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

Public Review Draft

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

First Public Review (February 2019)
(Draft Shows Proposed Changes to Current Standard)

This draft has been recommended for public review by the responsible project committee. To submit a comment on this proposed standard, go to the ASHRAE website at www.ashrae.org/standards-research--technology/public-review-drafts and access the online comment database. The draft is subject to modification until it is approved for publication by the Board of Directors and ANSI. Until this time, the current edition of the standard (as modified by any published addenda on the ASHRAE website) remains in effect. The current edition of any standard may be purchased from the ASHRAE Online Store at www.ashrae.org/bookstore or by calling 404-636-8400 or 1-800-727-4723 (for orders in the U.S. or Canada).

This standard is under continuous maintenance. To propose a change to the current standard, use the change submittal form available on the ASHRAE website, www.ashrae.org.

The appearance of any technical data or editorial material in this public review document does not constitute endorsement, warranty, or guaranty by ASHARE of any product, service, process, procedure, or design, and ASHRAE expressly disclaims such.

ASHRAE, 1791 Tullie Circle, NE, Atlanta GA 30329-2305

(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 addendum provides energy saving potential by removing one of three criteria for fan motor selections, it addresses concerns of prior interpretations, it increases the design options for load-matching variable-speed fan applications, it accommodates new motor and drive technologies, and it simplifies the motor selection criteria for fans.

Section 6.5.3.1.2 restricts the selection of fan motors for air distribution systems. The language is difficult to understand and the exceptions are more extensive than the requirement in the charging statement. This restriction relies on the assumption that fan motors are supplied with output power ratings and that slightly oversized fan motors cause inefficiencies.
In fact, only motors that are government regulated in terms of test procedure and labelling have verifiable output power rating on the nameplates. None-covered motor types that are common for fans are air-over rated motors and electronically commutated permanent magnet motors. Advanced motor topologies also prevent straight-forward output power ratings.
Related interpretations are 90.1-2013-11 and 90.1-2016-3 of January 29, 2017, 90.1-2013-13 of June 25, 2017.
A review of available motor sizes in table 10.8-1and application of the motor part-load efficiency model of ANSI/AMCA 207 revealed that fan motors oversized within the bounds of the 1st and 2nd exception to 6.5.3.1.2 largely yield higher wire-to-air fan efficiency than motors that are selected still closer to the design bhp. Examples: At 4.5 bhp the difference is about 1.7% power savings with the motor oversized within the bounds of the 2016 standard. At 9.5 bhp it is about 1.5% power. The reason is that the government regulated motor efficiencies increase with motor size.
The nameplate output power rating of government regulated motors is irrelevant when the design duty requires variable frequency drive operation below 60Hz. Then the motors must be oversized to deliver the required torque.
AC induction motors operated with variable frequency drives maintain high efficiency at part load. Permanent magnet fan motors maintain even higher efficiency. For all so-called drive applications exists a self-regulating effect because of the higher marginal cost of oversized combinations of drives and motors as opposed to oversized induction motors for across- the-line operation. The restriction of selections provides no benefits in variable-speed drive cases that meet fan electrical power reduction as described for supply fans in section 6.5.3.2.1.

Small fans especially are often supplied strictly with input power ratings rather than motor output power ratings. A lower limit expressed in electrical input power is needed The original 1 hp motor nameplate output power limit equates to 0.9 kW electrical motor input power according to the reference motor in ANSI/AMCA 208.

For the convenience of reviewers, the relevant definitions that currently exist in the standard are shown here:

control device: a specialized device used to regulate the operation of *equipment*.

fan nameplate electrical input power: the nominal electrical input power rating stamped on a fan assembly nameplate.

nameplate horsepower (hp): the nominal motor output power rating stamped on the motor nameplate.

nameplate kilowatt (kW): the nominal motor output power rating stamped on the motor nameplate.

nameplate rating: the design load operating conditions of a device as shown by the *manufacturer* on the nameplate or otherwise marked on the device.

variable-air-volume (VAV) system: *HVAC system* that *controls* the dry-bulb temperature within a *space* by varying the volumetric flow of heated or cooled supply air to the *space*.

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (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 ce to 90.1-2016

Make the following changes to 6.5.3.1.2 (IP)

6.5.3.1.2 Fan Motor ~~Nameplate Horsepower~~ Selection

1. For each fan less than 6 bhp, the selected fan motor shall be no larger than the first available motor with a *nameplate rating* ~~size~~ greater than 1.5 times the bhp.

2. For each fan 6 bhp and larger, the selected fan motor shall be no larger than the first available motor with a *nameplate rating* ~~size~~ greater than 1.3 times the bhp.

The fan bhp must be indicated on the design documents to allow for compliance verification by the *building official*.

Exceptions to 6.5.3.1.2

1. *Motors* equipped with electronic speed *control devices* to vary the fan airflow as a function of load.

~~1. For fans less than 6 bhp, where the first available motor larger than the bhp has a nameplate rating within 50% of the bhp, the next larger nameplate motor size may be selected.~~

~~2. For fans 6 bhp and larger, where the first available motor larger than the bhp has a nameplate rating within 30% of the bhp, the next larger nameplate motor size may be selected.~~

~~3~~2. *Systems* complying with Section 6.5.3.1.1, Option 1.

~~4~~3. Fans with motor *nameplate horsepower* of less than 1 hp.

4. Fans with a *fan nameplate electrical input power* of less than 0.89 kW.

Make the following changes to 6.5.3.1.2 (SI)

6.5.3.1.2 Fan Motor ~~Nameplate Kilowatts~~ Selection

1. For each fan less than 4.5 *kW*, the selected fan motor shall be no larger than the first available motor with a *nameplate rating* ~~size~~ greater than 1.5 times the fan input *kW*.

2. For each fan 4.5 *kW* and larger, the selected fan motor shall be no larger than the first available motor with a *nameplate rating* ~~size~~ greater than 1.3 times the fan input *kW*.

The fan shaft input *kW* must be indicated on the design documents to allow for compliance verification by the *building official*.

Exceptions to 6.5.3.1.2

1. *Motors* equipped with electronic speed *control devices* to vary the fan airflow as a function of load.

~~1. For fans less than 4.5 *kW*, where the first available motor larger than the fan input *kW* has a *nameplate rating* within 50% of the fan input *kW*, the next larger nameplate motor size may be selected.~~

~~2. For fans 4.5 *kW* and larger, where the first available motor larger than the fan input *kW* has a *nameplate rating* within 30% of the fan input *kW*, the next larger nameplate motor size may be selected.~~

~~3~~2. *Systems* complying with Section 6.5.3.1.1, Option 1.

~~4~~3. Fans with motor *nameplate kilowatts* of less than 0.75 *kW*.

4. Fans with a *fan nameplate electrical input power* of less than 0.89 kW.