A Michigan Energy Code Update

Lighting and HVAC Provisions of ASHRAE Standard 90.1-2019 & the New Michigan Commercial Energy Code

for AIA Detroit
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Today's Speaker

Sonya M. Pouncy, CEM, LEED-AP, CMVP

Sonya is a degreed Mechanical Engineer with more than 30 years of experience in the energy management and HVAC equipment industries.

She began her career with Carrier Corporation, for which she initially developed residential furnaces and later sold chillers, air-handlers and other heavy equipment. Since leaving Carrier, Sonya has worked with manufacturer's representatives, utilities and energy/engineering consultants. In 2020, she re-opened her own consultancy, Building Vitals, which helps facility managers identify, understand, and bridge the gap between where their building performance is and where they want it to be.

Sonya is active member of ASHRAE at both the local and national levels. She is a former president of the Detroit Chapter and currently serves as a member of its Government Affairs Committee and Student Activities Committee. Internationally, she is a current member and former Chair of ASHRAE TC 7.3—the Technical Committee on Operations, Maintenance, and Cost Management and the current Communications Coordinator for the society's Government Affairs Committee.

Learning Objectives

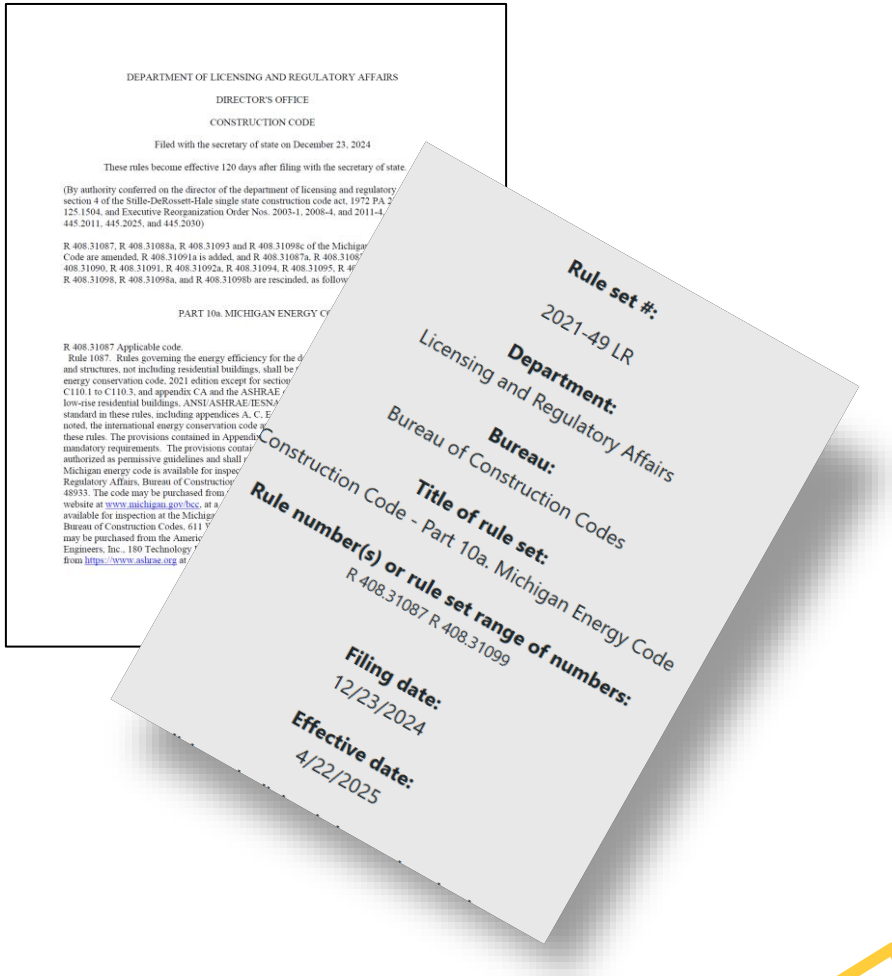
To better understand:

- The system design requirements for lighting, lighting control, and the control systems of certain other equipment in ASHRAE Standard 90.1-2019 as applied to the new Michigan Commercial Energy Code
- What new to (potentially) look for when commissioning control systems for lighting and certain other systems
- The system design requirements for the HVAC system, including its controls, in ASHRAE Standard 90.1-2019 as applied to the new Michigan Commercial Energy Code
- What new to (potentially) look for when commissioning HVAC equipment and control systems

New Michigan Energy Code Effective Date

APRIL 2025

Sun	Mon	Tue	Wed	Thu	Fri	Sat
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			



Michigan Energy Code Update: ASHRAE 90.1-2019

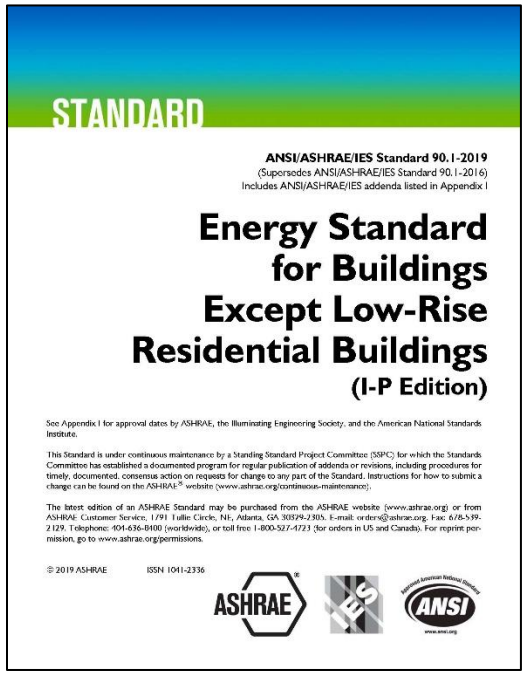
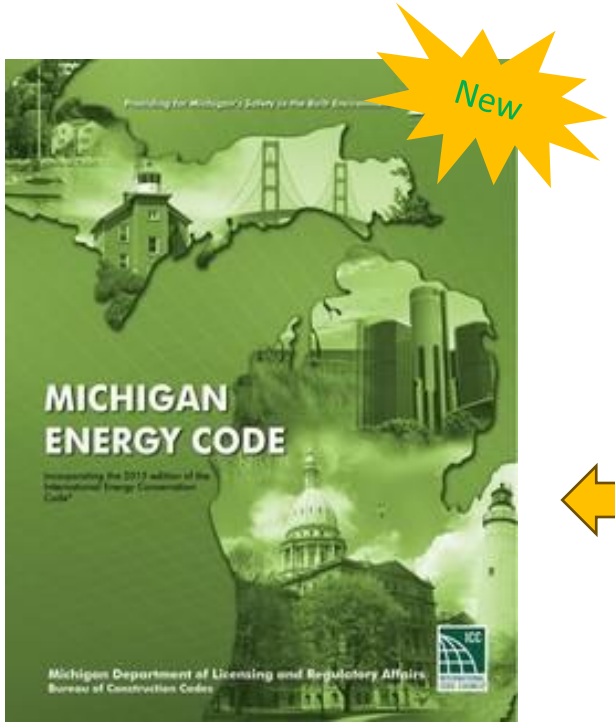


Image Source: ASHRAE 90.1-2019



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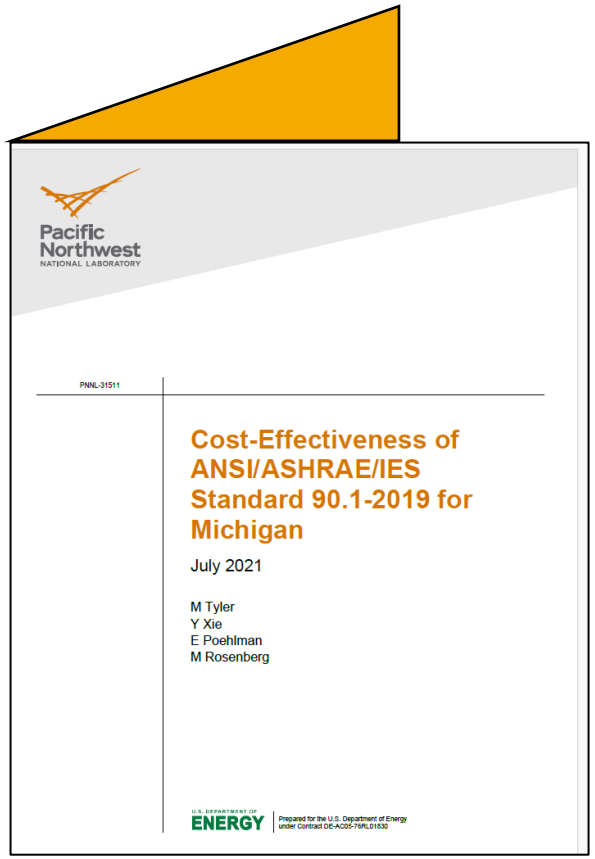
Energy Cost Savings with ASHRAE 90.1-2019



Standard Edition	Added Construction Cost $/ft^2	Annual Energy Savings $/ft^2	Net Annualized LCC Savings $/ft^2
90.1-2013	Baseline	Baseline	Baseline
90.1-2016	$0.248	$0.123	$7.09
90.1-2019	($1.198)	$0.063	$3.70

Data Nontraceable Source: U.S. DOE Determinations for ASHRAE 90.1-201 6 and 90.1-2019.

Michigan Energy Code Update: ASHRAE 90.1-2019

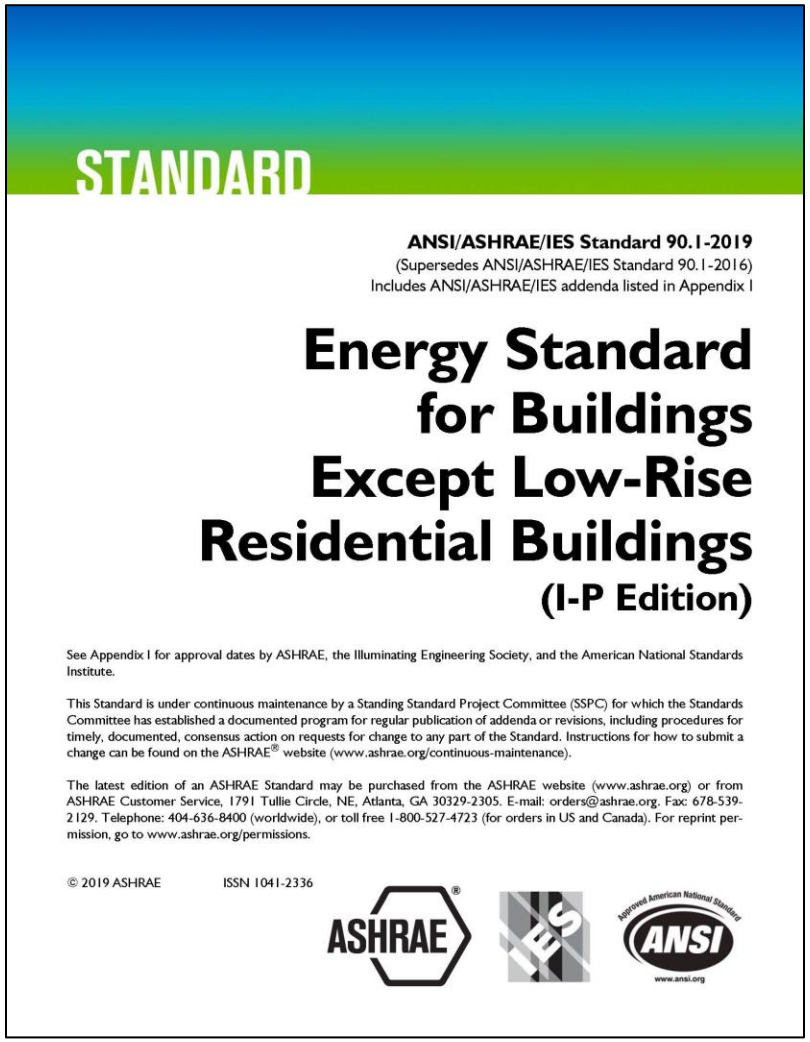


Image Source: ASHRAE 90.1-2019

- Section 1- Purpose
- Section 2- Scope
- Section 3- Definitions
- Section 4- Administration and Enforcement
- Section 5- Building Envelope
- **Section 6- Heating, Ventilation, 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

Disclaimers

- This presentation is an educational tool and is intended to provide an overview of the requirements for Lighting and Lighting Control Systems complying with the new Michigan Energy Code (MEC) for Commercial Buildings based on ASHRAE 90.1-2019.

- This overview is NOT exhaustive.

- To enhance understanding, material in this presentation is NOT written in code language.

- Exceptions apply to many provisions. Code users are encouraged to consult the current Michigan Energy Code (ASHRAE 90.1-2013), ASHRAE 90.1-2019 and IECC 2021 for complete details, criteria, requirements and exceptions.

The Michigan Energy Code

Intent is to …

"regulate the
design and construction of buildings for the
effective use and conservation of energy
over the useful life of each building."

Data Source: 2021 IECC. See the model code for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Purpose

To establish the **minimum** energy efficiency requirements of buildings, other than low-rise residential buildings, for:

- **Design**
- **Construction**
- **Operation and Maintenance Planning**
- **Utilization of on-site renewables**

Data Source: ASHRAE 90.1-2019. See Standard for full details.

Section 8 - POWER

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

COMPLIANCE PATHS for POWER DISTRIBUTION SYSTEMS						
Section		Path Options				
		Mandatory Provisions	Energy Cost Budget Method	Performance Rating Method	Alternate Compliance Path	
1	General	•	•	•	•	
4	Mandatory	•	•	•		
7	Submittals	•	•	•	•	
9	Verification, Testing, and Commissioning	•	•	•	•	New Section

New

New

New Paths

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Power System Mandatory Provisions Apply to:

New Construction

Additions

Alterations

- Added Equipment

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Mandatory Provisions for Power Distribution Equipment

Maximum Sizing Voltage Drop		
	ASHRAE 90.1-2013	ASHRAE 90.1-2019
Feeder Conductors	2%	5%
Branch Circuits	3%	

Minimum efficiency Levels for 3-Phase Low Voltage Dry Type Distribution Transformers		
kVA	ASHRAE 90.1-2013	ASHRAE 90.1-2019
15	97.0%	97.89%
30	97.5%	98.23%
[illegible]	97.7%	98.40%
500	98.7%	[illegible]
750	98.8%	99.23%
1000	98.9%	99.28%

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

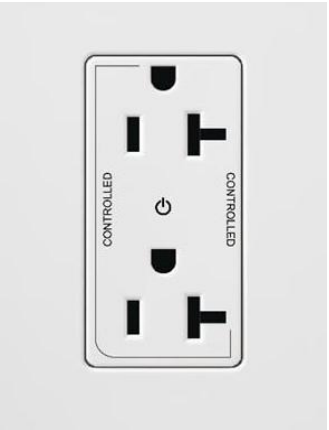
New

Criteria for Automatic Receptacle Control

- Control ≥ 50% of all 125V, 15A and 20A receptacles in:
  - Private Offices
  - Conference Rooms
  - Print/copy Rooms
  - Breakrooms
  - Classrooms
  - Individual Workstations
- Control ≥ 25% of all branch feeders for modular furniture **not shown on construction drawings**

Controlled

Source of Images:
Adapted from PNNL



Exceptions

- Receptacles designated for 24/7 use or where automatic control would present a safety or security risk

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

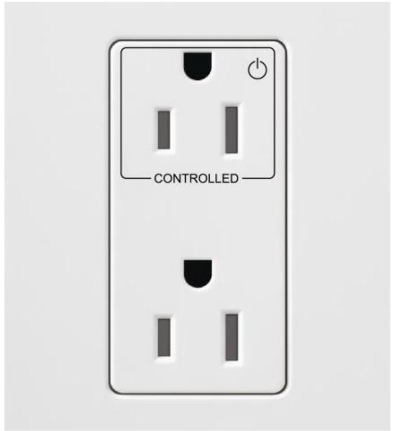
Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Automatic Receptacle Control

Allowable control methods are:

- Time-of-day Schedule with
  - Programs for ≤ 5,000 ft^2
  - Not more that one (1) floor
  - Manual override for ≤ 2 hours
- Occupancy Sensor programmed to turn receptacles OFF within 20 minutes of vacancy
- Automated Signal programmed to turn receptacles OFF within 20 minutes of vacancy



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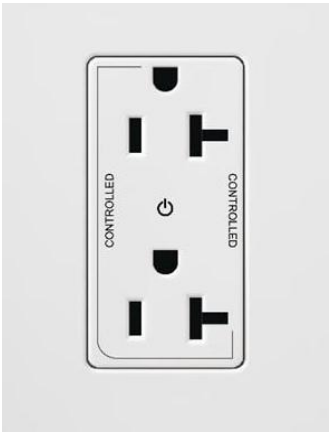


Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Electrical Energy Monitoring, Recording and Reporting

- Measure and record independent energy use for

- Maintain records for at least 3 years
- Sample Rate of at least 15 minutes
- Reported at hourly, daily, monthly and annually

Exceptions:

- Buildings < 25,000 ft^2
- Tenant spaces < 10,000 ft^2
- Dwelling units
- Residential buildings with common areas < 10,000 ft^2
- Receptacles in patient care areas
- Receptacles for IG equipment

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New Criteria for Whole Building Energy Monitoring

(from Section 10. Included here for continuity of subject)

Nat. Gas	Fuel Oil	Propane	Steam	Chilled Water	Hot Water

- Supplied by a utility, energy provider or plant not within the building
- Energy use sampling rate ≤ 60 minutes
- Hourly, Daily, Monthly, and Annual Reporting of consumption and demand
- Data maintained for ≥36 months
- **Exceptions:**
  - Buildings or Additions 25,000 ft^2
  - Individual tenant spaces 10,000 ft^2
  - Fuel used for onsite emergency equipment
  - Dwelling units
  - Residential buildings with 10,000 ft^2 common area

