CP-17-00111

2017 Michigan Energy Code Changes Overview-Commercial

Michigan Energy Code Training and Implementation Program

1.0 Hour Commercial Program Course Number ***CP-17-00111***

NAVIGANT

Consumers Energy
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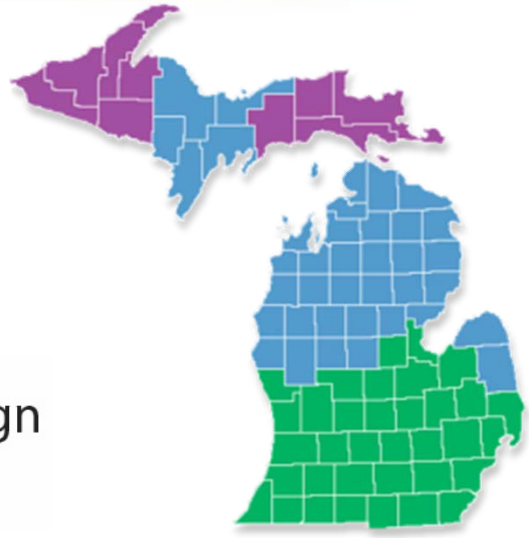

MICHIGAN STATE UNIVERSITY | School of Planning, Design and Construction

Presenters

Michigan Commercial Energy Code Training and Implementation Program:

Tim Mrozowski, A.I.A. LEED® AP

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Instructor # 1540

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Instructor # 1616

Course Number:

CP-17-00111

1 Hour Technical:

- *All Categories*
- *BI, BO, PR, MI, EI, PI*
- *Pending*

Michigan Energy Code-Commercial (1 of 15)

- Michigan updated its Commercial Energy Code and it is effective September 20, 2017
- The Code is now referred to as the “Michigan Energy Code”

Overall Training Project Objectives

To train building officials, inspectors, architects, engineers, contractors, subcontractors, suppliers, and owners in the revised Michigan energy code for the purpose of:

1. Increasing understanding
2. Improving compliance
3. Reducing administrative time
4. Improving customer relationships

Presentation Overview

MICHIGAN STATE UNIVERSITY

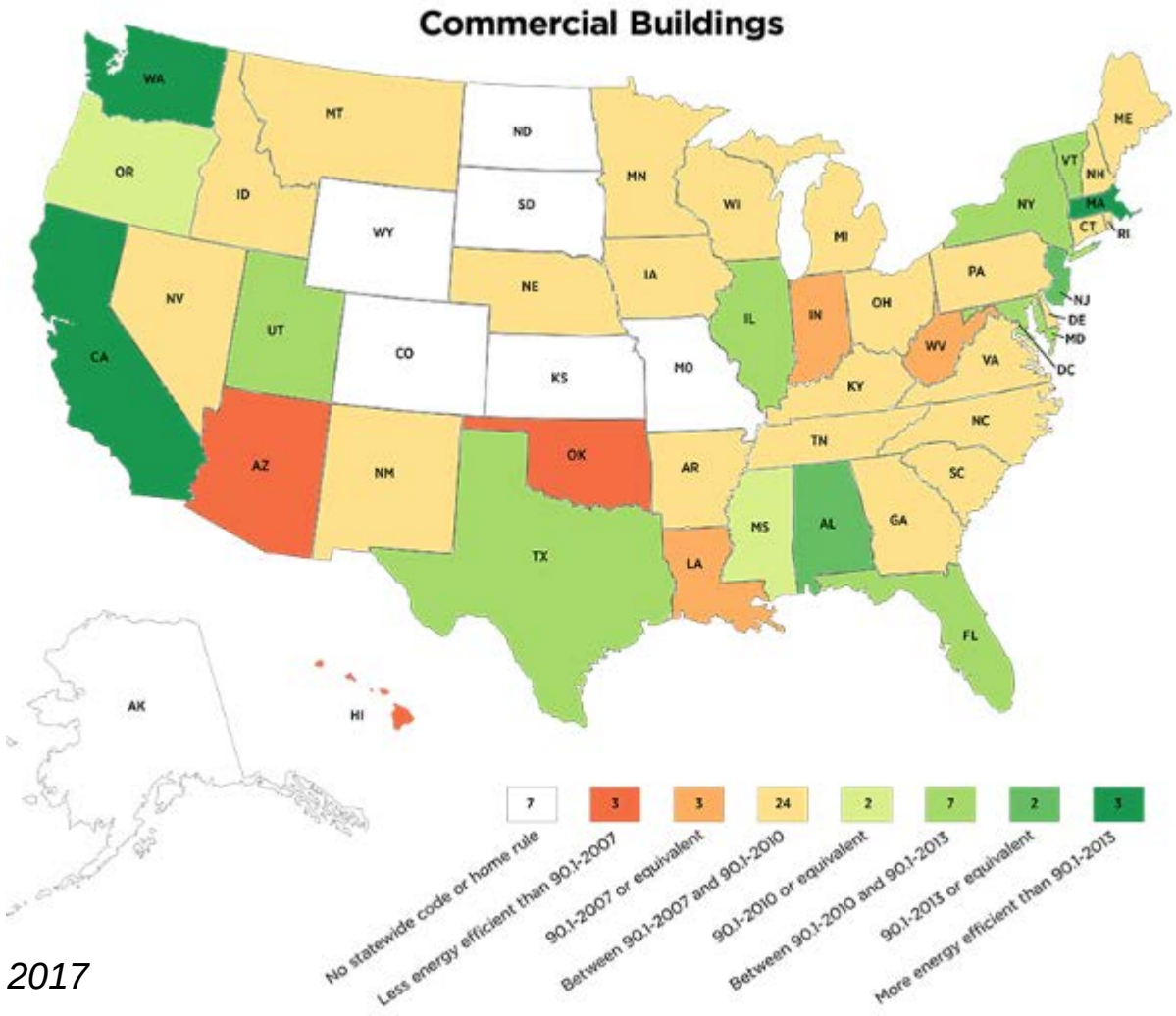
- Background on new code
- Michigan code status
- When does it apply?
- Significant changes
- Other compliance paths
  - COMCheck
  - Above Code Programs
  - Energy Cost Budget Method
  - Whole Building Simulations-Appendix G and LEED V4 Requirements

Disclaimer

This presentation presents an educational overview of the significant changes in the Michigan Energy Code for Commercial Buildings effective September 20, 2017.

While it is believed to be accurate it is not intended to substitute for actual code language. Code language is addressed only generally and is not verbatim, language is paraphrased and not all code sections are addressed in this presentation. Designers, contractors, code officials etc, should always use the actual code in projects.

