Institution of Gas Engineers & Managers

Interim Hydrogen training specification

IGEM/IG/1 Edition 2 Supplement 5
Communication 1878

Institution of Gas Engineers & Managers

IGEM/IG/1 Edition 2 Supplement 5
Communication 1878

Interim Hydrogen training specification

UTILISATION SECTOR

Founded 1863
Royal Charter 1929

ISBN 978-1-7392981-4-2
Published by the Institution of Gas Engineers and Managers

Previous Publications:

For information on other IGEM Standards please visit our website, www.igem.org.uk

CONTENTS

SECTION 1: INTRODUCTION

1.1 This interim hydrogen training Specification relates to:
Persons within the gas industry wishing to extend range (as defined in Guidance Note 8 (GN8)).

1.2 Learners will require a minimum of 12 months Gas Safe Registration before being eligible for the hydrogen training.

1.3 This Specification focuses on the differences between Natural Gas and hydrogen and is not designed to train learners on appliances.

1.4 The Standards Setting Body (SSB) formed a working group facilitated by Energy & Utility Skills to prepare this Specification and it has been contributed to and approved by the (Standards Consultation Forum (SCF).

1.5 This Standard has been approved by the Gas Utilisation Committee, Gas Measurement Committee, Gas Transmission and Distribution Committee, Hydrogen Committee, Strategic Management Board (SMB) and IGEM's Technical Coordinating Committee (TCC) after consultation with industry stakeholders, Gas Safe Register and HSE. It is published by the authority of the Council of IGEM

1.6 This Specification was published in August 2023.

SECTION 2: SCOPE

2.1 This interim training Specification covers training for:

- those persons wishing to extend their range to include blends of up to 100% hydrogen (as defined in GN8)
- those persons involved in working on the coordinated neighborhood and/or village trials for hydrogen.

2.2 The requirements of the training include knowledge and understanding and performance criteria that will be undertaken off-site.

2.3 The requirements include the minimum time spent on each subject along with the activities that are required to be undertaken.

SECTION 3: TRAINING AND EVALUATION

3.1 'Off-site' training shall be that which the learner is trained in a classroom environment for theory input and practical workshop areas (which simulate the on-site environment) for demonstration and skills' practice. The appliance types listed in Appendix 2 shall be used for the training. The balance between theory and practical work will be dependent on the content of the subject.

3.2 Written and practical tests shall be completed throughout and/or at the end of the programme to evaluate the off-site training.

3.3 The marking scheme for the evaluation shall be open and transparent to the engineer and the trainer.

3.4 Arrangements shall be in place for moderation and an independent review.

3.5 The evaluation shall confirm that new entrants have a full understanding of all matters of gas safety (relating to the competency being undertaken) prior to a certificate being issued.

3.6 **TRAINING**

3.6.1 *Minimum 'Off-site' duration*

The minimum guided learning hours for the core competencies shall be 25 hours. For the purpose of minimum guided learning hours, for consecutive learning days, each day shall be no longer than 7.5 hours, or in the instance of day release a maximum of 10 hours. The subjects covered in the core unit shall be as detailed in Table 1 Appendix 1 and the training is to cover both the theoretical and practical aspects of the work.

3.7 **EVALUATION OF LEARNING**

3.7.1 The training provider shall undertake an evaluation of the learning.

3.7.2 The evaluation of the learning at the training centre shall be a mixture of verbal, written and practical tests that need to be conducted during and/or at the end of the training.

3.7.3 Pass mark shall be set at 100% for matters of gas safety and on all others, satisfy assessment criteria in line with recognised industry standards.

3.8 **CERTIFICATE**

A certificate shall be presented to each successful candidate. Detailing, as a minimum; the name of the candidate, National Insurance number, the title of the training programme, listing the range and scope undertaken, date the certificate was awarded and the name of the organisation issuing the certificate and the training provider code.

