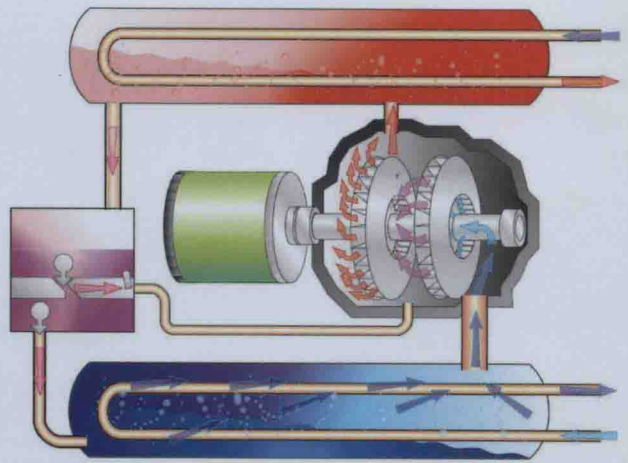
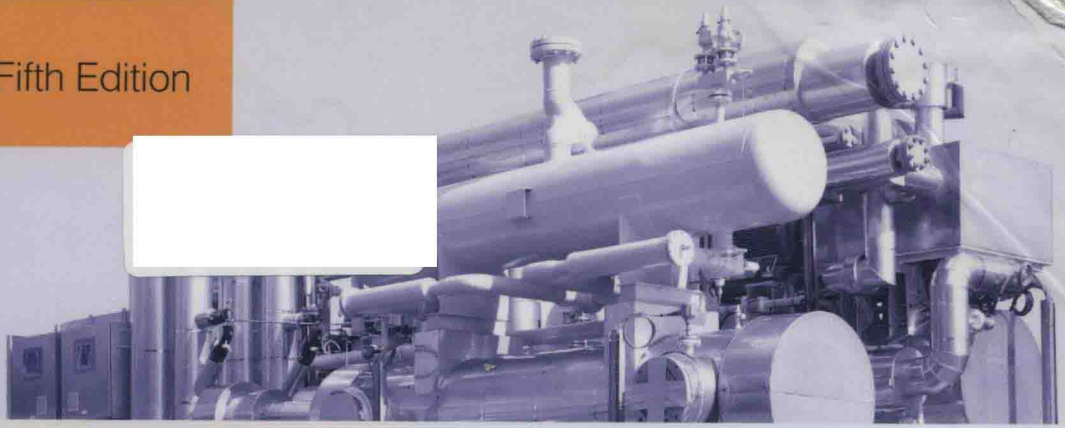


Fifth Edition



Refrigeration, Air Conditioning and Heat Pumps

G F Hundy • A R Trott • T C Welch



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REFRIGERATION, AIR CONDITIONING AND HEAT PUMPS

Refrigeration: The process of removing heat.

Air-conditioning: A form of air treatment whereby temperature, humidity, ventilation, and air cleanliness are all controlled within limits determined by the requirements of the air conditioned enclosure.

BS 5643: 1984

Heat pump: A device which extracts energy from a source at low temperature and makes it available as useful heat energy at a higher temperature.

R. D. Heap, 1982

PREFACE

In this fifth revision I have included further information about developments and innovations whilst at the same time retaining the fundamentals and depth of technical detail. The addition of heat pumps to the title reflects the fact that heating provision using refrigeration technology is now a serious contender in many situations. A further area of innovation is integrated heating and cooling whereby previously discarded heat is utilised or raised to a temperature where it can be utilised. Refrigeration is all about moving or 'pumping' heat from a lower to a higher temperature.

The task of refrigeration engineers is to achieve this movement of heat with the lowest power consumption in a cost effective manner. This is always a trade-off, but innovative technology is delivering advances. This has to be set against a background of environmental impact. Many effective refrigerants contribute to global warming if released to atmosphere, and improved containment together with legislation regarding the usage of these substances has impelled developments. The industry has paved the way for these constraints by developing new, less-damaging chemicals, and showing how other so-called 'natural' products can be used in applications where they were previously considered unsafe or just impractical. Standards, good practice guides, and training, all supported by industry, are vital components of this story, which is continuing today.

A.R. Trott designed this book to give an appreciation of the subject, building on the unchanging fundamentals in a logical way. This was further developed by T.C. Welch and I am indebted to both these authors for developing this approach. I would also like to thank friends and colleagues in the industry who have helped with information, proofread drafts, and provided suitable illustrations.

Guy Hundy
October 2015



PREFACE TO THE PREVIOUS EDITION

Refrigeration and air conditioning absorb about 15% of the United Kingdom's electrical generation capacity and it is not always appreciated that refrigeration technology is essential to our modern way of life. Without it, distribution of food to urban areas may not be possible. In a typical office, air conditioning can account for over 30% of annual electricity consumption, yet who cares about checking the system to find out if it is working efficiently?

Reducing the environmental impact of cooling whilst maintaining and expanding expectations is the driver of many of the developments which have been made since the last edition of this book. Aimed at students, and professionals in other disciplines, not too theoretical but with sufficient depth to give an understanding of the issues, this book takes the reader from the fundamentals, through to system design, applications, contract specifications and maintenance. Almost every chapter could be expanded into a book in itself and references are provided to assist those wishing to delve deeper. Standards and legislation are subject to change and readers are recommended to consult the Institute of Refrigeration web site for the latest developments.

This edition gives an up-to-date appreciation of the issues involved in refrigerant choice, efficiency, load reduction and effective air conditioning. Managing heat energy is going to be crucial in the quest of the United Kingdom to reduce carbon emissions – and managing heat rather than burning fuel to generate more of it, is what heat pumps do. Refrigeration technology has a potentially huge role to play in heating, which is where a very large proportion of the energy in United Kingdom is spent.

In navigating this book you should be guided by the context of your interest, but at the same time develop an awareness of related topics. Most real problems cross boundaries, which are in any case difficult to define, and some of the most exciting developments have occurred when taking concepts from various branches to other applications in innovative ways.

I am much indebted to friends and colleagues in the industry who have helped with information, proofread drafts, and given guidance on many of the topics. Thanks are due in particular to individuals who have gone out of their way to provide suitable illustrations and to their organisations for supporting them.

Guy Hundy
July 2008



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LIST OF ABBREVIATIONS

IOR	Institute of Refrigeration, London
IIR	International Institute of Refrigeration, Paris
IPCC	International Panel on Climate Change
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Atlanta
IMechE	Institution of Mechanical Engineers, London
CIBSE	Chartered Institution of Building Services Engineers, London
ACRIB	Air Conditioning and Refrigeration Industry Board (United Kingdom)
DEFRA	Department for Environment Food & Rural Affairs (United Kingdom)
ASERCOM	Association of European Refrigeration Compressor and Controls Manufacturers
IEA	International Energy Agency
VDMA	Verband Deutscher Maschinen- und Anlagenbau e.V. (German engineering association)
LSBU	London South Bank University
ODP	Ozone Depletion Potential
GWP	Global Warming Potential
TEWI	Total Equivalent Warming Impact

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