

Extracting Fan Power from Efficiency Ratings

ASHRAE 90.1-2007 Appendix G3.1.2.1 states:

All HVAC equipment in the baseline building design shall be modeled at the minimum efficiency levels, both part and full load, in accordance with Section 6.4. *Where efficiency ratings, such as EER and COP, include fan energy, the descriptor shall be broken down into its components so that supply fan energy can be modeled separately.*

To comply with G3.1.2.1, the efficiency without supply fan power must be calculated and modeled separately from AHRI efficiency. ASHRAE 90.1-2013 provides equations to extract fan power from efficiency ratings (i.e. determine EER or COP without supply fan power). While Appendix G applies to New Construction projects, these equations and the modeling approach must be applied to existing buildings as well.

Equations:

1. $COP_{nfcooling} = 7.84 \times (10^{-8}) \times EER \times Q + 0.338 \times EER$

2. $COP_{nfcooling} = -0.0076 \times SEER^2 + 0.3796 \times SEER$

3. $COP_{nfheating} = 1.48 \times (10^{-7}) \times COP_{47} \times Q + 1.062 \times COP_{47}$

(applies to heat-pump heating efficiency only)

4. $COP_{nfheating} = -0.0296 \times HSPF^2 + 0.7134 \times HSPF$

Where:

$COP_{nfcooling}$ and $COP_{nfheating}$: The packaged HVAC equipment efficiency excluding supply fan power for baseline HVAC Systems 1, 2, 3, 4, 5 and 6 (packaged terminal AC/HP, packaged single zone AC/HP, and packaged VAV).

EER, SEER, COP_{47} : applicable full load performance rating from Tables 6.8.1-1 through 6.8.1-4 at AHRI test conditions.

Q: AHRI-rated cooling capacity in Btu/h.

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Note: EIR entered in eQuest = $1 / \text{COP}_{\text{nf}}$

ERP Documentation

Please include all efficiency calculations and assumptions used to determine model inputs. This information should be included in a supplemental spreadsheet as an Appendix to the ERP. All spreadsheets should be submitted in Excel format so equations can be verified.