National Commercial Energy Code Status

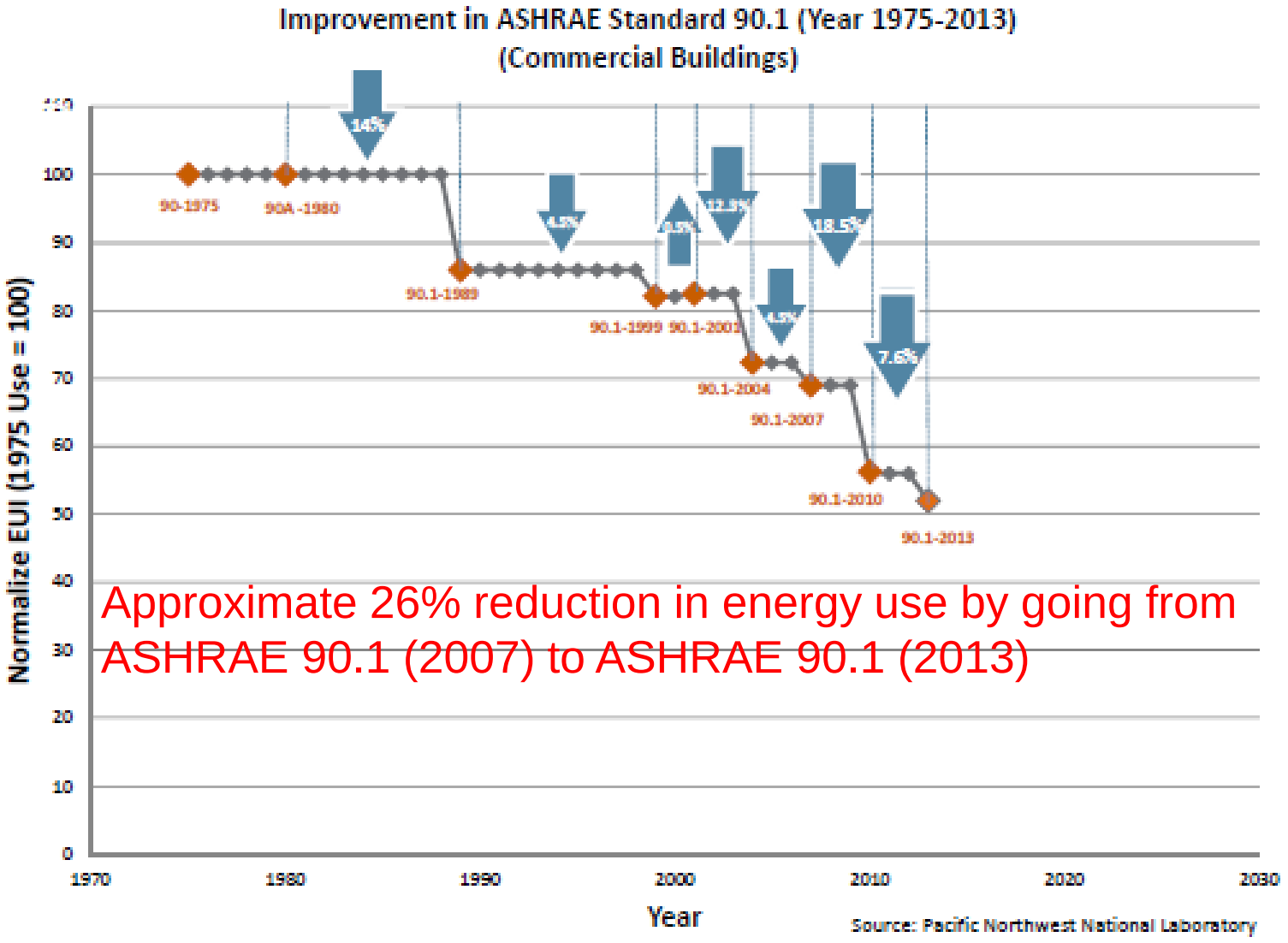


As July 31, 2017

Viewed September 5, 2017

https://www.energycodes.gov/status-state-energy-code-adoption

Impact of Energy Codes



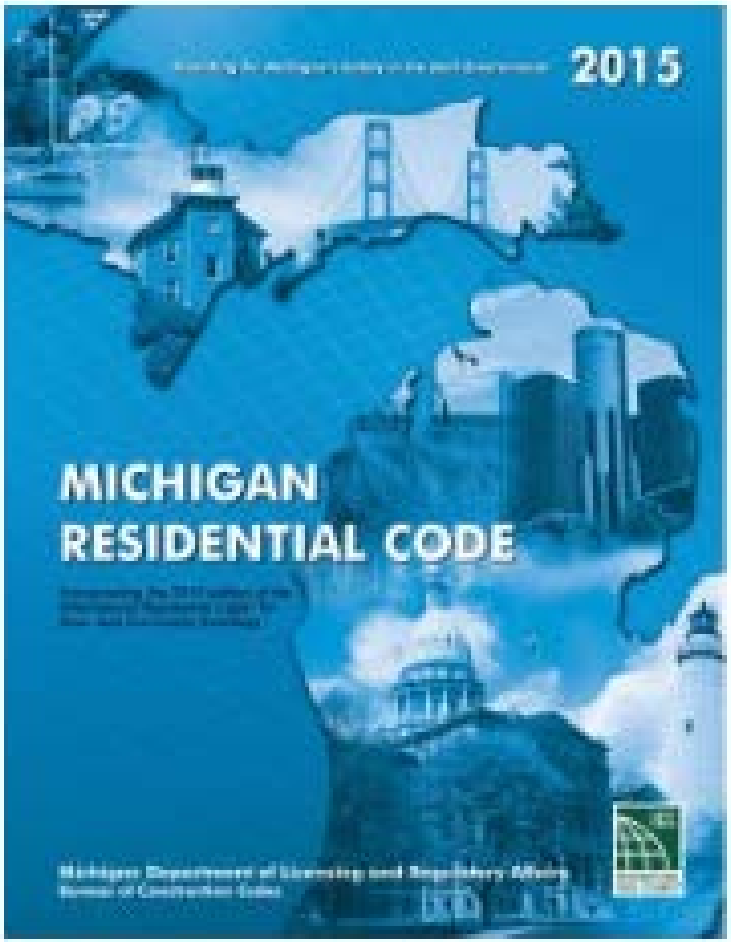
Michigan Residential Energy Code

- Michigan adopted IECC (2015) with Michigan Amendments
- Entitled “Michigan Energy Code”
- Effective Feb 2016

Applies to one and two family dwellings and townhouses

Will be applied to buildings classified as R2, R3, R4 not more than three stories above grade

Note. R1 (Hotels, Motels, Boarding Houses, Congregate Housing more than 10 people) are under Michigan Commercial energy code



Mixed Construction Types - Residential

One story steel + 3-4 stories wood residential over first floor retail with fire separation

Governed under the Michigan commercial energy code

Michigan Energy Code – Commercial (2 of 15)

Three documents are needed in addition to various reference standards

- The modifying Act Language from the Department of Licensing and Regulatory Affairs dated August 1, 2016
- The International Energy Conservation Code 2015 (IECC 2015)
- The ASHRAE 90.1 (2013) (ASHRAE 90.1 (2013) (referred to as the “Standard”)

Michigan Energy Code – Commercial (3 of 15)

Michigan Commercial Energy Code = the Act + portions of IECC 2015 + ASHRAE 90.1 (2013)

DEPARTMENT OF ~~ENERGY, LABOR, AND ECONOMIC GROWTH~~ LICENSING AND REGULATORY AFFAIRS

DIRECTOR'S OFFICE

CONSTRUCTION CODE

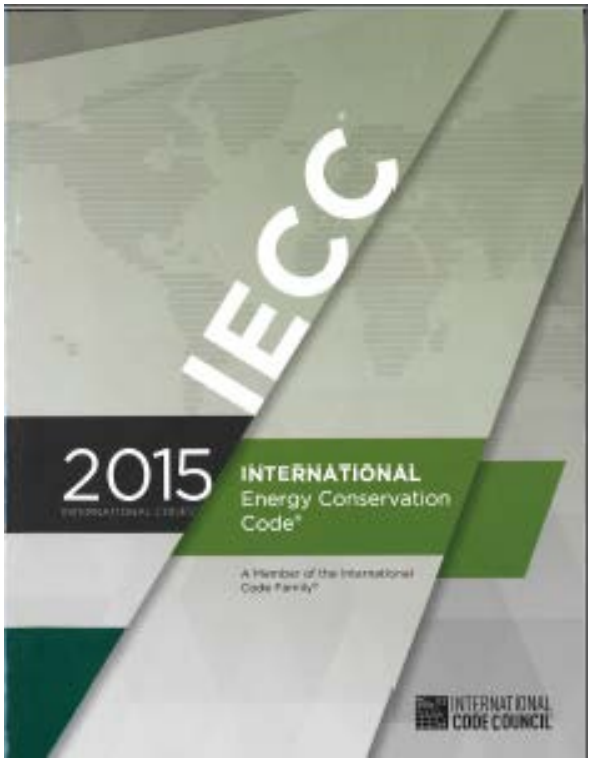
Filed with the Secretary of State
These rules take effect 120 days after filed with the Secretary of State

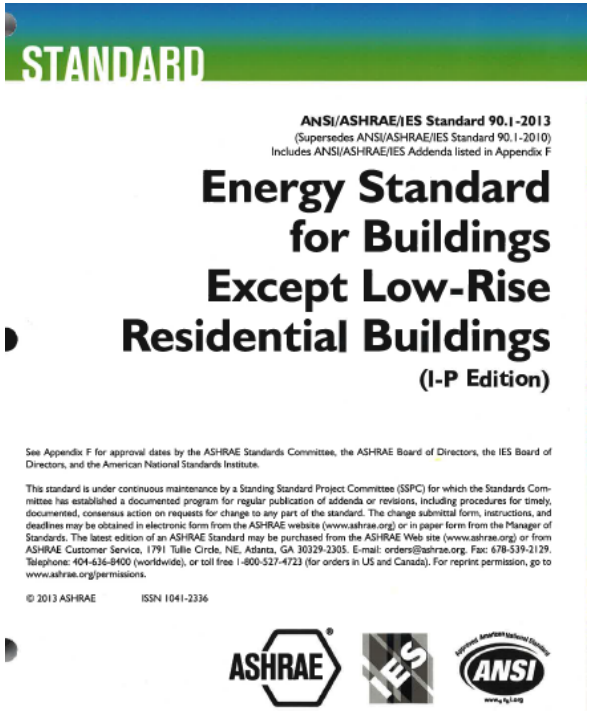
(By authority conferred on the director of the department of ~~energy, labor, and economic growth~~licensing and regulatory affairs by section 4 of 1972 PA 230, MCL 125.1504, and Executive Reorganization Order Nos. 2003-1, ~~and~~ 2008-~~4~~20, and 2011-4, MCL 445.2011, ~~and~~ MCL 445.2025, and MCL 445.2030)

R 408.31087, R 408.31087a, R 408.31088, and R 408.31090 of the Michigan Administrative Code are amended and R 408.31089 is rescinded and R 408.31087b, R 408.31088a, R 408.31091, R 408.31092, R 408.31092a, R 408.31093, R 408.31094, R 408.31095, R 408.31096, R 408.31097, R 408.31098, R 408.31098a, and R 408.31098b are added to the code as follows:

PART 10a
MICHIGAN ~~UNIFORM~~ ENERGY CODE

R ~~408.31087. Applicable~~ code.
~~Rule 1087.~~ Rules governing the energy efficiency for the design and construction of buildings and structures, not including residential buildings, shall be those contained in the international energy conservation code, ~~2009~~2015 edition, ~~section 501.1,~~ except for sections C107.2 to C107.5, C108.2 to C108.4, C301.2, C301.3, C302, C401.2.1 to C408.3.2, C502.2 to C502.2.6.2, C503.2 to C503.6 and the ASHRAE energy standard for buildings except low-rise residential buildings, ANSI/ASHRAE/IESNA standard 90.1-~~2007~~2013 (hereafter the standard), including appendices A, B, C, ~~and~~ D, and G, except for sections 8.4.2, 8.4.3 to 8.4.3.2 . With the amendments noted, ~~Section 501.1,~~ of the international energy conservation code and the standard are adopted in these rules by reference. The Michigan ~~uniform~~ energy code is available for inspection ~~or purchase~~ at the ~~Okemos~~ Lansing office of the
Michigan Department of ~~Energy, Labor and Economic Growth~~Licensing and Regulatory Affairs, Bureau of Construction Codes, ~~2501 Woodlake Circle, Okemos, Michigan 48864~~611 W. Ottawa Street, Lansing, Michigan 48933. The code may be purchased from the International Code Council, through the bureau's website at www.michigan.gov/bcc, at a cost as of the time of adoption of these rules of ~~$38.00~~$44.00 ~~or may be purchased from the International Code Council, 500 New Jersey~~





