



# ADDENDA

**ANSI/ASHRAE Addendum d to  
ANSI/ASHRAE Standard 90.4-2016**

# Energy Standard for Data Centers

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## FOREWORD

The intent of this addendum is to reduce inconsistencies between ASHRAE Standard 90.4, Energy Standard for Data Centers, and ASHRE/IES Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings. A broad overview of the changes is given below.

- Section 3, “Definitions”: Addendum d replaces existing definitions for some terms with cross references to their corresponding definitions in Standard 90.1, which are reproduced in Annex 1). This change promotes consistency in use of terminology across related documents.
- Section 4, “Administration and Enforcement”: Addendum d more clearly conveys to designers, contractors, and enforcement staff the intent that data center spaces are subject to the requirements of Standard 90.4 and that other spaces in a building are subject to the requirements in Standard 90.1. This clarity is especially important for mixed-use buildings in urban areas where the data center spaces are typically only a portion of a multistory building that often contains other unassociated office tenants as well as street-level retail shops and restaurants.

This addendum also reorganization parts of Section 4 so that it parallels the structure of Standard 90.1 in order to reduce potential confusion for users of both documents. Toward this end, a new Section 4.1.9 is added to address Reference Standard Reproduction Annexes, with the new language matching Standard 90.1; Section 4.2.2.4 is moved to Appendix C to be located with companion figures; and a new Section 4.2.5 is added to address verification and commissioning reporting, with the new language matching Standard 90.1.
- Section 5, “Building Envelope”; Section 7, “Service Water Heating”; Section 9, “Lighting”; and Section 10, “Other Equipment”: Addendum d makes several revisions to the numbering and organization of these four sections so that they have a consistent, parallel organization.
- Section 6, “Heating Ventilating and Air Conditioning”: Currently, most of the requirements for HVAC for data center spaces, including several compliance options, are all located in Section 6.2, which has a number of subsections and extends for many pages. To alleviate confusion, this addendum renumbers the sections to parallel the structure of Standard 90.1. The resulting organization is as follows:

- 6.1 General: Existing sections to remain
- 6.2 Compliance: Compliance remains; all other criteria moved to sections below

- 6.3 Simplified/Small Building: (Not used)
- 6.4 Mandatory Provisions: Former Sections 6.2.3 and 6.2.2 (renumber only, no changes to text)
- 6.5 Maximum Design Mechanical Load Component (Design MLC) Option: Former Section 6.2.1.1 (renumber only, no changes to text)
- 6.6 Maximum Annualized Mechanical Load Component (Annualized MLC) Option: Former Section 6.2.1.2 (renumber only, no changes to text)
- 6.7 Submittals: Former Section 6.3 (renumber, revised to match Standard 90.1)
- 6.8 Minimum Efficiency Tables: Former Section 6.4 (renumber only, not used)

In terms of text changes, Section 6.1, “General,” and Section 6.2, “Compliance,” are revised to parallel the corresponding portions of Sections 5, 7, 9, and 10 summarized above. Section 6.7, “Submittals,” adds the completion requirements for drawings and manuals from Standard 90.1 for consistency. (System balancing and system commissioning will be addressed in a future addendum.)

- Section 8, “Power”: Similar to Section 6, currently most of the requirements for electrical systems providing power for data center spaces all fit into Section 8.2, which has many subsections and extends for many pages. To alleviate confusion, this addendum renumbers the sections to parallel the structure of Standard 90.1. The resulting organization is as follows:

- 8.1 General: Existing sections to remain
- 8.2 Compliance: Compliance to remain; all other criteria moved to sections below
- 8.3 Simplified/Small Building: (Not used)
- 8.4 Mandatory Provisions: Former Sections 8.3 and 8.2.1 (renumber only, very limited changes to text)
- 8.5 Maximum Design Electrical Loss Component (Design ELC) Option for Designs Involving Electrical Systems Only: Former Section 8.2.1.1 (renumber only, no changes to text)
- 8.6 Maximum Design Electrical Loss Component (Design ELC) Option for Designs Involving Both Electrical and Mechanical Systems: Former Section 8.2.1.2 (renumber only, no changes to text)
- 8.7 Submittals: Former Section 8.4 (renumber, revised to match Standard 90.1)
- 8.8 Product Information: (Not used)

In terms of text changes, Section 8.1, “General,” and Section 8.2, “Compliance,” are revised to parallel the corresponding portions of Sections 5, 7, 9, and 10 summarized above.

- Section 11, “Alternative Compliance Method”: Section 11.1, “General,” and Section 11.2, “Compliance,” are revised to parallel the corresponding portions of Section 11 of Standard 90.1.

