BSR/ASHRAE/IES Addendum an
to ANSI/ASHRAE/IES Standard 90.1-2016

Public Review Draft

Proposed Addendum an to Standard 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings

Second Public Review (November 2018)
(Draft Shows Proposed Independent Substantive Changes to Previous Public Review Draft)

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(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

This ISC updates Addendum an based on public comments received during the first public review. The changes improve the language in the addendum.

The proposed changes in the ISC have no energy savings impact and have no cost impacts.

(The original addendum will have an energy savings impact in those buildings that use clean water pumps.)

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by <u>underlining</u> (for additions) and ~~strikethrough~~ (for deletions) except where the reviewer instructions specifically describe some other means of showing the changes. Only these changes to the current standard are open for review and comment at this time. Additional material is provided for context only and is not open for comment except as it relates to the proposed changes.]

Addendum an to 90.1-2016

Modify the standard as follows (IP and SI Units)

3.2 Definitions

Best Efficiency Point (BEP): The pump hydraulic power operating point (consisting of both flow and head conditions) that results in the maximum efficiency.

PEI_{CL}: The pump energy index for a constant load (hp) (kW).

PER_{CL}: The pump energy rating for a constant load (hp) (kW), determined in accordance with either testing for bare pumps, pumps sold with single-phase induction motors, and pumps sold with drivers other than electric motors, or testing for pumps sold with motors and rated using the testing-based approach, or testing for pumps sold with motors and rated using the calculation-based approach.

PER_{STD}: The PER_{CL} for a pump that is minimally compliant with U.S Department of Energy energy conservation standards with the same flow and specific speed characteristics as the tested pump (hp/kW),

PEI_{VL}: The pump energy index for a variable load.

PER_{VL}: The pump energy rating for a variable load (hp) (kW) determined in accordance with testing for pumps sold with motors and continuous or non-continuous controls rated using the testing-based approach, or testing for pumps sold with motors and continuous controls rated using the calculation-based approach.

pump: Equipment designed to move liquids that may include entrained gases, free solids, and totally dissolved solids by physical or mechanical action and includes a bare pump and, if included by the manufacturer at the time of sale, mechanical equipment, driver, and controls.

Informative Note: The US *Code of Federal Regulations* contains official definitions related to pumps in Title 10 Section 431.462. In the United States, the official definitions take precedence over the definitions shown below.

> ***clean water pump:*** A device that is designed for use in pumping water with a maximum non-absorbent free solid content of 0.016 pounds per cubic foot (0.26 kilograms per cubic meter), and with a maximum dissolved solid content of 3.1 pounds per cubic foot (50 kilograms per cubic meter), provided that the total gas content of the water does not exceed the saturation volume, and disregarding any additives necessary to prevent the water from freezing at a minimum of 14°F (-10°C).
>
> ***end suction close-coupled (ESCC) pump:*** A close-coupled, dry rotor, end suction device that has a shaft input power greater than or equal to 1.0 horsepower (0.75 kW) and less than or equal to 200 horsepower (150 kW) at its *Best Efficiency Point (BEP)* and full impeller diameter and that is not a dedicated-purpose pool pump. It is also a single-stage, rotodynamic pump in which the liquid enters the bare pump in a direction parallel to the impeller shaft and on the side opposite the bare pump's driver-end, and is then discharged through a volute in a plane perpendicular to the shaft.
>
> ***end suction frame mounted/own bearings (ESFM) pump:*** A mechanically-coupled, dry rotor, end suction device that has a shaft input power greater than or equal to 1.0 horsepower (0.75 kW) and less than or equal to 200 horsepower (150 kW) at its *Best Efficiency Point (BEP)* and full impeller diameter and that is not a dedicated-purpose pool pump. It is also a single-stage, rotodynamic pump in which the liquid enters the bare pump in a direction parallel to the impeller shaft and on the side opposite the bare pump's driver-end, and is then discharged through a volute in a plane perpendicular to the shaft.

