equipment layout and vent design. A description of the expected hazards is included as well as the precautions and procedures that can be used to mitigate them. This document also provides information beyond the design stage through the entire lifecycle of the facility.
BCGA	BCGA CP 52	The management of risks from gases in the workplace	2023	This document identifies the hazards from the use and potential escape, leak or accumulation of gases and provides guidance for risk assessment and appropriate mitigation measures. It includes guidance on labelling of the gases.

Publisher	Document Number	Title	Publication Date	Brief Description
BCGA	BCGA GN 13	DSEAR risk assessment guidance for compressed gases	2021	This document provides guidance on the application of DSEAR and related regulations to compressed gases, and acts as a guide for the generation of DSEAR risk assessments.
BCGA	BCGA GN 23	Gas Safety. Information, Instruction and training	2023	The document provides guidance on identifying the minimum knowledge required for the safe interaction of personnel with industrial gases.
BCGA	BCGA GN 41	Separation distances in the gases industry	2020	This document clarifies the meaning of and recommendations for separation distances and covers a range of risks including flammability, asphyxiation, pressure release and extreme cold.
BCGA	BCGA GN 45	Dangerous goods safety advisor	2022	This covers the purpose, role and duties of a dangerous goods safety advisor, a role which is required in any organisation involved in the filling, packaging, loading or unloading dangerous goods for carriage.

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	PD ISO/TR 15916:2025	Basic considerations for the safety of hydrogen systems	06/02/2026	Contains generic guidance for the use of both LH2 and GH2 where the safety concerns, hazards, and risks of using hydrogen are identified. Given the large scope, the information is broad, and it is recommended that other supporting documents should be consulted for specific applications. It gives information on the properties of hydrogen, explanations of the types of hazards and mitigation measures that can be used and contains the mitigation and control techniques that can be used for safe operation. It includes guidance on hydrogen detection and recommended practices for organisations.
BSI	BS ISO 26142:2010	Hydrogen detection apparatus. Stationary applications	30/06/2010	Contains general requirements for the function of hydrogen detectors that form part of an overall safety system; does not cover other aspects of safety responses. Gives general requirements such as alarm levels and power indication and includes detailed testing procedures that can be incorporated. Detector positioning is not extensively covered as it is dependent on the layout of the facility.
BSI	BS EN ICE 60079-0:2018+A11:2024	Explosive Atmospheres Part 0: Equipment - General requirements	29/02/2024	These standards relate to guidance around the equipment and safety aspects of atmospheres where flammable gas or vapour hazards may arise and there may be an ignition hazard. There are many parts, and a few are detailed below. Reference to the entire suite is recommended.

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BSI EN IEC 60079-10-1:2021	Explosive Atmospheres Part 10-1: Classification of Areas - Explosive gas atmospheres	30/04/2021	Part 0 relates to the general requirements for equipment and components intended for use in explosive atmospheres. Part 10-1 covers the classification of flammable regions in to 3 zonal definitions – zone 0, where explosive gas is present continuously, zone 1 where an explosive gas atmosphere is likely to arise in normal operation and zone 2 where an explosive gas atmosphere is not likely to occur in normal operation, but if it does occur it will be for a short duration only. Part 14 contains specific information relating to the design, selection, erection and initial inspection of electrical installations in explosive atmospheres. Part 17 covers only those factors directly related to the inspection and maintenance of electrical installations specifically designed for hazardous areas resulting from explosive atmospheres Part 25 contains specific requirements for the design, construction and assessment of intrinsically safe electrical systems. Part 29-0 to 29-4 covers guidance on gas detectors, including selection, installation, use and maintenance and test methods
BSI	BS IEC 60079-14:2024	Explosive atmospheres Part 14: Electrical Installation design, selection & erection	30/04/2016	
BSI	BSI EN IEC 60079-17:2024	Explosive atmospheres Part 17: Electrical installations inspection & maintenance	31/01/2024	
BSI	BSI EN IEC 60079-25:2022+A1:2025	Explosive Atmospheres Part 25: Intrinsically safe electrical systems	30/11/2025	

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN IEC 60079-29-0:2026	Explosive Atmospheres: Gas Detection Equipment General requirement and test methods		
EIGA	EIGA 06/19	Safety in storage, handling and distribution of liquid hydrogen	2019	This contains guidance and core principles for the layout, design and operation of fixed liquid hydrogen storage facilities and the transportation of hydrogen by road, sea and rail.
EIGA	EIGA 15/21	Gaseous hydrogen installations	2021	This publication covers gaseous hydrogen compression, purification, filling into containers and storage above ground. It does not include production and transport, nor safety aspects in its use or production. It covers the design, layout, mitigation measures and system components, and includes information on safety distances and operation including start-up and shutdown.
EIGA	EIGA 23.07/18	Hydrogen safety training	2018	This training leaflet summarises the basic operational safety knowledge required for employees working in the gas industry.
EIGA	EIGA 75/21 Rev 1	Methodology for determination of safety and separation distances	2021	Outlines a conservative methodology to determine safe separation distances for the industrial gases industry and can apply to cryogenic liquid, pressurised liquid or gaseous phase. It comments that the methodology requires detailed knowledge of risk and consequence modelling and hence should only be used by specialists with this knowledge.

