

CONTENTS

Host Chapter	x
Program Committee and Transactions Staff	x
State of the Society by Neil R. Patterson, ASHRAE 1993-94 President	xi
Inaugural Address by 1994-95 President Billy R. Manning	xiv
Technical Program Abstracts	xvii

TECHNICAL PAPERS

3784	Analysis of an Underground Electric Heating System with Short-Term Energy Storage by Bassem H. Ramadan	3
3785	Development of a Solar-Powered Freezer by Ahmadul Ameen	14
3786	A Model of the Effect of Dust on the Emissivity of Radiant Barriers by Homero Noboa, Dennis O'Neal, and William D. Turner	23
3787	Stability of Flux-Controlled Radiant Slabs by Charles R. MacCluer	31
3788	Measured Residential Cooling Energy Savings from Reflective Roof Coatings in Florida by Danny S. Parker, James B. Cummings, John R. Sherwin, Theodore C. Stedman, and Janet E.R. McIlvaine	36
3789	Window U-Factor Effects on Residential Cooling Load by Robert Sullivan, Karl J. Frost, Dariush K. Arasteh, and Stephen Selkowitz	50
3790	Evaluation of Strategies for Controlling Humidity in Residences in Humid Climates by John T. Trowbridge, Kenneth S. Ball, John L. Peterson, Bruce D. Hunn, and Maureen M. Grasso	59
3791	Electrical Residential Water Heating: A Consumption and Conservation Survey by Nikos Pontikakis and Douglas W. Ruth	74
3792	Cost-Optimal Analysis of Cooling Towers by Michael Kintner-Meyer and Ashley F. Emery	92
3793	Preview Control Systems for HVAC by Mohammed Zaheer-uddin	102
3794	Cooling Tower Performance: Theory and Experiments by Michel A. Bernier	114
3795	Optimal Design of a Cold-Sea-Water Chiller by Akshay Bhargava, Mohamed Trabia, and Samir F. Moujaes ..	122
3796	A Temperature-Based Variable for Monitoring Outdoor Coil Airflow in an Air-Source Heat Pump during Frost-Forming Conditions by W. Vance Payne II and Dennis L. O'Neal	131
3797	Predicting System Performance of Alternative Refrigerants Using a Water-Water Heat Pump by B. Ouazia and W.K. Snelson	140
3798	Analysis of Error in Using Simple Linear Models to Approximate the Output of Fan-Coil Units for Energy Cost Allocation Purposes by Martha J. Hewett	148
3799	Heat-Recovery Heat Pump Operating Experiences (RP-656) by R.L. Douglas Cane, S. Blair Clemes, and Didier A. Forgas	165
3800	Spray Evaporation Heat Transfer of R-134a on Plain Tubes (RP-668) by Shane A. Moeykens and Michael B. Pate	173
3801	An Empirical Methodology for the Design of Vertical-Tube Absorbers by Vikas Patnaik, William A. Miller, and Horacio Perez-Blanco	185
3802	Miscibility of Seven Different Lubricants with Ten Different Non-CFC Refrigerants by Steven C. Zoz, Lyle J. Berkenbosch, and Michael B. Pate	197
3803	Cross-Ventilation and Room Partitions: Wind Tunnel Experiments on Indoor Airflow Distribution by Quingsan Cao and Xiaohua G. He	208
3804	Solubility, Viscosity, and Density Measurements of Refrigerant-Lubricant Mixtures—Part I: Branched Acid Pentaerythritol Polyolesters with R-134a (RP-716) by Richard C. Cavestri, Jens Munk, and Mark Menning ...	220
3805	Solubility, Viscosity, and Density Measurements of Refrigerant-Lubricant Mixtures—Part II: Polyalkylene Glycols with R-134a (RP-716) by Richard C. Cavestri, Jens Munk, and Mark Menning	231
3806	Shell-Side Condensation Heat Transfer of R-134a—Part I: Finned-Tube Performance (RP-676) by Joseph B. Huber, Lance E. Rewerts, and Michael B. Pate	239
3807	Shell-Side Condensation Heat Transfer of R-134a—Part II: Enhanced Tube Performance (RP-676) by Joseph B. Huber, Lance E. Rewerts, and Michael B. Pate	248
3808	Shell-Side Condensation Heat Transfer of R-134a—Part III: Comparison with R-12 (RP-676) by Joseph B. Huber, Lance E. Rewerts, and Michael B. Pate	257
3809	In-Tube Heat Transfer and Pressure Drop of R-134a and Ester Lubricant Mixtures in a Smooth Tube and a Micro-Fin Tube: Part I—Evaporation (RP-630) by Steven J. Eckels, Thomas M. Doerr, and Michael B. Pate ..	265