Note that the focus of this addendum is to reduce inconsistencies between Standard 90.4 and Standard 90.1. The issue of alterations to existing data center spaces was

addressed in separate addendum a, and the issue of additions to existing data center spaces was addressed in separate addendum b. The text in this addendum incorporates the changes in addendum a and addendum b. System balancing and system commissioning will be addressed in a future addendum.

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

## Addendum d to Standard 90.4-2016

*Modify the standard as shown (I-P and SI). For the sake of brevity, where the original text is not modified, it is not displayed in the addendum.*

### 3. DEFINITIONS

**3.1 General.** Certain terms, abbreviations, and acronyms are defined in this section for the purposes of this standard. When the tense or plurality of the term differs from the defined term, the defined term still applies. These definitions are applicable to all sections of this standard except where specifically limited.

**3.1.1 Coordination.** Where terms are not defined in this standard but are defined in ANSI/ASHRAE/IES Standard 90.1, those terms shall have the meanings as assigned to them in ANSI/ASHRAE/IES Standard 90.1. Where terms are not defined in either document, they shall have their ordinary accepted meanings within the context in which they are used. Ordinarily accepted meanings shall be based on standard American English language usage as documented in an unabridged dictionary accepted by the adopting authority.

**Informative Note:** See Annex 1 for ANSI/ASHRAE/IES Standard 90.1 definitions.

### 3.2 Definitions

**addition:** see ANSI/ASHRAE/IES Standard 90.1.

**adopting authority:** see ANSI/ASHRAE/IES Standard 90.1.

**alteration:** see ANSI/ASHRAE/IES Standard 90.1.

**authority having jurisdiction (AHJ):** see ANSI/ASHRAE/IES Standard 90.1.

**automatic:** self-acting, operating by its own mechanism when actuated by some non-*manual* influence and without human intervention, such as a change in current strength, pressure, temperature, or mechanical configuration. (See *manual*.)

**automatic:** see ANSI/ASHRAE/IES Standard 90.1.

**branch circuit:** see ANSI/ASHRAE/IES Standard 90.1.

**building:** see ANSI/ASHRAE/IES Standard 90.1.

**building envelope:** see ANSI/ASHRAE/IES Standard 90.1.

**building official:** see ANSI/ASHRAE/IES Standard 90.1.

**circuit breaker:** a device designed to open and close a circuit by non-*automatic* means and to open the circuit *automatically* at a predetermined *overcurrent* without damage to itself when properly applied within its rating.

**circuit breaker:** see ANSI/ASHRAE/IES Standard 90.1.

**conditioned floor area:** ~~floor area of a building or structure that is conditioned space. See *space, conditioned.*~~

**conditioned floor area:** see ANSI/ASHRAE/IES Standard 90.1.

**construction:** ~~the fabrication and erection of a new building or any addition to or alteration of an existing building.~~

**construction:** see ANSI/ASHRAE/IES Standard 90.1.

**construction documents:** drawings and specifications used to construct a *building, building systems, or portions thereof.*

**construction documents:** see ANSI/ASHRAE/IES Standard 90.1.

**control:** see ANSI/ASHRAE/IES Standard 90.1.

**cooled space:** see ANSI/ASHRAE/IES Standard 90.1.

**design conditions:** see ANSI/ASHRAE/IES Standard 90.1.

**design professional:** see ANSI/ASHRAE/IES Standard 90.1.

**distribution system:** see ANSI/ASHRAE/IES Standard 90.1.

**efficiency:** performance at specified rating conditions, usually expressed as a percentage or as a decimal factor of 1.0 or less.

**efficiency:** see ANSI/ASHRAE/IES Standard 90.1.

**enclosed space:** see ANSI/ASHRAE/IES Standard 90.1.

**energy:** see ANSI/ASHRAE/IES Standard 90.1.

**equipment:** devices for conditioning of electric power and *information technology equipment (ITE) in data center systems.* For devices used for other purposes or in other systems, the definition of equipment in ANSI/ASHRAE/IES Standard 90.1 applies.

**existing building:** see ANSI/ASHRAE/IES Standard 90.1.

**existing equipment:** see ANSI/ASHRAE/IES Standard 90.1.

**existing system:** see ANSI/ASHRAE/IES Standard 90.1.

**floor area:** see ANSI/ASHRAE/IES Standard 90.1.

**fossil fuel:** see ANSI/ASHRAE/IES Standard 90.1.

**fuel:** see ANSI/ASHRAE/IES Standard 90.1.

**historic:** see ANSI/ASHRAE/IES Standard 90.1.

**HVAC system:** see ANSI/ASHRAE/IES Standard 90.1.

**IT equipment energy:** ~~annual energy used for computer, data storage and network equipment along with supplemental equipment represented by the uninterruptible power supply (UPS) output.~~

