CONTENTS

Program C State of the Plenary Ad	ter: Portland committee and Transactions Staff e Society Report by Donald R. Bahnfleth Idress: Product and Professional Liability by Douglas A. Riggs.	vii vii viii xi 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	Infiltraton 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 Con- densers 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 Supression 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 Stores 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 (ASHRAE) ASHRAE (Officers, Directors, Committeemen and Staff Chapter Officers Technical Committees and Task Groups Standards Project Committees Past Meetings	569 572 574 580 584

Society Presidents	585
ASHRAE Honors and Awards	586
ASHRAE Intersociety Representatives	592
ASHRAE International Associates	593
In Memorium	594
Index of Technical and Symposium Papers, Volume 92, Part 2	597

vi

ł

CONTENTS

	ter: Portland Committee and Transactions Staff	viii viii 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	
	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. Privon	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

		lerate Activity Levels by B.W. Jones, K. Hsieh, and M.	761
PO-86-15	VENTILATIVE COOLING		
	A Method for Designing Naturally Cooled Buildings Usi	ing Bin Climate Data by E.A. Arens and N.S. Watanabe	773
		I Cooling Load and Human Comfort by S.J. Byrne, Y.J.	793
		ural Ventilation and Ceiling Fans by S. Chandra, P.W.	804
Air Core Systems for Passive and Hybrid Energy-Conserving Bu	serving Buildings by B.D. Howard	815	
Index of Te		n an	833