Michigan Energy Code – Commercial (4 of 15)

Act defines adoptions, ammendments and deletions

DEPARTMENT OF ~~ENERGY, LABOR, AND ECONOMIC GROWTH~~ LICENSING AND REGULATORY AFFAIRS

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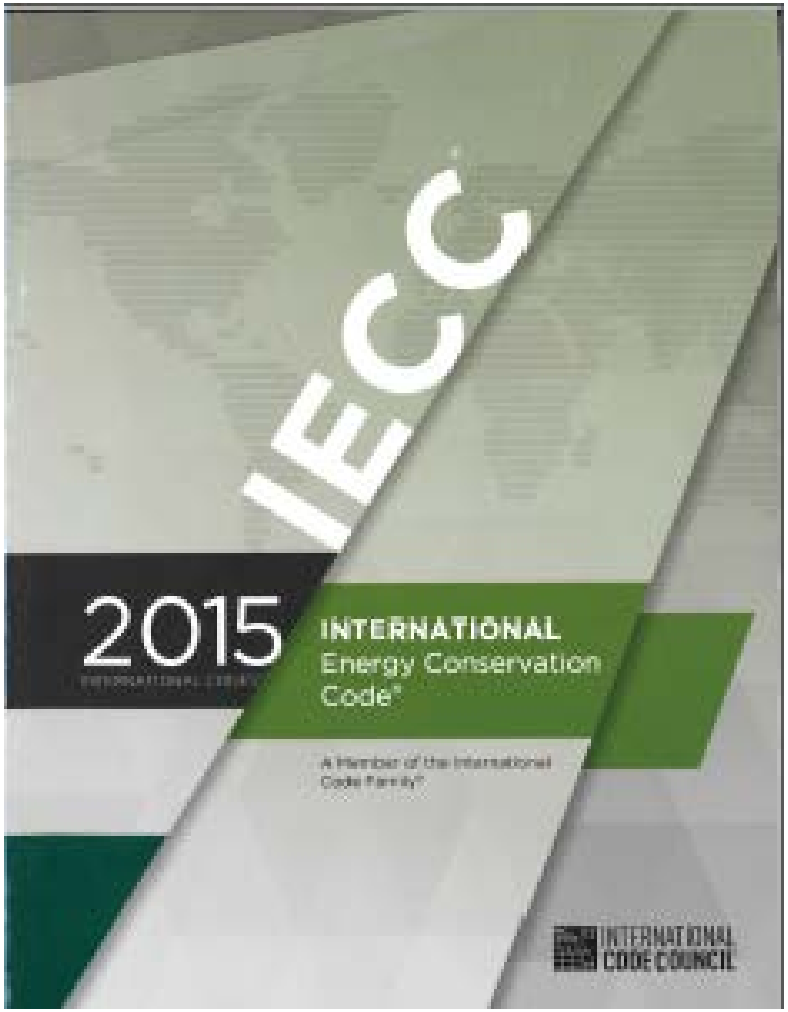
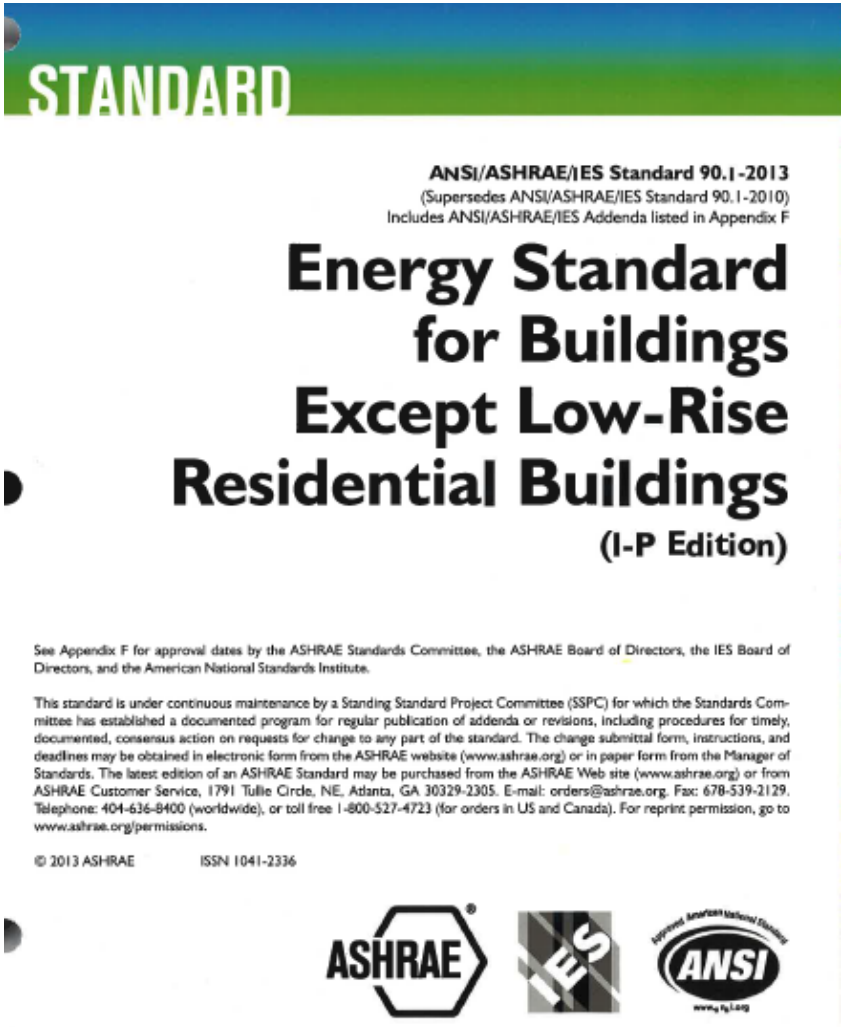
Michigan Energy Code – Commercial (5 of 15)

Scoping requirements in referenced sections of IECC 2015



Michigan Energy Code – Commercial (6 of 15)

Technical provisions In ASHRAE 90.1 (2013)



STANDARD

ANSI/ASHRAE/IES Standard 90.1-2013
(Supersedes ANSI/ASHRAE/IES Standard 90.1-2010)
Includes ANSI/ASHRAE/IES Addenda listed in Appendix F

Energy Standard for Buildings Except Low-Rise Residential Buildings

(I-P Edition)

See Appendix F for approval dates by the ASHRAE Standards Committee, the ASHRAE Board of Directors, the IES Board of Directors, and the American National Standards Institute.

This standard is under continuous maintenance 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. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE website (www.ashrae.org) or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE Web site (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 678-539-2129. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

 ISSN 1041-2336

ASHRAE IES ANSI

Michigan Energy Code – Commercial (7 of 15)

The Act either directly or indirectly lays out:

- The portions of IECC 2015 and ASHRAE 90.1 which are used or not used and any deletions and changes

  - Direct= explicit statement that something is included or not included
  - Indirect = when you must navigate to a section and view any amendments or deletions to learn if something is included or excluded.

Act Language

The international energy conservation code, ~~2009~~**2015** edition, ~~section 501.1,~~ **except for sections C107.2 to C107.5, C108.2 to C108.4, C301.2, C301.3, C302, C401.2.1 to C408.3.2, C502.2 to C502.2.6.2, C503.2 to C503.6**

and the ASHRAE energy standard for buildings except low-rise residential buildings, ANSI/ASHRAE/IESNA standard 90.1-~~2007~~**2013** (hereafter the standard), including appendices A, B, C, ~~and~~ D**, and G, except for sections 8.4.2, 8.4.3 to 8.4.3.2** . With the amendments noted, ~~Section 501.1, of~~ the international energy conservation code and the standard are adopted in these rules by reference.

Michigan Energy Code – Commercial (8 of 15)

Navigating the changes:

- Map and mark in your books the applicable sections, deletions, amendments and changes referenced in the Act language to sections in:
  - IECC 2015
  - ASHRAE 90.1 (2013)

