

CONTENTS

Host Chapter: Portland	vii
Program Committee and Transactions Staff	vii
State of the Society Report by Donald R. Bahnfleth	viii
Plenary Address: Product and Professional Liability by Douglas A. Riggs	xi
Abstracts	xvi

FIRST TECHNICAL SESSION

2973	Groundwater Heat Pump Demonstration Results for Residential Applications in New York by G.B. Rackliffe and K.B. Schabel	3
2974	Shortening the Defrost Time on a Heat-Pump Air Conditioner by E. Kuwahara, T. Kawamura, and M. Yamazaki	20
2975	Performance of a Ground-Coupled Heat Pump with Multiple Dissimilar U-Tube Coils in Series by V.C. Mei and V.D. Baxter	30
2976	Thermodynamic Evaluation of a Combined Heat Pump and Gas-Fired Water Heater System by H. Torab and R.E. Sonntag	43
2977	Advanced Versions of Heat Pumps with Zeotropic Refrigerant Mixtures by R. Radermacher	52

SECOND TECHNICAL SESSION

2978	Experimental Determination of Heat- and Mass-Transfer Coefficients in Aspen Pads by J.A. Dowdy, R.L. Reid, and E.T. Handy	60
2979	Comparison of Performance Indices for Heat-Recovery Ventilators by R.C. Alexander	71
2980	An Experimental Study of the Transient Response of a Radiant Panel Ceiling and Enclosure by Z. Zhang and M.B. Pate	85
2981	Effect of Geometric Configuration and Surface Area on the Thermal Transmittance of Edge-Sealed Draperies by H.H. Epps, B.C. Goswami, and C.B. Hassenboehler	95
2982	Thermal Control Wall Prototype and Test Results by M. Nakao, K. Ohshima, and H. Jitsukawa	111

THIRD TECHNICAL SESSION

2983	A Simplified Energy Audit Technique for Generic Buildings by B.K. Hodge, W.G. Steele, and R. King	121
2984	Residential Prototype Thermal Load Comparisons and Variations with Geographic Location by R. Sullivan, Y.J. Huang, I. Turiel, R.L. Ritschard, and J.L. Bull	133
2985	Residential Energy Simulations in the Pacific Northwest: A Comparison of Four Widely Used Models by H. Akbari, C.C. Conner, and A.J. Usibelli	145
2986	Infiltration Degree-Days: A Statistic for Quantifying Infiltration-Related Climate by M. Sherman	161
2987	Graphic Correlation of Factors Influencing HVAC Cost Estimate by C.A. Schalla	182

FOURTH TECHNICAL SESSION

2988	Round Duct Can Stop Rumble Noise in Air-Handling Installations by R.G. Harold	189
2989	Measured Performance of Variable Air Volume Boxes by L. Krajnovich, D.C. Hittle	203
2990	Investigation of Scaling and Performance Issues Associated with Water Spray Augmentation of Air-Cooled Condensers by M.V. Jordan, G.R. Guinn, and J.A. Hall	215
2991	Improved Pipeline Configurations for District Heating and Cooling Distribution Systems by R.F. Babus'Haq, S.D. Probert, and M.J. Shilston	234
2992	Effect of Freezing Rate and Storage Time on Shelf-Life Quality of Hot Boned and Conventionally Boned Ground Beef (RP-350) by V.G. Gapud and D.V. Schlimme	246

FIFTH TECHNICAL SESSION

2993	Prediction of Ground-Level Sunbeams from Specular Reflective Glass by D.B. Tait, and J.I. Yellott	268
2994	Initial Formation of a Thermocline in Stratified Thermal Storage Tanks by J. Yoo, M.W. Wildin, and C.R. Truman	280
2995	A Numerical and Experimental Study of Stratified Thermal Storage by F.J. Oppel, A.J. Ghajar, and P.M. Moretti	293
2996	Design Strategies for Energy-Efficient Atrium Spaces (RP-315) by D.C. Landsberg, H.P. Misuriello, and S. Moreno	310
2997	Thermal Comfort of the Elderly is Affected by Clothing, Activity, and Psychological Adjustment (RP-421) by K. Cena, J.R. Spotila, and H.W. Avery	329

