



JEFF STEIN, P.E.

PRINCIPAL

Jeff Stein is a registered mechanical engineer with over 22 years of HVAC work experience including HVAC and controls design, simulation modeling, measurement and verification, commissioning, energy auditing, policy analysis, program design, and fundamental research. He specializes in detailed lifecycle cost analysis to ensure that owners are able to choose the best systems, and in commissioning to ensure that systems operate as expected. He has served as the lead mechanical engineer and commissioning agent for projects ranging from office buildings to data centers, airport terminals, classroom buildings, laboratories, industrial facilities, and natatoria.

He is particularly proud of several live data center retro-commissioning projects for Fortune 500 companies, where he was able to cut HVAC energy by more than 40% and to identify and eliminate several high-risk control system failure scenarios.

Mr. Stein has published several peer-reviewed journal articles and design guides, given numerous seminars and taught courses to fellow engineers around the country on topics including data center cooling, advanced variable air volume (VAV) system design and control, underfloor air system design, and chiller plant optimization.

Mr. Stein has been a lead investigator on several building science research projects ranging from data center waterside economizers to boiler system testing. As part of a major research project funded by the California Energy Commission, Mr. Stein developed the Characteristic System Curve Model for predicting the performance of fans, which was incorporated into EnergyPlus. Mr. Stein was the leader for a research project conducted at the Pacific Energy Center on the stability and accuracy of VAV boxes at low flows. Mr. Stein used the results from this ground-breaking research to develop new California and ASHRAE energy code requirements for VAV controls that are credited with saving \$0.05/ft²-yr across a wide cross-section of new and existing commercial buildings.

Mr. Stein serves on several ASHRAE committees at the national level, including 90.1 (energy standards), 9.9 and 90.4 (data centers), 155 (boiler ratings), and 195 (terminal unit controls). As a member of SSPC 90.1, Mr. Stein has spearheaded recent improvements to ASHRAE's commercial building energy standard in the areas of data centers, hospitals, chiller efficiency, VAV box controls, and hydronic system design.

EDUCATION

B.S. Operations Research and Industrial Engineering, Cornell University, 1990 (GPA: 3.8, rank: 2/96)

M.S. Energy and Resources, University of California Berkeley, 1997 (GPA: 4.0)

REGISTRATIONS

licensed Mechanical Engineer in several states including California, North Carolina, Nevada, Utah, and Arizona

AFFILIATIONS

American Society of Heating, Refrigeration, and Air-Conditioning Engineers
United States Green Building Council

YEARS OF EXPERIENCE

28 years total
18 years with Taylor Eng.



EXPERIENCE

- 2000 – present Principal at Taylor Engineering, Alameda, CA
- 1998 – 2000 Energy Engineer at Eley Associates, San Francisco, CA
- 1997 – 1998 HVAC Design Engineer at ACCO Engineered Systems, Concord, CA
- 1996 – 1997 Graduate Student Research Assistant in the Building Energy Analysis Group at Lawrence Berkeley National Laboratory, Berkeley, CA
- 1993 – 1995 Program Manager at the U.S. Export Council for Renewable Energy, Washington, DC
- 1992 – 1993 Research Associate at the EPA's Global Change Division, Washington, DC
- 1990 – 1991 Solar Systems Engineer at Luz Industries Israel, Jerusalem, Israel

PROFESSIONAL ASSOCIATIONS

American Society of Heating, Refrigeration, and Air-conditioning Engineers (ASHRAE)

Member, 2000 – present. Committee memberships include:

1.4 (Control Theory and Application)

5.3 (Room Air Distribution)

9.9 (Mission Critical Facilities)

90.1 (Energy Standard for Buildings Except Low-Rise Residential Buildings)

90.4 (Energy Standard for Data Centers)

130 (Methods of Testing Air Terminal Units)

155P (Method of Testing for Rating Commercial Space Heating Boiler Systems)

195 (Method of Testing for Rating Air Terminal Unit Controls)

HONORS AND AWARDS

First Place in New Commercial Buildings Category for Electronic Arts II, ASHRAE, Region X, Technology Award Program, 2003

Student Travel Grant for Outstanding Student Involvement in HVAC & R, ASHRAE, Golden Gate Chapter, 1997

Energy Foundation Fellowship, 1995-1996.