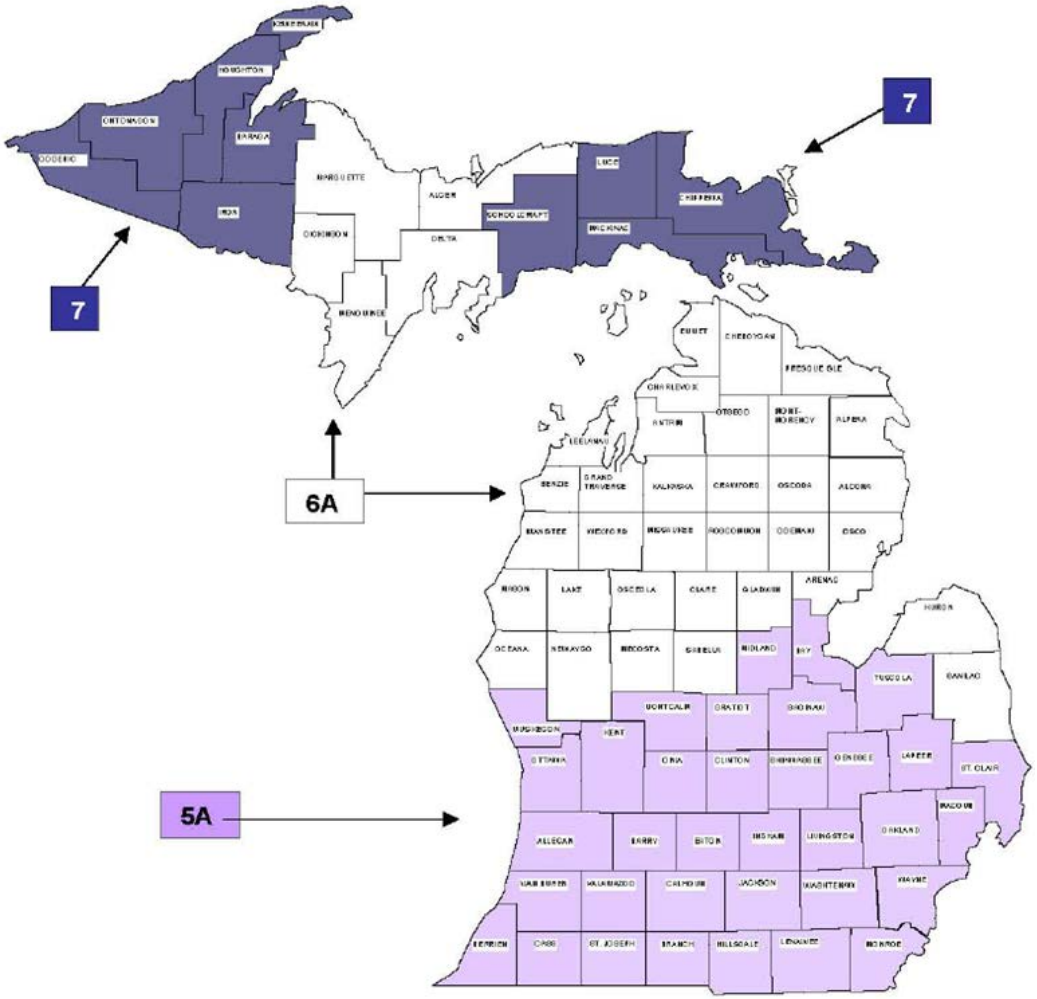
Michigan Energy Code – Commercial (9 of 15)

IECC 2015 Layout:

Commercial Provisions-prefaced by “C” Residential Provisions prefaced by “R” (Not applicable to the commercial energy code)

Michigan Climate Zones

Map remains the same



Michigan Uniform Energy Code

Michigan Energy Code – Commercial (10 of 15)

CHAPTER 3 (CE) GENERAL REQUIREMENTS:

C303.1.3 Fenestration Product Rating-(amended by Mich. Act to allow for computer simulations to be used to determine product U factors and indicates conditions when default U factor, SHGC and VT should be used.

Fenestration product rating. U-factors or fenestration products (windows, doors, and skylights) shall be determined in accordance with NFRC 100 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking a labeled U-factor shall be assigned a default U-factor from Table C303.1.3(1) or C303.1.3(2).

Exception:

1. Computer simulations by independent NFRC certified laboratories or approval under the Stille-Derossett-Hale Single State Construction Code Act, 1972 PA 230, MCL 125.1501 to 125.1531, is considered in compliance with this section.
2. Where required, garage door U-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105. U-factors shall be determined by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking a labeled U-factor shall be assigned a default U-factor from Table C303.1.3(1) or C303.1.3(2). The solar heat gain coefficient (SHGC) and visible transmittance (VT) of glazed fenestration products (windows, glazed doors, and skylights) shall be determined in accordance with NFRC 200 by an accredited, independent laboratory, and labeled and certified by the manufacturer. Products lacking such a labeled SHGC or VT shall be assigned a default SHGC or VT from table C303.1.3(3).

Michigan Energy Code – Commercial (11 of 15)

CHAPTER 5 (CE) EXISTING BUILDINGS

SECTION 5.1.3 (MAY BE TYPO- SHOULD READ 503.1 *(Important amendment by Mich. Act addressing alterations that need not comply with ASHRAE 90.1 (2013) it identifies the following conditions.*

Exceptions:

1. **Installation of storm windows or glazing panels over existing glazing, provided the storm window or glazing panel contains a low-emissivity coating. However, a low-emissivity coating is not required where the existing glazing already has a low-emissivity coating. Installation may be either on the inside or outside of the existing glazing.**
2. **Replacement of glazing in existing sash and frame, provided the U-factor and SHGC will be equal to or lower than before the glass replacement.**

Michigan Energy Code – Commercial (12 of 15)

Exceptions (Continued)

3. **Alterations to roof or ceiling, wall, or floor cavities that are insulated to full depth with insulation having a minimum nominal value of R-3.0/in.**
4. **Alterations to walls and floors, where the existing structure is without framing cavities and no new framing cavities are created.**

See next slide for exceptions 5-7

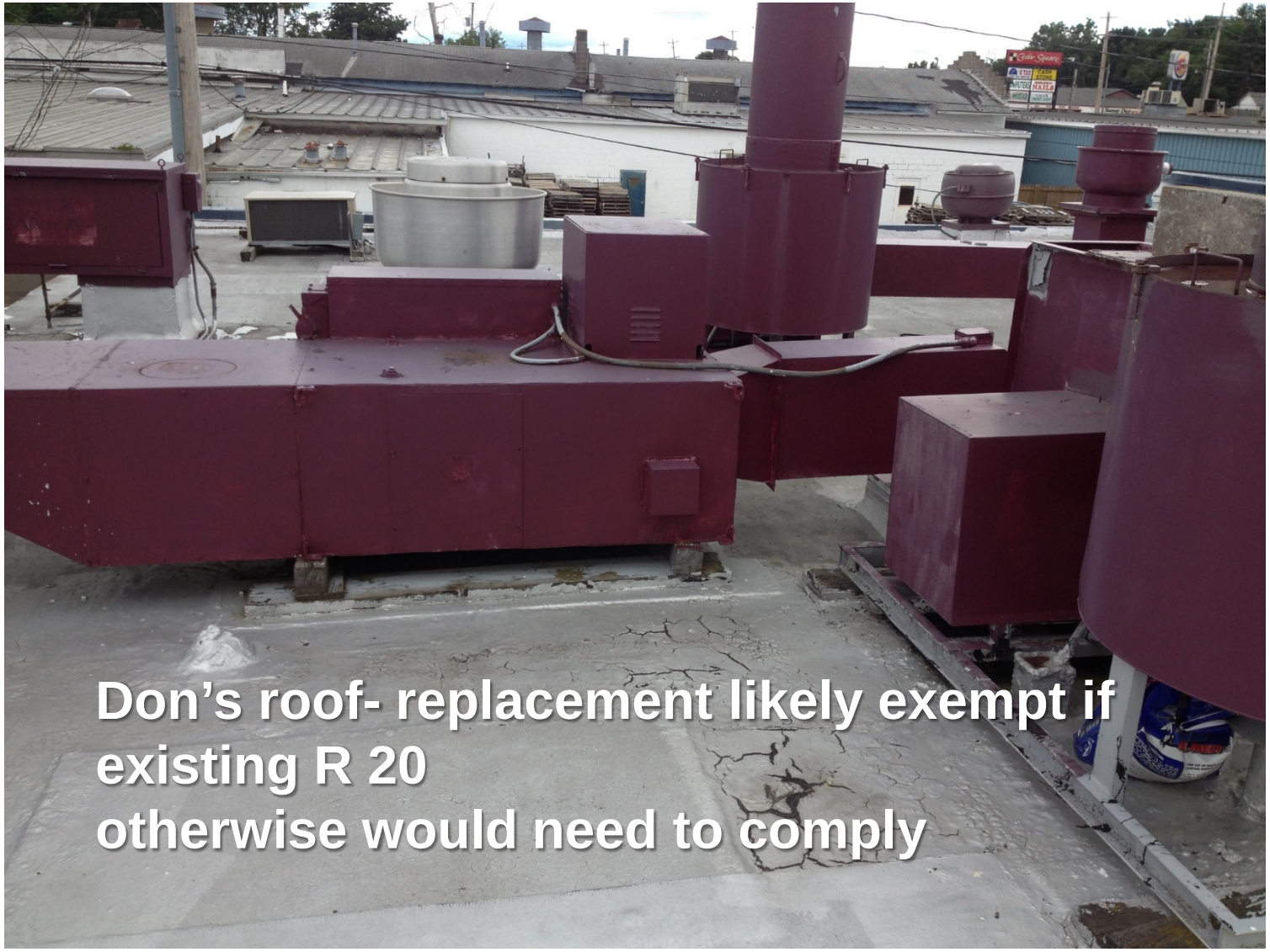
8. **Replacement of existing fenestration, provided that the area of the replacement fenestration does not exceed 25% of the total fenestration area of an existing building and that the U-factor and SHGC, will be equal to or lower than before the fenestration replacement.**

Michigan Energy Code – Commercial (13 of 15)

Exceptions (Continued)

5. Roof recovering.
6. Removal and replacement of a roof membrane where there is existing roof insulation integral to or below the roof deck.
7. Removal and replacement of a roof membrane where the insulation is installed entirely above the roof deck, a minimum of R-20 insulation shall be permitted where the placement of additional insulation greater than R-20 insulation would require either of the following:
   a. Raising the height of parapets, weep systems, or through wall flashings where roof abuts adjoining walls or parapets.
   b. Raising the height of mechanical or electrical equipment, mechanical curbs, roof hatches, skylight curbs, service equipment, piping, conduit, duct work, roof platforms, ladders, stairs, guard rails, expansion joints, roof davits, or door thresholds.