Publisher	Document Number	Title	Publication Date	Brief Description
EIGA	EIGA 134/12	Potentially Explosive Atmospheres EU Directive 1999/92/EC	2012	This document covers the handling and storage of flammable gases and liquids where an explosive atmosphere with air under atmospheric conditions might arise. It includes assessment of explosion risks, hazardous area classification, assessment of ignition risks, maintenance and documentation.
EIGA	EIGA 211/24	Hydrogen vent systems for customer applications	September 2024	This provides recommendations and a methodology for the safe design, installation and maintenance of hydrogen vent systems. Guidance is included for both gaseous and liquid hydrogen facilities. The exception is a hydrogen flaring system, which is not included in this document.
EIGA	EIGA 246/23	Guideline for small scale hydrogen production	2023	This document covers production of hydrogen capable of producing between 45 Nm^3/hr to 10000 Nm^3/hr. It includes safety and operating guidelines addressing the hazards and offers guidelines on where to site these production units and how to interface with bulk storage facilities, including compression and high-pressure storage.
EIGA	EIGA 247/24	Hydrogen overview – distribution, storage applications	2024	This document covers gaseous and liquid hydrogen equipment and applications and covers hydrogen safety, distribution of hydrogen and storage systems, including maintenance, separation distances and hazard zones.
EIGA	EIGA 250/24	Standard procedures for hydrogen supply systems	2024	This document includes recommended best practices and standardised procedure for personnel using hydrogen supply systems, limited to bulk gaseous and cryogenic liquid hydrogen and includes a list of applicable codes and standards that may be relevant.

Publisher	Document Number	Title	Publication Date	Brief Description
ICC	ICC IFC-2024	International Fire Code	August 2025	Covers the hazard of fire and explosion arising from the storage, handling or use of structures, materials or devices. This publication gives a wide range of guidelines related to buildings, facilities, storage and processes related to fire and explosion risk, including for compressed gases, cryogenic fluids and flammable gases and flammable cryogenic fluids. Information on recommended separation distances is included.
NASA	NASA 19970033338	Safety Standards for hydrogen and hydrogen systems; guidelines for hydrogen system design, materials selection, operations, storage and transportation	01/01/1997	This document provides a practical set of guidelines for safe gaseous and liquid hydrogen use, and it references further US standards and guidelines. Its remit includes storage, venting, exhausting and purging, and contains information on the combustion and potential detonation behaviour of hydrogen. It also covers the impact of hydrogen and cryogenic temperatures on material properties. Information on safety reviews, facility guidelines, including separation distances, access control, management of leaks and spills is also given. Guidance on hydrogen storage vessels, piping and components, transport and operating procedures is included. Given the date of publication care needs to be taken to ensure recommendations are still current.

Publisher	Document Number	Title	Publication Date	Brief Description
NFPA	NFPA 2:2026	Hydrogen Technologies core	2026	Although this code is enforceable in the US, compliance to this code is not required in UK law. It does, however, contain useful background data as it identifies current best practices for operating with hydrogen, including liquefied hydrogen systems. The standard provides fundamental safeguards for the generation, installation, storage, piping, use, and handling of hydrogen in compressed gas or cryogenic liquid form. General fire safety and hydrogen safety provisions are included. Information on the safe design, operation and maintenance of GH2 & LH2 systems is given. It also includes information on explosion control, GH2 and LH2 vehicle fuelling facilities and hydrogen generation systems are also covered. Separation distances (based on quantity stored, pressure, and pipe diameter) are provided to various features such as other hazardous materials, buildings, combustible materials, air intakes etc. The annexes provide additional information, including the determination of overpressure and fireball size

Publisher	Document Number	Title	Publication Date	Brief Description
NFPA	NFPA 55:2023	Compressed Gases and Cryogenic Fluids Code	2023	Although this code is enforceable in the US, compliance to this code is not required in UK law. It does, however, contain useful background data as it identifies current best practices for operating with hydrogen, including liquefied hydrogen systems. This standard provides safeguards for the installation, storage, use, and handling of compressed gases and cryogenic fluids in portable and stationary cylinders, containers and tanks for users, producers, distributors and others. This document contains similar information to NFPA 2 Hydrogen Technologies Code 2026. There is general guidance on vessel and pipework design for compressed gases, such as selecting pressure relief systems. Separation of gas storage by hazard class is included, as well as methods of reducing these distances if required. The chapter also details considerations for falling objects or corrosive chemicals (such as the automated fire suppression system) may impact the placement of hydrogen gas cylinders in any facility. The chapter on cryogenic fluids separates non-bulk LH2 storage into 5 categories for separation distances and includes various generic considerations for the use of cryogenic fluids. This is supplemented by the chapter on bulk liquefied hydrogen systems, which applies to containers over 150 L, and contains more specific information and in-depth separation distances for this application. Information on the safe design, operation and maintenance of GH2 systems is provided, including separation distances based on the pressure and pipe diameter.

