



# Hydrogen Standardization and Safety

Abbey Dorian – Energy Sector Lead



# What is BSI?

BSI has a presence on every continent, with 87 offices in 31 countries across the world. Our clients range from globally recognized brands to small, local businesses.

- Standards & information
- Auditing, certification & training
- Consulting practices

Formed in 1901, BSI was the world's first National Standards Body. We were responsible for originating many of the world's most commonly used management standards and publish around 3,000 standards annually.



# We are the UK's National Standards Body

- Independent and apolitical, but operating in the national interest (MoU)
- Independent from government and industry; a profit-for-purpose organisation
- Stakeholder-led: it all comes from consensus and consultation
- Potential to deliver or support government policy (but in accordance with BSI's rules and principles)
- Legitimacy and reputation
- Decisions and business development are always in this context
- Limited government funding for specific purposes



# Types of Standards

## Specification

- Sets out **detailed requirements**, to be satisfied by a product, material, process, service or system, and the procedures for checking conformity to these requirements

## Code of practice

- Gives **recommendations for accepted good practice** which brings together the results of practical experience and acquired knowledge of ease of access and use of information.

## Guide

- Gives **broad and general information** about a subject, with background information where appropriate.

## Test method

- Sets out **detailed procedure** for performing an activity, e.g., measuring a quantity, testing a product, determining a characteristic and sets out a way of determining and presenting the results.