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

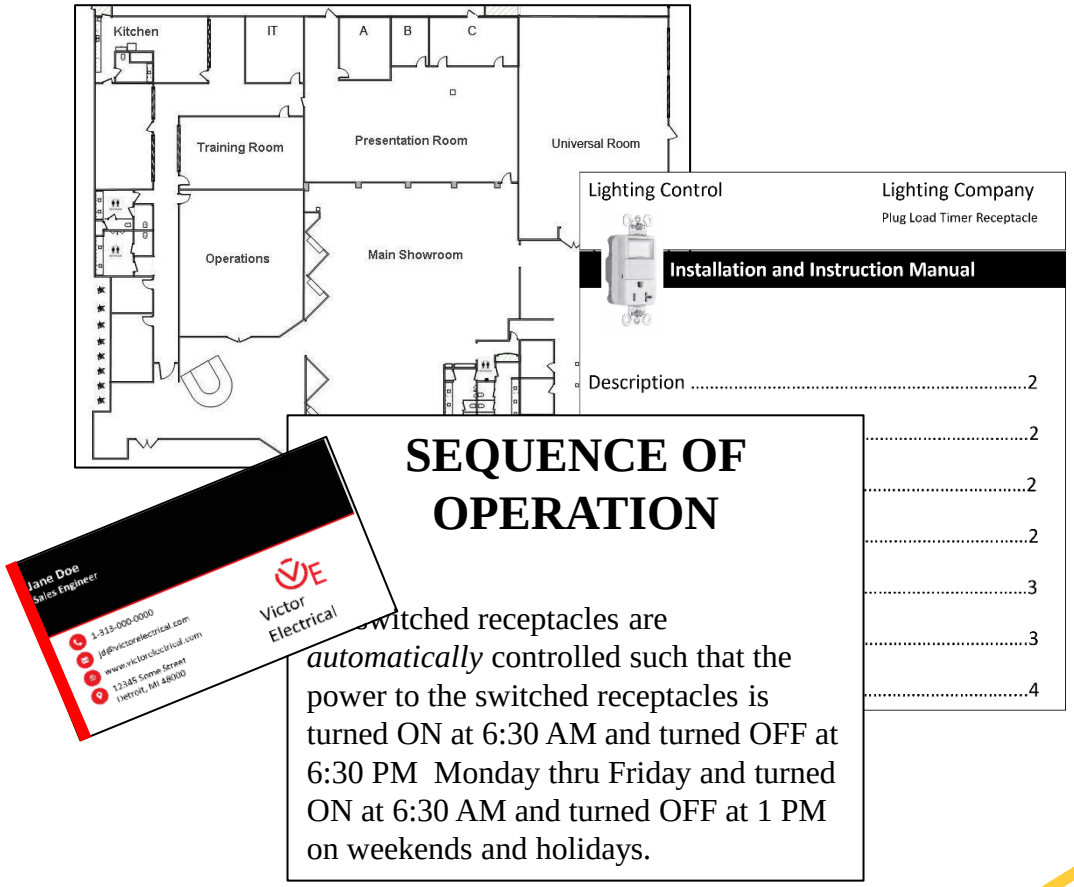
Documentation Requirements for Power Distribution Systems

Record Drawings

- Single line diagram
- Floor plans

Operation and Maintenance Manuals

- Submittal data
- Operating instructions
- Routine maintenance required
- Name & address of qualified service agency
- Narrative of intended system operation



Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Performance Verification of Power Distribution Systems

Verification & Testing

- Automatic Receptacles
- Energy Monitoring

Commissioning

- Power system energy performance

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Section 9 - LIGHTING

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

Road Map to Compliance

Step1: Determine if the project needs to comply

Step 2: Determine the interior lighting power allowance

Step 3: Determine the exterior lighting power allowance

Step 4: Determine the installed interior lighting power

Step 5: Determine the installed exterior lighting power

Step 6: Confirm that the installed lighting power is $\leq$ the allowable lighting power

Step 7: Meet all mandatory provisions including those for lighting controls and exit signs

Step 8: Perform functional testing of lighting controls

Step 9: Submit all required documentation

Michigan Energy Code Update: ASHRAE 90.1-2019

COMPLIANCE PATHS for LIGHTING & LIGHTING CONTROLS							
Section		Path Options					
		Building Area Method	Space by Space Method	Energy Cost Budget Method	Performance Rating Method	Simplified Building Method	
1	General	●	●	●	●	●	
4	Mandatory	●	●	●	●		
7	Submittals	●	●	●	●	●	
9	Verification, Testing, and Commissioning	●	●	●	●	●	New Section

New

New

New Paths

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Lighting and Lighting Control Provisions Apply to:

New Construction

- Interior Spaces
- Exterior Features
- Exterior Grounds

Additions

- New Equipment

Alterations

- Control Upgrades
- Luminaire Upgrades that impact 50% or more of the connected load, including:
  - Replacements
  - Removals
  - Additions

Michigan Amendment

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

UL LED Lighting Upgrade Types

A	B	C
LED Tubes with Internal Driver Integrated driver works with existing fluorescent ballasts.	**Double-Ended Bypass LED Tube** Wired to the main voltage supplied to the existing linear fluorescent fixture.	**LED Tube with Remote Driver** Remote driver connected to low voltage sockets of the existing linear fluorescent fixture.
Maintenance	Alteration	Alteration
New Controls **NOT Required**	New Shut OFF Controls **Required**	New Shut OFF Controls **Required**

Michigan Energy Code Update: ASHRAE 90.1-2019

Lighting and Lighting Control Provisions Apply to:

New Construction

Additions

Alterations

Exceptions to applicability for New Construction and Additions :

- Emergency Lighting
- ~~Dwelling Unit Lighting~~ → Dwelling units have been removed from these exceptions
- Health & Life Safety Lighting
- Lighting power by gas or other fuel sources
- The smaller powered of two or more co-located lighting systems designed to not work simultaneously

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Dwelling Units

At least 75% of permanently installed luminaires must have either:

- Lamps with an efficacy of 55 lm/W; or
- Total luminaire efficacy of 45 lm/W

Exceptions:

- Lighting controlled with dimmers
- Lighting with 9.4.1.1.h compliant automatic full OFF controls
- Hotel & motel guest rooms

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Exceptions to Prescriptive Requirements for Interior Lighting Power Limitations ASHRAE 90.1-2013

- Display and accent lighting in museums, galleries & monuments
- Exit signs
- Lighting integral to instrumentation
- Lighting for use during medical procedures
- Lighting integral to refrigerator and freezer cases
- Lighting integral to food warming/prep equipment
- Lighting for life support of non-human life forms
- Lighting in display windows
- Lighting inside registered historic landmarks
- Lighting integral to advertising or directional signage
- Lighting for sale or education
- Theater lighting
- Television broadcast lighting
- Casino gaming lighting
- Furniture-mounted task lighting
- Dressing room mirrors
- Pulpit and choir loft accent lighting
- Parking garage transition lighting

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Major Revision

Exceptions to Interior Lighting Power and Minimum Control Strategies ASHRAE 90.1-2019

Item	Application	Controlled Separately and in Addition to General Lighting	Required Controls
1	Lighting integral to medical equipment or instrumentation & installed by manufacturer	Yes	None
2	Lighting for use during medical procedures	Yes	Local control (9.4.1.1.a)
3	Lighting for life support of non-human life forms	Yes	Local control (9.4.1.1.a)
[illegible]	Lighting inside registered historic landmarks	No	Local control (9.4.1.1.a) and either Auto Full OFF ((9.4.1.1.h) or Scheduled ShutOFF (9.4.1.1.i)
17	Furniture-mounted task lighting	Yes	[illegible]
18	Lighting for parking garage transition zones measuring ≤ 50 ft wide and ≤ 66 ft depth into garage	Yes	Scheduled ShutOFF and Garage Daylight Transition Zone control (9.4.1.2.a and 9.4.1.2.c)

Data Source: Excerpted from ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Building Area Method Criteria for Interior Lighting Power Densities

Determine interior lighting power allowance by:

1. Determine appropriate building area type(s) from Table 9.5.1
2. Determine gross lighted floor area
3. Multiply floor area by the LPD Tabulated in Table 9.5.1
4. Sum the LPDs for all building areas

NOTE: Some tradeoffs are allowed

SAMPLE BUILDING AREA METHOD LIGHTING POWER DENSITIES

Building Area	90.1-2013 LPD, W/ft^2	90.1-2019 LPD, W/ft^2
Automotive	0.80	0.75
Convention Center	1.01	0.64
Dining: Family	0.95	0.71
Fire Station	0.67	0.56
Parking Garage	0.21	0.18
Police	0.87	0.66
School	0.87	0.72

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Space-by-Space Method Criteria for Interior Lighting Power Densities

Determine interior lighting power allowance for spaces with partitions ≥ 80% of the ceiling height by:

1. Determine appropriate space type(s) from Table 9.6.1
   - Subdivide multipurpose spaces to either 20% of original space or 1,000 ft^2
2. Determine space floor area defined by centerline of interior walls, diving lines and exterior walls
3. Multiply floor area by the LPD Tabulated in Table 9.6.1
4. Sum the LPDs for all space areas

NOTE: Some trade-offs are allowed

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standards for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Space-by-Space Method Criteria for Interior Lighting Power Densities

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

			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.								
Informative Note: This table is divided into two sections: this first section covers *space* types that can be commonly found in mu ple *building* types. The secon part of this table covers *space* types that are typically fou in a single *building* type.			Local *Control* (See Section 9.4.1.1 [a])	Restricted to *Manual* ON (See Section 9.4.1.1 [b])	Restricted to Partial *Automatic* ON (See Section 9.4.1.1 [c])	Bilevel Lighting *Control* (See Section 9.4.1.1 [d])	*Automatic* Daylight Responsive *Controls* for Sidelighting (See Section 9.4.1.1 [e][6])	*Automatic* Daylight Responsive *Controls* for *Toplighting* (See Section 9.4.1.1 [f][6])	*Automatic* Partial OFF (See Section 9.4.1.1 [g] [Full Off complies])	*Automatic* Full OFF (See Section 9.4.1.1 [h])	Scheduled Shutoff (See Section 9.4.1.1 [i])
Common *Space* Types[1]	*LPD* Allowances, W/ft[2]	*RCR* Threshold	a	b	c	d	e	f	g	h	i
Atrium											
<20 ft in height	0.39	NA	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
≥20 ft and ≤40 ft in height	0.48	NA	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
>40 ft in height	0.60	11	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Audience Seating Area											
Auditorium	0.61	6	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Gymnasium	0.23	6	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Motion picture theater	0.27	4	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Penitentiary	0.67	4	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
Performing arts theater	1.16	8	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Religious facility	0.72	4	REQ	ADD1	ADD1	REQ	REQ	REQ		ADD2	ADD2
Sports arena	0.33	4	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2
All other audience seating areas	0.23	4	REQ	ADD1	ADD1		REQ	REQ		ADD2	ADD2

Image Source: ASHRAE 90.1-2019 as quoted in U.S. DOE Building Energy Code Program, PNNL-SA-153216, "ANSI/ASHRAE/IES Standard 90.1-2019 : Power and Lighting."

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Space-by-Space Method Criteria for Interior Lighting Power Densities

SAMPLE SPACE-BY-SPACE AREA METHOD LIGHTING POWER DENSITIES			
Space Area	90.1-2013 LPD, W/ft^2	90.1-2019 LPD, W/ft^2	IECC 2021 LPD, W/ft^2
Atrium, Height < 20 ft	0.03 x Height	0.39	0.48
Atrium, 20 ft ≤ Height < 40 ft	0.03 x Height	0.48	
Atrium, Height > 40 ft	0.40 + 0.02 x Height	0.60	0.60
Storage Room, < 50 ft^2	1.24	0.51	0.38
Storage Room, ≥ 50 ft^2	0.63	0.38	

Data Source: ASHRAE 90.1-2013 and 90.1-2019 and IECC 2021. Exceptions may apply. See Standards for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Example

Find:
Allowable lighting power for the 12 qty screening rooms in a movie theater, if each screening room is 1,000 ft^2

LPD = 0.27 W/ft^2

Allowable lighting power
= 0.27 W/ft^2 x 1,000 ft^2 x 12 qty
= 3,240 W

Table 9.6.1 ***Lighting Power Density*** **Allowances Using the Space-by-Space Method and Minimum**

Table 9.6.1:

Common *Space* Types[1]	*LPD* Allowances, W/ft^2	*RCR* Threshold	a	b	c
			The *control* functions below shall Section 9.4.1.1 For each *space* t (1) All REQs shall be implemer (2) At least one ADD1 (when p (3) At least one ADD2 (when p		
			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.	Local *Control* (See Section 9.4.1.1[a])	Restricted to *Manual* ON (See Section 9.4.1.1[b])	Re to Au ON Se
Atrium						
<20 ft in height	0.39	NA	REQ	ADD1	A
≥20 ft and ≤40 ft in height	0.48	NA	REQ	ADD1	A
>40 ft in height	0.60	11	REQ	ADD1	A
Audience Seating Area						
Auditorium	0.61	6	REQ	ADD1	A
Gymnasium	0.23	6	REQ	ADD1	A
Motion picture theater	0.27	4	REQ	ADD1	A
Penitentiary	0.67	4	REQ	ADD1	A
Performing arts theater	1.16	8	REQ		
Religious facility	0.72	4			
Sports arena	0.33				
...her audience seating areas	0.3...				

Image Source: Excerpted from ASHRAE 90.1-2019 as quoted in U.S. DOE Building Energy Code Program, PNNL-SA-153216, "ANSI/ASHRAE/IES Standard 90.1-2019 : Power and Lighting."

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Space-by-Space Additional Interior Lighting Power Allowance for Aesthetics

For spaces in which lighting is specified for decoration, or highlighting exhibitions, etc. and has a LPD of:

90.1-2013 LPD, W/ft^2	90.1-2019 LPD, W/ft^2
1.0	0.75

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Space-by-Space Additional Interior Lighting Power Allowance for Merchandise

ADDITIONAL POWER ALLOWANCE MULTIPLIERS			
Retail Area	Floor Area Used For	90.1-2013 W/ft²	90.1-2019 W/ft²
1	All products not listed below	0.6	**0.45**
2	Vehicles, sporting goods, small electronics	0.6	**0.45**
3	Furniture, clothing, cosmetics, art	1.4	**1.05**
4	Jewelry, crystal, china	2.5	**1.88**

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards for full details.

Additional Power Allowance

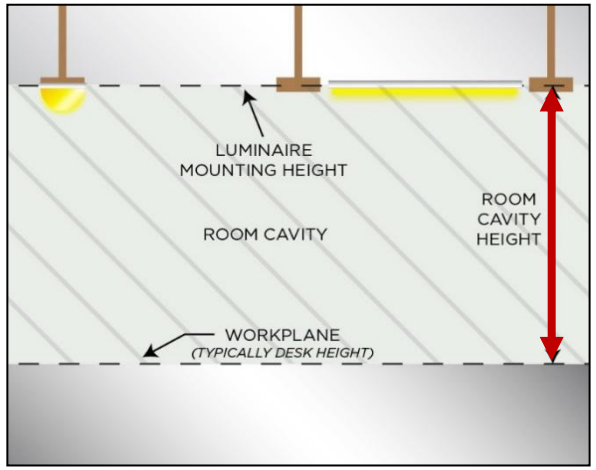
$$= 1000W + (Area_{RA1} \times M_{RA1}) + (Area_{RA2} \times M_{RA2}) + (Area_{RA3} \times M_{RA3}) + (Area_{RA4} \times M_{RA4})$$

Michigan Energy Code Update: ASHRAE 90.1-2019

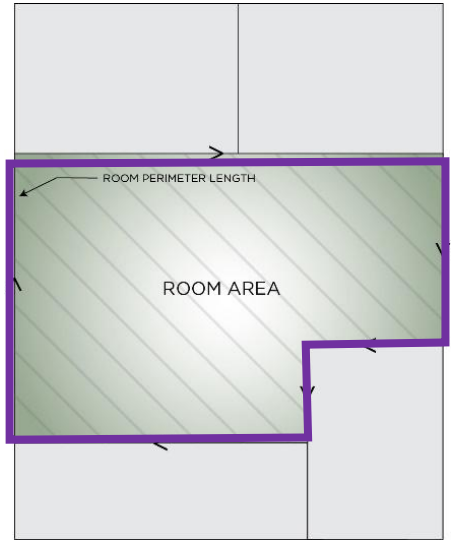
Space-by-Space Additional Interior Lighting Power for Atypical Geometries

- For spaces with room cavity ratios in excess of those listed in Table 9.6.1,
- Additional Power Allowance = Base LPD x 0.2
- Room Cavity Ratio =

$$\frac{2.5 \times \text{Room Cavity Height} \times \text{Room Perimeter}}{\text{Room Floor Area}}$$

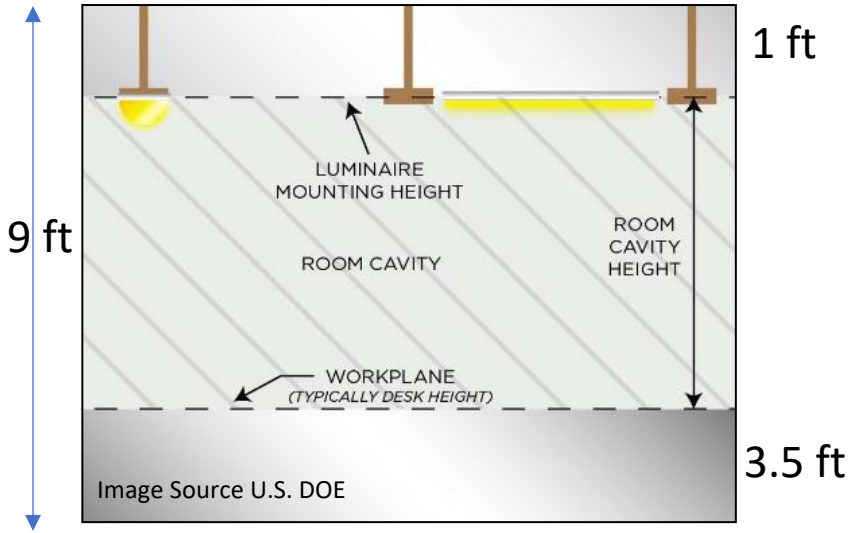


Source of Images: Adapted from U.S. DOE

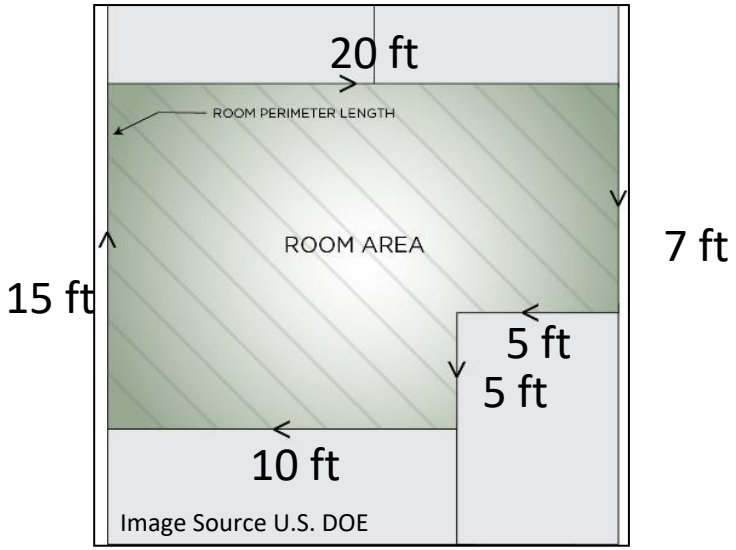


Michigan Energy Code Update: ASHRAE 90.1-2019

Example



Elevation View



Plan View

Find:
Is there an additional power allowance for this Conference Room?

