anemometer is not capable of compensating for sudden changes. In the context of this test procedure, the air velocity measured by a sensor may vary markedly if the temperature in the test room has changed significantly and quickly between measurements. Consequently, test results may vary significantly.

DOE considered many options to address the temperature control and air velocity measurement issues, including alternative air velocity sensors and changes to test room specifications related to temperature control. DOE determined that hot-wire anemometers are still the preferred sensor for air velocity measurements. DOE did not find an alternative air velocity measurement sensor type or apparatus that would produce significantly better air velocity measurements at similar cost, effectiveness, or industry familiarity. In addition, changes to the test room specifications related to temperature control could result in additional test burden due to capital investment in new equipment or test room renovations. Ultimately, DOE found in its review of available test data that average air velocity measurements did not vary significantly between axes for all tests. This leads DOE to believe that reducing variation is achievable without using alternative air velocity sensors or specifying significant changes to the test room and equipment. Instead, in this final rule, DOE is adopting the following provisions to minimize test procedure output variation:

- Specifying criteria for air velocity and power measurements that indicate stable measurements.
- Require measurement axes be perpendicular to test room walls.
- Require forced-air space conditioning equipment be turned off during air velocity measurements, but allow for conditioning equipment that does not supply air to the test room, such as radiant conditioning equipment, to be left on.
- Require voltage be measured within 6 inches of connection supplied with fan.

These provisions are modifications to those proposed in the June 2015 test procedure SNOPR. The June 2015 SNOPR proposed air velocity and power measurements and tolerances on each. A lab should be able to measure air velocity and power in the same way it would have per the test procedure proposed in the SNOPR. 80 FR 31500–31502 (June 3, 2015) The stability criteria established by this final rule specify that air velocity and power be measured until variation in those measurements is satisfactorily limited. The SNOPR proposed axes be perpendicular to walls or directed into corners. 80 FR 31500, 31501 (June 3, 2015) This document maintains the requirement for axes perpendicular to walls but disallows axes directed into the corners because of a higher degree of observed output variation when using this configuration. The SNOPR proposed to turn off space-conditioning equipment during air velocity measurements. 80 FR 31501 (June 3, 2015) This document maintains that requirement for forced-air equipment, but allows non-forced-air equipment to remain on. This allowance is a zero-burden method for improving temperature control and in turn, minimizing test result variation. The SNOPR proposed voltage measurements. 80 FR 31501 (June 3, 2015) This document clarifies where this measurement should be taken to minimize test result variation. DOE does not expect these provisions to change measured efficiency, only improve measurement repeatability. Also, DOE does not expect these provisions to result in significant increases in test burden.

In this final rule, DOE is establishing stability criteria to minimize test result variation. These stability criteria are in terms of acceptable air velocity and power measurement variation. Subsequent measurements must be made until stable measurements are achieved. Stable measurements are achieved when: (1) The average air velocity for all axes for each sensor varies by less than 5% compared to the average air velocity measured for that same sensor in a successive set of air velocity measurements, and (2) average power consumption varies by less than 1% in a successive set of power consumption measurements. Variations that do not meet those criteria indicate that a significant change in temperature likely occurred during the test and results will vary too significantly. DOE is adopting a provision that measurements that do not meet the definition of stable measurements are prohibited from being used in the test result. Instead, this final rule specifies that the measurement of air velocity and power be repeated until stable measurements are achieved. DOE understands that this will result in tests that require at least two iterations of measurements in each axis for each speed tested to achieve stable measurements and a valid test. These iterations represent additional test time and therefore burden. Each additional axis is 100 additional seconds plus the time it may take a sensor arm to travel to another axis if a single, sweeping sensor arm is being used. DOE estimates additional measurements to meet stability criteria to be less than 10 minutes total for four additional axes of measurements (*i.e.*, one additional iteration). Even if two additional measurements in all 4 axes are necessary for each speed, 40 minutes (two iterations multiplied by 10 minutes multiplied by two speeds) of additional test time is not a significant increase in overall test time which is roughly 3 hours including set up and warm up periods and one iteration of air velocity and power measurements per speed tested. DOE recognizes that some labs may need to make investments in facility upgrades to improve temperature control to meet these stability criteria. These upgrades could include low-cost weatherization techniques like adding weather stripping to test-room doors or adding insulation, or more costly improvements like switching from forced-air to non-forced-air space-conditioning equipment. DOE testing indicates that these stability requirements can be met in labs that performed testing per the test procedure proposed in the SNOPR and the ENERGY STAR test procedure using forced-air conditioning equipment. Therefore, these stability provisions do not require significant investment in changes to the lab set up compared to test procedures that the industry is already using.

Requiring measurement axes to be perpendicular to test room walls will reduce air swirl patterns that can occur in test room corners and potentially lead to unstable test measurements. This provision should not result in any additional test burden because no additional time or materials are needed.

Requiring forced-air space conditioning equipment be turned off during air velocity measurements, but allowing for conditioning equipment that does not supply air to the test room to be left on, is similar to what DOE proposed in the SNOPR. The difference in the provision being adopted in this final rule and the SNOPR proposal is that forced-air and non-forced air space conditioning equipment are differentiated and non-forced air space conditioning equipment can be left on during air velocity measurements. Allowing non-forced air space conditioning equipment to operate during air velocity measurements will help keep test room temperature conditions stable. Allowing forced-air space conditioning equipment to remain on during air velocity measurements may also help keep test room temperature stable, but the air supplied