Publisher	Document Number	Title	Publication Date	Brief Description
NFPA	NFPA 68:2023	Standard on Explosions Protection by Deflagration	2023	This standard provides guidance on the design, location, installation, maintenance and use of systems designed to vent the gases and pressure that results from a deflagration to minimise structural and mechanical damage. It covers the fundamentals in venting deflagrations, gives more details on venting for gas mixtures and mists and covers inspection and maintenance requirements. The annexes include more background information on the fundamental physics behind the phenomena, along with an example of vent sizing.
PGS	PGS 2	Methods for the calculation of physical effects (The yellow book)	2005	This publication presents models to determine the possible effects due to the release of hazardous substances. Although not specific to hydrogen, the methodology is applicable to revaluating the impact of potential releases of hydrogen and thus used in risk analyses Within the Netherlands this book has been superseded by the SAFETI-NL package.
PGS	PGS 35	Hydrogen; installations for delivery of hydrogen to road vehicles	August 2021	The publication gives guidelines for hydrogen delivery installations and covers delivery installation, construction, and testing and maintenance and safety. It covers both liquid and gaseous hydrogen. Although written for road vehicles within the Netherlands, it may provide useful information.
US Department of Labor	OSHA 1910.103 - Hydrogen	Occupational health standards related to the use of hydrogen	2007	US Occupational Safety and Health Administration issued document. Contains recommendations on separation distances for both gaseous and liquid hydrogen.

Cryogenic Storage – General

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN 1626:2008	Cryogenic vessels. Valves for cryogenic service.	29/02/2009	This specifies the requirements for the design, manufacture and testing of valves for cryogenic service below 10°C, although ambient conditions are also considered to allow for start-up and run-down. In addition to providing useful information during the purchase of such valves, Annex A provides information of recommended methods for the testing of leak tightness of cryogenic valves.
BSI	BS EN 1797:2001	Cryogenic vessels. Gas/material compatibility.	28/08/2001	This standard covers the gas/ materials compatibility for cryogenic vessels, eg chemical resistance, but it does not cover mechanical properties. It primarily focuses on the requirements for storing oxygen, although it does cover materials that can be in contact with oxygen enriched environment, eg insulating materials for hydrogen in the case of air condensation
BSI	BS 5429:1976	Safe operation of small-scale storage facilities for cryogenic liquids	31/12/2011	This standard aims to provide the user of cryogenic fluids with a basic appreciation of the problems and hazards associated with them. The document deals with liquid oxygen, nitrogen, argon and natural gas, although the hazards identified will also be relevant for liquid hydrogen.
BSI	BS 6364:1984	Specification for valves for cryogenic service	29/02/1984	This standard specifies details of the design of the valve, which materials should be used and how they are tested, including a cryogenic test.

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN 13371:2002	Cryogenic vessels. Couplings for cryogenic service.	05/03/2002	This relates to the design, manufacture and testing of coupling for cryogenic service, specifically for the temporary connection of flexible hoses to cryogenic vessels. It covers the conditions from -270°C to +65°C, to a maximum nominal pressure of 80bar. Permanent couplings are not covered.
BSI	BS EN 13648-1:2008	Cryogenic vessels. Safety devices for protection against excessive pressure. Part 1: Safety valves for cryogenic service	28/02/2009	These standards cover the design, manufacture and testing of safety valves for cryogenic service, ie below -10°C, as well as at ambient conditions. Part 1 covers the design, manufacture and testing for safety valves, whereas part 2 provides the same information for bursting discs. Part 3 gives calculation methods for determining what mass flow will need to be relieved for vacuum insulated vessels for normal operation, loss of vacuum or vessels with no vacuum, loss of vacuum and fire engulfment and complete failure of insulation and fire engulfment.
BSI	BS EN 13648-2:2002	Cryogenic vessels. Safety devices for protection against excessive pressure. Part 2: Bursting disc safety devices for cryogenic service	03/07/2002	
BSI	BS EN 13648-3:2002	Cryogenic vessels. Safety devices for protection against excessive pressure. Part 3 Determination of required discharge – Capacity and sizing		

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS ISO 21011:2008	Cryogenic vessels. Valves for cryogenic service.	31/01/2009	The relates to the design, manufacture and testing of valves for temperatures below -40°, as well as at ambient to cryogenic temperatures. It includes all valves, include vacuum jacketed. It covers material selection, operating positions, testing and marking of the valves.
BSI	BS EN ISO 21012:2024	Cryogenic vessels. Hoses	31/10/2024	This covers the design, construction and testing required for uninsulated cryogenic hoses, The most relevant aspects of the standards revolve around testing and marking required for the hoses, in particular the commissioning and periodic inspections that will be required..
BSI	BS ISO 21013-1:2021+A1:2024	Cryogenic vessels - Pressure-relief accessories for cryogenic service. Part 1: Reclosable pressure-relief valves	31/07/2008	These standards cover the design, manufacturing and testing requirements for pressure relief valves in cryogenic service. Parts 1 and 2 deal with design, material selection and qualification and testing, with part 1 covering reclosable valves, and part 2 non-reclosable valves, ie bursting discs or buckling pins. Part 3 deals with sizing and capacity determination for vacuum-insulated and non-vacuum-insulated vessels in a variety of failure scenarios. Part 4 relates to pilot operated pressure-relief valves for cryogenic service., designed to relieve single phase gas vapours, gases or mixtures of gases
BSI	BS ISO 21013-2:2025	Cryogenic vessels - Pressure-relief accessories for cryogenic service. Part 2: Non-re-closable pressure-relief devices	0/04/2025	

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN ISO 21013-3:2016	Cryogenic vessels - Pressure-relief accessories for cryogenic service. Part 3: Sizing and capacity determination	30/06/2016	and vapours and provides guidance on the design, qualification and testing of these components.
BSI	BS ISO 21013-4:2012+A1:2019	Cryogenic vessels - Pilot operated pressure relief devices. Part 4: Pressure-relief accessories for cryogenic service	31/05/2019	
BSI	BS ISO 21014:2019+A1:2022	Cryogenic vessels - Cryogenic insulation performance.	30/09/2022	This standard provides methods for the determination of the heat-leak performance of cryogenic vessels, for both open and closed systems.
BSI	BS EN ISO 21028-1:2016	Cryogenic vessels - Toughness requirements for materials at cryogenic temperature Part 1: Temperatures below -80°C	31/10/2016	These standards provide information on the toughness requirement of metallic materials to ensure their suitability for cryogenic vessels, with each art covering the temperature range specified in their title.