1. Area of Conference Room B is = (20 x 15) – (5 x 5) = 275 ft^2
2. Perimeter of Conference Room B = 20 + 7 + 5 + 5 +10 +15 = 62 ft
3. Room Cavity Height = 9 – 3.5 – 1 = 4.5 ft
4. Room Cavity Ratio = 2.5 x 4.5 x 62 ÷ 275 = 2.54

Michigan Energy Code Update: ASHRAE 90.1-2019

Example, continued

5. Compare Room RCR to tabulated threshold value

Space Type	ASHRAE 90.1-2013		ASHRAE 90.1-2019	
	LDP Allowance	RCR Threshold	LDP Allowance	RCR Threshold
Banking Area	1.01	6	0.61	6
Conference Room	1.23	6	0.97	6
Copy Room	0.72	6	0.31	6

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Conference Room RCR = 2.54 < Threshold RCR, so there is **NO** additional allowance in this case.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Space-by-Space Room Cavity Ratio Thresholds

Space Type	ASHRAE 90.1-2013		ASHRAE 90.1-2019	
	LDP Allowance	RCR Threshold	LDP Allowance	RCR Threshold
Atrium, Height < 20 ft	0.03 x Height	NA	0.39	NA
Atrium, 20 ft ≤ Height < 40 ft	0.03 x Height	NA	0.48	NA
Atrium, Height > 40 ft	0.40 + 0.02 x Height	NA	0.60	11
Conference Room	1.23	6	0.97	6
Low Bay Manufacturing	1.19	4	0.86	3
High Bay Manufacturing	1.23	4	1.24	6
Extra High Bay Manufacturing	1.05	4	1.42	8
Storage Room, < 50 ft^2	1.24	6	0.51	9
Storage Room, ≥ 50 ft^2	0.63	6	0.38	6

Data Source: Excerpted from ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Exterior Lighting Power Criteria

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.

Image Source U.S. DOE

Michigan Energy Code Update: ASHRAE 90.1-2019

Tradeable Surfaces

Tradable: allowed wattage may be traded among these applications:

- Uncovered Parking
- Building Grounds
- Entrances, Exits & Loading Docks
- Sales Canopies
- Outdoor Sales Areas

Non-Tradeable Surfaces

Non-Tradable: allowed wattage cannot be traded between these surfaces or with other exterior lighting applications:

- Building Facades
- ATMs
- Entrances at Guarded Facilities
- Loading areas for law enforcement & emergency service vehicles
- Drive through windows
- Parking near 24-hour retails entrances
- Locations approved by AHJ

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Lighting Power Allowances for Building Exterior Areas

Area	Zone 0 Undeveloped Forest/Park	Zone 1 Developed Forest/Park	Zone 2 Residential & Mixed use	Zone 3 All Other	Zone 4 High Activity Downtown
Base Site Allowance	0 W	~~500 W~~ **350 W**	~~600 W~~ **400 W**	~~750 W~~ **500 W**	~~1300 W~~ **900 W**
Tradeable Surfaces					
Uncovered Parking & Drives	0 W	~~0.04 W/ft²~~ **0.03 W/ft²**	~~0.06 W/ft²~~ **0.04 W/ft²**	~~0.10 W/ft²~~ **0.06 W/ft²**	~~0.13 W/ft²~~ **0.08 W/ft²**
Walkways < 10 ft wide	0 W	~~0.7 W/ft²~~ **0.5 W/ft²**	~~0.7 W/ft²~~ **0.5 W/ft²**	~~0.8 W/ft²~~ **0.6 W/ft²**	~~1.0 W/ft²~~ **0.7 W/ft²**
Walkways ≥ 10 ft wide & Plazas	0 W	~~0.14 W/ft²~~ **0.1 W/ft²**	~~0.14 W/ft²~~ **0.1 W/ft²**	~~10 ft/ft²~~ **0.11 W/ft²**	~~0.20 W/ft²~~ **0.14 W/ft²**

Data Source: from ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Lighting Power Allowances for Building Exterior Areas

Area	Zone 0 Undeveloped Forest/Park	Zone 1 Developed Forest/Park	Zone 2 Residential & Mixed use	Zone 3 All Other	Zone 4 High Activity Downtown
Base Site Allowance	0 W	~~500 W~~ **350 W**	~~600 W~~ **400 W**	~~750 W~~ **500 W**	~~1300 W~~ **900 W**
Non-Tradeable Surfaces					
Facades	0 W	0 W/ft^2	0.10 W/ft^2 or 2.5 W/ft	0.15 W/ft^2 or 3.75 W/ft	0.20 W/ft^2 or 5.0 W/ft
ATM & Night Depositories	0 W	~~270 W, 1st ATM + 90 W, ea. add'l ATM~~ **135 W, 1st ATM + 45 W, ea. add'l ATM**			
Not listed, not comparable	0 W	65% of interior LPD allowance	65% of interior LPD allowance	80% of interior LPD allowance	100% of interior LPD allowance

New

Data Source: from ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Lighting EXEMPT from exterior building lighting power allowance limits:

Exceptions:

- When independent of non-exempt lighting and equipped with §9.4.1.4 compliant controls, lighting that is/for:
  - Integral to signage
  - Athletic fields
  - Industrial purposes
  - Theme/amusement parks
  - Highlighting public monuments
  - Water features

Exceptions:

- When controlled separately, lighting used for:
  - Signaling, way-finding and markers
  - Integral to equipment
  - Theatrical purposes
  - Temporary purposes
  - Hazardous locations
  - Swimming pools
  - Searchlights

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Question

A building in exterior Lighting Zone 4 has a 40,000 ft^2 lighted surface parking lot and one 45,000 ft^2 lighted façade. The installed parking lot lighting power is 4500 W and the installed façade lighting power is 8,500 W.

Is the project in compliance?

Answer

Base allowance	= 900 W
Uncovered Parking Allowance = 0.08 W/ft^2 x 40,000 ft^2	= 3,200 W
Façade Allowance = 0.2 W/ft^2 x 45,000 ft^2	= 9,000 W
Total Allowance =	= 13,100 W
Installed power = 4500 W + 8,500 W	= 13,000 W

Installed power is less than power allowance, so **YES**, the project is in compliance.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approach to Lighting

Office

School

Retail

Building Exteriors

- New Construction & Tenant Improvements with floor area of ≤ 25,000 ft^2
- Eligible building type comprises ≥ 80% of interior space
- Prescriptive
  - Interior LPA
  - Exterior LPA
  - Controls

Exception

- Lighting ≤ 0.02 W/ft^2

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approach to Lighting

Office

School

Retail

Building Exteriors

Required Lighting Power Reductions for Existing Building Alterations	
Existing Lighting Technology	**Minimum Power Reduction**
T12	35%
T8 or T5	20%
HID	45%
Incandescent	75%

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approaches to Lighting: Office Buildings

SPACE	LPA W/ft²	CONTROL REQUIREMENTS *(in addition to those required for all spaces except stairwells, corridors, and parking garages)*
All spaces except stairwells corridors & parking garages	0.70	• Auto OFF when unoccupied or scheduled to be unoccupied • Manual Control allowing lighting power reduction to ≥ 50% and Full OFF
Offices ≤250 ft² and meeting, class, storage, & break rooms	0.70	• Manual ON occupant sensors
Office areas > 250 ft² and restrooms	0.70	• Occupant sensors
Stairwells and corridors in building & parking garage	0.70	• Auto OFF when building unoccupied or scheduled to be unoccupied • Occ. sensors reduce power ≥ 50% when no activity detected for ≤ 20 mins
Parking garages	0.13	• Auto OFF during non-operating hours • Occ. sensors reduce power ≥ 50% when no activity detected for ≤ 20 mins

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Comparison of Lighting Approaches for 250 ft^2 Private Office

Simplified Building

- LPD allowance is 0.70 W/ft^2
- Required control method is
  - Manual ON occupancy sensor

Space-by-Space

- LPD allowance is 0.74 W/ft^2
- Required control methods are:
  - Local control
  - Bi-level Control
  - Automatic Daylighting Control
  - Automatic Full OFF
  - Either Manual ON or Partial Automatic ON

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approaches to Lighting: Retail Buildings

SPACE	LPA W/ft²	CONTROL REQUIREMENTS *(in addition to those required for all spaces except stairwells, corridors, and parking garages)*
Spaces other than garages, stairwells, corridors	1.0	• Auto OFF when unoccupied or scheduled to be unoccupied • Manual Control allowing lighting power reduction to ≥ 50% and Full OFF
Sales Area	1.0	• Auto reduce general lighting by ≥75% during non-business hours • Auto OFF for all non-general lighting during non-business hours • Continuous auto dimming for spaces with top daylighting
Stock, dressing, locker, restrooms	1.0	• Auto-ON or Manual ON occupant sensors • Continuous day dimming for spaces with top-lighting
Offices, meeting, training, storage, utility, break rooms	1.0	• Manual ON occupant sensors • Continuous day dimming for spaces with top-lighting
Stairwells and corridors in building & parking garage	1.0	• Auto OFF when building unoccupied or scheduled to be unoccupied • Occ. sensors reduce power ≥ 50% when no activity detected for ≤ 20 mins
Parking garages	0.13	• Auto OFF during non-operating hours • Occ. sensors reduce power ≥ 50% when no activity detected for ≤ 20 mins

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approaches to Lighting: School Buildings

SPACE	LPA W/ft²	CONTROL REQUIREMENTS *(in addition to those required for all spaces except stairwells, corridors, and parking garages)*
All spaces except stairwells corridors & parking garages	0.70	• Auto OFF when unoccupied or scheduled to be unoccupied • Manual Control allowing lighting power reduction to ≥ 50% and Full OFF
Offices, meeting, class, library, storage, & break rooms	0.70	• Manual ON occupant sensors
Gym, cafeteria	0.70	• Occupant sensors
Restrooms	0.70	• Occupant sensors
Stairwells and corridors in building & parking garage	0.70	• Auto OFF when building unoccupied or scheduled to be unoccupied • Occ. sensors reduce power ≥ 50% when no activity detected for ≤ 20 mins
Parking garages	0.13	• Auto OFF during non-operating hours • Occ. sensors reduce power ≥ 50% when no activity detected for ≤ 20 mins

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approaches to Lighting: Building Exteriors

SPACE	LIGHTING POWER DENSITY ALLOWANCE			
	UNIT	EXTERIOR LIGHTING ZONES		
		0,1,3	2	4
Base Allowance	W	200	0.08	0.13
Façade, special features, walkways, plazas	W/ft^2	0.10	0.03	0.05
Landscaping	W/ft^2	0.04	11	18
Entry Doors	W/linear ft	14	0.56	0.88
Stairs, ramps	W/ft^2	0.70	0.04	0.06
Parking lots, driveways	W/ft^2	0.05	0.16	0.25
Unlisted areas	W/ft^2	0.20	0.08	0.13

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Simplified Building Approaches to Lighting: Building Exteriors

SPACE	CONTROL REQUIREMENTS *(in addition to photocell or astronomical clock programmed to turn lighting OFF when sufficient daylight is available)*
Base Allowance	• Auto OFF or reduced to lighting power ≤ 75% during nonoperating hours
Façade, special features, walkways, plazas	• Auto OFF or reduced to lighting power ≤ 75% during nonoperating hours
Landscaping	• Auto OFF or reduced to lighting power ≤ 75% during nonoperating hours
Entry Doors	• Auto OFF or reduced to lighting power ≤ 75% during nonoperating hours
Stairs, ramps	• No additional controls required
Parking lots, driveways	• For luminaires mounted ≤ 25 ft, auto reduce power ≥ 50% when no activity detected for ≤ 15 mins
Unlisted areas	• Auto OFF or reduced to lighting power ≤ 75% during nonoperating hours

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Mandatory Interior Lighting Control Strategies under All Compliance Paths

TURN ON

- Local Control
- Manual ON
- Automatic Partial ON

MODULATE

- Bi-Level Control
- Automatic Side-Daylighting
- Automatic Top-Daylighting

SHUT OFF

- Automatic Partial OFF
- Automatic Full OFF
- Scheduled Shut-OFF
- NonBusiness Hr Shut-OFF

New

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

“The penetration of lighting controls remains low and presents an energy efficiency opportunity”

- *Commercial and Industrial Market Characterization Results*.
Report to MPSC EWR Collaborative
16 November 2021
by TRC and Consumers Energy

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Interior Lighting Control Strategies

Local Control

- At least one manual switch in the space
- Controlled area:
  - ≤ 2,500 ft^2 for spaces ≤ 10,000ft^2
  - ≤ 10,000 ft^2 for spaces >10,000ft^2

Exceptions:

- Remote location allowed for safety or security reasons

LOCAL CONTROL

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Interior Lighting Control Strategies

Manual ON

- No light automatically turned on

Exceptions:

- Auto-ON allowed for safety or security reasons

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

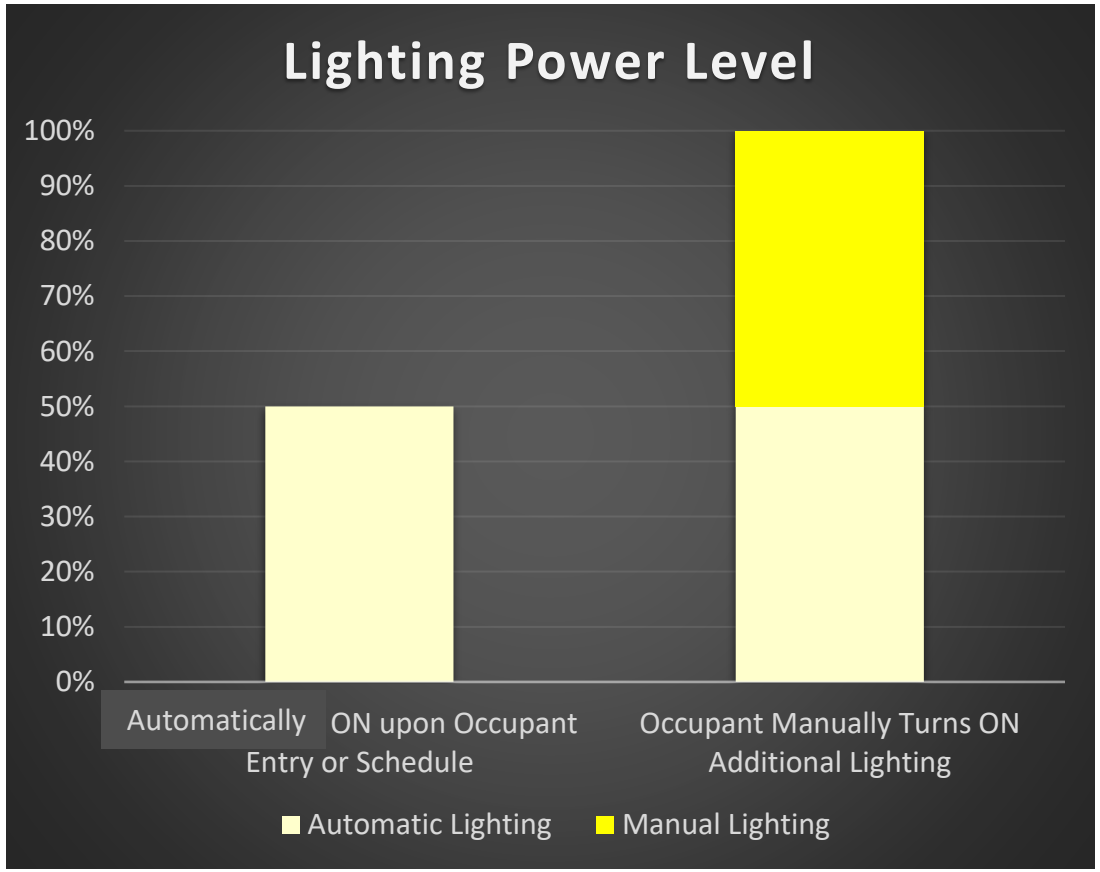
Criteria for Interior Lighting Control Strategies

Partial Automatic ON

- No more than **half** of the general lighting power can be turned on automatically

Exception

- More than 50% of general lighting can be turned ON for open plan office control zones of ≤ 600 ft^2



Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Interior Lighting Control Strategies

Bi-Level Lighting

- At least one intermediate level
- Control Types:
  - Manual
  - Automatic
- Control Options:
  - Stepped Ballasts
  - Dual Ballasts
  - Separate Luminaires
  - Continuous Dimming

MINIMUM LIGHTING POWER STEPS		
Light Status	Light Level	% Lighting Power
ON	Full	100%
ON	Intermediate, X	30% ≤ X ≤ 70%
OFF	Zero	0%

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Interior Lighting Control Strategies

Automatic Control for Side Daylighting

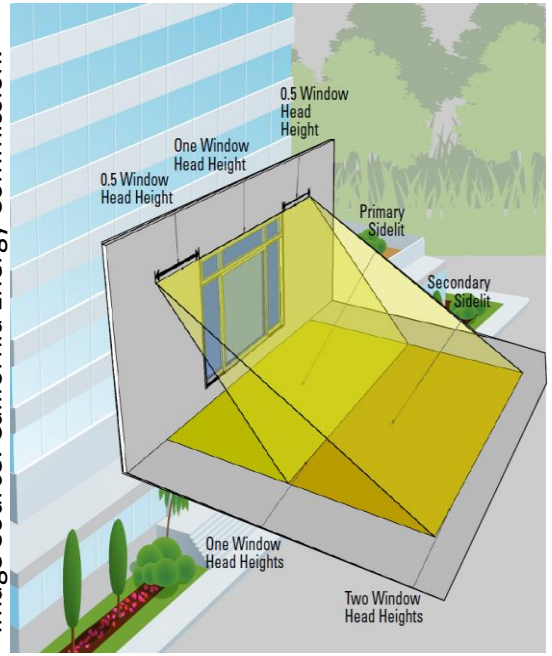


Image Source: California Energy Commission.

