(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

ASHRAE Standard 222 is a method of test for determining the performance of HVAC&R-related adjustable-speed electric alternating-current power drive systems, which include a complete drive module and a motor. The complete drive module is a semiconductor power converter with means for the control, protection, monitoring, and measurement of motors. Complete drive modules are fully integrated in the motor casing, directly attached to the motor, or mounted remotely from the motor with connecting cables. The standard is intended for rating the energy efficiency and electrical compatibility of the power drive systems with the power grid and with motor insulation.

An example application of the standard is its anticipated reference by AHRI and others for product certification and verification purposes of variable-frequency-drive systems. Those systems are a type of complete drive module that regulates the speed of a motor by adjusting the fundamental frequency and the voltage of the electrical power supplied to the motor. As such, the body of this standard is derived from AHRI Standard 1210, Appendix C, "Methods of Testing Variable Frequency Drives—Normative." AHRI requested that ASHRAE take ownership of this test method along with its ongoing maintenance and increased scope.

Power drive systems provide a variety of hardware and software options that influence their energy efficiency, power line harmonics, and motor stress. The methods in this standard characterize the overall power drive system performance for each uniquely tested configuration.

Several efficiency test standards exist for motors and for power drive systems, including loss segregation methods and caloric methods. The efficiency determination in this standard is based strictly on a method involving input power and output power.

Hazardous currents, voltages, and forces can be present during power drive system tests. Users of this standard are cautioned to obtain appropriate safety training and equipment prior to conducting tests. For example, NFPA 70E-2018, Standard for Electrical Safety in the Workplace*, and OSHA 29 CFR 1910, Sub Part S, describe safety equipment required to perform measurements involving energized equipment, including arc-flash protection, approach boundaries, and other personal protective equipment.*

1. PURPOSE

To determine the performance of power drive systems for rating the energy efficiency and electrical compatibility with the power grid and with motor insulation.

2. SCOPE

2.1 The standard is intended for HVAC&R applications that operate from low voltage (≤600 V).

2.2 This standard applies to adjustable speed electric alternating current (AC) power drive systems, which combine semiconductor power converters, including means for their control, protection, monitoring, and measurement with connected electric motors. All electric rotary motor types are included.

2.3 This standard includes the following:

a. Power converters that are completely integrated in motor casings
b. Remote power converters that are tested with motors defined in this standard

3. DEFINITIONS

accuracy: the degree of conformity of an indicated value to an accepted standard value or true value. The degree of inaccuracy is known as total measurement error and is the sum of bias and precision errors.

bias error: the difference between the true or actual value to be measured and the mean indicated value from the measuring system that persists and is usually due to the particular instrument or technique of measurement. This error is determined and minimized through calibration.

carrier switching frequency: the frequency at which the power output devices of complete drive modules are switched ON and OFF to modulate motor input power.

complete drive module (CDM): the semiconductor power converter with means for their control, protection, monitoring, and measurement of motors. Complete drive modules are fully integrated in the motor casing, directly attached to the motor, or mounted remotely from the motor with connecting cables.

complete drive module speed set point: a control input that influences the power drive system shaft speed. Various types of control inputs and indicators exist for modern complete drive modules, including push buttons with an LED display, dip switch, analog electrical signal from an external source, digital controls, and others.

confidence level: the probability that a stated interval will include the true value. In analyzing measured data, a confidence level of 95% (approximately two standard deviations) is often used.

DC bus: the link inside of a complete drive module that connects a rectifier and an inverter; also known as *DC link*.

DC bus voltage: the voltage amplitude that is measurable at the output of a remote complete drive module.

DC bus voltage reference: for the voltage rise time test, the reference is defined as supply voltage V_s multiplied by $\sqrt{2}$.

drive system energy efficiency: the ratio of the mechanical output power from the motor to the electric input power of the power drive system.

dynamometer: a laboratory device for applying and measuring resistive torque to the rotating shaft of a test motor.

equipment under test (EUT): the tested power drive system.