

CHPB-23-2018: Automated Load-Based Performance Testing for ACs and Heat Pumps

Primary Objectives (Year 2)

- Evaluate/improve load-based testing method
- Apply to additional equipment (variable-speed, single- and two-stage units)
- Evaluate benefits/costs compared to current approaches (seasonal performance, time)
- Investigate approaches for mapping performance from load-based testing
- Technology transfer to CHPB members

Expected Results / Impact:

- Improved method for rating equipment performance
- Validated method for generating equipment performance map through automated testing
- Extension of method to packaged equipment with integrated economizers (for Year 3 proposal)

Schedule

- Months 1 – 6: Testing and Rating of Additional Residential Heat Pumps
- Months 5 – 8: Application to Staged and Variable-Speed Commercial Equipment
- Months 6 - 10: Improved Virtual Building Loads
- Months 5 - 11: Equipment Performance Mapping
- Months 10 - 11: RTU w/ Economizer Approach
- Months 1 – 12: Tech. Transfer

Approach:

- Working closely with CSA C656 development
- Virtual building model responds to ambient dependent / time-varying loads and equipment cooling/heating rates
- Testing is fully automated using Psych chambers

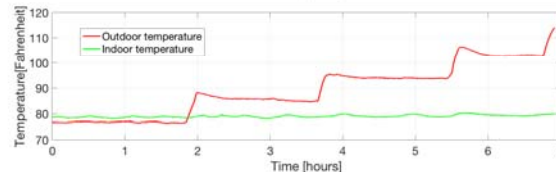
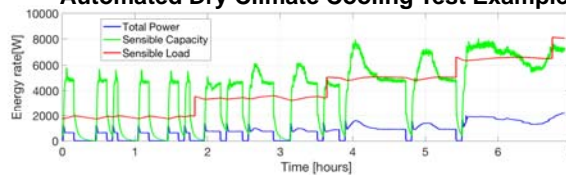


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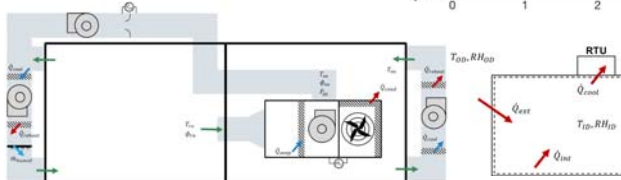
Year 1 Accomplishments

- Dynamic latent load model
- Guidelines for model parameters
- Load scaling approach
- Convergence criteria for all situations
- Implemented fully automated procedure
- Completed ratings tests for 2 units
- Studied impact of equipment sizing factor on seasonal efficiency ratings
- Demonstrated hardware/ software for automated refrig. charge optimization

Automated Dry Climate Cooling Test Example



RTU Example



$$\dot{Q}_b(\square 1) = \dot{Q}_b(\square) + \frac{\Delta \dot{Q}}{\square} [\dot{Q}_{int,s} + \square \dot{Q}_b(\square) - \dot{Q}_b(\square) - \dot{Q}_{ools}(\square)]$$