Don’s Roof


Don’s roof- replacement likely exempt if existing R 20
otherwise would need to comply

Michigan Energy Code – Commercial (14 of 15)

C503.2-Change space conditioning *(not adopted by Mich. Act)*

C502.2-502.2.6.2 *(not adopted by Mich. Act)*

C503.2-Change space conditioning *(not adopted by Mich. Act)*

C503.3-Building Envelope *(not adopted by Mich. Act)*

C503.4 Heating and cooling systems *(not adopted by Mich. Act)*

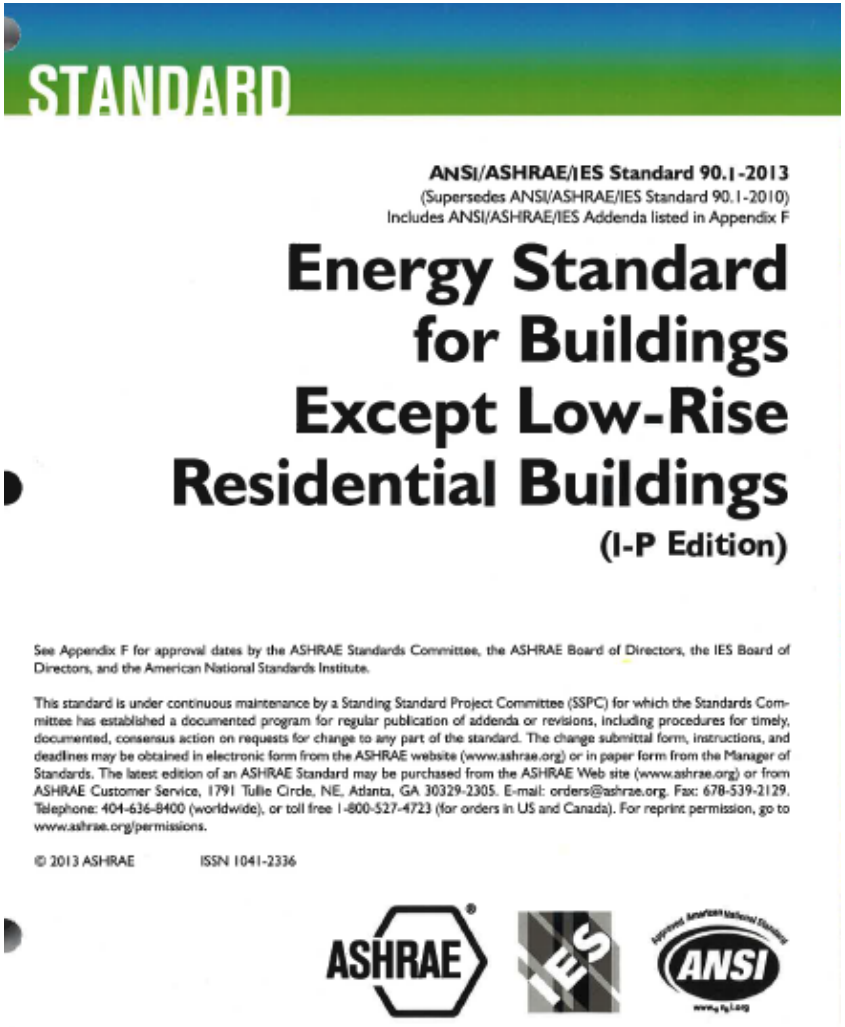
C503.5-Service hot water systems *(not adopted by Mich. Act)*

C503.6 Lighting Systems *(not adopted by Mich. Act)*

***These sections were not adopted because ASHRAE 90.1 (2013) was adopted to cover the technical provisions**

Michigan Energy Code – Commercial (15 of 15)

Technical provisions In ASHRAE 90.1 (2013)



ASHRAE 90.1 (2013) MICHIGAN AMENDMENTS

ASHRAE 90.1 (2013) MICHIGAN AMENDMENTS (MARK YOU BOOKS) *Three Items are amended by Michigan*

Key word is “Standard” in the Michigan Act.

- **Section 5.4.3.4 Vestibules (Mich. Act amends exceptions for when a vestibule is not required**
- **Section 6.7.2.4 System Commissioning (Mich. Act amends system commissioning for HVAC controls for projects over 10,000 SF rather than the SF 50,000 indicated in ASHRAE 90.1 (2013).**
- **Section 9.1.2 Lighting Alterations (Mich. Act amends the exception for when lighting needs to comply with the code during alterations to 50% of connected load rather than the 10% indicated in ASHRAE 90.1 (2013).**

ASHRAE 90.1 (2013) for use in Michigan

Bird's Eye View of changes from ASHRAE 90.1 (2013) from ASHRAE 90.1 (2007)

ASHRAE 90.1 (2013) Significant Changes

What makes it hard to compare:

No summary document was found to date that lays out the detailed changes from ASHRAE 90.1 (2007) to ASHRAE 90.1 (2013)

There are no sidebar markings in ASHRAE 90.1 (2013) to indicate changes from 2010 or 2007.

Appendix F does list changes from ASHRAE 90.1 (2010), but ASHRAE 90.1 (2010) was not adopted by Michigan

ASHRAE 90.1 (2013) Structure

Layout of ASHRAE 90.1 (2013) is the same as ASHRAE 90.1 (2007)

Section 1 - Purpose
Section 2 - Scope
Section 3 - Definitions, Abbreviations, and Acronyms
Section 4 - Administration and Enforcement
Section 5 - Building Envelope
Section 6 - Heating, Ventilating, and Air Conditioning
Section 7 - Service Water Heating
Section 8 - Power
Section 9 - Lighting
Section 10 - Other Equipment
Section 11 - Energy Cost Budget Method
Section 12 - Normative References

A. Rated R-Value of Insulation and Assembly U-Factor, C-Factor, and F-Factor Determinations
B. Building Envelope Climate Criteria
C. Methodology for Building Envelope Trade-Off Option in Subsection 5.6
D. Climatic Data
E. Informative References –not adopted by Michigan
F. Addenda Description Information not adopted by Michigan
G. Performance Rating Method

ASHRAE 90.1 Chapter 2 Definitions

*"It depends upon **what the meaning** of the word 'is' is."*

- There are significant changes to the definitions in ASHRAE 90.1 (2013) from ASHRAE 90.1 (2007)
- Page count for definitions in this section went from 10 in ASHRAE 90.1 (2007) to 18 in ASHRAE 90.1 2013)
- Approximately 100 new or modified definitions
- Some are highly technical and reflect new code provisions such as daylighting, sensible heat and cooling panels, computer rooms and various controls.

ASHRAE 90.1 Chapter 5 - Envelope

Significant Changes include:

- *Alterations exceptions*

Mandatory Provisions -5.4

- *Air Leakage Limitations*
- *Requirements for Air Barriers*
- *Vestibule Language*

Prescriptive Path-changes -5.5

- *Maximum and Minimum Skylight Areas*
- *Maximum Fenestration areas*
- *Fenestration Orientation*
- *All updated R values and U factors throughout*

Submittal Requirements -5.8

Daylight and VLT on plans in some cases

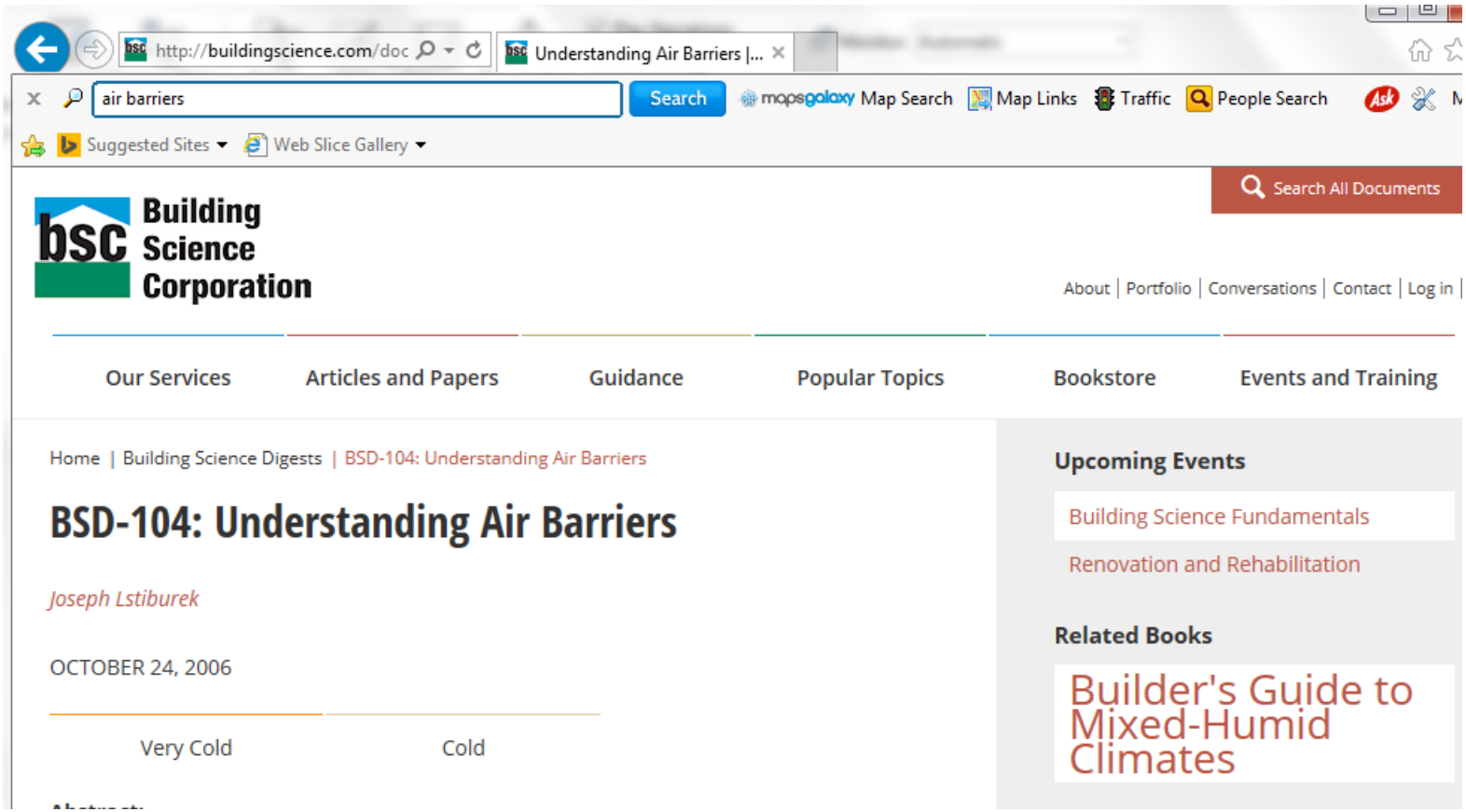
Section 5 – 5.4.3.1.3 Air Barrier Materials