3810	In-Tube Heat Transfer and Pressure Drop of R-134a and Ester Lubricant Mixtures in a Smooth Tube and a Micro-Fin Tube: Part II—Condensation (RP-630) by Steven J. Eckels, Thomas M. Doerr, and Michael B. Pate	283
3811	Computer Program for Cryogenic Piping Systems by Li Zhang and Kau-Fui V. Wong	295
3812	A Steady-State Calorimetry Method to Measure the Ventilation Rate in an Airspace by Yuanhui Zhang, Leslie L. Christianson, and Gerald L. Riskowski	300
3813	Thermal Stratification of Chilled-Water Slot Flows into Storage Tanks by William E. Stewart, Jr., Lihong Cai, and C.W. Sohn	305
3814	A Simple Model for Calculating the Performance of a Lithium-Bromide/Water Coil Absorber by Jeffrey S. Seewald and Horacio Perez-Blanco	318
3815	Thermodynamic Aspects of Selecting an Economical Domestic Cooling System for Desert Areas by Hillel Arkin and Ronie Navon	329
3816	A Steady-State Simulation of an Advanced Desiccant-Enhanced Cooling and Dehumidification System by Eileen E. Chant and Sheldon M. Jeter	339
3817	Time-Temperature-Humidity Relations for the Storage of Fresh Commodities (RP-678) by Khe V. Chau	348
3818	Indirect Evaporative Cooler with Condensation of Primary Airflow by H.J.M. "Rik" Vollebregt and Taeke de Jong	354
3819	An Experimental Study of the Ventilation Performance of Cold-Air Distribution Systems by J.S. Zhang, Ruihong Zhang, Zhenhai Li, C.Y. Shaw, Leslie L. Christianson, and L.H. Sparks	360
3820	Identification and Control of Viral Aerosols in Indoor Environments (RP-776) by Lisa M. Brosseau, Donald Vesley, Thomas H. Kuehn, Sagar M. Goyal, Shu-Kuang Chen, and Christine L. Gabel	368
3821	Low-Frequency Noise Assessment Metrics—What Do We Know? (RP-714) by Norman Broner	380
3822	Equivalent Round Diameter of Spiral Flat Oval Ducts (RP-690) by Brad S. Townsend, Fariborz Khodabakhsh, and Stephen A. Idem	389
3823	Unsteady-State Thermal Analysis of a Large Space with Vertical Temperature Distribution by Yoshinobu Arai, Satoshi Togari, and Katsuhiko Miura	396
3824	A Field Test Method for Determining Exhaust Rates in Grease Hoods for Commercial Kitchens (RP-623) by Elliott B. Gordon and Fuoad A. Parvin	412
3825	Stack Effect in Tall Buildings (RP-661) by John E. Lovatt and A. Grant Wilson	420
3826	The Transient Nature of Thermal Loads Generated by People (RP-619) by Byron W. Jones, Qing He, Jerry M. Sipes, and Elizabeth A. McCullough	432
3827	Air Velocity Profiles Around a Person Standing in Front of Exhaust Hoods by Stephen KW. Chang	439
3828	Computer-Aided Design for Smoke Management in Atria and Covered Malls (RP-658) by James A. Milke and Frederick W. Mowrer	448
3829	Field Experiments on Occupant Comfort and Office Thermal Environments in a Hot-Humid Climate (RP-702) by Richard J. de Dear and Marc E. Fountain	457
3830	Spot Cooling—Part 1: Human Responses to Cooling with Air Jets (RP-518) by Arsen K. Melikov, Laila Halkjaer, Razmik S. Arakelian, and P. Ole Fanger	476
3831	Spot Cooling—Part 2: Recommendations for Design of Spot-Cooling Systems (RP-518) by Arsen K. Melikov, Razmik S. Arakelian, Laila Halkjaer, and P. Ole Fanger	500
3832	Evaluation of Test Methods for Determining the Effectiveness and Capacity of Gas-Phase Air Filtration Equipment for Indoor Air Applications—Phase I: Literature Review and Test Recommendations (RP-674) by Douglas W. VanOsdell	511

SYMPOSIUM PAPERS

OR-94-1 After R-22 and R-502, What?

