

CONTENTS

	Page
Foreword	v
Preface	vii
Chapter 1 Introduction to LPG, its Usage and Statistics on World Consumption	1
Part 1 : Nature, Properties and Small-Bulk Utilization	
Chapter 2 Manufacture of LPG	11
2.1 Introduction	11
2.2 Recovery of LPG	12
2.3 Purification of LPG	19
Further Reading	23
References	23
Chapter 3 Composition and Chemical Properties	25
3.1 Introduction	25
3.2 Main components	25
3.3 Trace components in LP gases and their origin	28
3.4 Chemical reactions of LPG	37
Further Reading	46
References	46
Chapter 4 Physical Properties	48
4.1 Introduction	48
4.2 Properties of liquid phase	50
4.3 Properties of the gaseous phase, standard conditions of temperature and pressure	59
4.4 Properties of the saturated vapour	66
4.5 Icing phenomena	70
4.6 Vaporization and component separation	71
Further Reading	74
References	75
Chapter 5 Quality Control and Analytical Methods	76
5.1 Introduction	76
5.2 Why is control on quality important?	76
5.3 What are the important specification items?	78
5.4 What specification exist?	80
5.5 A guide to specification thinking	83
5.6 Test procedures and analysers	85
References	102
Chapter 6 Combustion of LPG	105
6.1 Oxidation of hydrocarbons	105
6.2 Combustion of gases	109
6.3 Efficiency of LPG combustion	116
Further Reading	121
Chapter 7 Burners and Ancillary Equipment	122
7.1 Gas burners	122
7.2 Burner ancillaries	134
7.3 Conclusion	138
Further Reading	138
References	138

Chapter 8	Bulk Distribution and Handling	139
8.1	Introduction	139
8.2	Distribution of LPG	139
8.3	Storage at fixed LPG installations (refineries and user plants)	145
8.4	Components of a bulk LPG installation, other than storage vessels	157
8.5	Piped LPG schemes for utility gas	166
8.6	Use of plastic pipework	171
8.7	Liquid LPG-burning installations	173
8.8	General safety precautions	174
8.9	Fire precautions	175
8.10	Standards and regulations	177
	Further Reading	178
	References	178
Chapter 9	LPG Cylinders and Associated Equipment	180
9.1	Introduction	180
9.2	Cylinders for propane and butane	180
9.3	Pressure reduction and flow control	182
9.4	Filling LPG cylinders	188
9.5	Regulations and safety	192
	References	193
Chapter 10	Domestic and Commercial Utilization of LPG	195
10.1	Introduction	195
10.2	Domestic applications	196
10.3	Commercial applications	209
	References	214
Chapter 11	LPG as an Automotive Fuel	216
11.1	Introduction	216
11.2	LPG as a spark ignition fuel	218
11.3	LPG as a supplementary diesel fuel	225
11.4	LPG quality for automotive uses	228
11.5	LPG taxation	230
	Further Reading	231
	References	231
Part 2 : The Industrial Uses of LPG		
Chapter 12	LPG as a Feedstock for the Chemical and Gas Industries	237
12.1	Gas fractionation	237
12.2	Conversion processes based on single components	239
12.3	Conversion based on LPG mixtures	241
	Further Reading	251
	References	251
Chapter 13	LPG in the Food Industry	253
13.1	Introduction	253
13.2	Solid foods manufacture	253
13.3	Manufacture of beverages	260
13.4	Synthetic foods and substitutes	264
	Further Reading	265
Chapter 14	LPG in Glass and Ceramics Manufacture	266
14.1	Introduction	266
14.2	LPG utilization by the glass industry	266
14.3	Use of LPG in the ceramics industry	273
14.4	Advantages of gas firing	285
	Further Reading	285
	References	286

Chapter 15	Use of LPG in the Building Industry	287
15.1	Introduction	287
15.2	Lime and cement manufacture	287
15.3	Bitumen processing	292
15.4	Gravel, sand and aggregate drying	294
15.5	Concrete curing	294
	References	295
Chapter 16	Gaseous Fuels for the Iron and Steel Industry	297
16.1	Introduction	297
16.2	Definition of the Iron and Steel Industry	298
16.3	Outlets for LP gases in the Iron and Steel Industry	305
	Further Reading	306
	References	306
Chapter 17	LPG in the Engineering Industries	307
17.1	Introduction	307
17.2	Melting and casting	308
17.3	Non-melting heat treatment	311
17.4	Controlled atmospheres	313
17.5	Heat processing and furnaces	317
	Further Reading	323
	References	323
Chapter 18	Steam Raising and Power Generation	325
18.1	Introduction	325
18.2	Economics of power generation	326
18.3	Gas-fired power generation systems	327
18.4	Steam raising	334
18.5	Total energy systems	336
	References	338
Chapter 19	The Use of LPG in Farming	340
19.1	Introduction	340
19.2	Drying Processes	341
19.3	Flame Cultivation	346
19.4	Use in Horticulture	348
19.5	LPG used in livestock farming	350
19.6	Miscellaneous farm uses	352
	Further Reading	353
Chapter 20	Use of LPG as an Aerosol Propellant	354
20.1	Introduction	354
20.2	Nature and size of the aerosol industry	354
20.3	The aerosol Container	356
20.4	Aerosol propellants	357
20.5	LPG propellants	358
20.6	Purification of commercial LP gases for aerosol use	360
20.7	Conclusion	363
	References	364
Chapter 21	Miscellaneous industrial LPG uses	365
21.1	Introduction	365
21.2	LPG as a solvent and flotation agent	365
21.3	LPG used in mineral oil refining	370
21.4	Autorefrigeration by LPG evaporation	373
21.5	Industrial drying and related applications	374
	References	381

Appendices	382
1. Important Conversion Factors	382
2. Liquid Volume Correction Factors	384
3. Pressure-Enthalpy Diagrams for Propane and <i>n</i> -Butane	387
4. Specifications for Propanes and Butanes	389
5. LPG Orifice Capacity	391
6. Some World Manufacturers of Combustion Equipment	392
7. Common Properties of Commercial LPG	394
Index	397