



Third Edition

# Gas Installation Technology

---

Andrew S. Burcham  
Stephen J. Denney  
Roy D. Treloar

WILEY Blackwell





## Gas Installation Technology



# Gas Installation Technology

*Third Edition*

*Andrew S. Burcham CertEd, MCIPHE, Eng Tech MIGEM*

Colchester Institute  
Colchester, UK

*Stephen J. Denney CertEd, MCIPHE, M.W.M.Soc (Snr)*

Colchester Institute  
Colchester, UK

*Roy D. Treloar*

**WILEY** Blackwell

This edition first published 2024  
© 2024 John Wiley & Sons Ltd.

*Edition History*

John Wiley & Sons, Ltd (2e, 2010)  
Blackwell Publishing Ltd (1e, 2005)

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, except as permitted by law. Advice on how to obtain permission to reuse material from this title is available at <http://www.wiley.com/go/permissions>.

The right of Andrew S. Burcham, Stephen J. Denney and Roy D. Treloar to be identified as the authors of this work has been asserted in accordance with law.

*Registered Office(s)*

John Wiley & Sons, Inc., 111 River Street, Hoboken, NJ 07030, USA  
John Wiley & Sons Ltd, The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK

For details of our global editorial offices, customer services, and more information about Wiley products visit us at [www.wiley.com](http://www.wiley.com).

Wiley also publishes its books in a variety of electronic formats and by print-on-demand. Some content that appears in standard print versions of this book may not be available in other formats.

Trademarks: Wiley and the Wiley logo are trademarks or registered trademarks of John Wiley & Sons, Inc. and/or its affiliates in the United States and other countries and may not be used without written permission. All other trademarks are the property of their respective owners. John Wiley & Sons, Inc. is not associated with any product or vendor mentioned in this book.

*Limit of Liability/Disclaimer of Warranty*

While the publisher and authors have used their best efforts in preparing this work, they make no representations or warranties with respect to the accuracy or completeness of the contents of this work and specifically disclaim all warranties, including without limitation any implied warranties of merchantability or fitness for a particular purpose. No warranty may be created or extended by sales representatives, written sales materials or promotional statements for this work. This work is sold with the understanding that the publisher is not engaged in rendering professional services. The advice and strategies contained herein may not be suitable for your situation. You should consult with a specialist where appropriate. The fact that an organization, website, or product is referred to in this work as a citation and/or potential source of further information does not mean that the publisher and authors endorse the information or services the organization, website, or product may provide or recommendations it may make. Further, readers should be aware that websites listed in this work may have changed or disappeared between when this work was written and when it is read. Neither the publisher nor authors shall be liable for any loss of profit or any other commercial damages, including but not limited to special, incidental, consequential, or other damages.

*Library of Congress Cataloging-in-Publication Data*

Names: Burcham, Andrew S., author. | Denney, Stephen J., author. | Treloar, Roy D., author.

Title: Gas installation technology / Andrew S. Burcham, Colchester Institute, Colchester, UK, Stephen J. Denney, Colchester Institute, Colchester, UK, Roy D. Treloar.

Description: Third edition. | Hoboken, NJ, USA : Wiley-Blackwell, 2024. | Revised edition of: Gas installation technology / R.D. Treloar, 2nd ed. Chichester, West Sussex, U.K. ; Ames, Iowa : Wiley-Blackwell, 2010.

Identifiers: LCCN 2023047916 (print) | LCCN 2023047917 (ebook) | ISBN 9781119908180 (PB) | ISBN 9781119908197 (ePDF) | ISBN 9781119908203 (epub)

Subjects: LCSH: Gas-fitting. | Gas appliances--Installation.

Classification: LCC TH6810 .T74 2024 (print) | LCC TH6810 (ebook) | DDC 696/.2--dc23/eng/20231208

LC record available at <https://lccn.loc.gov/2023047916>

LC ebook record available at <https://lccn.loc.gov/2023047917>

Cover Design: Wiley

Cover Image: © KTPPhoto/Getty Images

Set in 9.5/12.5pt STIXTwoText by Straive, Chennai, India

## Contents

**Introduction** *xi*

**Acknowledgements** *xiii*

### **1 The Gas Industry** *1*

The Gas Industry *1*

Nationally Accredited Certification Scheme for Individual Gas Fitting  
Operatives (ACS) *4*

Required ACS Assessments and Flowcharts *9*

Legislation Affecting Gas Operatives *10*

Specific Legislation Affecting Gas Operatives *15*

Industry Documents and British Standards *17*

Gas Safety (Installation and Use) Regulations *21*

The Future of Gas *24*

### **2 Gas Utilisation** *27*

Gas: Its Origin *27*

Characteristics and Properties of Gases *29*

Liquefied Petroleum Gas (LPG) *33*

The Combustion Process *34*

Air Requirements for Combustion *37*

Products of Combustion *39*

The Gas Flame *41*

Flame Pattern and Characteristics *44*

Atmospheric Burners *46*

Pre-mix Burners *48*

Gas Pressure and Flow *50*

Gas Pressure Readings *52*

Quick Reference Guide to Taking Pressures *54*

Estimating a Suitable Pipe Size *56*

Domestic Natural Gas Pipe Sizing *58*

Domestic LPG Pipe Sizing *62*

Commercial Natural Gas Pipe Sizing *67*

Gas Rates and Heat Input *69*

Electronic and Smart Meters	72
Quick Reference Tables: Gas Rate/Heat Input	73
The Physical Laws Relating to Gas	76
Measurement of Gas	78

### 3 Gas Controls 87

Quarter Turn Gas Control Valves	87
Screw Down Gas Control Valves	90
Valve Application	93
Spring-loaded Gas Control Valves	94
Electrically Operated Gas Control Valves	96
Heat-operated Gas Control Valves	98
Pressure-operated Controls Valves	100
Low- and High-pressure Cut-off Devices	102
Pressure Regulators	105
LPG Regulators	108
Flame Supervision Devices	113
Testing Flame Supervision Devices	120
Thermostatic Control	120
Multi-functional Gas Valve	122
Air/Gas Ratio Valve	125
Ignition Devices	127
Vitiation-sensing Devices	129
Pressure and Flow Proving Devices	132

### 4 Installation Practices 135

Polyethylene Pipe Jointing	135
Copper Pipe Jointing	138
Mild Steel Pipe Jointing	141
Semi-rigid and Flexible Pipe Connections	143
Gas Service and Installation Pipework	145
Connections to High-rise Buildings	150
Gas Meter Installations	153
Commercial Gas Installations	158
Internal Installation Pipework	160
Pipework Laid in Floors	162
Pipework in Walls	165
Pipework Support and Allowance for Movement	168
Timber-framed Dwellings	170
LPG Supply	173
LPG Cylinder Installation	174
Storage and Transportation of LPG Cylinders	176
LPG Bulk Tank Installation	178
Gas Supplies from a Bulk Tank Installation	181
LPG Cylinder Sizing	184