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN ISO 21028-1:2018	Cryogenic vessels - Toughness requirements for materials at cryogenic temperature Part 2: Temperatures between -80°C and -20°C	30/04/2018	
BSI	BS EN ISO 23208:2019+A1:2020	Cryogenic vessels - Cleanliness for cryogenic service.	31/08/2020	This specifies the minimum cleanliness for all surfaces of cryogenic vessels and associated equipment and accessories for any operating condition to minimise the risk of malfunction.
BSI	BS EN ISO 24490:2025	Cryogenic vessels – Centrifugal pumps for cryogenic service	30/11/2025	This relates to minimum requirements for the design, manufacture and testing of centrifugal pumps for cryogenic service, and covers the design of installations. It does not cover operation or maintenance,
EIGA	EIGA 151/23	Prevention of excessive pressure during filing of cryogenic vessels	2023	This document provides guidance to the filler/owner of either tasnportable r static cryogenic tanks, detailing systems and procedure that can be used to prevent them being over pressurized during filling.
EIGA	EIGA 244/23	Reciprocating cryogenic pumps and pump installations for hydrogen and liquefied natural gas	2023	This document covers new pump installations for cryogenic hydrogen designed after the date of this publication. It provides information on the individual components included in a cryogenic pump installation, the instrumentation required, its installation, operation and maintenance.
SAE	SAE ARP 900C-2019	Methods for evaluating cryogenic filters	December 2019	Includes test methods to evaluate filtration and operating characteristics of filters to be used in cryogenic systems.

Cryogenic Storage – Static Vessels

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN 13458-1:2002	Cryogenic vessels - Static vacuum insulated vessels. Part 1: Fundamental requirements	01/07/2002	These standards cover the requirements for static vacuum insulated cryogenic vessels operating above 0.1 bar. Part 1 covers the fundamental requirements, including mechanical loads, chemical effects, thermal condition and material selection. Part 2 relates to the design, manufacture, inspection and testing. Part 3 covers installation, entry into service, inspection, filling maintenance and emergency procedure. There is some overlap with BS EN 13458 parts 1 and 2.
BSI	BS EN 13458-2:2002	Cryogenic vessels - Static vacuum insulated vessels. Part 2: Design, fabrication, inspection and testing	29/11/2002	
BSI	BS EN 13458-3:2003	Cryogenic vessels – Static vacuum insulated vessels Part 3: Operational requirements	11/06/2003	
BSI	BS EN 14197-1:2003	Cryogenic vessels – Static non-vacuum insulated vessels. Part 1: Fundamentals	02/09/2003	These standards relate to non-vacuum insulated static vessels design work a maximum allowable working pressure greater than 0.5bar. Part 1 relates to the fundamentals, and includes information on mechanical loads, corrosion effects, thermal loads and material selection. Part 2 covers details

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN 14197-2:2003 + A1:2006	Cryogenic vessels – Static non-vacuum insulated vessels. Part 2: Design fabrication, inspection and testing	30/05/2008	on the design process and manufacturing standards together with more detailed technical information in the annexes. Part 3 relates to training, safety requirements, installation, inspection, filling and maintenance and repair.
BSI	BS EN 14197-3:2004	Cryogenic vessels – Static non-vacuum insulated vessels. Part 3: Operational Requirements	29/09/2006	
BSI	BS ISO 21009-1:2022	Cryogenic vessels - Static vacuum-insulated vessels. Part 1: Design, fabrication, inspection and tests	31/10/2022	These standards deal with cryogenic vessels with a maximum working pressure above 0.5 bar. Part 1 deals with the design, fabrication, inspection and testing of the vessels, with sections specifying the required testing and acceptance levels for a range of imperfections and relevant tank marking. Part 2 covers operational requirements throughout the lifecycle fo the vessel, including commissioning, maintenance and periodic inspection
BSI	BS EN ISO 21009-2:2024	Cryogenic vessels - Static vacuum insulated vessels Part 2: Operational requirements	31/10/2024	

Publisher	Document Number	Title	Publication Date	Brief Description
EIGA	EIGA 224/20	Static vacuum insulated cryogenic vessels operation and inspection	2020	This covers the operation and required inspections of static vacuum insulated cryogenic vessels designed for a maximum allowable working pressure of more than 0.5 bar, and volumes up to 125000 litres water capacity. It covers general information on the cryogenic equipment, installation layout and design, commissioning, maintenance and repair, inspection and personnel training.