# We are part of an international and European standards landscape

## International Organization for Standardization

164 National Standards Body members globally



## International Electrotechnical Commission

80 members (National Committees) and 80 affiliates globally



## International Telecommunications Union

Agency of the UN. Members are national governments and industry



## European Committee for Standardization

CEN & CENELEC have 34 member countries



## European Committee for Electrotechnical Standardization

Like UK, 24 countries have common CEN and CENELEC membership

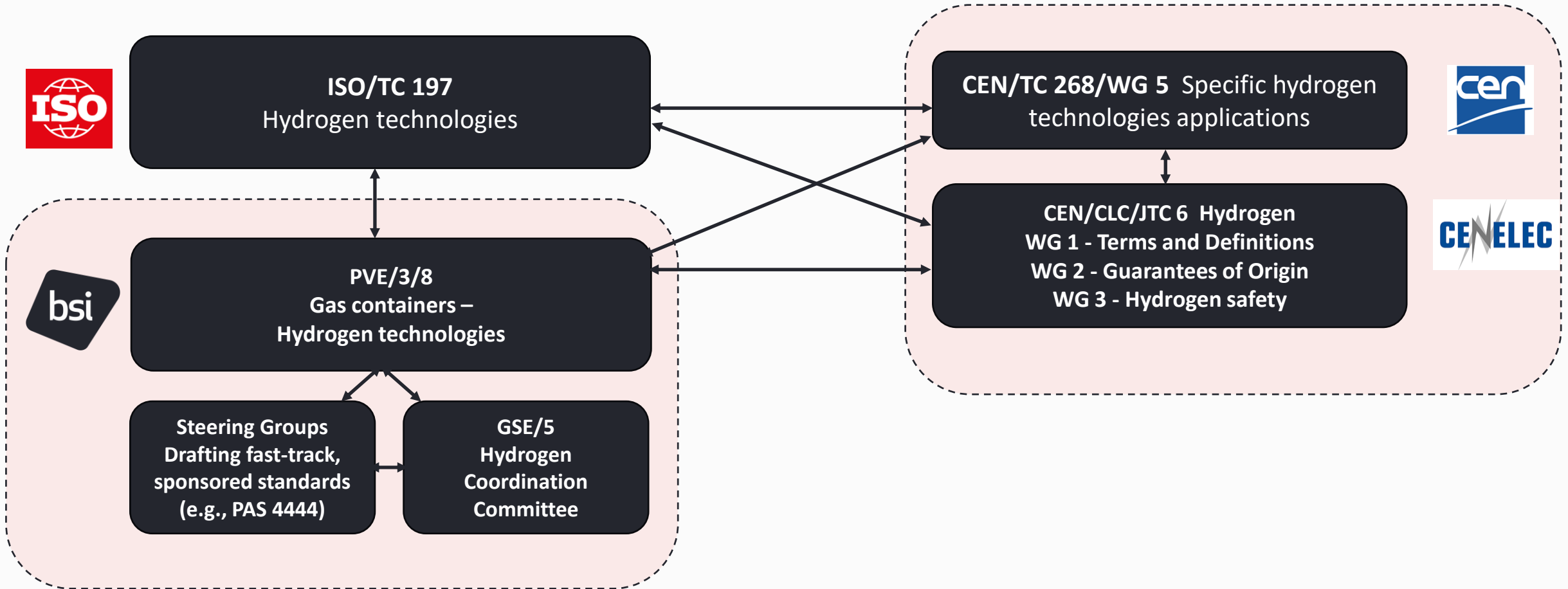


## European Telecommunications Standards Institute

Industry, government and NSBs



# BSI's relationship with international and European committees





# Strategic Work

Hydrogen

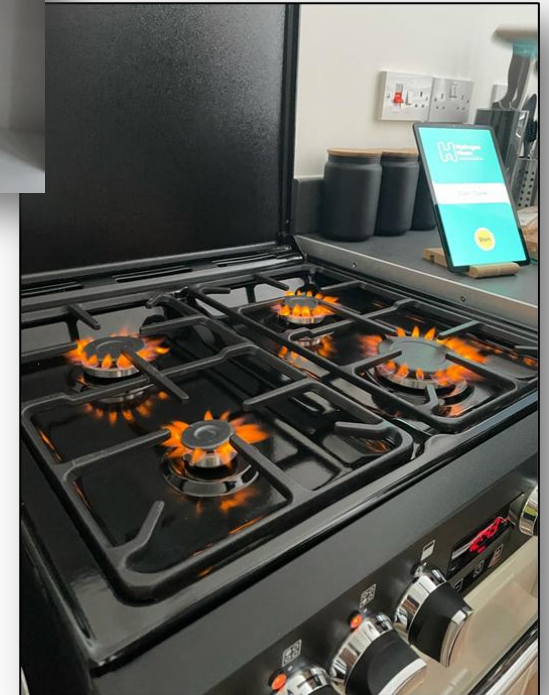






# Hy4Heat

- To establish if it is technically possible and safe to replace natural gas with hydrogen in residential and commercial buildings.
- Primarily covered space heating and cooking.
- Funded commercial product design and development.
- Developed safety case for larger-scale trials.
- Final report published April 2022. [hy4heat.info](https://www.hy4heat.info)





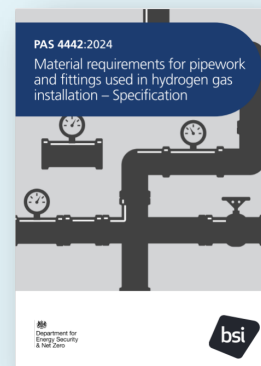
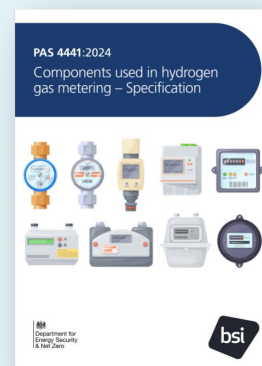
# Standardization supporting Policy Hydrogen Skills and Standards for Heat Programme

- Deliver the Hydrogen Skills and Standards for Heat Programme to support consideration of **hydrogen for heat as a potential decarbonisation pathway for domestic and non-domestic, small commercial buildings and light-industrial setting where gas is used in a manufacturing process.**
- Establish an agreed set of principles, requirements and guidance on functionality, safety, installation, operating and servicing requirements for ancillary devices, pipework, materials, meters, and appliances.

## Phase 1 – Standards Landscape and workshop

Standard research project relating to hydrogen ancillary devices in domestic settings (cover buildings that have a direct gas connection to the underground distribution system not routed through other buildings or common spaces within the building) and non-domestic settings (small commercial buildings and light-industrial setting where gas is used in a manufacturing process).