MINIMUM LIGHTING POWER for SIDE-LIGHTING CONTROL					
Power in Primary Side-lit Floor Area	Power in Primary & Secondary Side-lit Floor Areas	Primary Lit Floor Area Controlled	Secondary Lit Floor Area Controlled	Minimum Steps	
				ASHRAE 90.1-2013	ASHRAE 90.1-2019
≥ 150 W	< 300 W	Yes	No	100% 50% ≤ X ≤ 70% 20%≤ X ≤ 40% 0%	Continuous Dimming down to 20% or less and OFF
Any value	≥ 300 W	Yes	Yes		

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Interior Lighting Control Strategies

Automatic Control for Side Daylighting

ASHRAE 90.1-2013

- Controller readily accessible
- Control of secondary lighted area independent of primary lighted area

ASHRAE 90.1-2019

- Controller located ≤ 11 ft AFF
- Control of secondary lighted area independent of primary lighted area
- Controller must be coordinate with Automatic Partial OFF controller, if present
- Able to calibrated remotely

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Calculating Primary & Secondary Side-Lighted Areas

EXAMPLE

What is the size of the primary and secondary lighted areas for a space at the perimeter of a building has 8 unobstructed windows along the wall with the following dimensions:

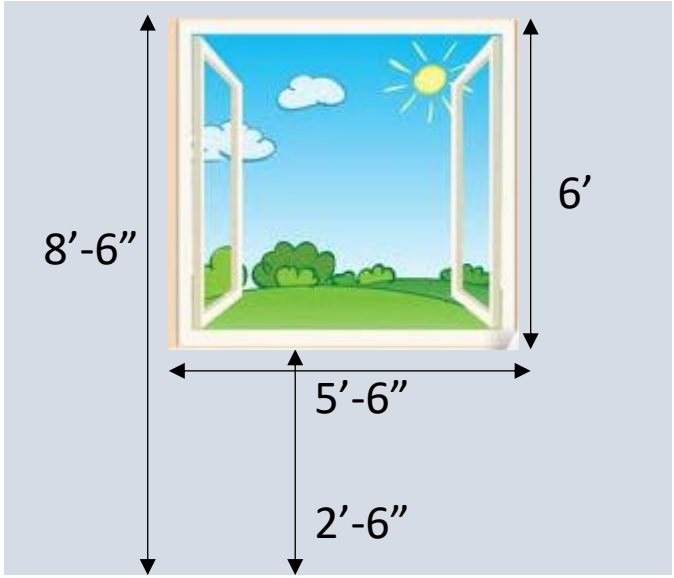
Window Height (WH)= 6’

Window Width (WW)= 5’-6”

Window Head Height (HH)= 8’-6”

Window Sill Height (SH)= 2’-6”

Window Spacing = 10’ on center



Michigan Energy Code Update: ASHRAE 90.1-2019

Calculating Primary & Secondary Side-Lighted Areas

EXAMPLE, continued

Primary Floor Area

= (HH x [WW + (2 x ½ HH)]) x Qty

= 8.5 x (5.5 + 2 x ½ x 8.5) x 8

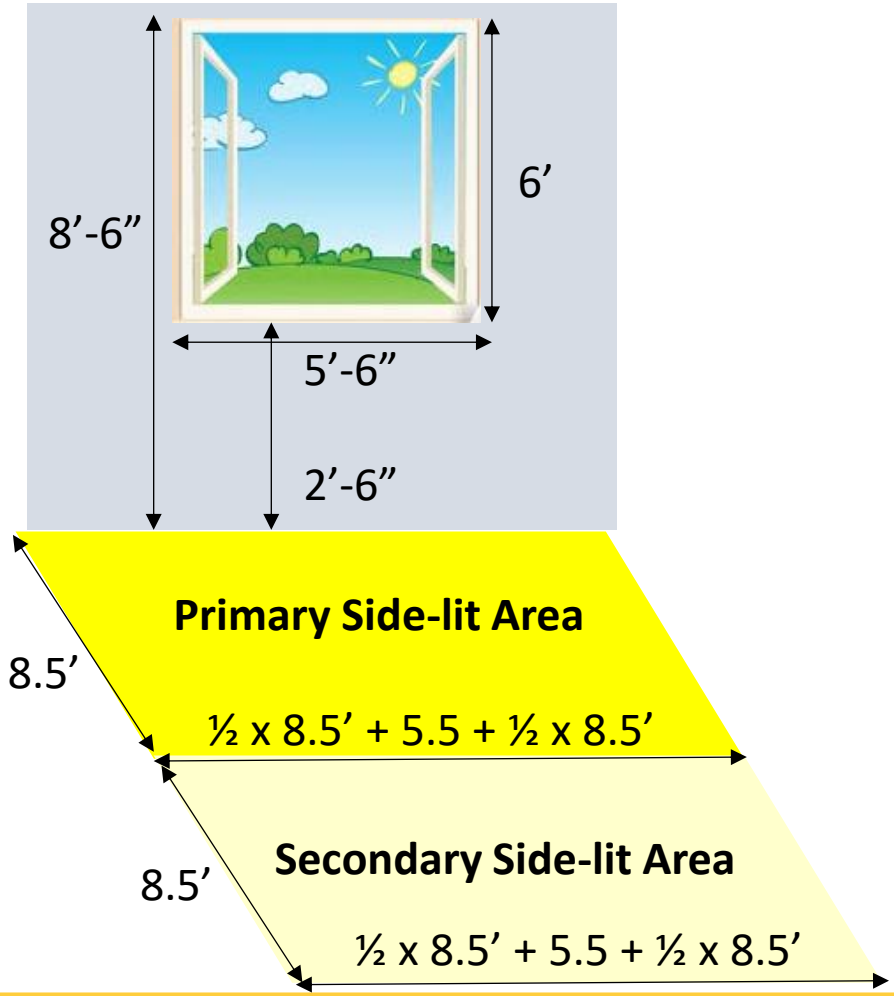
= 119 ft^2 per window x 8 windows

= 952 ft^2

Secondary Floor Area

= Primary Floor Area

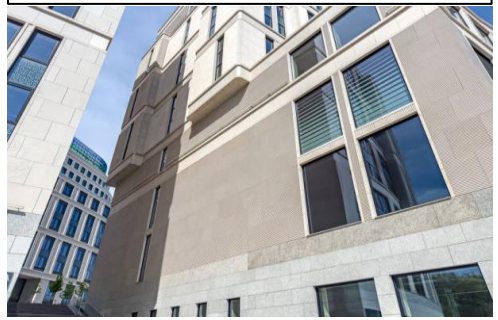
= 952 ft^2



Michigan Energy Code Update: ASHRAE 90.1-2019

Exemptions for Automatic Control of Side Daylighting

Side-lit areas shaded by an adjacent structure that is twice as high above the window as its horizontal distance from the window



Areas with total glazing of < 20 ft^2

Retail spaces

New

Spaces with external projections having a PF of > 1 if north-facing and >1.5 for all other orientations and no windows above the projection

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Minimum Skylight Fenestration

- In any enclosed space that is:
  - ≥ 2,500 ft^2
  - Directly under a roof with ceiling height > 15 ft
  - One of the listed spaces
- Total daylight area under skylights shall be ≥ half the floor area and either:
  - Provide ≥ 3% ratio of skylight area to daylight area under the skylights with a VT ≥ 0.4
  - Provide a skylight effective aperture of ≥ 1%
- Glazing material to have a haze value of ≥ 90%

Required in:

- Atrium
- Vehicle Service Areas
- Convention Centers
- Corridors
- Concourse
- Office
- Storage
- Fitness
- Playing
- Distribution & Sorting
- Gymnasia
- Lobby
- Manufacturing Bays
- Workshops
- Courtroom
- Automotive Service
- Fire Station Engine
- Library
- Retail
- Transportation
- Baggage & Seating

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Exceptions for which Skylights are not required:

1. Climate Zones 6 and 7
2. Enclosed spaces for which it is documented that daylight would be blocked annually for more than 1500 hours between 8 a.m. and 4 p.m.
3. Enclosed spaces where the daylight area under roof monitors is >50% of the enclosed floor area
4. Enclosed spaces for which it is documented that 90% of the skylight area would be shaded by permanent features of the building at 12 noon on Jun 21st
5. Enclosed spaces where the total area minus the primary and secondary side-lighted areas is < 2,500 ft^2 and the lighting is properly controlled for side day-lighting

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Interior Lighting Control Strategies

Automatic Control for Top Daylighting

MINIMUM LIGHTING POWER for TOP-LIGHTING CONTROL					
Power in Top-lit Floor Area	Top-lit Floor Area Controlled	Non-overlapped Side-lit Area Controlled	Overlapped Side-lit Area Controlled	Minimum Steps	
				ASHRAE 90.1-2013	ASHRAE 90.1-2019
≥ 150 W	Yes	with Side-Lighting	with Top- Lighting	100% 50% ≤ X ≤ 70% 20%≤ X ≤ 40% 0%	Continuous Dimming down to 20% or less and OFF

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Interior Lighting Control Strategies

Automatic Control for Top Daylighting

ASHRAE 90.1-2013

- Controller readily accessible

ASHRAE 90.1-2019

- Controller located ≤ 11 ft AFF
- Controller must be coordinate with Automatic Partial OFF controller, if present
- Able to calibrated remotely

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Exemptions for Automatic Control of Top Daylighting

ASHRAE 90.1-2013

- Day-lit areas significantly shaded by a permanent adjacent structure blocking direct sunlight :
  - More than 1500 hours per year, and
  - Between 8 am and 4 pm
- When VT of skylights is less than 0.4

ASHRAE 90.1-2019

- Day-lit areas significantly shaded by a permanent adjacent structure blocking direct sunlight :
  - More than 1500 hours per year, and
  - Between 8 am and 4 pm
- When skylight effective aperture for the space is < 0.006

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Definitions

visible transmittance, *n*. ratio of visible radiation entering space to the incident visible radiation. Certified value provided by manufacturer.

skylight effective aperture, *n*. overall visible transmittance of the roof via skylights. Calculated as:

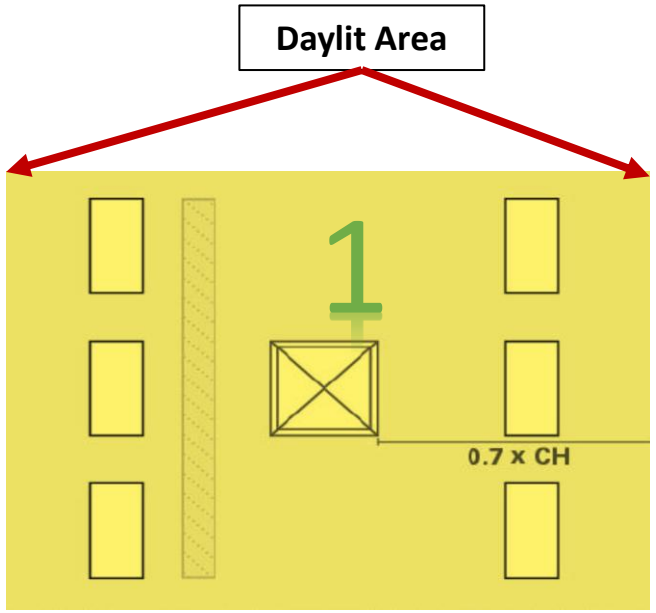
$$\frac{0.85 \times \text{Skylight Area} \times \text{Visible Transmittance} \times \text{WF}}{\text{Daylight floor area under skylight}}$$

Well Factor, WF =
0.9 for well depths < 2 ft or
0.7 for depths ≥ 2 ft

Michigan Energy Code Update: ASHRAE 90.1-2019

Calculating Daylight Area Under Skylights

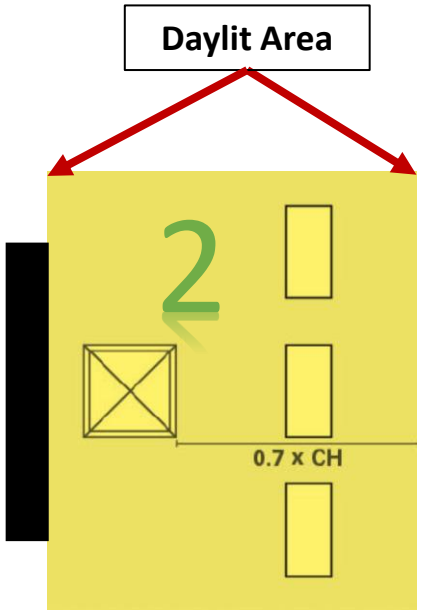
Daylit area is bound horizontally in each direction by the smaller of:



0.7 x CH

where CH is the ceiling height

OR



the nearest face of any opaque, vertical obstruction that is located at a distance, d, that is

$[0.7 \times (CH-OH)] \leq d \leq [0.7 \times CH]$

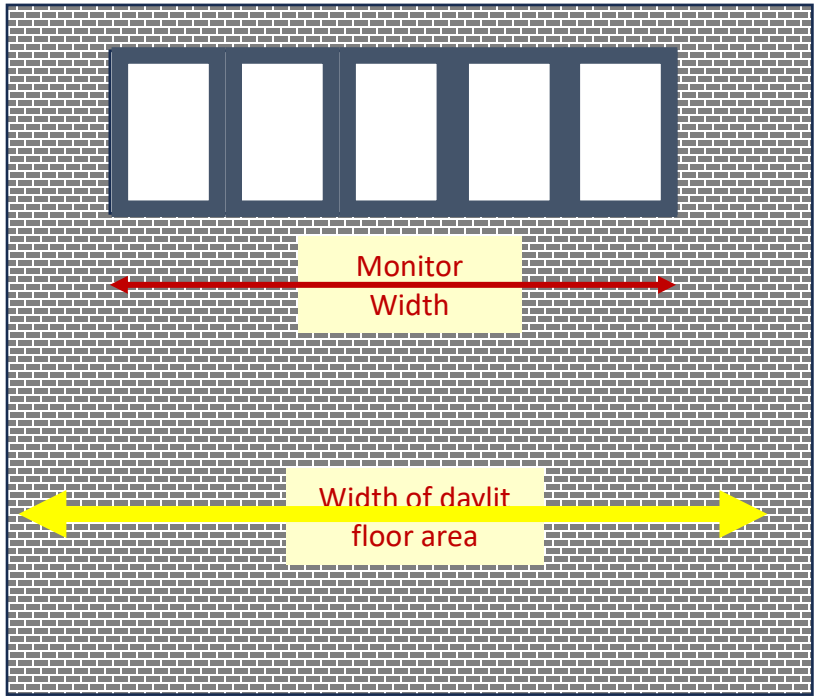
where OH is the height of the obstruction

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Calculating Daylight Area Under Roof Monitors and Clerestory Windows

Daylit Area Under Monitors = Width of daylit area x Horizontal Length of daylight area



Width of daylit area is

Monitor width plus the smaller of:

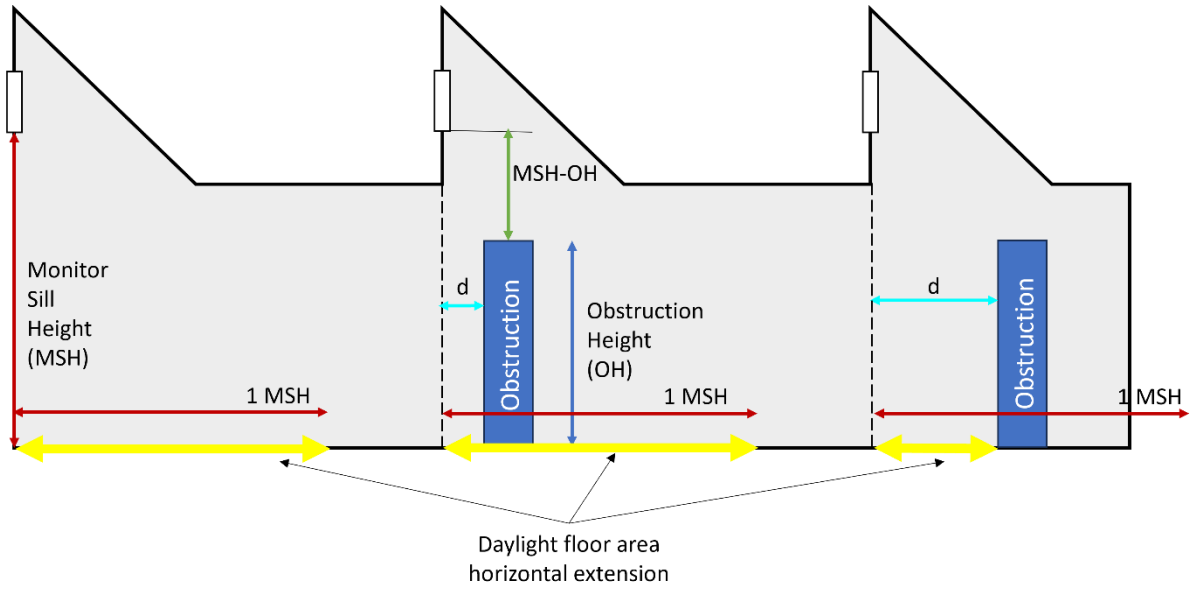
a) 2 ft
b) Distance to any vertical obstruction 5 ft or taller
c) Distance to edge of any primary side-lighted area

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Calculating Daylight Area Under Roof Monitors and Clerestory Windows

Daylit Area Under Monitors = Width of daylit area x Horizontal Length of daylight area



Horizonal Length of daylit area is

The smaller of:

a) Monitor sill height (MSH)
b) Distance to the nearest face of any opaque, vertical obstruction that is located at a distance, **d**, that is **(MSH-OH) ≤ d ≤ MSH**