Cryogenic Storage – Transportable Vessels

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN 1251-1:2000	Cryogenic vessels - Transportable vacuum insulated vessels of not more than 1000 litres volume. Part 1 Fundamental requirements	15/05/2000	These documents provide the standards for transportable vacuum insulated cryogenic vessels of not more than 1000 litres volume that are designed to operate above atmospheric pressure. Part 1 deals with fundamental requirements, whereas part 2 gives more detail on the design of the vehicle. Awareness of their contents will aid aerodromes that plan to use vacuum insulated tanks for the transport of LH2 between the fuel farm and the aircraft to ascertain that vehicles purchased are fit for purpose.
BSI	BS EN 1251-2:2000	Cryogenic vessels - Transportable vacuum insulated vessels of not more than 1000 litres volume. Part 2: Design, fabrication, inspection and testing	15/05/2000	
BSI	BS EN 13530-1:2002	Cryogenic vessels – Large transportable vacuum insulated vessels. Part 1: Fundamental requirements	24/05/2002	These standards relate to large (> 1000 litres volume) transportable vacuum insulated cryogenic vessels designed to operate above atmospheric pressure. Part 1 covers mechanical loads, chemical effects, thermal loads, material selection, design fabrication and inspection and periodic inspection. Part 2 gives more details on design, manufacturing, inspection and testing. Part 3 gives information on training, safety requirements, filling and maintenance and repair.
BSI	BS EN 13530-2:2002	Cryogenic vessels – Large transportable vacuum insulated vessels.	25/05/2004	

Publisher	Document Number	Title	Publication Date	Brief Description
		Part 2: Design fabrication, inspection and testing		
BSI	BS EN 13530-3: 2002	Cryogenic vessels – Large transportable vacuum insulated vessels. Part 3: Operational Requirements	29/05/2002	
BSI	BS EN 14398-1:2003	Cryogenic vessels – Large transportable non-vacuum insulated vessels Part 1: Fundamental requirements	03/09/2003	These standards relate to non-vacuum insulated cryogenic large transportable vessels static vessels of a volume of more than 1000 litres. Part 1 relates to the fundamentals, and includes information on mechanical loads, chemical effects, thermal loads and material selection. Part 2 covers details on the design process, manufacturing standards and testing together with more detailed technical information in the annexes. Part 3 relates to training, safety requirements, filling and maintenance and repair.
BSI	BS EN 14398-2:2003+ A2:2008	Cryogenic vessels – Large transportable non-vacuum insulated vessels Part 2: Design, fabrication, inspection and testing	29/12/2006	
BSI	BS EN 14398-3:2003	Cryogenic vessels – Large transportable non-vacuum insulated vessels	04/09/2003	

Publisher	Document Number	Title	Publication Date	Brief Description
		Part 3: Operational Requirements		
BSI	BS ISO 20421-1:2019+A1:2022	Cryogenic vessels – Large transportable vacuum-insulated vessels Part 1: Design, fabrication, inspection and testing	30/06/2022	The standards relate to large transportable vacuum-insulated cryogenic vessels of more than 450 litres volume, which are attached to a means of transport, whether permanently or non-permanently. Part 1 covers mechanical loads, chemical effects thermal loads, materials, design, fabrication and inspection and testing. Part 2 relates to training, general safety, putting into service, transport, and filling. It also includes additional requirements for flammable gases.
BSI	BS EN ISO 20421-2:2017	Cryogenic vessels – Large transportable vacuum-insulated vessels Part 2: Operational requirements	28/02/2017	
BSI	BS ISO 21029-1:2018+A1:2019	Cryogenic vessels. Transportable vacuum insulated vessels of not more than 1 000 litres volume. Part 1: Design, fabrication, inspection and tests	31/05/2019	These standards relate to transportable vacuum-insulated cryogenic pressure vessels of not more than 1000 litres volume. Part 1 details design, fabrication, inspection and testing.

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS EN ISO 21029-2:2015	Cryogenic vessels. Transportable vacuum insulated vessels of not more than 1 000 litres volume. Part 2: Operational requirements	30/09/2015	Part 2 covering operational requirements, including service, filling, withdrawal transport within the location, storage maintenance, periodic inspection and emergency procedures.

Gaseous Storage

Publisher	Document Number	Title	Publication Date	Brief Description
BCGA	BCGA CP 33 Revision 2 2025	Gas supply and distribution systems. Compressed flammable gases	2025	This document gives best practices for the storage of compressed flammable gases in pressure vessels permanently fixed on a site and supply vehicles which act as temporary storage, where they are located, equipment related to transfer activities and venting systems. It does not cover on-site gas compression and the manufacture of compressed flammable gases on the site. It defines roles and responsibilities, competence and the legal framework before continuing to cover details on the system itself, including the source of the gas, its storage, filling systems and safety systems. The user responsibilities are also outlined along with the responsibilities of the storage system designer.
BCGA	BCGA CP 39. Revision 2: 2017	In-service requirements of pressure equipment	2016	This concerns in-service requirements of pressure equipment, regardless of operating conditions. The scope is specifically focused on the hazard presented by the release of stored energy (pressure) rather than any secondary effects of release (e.g. flammability). Guidance on PSSR and PUWER inspections, including a risk-based methodology for developing the written scheme of examination and maintenance requirements, is included as well as general safe use principles.