**IT equipment energy:** see ANSI/ASHRAE/IES Standard 90.1.

**kilovolt-ampere (kVA):** see ANSI/ASHRAE/IES Standard 90.1.

**kilowatt (kW):** the basic unit of electric power, equal to 1000 W. For Alternating Current circuits and single-phase equipment it is the product of the voltage times the ampere times the Power Factor (pf) of the connected *equipment.*

**kilowatt (kW):** see ANSI/ASHRAE/IES Standard 90.1.

**labeled:** see ANSI/ASHRAE/IES Standard 90.1.

**lighting power density:** see ANSI/ASHRAE/IES Standard 90.1.

**manual (nonautomatic):** see ANSI/ASHRAE/IES Standard 90.1.

**manufacturer:** see ANSI/ASHRAE/IES Standard 90.1.

**mechanical cooling:** see ANSI/ASHRAE/IES Standard 90.1.

**outdoor (outside) air:** see ANSI/ASHRAE/IES Standard 90.1.

**proposed design:** a computer representation of the actual proposed building design or portion thereof used as the basis for calculating the design energy cost.

**proposed design:** see ANSI/ASHRAE/IES Standard 90.1.

**record drawings:** see ANSI/ASHRAE/IES Standard 90.1.

**repair:** see ANSI/ASHRAE/IES Standard 90.1.

**roof:** see ANSI/ASHRAE/IES Standard 90.1.

**service:** see ANSI/ASHRAE/IES Standard 90.1.

**service water heating:** see ANSI/ASHRAE/IES Standard 90.1.

**single-line diagram:** see ANSI/ASHRAE/IES Standard 90.1.

**skylight:** an area of the building envelope that lets in light that has a slope of less than 60 degrees from the horizontal plane.

**skylight:** see ANSI/ASHRAE/IES Standard 90.1.

**space:** see ANSI/ASHRAE/IES Standard 90.1.

**terminal:** a device by which energy from a system is finally delivered (e.g., registers, diffusers, lighting fixtures, faucets) terminating prior to the interface with the ITE enclosure. For devices used for other purposes or in other systems, the definition of terminal in ANSI/ASHRAE/IES Standard 90.1 applies.

**transformer:** see ANSI/ASHRAE/IES Standard 90.1.

**unconditioned space:** see ANSI/ASHRAE/IES Standard 90.1.

**ventilation:** see ANSI/ASHRAE/IES Standard 90.1.

**wall:** see ANSI/ASHRAE/IES Standard 90.1.

## 4. ADMINISTRATION AND ENFORCEMENT

### 4.1 General

#### 4.1.1 Scope

**4.1.1.1 New Buildings Data Centers.** ~~New~~ *Data centers spaces in new buildings shall comply with the standard as described in Section 4.2. Other spaces in new buildings shall comply with Section 4.1.1.1 of ANSI/ASHRAE/IES Standard 90.1.*

[ . . . ]

**4.1.1.2 Additions to Existing Buildings Data Centers.** *Data center spaces in an addition to an existing data center and shall comply with the standard as described in Section 4.2. Other spaces in an addition shall comply with Section 4.1.1.2 of ANSI/ASHRAE/IES Standard 90.1.*

**4.1.1.3 Alterations of Existing Buildings Data Centers.** *Alterations of existing data centers spaces shall comply with the standard as described in Section 4.2. Alterations of other spaces shall comply with Section 4.1.1.3 of ANSI/ASHRAE/IES Standard 90.1.*

**4.1.1.4 Replacement of Portions of Existing Buildings Data Centers.** *Portions of a data center space's building envelope, heating, ventilating, air-conditioning, service water heating, power, lighting, and other systems and equipment that are being replaced shall be considered as alterations of existing data centers space and shall comply with the standard as described in Section 4.2. Replacements in other spaces shall comply with Section 4.1.1.4 of ANSI/ASHRAE/IES Standard 90.1.*

**4.1.1.5 Changes in Space Conditioning.** *Whenever unconditioned space or semiheated spaces in that is a data center space are is converted to a conditioned spaces, such conditioned spaces shall be brought into compliance with all the requirements of this standard that apply to the data center space's building envelope, heating, ventilating, air-conditioning, service water heating, power, lighting, and other systems and equipment of the space as if the data center space was new. Changes of space conditioning in other spaces shall comply with Section 4.1.1.5 of ANSI/ASHRAE/IES Standard 90.1.*

[ . . . ]

**4.1.9 Reference Standard Reproduction Annexes.** *The reference standard reproduction annexes contain material that is cited in this standard but contained in another standard. The reference standard reproduction annexes are not part of this standard but are included in the publication of this standard to facilitate use of this standard.*

## 4.2 Compliance

### 4.2.1 Compliance Paths

**4.2.1.1 New Buildings Data Centers.** ~~New~~ *Data centers spaces in new buildings shall comply with the provisions of Sections 5, 7, 9, and 10 and one of the following:*

- a. Sections 6 and 8 or
- b. Section 11.