The Impact of Charge on the Cooling Performance of an Air-to-Air Heat Pump for R-22 and Three Binary Blends of R-32 and R-134a by Jay H. Robinson and Dennis L. O'Neal	529
Composition Shifts of Zeotropic HFC Refrigerants in Service by Stuart Corr, F. Thomas Murphy, and Stuart Wilkinson	538
In-Tube Condensation Heat Transfer of Refrigerant Mixtures by Thomas M. Doerr, Steven J. Eckels, and Michael B. Pate	547
Soft Optimization Test Results of R-32/R-125/R-134a (10%/70%/20%) Compared to R-502 by Jeffrey W. Linton, W. Keith Snelson, Andrew R. Triebe, and Patrick F. Hearty	558
HCFC-22 Alternative for Air Conditioners and Heat Pumps by Donald B. Bivens, Charles C. Allgood, Joseph J. Rizzo, Mark B. Shiflett, Donna M. Patron, Tuneen E.C. Chisolm, Glenn S. Shealy, A. Yokozeki, Ward D. Wells, and Kelly A. Geiger	566

OR-94-2 Recent Advances in Transportation Air Conditioning—Session I

Experimental Study of Heat Transfer and Flow Friction Characteristics of Automotive Evaporators by C.B. Chiou, C.C. Wang, Y.J. Chang, and D.C. Lu	575
Two-Phase Flow of HFC-134a and CFC-12 through Short-Tube Orifices by Yongchan Kim, Dennis L. O'Neal, and Xiuling Yuan	582
See also Technical Paper 3826	

OR-94-3 Migration of Outdoor Pollutants Indoors

Reentry of Radon from Mitigation System Outlets by Grenville K. Yuill and Richard J. Coughlin	595
Wind Tunnel Modeling of Diesel Odors for Fresh-Air-Intake Design by Michael A. Ratcliff, Ronald L. Petersen, and Brad C. Cochran	603
Evaluation and Quantification of the Impact of Cooling Tower Emissions on Indoor Air Quality by Mark D. Vanderheyden and Glenn D. Schuyler	612

OR-94-4 International Approaches in Industrial Ventilation

Evaluation of Thermal Environment in Industrial Work Spaces by Bjarne W. Olesen and Alexander M. Zhivov	623
See also Technical Paper 3827	
Criteria for Physical Simulation of Ventilation Processes in Rooms with Heat Sources and Sinks by Eugene O. Shilkrot	636

OR-94-5 Recent Advances in Transportation Air Conditioning—Session II

Heat Transfer and Flow Characteristics of Automotive Brazed Aluminum Heat Exchangers by Y.J. Chang, Chi-chuan Wang, and W.J. Chang	643
Experimental Study of a Liquid Overfeeding Mobile Air-Conditioning System by Vince C. Mei, F.C. Chen, and R.A. Sullivan	653
An Efficient New Automobile Air-Conditioning System Based on CO ₂ Vapor Compression by Jostein Pettersen	657

OR-94-6 Numerical Methods for Predicting Air Motion

Numerical Prediction of a Turbulent Fountain in a Room by Donald J. Bergstrom	669
Computational Determination of the Behavior of a Cold Air Ceiling Jet in a Room with a Plume by Kevin D. Knappmiller and Allan T. Kirkpatrick	677
CFD Characterization of Natural Convection in a Two-Cell Enclosure with a "Door" by Paul T. Williams and A.J. Baker	685
Comparison of Numerical Predictions of Horizontal Nonisothermal Jet in a Room with Three Turbulence Models— <i>k-ε</i> EVM, ASM, and DSM by Shuzo Murakami, Shinsuke Kato, and Ryoza Ooka	697

OR-94-7 Advances in Enhanced Heat and Mass Transfer in Heat Exchangers, Part 1

A Metal Matrix for Heat Transfer Enhancement during Phase-Change Processes by Jamil A. Khan and Jeffrey H. Morehouse	707
Condensation Heat Transfer of a Heat Pump System Using the Refrigerant Mixture R-32/R-134a by Sung T. Ro, H.S. Jun, Y.S. Chang, and J.Y. Shin	715
An Analytical Model of Condensation Heat Transfer of Nonazeotropic Refrigerant Mixtures in a Horizontal Tube by Ding C. Lu and Chung C. Lee	721

OR-94-8 The Impact of Indoor Environment on Productivity—Part 1

A Human Factors Approach to Performance and Productivity by Frederick H. Rohles, Jr.	735
The Impact of the Building Indoor Environment on Occupant Productivity—Part 1: Recent Studies, Measures, and Costs by Harold G. Lorsch and Ossama A. Abdou	741
Environmentally Responsive Workstations and Office-Worker Productivity by Walter M. Kroner and Jean A. Stark-Martin	750