Publisher	Document Number	Title	Publication Date	Brief Description
BCGA	BCGA CP 44. Revision 1: 2022	The storage of gas cylinders	2016	This provides advice and guidance on the safe storage and use of gas cylinders. It explains the expected hazards that may arise from gas cylinders and provides generic safety information as well as guidance on the construction of a gas store and the management of cylinders. Safe handling techniques are also included.
BCGA	BCGA GN 25	Guidance on assessing the competency of personnel undertaking periodic inspection and testing of gas cylinders	2021	The document provides guidance to ensure the personnel undertaking periodic inspection and testing of gas cylinders are competent and provides best practice on the development of competency development programme.
BSI	BS EN ISO 11114-1:2020 + A1:2023	Gas cylinders – Compatibility of cylinder and valve materials with gas contents Part 1 Metallic materials	2023	This document gives compatibility data for the selection of safe combinations of metallic cylinder and valve materials with the cylinder gas content. There are specific comments related to hydrogen within the document. Part 1 covers metallic materials Part 2 covers non-metallic materials, including seals and internal coating Other parts relate to testing of the materials
BSI	BS EN ISO 11114-2:2021	Gas cylinders – Compatibility of cylinder and valve materials with gas contents Part 2: Non-metallic materials	2021	

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS ISO 11625:2007	Gas Cylinders – Safe handling	31/10/2007	Contains specific requirements for the use and storage of gas cylinders and applies to single cylinders from 0.5 to 150 L water capacity; such cylinders are likely be used on an aerodrome (eg nitrogen for flushing a hydrogen system) As well as generic safety information and signage, notes on the safe movement and proper storage of cylinders are included.
BSI	BS EN 17339:2024	Transportable gas cylinders. Hoop wrapped and fully wrapped carbon composite cylinders and tubes for hydrogen.	30/10/2024	Defines specifications for the design, manufacture, inspection and testing of refillable, transportable composite cylinders and tubes filled with hydrogen.
BSI	BS EN 17533:2025	Gaseous hydrogen – cylinders and tubes for stationary storage	31/05/2025	This standard covers the design, manufacturing and testing of cylinders, tubes and other pressure vessels for the storage of gaseous hydrogen up to a water capacity of 10,000 litres and the maximum allowable working pressure not greater than 1100 bar. It covers design requirements, and testing and includes information on the calculation approach in the appendices.

Fuelling

Publisher	Document Number	Title	Publication Date	Brief Description
BCGA	BCGA CP 41	The design, construction, maintenance and operation of filling stations dispensing gaseous fuels.	2018	This code of practice aims to give a minimum standard to ensure a high level of safety for those involved in the design, planning, operation and regulatory approval of gaseous fuel stations, including hydrogen.
BSI	ISO 13984:2026	Liquid hydrogen - Land vehicle fuelling system interface.	31/3/2026	This standard specifies fuelling protocols for LH2, including design, installation and operating requirements. It applies to land vehicles equipped with a liquid hydrogen storage system, with volumes between 0.6 m^3 and 4 m^3.
BSI	BS EN 17127:2024	Outdoor hydrogen refuelling points dispensing gaseous hydrogen and incorporating filling protocols.	29/02/2024	This document gives the minimum requirements of gaseous hydrogen refuelling equipment. It does not cover the safety and performance requirements for the entire hydrogen fuelling station.
BSI	BS EN ISO 17268-1:2025	Gaseous hydrogen land vehicle refuelling connection devices. Part 1 Flow capacities up to and including 120 g/s	31/08/2025	These documents detail the design, safety and operation characteristics of gaseous hydrogen land vehicle refuelling connectors Part 1 covers up to 120g/s Part 2 for greater than 120 g/s is currently in draft
BSI	BS ISO 19880-1:2020	Gaseous hydrogen – Fuelling stations Part 1: General requirements	30/04/2020	These document covers design, installation, commissioning, operation, inspection and maintenance requirements for the safety of public and non-public fuelling stations primarily that dispense gaseous hydrogen to light

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS ISO 19880-2:2025	Gaseous hydrogen – Fuelling stations Part 2. Dispensers and dispensing systems	28/02/2025	duty road vehicles, although medium and heavy duty (eg uses and trucks) are also covered. LH2 fuelling is not covered. It covers hydrogen delivery in gaseous or liquid trucks, on-site hydrogen generation using water electrolysis, liquid hydrogen storage, hydrogen purification systems, gaseous hydrogen compression, pumps and vaporizers, gaseous hydrogen buffer storage, any pre-cooling devices and gaseous hydrogen dispensing systems. Part 1 covers risk management, hydrogen supply safety, equipment and controls, including material selection, hydrogen storage and venting, dispensing systems, hydrogen quality, electrical equipment, instrumentation and control, inspection, testing and operation. Part 2 includes more details on dispensers and dispensing systems, including material requirements, equipment, electrical requirements, control of dispensing and testing. Part 3 covers valves, specifically the testing required. Part 5 looks at dispenser hoses and hose assemblies, including materials and construction and performance requirements and testing. Part 7 relates to rubber O-rings, covering diameters and tolerances, housing dimension, inspection and material specification. Part 8 deals with fuel quality control, covering quality control approaches, potential sources of impurities and a quality assurance methodology.
BSI	BS ISO 19880-3:2018	Gaseous hydrogen - Fuelling stations. Part 3: Valves	30/06/2018	
BSI	BS ISO 19880-5:2025	Gaseous hydrogen - Fuelling stations. Part 5: Dispenser hoses and hose assemblies	31/07/2025	
BSI	BS ISO 19880-7:2025	Gaseous hydrogen - Fuelling stations. Part 7: Rubber O-rings	31/08/2025	
BSI	BS ISO 19880-8:2024	Gaseous hydrogen - Fuelling stations. Part 8: Fuel quality control	31/01/2025	

