

# STANDARD

**ANSI/ASHRAE/IES Addendum d to  
ANSI/ASHRAE/IES Standard 90.1-2022**

# **Energy Standard for Sites and Buildings Except Low-Rise Residential Buildings**

Approved by ASHRAE and the American National Standards Institute on June 30, 2023, and by the Illuminating Engineering Society on June 7, 2023.

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

*Further review of Energy Credit H05: Ground-Source Heat-Pump System determined that, for ground-source fields with supplemental dry cooler or evaporative heat rejection for Climate Zones 0A, 0B, and 1A, the ground field could be further reduced with a larger heat rejection device. The smaller ground-source field results in increased fan and pump use required for heat rejection. The analysis showed that the reduced net savings of the more economical ground-source field could be accounted for in the table by multiplying the original dry cooler adjustment values by 70% and the evaporative heat rejection adjustment values by 85% for these three climate zones. The table has been revised to reflect these adjusted values and reformatting for clarity. Note that only new values are underlined in the table, even though the other values have been rearranged. This is because only the  $HR_{adj}$  values for ground source fields with supplemental dry cooler or evaporative heat rejection in Climate Zones 0A, 0B, and 1A are updated by this addendum.*

*The reduced values of  $HR_{adj}$  result in a more optimized ground-loop system justified in these three climate zones. However, the field reduction was inappropriate for colder climate zones where the heating load determined the minimum bore size. There are also adjustments in the text for Section 11.5.2.2.5, noting the other options for ground-source systems, and some minor editorial changes for clarity, including correcting the SI conversion for 12,000 Btu/h (3.5 kW).*

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

## Addendum d to Standard 90.1-2022

### Revise Section 11.5.2.2.5 as shown (I-P and SI).

**11.5.2.2.5 H05: Ground Source Heat Pump System.** To achieve this credit, a ground source heat pump system shall provide cooling and heating for at least 25% of the gross conditioned building area. The ground source heat pump systems shall include building ground loop HVAC systems coupled with a closed-bore ground-heat exchanger, submerged heat exchanger using water-based fluid as a heat transfer medium, ground-water (well), or fluid infrastructure (such as effluent and wastewater), and shall comply with the following:

- a. Loop pump(s) shall have controls and/or devices that will result in pump motor demand of no more than 30% of design wattage at 50% of design water flow and allow turn down to 15% flow. Alternatively, a separate field loop pump shall be provided, with either a variable-speed building pump or individual pumps for each ground source heat pump.
- b. The geothermal-source exchanger shall be sized based on the heating and cooling loads served by the ground-source heat pump system and shall comply with one of the following, as allowed by climate zone, as shown in Table 11.5.2.2.5:
  1. **100% Hours Source Size.** The system shall meet one of the following:
    - i. A closed bore field shall have at least 400 lineal feet (120 lin m) of bore piping per 12,000 Btu/h (3,500 kW) of system cooling or heating capacity, whichever is greater. The system shall not include additional heat rejection or addition devices.
    - ii. The ground source shall be sized to provide 100% of both the cooling and heating system annual operating hours without requiring any supplemental heating or heat rejection from non-ground sources, as demonstrated by an analysis or testing approved by the authority having jurisdiction.
  2. **90% Hours Source Size.** The ground source shall be sized such that the loop heat pumps provide 100% of the heating and cooling loads for at least 90%, but less than 100%, of both the cooling and heating system annual operating hours without requiring any supplemental heating or heat rejection from non-ground sources, as demonstrated by an analysis approved by the authority having jurisdiction. Heat rejection shall include a ~~two-speed or~~ variable-speed fan system.
  3. **70% Hours Source Size.** The ground source shall be sized such that the loop heat pumps provide 100% of the heating and cooling loads for at least 70%, but less than 90%, of both the cooling and heating system annual operating hours without requiring any supplemental heating or heat rejection

from non-ground sources, as demonstrated by an analysis approved by the authority having jurisdiction. Heat rejection shall include a variable-speed fan system.

The ~~allowed base~~ credits are ~~based on~~ for a ground-source heat pump system serving 25% of the gross conditioned building area and includes dry cooler partial heat rejection. Adjust the base credits as follows:

$$EC_{H05\_adj} = EC_{H05\_base} \times \frac{\text{Floor}_{GSHP}}{0.25} \times HR_{adj}$$

where

$EC_{H05\_adj}$  = energy credits achieved for ground-source heat-pump system

$EC_{H05\_base}$  = H05 base ~~energy~~ energy credit from Section 11.5.3

$\text{Floor}_{GSHP}$  = fraction of whole-project gross conditioned floor area with heating and cooling provided by the ground-source heat pump system

$HR_{adj}$  = heat-rejection adjustment factor by climate zone from Table 11.5.2.2.5 based on ground-source hours capacity sizing

**Note: Relocated or duplicated values in the table below are not underlined, as the values have not changed, and the new placement in the table is editorial. Instead, they are indicated in light gray highlight.**

**Table 11.5.2.2.5 GSHP Heat Rejection Adjustments**

Climate Zones	HR <sub>adj</sub> by <del>Field</del> Ground Source Capacity				
	<del>Full-Sized Bore Field with no Heat Rejection</del>		90% Hours Source Size; Dry-Cooler Heat Rejection		<del>90% Hours Source Size; Evaporative Heat Rejection</del>
	Dry Cooler Heat Rejection		Evaporative Heat Rejection		No Heat Rejection
	90% Hours Source Size	70% Hours Source Size	90% Hours Source Size	70% Hours Source Size	100% Hours Source Size
All climate zones	1.0				
0A		0.70	2.6	2.2	3.3
0B, 1A		0.70	5.3	4.5	7.6
0A, 1B, 2B, 3A, 3B, 4A, 4B			2.6		3.3
0B, 1A, 2A, 3C			5.3		7.6
4C, 5A, 5B, 5C			1.5		2.3
6A, 6B, 7, 8			1.1		1.4

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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.

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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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