ADDENDA

ANSI/ASHRAE Addendum a to
ANSI/ASHRAE Standard 90.4-2019

Energy Standard for Data Centers

Approved by ASHRAE and the American National Standards Institute on October 30, 2020.

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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FOREWORD

Addendum a encourages recovery of waste heat from data centers for use in space heating and industrial applications, resulting in net energy savings on a societal level. The addendum also encourage siting of data centers in proximity to heat-consuming commercial and industrial processes (e.g., food production facilities) in order to take advantage of heat transfer, minimize waste, and reduce overall energy use.

Addendum a also improves and clarifies ambiguous and obsolete language in Section 6.5. For example, 6.5 currently says "In the case of cooling provided by a source other than electricity, the energy consumption shall be converted to kilowatt-hours" but does not say how to perform this conversion. This addendum clarifies how to perform the conversion. Currently, Section 6.5 also says to include chiller and AHU fan energy serving a UPS room but does not say to include cooling tower or pump energy serving the UPS room, which was clearly the intent. This addendum clarifies that the energy of all mechanical equipment serving UPS rooms is also included.

The other substantive change to Section 6.5 is removal of language that states in part, "...if the data center utilizes mechanical cooling, the calculated rack inlet temperature and dew point must be within Thermal Guidelines for Data Processing Environments *recommended thermal envelope for more than 8460 of the hours per year." Many data centers operate outside the ASHRAE Thermal Guidelines for more than 300 hours per year and do not have the capacity to stay within them for 8460 hours. This addendum allows designers to model their data centers as they are truly intended to operate.*

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 a to Standard 90.4-2019

Replace Section 6.5 in its entirety with the following section (Note: Equations, though not underlined, are new text.)

6.5 Maximum *Annualized Mechanical Load Component (Annualized MLC)*. *Annualized MLC* shall be calculated using Equation 6.5. The resulting value shall be less than or equal to the value in Table 6.5, "Maximum *Annualized Mechanical Load Component (Annualized MLC)*".

$$\text{Annualized MLC} = \frac{\sum N = 25, 50, 75, 100 (\text{MechE}_N - \text{HeatRec}_N)}{\sum N = 25, 50, 75, 100 \text{DataCenterITE}_N} \quad (6.5)$$

where

MechE_N (kWh) = total annual *energy* consumed by all mechanical *equipment* (e.g., fans, pumps, motors, drives, compressors, humidifiers, dehumidifiers, water filtration or treatment equipment) at a constant *ITE* load of *N*% of the design *ITE* load. This includes mechanical *equipment* serving *data center* electrical *equipment* (e.g., *UPS systems* and *transformers*). *Energy* use of shared *systems* that serve both *data center spaces* and non-*data-center spaces* must be prorated on an hourly capacity-weighted basis. (***Informative Note:*** For example, if 62% of the load on a chiller plant in a given hour comes from *data center spaces*, with the remaining 38% from non-*data-center spaces*, then only 62% of the total chiller plant *energy* for that hour can be included in the MechE.)

Mechanical *equipment energy* for *equipment* dedicated to *data center spaces* shall be calculated with Typical

Meteorological Year Version 3 (TMY3) data with 8760 hourly bins or that is binned by dry bulb and wet bulb (or dew point) with a resolution ≤2°F (1°C).

HeatRec$_N$ (kWh) = net increase in *data center* mechanical *equipment energy* caused by transferring waste heat from the *data center*, when the *data center* is operating at a constant *ITE* load of *N*% of the design *ITE* load, to a non-*data-center* mechanical *system* (e.g., *space* heating or industrial process *energy*). The net offset is quantified by simulating the *data center* with and without *data center* heat transfer. (***Informative Note:*** The purpose of the HeatRec term is to ensure that, by encouraging the transfer of otherwise wasted heat to a useful purpose, the design is not penalized in the *MLC* calculation by any net *energy* increases incurred by adding heat transfer *equipment* [e.g., transfer fans] or operating *data center* cooling *equipment* at lower *efficiency* in order to facilitate heat recovery [e.g., operating a heat recovery chiller at high lift]).

Annual *energy* for shared *systems* and for heat recovery shall be calculated using an 8760 hour TMY3 file and accurate heating/cooling load profiles.

Data CenterITE$_N$ (kWh) = total annual *energy* consumed by the *ITE* at a constant *ITE* load of *N*% of the design *ITE* load. For example, DataCenterITE$_{50}$ for a design ITE load of 1000 *kW* = 1000 *kW* × 8760 h × 0.5 = 4,380,000 kWh. *ITE energy* does not include *UPS losses* but does include server fan *energy*.

Calculations/simulations shall be made using the *control* sequences and set points in the compliance documentation. (***Informative Note*:** As an example, if a *data center* includes redundant air handlers, but all air handlers will operate in unison at reduced speed during normal operation, then calculations will reflect *equipment* part-load performance at those simulated conditions as noted on the design documents.)

Mechanical *equipment energy* not provided by electricity shall be converted to kWh using the following formula: 3412 Btu = 1.0 kWh.

Exception to 6.5: *Energy* from shared *systems* shall be calculated in accordance with Section 11.3.

Informative Notes to Section 6.5:

1. As an example, if a *data center* receives child water from a central chilled-water plant that serves the *data center* and other *spaces* (i.e., *spaces* that do or do not meet the definition of a *data center*), the total shared *system* input *energy* is multiplied by the *data center*'s fraction of total *system* capacity for each hour to determine the *data center*'s input *energy* in accordance with Section 11.3.
2. As an example, if a natural gas appliance uses 1 therm gas input, 1 therm = 100,000 Btu. Using the formula 100,000 Btu/(3412 Btu/1.0 kWh) = 29.3 kWh equivalent.

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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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As an industry leader in research, standards writing, publishing, certification, and continuing education, ASHRAE and its members are dedicated to promoting a healthy and sustainable built environment for all, through strategic partnerships with organizations in the HVAC&R community and across related industries.

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