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Guidance Type: Test Procedures

Category: Residential Products

Product: Residential water heaters

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Q: What operational-mode settings should be used when testing a residential storage-type heat pump water heater for the first-hour rating test and the simulated-use test?

A: The test procedures for residential water heaters are found in [10 CFR 430.23\(e\)](#) and [10 CFR Part 430, Subpart B, Appendix E](#). These test procedures specify testing conditions and a method of test for residential heat pump water heaters. The U.S. Department of Energy (DOE) has received an inquiry regarding how to test a heat pump water heater, because different models produced by various manufacturers may offer a variety of operational-mode settings that can be selected by the consumer (*e.g.*, heat-pump-only, electric-resistance-only, and some combination thereof). Appendix E to Subpart B to 10 CFR Part 430 specifies two different test methods for residential water heaters, including the first-hour rating test and the simulated-use test.

For heat pump water heaters, the same operational mode (*i.e.*, ONLY ONE MODE) should be used for conducting both the simulated-use test and the first-hour rating test. In further clarification, this operational mode should be the default mode (or similarly-named, suggested mode for normal operation), as defined by the manufacturer in its product literature for giving selection guidance to the consumer. If a default mode is not defined in the product literature, each test should be conducted under an operational mode in which both the heat pump and any electric resistance backup heating element(s) are activated by the unit's control scheme, and which can achieve the internal storage tank temperature specified in the DOE test procedure; if multiple operational modes meet these criteria, the water heater should be tested under the most energy-intensive mode. If no default mode is specified and the unit does not offer an operational mode that utilizes both the heat pump and the electric resistance backup heating element(s), the first-hour rating test and the simulated-use test should be tested in heat-pump-only mode.

Background: On January 30, 2012, the Department issued a draft guidance document on test procedures for residential water heaters, which are found at [10 CFR 430.23\(e\)](#) and [10 CFR Part 430, Subpart B, Appendix E](#), that addressed the question: "What operational-mode settings should be used when testing a residential storage-type heat pump water heater for the first-hour rating test and the simulated-use test?" (EERE-2011-BT-TP-0074) The draft guidance suggested that heat pump water heaters should be tested under the same operational mode during both the first-hour rating test and the simulated-use test and that the mode selected should be the one defined as the default mode in the manufacturer's literature. In the event that the manufacturer does not specify a default mode, the unit should be tested under the most energy-intensive mode, in which both the heat pump and any electric resistance backup heating elements can be activated by the unit's control scheme and which can achieve the internal storage tank temperature

specified in the DOE test procedure. In response to this draft guidance, DOE received comments from four entities.

Bradford White, Rheem Manufacturing, A.O. Smith Corporation, and the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) supported the approach to conduct the first-hour rating test and the simulated-use test under the same operational modes. Furthermore, these commenters supported the guidance to test under the default mode as specified by the manufacturers. AHRI asked the question, “Are the terms ‘default mode’ and ‘mode for normal operation’ synonymous?” In response, DOE did intend for these terms to be synonymous, as a review of manufacturers’ product literature indicated that some manufacturers use the term “default mode” while others used terms such as “normal operating mode” to specify the suggested mode. To ensure that this wording does not introduce inconsistency during testing, the text in this DOE guidance has been modified to parenthetically indicate that alternative phrasing is acceptable for describing the “default mode,” but that the tests still must be conducted under this mode.

AHRI and A.O. Smith Corporation recommended that operational mode settings be further described as those that may be selected by the consumer. The Department agrees with this recommendation, and the text in the guidance has been clarified to so indicate.

AHRI asked whether the point about multiple operational modes discussed in the guidance addresses only those modes where both the heat pump and electric resistance elements are activated. DOE does not intend this guidance to apply to only those cases, rather applying also to modes where either the heat pump or electric resistance elements are deactivated. These modes were previously described as examples in the guidance, so the Department has not amended the text to address this question.

A.O. Smith Water Products Company commented that manufacturers may also incorporate a high-demand hybrid mode and a high-efficiency hybrid mode in heat pump water heaters. For models with two hybrid modes, A.O. Smith Water Products Company suggests that DOE require that the ratings be the result of testing in the high-efficiency hybrid mode. DOE believes that the unit should be tested under its most typical operating mode, so it does not agree that the unit should automatically be tested in the mode most likely corresponding to the lowest energy usage unless that mode is specified as the default mode in the manufacturer’s literature. When no default mode is specified, the unit should be tested under the most energy-intensive mode, in which both the heat pump and any electric resistance backup heating elements can be activated by the unit’s control scheme and which can achieve the internal storage tank temperature specified in the DOE test procedure. DOE believes that it is likely that the consumer would select this setting in the event that a default mode is not specified, so the test method should capture the energy performance under this energy-intensive mode. However, AHRI and AO Smith commented that as a result of DOE’s guidance, manufacturers will specify in product literature a “default” or “normal” mode, so consumers will, therefore, be clear on the typical setting.