Material	Thickness (minimum)
Plywood	3/8 in.
Oriented strand board	3/8 in.
Extruded polystyrene insulation board	½ in.
Foil-faced urethane insulation board	½ in.
Exterior gypsum sheathing or interior gypsum board	½ in.
Cement board	½ in.
Built up roofing membrane	
Modified bituminous roof membrane	
Fully adhered single-ply roof membrane	
A Portland cement/sand parge, stucco, or gypsum plaster	½ in.
Cast-in-place and precast concrete	
Sheet metal	
Closed cell 2 lb/ft^3 nominal density spray polyurethane foam	1 in.

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 ENVELOPE - VISITED SEPT. 5, 2017

Thermal Envelope- Changes

Air Barriers – good information sources Building Science Corp



http://buildingscience.com/documents/digests/bsd-104-understanding-air-barriers *visited Jan 21, 2016*

ASHRAE 90.1 (2013) Significant Changes – Section 5 (1 of 3)

Section 5- Building Envelope

Mandatory Provisions (Section 5.4)

5.3.4. Vestibules - requires vestibules for building entrances, sets maximum size for vestibules at 50sf or 2% of gross conditioned floor area for level served. Michigan has amended the exceptions in this section.

5.4.3.1 addresses vestibules for large spaces greater than 40,000 sf when equipped with automatic doors and requires they have a minimum 16 ft between doors.

Section 5 Air Leakage – Vestibules Exceptions

Exceptions:

- *1. Doors not intended to be used by the public, such as doors to storage, mechanical, electrical, or equipment rooms.*
- *2. Doors opening directly from a sleeping unit or dwelling unit.*
- *3. Doors that open directly from a space less than 3,000 feet^2 (298 m^2) in area.*
- *4. Revolving doors.*
- *5. Doors used primarily to facilitate shipping, receiving, or material handling.*
- *6. Doors with no exterior entrance hardware.*
- *7. Doors leading solely to outdoor dining space*

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 ENVELOPE - VISITED SEPT. 5, 2017

Building Envelope Requirements (Table 5.5-5)

Climate Zone 5

- Nonresidential Examples See Tables for Zones 5,6,7
  - Roofs: insulation entirely above deck = R-30 (R-20.0 c.i.)
  - Roofs: Attic and other = R-49 (R-38.0)
  - Above-Grade Walls: mass = R-11.4 c.i. (R-11.4 c.i.)
  - Above-Grade Walls: steel-framed = R-13+R-10 c.i. (R-13.0 + R-7.5 c.i.)
  - Above-Grade Walls: wood-framed = R-13+ R-7.5 c.i. or R-19 + R-5 c.i. (R-13.0 + R-3.8 c.i)
  - Below-Grade Walls: below-grade wall = R- 7.5 c.i. (R-7.5 c.i.)
  - Floors: mass = R-14.6 c.i. (R-10.4 c.i.)
  - Floors: steel joist = R-30 (R-30.0)
  - Slab-On-Grade Floors: heated = R-20 for 48: (R-15 for 24 in.)
  - Doors: nonswinging = U-0.500 (U-0.500)

Presenter's note: ( ) = 2007 ASHRAE 90.1 values

Section 5 – 5.5.4.3 and 5.8.2.3 Fenestration U-Factor

U-factor not greater than specified in Tables 5.5-1 through 5.5-8

- For climate zone 5
  - U-0.32 for non-metal framing (U=0.35 in 2007)
  - U-0.42 for fixed metal framing (U=0.45 in 2007)
  - U-0.50 for operable metal framing (U=0.55 in 2007)
  - U-0.77 for entrance door metal framing
    (U=0.7 swinging and 0.5 non-swinging in 2007)
  - U-0.50 for Skylights (Varies with application in 2007)

Labeled and certified by manufacturer

Exceptions

- A8.1 acceptable for skylights, A8.2 acceptable for other vertical fenestration, and A7 acceptable for opaque doors
- ANSI/DASMA 105 acceptable for garage doors

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 ENVELOPE - VISITED SEPT. 5, 2017

Using the Evaluation Checklists
Fenestration

National Fenestration Rating Council®
CERTIFIED

World's Best Window Co.

Millennium 2000+
Vinyl-Clad Wood Frame
Double Glazing • Argon Fill • Low E
Product Type: **Vertical Slider**

ENERGY PERFORMANCE RATINGS

U-Factor (U.S./I-P)	Solar Heat Gain Coefficient
0.30	**0.30**

ADDITIONAL PERFORMANCE RATINGS

Visible Transmittance	Air Leakage (U.S./I-P)
0.51	**0.2**

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.
www.nfrc.org

FR8 [5.8.2.1][2]	Fenestration products rated in accordance with NFRC.

ASHRAE 90.1 (2013) Significant Changes – Section 5 (2 of 3)

Section 5- Building Envelope

Prescriptive Building Envelope Option (Section 5.5)

5.5.4.2 Fenestration Areas

5.5.4.2.2-Maximum Skylight Fenestration Area sets (0-3%) maximum skylight areas from Tables 5.5-1 to 5.5-8 and provides an exception for 6% of gross roof area for certain daylight areas

5.5.4.2.3-Minimum Skylight Fenestration Area -establishes minimum skylight for certain functional spaces greater than 2,500 sf and meeting various roof/ceiling conditions. This section also provides exceptions.

ASHRAE 90.1 (2013) Significant Changes – Section 5 (3 of 3)

Section 5- Building Envelope

Prescriptive Building Envelope Option (Section 5.5)

5.5.4.4 Fenestration Solar Heat Gain Coefficient (SHGC)- sets the SHGC requirements as meeting Tables 5.5-1 to 5.5-8 and identifies exceptions

5.5.4.5 Fenestration Orientation- puts limitations on how much fenestration can be located on the West or East facades through calculations based on total wall area and West and East wall areas.

5.5.4.6 Visible Light Transmission-new section sets VT/SHGC per Tables 5.5-1 to 5.5-8 when using automatic daylight controls in accordance with 9.4.1.1(e)

Section 5 – 5.5.4.5 - Fenestration Orientation

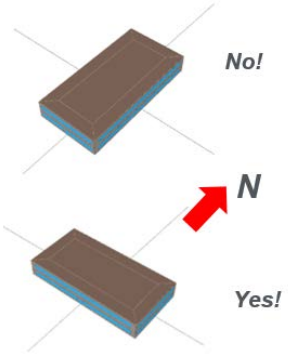
Two options to comply:

$$a)\ A_w \leq \frac{A_t}{4} \text{ and } A_e \leq \frac{A_t}{4}$$

$$b)\ A_w \times SHGC_w \leq \frac{A_t \times SHGC_c}{4} \text{ and } A_e \times SHGC_e \leq \frac{A_t \times SHGC_c}{4}$$

Where,

A_w and $SHGC_w$ = west-oriented vertical fenestration area and SHGC
A_e and $SHGC_e$ = east-oriented vertical fenestration area and SHGC
A_t = total vertical fenestration area
$SHGC_c$ = SHGC criteria in Tables 5.5-1 through 5.5-8



Exceptions

- *Complies with Exception 3 of Section 5.5.4.4.1*
- *Buildings shaded by other buildings within 20 ft to the south which is at least ½ as tall as the proposed building*
- *Buildings with shade on 75% of the west and east*
- *Alterations and additions that don't increase vertical fenestration area*
- *Buildings where west- and east-oriented vertical fenestration area < 20% of gross wall area for each of those facades and SHGC on those facades < 90% of $SHGC_c$*
- *In climate zone 8*

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 ENVELOPE - VISITED SEPT. 5, 2017

Section 5 – 5.5.4 Fenestration

Criteria apply to fenestration, including windows, glass doors, glass block, plastic panels, and skylights

- specified by fenestration type, space conditioning category and by climate zone

Compliance with values in Tables 5.5-1 through 5.5-8

- U-factor not greater than specified
- SHGC not greater than specified
- *Meet or exceed minimum VT/SHGC*
- Use NFRC ratings or default values in Appendix A
- Area weighting allowed within same class of construction and space conditioning category

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 ENVELOPE - VISITED SEPT. 5, 2017

Section 5 – 5.5.4.2.3 Minimum Skylight Area

Minimum skylight area must be provided in enclosed spaces that are

- ≥ *2,500* ft^2
- In spaces with ceiling height > 15 ft and
- Space types

- Office
- Lobby
- Atrium
- Concourse
- Corridor
- Storage *(incl. nonrefrigerated warehouse)*
- Gymnasium*/fitness/exercise*
- *Area, playing area*
- Gymnasium seating
- Convention exhibit/event space
- Courtroom
- Automotive space
- Fire state engine room
- Manufacturing
- *Corridor/transition and bay areas*
- Retail
- *Library reading and stack areas*
- Distribution/sorting area
- Transportation
- *Baggage and seating areas*
- Workshop