- 5 Testing and Purging 187**
  - Testing and Purging 187
  - Tightness Testing With Air (Domestic) 193
  - Tightness Testing Natural Gas Installations (Domestic) 194
  - Tightness Testing LPG Installations (Domestic) 199
  - Purging Domestic Gas Installations 204
  - Commercial Strength and Tightness Testing (TPCP1A) 209
  - Commercial Strength and Tightness Testing (TPCP1) 217
  - Direct Purging Commercial Pipework 230
  - Indirect Purging Using Nitrogen ( $N_2$ ) 239
  
- 6 Flues and Chimneys 243**
  - Flue/Chimney Classification 243
  - Chimney/Flue Material and Specification 244
  - Natural Draught Open-Flue Systems 248
  - Installation of an Open-Flue Chimney 250
  - Minimum Open-Flue Heights Domestic  $\leq 70$  kW 252
  - Minimum Open-Flue Heights Commercial  $> 70$  kW 254
  - Open-Flue Terminal Design and Location 258
  - Condensation within Open-Flue Systems 262
  - Brick Chimneys 264
  - Flexible Stainless Steel Flue Liners 267
  - Pre-cast Flue Blocks 270
  - Pipes Used for Chimneys 272
  - Fan Draught Open-Flue Chimney Systems 274
  - Shared Open-Flue Chimney Systems 276
  - Checking and Testing Open-Flue Systems 279
  - Room-Sealed Flue Chimneys 282
  - Fan-Assisted Room-Sealed Flue Appliance 284
  - Room-Sealed and Fan Flue Terminal Locations  $\leq 70$  kW 288
  - Room-Sealed and Open-Flue Terminal Locations  $> 70$  kW 293
  - Shared Room-Sealed Flue Systems 295
  - Fan Dilution System 301
  - Concealed Flues 302
  
- 7 Ventilation 305**
  - Need for Ventilation 305
  - Ventilation Location 308
  - Effective Ventilation 311
  - Purge Ventilation (Rapid Ventilation) 315
  - Ventilation Sizing and Tables 316
  - Domestic Ventilation Tables 319
  - Commercial Ventilation Tables 321
  - Worked Examples for Domestic Premises 325
  - Worked Examples for Commercial Premises 330
  - Domestic Ventilation Ready Reckoner 334

- 8 Gas Installer Responsibility 337**
- Working on Gas Installations and Appliances 337
  - Commissioning 339
  - Servicing Gas Appliances/Installations 346
  - Installation of Second-hand Appliances 348
  - Landlords' Gas Safety Responsibilities 348
  - Gas Industry Unsafe Situations 351
  - Gas Escape Procedures 357
  - Reporting of Injuries, Diseases and Dangerous Occurrences Regulations (RIDDOR) 359
  - Carbon Monoxide Detection 361
  - Gas Operative's Response to an Activated CO Alarm 362
  - Determining the Ambient Level of CO in a Room (CO Build-up Test) 364
  - Ambient Air Testing for CO<sub>2</sub> in a Non-Domestic Setting 367
  - Combustion Performance Analysis 368
- 9 Domestic Appliances 375**
- Gas Fires and Space Heaters 375
  - Component Parts of a Gas Fire 377
  - Open-Flued Radiant Convector Gas Fires 379
  - Open-Flued Solid Fuel Effect Fires and Heaters 381
  - Installation of Open-Flued Gas Fires 384
  - Decorative Fuel Effect (DFE) Gas Fires 391
  - Fan Flued and Room-Sealed Space Heaters 393
  - Flueless Space Heaters 396
  - Commissioning and Servicing Space Heaters 398
  - Domestic Gas Cookers 401
  - Installation of Cooking Appliances 406
  - Domestic Flued Cooking Range 408
  - Commissioning and Servicing Cookers 410
  - Instantaneous Gas Water Heaters 413
  - Instantaneous Water Heater Operation 416
  - Components and their Operation 419
  - Installation of Water Heaters 421
  - Commissioning and Servicing of Water Heaters 422
  - Domestic Gas Boilers 426
  - Conventional or Traditional Gas Boilers 428
  - The Combination Boiler 430
  - The Condensing Boiler 431
  - Installation of Domestic Gas Boilers 435
  - Commissioning and Servicing Gas Boilers 437
  - Domestic Ducted Warm Air Heaters 441
  - Installations of Warm Air Heaters 444
  - Commissioning and Servicing Warm Air Heaters 447
  - Domestic Tumble Dryers 450



- Installation of Domestic Tumble Dryers 453
- Domestic Gas Refrigerators 455
- Leisure Appliances 456
- Greenhouse Heaters and Gas Pokers 460
  
- 10 Commercial Appliances 463**
  - Commercial Boilers 463
  - Commercial Boiler Gas Control Systems 465
  - Commercial Warm Air Heaters 467
  - Commercial Direct Fired Air Heaters 470
  - Commercial Indirect-Fired Air Heaters 471
  - Commercial Hot Water Storage Heaters 473
  - Commercial Instantaneous Water Heaters 475
  - Overhead Radiant Heaters 477
  - Ventilation for Overhead Radiant Heaters (Type A – Flueless) 482
  - Gas Boosters 485
  
- 11 Commercial Laundry 493**
  - Commercial Laundry Equipment 493
  - Tumble Dryer and Rotary Ironer 494
  - Make-up Air 494
  - Exhaust and Ducting Systems 496
  - Commissioning and Maintenance 497
  - Gas Washing Machine 498
  
- 12 Commercial Catering 501**
  - Commercial Catering 501
  - Catering Establishments 503
  - Ventilation/Extraction in Commercial Kitchens 506
  - Commercial Catering Appliances 515
  - Mobile Catering Units 532
  
- 13 Educational Establishments 535**
  - Educational Establishments 535
  - General Considerations 535
  - Gas Pipework 535
  - Isolation Valves and Interlocks 537
  - Boiler Rooms and Plant Rooms 538
  - Ventilation and Flues 539
  - Appliances 541
  - Commissioning, Testing and Maintenance 541
  
- 14 Non-permanent Dwellings 543**
  - Residential Park Homes 543
  - Leisure Accommodation Vehicles – General Requirements 545

Leisure Accommodation Vehicles – Caravan Holiday Homes 548  
Leisure Accommodation Vehicles – Caravans and Motor Caravans 551  
Gas Supply on Boats 553  
Pipework Installation on Boats 556  
Tightness Testing on Boats 557  
Appliances and Ventilation for Boats 559

**15 Electrical Work 563**

Electricity 563  
Electrical Safety 565  
Bonding 567  
Safe Isolation 571  
Inspection and Testing 576  
Fault Diagnosis of Basic Electrical Controls 577

**16 The ACS Assessment Process 581**

The ACS Assessment Process 581  
Matters of Gas Safety Criteria 583  
Your ACS Assessment (CCN1) 584

**Glossary 591**

**Appendix A Abbreviations, Acronyms and Units 605**

**Index 609**

## Introduction

The highly respected second edition of Gas Installation Technology was completed in 2010, and as with any technical work, revisions are needed in light of new thinking, industry updates, advances and innovations. This third edition builds on the fine foundation of the work completed by Roy Treloar and continues to cover all areas of the gas industry that operatives are likely to encounter.