SAMPLE OF PUBLICATIONS

Data Center Controls Reliability, ASHRAE Journal, October 2018

VAV Reheat Versus Active Chilled Beams & DOAS, ASHRAE Journal, May 2013

Waterside Economizing in Data Centers: Design and Control Considerations, ASHRAE Transactions, vol. 115, pt. 2, Louisville 2009

A Heat Pipe Indirect/Direct Evaporative Cooling/Humidification Design for Natatorium IAQ, and Energy Savings Too, ASHRAE Conference Proceeding, Las Vegas 2017

Advanced Variable Air Volume System Design Guide,

http://www.energydesignresources.com/media/2651/EDR_DesignGuidelines_VAV.pdf ,
March 2007

Stability and Accuracy of VAV Terminal Units at Low Flow, co-authored with Darryl Dickerhoff, PG&E Emerging Technologies Program, May 2007, http://www.etcc-ca.com/sites/default/files/OLD/images/stories/pdf/ETCC_Report_371.pdf

Specifying VAV Boxes, HPAC Magazine, November 2005

It's in the Details: Engineering for Low Cost and High Efficiency, co-authored with Steven T. Taylor, ASHRAE Journal, October 2005

Sizing VAV Boxes, co-authored with Steve Taylor, ASHRAE Journal, March 2004

Development and Testing of the Characteristic Curve Fan Model, co-authored with Mark Hydeman, ASHRAE Transactions, January 2004

Balancing Variable Flow Hydronic Systems, co-authored with Steve Taylor, ASHRAE Journal, October 2002

The Jury is (Halfway) In: New Building Performance Contracting Results, proceedings of the American Council for an Energy Efficient Economy 2000 Summer Study on Energy Efficiency in Buildings

SAMPLE OF PRESENTATIONS AND SEMINARS

Advanced Control Sequences to Optimize Energy Performance of Economizing Data Centers, seminar, ASHRAE Winter Meeting, Chicago, 2015

Integrated Water Side Economizers, seminar, ASHRAE Summer Meeting, Denver, 2013

Designing Efficient Boiler Systems for Commercial Buildings, full day seminar at PG&E Energy Center, 2010

Waterside Economizing in Data Centers: Design and Control Considerations, symposium, ASHRAE Summer Meeting, Louisville, 2009

Lessons Learned in the Design and Control of Underfloor Systems, seminar, ASHRAE Summer Meeting, Quebec, 2006

Selecting and Controlling VAV Boxes, seminar, ASHRAE Winter Meeting, Chicago, 2006

Development and Testing of the Characteristic Curve Fan Model, symposium, ASHRAE Winter Meeting, Anaheim, 2004

Optimizing Variable Air Volume Systems, full-day seminar covering all aspects of VAV systems, presented annually at the PG&E Energy Center for the last 10 years and to several ASHRAE chapters around the country.



