ADDENDA

ANSI/ASHRAE Addendum f to
ANSI/ASHRAE Standard 90.4-2016

Energy Standard for Data Centers

Approved by the ASHRAE Standards Committee on June 22, 2019; by the ASHRAE Technology Council on June 26, 2019; and by the American National Standards Institute on June 27, 2019.

This addendum was approved by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. Instructions for how to submit a change can be found on the ASHRAE® website (https://www.ashrae.org/continuous-maintenance).

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ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

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The Senior Manager of Standards of ASHRAE should be contacted for

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard, or
d. permission to reprint portions of the Standard.

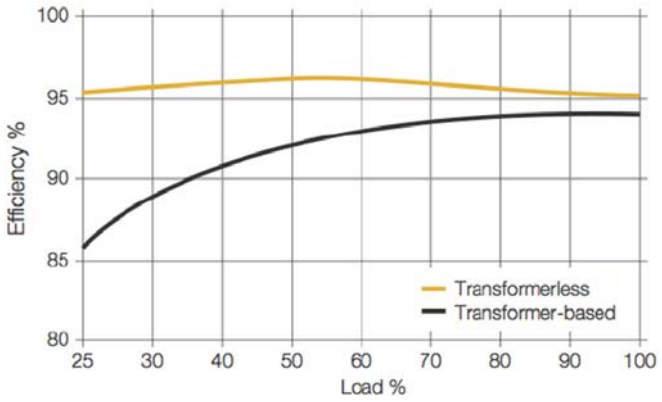
(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus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

FOREWORD

The first edition of Standard 90.4 was published in July 2016. Accordingly, the Electrical Loss Component (ELC) data were based on the performance of electrical distribution equipment on the market and deployed in the industry at that time. In the years following the initial publication of Standard 90.4, the market has witnessed material improvements in the efficiency of core electrical distribution equipment, particularly in the performance of the UPS module. This has been borne out via two distinct developments:

a. UPS modules have become incrementally more efficient.

b. The UPS module efficiency curve has flattened such that the modules maintain the higher efficiency levels along a greater extent of the curve, including at the lower end of the x-axis (Load %), where previously the efficiency would exhibit a sharp drop-off. This is the case both for the movement by manufacturers of bringing transformerless solutions to market (as illustrated by the example in the displayed graph) and for general improvements in efficiency across the board for various UPS module technologies.



Further, this development is consistent across the offerings of the major UPS vendors and independent of operating mode (e.g., economy mode, among others.)

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 f to Standard 90.4-2016

Modify Tables 8.2.1.1 and 8.2.1.2 as shown.

TABLE 8.2.1.1 Maximum *Design Electrical Loss Component (Design ELC)* and *ELC Segments Systems* (IT Design Load <100 *kW*)[a]

***UPS Redundancy* Configuration**	**Single Feed *UPS* (*N*, *N+1*, etc.) or No *UPS*[b]**		**Active Dual Feed *UPS* (*2N*, *2N+1*, etc.)[c]**	
Calculation Percentage	100% of IT design load segment ELC	50% of IT design load segment ELC	50% of IT design load segment ELC	25% of IT design load segment ELC
Segments of ELC and Overall ELC	*Loss/efficiency*	*Loss/efficiency*	*Loss/efficiency*	*Loss/efficiency*
Incoming Electrical Service Segment	15.0%/85.0%	11.0%/89.0%	11.0%/89.0%	10.0%/90.0%
UPS Segment	~~12.0%/88.0%~~ 8.0%/92.0%	~~14.0%/86.0%~~ 10.0%/90.0%	~~14.0%/86.0%~~ 10.0%/90.0%	~~20.0%/80.0%~~ 13.5%/86.5%
ITE Distribution Segment	6.0%/94.0%	4.0%/96.0%	4.0%/96.0%	3.0%/97.0%
Electrical *Loss*/*Efficiency* Total	~~29.7%/70.3%~~ 26.5%/73.5%	~~26.5%/73.5%~~ 23.1%/76.9%	~~26.5%/73.5%~~ 23.1%/76.9%	~~30.2%/69.8%~~ 24.5%/75.5%
ELC	~~0.297~~ 0.265	~~0.265~~ 0.231	~~0.265~~ 0.231	~~0.302~~ 0.245

a. ***Informative Note:*** Example calculations are shown in Informative Appendix C.

b. ***Informative Note:*** These columns apply to electrical configurations resulting in a single output feed from the *UPS*, irrespective of the number of *UPS* modules that may be paralleled prior to the output feed, or the number of branches or subfeeders into which that output feeder may be divided.

c. ***Informative Note:*** These columns apply to electrical configurations made up of two distinct and electrically separated *UPS systems* resulting in two distinct and electrically separate output feeds, either of which is capable of independently supporting the total design load. *Systems* that meet these criteria may be made up of any number of *UPS* modules that are paralleled prior to each output feed. Crossties and/or transfer switches downstream of the independent feeds shall not continually tie the two output sections together.

TABLE 8.2.1.2 Maximum *Design Electrical Loss Component (Design ELC)* and *ELC Segments Systems* (IT Design Load ≥ 100 *kW*)[a]

***UPS Redundancy* Configuration**	**Single Feed *UPS* (*N*, *N+1*, etc.) or No *UPS*[b]**		**Active Dual Feed *UPS* (*2N*, *2N+1*, etc.)[c]**	
Calculation Percentage	100% of IT design load segment ELC	50% of IT design load segment ELC	50% of IT design load segment ELC	25% of IT design load segment ELC
Segments of ELC and Overall ELC	*Loss*/*efficiency*	*Loss*/*efficiency*	*Loss*/*efficiency*	*Loss*/*efficiency*
Incoming Electrical Service Segment	15.0%/85.0%	11.0%/89.0%	11.0%/89.0%	10.0%/90.0%
UPS Segment	~~9.0%/91.0%~~ 6.5%/93.5%	~~10.0%/90.0%~~ 8.0%/92.0%	~~10.0%/90.0%~~ 8.0%/92.0%	~~15.0%/85.0%~~ 11.0%/89.0%
***ITE* Distribution System**	5.0%/95.0%	4.0%/96.0%	4.0%/96.0%	3.0%/97.0%
Electrical *Loss*/*Efficiency* Total	~~26.5%/73.5%~~ 24.5%/75.5%	~~23.1%/76.9%~~ 18.9%/81.1%	~~23/1%/76.9%~~ 18.9%/81.1%	~~25.8%/74.2%~~ 22.3%/77.7%
ELC	~~0.265~~ 0.245	~~0.231~~ 0.189	~~0.231~~ 0.189	~~0.258~~ 0.223

a. ***Informative Note:*** Example calculations are shown in Informative Appendix C.

b. ***Informative Note:*** These columns apply to electrical configurations resulting in a single output feed from the *UPS*, irrespective of the number of *UPS* modules that may be paralleled prior to the output feed, or the number of branches or subfeeders into which that output feeder may be divided.

c. ***Informative Note:*** These columns apply to electrical configurations made up of two distinct and electrically separated *UPS* systems resulting in two distinct and electrically separate output feeds, either of which is capable of independently supporting the total design load. Systems that meet these criteria may be made up of any number of *UPS* modules that are paralleled prior to each output feed. Crossties and/or transfer switches downstream of the independent feeds shall not continually tie the two output sections together.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

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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