PETITION FOR DECLARATORY STATEMENT
BEFORE THE FLORIDA BUILDING COMMISSION

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DS 2015-125

Re: Voltage drop for feeders & branch circuits FBC-Energy Conservation – 2014 – C405.7.3 & (7.31 & 7.32)

(See attached backup)

To whom it may concern,

As an electrical contractor, I am constantly coming across the huge increase in cost to up size feeders required to meet the FBC 2% voltage drop for feeders vs. the National Electrical Code 3% for feeders. I have three jobs right now alone where the additional cost exceeds $100,000.00 per job – Naples Square - 5 story multi-family, Aqua - 10 story high rise, and Sea Glass – 22 story high rise.

A job we are bidding is Arthrex's new 160, 000 square foot warehouse where the 2% feeder voltage drop will add $50, 000 or more to the cost for larger copper feeders and conduit.

My understanding is the 2014 FBC code was adopted from ASHRAE 90.1 section 8.4.1 – 2010.

Since then, ASHRAE has revised this code per Addendum c to standard ASHRAE 90.1 – 2013. The Addendum c allows voltage drop for feeders and branch combined to be a maximum of 5% voltage drop total. The reasons given for this Addendum c revision were "reduces first costs in certain projects while remaining neutral on energy costs".

Obviously, lights, equipment, and appliances do not know whether the voltage drop came from the feeders or the branch circuits.

Even United States Green Building Council's LEED interpretation allows ASHRAE 90.1 – Section 8.4 to be met with a total voltage drop of 5%.

With consideration to 2015 Florida Statues Section 553.775- "protects the public safety, health, and welfare at the most reasonable cost to the consumer" I therefore ask the question-

"Can electrical engineers design commercial construction projects to allow feeders to have more than a 2% voltage drop, as long as the feeders and branch circuits combined shall be sized for a maximum of 5% voltage drop to meet the intent of FBC – Energy Conservation – 2014 – C405.7.3"?

The financial benefit to new commercial projects would be huge with no change in energy costs.

Thank you for your immediate attention to this matter.

Sincerely,

Gary R. Beaumont
Beaumont Electric Co.
License #EC-0001047

sections of this code are subject to the design conditions in ASHRAE Standard 90.1.

C405.7.2 Electrical metering.
In buildings having individual dwelling units, provisions shall be made to determine the electrical energy consumed by each tenant by separately metering individual dwelling units.

C405.7.3 Voltage drop.

C405.7.3.1 Feeders and customer owned service conductors.
Feeder and customer owned service conductors shall be sized for a maximum voltage drop of 2 percent at design load.

C405.7.3.2 Branch circuits.
Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent at design load.

C405.7.4 Completion requirements.

C405.7.4.1 Drawings.
Construction documents shall require that, within 30 days after the date of system acceptance, record drawings of the actual installation shall be provided to the building owner, including:

1. a single-line diagram of the building electrical distribution system and

2. floor plans indicating location and area served for all distribution.

C405.7.4.2 Manuals.
Construction documents shall require that an operating manual and maintenance manual be provided to the building owner. The manuals shall include, at a minimum, the following:

1. Submittal data stating equipment rating and selected options for each piece of equipment requiring maintenance.

2. Operation manuals and maintenance manuals for each piece of equipment requiring maintenance. Required routine maintenance actions shall be clearly identified.

3. Names and addresses of at least one qualified service agency.

Note: Enforcement agencies should only check to be sure that the construction documents require this information to be transmitted to the owner and should not expect copies of any of the materials.

SECTION C406 ADDITIONAL EFFICIENCY PACKAGE OPTIONS

C406.1 Requirements.
Buildings shall comply with at least one of the following:

(This foreword is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

FOREWORD

Section 8.4.1 previously separated feeder conductors from branch circuits when limiting voltage drop. By specifying the same combined voltage drop over the combination of components, this addendum reduces first costs in certain projects while remaining neutral on energy costs.

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

Addendum c to Standard 90.1-2013

Modify the standard as follows (I-P and SI units).

8.4 Mandatory Provisions

~~**8.4.1 Voltage Drop**~~

~~**Exception:** Feeder conductors and branch circuits that are dedicated to emergency services~~

~~**8.4.1.1 Feeders.** Feeder conductors shall be sized for a maximum voltage drop of 2% at design load.~~

~~**8.4.1.2 Branch Circuits.** Branch circuit conductors shall be sized for a maximum voltage drop of 3% at design load.~~

8.4.1 Voltage Drop. The conductors for feeders and branch circuits combined shall be sized for a maximum of 5% voltage drop total.