*Other spaces in new buildings shall comply with Section 4.2.1.1 of ANSI/ASHRAE/IES Standard 90.1.*

**4.2.1.2 Additions to Existing Buildings Data Centers.** ~~Data center spaces in A~~ *additions to existing data centers shall comply with the provisions of Sections 5, 7, 9, and 10 and one of the following:*

- a. Sections 6 and 8 or
- b. Section 11.

*Other spaces in additions shall comply with Section 4.2.1.2 of ANSI/ASHRAE/IES Standard 90.1.*

**4.2.1.3 Alterations of Existing Buildings Data Centers.** ~~Alterations to~~ *of existing data centers spaces shall comply with the provisions of Sections 5, 7, 9, and 10 and with either Sections 6 and 8 or Section 11, provided such compliance will not result in the increase of energy consumption of the building.*

#### Exceptions:

1. ITE adds, moves and changes are excluded.
2. ITE enclosures are excluded.

3. A data center space that has been specifically designated as *historically significant* by the *adopting authority*, listed in The National Register of *Historic Places* or has been determined to be eligible for listing by the US Secretary of the Interior, need not comply with these requirements.
4. Where one or more components or portions of an existing data center space's mechanical, electrical or lighting *system* is being replaced without changing capacities; the annual energy consumption of the of the system in which replacements are made shall not be greater than the annual energy consumption of the existing system. Compliance can be demonstrated using manufacturer's published efficiency data for the new and existing devices, or by comparative calculations of the annual energy consumptions of the existing and revised systems, performed by a design professional using calculation methods commonly accepted in the industry.

Component or system replacements or modifications that result in changes in either capacity or type of technology require compliance with the applicable sections and versions of this standard in accordance with Section 4.2.2.4.

Alterations of other spaces shall comply with Section 4.2.1.3 of ANSI/ASHRAE/IES Standard 90.1.

[ . . . ]

## 4.2.2 Compliance Documentation

**4.2.2.1 Construction Details.** Compliance documents for data center spaces shall show all the pertinent data and features of the *data center*, *equipment*, and *systems* in sufficient detail to permit a determination of compliance by the building official and to indicate compliance with the requirements of this standard.

Compliance documents for other spaces shall comply with Section 4.2.2.1 of ANSI/ASHRAE/IES Standard 90.1.

**4.2.2.2 Supplemental Information.** Supplemental information necessary to verify compliance with this standard for data center spaces, such as calculations, worksheets, compliance forms, vendor literature, or other data, shall be made available when required by the building official. Compliance may be documented using mechanical and electrical calculations to complete each required path shown below. If compliance is to be shown for mechanical systems only, the designer performs calculation in Section ~~6.2.1.1~~ 6.5 or ~~6.2.1.2~~ 6.6. If compliance is to be shown for electrical system only, the designer performs the calculation in Section ~~8.2.1.1~~ 8.5. The calculation in Section ~~6.2.1.2~~ 6.6 can be used to take credit for existing mechanical system efficiencies when compliance is to be shown for electrical system only. The calculation in Sections ~~8.2.1.1~~ 8.5 and ~~6.2.1.2~~ 6.6 can be used to take credit for existing electrical system efficiencies when compliance is to be shown for mechanical system only.

Supplemental information for other spaces shall comply with Section 4.2.2.2 of ANSI/ASHRAE/IES Standard 90.1.

[ . . . ]

**4.2.2.3 Manuals.** Operating and maintenance information for data center spaces shall be provided to the *data center* owner. This information shall include, but not be limited to, the information specified below:

- a. Submittal data stating *equipment* size.

Operating and maintenance information for other spaces shall comply with Section 4.2.2.3 of ANSI/ASHRAE/IES Standard 90.1.

~~**4.2.2.4 Version Applicability.** Previous or subsequent versions of Standard 90.4 may apply to *data center* expansions and modifications, depending on how they were designed and occur. The version used for compliance shall be the most current version of the standard or as specified in Table 4.2.2.4.~~

~~**Informative Note:** See Informative Appendix C, Figures C-2, C-3, and C-4, for illustrative diagrams.~~

**4.2.3 Labeling of Material and Equipment.** Materials and *equipment* for data center spaces shall be labeled in a manner that will allow for a determination of their compliance with the applicable provisions of this standard.

Labeling of materials and equipment for other spaces shall comply with Section 4.2.3 of ANSI/ASHRAE/IES Standard 90.1.

