Variable Refrigerant Flow Test Procedure Developments: Connecting Dynamic and Steady-State Tests

Catherine Rivest, US Department of Energy

IEA Technology Collaboration Programme on Energy Efficient End-Use Equipment

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United States Variable Refrigerant Flow Test Procedure Developments

- Current Federal Test Procedure:
  - Cooling mode metric is in terms of Energy Efficiency Ratio (EER)
    - Full-Load steady state test with manufacturer involvement.
    - Metric doesn't capture benefit of variable capacity.

- Working group was formed with the goal of negotiating test procedure recommendations to DOE which would result in a test procedure that:
  - Reflects energy efficiency and energy use during a representative average use cycle.
  - Isn't unduly burdensome to conduct.
  - Is reproducible.

- Initial stakeholder positions generally split between two approaches:
  - Dynamic Test
  - AHRI 1230 Steady-State Tests
    - IEER metric composed of 4 load points: 100%, 75%, 50%, 25%

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Controls Verification Procedure (CVP)

- AHRI 1230 allows for certain parameters to be overridden in order for the steady state test to be performed.

- "Critical Parameters" are key variables that have been deemed to have a measurable impact on efficiency.
  - Operational state or position of a component.
    - i.e. compressor speed(s), fan speed(s), and valve position(s)

- During the control verification procedure (CVP) at a given test condition:
  - The unit's operation is directed by it's own "native controls". No parameters are "overridden".
  - Indoor room temperature is gradually decreased in a "ramping" procedure, passing through the VRF system setpoint.
  - "Critical Parameters" are observed throughout the duration of the test. Average values for critical parameters are calculated during a shorter period (defined in the test procedure)
  - The number of thermally active indoor units (connected capacity) decreases at part load test conditions.

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Critical Parameters - Connecting Dynamic and Steady-State Tests

The CVP identifies VRF system controls behaviour and establishes system operation boundaries for AHRI 1230 steady-state test conditions. The CVP is not intended to quantify the performance or efficiency at any condition.

Controls Verification Procedure

- Operate under Native Control settings
- Respond to dynamic conditions
- Observe controls behavior

Critical Parameters →

Steady-State Test

- Override critical parameters within tolerances of values obtained from CVP
- Develop performance ratings

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