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

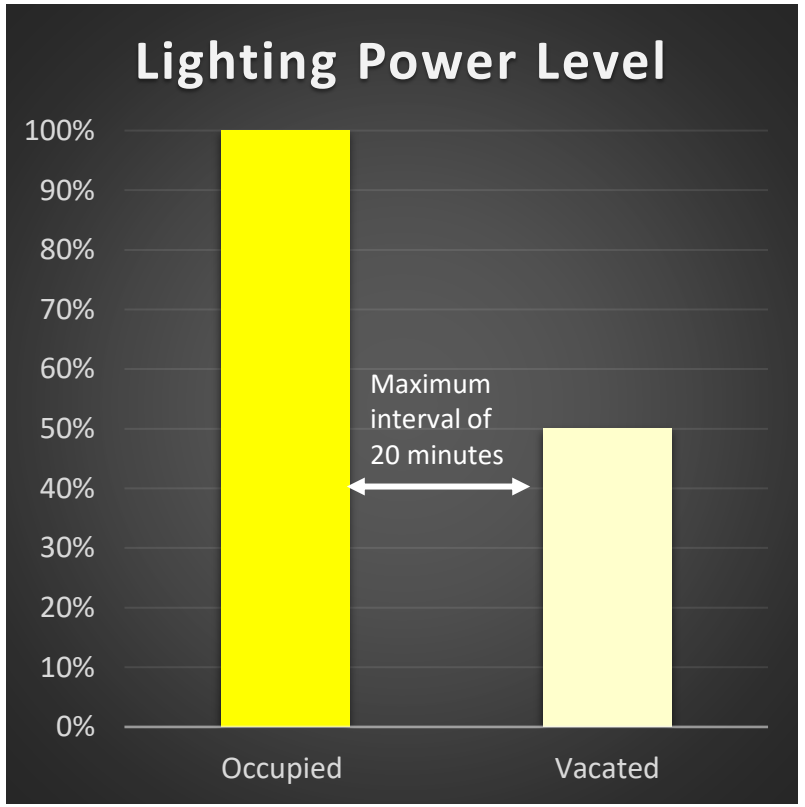
Criteria for Interior Lighting Control Strategies

Automatic Partial OFF

Automatically turn OFF **at least half** of the lighting power no later than 20 minutes after everyone leaves the space

Exceptions (all must be met):

- Space lighted by HIDs
- The space has an LPD ≤ 0.8W/ft^2
- General lighting power is automatically reduced by 30% no more than 20 minutes after everyone leaves the space
- Lighting load is ≤ 0.02 W/ft^2 x building gross lighted floor area



Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

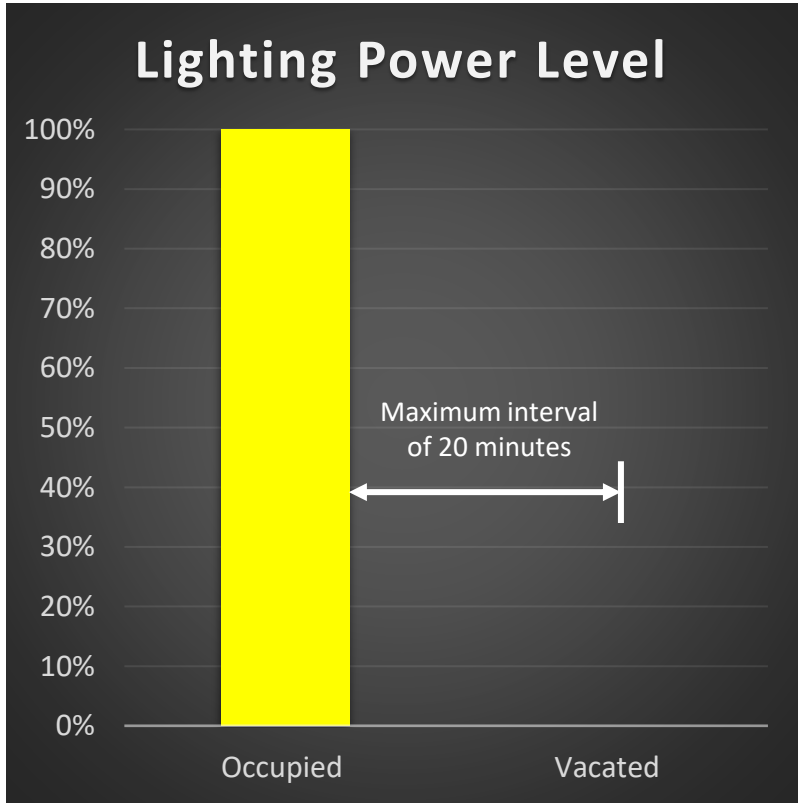
Criteria for Interior Lighting Control Strategies

Automatic Full OFF

- Automatically turn OFF **ALL** of the lighting power no later than 20 minutes after everyone leaves the space.
- Controlled areas must be ≤ 5,000 ft^2

Exceptions:

- General and task lighting in shop and laboratory classrooms
- General and task lighting in spaces where auto OFF would endanger safety or security
- Lighting required for 24/7 operation
- Lighting load is ≤ 0.02 W/ft^2 x building gross lighted floor area



Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

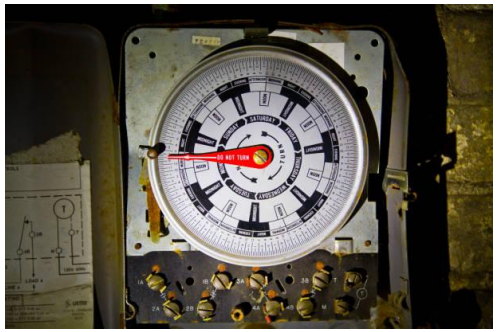
Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Interior Lighting Control Strategies

Scheduled OFF

All lighting automatically turned OFF when space is scheduled to be unoccupied



Control types:

- Time of day programming
- Signal from another device

Controlled area per controller:

- ≤ 25,000 ft^2
- 1 floor

Programmability:

- Weekdays
- Weekends
- Holidays

Optional Overrides:

- Time limit of 2 hours
- Controlled area of ≤ 5,000 ft^2

Exceptions:

- Lighting required for 24/7 operation
- Lighting in patient care areas
- Where auto shut OFF would endanger safety or security
- Lighting load is ≤ 0.02 W/ft^2 x building gross lighted floor area

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

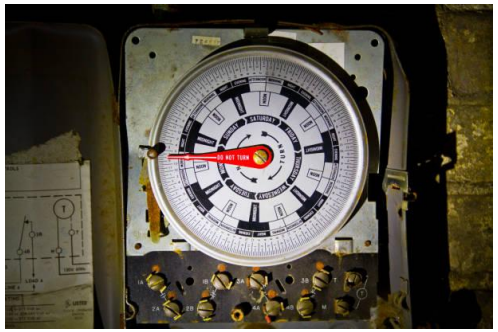
Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Interior Lighting Control Strategies

New

Scheduled OFF during non-business hours

Specialty lighting automatically turned OFF when business is scheduled to be closed



Applications:

- Decorative
- Art & Exhibits
- Sales

Control types:

- Time of day programming
- Signal from another device

Optional Overrides:

- Time limit of 2 hours

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Interior Lighting Control Strategies

Guestrooms

- Except where controlled by captive key cards, lighting and switched receptacles automatically turn off **20 minutes** after occupants leave the room.

- Except for night-lighting that is ≤ 5 W, bathrooms must have separate controller that automatically turns OFF bathroom lighting **30 minutes** after occupants have left the bathroom.

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Parking Garage Lighting Control Strategies

Scheduled OFF

- All lighting automatically turned OFF when space is scheduled to be unoccupied

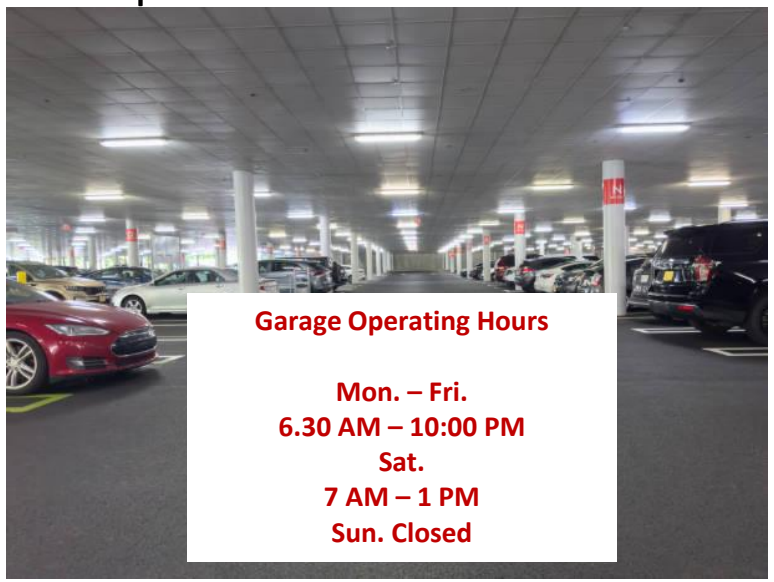
Control types:
- Time of day programming
- Signal from another device

Controlled area per controller:
- ≤ 25,000 ft^2
- ≤ 1 floor

Programmability:
- Weekdays
- Weekends
- Holidays

Optional Overrides:
- Time limit of 2 hours
- Area of ≤ 5,000 ft^2

Exceptions:
- Lighting required for 24/7 operation
- Where auto shut OFF would endanger safety or security



Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Parking Garage Lighting Control Strategies

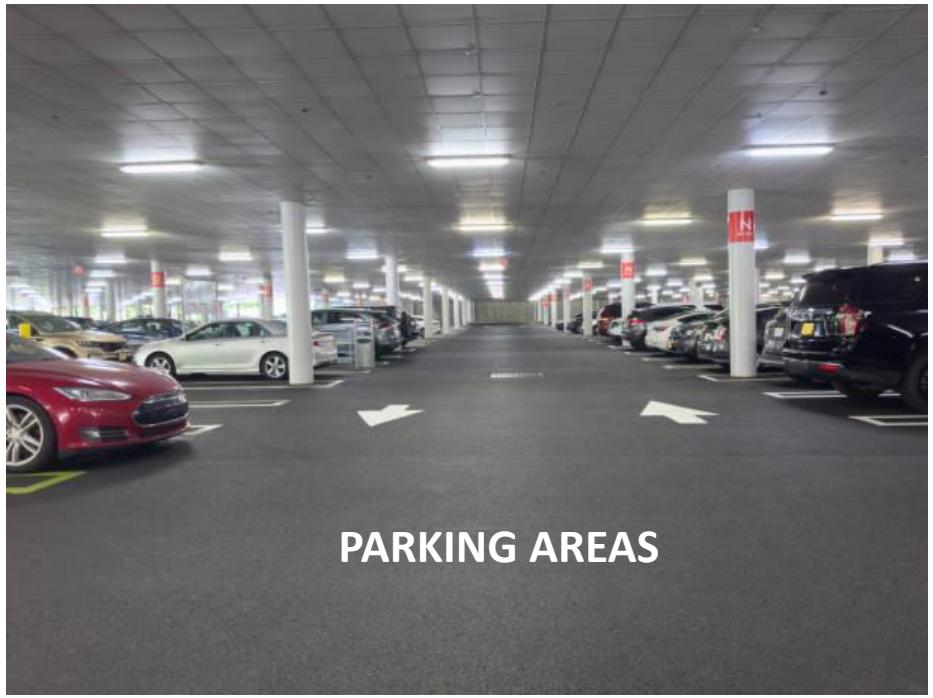
Automatic Partial OFF

Control Action	90.1-2013	90.1-2019
Reduction	30%	50%
Time Limit	20 min	10 min

- Control types:
  - Occupancy / Vacancy
- Area per controller:
  - ≤ 3,600 ft^2

Exceptions:

- Daylight transition zones
- Ramps without parking



Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Parking Garage Lighting Control Strategies

Day-light Responsive Control at Entrances and Exits

Control Action	90.1-2013	90.1-2019
Reduction	50%	≤ general lighting level
Time Period	sunset to sunrise	sunset to sunrise

- Controlled independent of the general lighting controls
- Control types:
  - Stepped
  - Continuous Dimming
- Control Methods:
  - Time Switch
  - Photosensor

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

- Transition Area Limits
  - 50 ft wide
  - 66 ft depth into structure

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Parking Garage Lighting Control Strategies

Exceptions:

- Day-light transition zones
- Ramps without parking
- Screen or architectural elements obstruct > 50% of the opening
- Height of adjacent structure or natural object is ≥ twice its horizontal distance

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Day-light Responsive at Perimeter

ASHRAE 90.1-2013

Luminaires within 20 ft of any perimeter wall having a net opening-to-wall area ratio ≥ 40% must have day-light responsive control that maintains the required illuminance level with the lowest sufficient power input.

ASHRAE 90.1-2019

Luminaires within 20 ft of any perimeter wall totaling at least **24 ft²** must have day-light responsive control that maintains the required illuminance level with the lowest sufficient power input using **continuous dimming**.

Michigan Energy Code Update: ASHRAE 90.1-2019

Example

Find: Compliant controls for a conference room

Excerpt of Table 9.6.1

SPACE TYPE	LPD, W/ft²	RCR Threshold	CONTROL STRATEGIES								
			Local Control	Manual ON	Partial Auto ON	Bi-Level Control	Auto Side Day Lighting	Auto Top Day Lighting	Automatic Partial OFF	Auto Full OFF	Scheduled Shut OFF
Banking Area	0.61	6	REQ	ADD 1	ADD 1	REQ	REQ	REQ		ADD 2	ADD 2
Conference Room	0.97	6	REQ	ADD 1	ADD 1	REQ	REQ	REQ		REQ	
Copy Room	0.31	6	REQ	ADD 1	ADD 1	REQ	REQ	REQ		REQ	

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Question

The full general power of a corridor remains on after it has been vacated for an hour during business hours. Are the lighting controls compliant? **No.**

Excerpt of Table 9.6.1

SPACE TYPE	LPD, W/ft²	RCR Threshold	CONTROL STRATEGIES								
			Local Control	Manual ON	Partial Automatic ON	Bi-Level Control	Automatic Daylight Side-Lighting Control	Automatic Daylight Top-Lighting Control	Auto Partial OFF	Auto Full OFF	Sched. OFF
Corridor, Visually Impaired	0.71	Width < 8 ft	REQ				REQ	REQ	REQ	ADD 2	ADD 2
Corridor, Hospital	0.71	Width < 8 ft	REQ				REQ	REQ	ADD 2	ADD 2	ADD 2
Corridor, All Other	0.41	Width < 8 ft	REQ				REQ	REQ	REQ	ADD 2	ADD 2

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Additional LPD Allowance Control Factors for Extra Controls

Excerpt of Table 9.6.3

Additional Control Method (in addition to mandatory requirements)	Open Office	Private Office	Conference Room[1]	Retail Sales	Lobby, Atrium, Corridor, Gym, Parking Garage[1]
Manual, Continuous Dimming, or Programmable Multi-level Dimming	0.05	0.05	0.10	0.10	Zero
Occupancy sensor for the downlight component of workstation luminaires with continuous dimming to OFF	0.30	Zero	Zero	Zero	Zero

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.
1. Applicable to additional space types as well.

Additional Power Allowance = Lighting Power Under Extra Control x Control Factor

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Additional LPD Allowance Control Factors for Extra Controls

Control Method in addition to mandatory requirements	ASHRAE	
	90.1-2013	90.1-2019
Manual, Continuous Dimming, or Programmable Multi-level Dimming	✓	✓
Programmable Multi-level Dimming using time scheduling	✓	✓
Occupancy sensor for the downlight component of workstation luminaires with continuous dimming to OFF	✓	✓
Occupancy sensor for the downlight component of workstation luminaires with continuous dimming to OFF and occupant continuous dimming	✓	✓
Automatic continuous daylight dimming in secondary side-lighted areas	✓	X

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Exterior Lighting Control Strategies

- Automatically turned OFF when sufficient daylight is available
- Time switches must have:
  - Battery Back-up
  - Flash memory or other storage means for up to 10 hours

- **Exceptions:**
  - Covered entrances and exits of building or parking structures
  - Light integral to signage and installed by the manufacturer.

EXTERIOR LIGHTING CONTROL		
BUILDING ELEMENT	**LIGHTING OFF**	**LIGHTING ON**
Façade and Landscaping	At the later of: • 12 midnight • Closing • Time established by AHJ When day-light is available	At the earlier of: • 6 am • Opening • Time established by AHJ

50%

BUILDING ELEMENT	**REDUCED BY AT LEAST 30%**	**LIGHTING ON**
Unspecified and Signage	At the later of: • 12 midnight • Within 1 hr of closing During any period with no activity for longer than 15 minutes	At the earlier of: • 6 am • Opening

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Exterior Lighting Control Strategies

Controls for luminaires > 78 W with mounting height ≤ 24 ft must automatically reduce power ≥ 50% when no activity has been detected for ≤ 15 minutes.

Maximum of 1500 W under a single controller.

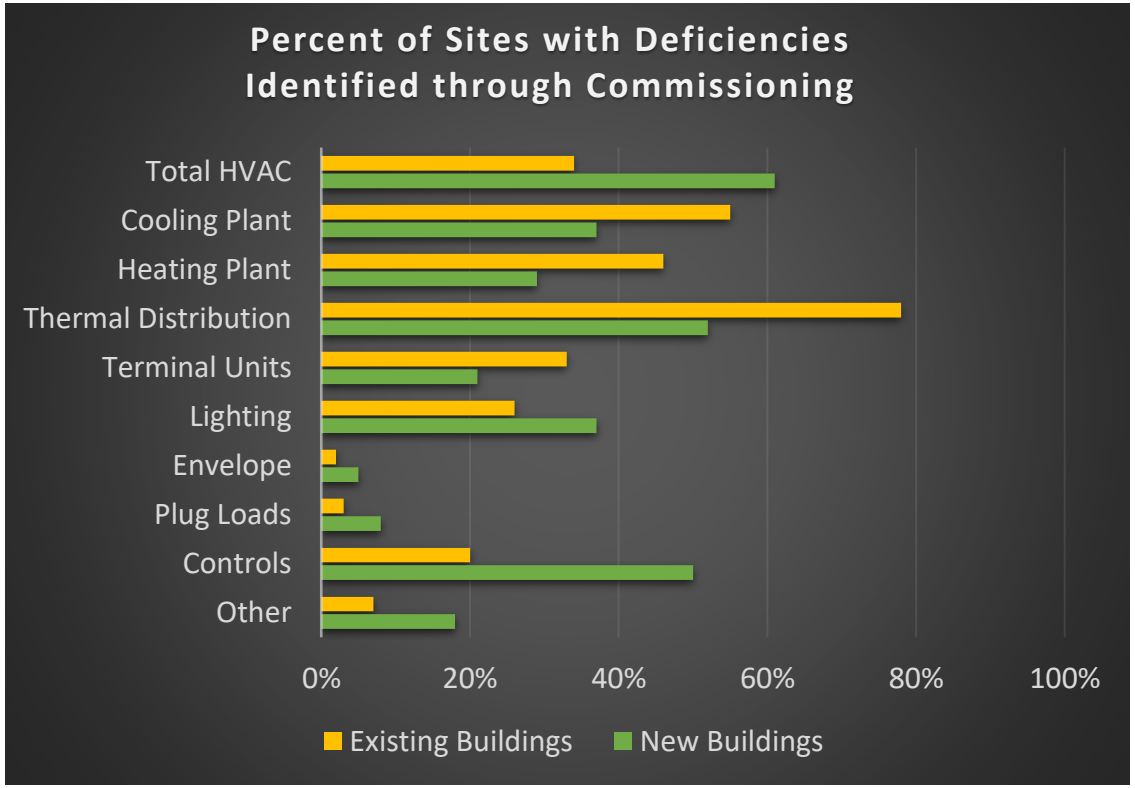
Data Source: ASHRAE 90.1-2013. See complete Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria of Function Testing for Lighting Controls

Lighting control devices and system is function tested to ensure all hardware and software is:

- Properly calibrated
- Properly located
- Properly adjusted
- Properly programmed
- Working in accordance with construction documents and manufacturers' instructions



Source: Data Source: ***Building Commissioning: A Golden Opportunity to Reducing Energy Costs and Green House Gas Emissions*** by Evan Mills, Ph.D. Lawrence Berkeley National Laboratory, 2009.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Who Can Perform Function Testing for Lighting Controls

ASHRAE 90.1-2013

"The individual(s) responsible for the functional testing **shall not be directly involved in either the design or construction of the project** and shall provide documentation certifying that the installed lighting controls meet or exceed all documented performance criteria."