REPRESENTATIVE DESIGN AND CONSULTING PROJECTS

San Francisco Airport (SFO) Terminal 2	Airport	San Francisco CA
Western Digital Headquarters	Central Plant	San Jose CA
Sonoma State University Central Plant	Central Plant	Sonoma CA
Headway Technologies	Cleanroom	Milpitas CA
KLA Tencor	Cleanroom	Milpitas CA
Holy Names University	College	Oakland CA
Berkeley City College	College / Lab	Berkeley CA
CA Prison Health Care Receivership	Correctional Facility	Stockton CA
NDA 30 MW Newark Data Center	Data Center	Newark CA
NDA 40 MW Prineville Data Center	Data Center	Prineville OR
NDA 40 MW Reno Data Center	Data Center	Reno NV
NDA 24 MW North Carolina Data Center	Data Center	Maiden NC
NDA 50 MW Salt Lake City Data Center	Data Center	Salt Lake City UT
NDA 20 MW Phoenix Data Center	Data Center	Phoenix AZ
NDA 50 MW Colocation Campus	Data Center	Santa Clara CA
Kaiser Permanente	Data Center	Pleasanton CA, Napa CA
Oracle Santa Clara MSY, SCA05/15	Data Center	Santa Clara CA
San Francisco Federal Building	Data Center	San Francisco CA
Symantec Tucson Data Center	Data Center	Tucson AZ
Student Health Center	Health Clinic	Sonoma CA
San Francisco General Hospital	Hospital	San Francisco CA
U.S. Department of Agriculture	Laboratory	Alameda CA
U.S. Food and Drug Administration	Laboratory	Alameda CA
DiCon Fiberoptics, Inc	Manufacturing	Richmond CA
BioMarin Pharmaceutical Inc	Manufacturing	Novato CA
Kaiser Vallejo MOB + Addition	Medical Office Bldg	Vallejo CA
Contemporary Art Museum Presidio	Museum / Office	San Francisco CA
Emerald Glen Recreation Center	Natatorium	Dublin CA
Morgan Hill Recreation Center	Natatorium	Morgan Hill CA
388 Market Street	Office/Residential/Retail	San Francisco CA
Pathline Park	Office Campus	Sunnyvale CA
Electronic Arts Headquarters	Office	Redwood City CA
Brocade Communications	Office / Data Center	San Jose, Broomfield CO
Capitol Area East End Complex	Office / Data Center	Sacramento CA
Oracle Headquarters	Office / Data Center	Redwood Shores CA
Oracle Pleasanton Building 2	Office / Data Center	Pleasanton CA
Symantec Headquarters	Office / Data Center	Culver City CA
ACM Aviation Facility	Office / Hangar	San Jose Int'l Airport CA
Westfield Mall	Retail	San Francisco CA



REPRESENTATIVE BUILDING SCIENCE RESEARCH

Data Center Research. Participated in a variety of research projects sponsored by US DOE, the California Utilities, the California Energy Commission, and ASHRAE including lead investigator on lifecycle cost analyses to support state and national energy code requirements for air/water economizers, minimum CRAC efficiencies, fan power limitations, humidity control limitations, and containment; consultant to eQuest developers on data center simulation.

Boiler Research. Principal investigator in a series of research projects funded by California Utilities including the creation of a boiler testing laboratory on the grounds of the PG&E Applied Technology Services complex in San Ramon CA, wrote testing plans for several boilers, analyzed test results, revised test bed and testing plans, provided feedback to ASHRAE on the development of Standard 155 *MOT for Rating Boiler Systems*. Mr. Stein is vice chair of Standard 155.

VAV Systems Research. Participated in a 3-year research project funded by the California Energy Commission on the design and optimization of airside VAV systems and wrote the *Advanced VAV Design Guide*, which is widely used in the HVAC industry today. As part of this research, Mr. Stein developed the Characteristic System Curve Model for predicting the performance of fans. This model is being incorporated into the new DOE EnergyPlus simulation engine.

VAV Box Research. Team leader for a research project conducted at the PG&E Pacific Energy Center on the stability and accuracy of VAV boxes at low flows. Mr. Stein used the results from this ground-breaking research to develop new California and ASHRAE energy code requirements for VAV controls that are predicted to save about \$0.05/ft²-yr across a wide cross-section of new and existing commercial buildings. Project monitoring sub-committee chair for ASHRAE research project RP-1353, which was a continuation of the PG&E research. Mr. Stein leveraged these research projects to create ASHRAE Standard 195 (Method of Testing for Rating Air Terminal Unit Controls), which will allow engineers to design more efficient systems and encourage manufacturers to develop more efficient terminal units.