



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

Public Review Draft

Proposed Addendum f to Standard 90.4-2016, *Energy Standard for Data Centers*

**First Public Review (March 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 ASHRAE of any product, service, process, procedure, or design, and ASHRAE expressly disclaims such.

© 2018 ASHRAE. This draft is covered under ASHRAE copyright. Permission to reproduce or redistribute all or any part of this document must be obtained from the ASHRAE Manager of Standards, 1791 Tullie Circle, NE, Atlanta, GA 30329. Phone: 404-636-8400, Ext. 1125. Fax: 404-321-5478. E-mail: standards.section@ashrae.org.

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

This document may not be distributed in whole or in part in either paper or electronic form outside of the PC without the express permission of the MOS and shall include a statement indicating such.

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

BSR/ASHRAE Addendum f to ANSI/ASHRAE Standard 90.4-2016, *Energy Standard for Data Centers*
First Public Review Draft

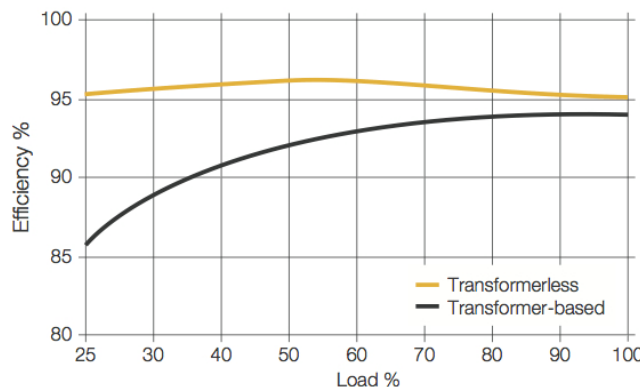
(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus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

FOREWORD

The original issue of Standard 90.4 (90.4-2016) was published in July 2016. Accordingly, the basis for the standard's Electrical Loss Component (ELC) were based on the published efficiencies of electrical distribution equipment on the market and deployed in the industry in the 2 – 3 years preceding the publication of 90.4-2016. In the intervening years, 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:

- 1) UPS Modules have become incrementally more efficient
- 2) 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 transformer-less solutions to market (as illustrated by the example in the graph below) 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 various UPS module operating modes (e.g. Economy mode).



This addendum to the standard is being proposed to better align with current vintages of UPS technology in terms of performance and industry evolution over the period since the original publication of 90.4-2016.

This document may not be distributed in whole or in part in either paper or electronic form outside of the PC without the express permission of the MOS and shall include a statement indicating such.

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

BSR/ASHRAE Addendum f to ANSI/ASHRAE Standard 90.4-2016, *Energy Standard for Data Centers*
First Public Review Draft

[Note to Reviewers: This addendum makes proposed changes to the current standard. These changes are indicated in the text by underlining (for additions) and ~~striketrough~~ (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 f to 90.4-2016

Modify the standard as follows (IP and SI Units)

Modify Tables 8.2.1.1 and 8.2.1.2 as follows:

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	<i>Loss/efficiency</i>	<i>Loss/efficiency</i>	<i>Loss/efficiency</i>	<i>Loss/efficiency</i>
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% <u>8.0% / 92.0%</u>	14.0%/86.0% <u>10.0% / 90.0%</u>	14.0%/86.0% <u>10.0% / 90.0%</u>	20.0%/80.0% <u>13.5% / 86.5%</u>
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% <u>26.5% / 73.5%</u>	26.5%/73.5% <u>23.1% / 76.9%</u>	26.5%/73.5% <u>23.1% / 76.9%</u>	30.2%/69.8% <u>24.5% / 75.5%</u>
ELC	0.297 <u>0.265</u>	0.265 <u>0.231</u>	0.265 <u>0.231</u>	0.302 <u>0.245</u>

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. Cross ties and/or transfer switches downstream of the independent feeds shall not continually tie the two output sections together.

This document may not be distributed in whole or in part in either paper or electronic form outside of the PC without the express permission of the MOS and shall include a statement indicating such.

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

BSR/ASHRAE Addendum f to ANSI/ASHRAE Standard 90.4-2016, *Energy Standard for Data Centers*
First Public Review Draft

TABLE 8.2.1.2 Maximum Design Electrical Loss Component (Design ELC) and ELC Segments Systems (IT Design Load \geq 100 kW)^a

<i>UPS Redundancy Configuration</i>	<i>Single Feed UPS (N, N+1, etc.) or No UPS^b</i>		<i>Active Dual Feed UPS (2N, 2N+1, etc.)^c</i>	
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	<i>Loss/efficiency</i>	<i>Loss/efficiency</i>	<i>Loss/efficiency</i>	<i>Loss/efficiency</i>
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% <u>6.5% / 93.5%</u>	10.0%/90.0% <u>8% / 92%</u>	10.0%/90.0% <u>8% / 92%</u>	15.0%/85.0% <u>11.0% / 89.0%</u>
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% <u>24.5% / 75.5%</u>	23.1%/76.9% <u>18.9% / 81.1%</u>	23.1%/76.9% <u>18.9% / 81.1%</u>	25.8%/74.2% <u>22.3% / 77.7%</u>
ELC	0.265 <u>0.245</u>	0.231 <u>0.189</u>	0.231 <u>0.189</u>	0.258 <u>0.223</u>

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.