In addition to being fully updated to current standards, the layout has been revised and includes a number of additions. An appendix has been included along with a comprehensive index and section-numbered text for ease of referencing. Commercial Catering and Commercial Laundry have been given their own dedicated parts, and there are additional parts focusing on Educational Establishments and the ACS Assessment Process. Full-colour photographs are now displayed throughout.

The information contained within continues to purposely group together all the various aspects of gas work to include both natural gas and LPG within domestic and commercial installations. This overcomes the problem of repeating topics and allows all relevant information to be contained within one volume. There are variances to this, hence the need to sometimes identify specific installation types and procedures, and this has been done where necessary.

Although many recent industry standards and documents have adopted new style unit symbols in their specification text, we have continued to use the more familiar original notations throughout this book, as shown below and defined in the Appendix:

New style unit symbols	Original style as used within this book
$\text{m s}^{-1}$	m/s
$\text{m}^3 \text{h}^{-1}$	$\text{m}^3/\text{h}$
$\text{m}^3 \text{s}^{-1} \text{m}^2$	$\text{m}^3/\text{s}/\text{m}^2$

The book is not designed to be read from cover to cover, and the reader will invariably need to dip into it to retrieve information on a specific problem or interest. A particular topic of interest can be found in one of the following ways:

- First, by referring to the contents page which identifies the subject areas of the book.
- Second, by referring to the index and choosing a term related to the subject in question.

This book will be beneficial to both new entrants to the gas industry and highly experienced engineers alike. It will prove an invaluable on-site guide for all gas engineers, and we hope that it will also prove useful during training and in preparation for your ACS assessments.

It should be noted that Building Regulations differ depending on where you are working in the United Kingdom. As it has not been possible to list all regional differences, this publication primarily refers to Building Regulations (England). Therefore, operatives should ensure that they are working to the correct regulations by contacting their Local Authority Building Control.

With the completion of this revised edition, it is our sincere hope and expectation that *Gas Installation Technology* will continue to be widely used and respected by all sectors of the gas industry.

*Stephen Denney/Andrew Burcham*

## Acknowledgements

We would like to acknowledge Roy Treloar for his work in the first two editions of Gas Installation Technology without which this edition would not exist. We also express our gratitude to Colchester Institute, Leslie Bennett, Carmine Sagnella, Jemma Hyde and Geoffrey Eaton who assisted us in various ways during the production of this publication. Also, to Ian Cook, Kai Sillery and Andy Lord for contributing personal photographs displayed in Parts 2 and 9.

Our thanks also go to the following companies and organisations for their kind permission to reproduce photographs which are new to this edition: Alde International (UK) Ltd; Gas Safe Register; Johnson and Starley Ltd; Lifestyle Appliances Ltd; Maywick Ltd; Powrmatic Ltd; Rinnai UK; Titan Products Ltd; Truma Ltd.

We generously acknowledge that data in many of the tables within this book include extracts from various publications produced by organisations such as the British Standards Institute, the Institution of Gas Engineers and Managers, and the Building Engineering Services Association. These source documents have been referenced at the start of each relevant section.

*Stephen Denney/Andrew Burcham*



# 1

## The Gas Industry

### The Gas Industry

**1.1** The gas industry has gone through major changes in the past few decades. Prior to, and during, the early 1960s most gas installation work in the UK was undertaken by British Gas. In 1968, a 22-storey block of flats in Canning Town, East London, was devastated by a major gas explosion, which persuaded the industry that a body was needed to oversee this kind of work. As a result, in 1970 a voluntary gas body was formed, called the Confederation of Registered Gas Installers (CORGI).

During the early 1970s, plumbers and heating engineers began to take a greater interest in undertaking gas work, thanks to central heating systems becoming a requirement in the average home. In 1972 the first Gas Safety Regulations were introduced, which identified the legal responsibilities to which the installer had to adhere.

With the introduction of the Approved Code of Practice (ACOP) in 1990, gas installers started to take updated training and assessments in gas working practices. By 1991, anyone working in the gas industry for financial gain had to be registered with a Health and Safety Executive (HSE) approved body.

From 1991 through to 2009 CORGI (renamed the Council for Registered Gas Installers) held the register, which all gas engineers needed to be a member of. On 1 April 2009, under an agreement with the HSE, the Gas Safe Register was launched and replaced CORGI as the only gas safety registration body in Great Britain and Northern Ireland. The Gas Safe Register also operates in the Isle of Man, Jersey and Guernsey and works on behalf of the relevant Health and Safety Authorities in those regions.

Since 1991 all gas engineers have needed to be assessed as competent in the aspect of gas work that they wish to undertake; undertaking any work without this assessment would mean that they are in breach of the law and working illegally. The assessment that an individual undertakes is called the Nationally Accredited Certification Scheme for Individual Gas Fitting Operatives (ACS). There are many different assessments, and these are listed in Section 1.5.

## Working in the Gas Industry

**1.2** Today, if you wish to work in the gas industry, you must belong to a Gas Safe registered company or become registered in your own right. Becoming registered is no easy task, and currently there are really only two options available:

### Option 1

Gain a qualification such as a Level 3 Diploma in Gas Engineering or a Level 3 Plumbing and Domestic Heating diploma with a gas pathway.

These qualifications are usually linked to an apprenticeship and are vocational, meaning employment with a Gas Safe registered company is necessary. These qualifications require the completion of in-centre and work-based training. This provides the knowledge, skills and experience individuals need to apply for Gas Safe registration after completion of the knowledge and practical assessments associated with the course. In addition, you will also be required to build an 'on the job' portfolio of work-based evidence whilst working under the direct supervision of a registered gas engineer. Only after you have successfully completed your qualification can you apply for Gas Safe registration.

### Option 2

Enrol in an industry-recognised training programme that meets the requirements of IGEM/IG/1 'Standards of training in gas work'.