**4.2.4 Inspections.** All ~~*data center*~~ construction, additions, or *alterations of data center spaces* subject to the provisions of this standard shall be subject to inspection by the building official, and all such work shall remain accessible and exposed for inspection purposes until approved in accordance with the procedures specified by the building official. ~~Items for inspection include at least the following:~~

- ~~a. wall insulation after the insulation and vapor retarder are in place but before concealment~~
- ~~b. roof/ceiling insulation after roof/insulation is in place but before concealment~~
- ~~c. slab/foundation wall after slab/foundation insulation is in place but before concealment~~
- ~~d. fenestration after all glazing materials are in place~~
- ~~e. continuous air barrier after installation but before concealment~~
- ~~f. mechanical *systems* and *equipment* and insulation after installation but before concealment~~
- ~~g. electrical *equipment* and *systems* after installation but before concealment~~

Inspections of construction, additions, and alterations for other spaces shall comply with Section 4.2.4 of ANSI/ASHRAE/IES Standard 90.1.

**4.2.5 Verification and Commissioning Reporting.** Where reporting is required for data center spaces, the building official or other approved agencies shall report to the contractor their findings of conformance and nonconformance for correction.

Reporting for other spaces shall comply with Section 4.2.5 of ANSI/ASHRAE/IES Standard 90.1.

**4.2.5.1 Nonconformance.** If the nonconforming work for *data center* spaces is found not to be corrected within a predetermined time, as agreed upon by the contractor, the nonconforming work shall be reported in writing to the building official and design professional. At a time agreed to by the building official or other approved agencies, a final report shall be submitted to the building official and the contractor that outlines the inspection findings and documents the correction of nonconforming work.

Nonconforming work for other spaces shall comply with Section 4.2.5.1 of ANSI/ASHRAE/IES Standard 90.1.

## **5. BUILDING ENVELOPE**

### **5.1 General**

**5.1.1 Scope.** This section defines the minimum requirements of the data center building envelope.

### **5.2 Compliance Paths**

**5.2.1 Compliance.** Provisions of this section shall comply with Section 5 of ANSI/ASHRAE/IES Standard 90.1, or demonstrate energy efficiency improvement compared to a data center designed to comply with Section 5 of ANSI/ASHRAE/IES Standard 90.1.

## **5. BUILDING ENVELOPE**

### **5.1 General**

**5.1.1 Scope.** Section 5 specifies the requirements for the building envelope.

### **5.2 Compliance Paths**

**5.2.1 Compliance.** The building envelope shall comply with Section 5 of ANSI/ASHRAE/IES Standard 90.1.

## **6. HEATING, VENTILATING, AND AIR CONDITIONING**

### **6.1 General**

**6.1.1 Scope.** Section 6 specifies the requirements for heating, ventilating, and air-conditioning systems installed to serve data center spaces. Heating, ventilating, and air-conditioning systems installed to serve other spaces shall comply with Section 6 of ANSI/ASHRAE/IES Standard 90.1.

**6.1.1.1 New Buildings Data Centers.** Mechanical equipment and systems serving installed to serve the heating, cooling, and ventilating needs of new data centers spaces in new buildings shall comply with the requirements of this section as described in Section 6.2 or Section 11.

**6.1.1.2 Additions to Existing Buildings Data Centers.** Mechanical equipment and systems installed to serve the heating, cooling, or ventilating needs of data center spaces in additions to existing data centers shall comply with the requirements of this section as described in Section 6.2 or Section 11.

**Exception to Section 6.1.1.2:** Where HVAC is provided to a data center spaces in an addition by using the existing HVAC systems and equipment, such existing systems and equipment shall not be required to comply with this standard. However, any new systems or equipment installed must comply with specific

requirements applicable to those systems and equipment.

### **6.1.1.3 Alterations to Heating, Ventilating, Air Conditioning, and Refrigeration (HVACR) in Existing Buildings Data Centers**

**6.1.1.3.1** When replacing existing HVAC equipment with new HVAC equipment, the replacement equipment shall comply with the specific minimum efficiency requirements applicable to that equipment in ANSI/ASHRAE/IES Standard 90.1.

**Exceptions to Section 6.1.1.3.1:** Compliance shall not be required

1. For equipment that is being modified or repaired but not replaced, provided that such modifications and/or repairs will not result in an increase in the annual energy consumption of the equipment using the same energy type;
2. Where a replacement of equipment is like-for-like, or where alteration of existing equipment requires extensive revisions to other systems, equipment, or elements of a building to achieve compliance, and such replaced or altered equipment is a like-for-like replacement;
3. For a refrigerant change of in existing equipment; or
4. For the relocation of existing equipment within the same data center with no change that would result in an increase in the annual energy consumption of the equipment.