(This appendix is not part of this standard. It is merely informative and does not contain requirements necessary for conformance to the standard. It has not been processed according to the ANSI requirements for a standard and may contain material that has not been subject to public review or a consensus process. Unresolved objectors on informative material are not offered the right to appeal at ASHRAE or ANSI.)

INFORMATIVE APPENDIX A
2015 ADDENDA TO ANSI/ASHRAE/IES STANDARD 90.1-2013

This supplement includes Addenda a, c, d, e, g, h, j, k, m, n, o, p, q, r, s, z, aa, ac, ad, ae, ag, ak, bm, and dx to ANSI/ASHRAE/IES Standard 90.1-2013. The following table lists each addendum and describes the way in which the standard is affected by the change. It also lists the ASHRAE, IES, and ANSI approval dates for each addendum.

TABLE A-1 2015 Addenda Supplement to ANSI/ASHRAE/IES Standard 90.1-2013

Addendum	Section(s) Affected	Description of Changes*	ASHRAE Standards Committee Approval	ASHRAE BOD Approval	IES BOD Approval	ANSI Approval
a	5. "Building Envelope"	Addendum a revises the definition of and heating output thresholds for conditioned space. The revised heating output thresholds reflects the reduction in loads due to greater energy efficiency in Section 5, "Building Envelope."	9/16/2014	10/3/2014	7/1/2014	10/29/2014
c	8. "Power"	Section 8.4.1 previously separated feeder conductors from branch circuits when limiting voltage drop. By specifying the same combined voltage drop over the combination of components, this addendum reduces first costs in certain projects while remaining neutral on energy costs.	9/16/2014	10/3/2014	7/1/2014	10/6/2014
d	6. "Heating, Ventilating and Air Conditioning"	This addendum adds deeper thermostat setups and setbacks and ventilation control to unrented hotel guestrooms and more clarity to the existing hotel guestroom requirements.	9/16/2014	10/3/2014	7/1/2014	10/6/2014
e	9. "Lighting"	This addendum relaxes the existing threshold somewhat for lighting alterations (20% instead of 10%) but captures high energy efficiency by requiring more of the lighting control requirements.	5/27/2015	6/4/2015	6/1/2015	6/26/2015
g	6. "Heating, Ventilating and Air Conditioning"	The wording in Standard 90.1-2013 regarding the fan power pressure drop limitation adjustment can be interpreted in two ways. This change is intended to clarify which equation is the one that the committee intended and was originally used in the economic analysis.	9/16/2014	10/3/2014	7/1/2014	10/6/2014
h	Appendix C	The current language in Appendix C regarding HVAC fan power is contradictory. The existing language instructs the user to include fan energy in the HVAC packaged efficiency (which is cooling only) and not model the fan power explicitly. However, the current language also instructs the user to model the fan as cycling in heating. By including the fan energy in the packaged cooling efficiency, the fan energy cannot be modeled in heating. This addendum modifies the language to provide an efficiency rating for the compressor and condensing unit of the packaged equipment that does not include the fan energy but reflects the standard's minimum performance requirement.	9/16/2014	10/3/2014	7/1/2014	10/6/2014
j	6. "Heating, Ventilating and Air Conditioning"	This addendum removes the exception to the variable-air-volume system ventilation optimization when energy recovery ventilation is installed.	1/28/2015	1/28/2015	1/19/2015	1/29/2015
k	Appendix G	This addendum requires envelope assemblies to comply with Appendix A, "Rated R-Value of Insulation and Assembly U-Factor, C-Factor, and F-Factor Determinations," when complying with the Energy Cost Budget Method in Appendix G.	1/28/2015	1/28/2015	1/19/2015	1/29/2015

* These descriptions may not be complete and are provided for information only.