This standard, first published on 1 April 2014 by the Institution of Gas Engineers and Managers (IGEM), provides the agreed scope and structure of training for new entrants to the gas industry and will enable you to gain experience in the areas of gas work that you wish to undertake. The course will be an extended Managed Learning Programme (MLP) and will consist of a minimum number of classroom-based guided learning hours.

You will also need to complete a minimum number of hours 'on the job' training whilst working under the direct supervision of a Gas Safe registered engineer who is willing to sponsor and train you, acting as your mentor. During this period, you will need to complete a portfolio with authenticated evidence of installations that you have completed, demonstrating the relevant knowledge, skills and experience you have gained whilst working under the guidance of the registered installer.

You will then complete a range of theoretical and practical assessments at the training centre to prove your knowledge, skills and understanding of matters relating to gas safety. Upon successful completion of both on and off-site requirements, you will be issued with a certificate of training.

With your certificate of training, you can now apply to undertake the written and practical ACS assessments relevant to your MLP training course. Only after completing your MLP and passing your ACS assessments can you obtain work with a Gas Safe registered business or apply to become registered in your own right.

The contact details for the HSE gas registration scheme are:

### Gas Safe Register

Website: [www.gassaferegister.co.uk](http://www.gassaferegister.co.uk)

Email: [enquiries@gassaferegister.co.uk](mailto:enquiries@gassaferegister.co.uk)

Phone: Engineers: 0800 408 5577; Consumers: 0800 408 5500



Regardless of which option you choose, if in the future you would like to extend the scope or range of gas work undertaken, you will first need to provide evidence to the training centre that you have Gas Safe registration. There must also be a minimum period of 12 months since completion of your original core gas safety qualification or ACS. You will then be required to undertake further classroom-based training on your chosen subject before attempting the relevant ACS assessments.

Where an engineer wishes to extend the scope or range of gas work within 12 months of completing their core qualification or ACS, it is possible to undertake an MLP – Bridge with a recognised training provider. The training duration and content will follow the specification set out in IGEM/IG/1 for the relevant extensions. Gas Safe registration will be required.

## Gas Safe Register

**1.3** The Gas Safe Register is the only registration body for businesses and individuals working within the gas industry in Great Britain, Northern Ireland, Isle of Man, Jersey and Guernsey. By law, all individuals and businesses working with gas in these regions must be on the Gas Safe Register. Each operative is issued with a personal licence number but may not necessarily have their own individual registration. Often it is the business that is registered, but registration will only be granted providing the business employs at least one qualified gas engineer. All gas engineers that a business employs must be listed on the Gas Safe Register, which is publicly available for consumers to verify online.

As further proof that an operative is qualified and on the register, Gas Safe issues an identification card annually to all those registered. The operative should carry this as proof of registration and is encouraged to show this to their customers. On the reverse of the card is a list of the work categories that the operative is allowed to perform, see Figure 1.1.

Gas Safe carry out inspections of the work performed by businesses on the register to ensure compliance with the law. Gas Safe will also investigate gas safety complaints and, where necessary, apply sanctions for unsafe work or where there have been breaches to the rules of registration.



(a)

**Figure 1.1** (a) An example of the Gas Safe Register ID card (front). (b) An example of the Gas Safe Register ID card (rear). Credit: Gas Safe Register

Domestic	Gas	LPG	Non-Domestic	Gas	LPG
Pipework	31/03/23	31/03/23			
Cooker	31/03/23	31/03/23			
Fire	31/03/23	31/03/23			
Water Heater	31/03/23	31/03/23			
Gas Boiler	31/03/23	31/03/23			
Comb Analysis	31/03/23	31/03/23			
The cardholder is deemed competent only in the categories of work identified by a date.					<b>3456789</b>

(b)

Figure 1.1 (Continued)

Although registration has been a legal requirement since 1991, there are still regular instances of individuals working illegally and putting people’s lives at risk by leaving unsafe gas installations. Gas Safe play a critical role in investigating this illegal work and will pass investigation reports of illegal gas work performed by un-registered individuals and businesses to the HSE for further investigation and possible prosecution.

**Working Without Registration**

**1.4** By carefully examining the Gas Safety (Installation and Use) Regulations you will find that it is possible to undertake some gas work without the need for registration, but these circumstances are very limited. For example, Regulation 2 lists areas to which the Gas Regulations do not apply. These include certain work within factories, mines, quarries, agricultural premises etc. However, when working in such premises, competence in gas work is still required in order to comply with the requirements of the Health and Safety at Work Act. In addition, the Gas Regulations stipulate that whoever works on a gas fitting or installation must be competent to do so whether or not they are required to be an approved member of a class of persons (Gas Safe). This would also apply to do-it-yourself gas work or those performing favours for friends and family. The law requires that an individual who intends to carry out these types of gas work still needs to be competent. This can be proved by successfully completing an appropriate training course followed by an assessment of competence sufficient for, and relevant to, the type of work being undertaken.

**Nationally Accredited Certification Scheme for Individual Gas Fitting Operatives (ACS)**

**1.5** In order for gas operatives to prove competence and work in a particular aspect of the profession, they need to have undertaken the appropriate ACS gas assessment. There are many different assessments that are applicable to domestic, commercial, natural gas

and liquified petroleum gas (LPG) installations; there are also some specialist and service provider assessments. In addition to the list of assessments identified below, there is a range of changeover assessments, providing conversions between the various core assessments, e.g. domestic to commercial (CCN1 to COCN1). These are listed under *changeover assessments* in Section 1.6.

**The following specific ACS Assessments are organised alphabetically under these categories:**

- **Domestic**
- **Emergency Service Provider/Meter Installations**
- **LPG**
- **Non-Domestic**

### ***Domestic***

**CCN1** – Core domestic natural gas safety

**CENWAT** – Domestic central heating boilers and instantaneous water heaters ( $\leq 70$  kW)

**CKHB1** – Domestic gas range cooker/boilers

**CKR1** – Domestic gas cooking appliances

**CMDDA1** – Carbon monoxide/carbon dioxide atmosphere and appliance testing

**CPA1** – Combustion performance analysis

**DAH1** – Domestic gas ducted air heaters ( $\leq 70$  kW)

**DFDA1** – Appliances with forced draught burner in domestic dwellings

**EFJLP1** – Domestic/non-domestic electro-fusion jointing of PE pipework and fittings

**HTR1** – Domestic gas fires and wall heaters

**HWB1** – Gas fired swimming pool boilers

**LAU1** – Domestic gas laundry appliances

**LEI1** – domestic gas leisure/miscellaneous appliances (Barbecues, greenhouse heaters, refrigerators, gas poker, gas lighting and patio heaters)