**6.1.1.3.2** New cooling systems installed to serve previously uncooled spaces shall comply with this section as described in Section 6.2.

**6.2 Compliance Paths.** See Section 4.2.2.2.

**6.2.1 Mechanical System Compliance.** The heating, ventilating, and air-conditioning system shall comply with Section 6.1, "General"; Section 6.4, "Mandatory Provisions"; and Section 6.7, "Submittals"; and either

- a. Section 6.5, "Maximum Design Mechanical Load Component (Design MLC) Option", or
- b. Section 6.6, "Maximum Annualized Mechanical Load Component (Annualized MLC) Option".

[ . . . ]

### **6.3 Simplified/Small Building Option (Not Used)**

### **6.4 Mandatory Provisions**

**6.4.1 6.2.3** Verification of Equipment Efficiencies [ . . . ]

**6.4.2 6.2.2** Equipment Not Listed [ . . . ]

**6.5 6.2.1.1** Maximum Design Mechanical Load Component (Design MLC) Option. [ . . . ]

**6.6 6.2.1.2** Maximum Annualized Mechanical Load Component (Annualized MLC) Option. [ . . . ]

**6.7 6.3** Submittals (Not Used) [ . . . ]

**6.7.1 General.** The authority having jurisdiction may require submittal of compliance documentation and supple-

mental information in accordance with Section 4.2.2 of this standard.

**6.7.2 Completion Requirements.** The following requirements are mandatory provisions and are necessary for compliance with the standard.

**6.7.2.1 Drawings.** Construction documents shall require that, within 90 days after the date of system acceptance, record drawings of the actual installation be provided to the building owner or the designated representative of the building owner. Record drawings shall include, as a minimum, the location and performance data on each piece of equipment; general configuration of the duct and pipe distribution system, including sizes; and the terminal air or water design flow rates.

**6.7.2.2 Manuals.** Construction documents shall require that an operating manual and a maintenance manual be provided to the building owner or the designated representative of the building owner within 90 days after the date of system acceptance. These manuals shall be in accordance with industry-accepted standards and shall include, at a minimum, the following:

- a. Submittal data stating equipment size and selected options for each piece of equipment requiring maintenance.
- b. Operation manuals and maintenance manuals for each piece of equipment and system requiring maintenance, except equipment not furnished as part of the project. Required routine maintenance actions shall be clearly identified.
- c. Names and addresses of at least one service agency.
- d. HVAC controls system maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions. Desired or field-determined set points shall be permanently recorded on control drawings at control devices or, for digital control systems, in programming comments.
- e. A complete narrative of how each system is intended to operate, including suggested set points.

## **6.8 6.4 Minimum Efficiency Tables (Not Used)**

## **7. SERVICE WATER HEATING**

**7.1 General.** Provisions of this section shall comply with provisions of Section 7.1 of ANSI/ASHRAE/IES Standard 90.1.

**7.2 Definition of Compliance Paths.** Provisions of this section shall comply with provisions of Section 7 of ANSI/ASHRAE/IES Standard 90.1 or demonstrate energy efficiency improvement compared to a data center designed to comply with Section 7 of ANSI/ASHRAE/IES Standard 90.1.

## **7. SERVICE WATER HEATING**

### **7.1 General**

**7.1.1 Scope.** Section 7 specifies the requirements for service water heating.

### **7.2 Compliance Paths**

**7.2.1 Compliance.** The service water heating shall comply with Section 7 of ANSI/ASHRAE/IES Standard 90.1.

## **8. ELECTRICAL POWER**

### **8.1 General**

**8.1.1 Scope.** This section applies to Section 8 specifies the requirements for the building electrical systems delivering power to the data center space's IT load, and to equipment described below.

Electrical systems delivering power for other uses and other spaces shall comply with Section 8 of ANSI/ASHRAE/IES Standard 90.1.

**8.1.1.1 8.1.2 New Buildings.** Electrical Equipment and systems installed to serve the power needs of data center spaces in new buildings shall comply with the requirements of this section as described in Section 8.2 or Section 11.

**8.1.1.2 8.1.3 Additions to Existing Buildings.** Electrical equipment and systems installed to serve the power needs of data center spaces in additions to existing data centers shall comply with the requirements of this section as described in Section 8.2 or Section 11.

**Exception to Section 8.1.3 8.1.1.2:** Where electrical power is provided to a data center addition by using the existing electrical systems and equipment, such existing systems and equipment shall not be required to comply with this standard. However, any new systems or equipment installed must comply with specific requirements applicable to those systems and equipment.