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Corrections + Interpretations

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ID#10218 MADE ON 07/01/2012 **LEED INTERPRETATION**

PREREQUISITE/CREDIT: EAP2 - MINIMUM ENERGY PERFORMANCE

RATING SYSTEM: LEED BD+C: NEW CONSTRUCTION, LEED BD+C: CORE AND SHELL, LEED BD+C: SCHOOLS, LEED BD+C: HEALTHCARE, LEED BD+C: DATA CENTERS, LEED BD+C: HOSPITALITY, LEED ID+C: RETAIL, LEED ND: BUILT PROJECT

RATING SYSTEM VERSION: V3 - LEED 2009, V2 - SCHOOLS 2007, V2 - LEED 2.2, V2 - LEED 2.0

Inquiry

This LEED Interpretation pertains to the requirement to limit voltage drop for Energy & Atmosphere Prerequisite 2 for Minimum Energy Performance. The current limit is posing a significant hardship to tall buildings relative to satisfying the mandatory requirements of ASHRAE Standard 90.1-2007 (also applicable in 90.1-2010), referenced in the prerequisite.

Specifically, the requirement in Standard 90.1 to limit voltage drop to not greater that 2% for electrical feeders and 3% for branch circuits (section 8.4.1) has proven to be problematic for large projects which often contain feeders of extended length. By comparison, the National Electric Code does not explicitly regulate voltage drop, but suggests model Code language that limits either electrical feeder or branch circuit voltage drop to 3%, with the combined voltage drop of both feeders and branch circuits when added together not to exceed 5%.

This may appear to be a minor difference, However, when applied to long copper electrical feeders which are present in tall buildings, this absolute constraint from Standard 90.1 on the feeder voltage drop (of 2%) results in a significant increase in the required quantity of copper conductors and associated conduit.

As an example of a higher density regions attempting to resolve this issue, the New York City Electrical Code has adopted the National Electric Code model language as mandatory for all buildings and also included an exception for residential occupancies within buildings to limit electrical feeder voltage drop to 4%, and the combined voltage

drop of both feeders and branch circuits to not more than 5%.

This change is in recognition of the inherently short branch circuit lengths in typical NYC apartments, and is based on measured testing results which indicate that voltage drop is often negligible due to the conservative feeder and circuit sizing requirements mandated by other aspects of the Code. Thus, for residential buildings the allowable voltage drop of 4% is twice the allowable voltage drop of 2% as required in 90.1. Depending upon the length and capacity of a particular feeder, this difference can equate to a 3X variance in the required quantity of copper conductors and conduit, with a significant associated cost premium.

The magnitude of the cost premium to satisfy the 90.1 criteria in tall buildings, as compared with New York City Code requirements, can be equal to the total of all of the other cost premiums (hard and soft) associated with achieving LEED certification (at the Silver or Gold level) for a medium to large project in New York City.

In order to resolve this issue, we are proposing an alternate compliance path that we believe would meet the intent of the prerequisite, while at the same time preventing cost prohibitive use of significant amounts of additional copper.

Voltage drop is literally the loss of electrical energy (converted to heat) within a building, therefore regulating voltage drop is no different than regulating the energy efficiency of any electricity consuming device in a building (such as light fixtures or HVAC motors).

Several approaches could be implemented within the LEED rating system t ss this disproportionate prescriptive requirement of Standard 90.1. A simple and st rward approach would be to allow buildings utilizing Appendix G energy modeling LEED energy compliance path to include voltage drop as a regulated parameter within both the Energy Cost Budget and Design Energy Cost models. Under this approach, the 90.1 criteria (2% for feeders and 3% for branch circuits) would included in the Energy Cost Budget model, but the Design Energy Cost model would be allowed to include the actual voltage drop that will be implemented in the project design.

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This approach would achieve the direct intent of the voltage drop requirement of Standard 90.1 in regulating the energy efficiency of power distribution systems, but through the inherent trade-off methodology of Appendix G would allow projects the flexibility to eliminate a disproportionate cost premium that is otherwise incurred by a prescriptive requirement.

Ruling

The proposed alternative compliance path for meeting the mandatory requirement of ASHRAE 90.1-2007/2010 Section 8.4, Voltage Drop Limitation, allowing voltage drop as a regulated parameter within the energy models, is not acceptable; however, a simplified alternative compliance path can be approved. As noted in the Formal Inquiry, code requirements and guidelines allow flexibility in meeting voltage drop guidance in feeders and branches as long as the overall voltage drop from service entrance to the worst-case connection is within limits. For the purposes of this prerequisite, the mandatory provision of ASHRAE 90.1-2007/2010 Section 8.4 will be met as long as the total voltage drop does not exceed 5%. Internationally applicable.

Related Addenda (Corrections & Interpretations)