**MET1** – Domestic gas meters up to  $6 \text{ m}^3/\text{h}$

**WAT1** – Domestic gas instantaneous water heaters

### ***Emergency Service Provider/Meter Installations***

**CESP1** – Core domestic and non-domestic emergency service provider gas work

**CMA1** – Core domestic and non-domestic gas metering work

**CMA2 LS** – Core domestic limited scope meter work

**CMA3** – Gas meter installer domestic natural gas with a maximum capacity not exceeding  $6 \text{ m}^3/\text{h}$

**CMET1** – Natural gas low-pressure diaphragm and rotary displacement meter installations

**CMET2** – Natural gas diaphragm, rotary displacement and turbine meters not exceeding 7 bar

**CMIT1** – Emergency service provider limited scope gas work on meter instrumentation

**MET3 LS** – Domestic natural gas meter installations with a capacity not exceeding  $6 \text{ m}^3/\text{h}$  (limited scope)

**MET4** – Non-domestic diaphragm gas meter installations  $\leq 40 \text{ m}^3/\text{h}$

**REGT1** – Domestic medium pressure meter regulator installation and commission

**REGT2** – Non-domestic medium pressure regulators and controls installation and commission

### **LPG**

**CCLP1** – Core LPG gas safety

**CCLP1 B** – Core LPG gas safety: Boats, yachts and other vessels

**CCLP1 EP** – Core domestic LPG gas safety for external pipework – limited scope (Must be taken in conjunction with VESLP1)

**CCLP1 EPC** – Domestic LPG external pipework connections

**CCLP1 LAV** – Core LPG gas safety: Leisure accommodation vehicles

**CCLP1 MC & CABLP1** – Limited scope core gas safety for LPG mobile cabinet heaters & commission service, repair and break down domestic butane gas-fired mobile cabinet heaters

**CCLP1 PD** – Core LPG gas safety: Permanent dwellings

**CCLP1 RPH** – Core LPG gas safety: Residential park homes

**EFJLP1** – Domestic/Non-domestic electro-fusion jointing of PE pipework and fittings

**HTRLP2** – Domestic LPG closed flue gas fires

**HTRLP3** – Domestic LPG caravan space heaters

**LEILP1** – LPG single bottle supply leisure equipment (barbecues, greenhouse heaters, gas lighting and patio heaters)

**REFLP2** – Domestic LPG refrigerators in motorised and touring caravans, and boats

**VESLP1** – LPG single gas storage vessels & service pipework

**VESLP2** – LPG single & multi supply gas storage vessels and service pipework

**WAHLP1** – Domestic LPG boat/caravan warm air heaters

**WATLP2** – Domestic LPG caravan gas water heaters

### **Non-Domestic**

**BMP1** – Gas boosters operating pressure up to 0.5 bar pressure

**CCCNI** – Natural gas commercial catering core safety

**CCLNG1** – Natural gas commercial laundry core safety

**CCP1** – Commissioning plant and equipment

**CDGA1** – Direct-fired commercial heating appliances and equipment

**CGFE1** – Gas fuelled engines

**CGLP1** – LPG-fired generators

**CIGA1** – Indirect commercial gas-fired heating appliances and equipment

**CLE1** – Commercial laundry appliances

**CMC1** – Commercial mobile catering

**COCNI** – Natural gas commercial heating appliances core safety

**COCNPII LS** – Natural gas core commercial gas safety pipework installer/commissioner (limited scope)

**COMCAT1** – Commercial catering appliances with atmospheric burners, e.g. boiling burners, open/solid top (Ranges)

- COMCAT2** – Commercial catering appliances with atmospheric burners, e.g. pressure type water boilers (pressure steamers, pressure steaming ovens)
- COMCAT3** – Commercial catering appliances deep fat and pressure fryers
- COMCAT4** – Commercial catering appliances fish and chip ranges
- COMCAT5** – Commercial catering appliance forced draught burner appliances
- CORT1** – Commercial overhead radiant plaque and tube heaters
- EFJLP1** – Domestic/Non-domestic electro-fusion jointing of PE pipework and fittings (Natural gas & LPG)
- ICAE1 LS** – Limited scope commercial first fix appliances and equipment
- ICPN1** – First fix commercial pipework
- ICPN1 LS** – First fix commercial pipework limited scope
- TPCP1** – Testing and purging commercial gas pipework  $>1 \text{ m}^3$  with MOP  $\leq 16$  bar
- TPCP1A** – Testing and purging low-pressure commercial gas pipework  $\leq 1 \text{ m}^3$  with MOP  $\leq 40$  mbar at outlet of the primary meter regulator

## Changeover Assessments

**1.6** In order to undertake an assessment in the particular work category that you require, e.g. CENWAT (domestic boilers/water heaters), you also need to hold the specific core assessment (CCN1). This is because the core assessment is a prerequisite to all appliance assessments.

There are several core assessment categories and many have similar assessment criteria. Therefore, it is not always necessary to undertake the complete core for a specific range of appliances as a changeover assessment can be obtained. These include:

- CoCATA** – Changeover core domestic to non-domestic catering appliances
- CoCCLNG1** – Changeover core domestic to non-domestic core laundry
- CoCDN1** – Changeover non-domestic to domestic natural gas
- CoDCI** – Changeover core domestic to catering core
- CoDNCOI** – Changeover core domestic gas to non-domestic core gas safety
- CoDNESPI** – Changeover core domestic gas to emergency service provider &/or gas meter installer
- CoLPNGI** – Changeover domestic LPG to natural gas
- CoNGLPI** – Changeover domestic natural gas to LPG – generic
- CoNGLPI CMC** – Changeover non-domestic natural gas to LPG mobile catering
- CoNGLPI B** – Changeover domestic natural gas to LPG – boats
- CoNGLPI LAV** – Changeover domestic natural gas to LPG – leisure accommodation vehicles
- CoNGLPI PD** – Changeover domestic natural gas to LPG – permanent dwellings
- CoNGLPI RPH** – Changeover domestic natural gas to LPG – residential park homes

## Importance of Maintaining a Current Core Assessment

**1.7** Because the core is a mandatory requirement for any further appliance assessment it must always be maintained as a valid and current assessment certificate. Assessments are

valid for five years from the date of issue. Should the core certification run out, then the validation of all other certificates received after the date of the core, including changeover, ceases, even though they may have time to run. As soon as the core category has been re-assessed and the assessment passed, the other certificates become valid again.