APPENDIX 1: OFF-SITE TRAINING (CORE ACTIVITIES)

DOMESTIC UTILISATION (SUBJECTS)

The performance criteria (PC), knowledge and understanding (K&U) requirements for 'Off-site' training are structured to be consistent with the domestic core competencies (see Table 1).

The minimum guided learning hours assigned to each subject are detailed below:

DOMESTIC CORE COMPETENCIES	MINIMUM GUIDED LEARNING HOURS
Safety, Legislation and Standards	1
Products and Characteristics of hydrogen and its Combustion	3
Ventilation for Hydrogen Gas Burning Appliances	1
Installation of Pipework and Fittings • New • Repurposed • Ventilation of pipework	1
Tightness Testing and Purging	3
Metering Installations	1
Unsafe Situations including those specific to hydrogen, Emergency Notices and Warning Labels	1
Checking and Setting Hydrogen Appliance Burner Pressures and Gas Rates	2
Operation and Checking of Hydrogen Appliance Gas Safety Devices and Controls including Excess Flow Valves	2
Chimney and Condensate Installation, Inspection and Testing	2
Re-establish Existing Gas Supply and Re-light Appliances	2
Commissioning of Appliances	1
Handover and Customer Engagement	1
Service and Maintenance	1
Gas Emergency Actions and Procedures	1
Dealing with Reported Gas Escapes	2
Total:	**25**

TABLE 1 - THE MINIMUM GUIDED LEARNING HOURS ASSIGNED TO EACH SUBJECT

SAFETY, LEGISLATION AND STANDARDS

Knowledge and Understanding

In relation to working on downstream hydrogen installations, the learner will need to know and understand:

K1 Application of the Gas Safety Installation and Use Regulations (GS(I&U)R).

K2 Specific requirements relating to hydrogen installations and appliances.

K3 Safety precautions when other hazardous materials are encountered whilst working on hydrogen installations.

K4 The learner's responsibilities regarding health, safety, and the environment.

K5 Use of personal protective equipment (PPE).

K6 Information available to Gas Safe registered operatives relating specifically to hydrogen installations and applications:

- new standards.
- engineering instructions.
- codes of practice.

K7 Risk assessment methodology as applied to the suitability of existing installation pipework and equipment.

K8 Record keeping and filing of risk assessment, as necessary.

K9 Suitable, approved and prohibited materials for use with hydrogen installations and appliances.

PRODUCTS AND CHARACTERISTICS OF COMBUSTION

Performance Criteria

In relation to complete combustion, the learner will need to be able to:

P1 State significant behavioural differences of hydrogen compared with hydrocarbon gases.

P2 Identify correct flame performance.

P3 Analyse products of combustion for correct oxygen content.

P4 Identify false positives and early warning devices of a hydrogen gas escape.

In relation to approved gas detectors and indicators, the learner will need to be able to:

P5 Identify and operate approved gas detectors for use with hydrogen.

In relation to combustion performance analysis, the learner will need to be able to:

P6 Undertake combustion performance analysis on a hydrogen appliance.

Knowledge and Understanding

In relation to complete and incomplete combustion, the learner will need to know and understand:

K1 Combustion equations relating to hydrogen.

K2 Oxygen requirements for complete combustion.

In relation to combustion performance analysis, the learner will need to know and understand:

K3 Actions to take when undertaking combustion performance analysis.

In relation to combustion and its controls, the learner will need to know and understand:

K4 Why hydrogen is not subject to incomplete combustion.

K5 Products and characteristics of hydrogen and its combustion.

K6 Ignition temperature and flammable range

K7 How to use a gas analyser to measure oxygen content.
K8 Flame picture, flame lift and light back.
K9 Burner types
K10 Gas controls
K11 Fault diagnosis
K12 Safety devices
K13 Condensate requirements
K14 The effect of hydrogen on CO alarms.

VENTILATION FOR HYDROGEN GAS BURNING APPLIANCES

Performance Criteria

In relation to providing ventilation for domestic gas burning appliances, the learner will need to be able to:

P1 Explain procedures for the control of moisture from hydrogen appliances.