Publisher	Document Number	Title	Publication Date	Brief Description
EI	EI 3312	Guidance on hydrogen delivery systems for refuelling if motor vehicles, co-located with petrol filling stations	January 2025	This publication provides guidance sites for the refuelling of hydrogen-powered motor vehicles, including HGVs, and for authorities responsible for granting permits and supervising these companies when co-location with petrol filling stations (PFS) is proposed. It gives a summary of regulations, requirements, criteria and conditions based on current industry good practice as reflected in British Compressed Gases Association, (BCGA) CoP CP 41: *The design, construction, maintenance and operation of filling stations dispensing gaseous fuels*.
SAE	AIR8466	Hydrogen Fueling Stations for Airports, in Both Gaseous and Liquid Form	11/11/2024	Gives hydrogen fuelling protocol and process limits for both gaseous and liquid hydrogen fuelling of aircraft, through to wide-body.

Sampling

Publisher	Document Number	Title	Publication Date	Brief Description
ASTM	ASTM F310-07 (2020)	Standard Practice for Sampling Cryogenic Aerospace Fluids	14/04/2020	This practice establishes the apparatus, materials and potential hazards for taking samples of cryogenic aerospace fluids. Two standard procedures are also included.
ASTM	ASTM D7606 - 24a	Standard practice for sampling of high pressure hydrogen and related fuel cell feed gases	01/11/2024	Describes hydrogen sampling equipment, specifically for hydrogen, but may be used for other gases. It does not cover analysis of the sample itself.
ASTM	ASTM D7941M-23	Standard Test Method for Hydrogen Purity Analysis Using a Continuous Wave Cavity Ring-Down Spectroscopy Analyzer	10/02/2023	This documents a test method to determine the contaminants in fuel cell grade hydrogen using cavity ring-down spectroscopy (CRDS). It covers apparatus design, operating procedures and quality control to achieve the desired levels of accuracy.
ASTM	ASTM D7653-24	Standard test methods for determination of trace gaseous contaminants in hydrogen fuel by Fourier Transform Infrared (FTIR) spectroscopy	05/06/2024	This documents a test method to determine the trace impurities gaseous hydrogen using Fourier Transform Infrared (FTIR) spectroscopy, and can be used either at a fuelling station or on an extracted sample analysed elsewhere, either for fuel cells or internal combustion engines.
BSI	BS ISO 15859-2:2004	Space systems - Fluid characteristics, sampling and test methods. Part 2: Hydrogen	12/08/2004	This covers both gaseous and liquid hydrogen and gives composition limits, fluid sampling protocols and test methods. Other parts deal with other fluids.

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS ISO 19880-8:2024	Gaseous hydrogen. Fuelling stations. Fuel quality control	31/01/2025	See refuelling section for more details

Hydrogen Electrolysis

Publisher	Document Number	Title	Publication Date	Brief Description
BSI	BS ISO 19880-8:2024	Hydrogen generators using water electrolysis Part 1: Safety	31/07/2025	This covers safety requirements for hydrogen gas generation systems that use electrochemical reactions to electrolyses water to produce hydrogen. It does not apply to residential hydrogen generators, hydrogen generators that can be used to generate electricity, e.g. reversible fuel cells, and generators that use solid oxide electrolyte. Details are given on the requirements, including operating condition, risk management, equipment requirements, testing and required documentation.

Conclusions

The development of hydrogen powered aircraft in addition to land-based hydrogen powered transport, means airports need to consider the impact of this on their day-to-day operations and to complying with UK Health and Safety Legislation. Due to the innovative nature of the activities, a series of standards and working experience in the use of hydrogen in the aerospace sector is yet to be developed. Due to this, at the request of the CAA, HSE has conducted a review of the relevant regulations, codes and standards relating to gaseous and liquid hydrogen.

A large amount of relevant information was identified and reviewed for relevancy, with the documents that were deemed appropriate listed in this document. These are current as of the date of issue of this report and may not cover all activities required to support the introduction of hydrogen onto an aerodrome, since the details of such an installation is not known at this stage. HSE keeps its regulatory framework under review and is engaging with industry as new technologies are developed to ensure the health and safety regime in Great Britain remains fit for purpose and enables innovation. It is expected that the standards will evolve as the technology to support the introduction of hydrogen at aerodromes matures.

The overarching UK regulations that will apply to a hydrogen installation at an aerodrome have been identified and a summary of each included. Some will apply to facilities at all scales (such as DSEAR), while others (such as COMAH) may apply depending on the parameters of the facility. The available approved codes of practice (ACOPs) have been referenced to provide guidance for compliance with the relevant regulation. The information contained within this document should allow an airport to understand when each regulation will apply and navigate to the relevant guidance when required.

Applicable codes and standards were also identified and reviewed using various UK and international sources. Over 100 documents were identified, which have been grouped into the following categories:

i. Hydrogen safety and planning
ii. Cryogenic storage – general
iii. Cryogenic storage – static vessels
iv. Cryogenic storage – transportable vessels
v. Gaseous storage
vi. Fuelling
vii. Sampling
viii. Electrolysis

Which of the codes identified are relevant to a particular aerodrome will depend on the equipment and infrastructure included, and a brief description of the codes and standards has been included to aid in identifying which to consult.