ASHRAE 90.1-2019

"V&T providers shall not be individuals who performed design or installation of the systems or assemblies being verified or tested."

Acceptable V&T providers include:

- Owner's qualified employees
- Commissioning providers
- Design professionals
- Qualified designers
- Qualified technicians

Data Source: ASHRAE 90.1-2013 and 90.1-2019. Exceptions may apply. See Standards and or current MI Energy Code for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Functional Performance Testing Criteria for Occupancy Sensors

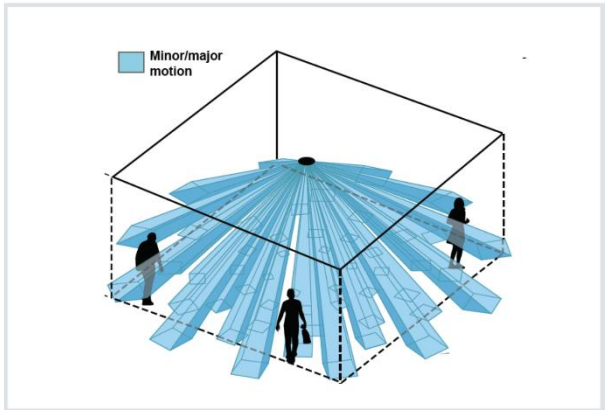
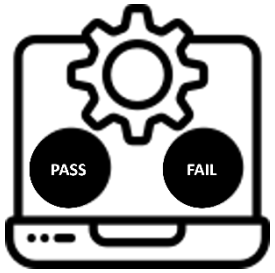


Image Source: Adapted from U.S. DOE



Test

- Status indicator operates
- Controlled lighting turns down to permitted level within required time
- Auto-ON operates properly
- Manual-ON operates properly
- Lights are not inadvertently turned on

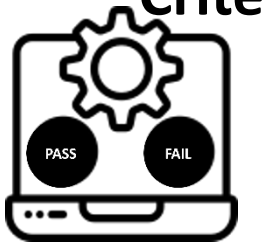
Certify

- Sensor located and aimed per manufacturer's recommendations

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

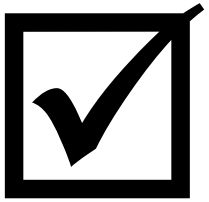
Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria of Function Testing for Automatic Time Switches



Test

- Proper operation of switches during simulated occupied condition
- Proper operation of overrides during simulated unoccupied condition
- All nonexempt lighting turns OFF during simulated unoccupied condition



Verify

- Programming with appropriate schedules for:
  - Weekdays
  - Weekends
  - Holidays
- Control switch operation
- Correct time and date
- Back-up batteries are installed and energized
- Override time limit is ≤ 2 hrs

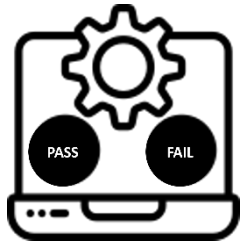
Document

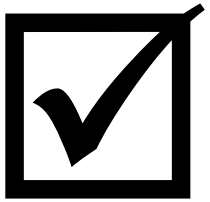
- Proper controls operation
- Programming
- Schedules
- Set-up
- Preference settings

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria of Function Testing for Daylight Responsive Controls





Test

- Controlled lighting adjusts to appropriate levels in response to available daylight

Verify

- Setpoints programmed
- Thresholds programmed
- All photocontrols are:
  - Properly located
  - Field calibrated
- Calibration location is readily accessible to maintenance personnel only
- Drawings show:
  - Sky-lit zones
  - Primary side-lit zones
  - Secondary side-lit zones

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

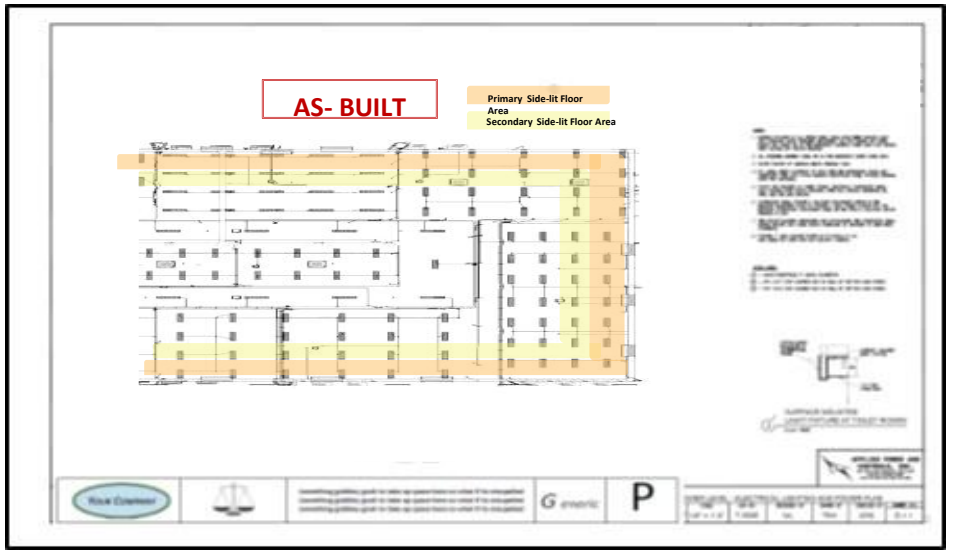
Michigan Energy Code Update: ASHRAE 90.1-2019

Submittals and Record Drawings

Submitted to the Owner or Owner's Representative more than 90 days after acceptance

As-built floor plans indicating, at a minimum, for **each piece of lighting equipment**, the following: :

- Location
- Luminaire Identifier
- Control
- Circuiting



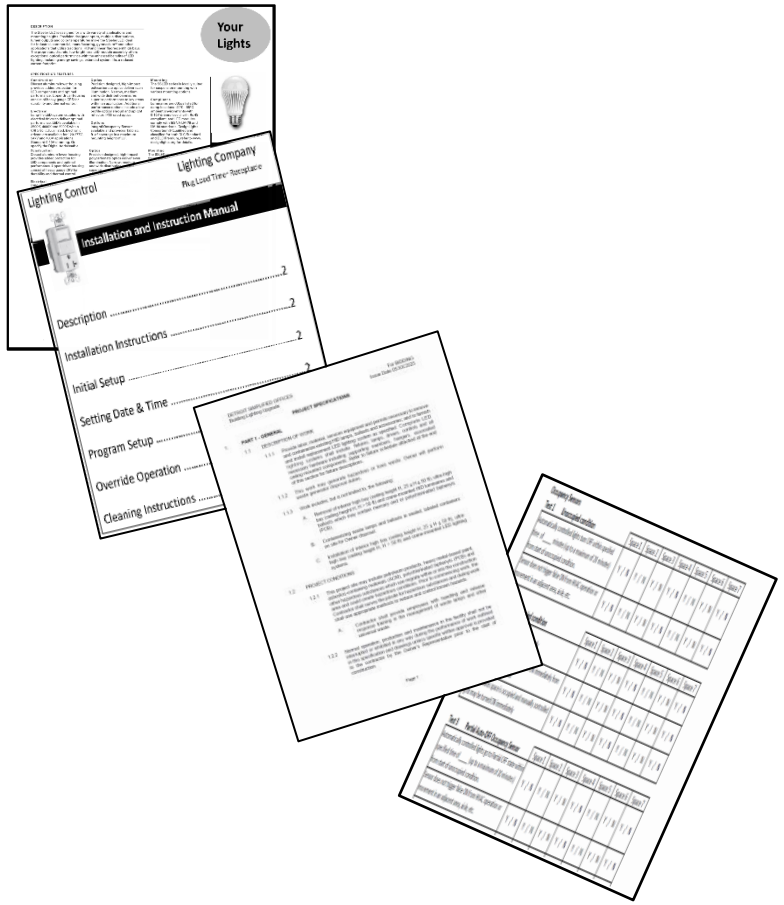
General lighting luminaires within daylight areas for:

- Skylights
- Roof Monitors
- Primary Side-light
- Secondary Side-light

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Documentation Requirements



Construction documents to require a system operating and maintenance manual supplied to the owner within 90 days of system acceptance:

- Submittal Data or rating and installed options for all lamps, ballasts, drivers, and controls
- Operation & Maintenance Manual with recommendations for re-lamping, cleaning, inspection and recalibration
- Operation Narrative with sequence of operation and setpoints

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Checklist Aids for Compliance

Interior Lighting Controls (Section 9.4.1.1)

Space ID	Building Type/Space Type (Table 9.6.1)	Control Function									
		Local Control—Section 9.4.1.1	Restricted to Manual ON—Section 9.4.1.1	Restricted to Partial Automatic ON—Section 9.4.1.1	Bilevel Lighting Control—Section 9.4.1.1	Automatic Daylight Responsive Controls for Sidelighting—Section 9.4.1.1	Automatic Daylight Responsive Controls for Toplighting—Section 9.4.1.1	Automatic Partial OFF (Full OFF complies)—Section 9.4.1.1	Automatic Full OFF—Section 9.4.1.1	Scheduled Shutoff—Section 9.4.1.1	Scheduled Off during non-business hours—
		a	b	c	d	e	f	g	h	i	j
		○	○	○	○	○	○	○	○	○	○
		○	○	○	○	○	○	○	○	○	○
		○	○	○	○	○	○	○	○	○	○
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		○	○	○	○	○	○	○	○	○	○
		○	○	○	○	○	○	○	○	○	○
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		○	○	○	○	○	○	○	○	○	○

Source of Images: Adapted from ASHRAE 90.1

Available at www.ashrae.org

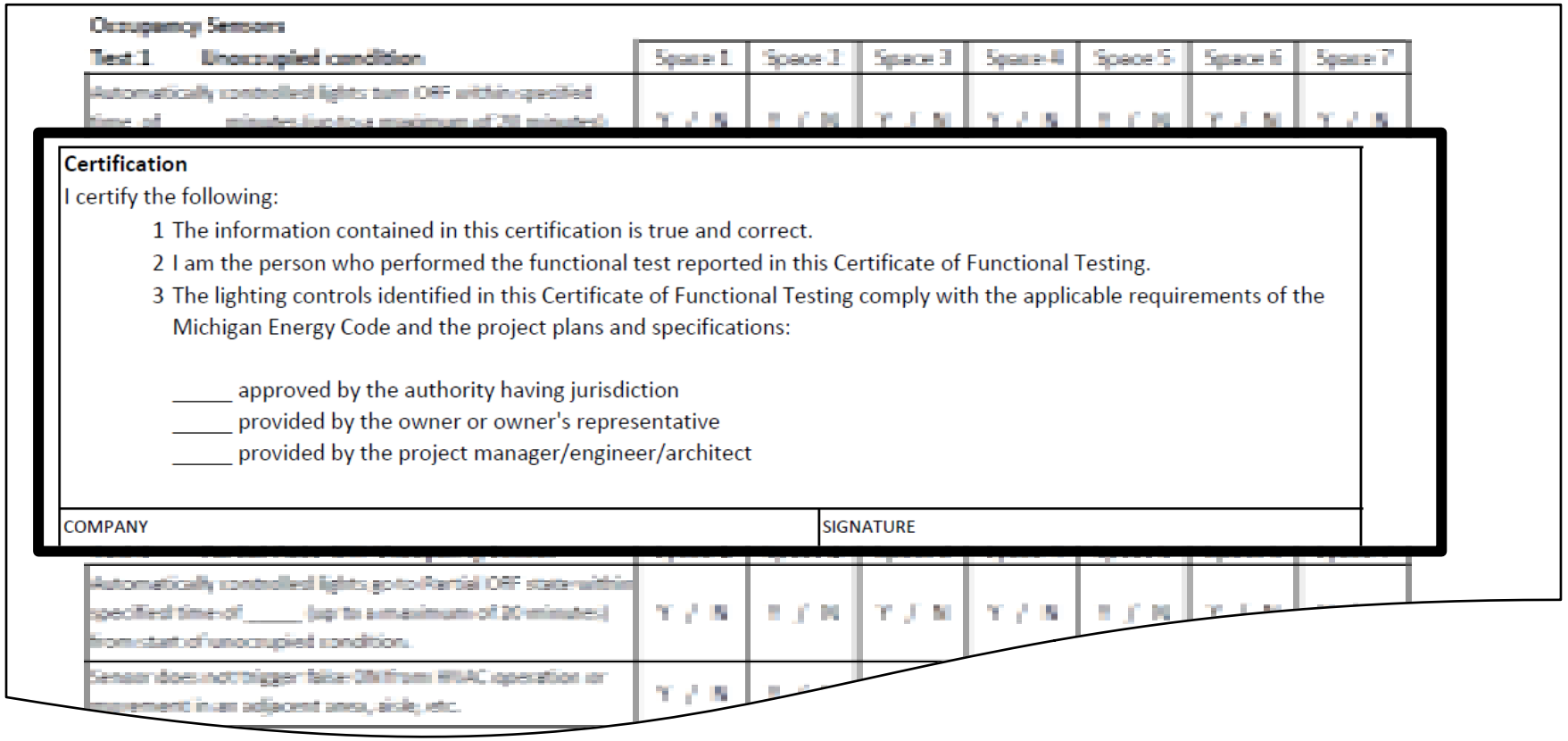
Search for:

90.1-2019 Lighting Compliance Form

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Example Lighting Function Test Reporting Form



Certification

I certify the following:

1 The information contained in this certification is true and correct.

2 I am the person who performed the functional test reported in this Certificate of Functional Testing.

3 The lighting controls identified in this Certificate of Functional Testing comply with the applicable requirements of the Michigan Energy Code and the project plans and specifications:

_____ approved by the authority having jurisdiction
_____ provided by the owner or owner's representative
_____ provided by the project manager/engineer/architect

COMPANY	SIGNATURE

Lighting in Section 10 – OTHER EQUIPMENT

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Elevator Lighting

- The total efficacy of all cab general lighting, not including signals and displays, to be ≥ 35 lm/W
- When stopped and unoccupied with doors closed for ≥15 minutes, cab interior lighting to de-energize
- Design Documentation
  - ISO 25745-2 Use Category
  - ISO 25745-2 Energy Efficiency Class

New

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

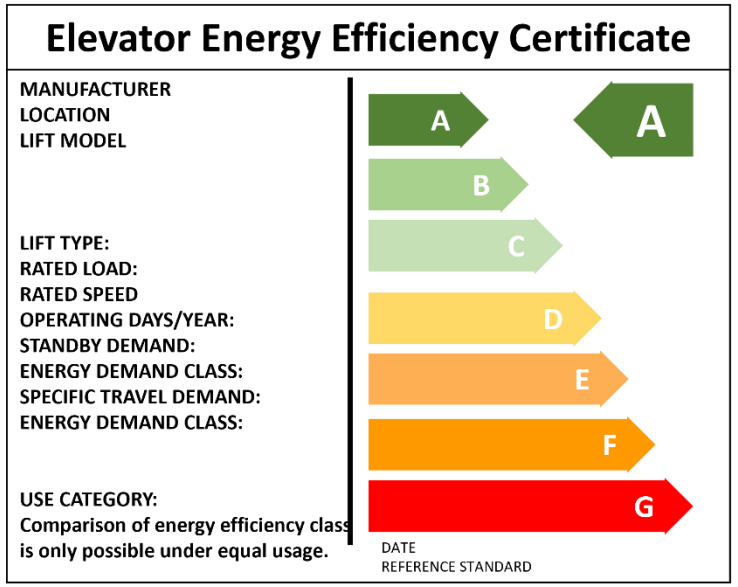
New

Design Documentation Criteria for Elevators

Use Category

Use Category	Use Intensity	Trips per Day
1	Very Low	<75
2	Low	75 ≤ X < 200
3	Medium	200 ≤ X < 500
4	High	500 ≤ X < 1000
5	Very High	1000 ≤ X < 2000
6	Extremely High	≥ 200

Energy Efficiency Class



Data Source: ASHRAE 90.1-2019 and ISO 25745-2. Exceptions may apply. See Standards for complete details.

