Not the complete Standard
This is an excerpt of Appendix G

Standard 90.1 Appendix G 2013
Performance Rating Method

Excerpt from ANSI/ASHRAE/IES Standard 90.1-2013 (I-P)

This document is an intermediate version of Normative Appendix G to ANSI/ASHRAE/IES Standard 90.1-2013. It incorporates addenda to the 2013 edition of the standard current as of August 11, 2015. These addenda are included in the 2015 Addenda Supplement to Standard 90.1, which can be downloaded for free online at www.ashrae.org/standards.

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INTRODUCTION

*This document presents a revised version of Normative Appendix G, "The Performance Rating Method," to Standard 90.1. It includes the version of the appendix published in Standard 90.1-2013 (I-P edition) plus addenda **k**, **r**, **z**, **aa**, **ad**, **bm**, and **dx**. Of these, addendum bm is the most significant.*

***Addendum bm** makes two major changes to Appendix G. First, it allows Appendix G to be used as a path for compliance with the standard. Previously Appendix G was used only to rate "beyond code" performance of buildings. Using this new version of Appendix G to show compliance with the 2016 version of the standard, the proposed building design needs to have a Performance Cost Index (PCI) less than that shown in Table 4.2.1.1 based on building type and climate zone. The second change is that the baseline design is now fixed at a certain level of performance, the stringency of which is expected not to change with subsequent versions of the standard. By this, a building of any era can be rated using the same method. The intent is that any building energy code or beyond-code program can use this methodology and simply set the appropriate target for their needs analogous to those in Table 4.2.1.1. Therefore, a beyond-code program may wish to set a target less than is shown in Table 4.2.1.1 (a target of 0 is a net zero building), while compliance with a previous version of the standard may wish to set a target above what's shown in Table 4.2.1.1. Because unregulated loads are not included in the compliance target in Table 4.2.1.1, beyond-code programs that encourage improvement in unregulated loads may wish to modify the target to include those loads.*

Portions of Sections 3 and 4 that are modified by addendum bm are reproduced in this publication for convenience.

Following is a brief description of the other addenda included:

- ***Addendum k** directs the modeler to use the default assemblies in Appendix A for baseline opaque envelope assemblies.*
- ***Addendum r** establishes the hierarchy of the decision-making process for selecting baseline HVAC systems.*
- ***Addendum z** provides detail on the simulation of baseline building heat pumps, including how auxiliary heat is used in conjunction with heat-pump heating.*
- ***Addendum aa** provides direction regarding when it is appropriate to model a heating-only system in Appendix G.*
- ***Addendum ad** clarifies when baseline HVAC systems should be modeled with preheat coils.*
- ***Addendum dx** makes changes to the baseline lighting power allowances in Appendix G.*

As several entities have expressed interest in developing programs based on the revised appendix, this version of Appendix G is being released outside of the normal three-year publication cycle of Standard 90.1. It is also being released to give advanced notice to software developers that may be interested in automating the process of creating the Appendix G baseline. While it is likely that the version of Appendix G published in the 2016 edition of the standard will include additional changes to Appendix G, it is not likely that they will be as extensive as those included in addendum bm.

(This is an excerpt of Section 3. This material includes new definitions and definitions that appear in Standard 90.1-2013, some of which are modified by addendum bm. This is normative text and is part of the standard. For a complete list of definitions, refer to the full standard.)

3. DEFINITIONS

addition: an extension or increase in floor area or height of a building outside of the *existing building envelope*.

alteration: a replacement or *addition* to a building or its systems and equipment; routine maintenance, repair, and service, or a change in the building's use classification or category shall not constitute an *alteration*.

automatic: self-acting, operating by its own mechanism when actuated by some nonmanual influence, such as a change in current strength, pressure, temperature, or mechanical configuration.

ballast: a device used in conjunction with an electric-discharge lamp to cause the lamp to start and operate under the proper circuit conditions of voltage, current, wave form, electrode heat, etc.

> ***electronic ballast:*** a *ballast* constructed using electronic circuitry.
>
> ***hybrid ballast:*** a *ballast* constructed using a combination of magnetic core and insulated wire winding and electronic circuitry.
>
> ***magnetic ballast:*** a *ballast* constructed with magnetic core and a winding of insulated wire.

baseline building design: a computer representation of a hypothetical design based on the proposed building project. This representation is used as the basis for calculating the *baseline building performance* 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.

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.

below-grade wall: see *wall*.

boiler: a self-contained, low-pressure appliance for supplying steam or hot water.