The use of hydrogen on an aerodrome is likely to reach the limits for hydrogen storage for either Land Use Planning or COMAH and may include technologies that were beyond the scope of this document. This document contains useful standards and regulatory information for this facility but may not provide a complete navigation tool. Consequently,

additional codes, standards and regulations not listed here may be relevant, especially if the scope of the operation broadens to other technologies.

The existing controls and best practice described in the regulations, codes, and standards identified in this document provide suitable steps that can be taken to effectively mitigate the risk of dangerous events occurring from the fire and explosion, pressure, cryogenic and other risks that are present in hydrogen installations.

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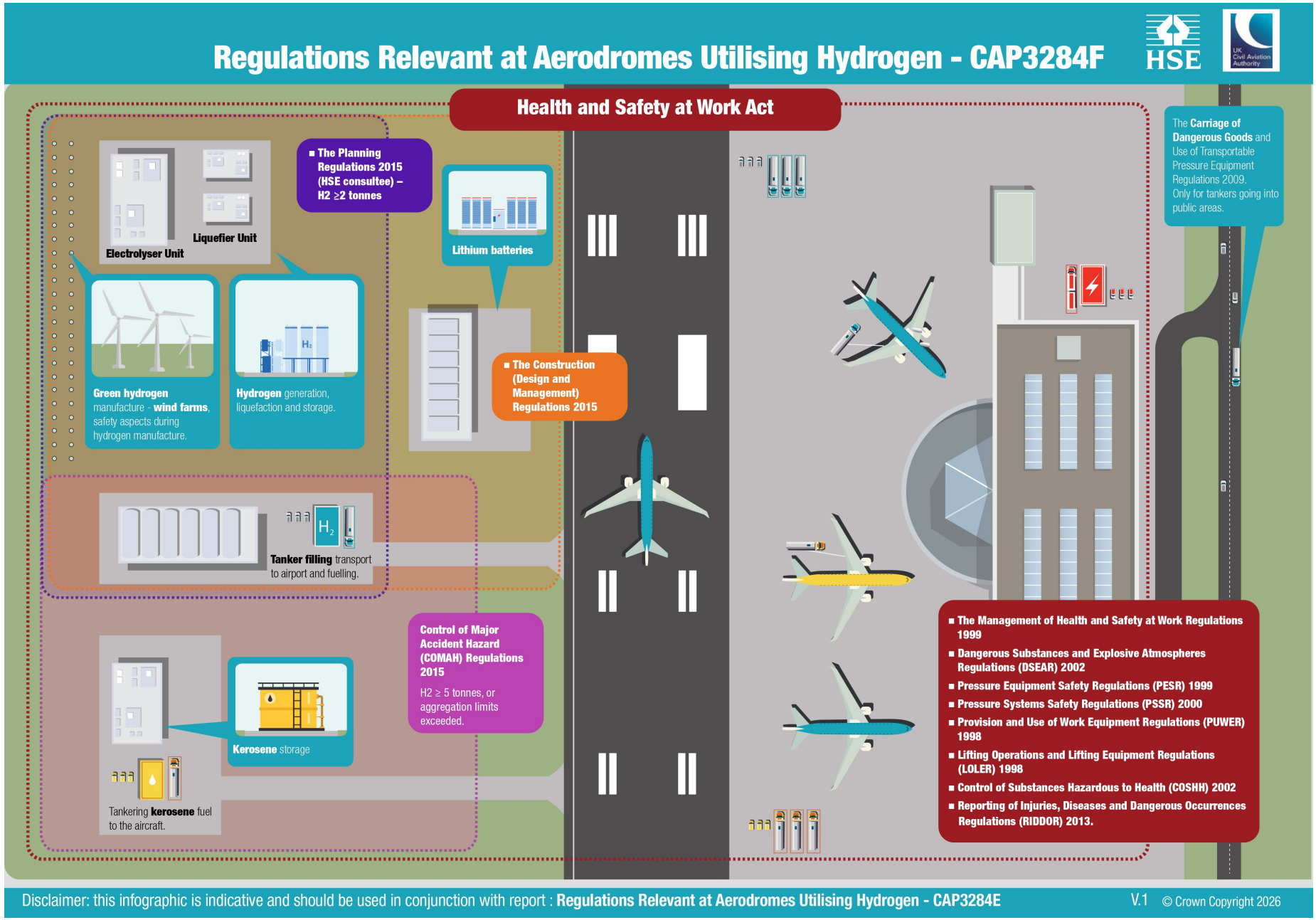
Regulations Relevant at Aerodromes Utilising Hydrogen - CAP3284F
HSE
UK Civil Aviation Authority
Health and Safety at Work Act
The Planning Regulations 2015 (HSE consultee) – H2 ≥2 tonnes
Electrolyser Unit
Liquefier Unit
Lithium batteries
Green hydrogen manufacture - wind farms, safety aspects during hydrogen manufacture.
Hydrogen generation, liquefaction and storage.
The Construction (Design and Management) Regulations 2015
Tanker filling transport to airport and fuelling.
Control of Major Accident Hazard (COMAH) Regulations 2015
H2 ≥ 5 tonnes, or aggregation limits exceeded.
Kerosene storage
Tankering kerosene fuel to the aircraft.
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