P2 Identify correct and incorrect ventilation provision.

P3 State the importance of, and requirements for compartment ventilation.

Knowledge and Understanding

In relation to providing ventilation for domestic gas burning appliances, the learner will need to know and understand:

K1 Factors affecting ventilation.
K2 Design and types of ventilation provision.
K3 Calculating ventilation requirements for hydrogen installations.
K4 Ventilation labels and notices.
K5 Air supply requirements for cooling and combustion
K6 Mechanical ventilation and extraction
K7 Design and materials
K8 Free area and position
K9 Route and configuration
K10 Maintenance.

INSTALLATION OF PIPEWORK AND FITTINGS

Knowledge and Understanding

In relation to the installation of domestic pipework and fittings, the learner will need to know and understand:

K1 Factors to consider when installing new gas installation pipework for use with hydrogen.
K2 Factors to consider when repurposing NG installation pipework for use with hydrogen.
K3 Copper and mild steel pipe and fittings standards, suitability, and use.
K4 Approved Jointing and cleaning agents for jointing copper and threaded pipework fittings.
K5 Restrictions on use of union and compression fittings.
K6 Pipe sizing for hydrogen installations.
K7 Factors affecting ventilation for pipework, including design and types of ventilation provision.

TIGHTNESS TESTING AND PURGING

Performance Criteria

In relation to testing and purging domestic hydrogen gas installations, the learner will need to be able to:

P1 Strength Test a new low-pressure installation and meter using air.

P2 Tightness Test a new low-pressure installation and meter using air.

P3 Purge a new low-pressure hydrogen gas installation (from air to hydrogen).

P4 Tightness Test an existing low-pressure installation and meter using hydrogen.

P5 Trace and repair a downstream hydrogen gas escape.

P6 Purge an existing low-pressure hydrogen gas installation prior to undertaking work (from hydrogen to air).

Knowledge and Understanding

In relation to testing and purging domestic hydrogen gas installations, the learner will need to know and understand:

K1 Define operating pressures for hydrogen installations.

K2 Types of pressure gauge and perceptible movement.

K3 Application of permissible pressure loss.

K4 Dealing with let by.

K5 Actions to take when a smell of gas persists after a satisfactory test or after the ECV has been turned off.

K6 Calculating installation and purge volumes.

K7 Requirement for inert purging of existing installations

K8 Testing pipework of diameter > 35 mm or total internal volume (IV) > 0.035 m^3.

K9 Testing before working on an installation.

METERING INSTALLATIONS

Performance Criteria

In relation to checking and/or setting meter regulators on hydrogen gas installations, the learner will need to be able to:

P1 Check that the meter fitted is for use with hydrogen.

P2 Check that the hydrogen meter is correctly located, installed, and labelled.

P3 Measure and record the installation standing pressure.

P4 Measure and record the installation working pressure at the outlet of the meter.

P5 Determine if the installation working pressure is correct or incorrect.

P6 State the actions to take if the working pressure is incorrect.

P7 Test and adjust the operation of Excess Flow Valves as necessary.

Knowledge and Understanding

In relation to checking and/or setting meter regulators on hydrogen gas installations, the learner will need to know and understand:

K1 The correct types of meter approved for use with hydrogen.

K2 The need for, and purpose of an Excess Flow Valve on a hydrogen installation.

K3 Meter box and enclosures approved for use with hydrogen meters.

K4 Safety notices and labels.

K5 Location criteria for hydrogen meter installations.

K6 Meter installation, exchange, and removal of hydrogen meters.

K7 Operation of Smart Meter excess flow valve.

UNSAFE SITUATIONS, EMERGENCY NOTICES AND WARNING LABELS

Performance Criteria

In relation to unsafe situations, emergency notices and warning labels, the learner will need to be able to:

P1 Identify and classify different categories of unsafe situations.

P2 Demonstrate the procedure to follow for each classification of unsafe situation.