### **8.1.1.3 8.1.4 Alterations to Existing Buildings**

**8.1.1.3.1** When replacing existing electrical equipment with new electrical equipment, the electrical loss component (ELC) for the electrical system into which the new equipment is connected shall comply with the specific minimum efficiency requirements of Section 8.5 or 8.6.

**Exceptions to Section 8.1.1.3.1:** Compliance shall not be required

1. Compliance shall not be required for the relocation or reuse of existing equipment at the same site for equipment that is being modified or repaired but not replaced, provided that such modifications and/or repairs will not result in an increase in the annual energy consumption of the equipment using the same energy type;
2. Where a replacement of equipment is like-for-like, or where alteration of existing equipment requires extensive revisions to other systems, equipment, or elements of a building to achieve compliance, and such replaced or altered equipment is a like-for-like replacement;
3. where there is a battery change in UPS equipment, even if a different battery type is used or a longer battery duration is installed, so long as the UPS system is not changed, or is a like-for-like replacement; or
4. for the relocation of existing equipment within the same data center with no change that would



result in an increase in the annual energy consumption of the equipment.

8.1.1.3.2 Where new electrical *systems* are installed to serve spaces that did not previously contain data processing equipment, or where the increase in power requirements for additional data processing equipment requires larger or additional electrical *systems*, the electrical *systems* shall comply with this section as described in Section 8.2.

8.1.4.1 Alterations to building service equipment or systems shall comply with the requirements of this section applicable to those specific portions of the building and its systems that are being altered.

8.1.4.2 Any new equipment subject to the requirements of this section that is installed in conjunction with the alterations as a direct replacement of existing equipment shall comply with the specific requirements applicable to that equipment.

**8.2 Compliance Paths.** Compliance with Section 8 shall be achieved by meeting all requirements in Section 8.1 and Section 8.2.1.

**8.2.1 Compliance.** The electrical system shall comply with Section 8.1, "General"; Section 8.4, "Mandatory Provisions"; and Section 8.7, "Submittals"; and either

- a. Section 8.5, "Maximum *Design Electrical Loss Component (Design ELC) Option for Designs Involving Electrical Systems Only*", or
- b. Section 8.6, "Maximum *Design Electrical Loss Component (Design ELC) Option for Designs Involving Both Electrical and Mechanical Systems*."

**8.2.2 Electrical Distribution Systems Alternative for Section 8.4.** Provisions of this section Electrical distribution systems shall comply either with provisions of ANSI/ASHRAE/IES Standard 90.1, Section 8, or with Section 8.3.4 of this standard.

**8.3 Simplified/Small Building Option (Not Used)**

**8.4 ~~8.3~~ Compliance Path Mandatory Provisions**

**8.4.1 ~~8.3.1~~ Electrical Distribution Systems for Mechanical Loads [ . . . ]**

8.4.1.1 ~~8.3.1.1~~ Multiple Electrical Paths [ . . . ]

8.4.1.2 ~~8.3.1.2~~ Minimum Efficiency or Maximum Loss [ . . . ]

8.4.1.3 ~~8.3.1.3~~ Corrections Allowed [ . . . ]

8.4.1.4 ~~8.3.1.4~~ Incoming Electrical Service Segment [ . . . ]

8.4.1.5 ~~8.3.1.5~~ UPS Segment Efficiency [ . . . ]

8.4.1.6 ~~8.3.1.6~~ ITE Distribution Segment Efficiency [ . . . ]

8.4.1.7 ~~8.3.1.7~~ Combined UPS and Pathway Loss Calculations [ . . . ]

8.4.1.8 ~~8.3.1.8~~ Alternate Designs [ . . . ]

8.4.1.9 ~~8.3.1.9~~ Derivation of Electrical Component Efficiencies [ . . . ]

8.4.1.10 ~~8.2.1~~ Electrical Systems Constant ITE Power. Electrical *systems* shall comply with Section 8.2.1.1. *ITE* power is not assumed to be seasonably variable in this standard. Therefore *ITE* energy can be calculated by multiplying

*ITE* power by 8760, the number of hours in a normal year. The *data center* design *ITE* power must be specified on the *construction documents*.

**8.5 ~~8.2.1.1~~ Maximum Design Electrical Loss Component (Design ELC) Option for Designs Involving Electrical Systems Only. [ . . . ]**

**8.6 ~~8.2.1.2~~ Maximum Design Electrical Loss Component (Design ELC) Option for Designs Involving Both Electrical and Mechanical Systems. [ . . . ]**

**8.3.2 Power Compliance Path**

**8.7 ~~8.4~~ Submittals**

**8.7.1 ~~8.4.1~~ Drawings.** *Construction documents* shall require that within a time determined by the building owner and the contractor(s) 30 days after the date of *system* acceptance, record drawings of the actual installation shall be provided to the building owner, including the following:

- a. A single-line diagram of the building electrical distribution *system*.
- b. Floor plans indicating locations of and areas served by all distribution.
- c. All conditions used for the Basis of Design and calculations such as *UPS N+1* and *UPS economy mode* operation.
- d. *Design electrical loss component* calculations showing the actual numbers used and demonstrating compliance with the applicable Table 8.2.1.1-8.5 values.