SIXTH TECHNICAL SESSION

2998	Operating Room Environment with Turbulent Airflow by N. Zamuner	343
2999	Ventilation and Exhaust Air Requirements for Hospitals—Part I: Standards (RP-312) by J.B. Chaddock	350
3000	Ventilation and Exhaust Air Requirements for Hospitals—Part II: Odors (RP-312) by J.B. Chaddock	372
3001	Ventilation Requirements in Hospital Operating Rooms—Part I: Control of Airborne Particles (RP-202) by J.E. Woods, D.T. Braymen, R.W. Rasmussen, G.L. Reynolds, and G.M. Montag	396
3002	Ventilation Requirements in Hospital Operating Rooms—Part II: Energy and Economic Implications (RP-202) by J.E. Woods, G.L. Reynolds, G.M. Montag, D.T. Braymen, and R.W. Rasmussen	427

SEVENTH TECHNICAL SESSION

3003	An Experimental Investigation of Heat Transfer in Forced-Convection Evaporation of Oil-Refrigerant Mixtures (RP-221) by J.A. Tichy, W.M.B. Duval, and N.A. Macken	450
3004	An Experimental Investigation of Pressure Drop in Forced-Convection Condensation and Evaporation of Oil-Refrigerant Mixtures (RP-221) by J.A. Tichy, J. Duque-Rivera, N.A. Macken, and W.M.B. Duval	461
3005	Simulation Program for a Two-Phase Thermosiphon-Loop Heat Exchanger (RP-140 & RP-188) by G.D. Mathur and T.W. McDonald	473
3006	Experimental Study of a Two-Phase Thermosiphon-Loop Heat Exchanger (RP-140 & RP-188) by F.A. Stauder and T.W. McDonald	486
3007	Experimental Studies on an Air-Air Jet Exhaust Pump by S.K. Chou	497

EIGHTH TECHNICAL SESSION

3008	Development of a Corrosion Suppression Approach Using Continuous Condensing for Recuperating Furnaces by L.G. Clawson and W.W. Teich	507
3009	Development of Jet-Impingement Heat Transfer in Pulse Combustion Burners by M.G. Ghassemzadeh and J.C. Griffiths	517
3010	Airflow in Rooms with Baseboard Heat: Flow Visualization Studies by G.A. Spolek, D.W. Herriott, and D.M. Low	528
3011	A Comparison of Building Thermal Performance Models Using Measured Data by J.F. Busch	537
3012	Analysis of Survey Data on HVAC Maintenance Costs by D.R. Dohrmann and T. Alereza	550

SOCIETY BUSINESS

ASHRAE Officers, Directors, Committeemen and Staff	569
ASHRAE Chapter Officers	572
ASHRAE Technical Committees and Task Groups	574
ASHRAE Standards Project Committees	580
ASHRAE Past Meetings	584
Society Presidents	585
ASHRAE Honors and Awards	586
ASHRAE Intersociety Representatives	592
ASHRAE International Associates	593
In Memoriam	594
Index of Technical and Symposium Papers, Volume 92, Part 2	597