### Working Within Scope of ACS Work Categories

**1.8** It is important that engineers recognise the limits of their competence and remain within the scope of their ACS work categories. Questions may arise about the qualifications needed to work on domestic appliances in a commercial environment. In this situation gas engineers will need to be particularly careful not to step outside the scope of their qualifications. Gas engineers should risk assess the situation and confirm the following before deciding to work on a domestic appliance in non-domestic premises:

- The appliance is designed for domestic use and the manufacturer allows the installation in this setting.
- The appliance can be isolated from the gas supply by its own appliance isolation valve.
- The pipework downstream of an isolation valve is within the scope of a domestic engineer (see Part 5: Section 5.1).
- The appliance can be used independently and does not incorporate other appliances, such as a modular boiler installation.
- The appliance is not within a commercial catering environment.

Where any of these considerations cannot be confirmed, a suitable commercial qualification will be required.

Consider the following examples.

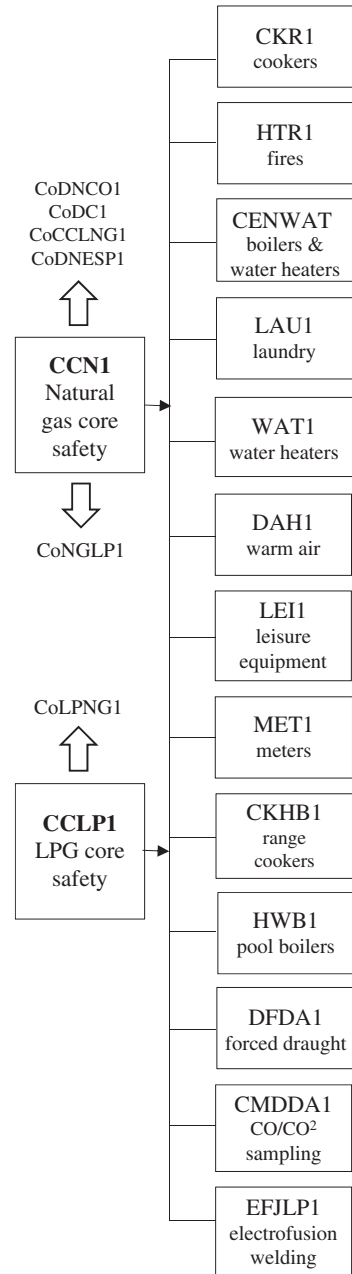
1. An operative holding CCN1 and CENWAT can work on a domestic boiler in commercial premises, providing the following conditions are met: The meter is no larger than a U16/G10; the installation does not exceed 35 mm in diameter and 0.035 m<sup>3</sup> in volume; and no other non-domestic appliances are installed. Alternatively, where the gas supply can be isolated by means of an isolation valve and the installation from the isolation valve does not exceed 35 mm in diameter and 0.035 m<sup>3</sup> in volume, the engineer can work on the boiler downstream from this valve.
2. An operative holding a commercial core can work on a domestic boiler in commercial premises if they also hold CENWAT. In these circumstances, they will not be required to hold the domestic core. However, they cannot work in domestic premises unless they obtain the domestic core. Likewise, where a commercial catering operative wishes to work on a domestic type of cooker in a commercial catering setting, they would need to acquire CKR1. In addition to CKR1, the domestic core would be required if they wanted to work on the appliance if fitted within a domestic property.
3. Where a domestic gas cooker is installed in a commercial catering setting along with other catering appliances, the installation must comply with BS 6173. So, although the appliance is of a domestic type, the gas operative would need to hold a suitable commercial catering qualification as well as CKR1. This would also apply to domestic-type cookers installed in food technology classrooms within educational establishments (see Parts 12 and 13).

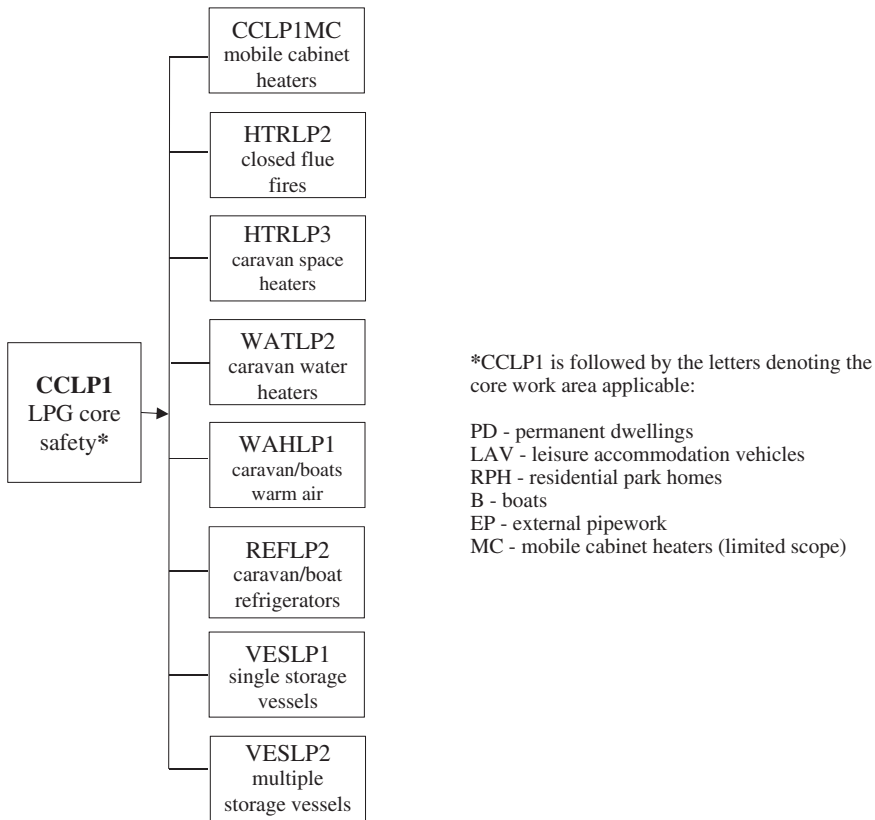
## Required ACS Assessments and Flowcharts

### Individual ACS Requirements

1.9 At first sight the vast list of ACS assessment criteria can look quite daunting and it is difficult to choose which assessment to undertake. However, this can be approached by using the flowcharts shown in Figures 1.2–1.5.

**Figure 1.2** Domestic natural gas and LPG ACS assessments





**Figure 1.3** ACS assessments specific to LPG

Points to consider:

- You must hold the specific core for the area of gas work in which you wish to work, e.g., commercial, domestic or LPG, and have any prerequisite assessments.
- If you have a domestic natural gas core and CKR1, you can work on natural gas cookers only. However, if you also have the LPG core, you can also work on LPG cookers. It is the core that denotes the type of installation into which the cooker is installed.