OR-94-9 New Algorithms for Building Energy Simulation Programs—Part I

A Toolkit for Primary HVAC System Energy Calculation—Part 1: Boiler Model (RP-665) by Jean-Pascal H. Bourdouxhe, Marc Grodent, Jean Lebrun, and Claudio Saavedra	759
A Toolkit for Primary HVAC System Energy Calculation—Part 2: Reciprocating Chiller Models (RP-665) by Jean-Pascal H. Bourdouxhe, Marc Grodent, Jean J. Lebrun, Claudio Saavedra, and Katia L. Silva	774
Impact of the Stochastic Nature of Climate on Building Thermal Analysis by Shuichi Hokoï, Mamoru Matsumoto, Masaki Kagawa, and Katsumi Niwa	787
An Approach to Predicting Cooling Energy Requirements for Residences by Grenville K. Yuill and Eric D. Werling	798

OR-94-10 Advances in Enhanced Heat and Mass Transfer in Heat

Condensation of R-134a on Enhanced Tubes by W.Y. Cheng and Chi-chuan Wang	809
Withdrawn	
In-Tube Boiling Heat Transfer Enhancement of R-123 Using the EHD Technique by Abtar Singh, Michael M. Ohadi, Serguei Dessiatoun, and William Chu	818
Effect of an Inclined Angle on the Heat Transfer and Pressure Drop Characteristics of a Wavy-Finned-Tube Heat Exchanger by W.R. Chang, Chi-chuan Wang, and Y.J. Chang	826

OR-94-11 New Algorithms for Building Energy Simulation Programs—Part II	
Modeling the Solar Heat Gain Reflected from Neighboring Structures (RP-756) by Susan M. Reilly, Christopher P. Dunne, Gregory J. Ward, and Frederick C. Winkelmann	835
A Foundation Heat Transfer Algorithm for Detailed Building Energy Programs by Moncef Krarti, David E. Claridge, and Jan F. Kreider	843
An Analysis of Different Insulation Strategies for Earth-Sheltered Buildings by Teresa Z. Forowicz	851
OR-94-12 Fire and Smoke Control	
Sensitivity of a Stairwell Pressurization System to the Airtightness of Building Components by G.K. Yuill and Kamel Haddad	869
See also Technical Paper 3828	
Case Study of Smoke Control System Testing for a Large Enclosed Stadium by Michael E. Dillon	878
OR-94-13 The Impact of Indoor Environment on Productivity—Part 2	
The Impact of the Building Indoor Environment on Occupant Productivity—Part 2: Effects of Temperature by Harold G. Lorsch and Ossama A. Abdou	895
The Impact of the Building Indoor Environment on Occupant Productivity—Part 3: Effects of Indoor Air Quality by Ossama A. Abdou and Harold G. Lorsch	902
Comparison of Employee Upper Respiratory Absenteeism Costs with Costs Associated with Improved Ventilation by Larry C. Holcomb and Joe F. Pedelty	914
Productivity in the United States: A Question of Capacity or Motivation? by Ralph F. Goldman	922
OR-94-14 Thermal Comfort in Warm Environments	
Locally Controlled Air Movement Preferred in Warm Isothermal Environments by Marc Fountain, Edward Arens, Richard de Dear, Fred Bauman, and Katsuhiko Miura	937
See also Technical Paper 3829	
See also Technical Paper 3830	
See also Technical Paper 3831	
Effects of Air Temperature, Humidity, and Air Movement on Thermal Comfort under Hot and Humid Conditions by Shin-ichi Tanabe and Ken-ichi Kimura	953
OR-94-15 Developments in Commercial Kitchen Ventilation Research	
Gas Flow Measurement Using Laminar Flow Elements by Jack Weigand	973
An Efficient CFD Algorithm for the Prediction of Contaminant Dispersion in Room Air Motion by Subrata Roy, Richard M. Kelso, and Allen J. Baker	980
Development and Application of a Standard Test Method for the Performance of Exhaust Hoods with Commercial Cooking Appliances by Elliott B. Gordon, Douglas J. Horton, and Fuoad A. Parvin	988
OR-94-16 Air Quality in Animal Facilities	
Environmental Management of Laboratory Animals: Research Needs by Ronaldo G. Maghirang, Gerald L. Riskowski, Leslie L. Christianson, and Paul C. Harrison	1003
Control of Building Air Quality by Allan H. Frey	1011
Contaminant-Removal Efficiencies in a Model Barn Using a Displacement Ventilation System and a Conventional Supply Slot System by Douglas R. Irwin and Robert W. Besant	1021
Spatially Enhanced Caging for Laboratory Rats at High Density by Ronaldo G. Maghirang, Gerald L. Riskowski, Paul C. Harrison, Alicia J. Anzaldo, Lynn Sebek, and Harold W. Gonyou	1034
Sprinkling Mineral Oil to Reduce Dust Concentration in Swine Buildings by Yuanhui Zhang, Leon Nijssen, Ernest M. Barber, John J.R. Feddes, and Mike Sheridan	1043
OR-94-17 Predicting Hourly Building Energy Usage: The Great Energy Predictor Shootout—The Aftermath	
Bayesian Nonlinear Modeling for the Prediction Competition by David J.C. MacKay	1053
Predicting System Loads with Artificial Neural Networks—Methods and Results from “The Great Energy Predictor Shootout” by Mattias B.O. Ohlsson, Carsten O. Peterson, Hong Pi, Thorsteinn S. Rögnvaldsson, and Bo P.W. Söderberg	1063
Generalized Nonlinear Regression with Ensemble of Neural Nets: The Great Energy Predictor Shootout by Bradley P. Feuston and John H. Thurtell	1075
Using Artificial Neural Nets to Predict Building Energy Parameters by William J. Stevenson	1081
A Piecewise-Linear Regression on the ASHRAE Time-Series Data by Makoto Iijima, Kenji Takagi, Ryo Takeuchi, and Takashi Matsumoto	1088
Artificial Neural Network Backpropagation Model with Three-Phase Annealing Developed for the Building Energy Predictor Shootout by Minoru Kawashima	1096
Predicting Hourly Building Energy Use: The Great Energy Predictor Shootout—Overview and Discussion of Results by Jan F. Kreider and Jeff S. Haberl	1104