CONTENTS

Host Chapter: Portland	viii
Program Committee and Transactions Staff	viii
Abstracts	ix
 PO-86-01 ENERGY USE AND CONTROL RELATION IN VARIABLE AIR VOLUME SYSTEMS	
Fan Electricity Consumption for Variable Air Volume by J.D. Spitler, C.O. Pedersen, D.C. Hittle, and D.L. Johnson	5
Fan Energy Use in Variable Air Volume Systems by P.W. Brothers and M.L. Warren	19
Control of Supply Air Temperature and Outdoor Airflow and Its Effect on Energy Use in a Variable Air Volume System by L.K. Norford, A. Rabl, and R.H. Socolow	30
VAV System Volume Control Using Electronic Strategies by G.V. Atkinson	46
 PO-86-02 REVERSING VALVE DESIGN FOR IMPROVED PERFORMANCE	
Heat Transfer, Pressure Drop, and Mass Leakage in Reversing Valves: Characterizing Parameters by G. Damasceno, W. Lee, L. White, and V.W. Goldschmidt	61
Evaluating Reversing Valve Performance in Heat Pump Systems by R.R. Krishnan	71
The Effect of Different Materials on Heat Transfer of Reversing Valves by R.T. Marks	81
A Refrigerant Enthalpy Method for Measuring Reversing Valve Heat Transfer by D.P. Hargraves	88
 PO-86-03 COMPUTERS IN UNIVERSITY HVAC EDUCATION	
A Simplified Hour-By-Hour Building Energy Analysis for Use in Engineering HVAC Courses by W. Murphy	97
An Applied Course in Digital Control of Mechanical Engineering Systems by R.R. Crawford and W.F. Stoecker	109
Demonstrating HVAC System Performance Through System Simulation by D. O'Neal and S.N. Kondepudi	116
Computer-Enhanced HVAC Education by T.H. Kuehn	130
Integrating Microcomputer-Based Spreadsheets into a Heating and Cooling Load Design Course by R. Shamdin, M.B. Pate, and R.M. Nelson	138
 PO-86-04 ADVANCES IN THERMALLY ACTIVATED HEAT PUMPS	
Braun Engine/Compressor as Tested for Heat Pump Application—An Update by A.T. Braun	153
An Update of Free-Piston Stirling Engine Heat Pump Development by R.A. Ackermann, J.M. Clinch, and G.T. Prvon	160
Real-Time In-Situ Refractometer for Concentration Measurements in Absorption Machines by D.T. Bostick, L.N. Klatt, J.E. Strain, and H. Perez-Blanco	174
 PO-86-05 APPLICATION OF ADAPTIVE CONTROL TO REAL HVAC APPLICATIONS	
Automated Controller Tuning for HVAC Applications by C.G. Nesler	189
Self-Tuning Digital Integral Control by M.J. Pinnella, E. Wechselberger, D.C. Hittle, and C.O. Pedersen ...	202
Adaptive Control Implementation Issues by S.G. Brandt	211
 PO-86-06 AN OVERVIEW OF NEW DEVELOPMENTS ON COMBUSTION RESEARCH FOR IN-SPACE CONVECTIVE HEATERS	
Effects of Middle Distillate Fuel Properties on Residential Oil Combustion Characteristics by S.W. Lee and A.C.S. Hayden	223
Combustion Testing Methods for Catalytic Heaters by E.R. Kweller	239
Carbon Monoxide Safety Systems for Gas Appliances by M.K. Goldstein, T.G. Anderson, and J.G. Palmer	258
Improving Flue Loss Methods for Measuring Wood Heater Thermal Performance by P.E. Tiegs and P.G. Burnet	269
 PO-86-07 MEASURED ENERGY PERFORMANCE IN COMMERCIAL BUILDINGS: RESULTS FROM ELCAP	
Early Results from Commercial ELCAP Buildings: Schedules as a Primary Determinant of Load Shapes in the Commercial Sector by P.D. Reiter	297
Relationship Between Electrical Loads and Ambient Temperature in Two Monitored Commercial Buildings by L.S. Palmiter and J.W. Hanford	310
Preliminary Analysis of Conservation Potential in Office Buildings by C.M. Cleary	319
The Project on Restaurant Energy Performance End-Use Monitoring and Analysis by R.P. Mazzucchi	328