## Legislation Affecting Gas Operatives

**1.10** Legislation places a mandatory/legal responsibility on the gas operative, who must comply with it in order to work within the industry. The piece of legislation that affects the gas engineer most is the Gas Safety (Installation and Use) Regulations. However, this is not the only legislation that needs to be observed. In fact, in this area, most actions undertaken as general work activities are affected by some piece of legislation.



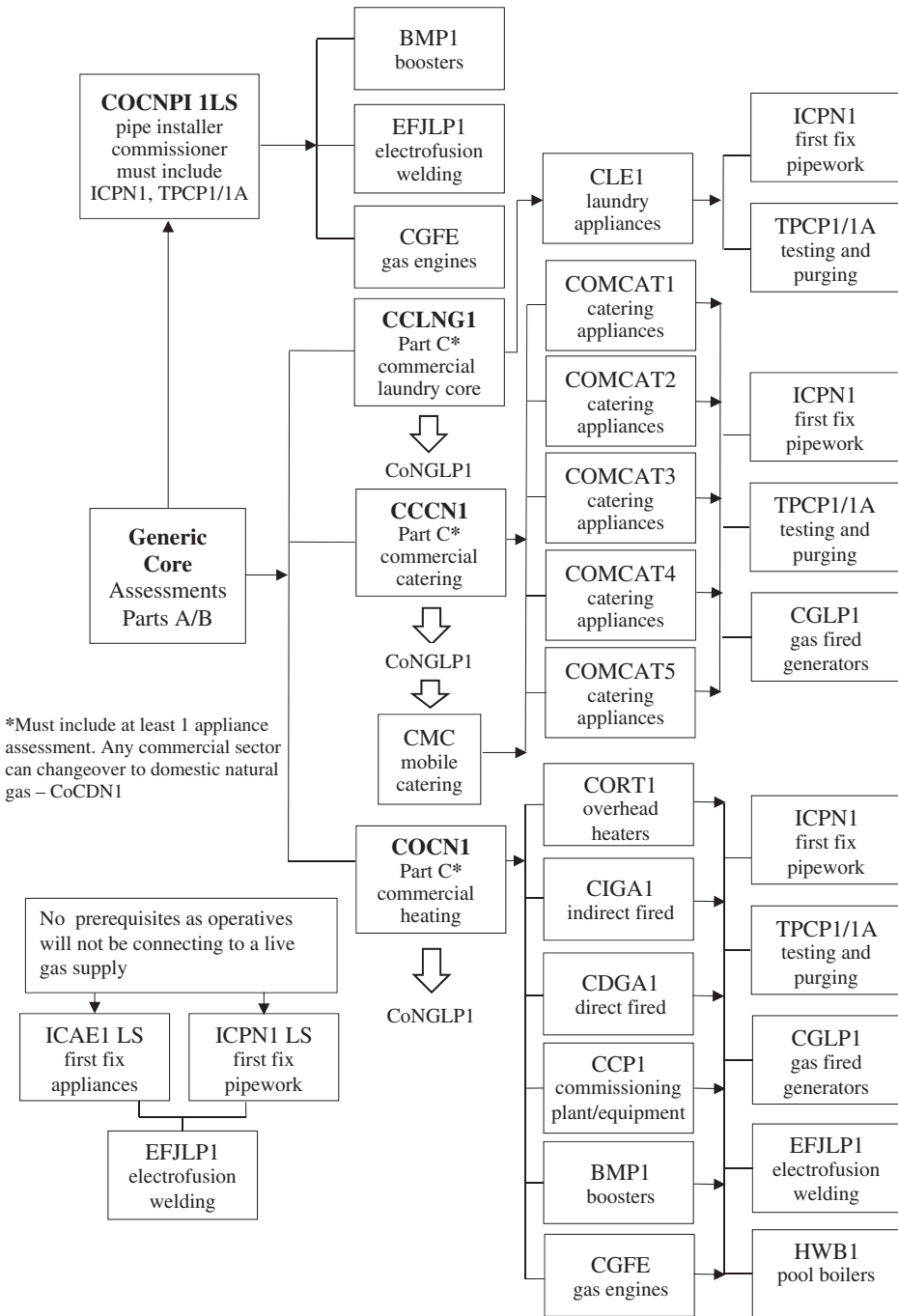


Figure 1.4 Commercial ACS assessments

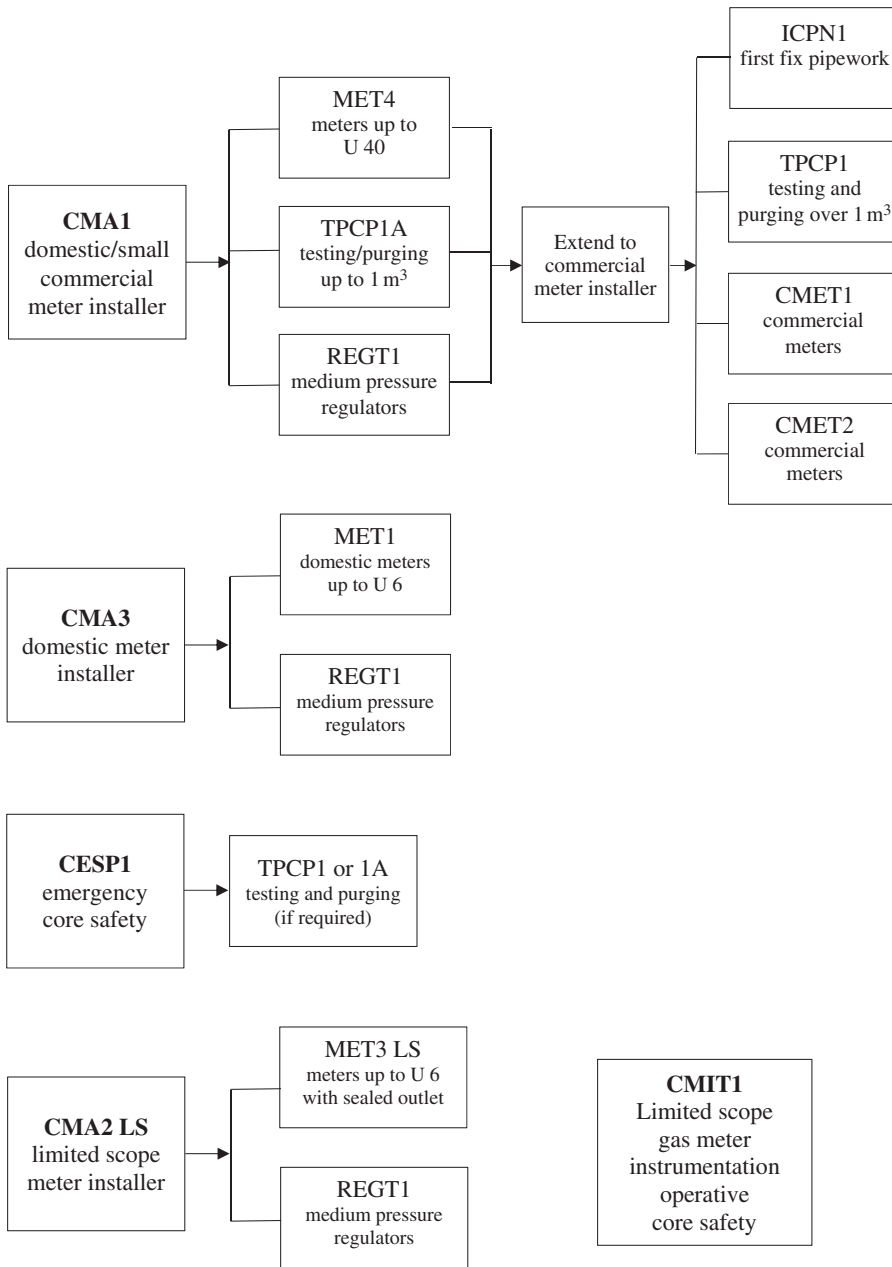


Figure 1.5 Emergency service provider operative and meter installer ACS assessments

## Hierarchy of Legislation and Standards

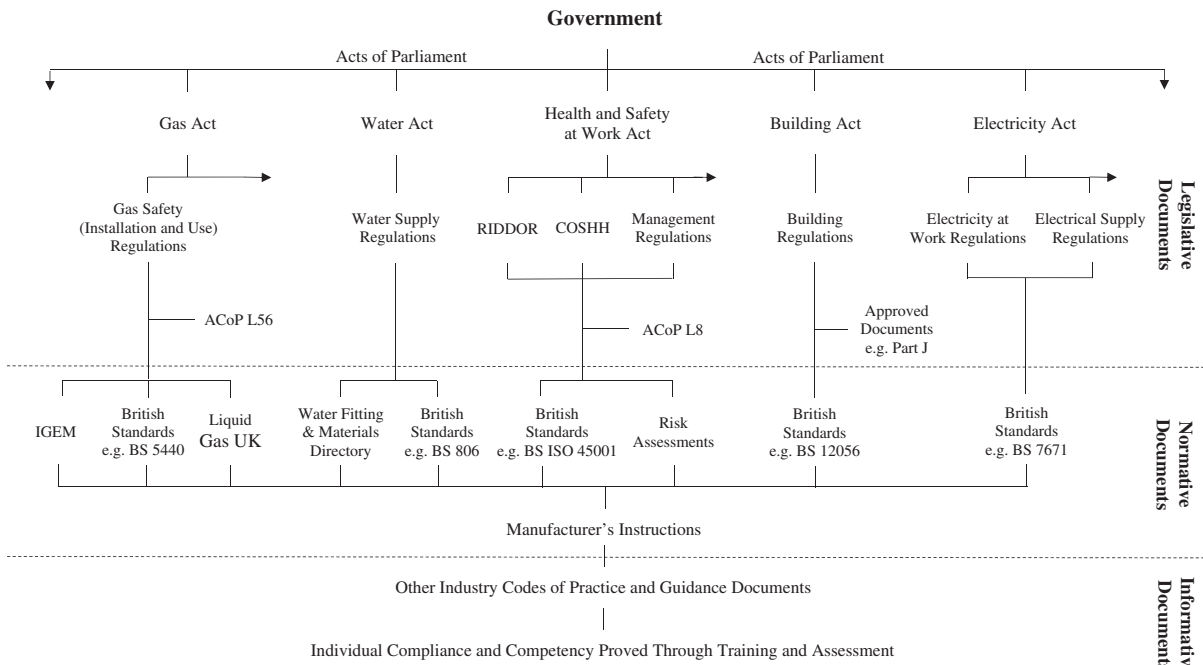
**1.11** By referring to Figure 1.6, which only represents a very small percentage of the **Legislative Documents** that must be observed, it will be seen that the law is divided into two parts, Acts of Parliament and Regulations. Acts of Parliament are the primary legislation in the United Kingdom whilst Regulations are secondary, or subordinate. Regulations are drawn up by government, often by authority given in an Act of Parliament, and are usually policed by an authority such as the HSE, local authority building control officers (BCOs) or water authorities.

Acts of Parliament and Regulations are updated as necessary and care needs to be taken to ensure that the latest version is referred to. As legislation often only states what can or cannot be done, without giving much detail, additional industry guidance documents are issued to help the installer practically comply with the law. For example, the Building Regulations have several supporting Approved Documents which give examples and solutions on how to comply with the enforceable legislation. The HSE also publish Approved Codes of Practice and guidance documents. Although these documents do not always have legal status, if the guidance in these documents is followed then there is usually the presumption that the law will be met. Where an individual chooses not to follow these guidance documents and they are prosecuted under health and safety law they will need to show that they have complied with the law in some other way or a court will find them at fault.