Questions

Coffee Break

Section 6 – HVAC

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

HVAC Provisions Apply to:

New Construction

- Heating
- Ventilation
- Air-Conditioning
- Refrigeration
- Ductwork
- Piping

Additions

- New Equipment

Alterations

- Direct Replacements
- Equipment for previously uncooled spaces
- Ductwork
- Piping

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New Criteria for Direct HVAC Equipment Replacements

Direct replacements must comply with the following criteria as applicable:

- Simplified Approach for HVAC Systems
- Equipment Efficiencies, Verification & Labeling
- Fan efficiency
- Walk-In Coolers & Walk-In Freezers
- Fractional Horsepower/ Kilowatt Fan Motors
- Zone Thermostatic Controls
- Set Point Overlap Restrictions
- OFF-Hour Controls
- Ventilation System Controls
- Freeze Protection and Snow/Ice Melt Systems
- Ventilation Controls for High Occupancy Areas
- Heated or Cooled Vestibules
- Air Economizers
- Integrated Economizer Control
- Economizer Heating System Impact
- Supply Fan Airflow Control
- Boiler Turndown
- Chiller and Boiler Isolation
- Fan Speed Control

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Exceptions for Alterations

Direct replacements need not comply when:

- Alteration is a modification or repair only and results in no increase in annual energy use
- Alteration is a like-for-like replacement and requires extensive revisions to other systems
- Alteration is a refrigerant change to existing equipment
- Alteration is a relocation of existing equipment
- Alteration is to ducts and piping where there is not enough space or access to meet these requirements

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

COMPLIANCE PATHS for HVAC SYSTEMS & CONTROLS						
Section		Path Options				
		3. Simplified Approach	5. Prescriptive Path	6. Alternate Compliance	Energy Cost Budget	Performance Rating Method
1	General	●	●	●	●	●
4	Mandatory		●	●	●	●
7	Submittals	●	●	●	●	●
8	Equipment Efficiencies	●	●	●	●	●
9	Verification, Testing, and Commissioning	●	●	●	●	●

New

New

New Section

New Path

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Compliance Path Criteria

6.4 Mandatory Provisions

- Min Equip Efficiencies
- Calculations
- Controls & Diagnostics
- HVAC System Construction & Insulation
- Walk-in Coolers & Freezers
- Refrigerated Display Cases
- Liquid-to-liquid HXs

6.5 Prescriptive Path

- Economizers
- Simultaneous Heating & Cooling Limitations
- Air System Design & Control
- Hydronic System Design & Control
- Heat Rejection Equipment
- Energy Recovery
- Exhaust Systems
- Radiant Heating Systems
- Hot Gas Bypass Limitations
- Door Switches
- Refrigeration Systems

6.4 Alternate Compliance

- Computer Room Systems

6.3 Simplified Approach

- Small Buildings

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC Simplified Approach

- Buildings ≤ 2 stories in height
- Gross floor area < 25,000 ft^2
- Heating equipment restricted to:
  - Unitary and split heat pumps
  - PTAC, PTAC-HP
  - Room A/C
  - Furnace, Unit Heater, or Duct Furnace
  - Boiler
- Cooling equipment restricted to:
  - Air-cooled unitary or split A/C or HP
  - Evaporatively-cooled unitary or split A/C or HP
  - PTAC, PTAC-HP

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for HVAC Simplified Approach

- System serves single zone
- Variable airflow per 6.5.3.2.1
- Cooling equipment restrictions & efficiency requirements
- Economizer per 6.5.1 and **6.4.3.12**
- Heating equipment restrictions & efficiency requirements
- Exhaust air energy recovery per 6.5.6.1
- Manual changeover or dual setpoint thermostat
- Heat pump auxiliary heat restrictions
- No reheat or simultaneous heating & cooling for humidity control
- 7-Day programmable thermostatic control for systems of a certain size
- **Automatic control for hotel/motel guestrooms in facilities with > 50 guest rooms**
- Piping insulation
- Plenum and ductwork sealing and insulation
- Construction documents to require TAB
- Outdoor & exhaust air intakes per 6.4.3.4
- No simultaneous heating & cooling
- Optimum start control when supply air >10,000 cfm
- Demand controlled ventilation per 6.4.3.8
- **Occupied standby controls per 6.5.3.8**
- **Ventilation design requirements per 6.5.3.7**
- Door Switches per 6.5.10

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

HVAC Mandatory Provisions

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

Additions and Deletions to Tabulated HVAC Equipment Efficiencies

Additional Equipment

- Indoor Pool Dehumidifiers
- DX-DOAS Units
  - with Energy Recovery
  - without Energy Recovery
- Water –Source Heat Pumps
- Heat Pump & Heat Recovery Chillers
- Ceiling mounted CRAC Units
- Walk-In Coolers & Freezers
  - with Display Door
  - without Display Door
- Refrigeration System for Walk-In Coolers & Freezers
- Warm-Air Furnaces for outside the U.S.

Removed Equipment

- Liquid-to-liquid Heat Exchangers

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Criteria for HVAC Equipment Efficiencies

- Change in table numbering system
- Improvement in minimum efficiencies
- Updates to efficiency reporting
- Additions and removals of listed equipment

Updated efficiencies

New units of measure

Table 6.8.1-1 Electrically Operated Unitary Air Conditioners and *Condensing Units*—Minimum *Efficiency* Requirements

Equipment Type	Size Category	Heating Section Type	Subcategory or Rating Condition	Minimum *Efficiency*	Test Procedure[a]
Air conditioners, air cooled	<65,000 Btu/h[b]	All	Split *system*, three phase and applications outside U.S. single phase [b]	13.0 *SEER* before 1/1/2023 13.4 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single-package, three phase and applications outside U.S. single phase [b]	14.0 *SEER* before 1/1/2023 13.4 *SEER2* after 1/1/2023	
Space constrained, air cooled	≤30,000 Btu/h[b]	All	Split *system*, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 11.7 *SEER2* after 1/1/2023	AHRI 210/240-2017 before 1/1/2023 AHRI 210/240-2023 after 1/1/2023
			Single package, three phase and applications outside U.S. single phase [b]	12.0 *SEER* before 1/1/2023 11.7 *SEER2* after 1/1/2023	

Image Source: adapted from ASHRAE 90.1-2013

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

NEW METRIC

SEER2

- Calculated the same as SEER
- SEER2 = Season Btu Output/Seasonal Electric Energy Input
- Test conditions changed

Data	Old Test Criteria	New Test Criteria
External Static Pressure	01. – 0.2 in. wc.	0.50 in. wc.
Fan Power (Coil Only Units)	365 W per 1000 cfm	441 W per 1000 cfm
Heating Test Conditions	47 °F and 17 °F	47 °F, 17 °F and 5 °F
Heating Load Start Point	65 °F	55 °F
Building Load Line Slope	0.77	Fixed Speed: 1.15 Variable Speed: 1.07

Michigan Energy Code Update: ASHRAE 90.1-2019

Options for Minimum Chiller Efficiencies

Equipment Type	Size Category	Units	Path A	Path B
Air Cooled Chiller	< 150 tons	EER	10.100 FL 13.700 IPLV.IP	9.700 FL 15.800 IPLV.IP
	≥ 150 tons	EER	10.100 FL 14.000 IPLV. IP	9.700 FL 16.100 IPLV. IP
Water-cooled, electric, centrifugal	≥ 150 tons, < 300 tons		0.610 FL 0.550 IPLV. IP	0.635 FL
	≥ 300 tons, < 400 tons	kW/ton	0.560 FL 0.520 IPLV. IP	0.595 FL 0.390 IPLV. IP
	≥ 400 tons, < 600 tons	kW/ton	0.560 FL 0.500 IPLV. IP	0.585 FL 0.380 IPLV. IP
	≥ 600 tons	kW/ton	0.560 FL 0.500 IPLV. IP	0.585 FL 0.380 IPLV. IP

Data Source: Excerpted from ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Calculating Efficiencies for Non-Standard Performance Conditions for Chillers

$$FL_{adj} = \frac{FL}{K_{adj}} \qquad PLV_{adj} = \frac{IPLV}{Kad} \qquad K_{adj} = A \times B$$

$$A = 0.00000014592 \times Lift^4 - 0.0000346496 \times Lift^3 + 0.00314196 \times Lift^2 - 0.147199 \times Lift + 3.93073$$

$$B = 0.0015 \times Lvg\ ChWT_{FL} + 0.934$$

FL_{adj} = Maximum full load kW/ton adjusted for nonstandard conditions
PLV_{adj} = Maximum part load kW/ton adjusted for nonstandard conditions
Lift = LvgCondWT - LvgChWT, °F

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Applying Non-Standard Performance Conditions for Chillers

ASHRAE 90.1-2013

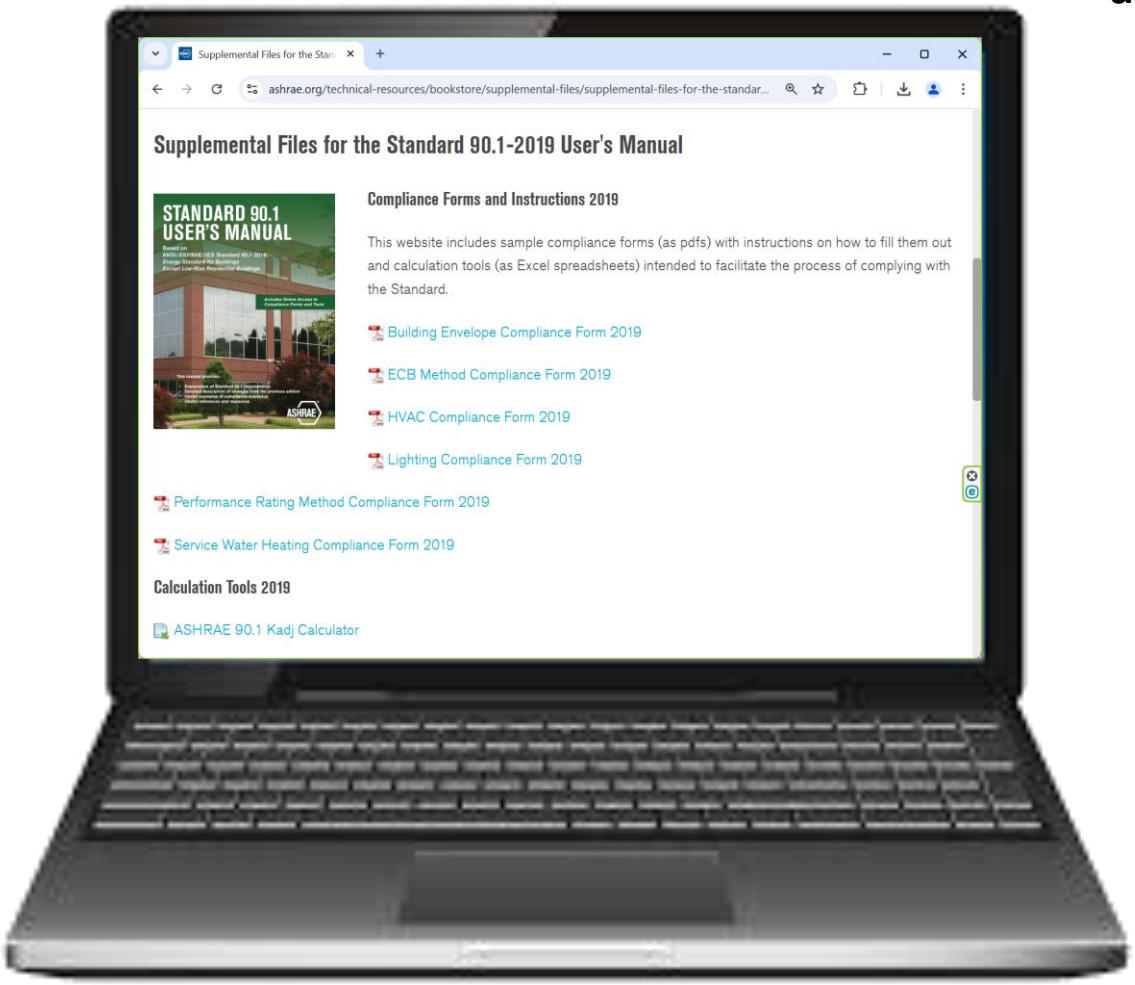
- Min LChWT = 36 °F
- Max ECWT = 115 °F
- 20 °F≤ Lift ≤ 80 °F

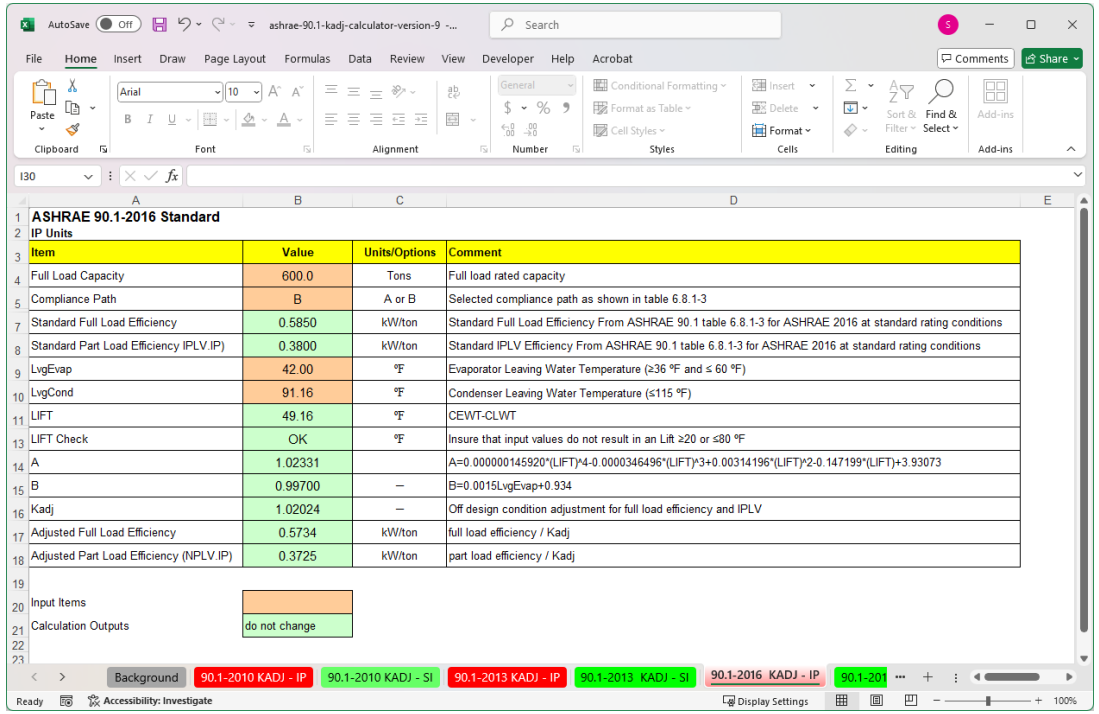
ASHRAE 90.1-2019

- 36 °F≤ LChWT ≤ 60 °F
- Max ECWT = 115 °F
- 20 °F≤ Lift ≤ 80 °F

Michigan Energy Code Update: ASHRAE 90.1-2019

ASHRAE K_{adj} Calculator





ASHRAE 90.1-2016 Standard
IP Units

Item	Value	Units/Options	Comment
Full Load Capacity	600.0	Tons	Full load rated capacity
Compliance Path	B	A or B	Selected compliance path as shown in table 6.8.1-3
Standard Full Load Efficiency	0.5850	kW/ton	Standard Full Load Efficiency From ASHRAE 90.1 table 6.8.1-3 for ASHRAE 2016 at standard rating conditions
Standard Part Load Efficiency IPLV.IP)	0.3800	kW/ton	Standard IPLV Efficiency From ASHRAE 90.1 table 6.8.1-3 for ASHRAE 2016 at standard rating conditions
LvgEvap	42.00	°F	Evaporator Leaving Water Temperature (≥36 °F and ≤ 60 °F)
LvgCond	91.16	°F	Condenser Leaving Water Temperature (≤115 °F)
LIFT	49.16	°F	CEWT-CLWT
LIFT Check	OK	°F	Insure that input values do not result in an Lift ≥20 or ≤80 °F
A	1.02331		A=0.000000145920*(LIFT)^4-0.0000346496*(LIFT)^3+0.00314196*(LIFT)^2-0.147199*(LIFT)+3.93073
B	0.99700	–	B=0.0015LvgEvap+0.934
Kadj	1.02024	–	Off design condition adjustment for full load efficiency and IPLV
Adjusted Full Load Efficiency	0.5734	kW/ton	full load efficiency / Kadj
Adjusted Part Load Efficiency (NPLV.IP)	0.3725	kW/ton	part load efficiency / Kadj

Input Items
Calculation Outputs — do not change

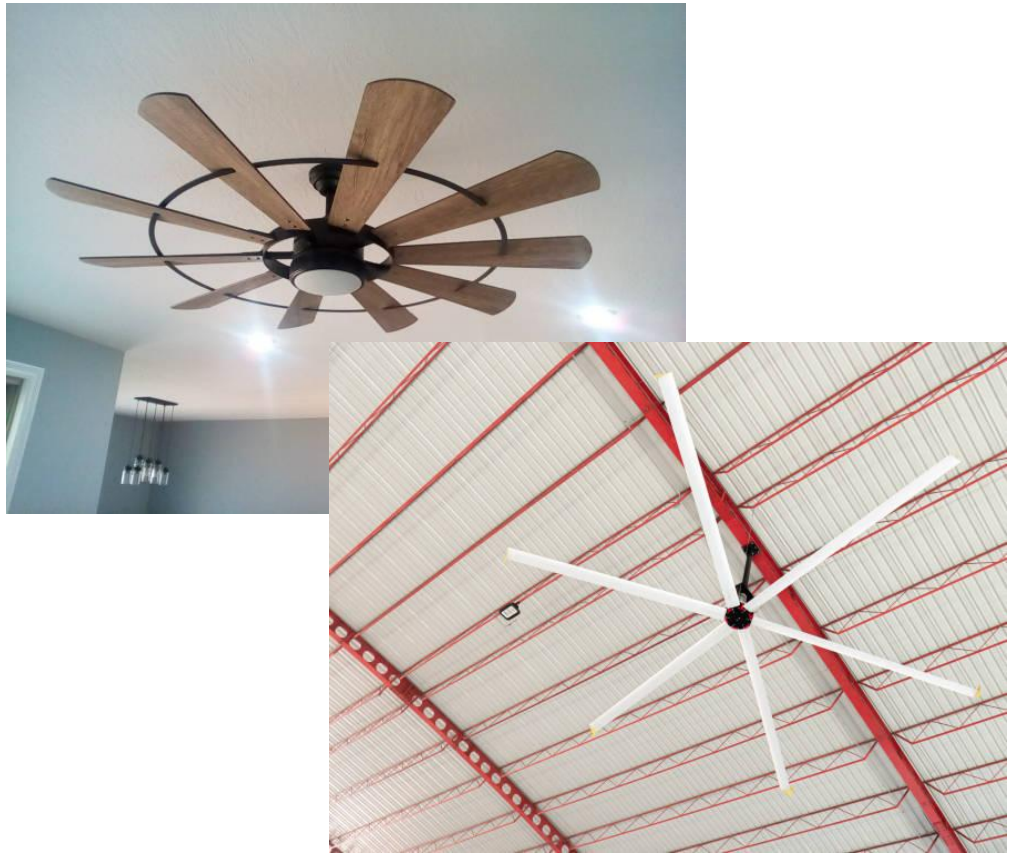
http://ashrae.org/UM90.1-2019

Data Source: ASHRAE 90.1-2019 User Manual. Exceptions may apply. See Manual for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Ceiling Fans