P3 Complete, explain and issue appropriate warning/advisory labels and notices.

Knowledge and Understanding

In relation to unsafe situations, emergency notices and warning labels, the learner will need to know and understand:

P4 IGEM/G/11 - Gas Industry Unsafe Situation Procedure (GIUSP).

P5 Situations reportable under RIDDOR.

P6 Situations reportable to Gas Safe Register and/or HSE which are not RIDDOR reportable.

P7 Correct use of notices and labels.

CHECKING AND SETTING HYDROGEN APPLIANCE BURNER PRESSURES AND GAS RATES

Performance Criteria

In relation to checking and setting hydrogen appliance burner pressures and gas rates, the learner will need to be able to:

P1 Measure an appliance operating pressure.

P2 Measure an appliance gas rate.

OPERATION AND CHECKING OF HYDROGEN APPLIANCE GAS SAFETY DEVICES AND CONTROLS

Performance Criteria

In relation to gas safety devices and controls the learner will need to be able to:

P1 Identify hydrogen gas specific safety devices and controls.

P2 Check gas safety devices and controls for correct operation and carry out any corrective action where necessary.

P3 Explain the operation of gas safety devices and controls.

Knowledge and Understanding

In relation to gas safety devices and controls the learner will need to know and understand:

K1 The principles of operation of hydrogen gas safety devices and controls.

K2 The sequence of operation of hydrogen gas safety devices and controls.

CHIMNEY AND CONDENSATE INSTALLATION, INSPECTION AND TESTING

Performance Criteria

In relation to chimney testing the learner will need to be able to:

P1 Visually inspect chimney systems to confirm correct and incorrect installation.

P2 Perform a spillage test on a hydrogen appliance connected to an open flue system.

P3 Carry out a Flue Flow Test

P4 Perform a combustion case seal test on a room sealed fan assisted positive pressure appliance.

Knowledge and Understanding

In relation to chimney installation inspection and testing the learner will need to know and understand:

K1 Causes of leakage of combustion products from room sealed fan assisted positive pressure appliance.

K2 Condensate management and discharge to waste.

K3 Condensate production from hydrogen appliances.

K4 How and where condensate may be discharged.

K5 Actions to take when inspection hatches are not available for flues in voids.

RE-ESTABLISH EXISTING GAS SUPPLY AND RE-LIGHT APPLIANCES

Performance Criteria

In relation to re-establishing an existing hydrogen gas supply and re-lighting the appliances, the learner will need to be able to:

P1 Check the installation is gas tight.

P2 Purge the installation and appliances of air.

P3 Establish a stable flame on each appliance.

P4 Check operation of any Flame Failure Device (FFD).

P5 Visually inspect each appliance for unsafe situations.

P6 Confirm satisfactory operation of user controls.

Knowledge and Understanding

In relation to re-establishing an existing hydrogen gas supply and re-lighting the appliances, the learner will need to know and understand:

K1 Actions to take when an un-commissioned appliance is identified.

K2 Actions to take if pipework and appliance(s) are not tested (commissioned) when the gas supply is re-established.

COMMISSIONING OF APPLIANCES

Performance Criteria

With reference to the range of domestic or non-domestic appliances, some of which may have specialist requirements, the learner will need to be able to:

P1 Demonstrate the ability to commission a hydrogen appliance in accordance with Manufacturer's Instructions.

Knowledge and Understanding:

In relation to appliance commissioning, the learner will need to know and understand:

K1 Specific commissioning requirements of hydrogen appliances fitted to an existing solid fuel chimney.

K2 Operational checks and procedures required prior to handover.

K3 Sources of additional information or support for hydrogen installations.

K4 Essential information on hydrogen usage to communicate with the end user.

HANDOVER AND CUSTOMER ENGAGEMENT

Performance Criteria

On completion and commissioning of a hydrogen appliance and installation, ready for handover to a consumer, the learner will need to be able to:

P1 Handover the appliance to the end user, explaining appliance operation in accordance with manufacturer's instructions.