The next tier of documentation is referred to as **Normative Documents** and include gas industry standards such as those produced by the British Standards Institute (BSI), the Institution of Gas Engineers and Managers (IGEM) and Liquid Gas UK. These documents, along with manufacturer's instructions, are essential for gas operatives and are aimed at correct installation, commissioning and maintenance of gas appliances, pipework and associated equipment. Finally, organisations including Gas Safe publish technical bulletins (TBs) and IGEM's Gas Industry Unsafe Situations Procedure. These documents provide useful information for gas operatives as they carry out their daily activities; these are referred to as **Informative Documents**.

To help gas operatives understand and comply with current legislation and guidance, the Gas Safe Register publishes a quarterly list of all **legislative, normative** and **informative** documents. This list should be studied thoroughly as it is used, along with manufacturer's instructions, by Gas Safe Register inspectors to assess compliance of all work undertaken by those working in the industry. Further examples of these documents will be discussed in more depth later in the chapter.

It may be beneficial to view the legislative, normative and informative documents as a pyramid with legislation at the bottom and you, the gas operative, balancing at the top (see Figure 1.7). As illustrated, legislative Acts of Parliament hold up all other laws and guidelines. The gas operative sits at the top with the responsibility of personal compliance, this can be a delicate balancing act. But if the individual has a knowledge and understanding of the legislation relating to the gas industry, then he/she has a firm foundation to work from and is less likely to fall foul of the law. If an individual fails to comply it is possible that the courts will take enforcement action.



**Figure 1.6** Examples of legislative, normative and informative documents