**8.7.2 ~~8.4.2~~ Manuals.** *Construction documents* shall require that an operating manual and maintenance manual be provided to the building owner. The manuals shall include, at a minimum, the following:

- a. Submittal data stating *equipment* rating and selected options for each piece of *equipment* requiring maintenance.
- b. Operation and maintenance manuals for each piece of *equipment* requiring maintenance. (Required routine maintenance actions shall be clearly identified.)
- c. Names and addresses of at least one qualified service agency.
- d. A complete narrative of how each *system* is intended to operate.

**8.8 Product Information (Not Used)**

**9. LIGHTING**

**9.1 General**

**9.1.1 Scope.** This section shall apply to interior equipment spaces of data centers.

**9.2 Definition of Compliance Paths**

**9.2.1 Lighting Systems.** Lighting systems and equipment shall comply with Section 9 of ANSI/ASHRAE/IES Standard 90.1

**9. LIGHTING**

**9.1 General**

**9.1.1 Scope.** Section 9 specifies the requirements for the lighting.

## **9.2 Compliance Paths**

**9.2.1 Compliance.** The lighting shall comply with Section 9 of ANSI/ASHRAE/IES Standard 90.1.

## **10. OTHER EQUIPMENT**

~~10.1 General. Provisions of this section shall comply with Section 10 of ANSI/ASHRAE/IES Standard 90.1.~~

## **10. OTHER EQUIPMENT**

### **10.1 General**

**10.1.1 Scope.** Section 10 specifies the requirements for other equipment.

### **10.2 Compliance Paths**

**10.2.1 Compliance.** Other equipment shall comply with Section 10 of ANSI/ASHRAE/IES Standard 90.1.

## **11. GUIDE TO ALTERNATIVE COMPLIANCE METHOD**

~~11.1 General. Provisions of this standard require the user to demonstrate compliance with provisions of Sections 5 through 10.~~

~~The complete submittal data requirements that the user must complete and provide to the authority having jurisdiction as required for the specific project are outlined in Section 4.~~

**11.1.1 Sections 6 and 8 Trade-Off Method Scope.** The Sections 6 and 8 Trade-Off Method is an alternative to individually demonstrating compliance with Sections 6 and 8 the requirements in Section 6.5 or 6.6 and the requirements in

Section 8.5 or 8.6. It shall be allowed for demonstrating compliance when evaluating the proposed designs when either the *design MLC* in Section 6 or the *design ELC* in Section 8 is greater than the maximum allowed by the standard.

**11.1.2 Sections 6 and 8 Trade-Off Method Rationale.** A design that has various physical or other types of constraints shall be allowed flexibility to demonstrate compliance with this standard. These constraints may impact the mechanical or electrical design. The Trade-Off Method allows a less efficient electrical *system* to be offset by a more efficient mechanical *system* or visa vice versa in order to demonstrate compliance.

**11.1.3 Trade-Offs Limited to Building Permit.** When the building permit being sought applies to less than the whole building, only the calculation parameters related to the systems to which the permit applies shall be allowed to vary. Parameters relating to unmodified existing conditions or to future building components shall be identical for both calculations.

~~11.2 Sections 6 and 8 Trade-Off Method~~ **11.2.1 Compliance.** Compliance with Section 11 shall be demonstrated by ~~meeting both~~ complying with all of the following conditions

- a. All requirements of Sections 5, 7, 9, and 10
- b. The requirements of Sections 6.1, 6.4, and 6.7
- c. The requirements of Sections 8.1, 8.4, and 8.7
- ~~b~~d. The sum of the calculated values of the *design MLC* value and the *design ELC* shall be equal to or less than the maximum overall *systems* design value. (The sum of the *design MLC* value and the *design ELC* value create an overall ~~S~~*systems* design value.)

[ . . . ]

## **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.

### **About ASHRAE**

ASHRAE, founded in 1894, is a global society advancing human well-being through sustainable technology for the built environment. The Society and its members focus on building systems, energy efficiency, indoor air quality, refrigeration, and sustainability. Through research, Standards writing, publishing, certification and continuing education, ASHRAE shapes tomorrow's built environment today.

For more information or to become a member of ASHRAE, visit [www.ashrae.org](http://www.ashrae.org).

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