P2 Explain and demonstrate specific new features of hydrogen appliances.

Knowledge and Understanding:

To complete a successful handover procedure, the learner will need to know and understand:

K1 Background to hydrogen transition.

K2 Development, research and testing to confirm safety of hydrogen as an alternative to natural gas.

K3 Benefits to consumers of hydrogen as a fuel.

SERVICE AND MAINTENANCE

Performance Criteria

Notwithstanding differences between types of domestic and non-domestic appliances, the learner will need to be able to:

P1 Demonstrate the ability to adjust appliance components as necessary to manufacturer's instructions.

P2 Recommission hydrogen appliances to full working operation.

Knowledge and Understanding

In relation to the maintenance of appliances, the learner will need to know and understand:

K1 Specific maintenance and servicing requirements of hydrogen appliances.

K2 Operational maintenance procedures.

K3 Appliance performance checks to be carried out following maintenance work.

K4 Combustion products checks and analysis.

K5 Interpretation of data resulting from combustion product analysis.

GAS EMERGENCY ACTIONS AND PROCEDURES

Knowledge and Understanding

In relation to emergency actions, the learner will need to know and understand:

K1 Properties and characteristics of Hydrogen gas.

K2 Priorities and actions when dealing with hydrogen gas escapes and incidents.

DEALING WITH REPORTED GAS ESCAPES

Performance Criteria

All engineers carrying out work on hydrogen installations must have the capability to act appropriately in the event of a potential reported, or actual leakage of hydrogen from the installation.

P1 Carry out immediate steps to make the installation safe.

P2 Complete tightness testing in accordance with hydrogen specific procedures.

P3 Initiate appropriate actions dependent upon tightness test outcome.

P4 Demonstrate correct use of appropriate gas detection equipment.

Knowledge and Understanding

To deal effectively with reported hydrogen gas escapes, the learner will need to know and understand:

K1 Hydrogen Installation Emergency Procedures.

K2 Evacuation criteria and procedures

K3 Essential communication with customer(s)

K4 Sources of support and additional resources if required.

K5 Effective liaison with Network Distribution personnel assisting in detection and repair.

K6 Communication with third parties such as emergency services.

APPENDIX 2: APPLIANCE LIST

HYDROGEN APPLIANCES REQUIRED FOR TRAINING PURPOSES	MINIMUM NUMBER
Central Heating Boilers (various manufacturers)	2
Cooker or Hob unit (domestic or non-domestic)	1
Gas Fire and/or Heater	1
Gas meter	1

APPENDIX 3: FURTHER GUIDANCE

Guidance for the learner, the training organisation and the Recogniser of training is to be provided and as a minimum shall include:

- the pre-requisites to allow entry to the training programme
- information for the learner about the type of work they can carry out after successfully completing the training and assessment
- confirmation on whether the learner is completing an ACOP leading to hydrogen competency being added to their gas safe registration of if the training is to allow entry to the hydrogen ACS competency
- responsibilities of the training organisation
- responsibilities of the learner.

APPENDIX 4: REFERENCES, GLOSSARY, ACRONYMS AND DEFINITIONS

This Standard is set out against a background of Legislation in force in GB at the time of publication (see Appendix 2). The devolution of power to the Scottish, Welsh and Northern Ireland Assemblies means that there may be variations to the Legislation described below for each of them and consideration of their particular requirements is to be made. Similar considerations are likely to apply in other countries and reference to appropriate national Legislation will be necessary.

All relevant Legislation is required to be complied with and relevant Approved Codes of Practice (ACoPs), official Guidance Notes and referenced codes, Standards, etc. are to be taken into account.

Care is to be taken to ensure that the latest editions of the relevant documents are used.

