ADDENDA

ANSI/ASHRAE/IES Addendum dd to
ANSI/ASHRAE/IES Standard 90.1-2013

Energy Standard for Buildings Except Low-Rise Residential Buildings

Approved by the ASHRAE Standards Committee on June 25, 2016; by the ASHRAE Technology Council on June 29, 2016; by the IES Board of Directors on June 27, 2016; and by the American National Standards Institute on June 30, 2016.

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Approved American National Standard ANSI www.ansi.org

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FOREWORD

This proposal reduces the threshold where variable flow and variable-speed drives (VSD) are required for pumping systems. The chilled-water VSD threshold is reduced from 7.5 hp (5.6 kW) in most climate zones, and heating-water VSD is added with pump hp (kilowatt) thresholds by climate zone. Variable-flow systems use less pumping energy than constant-flow systems. Variable-pumping systems also produce larger system temperature differences that can enhance chiller efficiency. Variable-flow systems can reduce flow either by throttling flow and then having the pump ride the curve to reduce flow and energy at higher pressure or by using a VSD. Using a VSD provides similar flow control at a lower energy cost, as pressure differential is reduced.

Energy Savings: *Operation of variable-flow systems is less expensive than constant-flow systems, and variable-speed drives increase the savings as compared to throttling control. An analysis of energy impact shows that annual savings from expanding the use of motor speed control in the proposal range from $580 to $364 for 15 to 2 hp (11.1 to 1.5 kW) pumps in typical chilled-water hydronic systems. For heating systems, some heating effect from the pump must be made up by the boiler, and annual savings range from $576 to $365 for 15 to 2 hp (11.1 to 1.5 kW) pumps. In some climate zones heating-water pumps have higher thresholds with proportionately higher costs and savings.*

Cost Impact: *The cost of variable-frequency drives continues to drop. Incremental cost for VSD and associated controls ranges from $6224 to $3920 for 15 to 2 horsepower (11.1 to 1.5 kW) pumps.*

Cost-effectiveness: *A cost-effectiveness analysis using ASHRAE SSPC 90.1 scalar methodology showed that the payback was less than the scalar threshold at varying horsepower based on hours of operation and system type (chilled water vs. heating water). Pump horsepower thresholds were selected for each climate zone based on expected system hours of operation.*

Note: In this addendum, changes to the current standard are indicated in the text by underlining (for additions) and strikethrough (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Addendum dd to 90.1-2013

Revise Sections 6.5.4.2 as follows (I-P and SI). Note: Base language is shown as revised by addendum ak to 90.1-2013, as published in the 2015 Supplement:

6.5.4.2 Hydronic Variable Flow Systems. Chilled- and hot-water distribution systems that include three (3) or more control valves designed to modulate or step open and close as a function of load shall be designed for variable fluid flow and shall be capable of reducing pump flow rates to no more than the larger of 25% of the design flow rate or the minimum flow required by the heating/ cooling equipment manufacturer for the proper operation of equipment. Individual or parallel ~~chilled-water~~ pumps serving variable-flow heating-water or chilled-water systems ~~having motors exceeding 5 hp~~ where the *nameplate horsepower* of the motor or combined parallel motors is at least the power shown in Table 6.5.4.2 shall have controls ~~and/~~or devices ~~(such as variable-speed control)~~ that will result in pump motor demand of no more than 30% of design wattage at 50% of design water flow. The controls or devices shall be controlled as a function of desired flow or to maintain a minimum required differential pressure. Differential pressure shall be measured at or near the most remote heat exchanger or the heat exchanger requiring the greatest differential pressure. The differential pressure setpoint shall be no more than 110% of that required to achieve design flow through the heat exchanger. Where differential pressure control is used to comply with this section and DDC systems are used, the setpoint shall be reset downward based on valve positions until one valve is nearly wide open.

Exceptions:

1. Differential pressure setpoint reset is not required where valve position is used to comply with Section 6.5.4.3.
2. Variable-pump flow control is not required on heating-water pumps where more than 50% of annual heat is generated by an electric boiler.

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TABLE 6.5.4.2

Pump Flow Control Requirements

Chilled Water Pumps In these Climate Zones	Heating Water Pumps In these Climate Zones	Motor Nameplate Horsepower
0a, 0b, 1a, 1b, 2b		≥2 HP (1.5 kW)
2a, 3b		≥3 HP (2.2 kW)
3a, 3c, 4a, 4b	7, 8	≥5 HP (3.7 kW)
4c, 5a, 5b, 5c, 6a, 6b	3c, 5a, 5c, 6a, 6b	≥7.5 HP (5.6 kW)
	4a, 4c, 5b	≥10 HP (7.5 kW)
7, 8	4b	≥15 HP (11.1 kW)
	2a, 2b, 3a, 3b	≥25 HP (18.7 kW)
	1b	≥100 HP (74.6 kW)
	0a, 0b, 1a	≥200 HP (149.2 kW)

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ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted Standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the Standards and Guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive Technical Committee structure, continue to generate up-to-date Standards and Guidelines where appropriate and adopt, recommend, and promote those new and revised Standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date Standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating Standards and Guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.

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