



# AUTOMOTIVE AIR CONDITIONING *AND* CLIMATE CONTROL SYSTEMS

Steven Daly



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Butterworth-Heinemann is an imprint of Elsevier  
Linacre House, Jordan Hill, Oxford OX2 8DP  
30 Corporate Drive, Suite 400, Burlington, MA 01803

First edition 2006

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#### British Library Cataloguing in Publication Data

A catalogue record for this book is available from the British Library

#### Library of Congress Cataloging-in-Publication Data

A catalog record for this book is available from the Library of Congress

ISBN-13: 978-0-7506-6955-9

ISBN-10: 0-7506-6955-1

For information on all Butterworth-Heinemann publications  
visit our web site at <http://books.elsevier.com>

Typeset by Charon Tec Ltd, Chennai, India  
[www.charontec.com](http://www.charontec.com)

Printed and bound in UK

06 07 08 09 10 10 9 8 7 6 5 4 3 2 1

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# Preface

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Vehicle subsystems are understandably never given the discourse (research) needed to allow the engineer to have a complete understanding of how such technology evolves. The subject of air-conditioning (A/C) is certainly a victim of such negligence within the UK. Textbooks exist for the US market, which contain contributions from US manufacturers like GM, but little literature exists which provides comprehensive coverage for Europe. This problem, combined with the global political pressure on manufacturers to reduce the emission of harmful refrigerant gases (R134a), is providing a catalyst for changes to A/C technology. Research into alternative refrigerants like CO<sub>2</sub> and alternative A/C systems has been ongoing for a number of years. The motor vehicle industry resists such radical moves and wants more of a progressive phasing out of R134a, giving more of a lead time for the replacement technology to be introduced. It is certainly accurate to predict that during the next couple of years A/C technology, which includes systems and procedures and possibly certification to technicians, will radically change.

This book is born out of the current debate between politics and industry and hopes to provide the reader with a thorough up-to-date knowledge of current A/C systems, refrigerants and the new possible replacement systems like CO<sub>2</sub>. The book is primarily *technology* focused, providing additional chapters on legislation and the environment. The book also has an unprecedented amount of electronic coverage with some of the very latest sensors and actuators, OBD and EOBD, test procedures using meters, scanners and oscilloscopes and additional information on how to read European wiring diagrams. This information is then applied to three practical case studies based on European manufacturers. It is imperative that A/C engineers have the fundamental understanding of automotive electronic control to enable them to successfully work within the field of automotive Heating, Ventilation and Air-Conditioning (HVAC). This book gives that level of coverage providing the reader with a holistic understanding of the climate control system.

I hope you enjoy reading this book as much as I enjoyed writing it.

Steven Daly



# Acknowledgements

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This book has been successfully produced due to the contribution of the following companies. They have provided diagrams, information and services in the quest to help provide a comprehensive account of the current and future technological advancement of the A/C industry.

1. Amerigon – Dan Pace
2. Autoclimate – Brian Webster, James Onion
3. Autodata Ltd – Malcom Rixon
4. Crocodile Clips – Kirsty Guthrie
5. Elsevier, Commissioning editor – Jonathan Simpson
6. Environ – Barry Quested, Scott Mitchell
7. EPA – Kristen Taddonio
8. Fluent CFD – Chris Carey, Helen Rushby
9. Fluke – Simon Worrall
10. Ford – David Grunfeld, Avtar Singh, Alan Jones, Steve Green, George Klinker
11. Rover
12. Sanden UK – Mike Tabb
13. SMMT – Eva de Marchi Taylor
14. Tellurex
15. Toyota UK – Paul Hunt, Lisa Halliday, Heidi Lismore
16. Vauxhall Motor Company – Adam Colins, Tony Rust, Barry James, Paul Usher
17. Visiteon – John Sherringham

All my love to my wife Tina and two children Luke and Jack. Without your support, patience and understanding I could not have completed this book.

# Introduction: An overview of the automotive air-conditioning market, training and qualifications

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The aim of this section is to:

- Enable the reader to appreciate the growth pattern of the A/C market.
- Enable the reader to appreciate the opportunities available due to the growth and development of the A/C market.

The A/C market can be viewed from various statistical viewpoints, several of which are included below. Ultimately, whatever the perspective, the picture is of tremendous and sustained market growth, both over the last decade and into the coming years.

## New registration of cars with A/C

The proportion of A/C registrations (the registration of new vehicles with A/C compared to without A/C) has risen dramatically since the mid-1990s. The pattern is a typical 'S-shaped' growth curve. The fastest rate of increase was between 1995 and 1998, when the penetration of factory-fit A/C tripled.

## The global statistics

Figure P.1 provides information on A/C registrations per international region including predictions on future demand. These percentages include vehicles with manual, semi-automatic and Automatic Climate Control (ACC).

The statistics provide evidence of an increased penetration of the ACC system on new vehicles. The ACC system is showing growth in regions where A/C penetration has not increased – NAFTA and Japan. This provides evidence of the increased level of comfort customers expect with the purchase of a new vehicle and of course the competition involved with new vehicle sales.