A4.1 REFERENCES

- L56 Safety in the Installation and Use of Gas Systems and Appliances - Approved Code of Practice
- IGEM/IG/1 Edition 2 Standards of training in gas work
- IGEM/H/1 Reference Standard for low pressure hydrogen utilisation
- IGEM/H/2 Hydrogen Interim Standard
- PAS 4441 Functional and Test requirements for Hydrogen Gas Metering
- PAS 4442 Material requirements for gas installation pipework fittings for use with hydrogen
- PAS 4443 Requirements for ancillary valves, devices and components installed within gas installation pipework for use with hydrogen.

A4.2 GLOSSARY AND ACRONYMS

- ACS Nationally Accredited Certification Scheme for Individual Gas Fitting Operatives
- ACOP Approved Code of Practice
- GS(I&U)R Gas Safety (Installation & Use) Regulations
- HSE Health and Safety Executive
- IGEM Institution of Gas Engineers and Managers
- LPG Liquefied Petroleum Gas
- RIDDOR Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
- SSB Standards Setting Body
- SCF Standards Consultation Forum
- SMB Strategic Management Board
- LGUK Liquid Gas UK.

A4.3 DEFINITIONS

Industry accepted definitions are contained in IGEM/G/4 which is freely available by downloading a printable version from IGEM's website, www.igem.org.uk.

The definitions listed below are relevant to the use of this Specification.

class of persons — all gas engineering businesses, including self-employed gas engineers, are (subject to the limited exceptions in regulation 3(4)) required to be in membership of a class of persons approved by HSE, whether they carry out such work as their main or part activity. Gas engineers who are employed by a member of an approved class of persons but who do separate work on their own behalf need to be in membership of

	such class of persons, e.g., Gas Safe registered, in their own right. This definition is an extract from GS(I&U)R.
competence	is a combination of practical skill, training, knowledge and experience to carry out the job in hand safely, and ensuring the installation is left in a safe condition for use.
industry recognised	the Standards Setting Body is required to recognise all training for developers/providers wishing to provide training for new entrants working under the GS(I&U)R and for training providers wishing to become recognised to offer training for those working outside the scope of GS(I&U)R.
learner	a person learning a subject or skill.
domestic utilisation sector	those premises containing gas installations which are downstream of the Natural Gas Network or LPG installation emergency control valve other than non-domestic premises.
Gas Safe registered engineer	Person who has the competences and assessments to undertake the work in hand and, supervises, mentor's and assesses a learner at on-site performance in the workplace through activities carried out for a customer at the learner's place of work.
`Off-site' training	training that is undertaken in a classroom or workshop (which may be indoor or outdoor).
Standards Setting Body	The Strategic Management Board and The Standards Consultation Forum are effectively the Standards Setting Body which ensures a process is followed to ensure consultation has been undertaken in a full and proper manner.
Standards Consultation Forum	ensures that employers and stakeholders allied to the gas industry are appropriately consulted as an integral part of the process of competence standard setting arising from proposals to amend or introduce new assessment mechanisms and associated aspects for businesses seeking registration on the Gas Safe Register. For membership details contact Energy and Utility Skills Ltd.
Strategic Management Board	ensures that the mechanisms and processes established for the production, maintenance and implementation of competence criteria and associated assessment specifications, operate in an effective and efficient manner to align fully with the Legislative requirements of the Gas Safety (Installation and Use) Regulations 1998 and subsequent registration requirements for consumer safety. For details, contact Energy and Utility Skills Ltd.
supervised	in the context of this document means 'the work experienced by the learner is either being carried out by the competent person/Gas Safe registered engineer and watched by the learner but being explained and coached or when appropriate being undertaken by the learner whilst overseen and checked by the supervisor. The supervisor being responsible and in control of the work at all times.
workplace	an industrial or commercial premise or a simulated premise within a training establishment. Where the learner works.

BLANK PAGE

Communication 1878

Price Code: C0

Institution of Gas Engineers & Managers (IGEM)
IGEM House, 26 & 28 High Street
Kegworth, Derbyshire DE74 2DA

t: +44 (0)1509 678 150
e: technical@igem.org.uk
www.igem.org.uk

Registered Charity No. 214011