**Phase 2 – Three PAS Standards** that will provide guidance for manufacturers, engineers and installers on:



# Scope

## Status

- **Current** (published)
- **In development** (proposals & drafts)

## Geographies



USA (ASTM/ASME/ANSI)



Europe (CEN/CENELEC)



International (ISO/IEC)



China (SAC)



Australia (AS/NZS)



UK (BS)



Japan (JAS)



Korea (KATS)

# PAS 4441:2024 Components used in hydrogen gas metering. Specification

**Scope:** This PAS specifies performance requirements for components used in and around the hydrogen gas meter. It covers meters and any excess flow value (EFV), or device with EFV functionality, and other associated equipment, e.g. meter box and pliable connections supplied for use with hydrogen. It also specifies the performance requirements for each component associated with meter installation to ascertain its safety.

## Key topics include:

- Hydrogen gas characteristics, category, and supply pressures.
- Components such as emergency control valve (ECV) and gas filter.
- Meter including flows not exceeding a nominal 20 m<sup>3</sup>/h (domestic) and flows more than 20 m<sup>3</sup>/h.
- Electronic gas volume conversion systems.
- Marking and instructions.



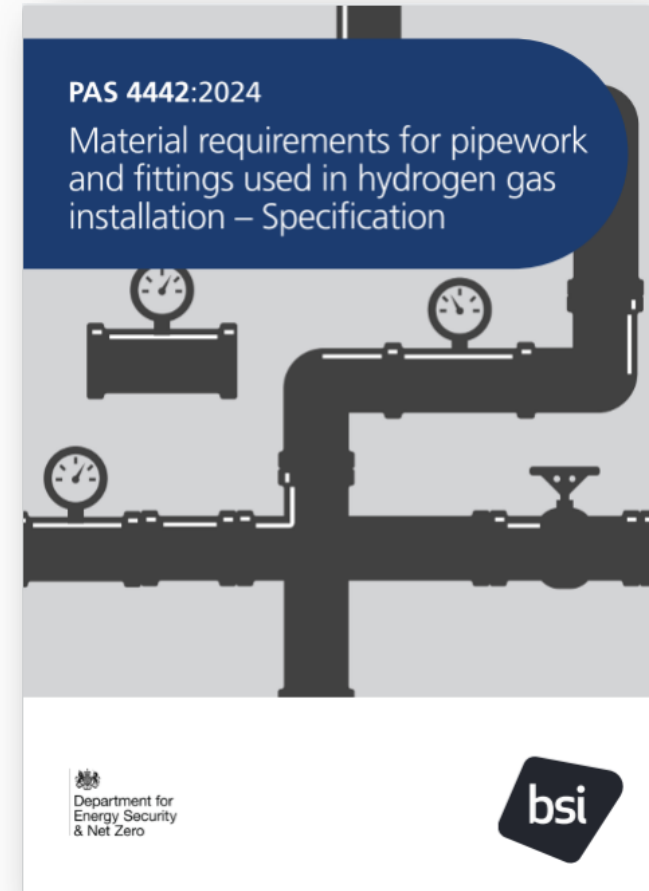


# PAS 4442:2024 Material requirements for pipework and fittings used in hydrogen gas installation. Specification

**Scope:** This PAS specifies the requirements for ancillary components for use with hydrogen gas only. The PAS covers the ancillary components for installing gas devices, meters and appliances. It will provide the performance testing for each component to determine the safety levels. The PAS is for use in both domestic and non-domestic (light commercial) properties.

## Key topics include:

- Gas classification
- Construction materials
- Performance of gas tightness
- Type tests and test gases
- Marking and instructions



# PAS 4443:2024 Assessment criteria: Ancillary valves, devices and components used in hydrogen gas installations. Specification

**Scope:** This PAS recommends the components for additional appliances for the use with hydrogen only. It will provide the performance testing for each appliance to determine the safety in installation and operation. The PAS is for use in both domestic and non-domestic (light commercial) properties.