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 ENVELOPE - VISITED SEPT. 5, 2017

ASHRAE 90.1 Chapter 6 – HVAC (1 of 9)

Significant Changes Chapter 6

Numerous detailed changes to many sections

ASHRAE 90.1 Chapter 6 – HVAC (2 of 9)

Significant Changes-Simplified approach for smaller buildings changed requirements for:

- **Single zone VAV controls**
- **Piping insulations**
- **Demand control ventilation**
- **Door switch requirements**

Section 6 – 6.3 Simplified Approach Option

The simplified approach is an optional path for compliance when the following are met:

- Buildings with 1 or 2 stories
- Buildings with gross floor area < 25,000 ft^2
- System serving single HVAC zone
- Unitary packaged or split air conditioners (air-cooled or evaporatively cooled)

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 HVAC - VISITED SEPT. 5, 2017

ASHRAE 90.1 Chapter 6 – HVAC (3 of 9)

Significant Changes-Mandatory Provisions 6.4

New requirements for:

- **Computer rooms**
- **Commercial refrigerators and freezers**
- **Commercial refrigeration**
- **Parking garages**
- **Sensible heating systems**
- **New equipment types**
- **Controls requirements**

ASHRAE 90.1 Chapter 6 – HVAC (4 of 9)

Significant Changes-Mandatory Provisions
6.4 New requirements for:

Minimum Equipment efficiencies 6.4.1.1

- **Load Calculations 6.4.2.1**
- **Pump Head –new section 6.4.2.2**
- **Set back controls-modification 6.4.3.2**
- **Optimum Start Controls 6.4.3.3.3**
- **Humidification and dehumidification modifications 6.4.3.6**
- **Heating in Vestibules-new section 6.4.3.9**
- **Direct Digital Control (DDC) – new section 6.4.3.10**

ASHRAE 90.1 Chapter 6 – HVAC (5 of 9)

Significant Changes-Mandatory Provisions 6.4
New requirements for:

- **Demand Control Ventilation -6.4.3.8**
- **Shutoff Damper Controls**
- **Damper Leakage 6.4.3.4.3**
- **Enclosed parking garage ventilation-new section 6.4.3.4.5**

ASHRAE 90.1 Chapter 6 – HVAC (6 of 9)

Significant Changes-Mandatory Provisions 6.4
New requirements for

- **Ventilation controls for high occupancy spaces 6.4.3.8**
- **Heating in Vestibules-new section automatic shutoff controls 6.4.3.9**
- **Direct Digital Control (DDC)-new section 6.4.3.10**
- **Piping Insulation-changes 6.4.4.1.3**

ASHRAE 90.1 Chapter 6 – HVAC (7 of 9)

Significant Changes-Mandatory Provisions 6.4

New requirements for

- **Sensible Heating Panels –new section 6.4.4.1.4**
- **Radiant Floor Heating Insulation –new section 6.4.4.1.5**
- **Duct Sealing- 6.4.4.2**
- **Walk-in coolers and freezers-new section 6.4.5**
- **6.4.6 Refrigerated Display Cases-new section 6.4.6**

ASHRAE 90.1 Chapter 6 – HVAC (8 of 9)

Numerous Changes-Prescriptive Requirements 6.5

- **Economizers 6.5.1**
- **Simultaneous heating and cooling 6.5.2**
- **Fan controls 6.5.3**
- **Hydronic systems 6.5.4**
- **Heat Recovery 6.5.6**
- **Exhaust Systems 6.5.7**
- **Door Switches-new section 6.5.10**
- **Condensers serving refrigeration systems 6.5.11**

ASHRAE 90.1 Chapter 6 – HVAC (9 of 9)

Changes-

Alternate Compliance Path-computer rooms 6.6

ASHRAE 90.1 Chapter 7 Service Water Heating

Significant Changes Include:

Performance Requirements for equipment Table 7.8

Piping Insulation thickness-7.4 Virtually all piping insulation thickness have changed

New requirements for buildings with high heat capacity service water systems 7.5.3

ASHRAE 90.1 Chapter 8 Power

Changes include:

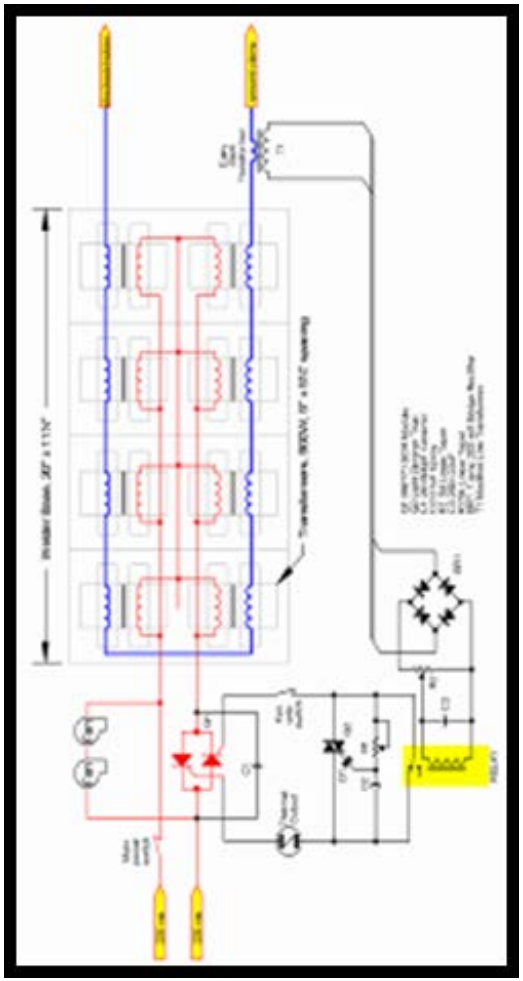
Mandatory Provisions (Section 8.4)

New section on low voltage dry-type distribution transformers 8.4.4

Voltage drop- change to exceptions for "feeder conductors and circuits for to emergency services 8.4.1

Michigan Deleted the following sections

- **8.4.2 Automatic receptacle control**
- **8.4.3 Electrical Energy Monitoring**
- **8.4.3.1 Monitoring**
  - **8.4.3.2 Recording and Record Keeping**



ASHRAE 90.1 Chapter 9 – Lighting (1 of 2)

Significant Changes include:

Mandatory Provisions-6.4 changes

- **Controls, controls and controls**
- **Parking Garages-LPD Densities and controls**
- **Functional Testing 9.4.3**

ASHRAE 90.1 Chapter 9 – Lighting (2 of 2)

Significant Changes include:

Mandatory Provisions-6.4 changes

Lighting Power Densities 9.6

- **Allowable lighting power densities have changed-lower**
- **Exterior lighting power densities and controls**
- **“Exterior lighting Zones”-new concept**

Submittal Requirements 9.7

Section 9 – Table 9.5.1 Building Types

Part of Table 9.5.1 shown below.

Complete table in the Standard has 32 different building types

Building Type	Lighting Power Density (W/ft^2)
Automotive Facility	*0.80*
Convention Center	*1.01*
Court House	*1.01*
Dining: Bar Lounge/Leisure	*1.01*
Dining: Cafeteria/Fast Food	*1.01*
Dining: Family	*1.01*
Dormitory	*0.57*
Exercise Center	*0.84*

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 Power and Lighting - VISITED SEPT. 5, 2017

Section 9 – Table 9.6.1 Space-by-Space Allowances

Small part of Table 9.6.1 shown below
Approximately 100 different space types included in the Standard

TABLE 9.6.1 Lighting Power Density Allowances Using the Space-by-Space Method and Minimum Control Requirements Using Either Method

Informative Note: This table is divided into two sections; this first section covers space types that can be commonly found in multiple building types. The second part of this table covers space types that are typically found in a single building type.

The control functions below shall be implemented in accordance with the descriptions found in the referenced paragraphs within Section 9.4.1.1. For each space type:
(1) All REQs shall be implemented.
(2) At least one ADD1 (when present) shall be implemented.
(3) At least one ADD2 (when present) shall be implemented.

Common Space Types[1]	LPD, W/ft²	RCR Threshold	a Local Control (See Section 9.4.1.1[a])	b Restricted to Manual ON (See Section 9.4.1.1[b])	c Restricted to Partial Automatic ON (See Section 9.4.1.1[c])	d Bilevel Lighting Control (See Section 9.4.1.1[d])	e Automatic Daylight Responsive Controls for Sidelighting (See Section 9.4.1.1[e])	f Automatic Daylight Responsive Controls for Toplighting (See Section 9.4.1.1[f])	g Automatic Partial OFF (See Section 9.4.1.1[g] [Full Off complies])	h Automatic Full OFF (See Section 9.4.1.1[h])	i Scheduled Shutoff (See Section 9.4.1.1[i])
Atrium											
... that is <20 ft in height	0.03/ft total height	NA	REQ	ADD1	ADD1	—	REQ	REQ	—	ADD2	ADD2
... that is ≥20 ft and ≤40 ft in height	0.03/ft total height	NA	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2
... that is >40 ft in height	0.40 + 0.02/ft total height	NA	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2
Audience Seating Area											
... in an auditorium	0.63	6	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2
... in a convention center	0.82	4	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 Power and Lighting - VISITED SEPT. 5, 2017

ASHRAE 90.1 (2013) Significant Changes – Section 9 (1 of 3)

Section 9 – Lighting

Simplified Building (Section 9.3) –not used

Mandatory Provisions (Section 9.4)

- 9.4.1 Lighting Controls
- 9.4.1.1 Interior Lighting Controls-this new section requires a number of lighting controls as indicated in Table 9.6.1.

–see next slide for continuation

Section 9.4.1.1 Interior Lighting Controls

For each space type, apply the lighting control functions listed.

