Fundamentals of Psychrometrics

Second Edition

Don Brandt

A Course Book for Self-Directed or Group Learning

ASHRAE®

Atlanta

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Manager of Professional Development

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Standard 90.1 for Architects
Standard 189.1 for High-Performance Green Buildings
Data Center Equipment Load Trends and Planning
Data Center Thermal Guidelines
Data Center Liquid Cooling

Don Brandt is an ASHRAE member from Phoenix, Arizona, who spent 39 years (4 of them part time) with Trane Co., mostly as a Commercial Sales Engineer and Sales Manager. He was involved in thousands of projects over that time period, including many with large industrial customers that had special HVAC and process applications. Brandt also taught the Trane A/C Clinic series many times to young engineers starting out in the industry.

Brandt has also been active in ASHRAE at all three levels of organization—Chapter, Regional, and Society—during this same period. He is a charter member and past president of the Anthracite Chapter in Northeast Pennsylvania. He was the Technical, Energy and Government Activities Committee (TEGA) Regional Vice Chair for Region X, the TEGA Vice Chair and Chair in 2002, Region X Director and Regional Chair from 2002–2005, on the Board of Directors from 2002–2005, and a member of Standards Committee from 2005–2009 as a Standards Project Liaison Subcommittee (SPLS) Liaison. In 2001 he became a member of Professional Development Committee, moving up to Chair in 2013. He is currently a member of the Energy Targets Multidisciplinary Task Group, a Nominating Member for Region X, and Member of the Appeals Board for Standards.

Brandt is a 1974 graduate of Penn State with a BS in Electrical Engineering and an active member of the Alumni Association. In retirement, he is an instructor for the successful ASHRAE HVAC Essentials Course, both Levels 1 and 2, that is held both in the United States and internationally. He also teaches a portion of the Association of Energy Engineers (AEE), Arizona Chapter, Certified Energy Manager (CEM) preparation class held on an annual basis.

Contents

Preface xi
Acknowledgments xiii
Chapter 1: Introduction to Psychrometrics 1
Introduction 1
Enthalpy 2
Air Density 2
Volumetric Airflow versus Mass Flow Calculations 2
Skill Development Exercises for Chapter 1 4
Chapter 2: Properties of Moist Air 5
Introduction 5
Temperature 5
Humidity 6
Enthalpy 6
Specific Volume 6
Using Appendix A 6
Terminology and Symbols for Psychrometrics 7
Skill Development Exercises for Chapter 2 8
Chapter 3: Introducing the Psychrometric Chart 11
The Modern Age of Psychrometrics 11
Creating the Psychrometric Chart 11
Finding Seven Psychrometric Quantities 14
Climatic Design Information 16
Psychrometric Chart for Extended Temperature and Altitude 17
Skill Development Exercises for Chapter 3 18
Chapter 4: Air-Conditioning Processes on the Psychrometric Chart 21
The Power of the Psychrometric Chart 21
Sensible Cooling 22
Sensible Heating 22
Latent Heat Addition 23
Latent Heat Removal 23
Total Heat Content 25
Cooling and Humidifying 26
Heating and Humidifying 28
Dehumidification and Heating 30
Skill Development Exercises for Chapter 4 32

Chapter 5: HVAC Design and the Psychrometric Chart 35
Schematic of an Air-Conditioning System 35
Mixing Airstreams—Cooling Systems 35
Mixing Airstreams—Heating Systems 37
Sensible Heat Ratio—Cooling 38
Sensible Heat Ratio—Cooling with Outdoor Air 40
Psychrometric Process—Heating 41
Skill Development Exercises for Chapter 5 44
Chapter 6: Psychrometrics in HVAC Equipment 47
The Air-Handling Unit:
Heart of the Commercial Air-Conditioning System 47
Psychrometrics of a Cooling Coil 47
Psychrometrics of Fan Heat 49
Psychrometrics of a Heating Coil 50
Humidification Equipment 50
Skill Development Exercises for Chapter 6 54
Chapter 7: Psychrometrics in Zoned HVAC Systems 57
Constant-Volume and Variable-Air-Volume Systems 57
Constant-Volume, Single-Zone System 58
Constant-Volume, Single-Zone System with Reheat 59
Constant-Volume, Single-Zone System
with Face and Bypass Dampers on the Cooling Coil 60
Constant-Volume System with Terminal Reheat 62
Constant-Volume Multizone and Dual-Duct Systems 63
Variable-Air-Volume Systems for Multiple Zones 65
Variable-Air-Volume Systems with Heating VAV Boxes 66
Skill Development Exercises for Chapter 7 69
Chapter 8: Energy Conservation and Psychrometrics 73
Introduction 73
Heat Recovery Devices 73
Energy Recovery Devices 78
Air-Side Economizer 81
Water-Side Economizer 81
Supply Air Temperature Reset 83
Skill Development Exercises for Chapter 8 85
Chapter 9: Special Applications and Psychrometric Considerations . 87
Introduction 87
Cooling Towers 87
Indoor Swimming Pools 89
Cleanrooms 90

Direct Evaporative Cooling 93
Indirect Evaporative Cooling 94
Skill Development Exercises for Chapter 9 97
Appendix A: Thermodynamic Properties of Moist Air 99
Appendix B: Dimensions, Units, and Unit Conversion Factors 103
Appendix C: Climatic Design Information 105
Appendix D: Thermodynamic Properties of Water at Saturation . . 135
Skill Development Exercises 139

Preface

Psychrometrics is a tool HVAC designers use to determine the amount of moisture in the air and to provide solutions to designers for the ultimate comfort of building occupants. It can be used to size air handling units; optimize energy performance; identify control sensors for building automation; describe the performance of cooling coils, cooling towers, and humidification equipment; and evaluate heat recovery strategies.

Yet the use of psychrometrics and the psychrometric chart is different from designer to designer. Some do not use the psychrometric chart, relying instead on simplified formulas or complex computer simulations. Others use the chart only for special situations, such as indoor swimming pool applications. And some use it as their primary system evaluation tool.

This course is meant to cover all of these uses of the psychrometric chart, to have something for all these different backgrounds, and to be an introduction for the young designer who has yet to pick an approach. The course addresses the use of psychrometrics and the psychrometric chart for typical applications and systems and includes some theory. This theory not only sets the basics but also gives students an appreciation of the simplification that the psychrometric chart provides. The psychrometric chart gives a visual description of HVAC design, one that could never be appreciated from formulas alone.

This second edition of the psychrometrics self-directed learning (SDL) course was rewritten in an attempt to teach the fundamentals of psychrometrics in about half the time as the previous version. The author has used his 41 years of experience in the HVAC industry as the expertise for the format and content.

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