In-line (IL) pump: A device that is either a twin-head pump or a single-stage, single-axis flow, dry rotor, rotodynamic pump that has a shaft input power greater than or equal to 1.0 horsepower (0.75 kW) and less than or equal to 200 horsepower (150 kW) at its *Best Efficiency Point (BEP)* and full impeller diameter, in which liquid is discharged through a volute in a plane perpendicular to the shaft. Such pumps do not include pumps that are mechanically coupled or close-coupled, have a pump power output that is less than or equal to 5.0 horsepower (3.7 kW) at its *Best Efficiency Point (BEP)* at full impeller diameter, and are distributed in commerce with a horizontal motor.

radially split, multi-stage, vertical, in-line diffuser casing (RSV) pump: A device that is a vertically suspended, multi-stage, single axis flow, dry rotor, rotodynamic pump and:
(1) Has a shaft input power greater than or equal to 1.0 horsepower (0.75 kW) and less than or equal to 200 horsepower (150 kW) at its *Best Efficiency Point (BEP)* and full impeller diameter and at the number of stages required for testing and,
(2) In which liquid is discharged in a place perpendicular to the impeller shaft; and
(3) For which each stage (or bowl) consists of an impeller and diffuser; and
(4) For which no external part of such a pump is designed to be submerged in the pumped liquid.

submersible turbine (ST) pump: A device that is a single-stage or multi-stage, dry rotor, rotodynamic pump that is designed to be operated with the motor and stage(s) fully submerged in the pumped liquid; that has a shaft input power greater than or equal to 1.0 horsepower (0.75 kW) and less than or equal to 200 horsepower (150 kW) at its *Best Efficiency Point (BEP)* and full impeller diameter and at the number of stages required for testing; and in which each stage of this pump consists of an impeller and diffuser, and liquid enters and exits each stage of the bare pump in a direction parallel to the impeller shaft.

10.4.6 Pumps

Clean water pumps meeting the following criteria shall comply with the requirements shown in Table 10.8-6:

(1) A flow rate of 25 gallons per minute (0.0016 cubic meters per second) or greater at its *Best Efficiency Point (BEP)* at full impeller diameter;

(2) Maximum head of 459 feet (140 meters) at its *Best Efficiency Point (BEP)* at full impeller diameter and the number of stages required for testing;

(3) Design temperature range from 14 to 248 °F (-10 to 120 ^{o}C);

(4) Designed to operate with either:

(i) A 2- or 4-pole induction motor; or

(ii) A non-induction motor with a speed of rotation operating range that includes speeds of rotation between 2,880 and 4,320 revolutions per minute and/or 1,440 and 2,160 revolutions per minute; and

(iii) In either (i) or (ii), the driver and impeller must rotate at the same speed;

(5) For ~~ST~~ *submersible turbine pumps*, a 6-inch (15 centimeters) or smaller bowl diameter; and

(6) For ~~ESCC~~ *end suction close-coupled pumps* and ~~ESFM~~ *end suction frame mounted/own bearings pumps* specific speed less than or equal to 5,000 rpm when calculated using U.S. customary units.

Exceptions to 10.4.6

The standards in this section do not apply to the following *pumps*:

1. Fire pumps.
2. Self-priming pumps.
3. Prime-assist pumps.
4. Magnet driven pumps.
5. Pumps designed to be used in a nuclear facility subject to US 10 CFR part 50, ‘‘Domestic Licensing of Production and Utilization Facilities’’.
6. Pumps meeting the design and construction requirements set forth in US Military Specification MIL–P–17639F, “Pumps, Centrifugal, Miscellaneous Service, Naval Shipboard Use” (as amended); MIL–P–17881D, “Pumps, Centrifugal, Boiler Feed, (Multi-Stage)” (as amended); MIL–P–17840C, “Pumps, Centrifugal, Close-Coupled, Navy Standard (For Surface Ship Application)” (as amended); MIL–P–18682D, “Pump, Centrifugal, Main Condenser Circulating, Naval Shipboard” (as amended); MIL–P–18472G, “Pumps, Centrifugal, Condensate, Feed Booster, Waste Heat Boiler, And Distilling Plant” (as amended).