> ***modulating boiler:*** a *boiler* that is capable of more than a single firing rate in response to a varying temperature or heating load.
>
> ***packaged boiler:*** a *boiler* that is shipped complete with heating equipment, mechanical draft equipment, and *automatic* controls, and that is usually shipped in one or more sections. A *packaged boiler* includes factory-built boilers manufactured as a unit or system, disassembled for shipment, and reassembled at the site.

building envelope: the exterior plus the semi-exterior portions of a building. For the purposes of determining *building envelope* requirements, the classifications are defined as follows:

> ***exterior building envelope:*** the elements of a building that separate conditioned spaces from the exterior.
>
> ***semi-exterior building envelope:*** the elements of a building that separate conditioned space from unconditioned space or that enclose semiheated spaces through which thermal energy may be transferred to or from the exterior, to or from unconditioned spaces, or to or from conditioned spaces.

building official: the officer or other designated representative authorized to act on behalf of the authority having jurisdiction.

dwelling unit: a single unit providing complete independent living facilities for one or more persons, including permanent provisions for living, sleeping, eating, cooking, and sanitation.

dynamic glazing: any glazing system/glazing infill that has the fully reversible ability to change its performance properties, including *U-factor*, solar heat gain coefficient, or *visible transmittance*. This includes, but is not limited to, shading systems between the glazing layers and chromogenic glazing.

efficiency: performance at specified rating conditions.

emittance: the ratio of the radiant heat flux emitted by a specimen to that emitted by a blackbody at the same temperature and under the same conditions.

existing building: a building or portion thereof that was previously occupied or approved for occupancy by the authority having jurisdiction.

on-site renewable energy: energy generated from renewable sources produced at the building site.

performance rating method: a calculation procedure that generates an index of merit for the performance of building designs that substantially exceeds the energy *efficiency* levels required by this standard or when using the *performance rating method* as an alternative path for minimum standard compliance in accordance with Section 4.2.1.1.

proposed building performance: the annual energy cost calculated for a *proposed design*.

proposed design: a computer representation of the actual proposed building design, or portion thereof, used as the basis for calculating the design energy cost.

rating authority: the organization, *building official*, or agency that adopts, enforces, or sanctions use of this rating methodology.

reflectance: the ratio of the light reflected by a surface to the light incident upon it.

regulated energy use: energy used by building systems and components with requirements prescribed in Sections 5 through 10. This includes energy used for HVAC, lighting, service water heating, motors, transformers, vertical transportation, refrigeration equipment, computer-room cooling equipment, and other building systems, components, and processes with requirements prescribed in Sections 5 through 10.

roof: the upper portion of the *building envelope*, including opaque areas and fenestration, that is horizontal or tilted at an angle of less than 60 degrees from horizontal. For the purposes

of determining *building envelope* requirements, the classifications are defined as follows:

attic and other roofs: all other *roofs*, including *roofs* with insulation entirely below (inside of) the *roof* structure (i.e., attics, cathedral ceilings, and single-rafter ceilings), *roofs* with insulation both above and below the *roof* structure, and *roofs* without insulation but excluding *metal building roofs*.

metal building roof: a *roof* that

a. is constructed with a metal, structural, weathering surface;
b. has no ventilated cavity; and
c. has the insulation entirely below deck (i.e., does not include composite concrete and metal deck construction nor a *roof* framing system that is separated from the superstructure by a wood substrate) and whose structure consists of one or more of the following configurations:
    1. Metal roofing in direct contact with the steel framing members
    2. Metal roofing separated from the steel framing members by insulation
    3. Insulated metal roofing panels installed as described in subitems (a) or (b)

roof with insulation entirely above deck: a *roof* with all insulation

a. installed above (outside of) the *roof* structure and
b. continuous (i.e., uninterrupted by framing members).

single-rafter roof: a subcategory of attic *roofs* where the *roof* above and the ceiling below are both attached to the same wood rafter and where insulation is located in the space between these wood rafters.

SHGC: see *solar heat gain coefficient*.

simulation program: a computer program that is capable of simulating the energy performance of building systems.

thermal block: a collection of one or more HVAC zones grouped together for simulation purposes. Spaces need not be contiguous to be combined within a single *thermal block*.

thermal transmittance (U-factor): heat transmission in unit time through unit area of a material or construction and the boundary air films, induced by unit temperature difference between the environments on each side (Btu/h·ft^{2}·°F).

U-factor: see *thermal transmittance.*

unregulated energy use: energy used by building systems and components that is not *regulated energy use*.

variable-air-volume (VAV) system: HVAC system that controls the dry-bulb temperature within a space by varying the volumetric flow of heated or cooled supply air to the space.

visible transmittance (VT): the ratio of visible radiation entering the space through the fenestration product to the incident visible radiation, determined as the spectral transmittance of the total fenestration system, weighted by the photopic response of the eye and integrated into a single dimensionless value.