## Key topics include:

- Gas classification
- Component design specification
- Performance
- Test and measuring equipment
- Maintenance
- Marking, instructions and packaging

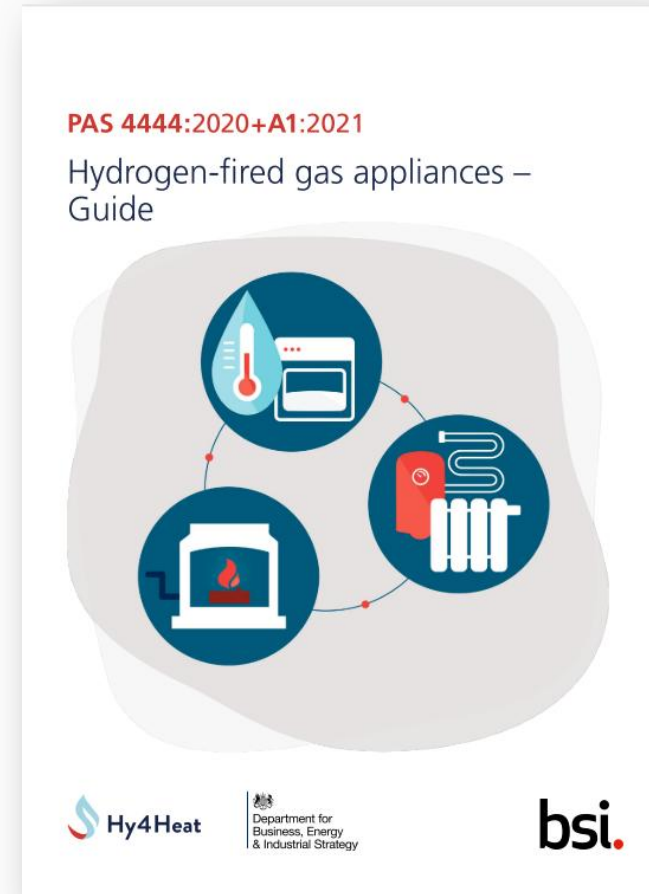


# PAS 4444:2020+A1:2021 Hydrogen-fired gas appliances. Guide

**Scope:** This document gives guidance on the development and construction of hydrogen-fired gas appliances, which are either purpose-built to use hydrogen or are designed to be converted to use hydrogen.

It covers the functional specification of the appliance, including specific advice on the demonstration of safety, including worst case conditions to stress the appliance in excess of that it is likely to experience in normal service. It also covers the setting of limit (upper and lower) hydrogen supply pressures and limit voltages. It discusses the possible arrangement of fittings and devices acknowledging the application to hydrogen fired appliances.

The PAS also covers tests regarding both delayed ignition and unintended ignition of accumulated gas (which has leaked from the gas circuit) within the case of the appliance and/or its flue. It covers advice on manufacturer's instructions regarding installation of such appliances (including fluing) and their servicing requirements.





# PAS 4445 - Large gas-fired equipment - Hydrogen firing and conversion - Code of Practice

**Scope:** The PAS covers hydrogen-fired equipment used in industrial and commercial settings, excluding equipment nominally rated below 70kW. It covers the functional specification of hydrogen-fired equipment, which is either purpose-built to use hydrogen, or is designed to be converted to use hydrogen. It includes specific advice on the demonstration of safety, including reasonably foreseeable conditions to stress the appliance in excess of that which is likely to be experienced in normal service, both before and after conversion to hydrogen.

The aims of the project are:

- to align the hydrogen-ready large equipment market,
- create a shared definition for hydrogen-ready large equipment, and
- give confidence to end-users that this equipment enables faster and cheaper fuel switching to hydrogen than would otherwise be the case.





# Thank you

BSI Group

Abbey Dorian

Energy Sector Lead

[Abbey.Dorian@bsigroup.com](mailto:Abbey.Dorian@bsigroup.com)