Informative Note

Appendix E contains further information on pump nomenclature and definitions which are available from ANSI-HI 1.1-1.2-2014 and ANSI-HI 2.1-2.2-2014.

(Note to editor: Table 10.8-6 values are the same for IP and SI)

Table 10.8-6 Maximum Pump Energy Index (PEI)

Maximum PEI for Pumps Manufactured on or after January 27, 2020

Pump Type	Nominal Speed of Rotation (rpm)	Operating Mode	Maximum PEI[a]	C-value[b]	Test Procedure
End Suction, Close Coupled	1800	Constant Load	1.00	128.47	10 CFR Part 431
End Suction, Close Coupled	3600	Constant Load	1.00	130.42	
End Suction, Close Coupled	1800	Variable Load	1.00	128.47	
End Suction, Close Coupled	3600	Variable Load	1.00	130.42	
End Suction, Frame Mounted	1800	Constant Load	1.00	128.85	
End Suction, Frame Mounted	3600	Constant Load	1.00	130.99	
End Suction, Frame Mounted	1800	Variable Load	1.00	128.85	
End Suction, Frame Mounted	3600	Variable Load	1.00	130.99	
In-Line	1800	Constant Load	1.00	129.30	
In-Line	3600	Constant Load	1.00	133.84	
In-Line	1800	Variable Load	1.00	129.30	
In-Line	3600	Variable Load	1.00	133.84	

Radially Split, Vertical	1800	Constant Load	1.00	129.63	
Radially Split, Vertical	3600	Constant Load	1.00	133.20	
Radially Split, Vertical	1800	Variable Load	1.00	129.63	
Radially Split, Vertical	3600	Variable Load	1.00	133.20	
Submersible Turbine	1800	Constant Load	1.00	138.78	
Submersible Turbine	3600	Constant Load	1.00	134.85	
Submersible Turbine	1800	Variable Load	1.00	138.78	
Submersible Turbine	3600	Variable Load	1.00	134.85	

a. For pumps with the ~~CL~~ Constant Load operating mode, the relevant PEI is PEI_{CL}. For pumps with the ~~VL~~ Variable Load operating mode, the relevant PEI is PEI_{VL}.
b. The C-values shown in this table shall be used in the equation for PER_{STD} when calculating PEI_{CL} or PEI_{VL}.

Section 12 Normative References

Reference	**Title**

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U.S. Department of Defense
3010 Defense Pentagon, Washington, DC 20301

MIL–P–17639F (1996)	Pumps, Centrifugal, Miscellaneous Service, Naval Shipboard Use
MIL–P–17840C (1986)	Pumps, Centrifugal, Close-Coupled, Navy Standard (For Surface Ship Application)
MIL–P–17881D (1972)	Pumps, Centrifugal, Boiler Feed, (Multi-Stage)
MIL–P–18472 (1989)	Pumps, Centrifugal, Condensate, Feed Booster, Waste Heat Boiler, And Distilling Plant
MIL–P–18682D (1984)	Pump, Centrifugal, Main Condenser Circulating, Naval Shipboard

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US Department of Energy
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10 CFR Part 431, Subpart Y	Pumps: Definitions, Energy Conservation Standards, and Uniform Test Method for the Measurement of Energy Consumption of Pumps

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U.S. Nuclear Regulatory Commission
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

10 CFR Part 50	Domestic Licensing of Production and Utilization Facilities

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(rest of the section is unchanged)

Informative Appendix E

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Hydraulic Institute (HI)
6 Campus Drive, First Floor North,
Parsippany, NJ 07054-4405
(T) 973-267-9700
http://pumps.org
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Subsection No.	Reference	Title/Source
10.4.6	ANSI/HI 1.1-1.2-2014	Rotodynamic Centrifugal Pumps for Nomenclature and Definitions

10.4.6	ANSI/HI 2.1-2.2-2014	Rotodynamic Vertical Pumps or Radial, Mixed, and Axial Flow Types for Nomenclature and Definitions

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(rest of the section is unchanged)