PO-86-08	PIONEERING ADVANCES IN ROOM COOLING	
	The Early Development of Self-Contained and Packaged Air Conditioners by F.H. Faust	353
	Early Developments in Air Conditioning and Heat Transfer by J.R. McClive	361
	Pioneer Developments in Self-Contained Air Conditioning by H.K. Steinfeld	366
	Room Coolers Prior to 1930 and the Technical Impediments to Their Development by B.A. Nagengast	375
PO-86-09	COMBINATION WATER-HEATING/SPACE-HEATING APPLIANCES	
	Synergism of a Combination Space-Heating/Water-Heating Appliance by J.A. Pietsch	387
	A Simple Method to Determine the Yearly Consumption of a Combined Space- and Water-Heating Appliance with a Heat Pump and Desuperheater by R.E. Cook, M.J. Davidson, M. D'Valentine, and V.W. Goldschmidt	399
	Combination Water-Heating/Space-Heating Appliance Performance by B.R. Subherwal	415
	The Effect of Hard Water Scale Buildup and Water Treatment on Residential Water Heater Performance by S.G. Talbert, G.H. Stickford, D.C. Newman, and W.N. Stiegelmeyer	433
PO-86-10	COMMISSIONING BUILDING HVAC SYSTEMS	
	Specifying Commissioning for Building HVAC Systems by G.W. Gupton	451
	Building Commissioning: A Contractor's Viewpoint by J.T. Prince	461
	Building Commissioning: What If You Want To Skip It? by K.M. Elovitz	469
	Effective Methods of Building Commissioning Documentation by L.A. Bihler	476
PO-86-11	HEAT TRANSFER ENHANCEMENT IN HVAC APPLICATION	
	Heat Transfer Augmentation in the Flueway of a Water Heater by C. Beckermann and V.W. Goldschmidt .	485
	Mechanism of Enhancement with Turbulators for Fire-Tube Boilers by V. Nirmalan, G.H. Junkhan, and A.E. Bergles	496
	Augmentation of R-113 In-Tube Evaporation with Micro-Fin Tubes by J.C. Khanpara, A.E. Bergles, and M.B. Pate	506
	The Effect of Oil Contamination on the Nucleate Pool-Boiling Performance of R-114 from a Porous-Coated Surface by A.S. Wanniarachchi, P.J. Marto, and J.T. Reilly	525
PO-86-12	LABORATORY EVALUATION OF THE THERMAL PERFORMANCE OF BUILDING ENVELOPE COMPONENTS	
	Measurements of Energy Flows Through Commercial Roof/Ceiling Insulation Systems by T.B. Broderick ..	541
	Heat-Transmission Tests on Sheet Steel Walls by W.C. Brown	554
	Laboratory Measurement of Thermal Transmittance of Several Masonry Wall Systems by L.S. Shu and R.D. Orlandi	567
	Heat-Transmission Coefficients for Metal Building Systems by M.K. Snyder	577
	Summary of Calibrated Hot Box Test Results for Twenty-One Wall Assemblies by M.G. Van Geem	584
	Thermal Resistance Measurements of Well-Insulated and Superinsulated Residential Walls Using a Calibrated Hot Box by R.R. Zarr, D.M. Burch, T.K. Faison, and C.E. Arnold	604
PO-86-13	ADVANCES IN METHODS FOR EVALUATING SEASONAL OR ANNUAL PERFORMANCE OF CENTRAL FORCED-AIR HEATING AND COOLING SYSTEMS	
	Validation of the ASHRAE SP43 Dynamic Simulation Model for Residential Forced-Warm-Air Systems by F.E. Jakob, R.D. Fischer, L.J. Flanigan, D.W. Locklin, K.E. Herold, and R.A. Cudnik	623
	SP43 Evaluation of System Options for Residential Forced-Air Heating by F.E. Jakob, D.W. Locklin, R.D. Fischer, L.J. Flanigan, and R.A. Cudnik	644
	Part-Load, Seasonal Efficiency Test Procedure Evaluation of Furnace Cycle Controllers by R.A. Wise and E.R. Kweller	674
	AGA'S New Automatic Data Acquisition System for Residential Heat Pumps: First Year's Results by W.J. Shadis and B. Karpay	685
	New Testing and Rating Procedures for Seasonal Performance of Heat Pumps with Variable Speed Compressors by D.G. Erbs, C.E. Bullock, and R.J. Voorhis	696
PO-86-14	HVAC IS FOR PEOPLE	
	A Standard Predictive Index of Human Response to the Thermal Environment by A.P. Gagge, A.P. Fobelets, and L.G. Berglund	709
	Parameters of Human Discomfort in Warm Environments by L.G. Berglund and D.J. Cunningham	732
	Measuring the Comfort-Producing Effectiveness of Space Heaters During Transient Warming by F.H. Rohles, M. Hashinaga, and T. Yamada	747

The Effect of Air Velocity on Thermal Comfort at Moderate Activity Levels by B.W. Jones, K. Hsieh, and M. Hashinaga	761
PO-86-15 VENTILATIVE COOLING	
A Method for Designing Naturally Cooled Buildings Using Bin Climate Data by E.A. Arens and N.S. Watanabe	773
The Impact of Wind-Induced Ventilation on Residential Cooling Load and Human Comfort by S.J. Byrne, Y.J. Huang, R.L. Ritschard, and D.M. Foley	793
Wind Tunnel and Full-Scale Data on Airflow from Natural Ventilation and Ceiling Fans by S. Chandra, P.W. Fairey, III, A.A. Kerestecioglu, and A.A. Kamel	804
Air Core Systems for Passive and Hybrid Energy-Conserving Buildings by B.D. Howard	815
Index of Technical and Symposium Papers, Volume 92, Part 2	833