***wall*:** that portion of the *building envelope*, including opaque area and fenestration, that is vertical or tilted at an angle of 60 degrees from horizontal or greater. This includes above- and *below-grade walls*, between floor spandrels, peripheral edges of floors, and foundation *walls*. For the purposes of determining *building envelope* requirements, the classifications are defined as follows:

above-grade wall: a *wall* that is not a *below-grade wall*.

below-grade wall: that portion of a *wall* in the *building envelope* that is entirely below the finish grade and in contact with the ground.

mass wall: a *wall* with a heat capacity exceeding (1) 7 Btu/ft^{2}·°F or (2) 5 Btu/ft^{2}·°F, provided that the *wall* has a material unit weight not greater than 120 lb/ft^{3}.

metal building wall: a *wall* whose structure consists of metal spanning members supported by steel structural members (i.e., does not include spandrel glass or metal panels in curtain *wall* systems).

steel-framed wall: a *wall* with a cavity (insulated or otherwise) whose exterior surfaces are separated by steel framing members (i.e., typical steel stud *walls* and curtain *wall* systems).

wood-framed and other walls: all other *wall* types, including wood stud *walls*.

(This text is new to Section 4. It was added by addendum bm. This is normative text and is part of the standard. For the complete text of Section 4, refer to the full standard.)

4.2 Compliance

4.2.1 Compliance Paths

4.2.1.1 New Buildings. New *buildings* shall comply with either the provisions of

a. Sections 5, "Building Envelope"; Section 6, "Heating, Ventilating, and Air Conditioning"; Section 7, "Service Water Heating"; Section 8, "Power"; Section 9, "Lighting"; and Section 10, "Other Equipment," or

b. Section 11, "Energy Cost Budget Method,." or

c. Appendix G, "Performance Rating Method."

When using Appendix G, the Performance Cost Index (PCI) shall be less than or equal to the Performance Cost Index Target (PCI_t) when calculated in accordance with the following:

$$PCI_t = (BBUEC + (BPF \times BBREC)) / BBP$$

where

PCI = Performance Cost Index calculated in accordance with Section G1.2.

BBUEC = Baseline Building Unregulated Energy Cost. The portion of the annual energy cost of a *baseline building design* that is due to *unregulated energy use*.

BBREC = Baseline Building Regulated Energy Cost. The portion of the annual energy cost of a baseline building design that is due to *regulated energy use*.

BPF = Building Performance Factor from Table 4.2.1.1. For building area types not listed in Table 4.2.1.1 use "All others." Where a building has multiple building area types, the required BPF shall be equal to the area-weighted average of the building area types.

BBP = *baseline building performance*.

Regulated energy cost shall be calculated by multiplying the total energy cost by the ratio of *regulated energy use* to total energy use for each fuel type. Unregulated energy cost shall be calculated by subtracting regulated energy cost from total energy cost.

TABLE 4.2.1.1 Building Performance Factor (BPF)

Building Area Typea	Climate Zone																
	1A	1B	2A	2B	3A	3B	3C	4A	4B	4C	5A	5B	5C	6A	6B	7	8
Multifamily	0.73	0.73	0.71	0.69	0.74	0.73	0.68	0.78	0.81	0.81	0.76	0.80	0.81	0.76	0.79	0.74	0.80
Healthcare/ hospital	0.64	0.56	0.60	0.56	0.60	0.56	0.54	0.57	0.53	0.55	0.59	0.52	0.55	0.57	0.52	0.56	0.56
Hotel/motel	0.64	0.65	0.62	0.60	0.63	0.65	0.64	0.62	0.64	0.62	0.60	0.61	0.60	0.59	0.61	0.57	0.58
Office	0.58	0.62	0.57	0.62	0.60	0.64	0.54	0.58	0.60	0.58	0.60	0.61	0.58	0.61	0.61	0.57	0.61
Restaurant	0.62	0.62	0.58	0.61	0.60	0.60	0.61	0.58	0.55	0.60	0.62	0.58	0.60	0.63	0.60	0.65	0.68
Retail	0.52	0.58	0.53	0.58	0.54	0.62	0.60	0.55	0.60	0.60	0.55	0.59	0.61	0.55	0.58	0.53	0.53
School	0.46	0.53	0.47	0.53	0.49	0.52	0.50	0.49	0.50	0.49	0.50	0.50	0.50	0.49	0.50	0.47	0.51
Warehouse	0.51	0.52	0.56	0.58	0.57	0.59	0.63	0.58	0.60	0.63	0.60	0.61	0.65	0.66	0.66	0.67	0.67
All others	0.62	0.61	0.55	0.57	0.56	0.61	0.59	0.58	0.57	0.61	0.60	0.57	0.61	0.56	0.56	0.53	0.52

a. In cases where both a general building area type and a specific building area type are listed, the specific building area type shall apply