Standard 90.4-2022

ANSI/ASHRAE Standard 90.4-2022, *Energy Standards for Data Centers*

Purpose

Provides minimum energy efficiency requirements for the design and operation of data centers.

Significance

Standard 90.4 offers a framework for the energy efficient design of data centers with special consideration to their unique load requirements compared to other buildings. This includes establishment of the maximum mechanical load component (MLC) and electrical loss component (ELC) values required for compliance that have been lowered in successive editions of the standard in recognition of the industry's changing technologies and improved efficiencies. Max MLC is the sum of all power required for cooling, fans, pumps and heat rejection equipment, divided by the power for the data center. ELC is calculated using the worst-case losses of each segment of the power chain to demonstrate a minimum level of electrically efficient design.

Standard 90.4 incentivizes energy efficient designs that harness the increasing availability of improved systems and techniques to enhance data center performance without compromising availability or reliability. The power design requirements of a data center generate heat that must be expelled from the data center; Standard 90.4 allows for credits for heat recovery and shared space economizers. Additionally, collocating with non-data-center spaces that would benefit from the heat produced by the data center can provide energy savings.

This standard was developed under the guiding principle that data centers are mission critical facilities demanding careful attention to the potential impact of its requirements. Since 2019, ASHRAE Standard 90.1 (Energy Standard for Buildings Except Low-Rise Residential Buildings) has referenced Standard 90.4 as an alternative compliance path for large computer rooms, i.e., data centers. A Spanish translation of 90.4-2022 is available from ASHRAE.

Scope

Standard 90.4 applies to data centers with a conditioned floor space that has a power density greater than 20 W/ft2 and IT equipment loads greater than 10 kW. It contains specific requirements for mechanical and electrical systems installed in new data centers or in data center additions/alterations that require new mechanical or electrical systems. It addresses a large number of facilities: there are hundreds of thousands of data centers in the U.S. alone, from small "Edge" rooms to large "Hyperscale" cloud facilities.

Use by Governments and Code Bodies

- ✓ [1]The National Renewable Energy Laboratory (NREL) recommends that data centers follow Standard 90.4 for data center temperature range and consider operating at the maximum allowable range as specified in the standard.
- ✓ The State of Oregon requires compliance with Standard 90.4-2019 for power distribution systems and equipment serving a data center.
- ✓ Virginia's and Washington's energy codes include sections 6 and 8 of Standard 90.4-2019, which are Heating, Ventilation, and Air- Conditioning; and Electrical, respectively.
- ✓ The 2021 and 2024 IECC (C403.1.2) requires systems to comply with Section 6 and 8 of Standard 90.4-2016 and 90.4-2022 respectively.

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Changes and Improvements in Standard 90.4-2022 since Standard 90.4-2019

- ✓ Provides additional examples for Mechanical Load Component calculations and Electrical Loss Component calculations.
- ✓ Both the MLC and ELC have been lowered for improved energy performance.
- ✓ Compliance can be achieved without the use of an economizer and while following ASHRAE TC 9.9 Thermal Guidelines for Data Processing Environments, 5th Edition.
- ✓ Provides new methodology to apply credit to MLC and ELC combined for on-site renewable energy deployment.
- ✓ Includes specific language to give credit for recovered heat (heat reclaim) shared with non- data center spaces.
- ✓ The latest version has removed the incoming service segment from ELC calculations due to its minimal impact on the efficiency of the electrical distribution system and the limits on the ability of designers to define it for the typical project.

[1]NREL. 2023. Reducing Commercial Building Process Loads and Refrigeration Unit Energy Consumption. *https://betterbuildingssolutioncenter.energy.gov/sites/default/files/attachments/ReducingCommercialBuildingProcessLoads.pdf*