

**INTERPRETATION IC 90.1-2016-14 OF
ANSI/ASHRAE/IES STANDARD 90.1-2016
Energy Standard for Buildings Except Low-Rise Residential Buildings**

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Reference: This request for interpretation refers to the requirements presented in ANSI/ASHRAE/IES Standard 90.1-2016, Table G3.1 No. 5 Baseline Column (a), regarding Appendix G Baseline Orientation.

Background: 90.1 Appendix G accounts for impact of building orientation on energy performance by comparing energy use of the proposed design, which must be modeled with the specified orientation, to the energy use of “exposure neutral” baseline. The associated rule is included in Table G3.1 No.5 (a), Baseline Building Performance column and is quoted below:

a. **Orientation.** The *baseline building performance* shall be generated by simulating the *building* with its actual *orientation* and again after rotating the entire *building* 90, 180, and 270 degrees, then averaging the results. The *building* shall be modeled so that it does not shade itself.

Exceptions:

1. If it can be demonstrated to the satisfaction of the *rating authority* that the *building orientation* is dictated by site considerations.
2. *Buildings* where the *vertical fenestration area* on each *orientation* varies by less than 5%.

Table G3.1 No.5 Baseline Building Performance column item (c) further requires that “The *vertical fenestration* shall be distributed on each face of the *building* in the same proportion as in the *proposed design*.”

Section 3 included the following relevant definition:

baseline building performance: the annual *energy cost* for a *building* design intended for use as a baseline for rating above-standard design or when using the *Performance Rating Method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

Section G3.1 Building Performance Calculations require that “The simulation model for calculating the proposed and *baseline building performance* shall be developed in accordance with the requirements in Table G3.1.”

Implementation of many of the requirements for calculating the *baseline building performance* differ in each of the four rotations. For example, heating and cooling loads of individual zones and capacities of the HVAC systems will typically be different for each baseline rotation – e.g., a zone with West-facing exterior walls and 40% WWR will have significantly different cooling load once the baseline is rotated and the exterior wall faces North. To accommodate that, Section G3.1.2.2.1 requires establishing baseline equipment capacities for each alternative orientation:

G3.1.2.2 Equipment Capacities

System coil capacities for the *baseline building design* shall be based on sizing runs for each *orientation* in accordance with Table G3.1, No. 5[a] and Section G3.1.2.2.1, and shall be oversized by 15% for cooling and 25% for heating.

Baseline equipment capacities affect other aspects of the baseline such as equipment efficiencies:

G3.1.2.1 Equipment Efficiencies

All HVAC *equipment* in the *baseline building design* shall be modeled at the minimum *efficiency* levels, both part load and full load, in accordance with Tables G3.5.1 through G3.5.6.

A PSZ system that has 60 kBtu/hr cooling capacity in the baseline with 0 rotation may have 80 kBtu/hr cooling capacity in the baseline rotated 90 degrees, which may in turn result in different efficiency for the same baseline system based on Table G3.5.1 – 3.0 COP_{nfcooling} for the system with 60 kBtu/hr cooling capacity and 3.5 COP_{nfcooling} for the system with 80 kBtu/hr cooling capacity.

Interpretation No.1: When the baseline is modeled with four alternative orientations following Table G3.1 No.5 Baseline Column (a), the rules of Appendix G must be fully applied to each baseline orientation, which may result in differences between configuration of each of the four baseline models in addition to surface azimuths. These differences may include but are not limited to the baseline equipment capacities and efficiencies.

Question No.1: Is this interpretation correct?

Answer No.1: Yes

Interpretation No.2: When the baseline is modeled with four alternative orientations following Table G3.1 No.5 Baseline Column (a), the rules of Appendix G must be fully applied to the building model representing the actual orientation only. For the additional three simulations, no other changes except the rotation are made and all other rules of Appendix G are not followed. This includes situations that result in unmet load hours in excess of those allowed by Section G3.1.2.4.

Question No.2: Is this interpretation correct?

Answer No.2: No

Comments No.2: Interpretation No.1 is correct.