- If using the Space-by-Space method for LPD requirements, use same space type for control requirements. For space types not listed, use a reasonable equivalent
- “REQ” = mandatory
- “ADD1” = at least one of these must be implemented
- “ADD2” = at least one of these must be implemented

TABLE 9.6.1 Lighting Power Density Allowances Using the Space-by-Space Method and Minimum Control Requirements Using Either Method

Informative Note: This table is divided into two sections; this first section covers space types that can be commonly found in multiple building types. The second part of this table covers space types that are typically found in a single building type.

The control functions below shall be implemented in accordance with the descriptions found in the referenced paragraphs within Section 9.4.1.1. For each space type:
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Common Space Types[1]	LPD, W/ft²	RCR Threshold	a Local Control (See Section 9.4.1.1[a])	b Restricted to Manual ON (See Section 9.4.1.1[b])	c Restricted to Partial Automatic ON (See Section 9.4.1.1[c])	d Bilevel Lighting Control (See Section 9.4.1.1[d])	e Automatic Daylight Responsive Controls for Sidelighting (See Section [illegible])	f Automatic Daylight Responsive Controls for Toplighting (See Section [illegible])	g Automatic Partial OFF (See Section 9.4.1.1[g] [Full Off complies])	h Automatic Full OFF (See Section 9.4.1.1[h])	i Scheduled Shutoff (See Section 9.4.1.1[i])
Atrium											
… that is <20 ft in height	0.03/ft total height	NA	REQ	ADD1	ADD1	—	REQ	REQ	—	ADD2	ADD2
… that is ≥20 ft and ≤40 ft in height	0.03/ft total height	NA	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2
… that is >40 ft in height	0.40 + 0.02/ft total height	NA	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2
Audience Seating Area											
… in an auditorium	0.63	6	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2
… in a convention center	0.82	4	REQ	ADD1	ADD1	REQ	REQ	REQ	—	ADD2	ADD2

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 Power and Lighting - VISITED SEPT. 5, 2017

Using the Evaluation Checklists
Installed Lamps and Fixtures

FI3 [9.1.3] [1]	Installed lamps and fixtures are consistent with what is shown on the approved lighting plans.

Section 9.4.5 - Exterior Lighting Power Zones

ZONE 1
Developed areas of parks, forest, and rural areas.

ZONE 2
Residential and mixed use, neighborhood business, light industrial with limited night use.

ZONE 3
All other.

ZONE 4
High activity commercial in major metro as designated by AHJ.

In 2010, Zone 0 was introduced to represent undeveloped areas within national parks, forest land, and rural areas as defined by AHJ.

Source: slide modified from www.energycodes.gov ANSI/ASHRAE Standard 90.1 2013 Power and Lighting - VISITED SEPT. 5, 2017

Section 9 Tradable Exterior LPDs

TABLE 9.4.3B Individual Lighting Power Allowances for Building Exteriors

	Zone 0	Zone 1	Zone 2	Zone 3	Zone 4
Base Site Allowance (base allowance may be used in tradable or non-tradable surfaces)					
	No Base Site in Zone 0	500 W	600 W	750 W	1300 W
Tradable Surfaces (LPDs for uncovered parking areas, building grounds, building entrances and exits, canopies and overhangs, and outdoor sales areas may b traded.)					
Uncovered parking areas					
Parking areas and drives	No allowance	0.04 W/ft2	0.06 W/ft2	0.10 W/ft2	0.13 W/ft2
Building grounds					
Walkways less than 10 ft wide	No allowance	0.7 W/linear foot	0.7 W/linear foot	0.8 W/linear foot	1.0 W/linear foot
Walkways 10 ft wide or greater Plaza areas Special feature areas	No allowance	0.14 W/ft2	0.14 W/ft2	0.16 W/ft2	0.2 W/ft2
Stairways	No allowance	0.75 W/ft2	1.0 W/ft2	1.0 W/ft2	1.0 W/ft2
Pedestrian tunnels	No allowance	0.15 W/ft2	0.15 W/ft2	0.2 W/ft2	0.3 W/ft2
Landscaping	No allowance	0.04 W/ft2	0.05 W/ft2	0.05 W/ft2	0.05 W/ft2
Building entrances and exits					

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ASHRAE 90.1 (2013) Significant Changes - Section 9 (2 of 3)

Section 9 – Lighting

9.4.3 Functional Testing-new section requires control systems be tested and calibrated with control hardware and software.

Requirements for testing Occupant Sensors, Automatic Time Switches and Daylight Controls

Testing to be conducted by someone other than the design professional or constructor for the project

Documentation required certifying the results.

ASHRAE 90.1 (2013) Significant Changes – Section 9 (3 of 3)

Section 9 – Lighting

Submittals (Section 9.7)

9.7 Submittals

Sections 9.7.1 General, 9.7.2 Completion Requirements, 9.7.2.1 Drawings, 9.7.2.2 Manuals and 9.7.2.3 Daylight Documentation together establish the requirements and time frames for submitting documents. Record drawings and manuals must be provided to the owner within 90 days.

ASHRAE 90.1 Chapter 10- Other Equipment

Significant Changes Include:

- Electric motor efficiencies 10.4.1
- Requirements for service water booster pumps 10.4.2
- New elevator requirements-lighting-ventilation-standby
- Escalators and Moving Walkways-standby 10.4.4.
- Whole Building Energy Monitoring 10.4.5

ASHRAE 90.1 Other Compliance Paths

Other Compliance Paths

- *COMCheck – Used for Envelope Tradeoffs*
- *Above Code Programs*
- *Energy Cost Budget Method*
- *Whole Building Simulations-Appendix G for LEED V4*

COMcheck Online Tool

COMCheck can be used for envelop tradeoffs –available at www.energycodes.gov

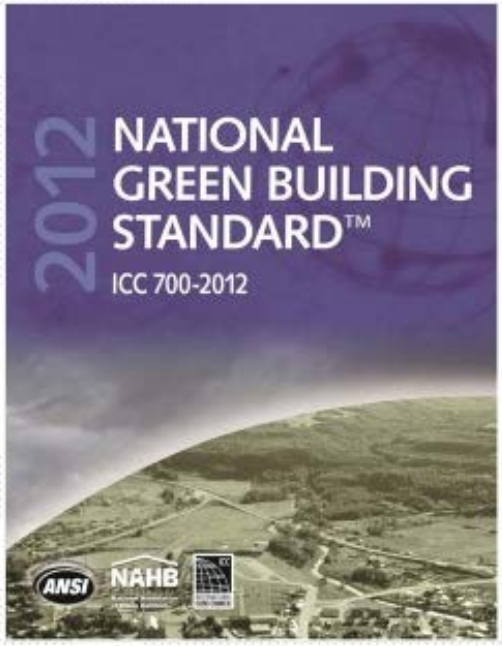
Michigan Energy Code-Commercial

SECTION C102

C102.1.1 *(amended by Mich. Act to identify example above code programs such as ICC 700 (2012) Silver and Energy Star Version 3 as complying,*

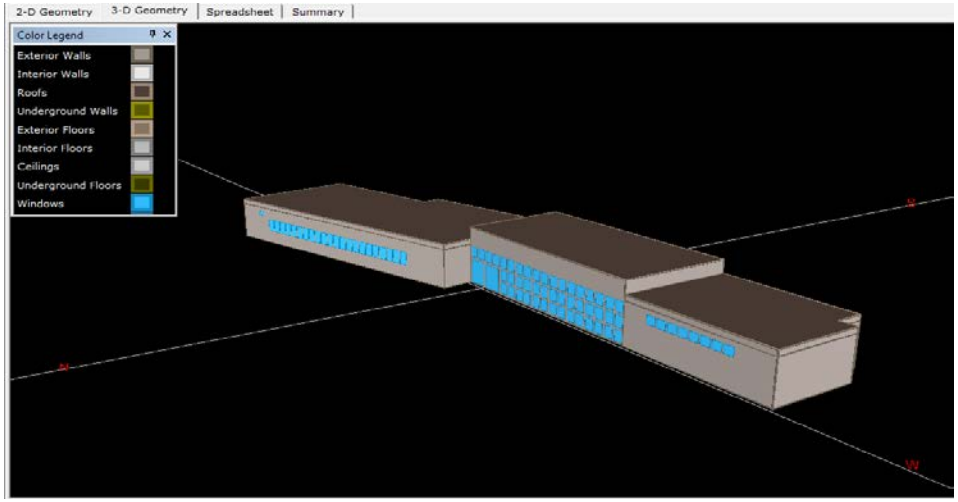
***Still requires mandatory provisions of Chapter 4 of IECC 2015 to be met*

(Note: while Michigan code states Energy Star v3.0, the newer v3.1 may be more appropriate as Energy Star may not recognize v3.0 in states that have adopted IECC 2012 or 2015)



Performance Paths in Standard 90.1

- Standard 90.1 includes two performance paths
  - Both based on energy simulation
  - Requires approved software
  - Both compare a proposed building design to a baseline building meeting the prescriptive requirements
  - Chapter 11 -Energy Cost Budget Method
  - Appendix G – Used for LEED projects



Energy Codes – Resources (1 of 2)

www.energycodes.gov

Energy Codes – Resources (2 of 2)

Link to Building Energy Codes Program on the Energy Codes website

https://www.energycodes.gov/training-courses/ansiashraeies-standard-901-2013

www.energycodes.gov

More MSU programs being developed

- Three hour Commercial Energy Code Training
- Two Hour Commercial Energy Code Training
- One Hour Commercial Energy Code Overview

- Michigan Energy Code Lighting Requirements

- One, two and three hour Michigan Residential Energy Code Training

www.energycodes.gov

Q + A

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