OR-94-18 Effectiveness of Gas Phase Air Cleaning Systems in the Maintenance of IAQ

Ozone-Removal Efficiencies of Activated Carbon Filters After More Than Three Years of Continuous Service by Charles J. Weschler, Helen C. Shields, and Datta V. Naik	1121
Withdrawn	
Tools for the Analysis of Gas-Phase Air-Cleaning Systems in Buildings by James W. Axley	1130
See also Technical Paper 3832	

OR-94-19 Legal Aspects of Commissioning

Assessment Criteria for Commissioning and Construction Quality Control—Assessing the Effectiveness of Total Building Commissioning by Paul C. Tseng, Sandra E. Batterden, and Wayne A. Appenzellar	1149
Legal Aspects of Commissioning of Building Systems by Michael A. Hornreich	1155
Legal Aspects of Building Commissioning—Claim Avoidance by Richard J. Tyler	1159
Legal Aspects of Commissioning by Kenneth M. Elovitz	1169

OR-94-20 Heat Transfer in Windows, Skylights, Curtainwalls, and Partially Glazed Doors

Thermal Performance of Complex Fenestration Systems by Stephen C. Carpenter and A.H. Elmahdy	1179
Thermal Performance and Rating of Swinging Doors by Stephen C. Carpenter and Jeff A. Baker	1187
A Two-Dimensional Numerical Model for Natural Convection in a Vertical, Rectangular Window Cavity by John L. Wright and Henry F. Sullivan	1193
Two-Dimensional Finite-Element Model of Heat Transfer in Complete Fenestration Systems by Dragan Curcija and William P. Goss	1207

OR-94-21 Diagnostic Techniques for Room Air Motion

The Measurement of High Frequency Variations in Concentrations of Indoor Air Constituents by Duncan Phillips and Gordon Bragg	1225
Measurement and Visualization of Diffuser Flow Fields Using Liquid Crystal Sheets by Allan T. Kirkpatrick, Mark Stetz, and Jill A. Engel	1230
Application of Infrared Thermography to Room Air Temperature Measurements by Vahab A. Hassani and Mark Stetz	1238

OR-94-22 Carbon Dioxide Concentration as an Indicator of Ventilation Rate and IAQ

Air Change Rates and Carbon Dioxide Concentrations in a High-Rise Office Building by James T. Reardon, Chia-yu Shaw, and Frank Vaculik	1251
A Study of Ventilation and Carbon Dioxide in an Office Building by Steven J. Nabinger, Andrew K. Persily, and W. Stuart Dols	1264
Performance of Humidity-Controlled House Ventilation System in Cold Climates by Anil J. Parekh and Mark A. Riley	1275

SOCIETY BUSINESS

1993-94 ASHRAE Officers, Directors, Committee Members, and Staff	1287
ASHRAE Chapter Officers	1291
ASHRAE Technical Committees and Task Groups	1293
ASHRAE Standards Project Committees	1308
ASHRAE Past Meetings	1314
Society Presidents	1316
ASHRAE Honors and Awards	1317
ASHRAE Intersociety Representatives	1326
ASHRAE Associate Societies	1327
In Memoriam	1329
Index of Technical and Symposium Papers, Volume 100, Part 2	1333