Large Diameter Ceiling Fans

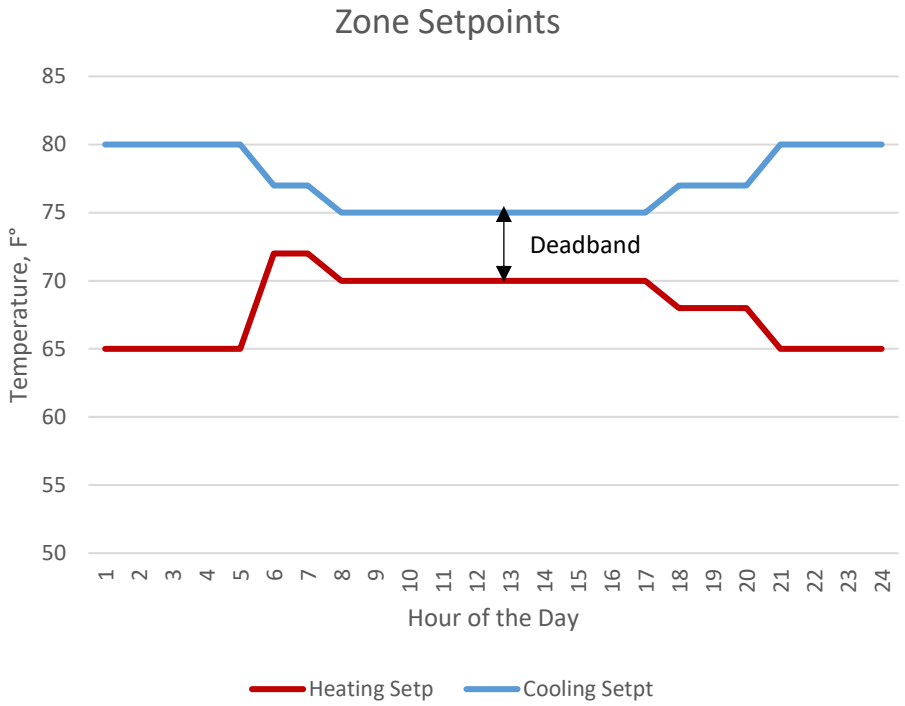
- Rated per AMCA 230 or 10 CFR 430
- Provide:
  - Blade tip diameter
  - Rated airflow at max speed
  - Rated power consumption at max speed
- Data must meet one of the following:
  - Rated by independent laboratory
  - Listed in U.S. DOE database
  - Certified per 6.4.1.5

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC Thermostatic Controls: Deadband

When controlling both heating and cooling, zone controls require deadband of ≥ 5°F in which both heating and cooling energy is either OFF or at a minimum.



Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC Thermostatic Controls: Setpoint Overlap Restriction

When separate controllers control a single zone, means must be provided to prevent the heating setpoint from exceeding the cooling setpoint minus any deadband.

$$T_H \leq T_C - DB$$

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC Thermostatic Controls: OFF-Hour Controls

Buildings are required to have OFF-Hour Controls

Exceptions:

- HVAC systems intended to operate 24/7
- Systems with readily accessible manual controls and a design heating capacity < 15 MBH

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC OFF-Hour Thermostatic Controls: Automatic Shutdown

OPTION 1

- 7-day programmable controller
- Retain programming and time setting during power loss of 10 days
- Manual override for up ≤ 2 hours

OPTION 2

- Occupant sensor that shuts OFF system within 30 minute of occupants vacating space

OPTION 3

- Manual timer that operates system for ≤ 2 hours

OPTION 4

- Security system interlock that shuts down HVAC system wen security system is activated

Exceptions:

Residential occupancies can use 2-day programmable controls

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC OFF-Hour Thermostatic Controls: Setback

Heating Systems

- Automatically restart and operate system to maintain zone temperature above an adjustable setpoint ≥ 10°F below the occupied setpoint.

Cooling Systems

- Automatically restart and operate mechanical cooling system to maintain zone temperature below an adjustable setpoint ≥ 5°F above the occupied setpoint.

Exceptions:

Minimum setback for radiant heating systems is 4°F

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC OFF-Hour Thermostatic Controls: Optimum Start

DDC systems with setback control are required to also have Optimum Start based on (a) the differential between space temperature and the occupied setpoint and (b) the time prior to occupancy.

Mass radiant floor slab systems must include floor temperature in the algorithm.

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for HVAC OFF-Hour Thermostatic Controls: Zone Isolation

- Separate zones not intended to be occupied simultaneously can be grouped into a single isolation zone.
- Maximum isolation zone size is 25,000 ft^2
- Isolations Zones can span only 1 floor
- Each isolation zone must have an isolating device per 6.4.3.3.1 to automatically shut OFF conditioned air, outdoors air, and exhaust air to/from the zone.
- For central systems, controls must provide stable operation while serving the only smallest isolation zone for any length of time

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Exceptions to Zone Isolation

Controls and isolation devices are not required for:

- Exhaust and outdoor air of isolation zones when the connected fan systems ≤ 5,000 cfm
- Exhaust air from a single isolation zone that is < 10% of the connected system design exhaust airflow
- Zones intended to operate continuously
- Zones intended to be inoperative only when all other zones are also inoperative

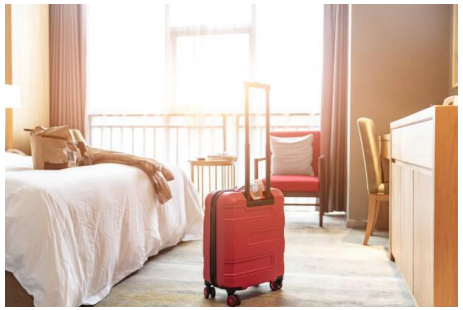
Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for HVAC OFF-Hour Thermostatic Controls: Hotel Rooms

Hotels with > 50 guestrooms are required to have automatic controls for the HVAC equipment in each guest room.



Unrented Unoccupied	Rented Unoccupied	Rented Occupied
Cooling Setpoint: ≥ 80 °F **Heating Setpoint:** ≤ 60 °F **Setpoint Start:** Within 16 hours of continuous vacancy, or 20 minutes for networked control	**Cooling Setpoint:** Renter setpoint + 4°F or more **Heating Setpoint:** Renter setpoint - 4°F or more **Setpoint Start:** Within 20 minutes of vacancy	**Cooling Setpoint:** Renter's setpoint **Heating Setpoint:** Renter's setpoint **Setpoint Start:** Upon sensing occupancy

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Exceptions to Thermostatic Controls for Hotel Rooms

- Networked guestroom controls are allowed to turn room thermostat to the building management's default occupied setpoint 60 minutes prior to scheduled occupancy
- Cooling for humidity control is permitted during unrented/unoccupied and rented/unoccupied periods.

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Ventilation System Controls: Hotel Rooms

When the hotel room is rented but unoccupied, .

Rented Unoccupied	
OPTION 1 **Ventilation Fan Status:** OFF **Exhaust Fan Status:** OFF **Setpoint Start:** Within 20 minutes of vacancy	**OPTION 2** **Room Outdoor Air Supply:** OFF **Room Exhaust Fan Status:** OFF **Setpoint Start:** Within 20 minutes of vacancy

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Ventilation System Controls: Elevator Shaft and Stair Vent Dampers

Stair and elevator shaft vents are closed during normal building operation and configured to automatically open as needed by fire and smoke detection systems

Table 6.4..3.4.3 Maximum Damper Leakage, cfm/ft^2 at 1 in.wc

	Building Height	Outdoor Air Intake		Exhaust/Relief	
		Motorized	Non-motorized	Motorized	Non-motorized
ASHRAE 90.1-013	< 3 Stories	NA	4	20	4
	≥ 3 Stories	NA	4	NA	4
ASHRAE 90.1-2019	< 3 Stories	**20**	4	20	4
	≥ 3 Stories	**20***	4	**20**	4

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Ventilation System Controls: ShutOFF Damper Controls

- Outdoor air intakes and exhaust systems have motorized dampers that automatically shut when the served spaces are not in use.
- Outdoor air and exhaust dampers automatically shut during: warm up, cool down, and setback

Exceptions:

- Automatic shutoff is not required when the supply of outdoor air would reduce energy costs
- Automatic shutoff is not required when outdoor air is required to meet code requirements
- Dampers are not required in exhaust system serving unconditioned spaces
- Dampers are not required in systems intended to operate 24/7
- Dampers are not required in ventilation or exhaust systems serving Type I kitchen exhaust hoods
- Non-motorized dampers are acceptable when the design outdoor airflow or exhaust air flow is ≤ 300 cfm

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Ventilation System Controls: Ventilation Fan Control

- Automatic shutdown control is required for fan motors > 0.75 hp when not required to be in use.

Exceptions:
- In HVAC systems intended to operate 24/7

Criteria for Ventilation System Controls: Parking Garage Ventilation

- System shall automatically detect contaminant levels and reduce airflow to a minimum airflow rate of ≤ 50% of design capacity when acceptable contaminant levels maintained

Exceptions:
- Garages < 30,000 ft^2 with no mechanical cooling or heating
- Garages with an area to ventilation power ratio of ≤ 1500 ft^2/hp and no mechanical cooling or heating
- When not permitted by the AHJ

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Heat Pump Auxiliary heat Control

Controls must prevent supplemental heater from operating when load can be satisfied by the heat pump alone during:

- Steady state operation
- Set Back recovery

Exceptions:

- Heat pumps with efficiencies regulated by NAECA and meeting minimum efficiency requirements of Table 6.8.1-2

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Humidification and Dehumidification

- No simultaneous humidification and dehumidification
- No use of fossil fuel or electricity to humidify above 30% RH or to dehumidify below 60% RH

Exceptions:

- Zones served by desiccant systems
- Where specific humidity levels are required, like museums and hospitals, and approved by the AHJ
- Where required by accreditation standards and controls have a 10% RH dead-band
- Zones required to maintain a precision of ±5% RH for compliance with codes or accreditation standards

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Freeze Protection & Snow Melt Systems

Image Credit: City of Holland, Michigan. Holland Area Convention and Visitors Bureau.

Freeze protection systems must have automatic controls configured to shut OFF systems when outdoor temperature is > 40°F.

Snow & ice melt systems must have automatic or manual controls configured to shut OFF system when outdoor temperature is > 40°F; and must have automatic controls configured to shut OFF system when:

- pavement temperature is > 50 °F.
- No precipitation is falling

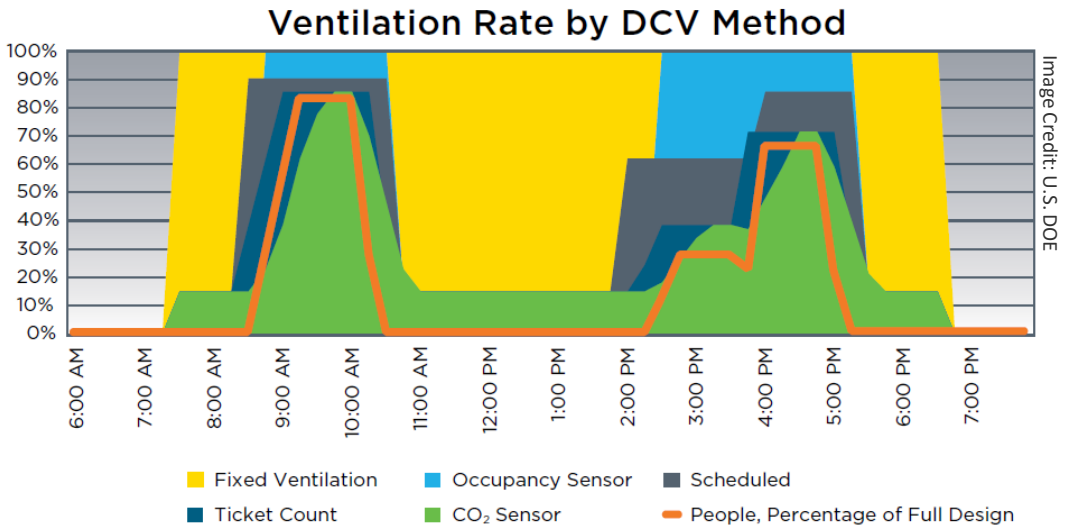
Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Ventilation Control in High-Occupancy Areas

Required for:

- Spaces > 500 ft^2
- Occupancy ≥ 25 people/1000 ft^2
- And served by one of:
  - Air-side economizer
  - Automatic modulating OA damper
  - Design OA flowrate > 3000 cfm



Exceptions:

- Systems with exhaust air energy recovery
- Multiple zone systems with no zone DDC communicating with a central panel
- Systems with a design OA flowrate < 750 cfm
- Spaces that are: correction cells, daycare sickrooms, science labs, barber, beauty and nail salon, or bowling alley seating

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Vestibule Heating and Cooling

Heating

- Automatic controls to shut off heating when OAT > 45°F
- Controlled by a thermostat in vestibule
- Maximum space heating setpoint of 60°F

Cooling

- **Minimum space cooling setpoint of 85°F**

Exceptions:

- **Vestibules tempered with site-recovered energy**
- Vestibules tempered with transfer air that would otherwise be exhausted

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Direct Digital Controls

New Equipment	DDC Required for New Construction when:	DDC Required for Alterations or Additions when:
AHU System	• All new zones served by the new system • System serving > 3 zones • Fan system bhp ≥ 10 hp	• All new zones served by the new system • System serving > 3 zones • Fan system bhp ≥ 10 hp • 75% of all zones are new **OR** • Existing AHU or FCU has DDC
Chilled Water Plant	• All coils & terminal units served • Plant design capacity ≥ 25 tons • Plant serving > 3 zones	• All chillers are new • Plant design capacity ≥ 25 tons
Hot Water Plant	• All coils and terminal units served • Plant design capacity ≥ 300 MBH • Plant serving > 3 zones	• All boilers are new • Plant design capacity ≥ 300 MBH
Zone Terminal Units		• Existing zones served by the same system (AHU or plant) have DDC

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Direct Digital Controls

Required Capabilities are:

- Monitor zone and system demand for
  - Fan Pressure
  - Pump Pressure
  - Heating
  - Cooling
- Transfer data between zones, air distribution system controllers an HVAC plant controllers
- Automatically detect zones & systems excessively driving reset logic and notify system operator
- Readily allow operator to remove zones from the algorithm
- Trend and graphically display input and output data

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Chilled Water Plant Monitoring

Applies to new electric chilled water plants in:

- New buildings
- Existing buildings

Applies to:

- Water cooled chiller plants > 1500 tons
- Air-cooled chiller plants > 860 tons

Required measurements:

- Electricity use
- Chilled water plant efficiency in kW/ton

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Economizer Fault Detection

- Permanently sensored for and able to display the values of OAT, SAT, and RAT, where required for control
- System status as indicated by:
  - Free cooling available
  - Economizer enabled
  - Compressor enabled
  - Mixed air low limit cycle active
- Capability to manually initiate each operating mode for testing and verification
- Configured to detect:
  - Air temperature sensor fault/failure
  - Damper not modulating
  - Excess outdoor air
  - Unit not operating or operating when should/should not
  - Configured to report faults to a system accessible by operating or service personnel or to annunciate to local zone thermostat

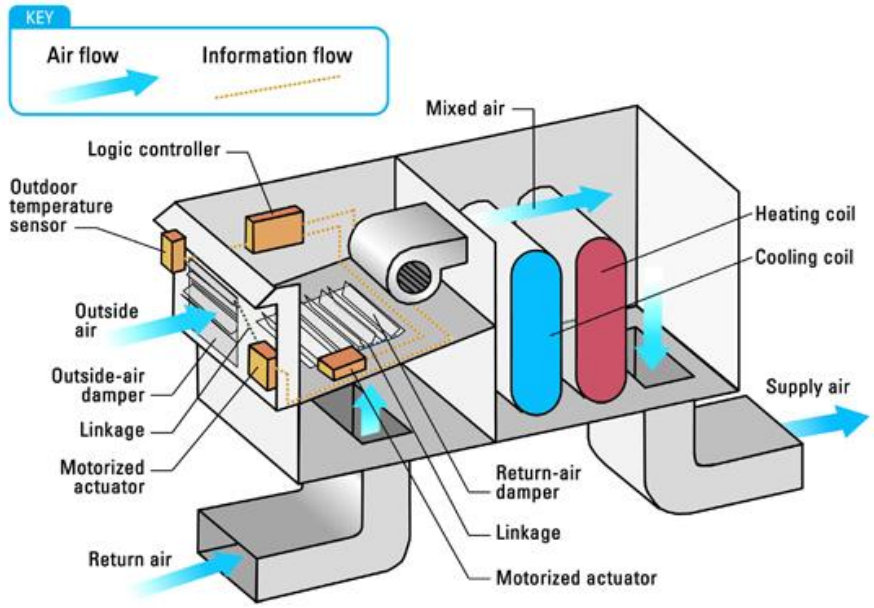


Image Credit: U.S. EPA/ Energy STAR

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Criteria for Duct Insulation R-Values

Increased minimum R-values

Simplifications include:

- Combined tables
- Combined Duct Locations
- Combined Climate Zones

Exceptions: No updates

Table 6.8.2 Minimum Duct Insulation R-Values

MI Climate Zone	Duct Location		
	Exterior	Unconditioned Space & Buried	Indirectly Conditioned Space
Supply and Return Ducts for Heating and Cooling			
5 – 7	R-12	R-6	R-1.9
Supply and Return Ducts for Heating Only			
5 – 7	R-12	R-6	R-1.9
Supply and Return Ducts for Cooling Only			
5 - 6	R-8	R-6	R-1.9
7	R-1.9	R-1.9	R-1.9

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

No Criteria Changes for These Other Components to Be Insulated

Piping

Thermally Ineffective Sensible Heating Panels

Image Credit: Warren Gretz, NREL

Radiant Floor Heating

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

No Criteria Changes for Duct Sealing

All ductwork with pressure class ratings constructed to Seal Class A including:

- Branch Connections
- Access Doors
- Access Panels
- Equipment Connections

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

No Criteria Changes for Duct Leakage Testing

Test ≥ 25% ductwork with design operating pressure > 3 in. wc.

L_{MAX} = $C_L P^{0.65}$

C_L = duct leakage class, cfm/100 ft² of duct surface area per inch of water

= **4** cfm/100 ft²

P = test pressure, which is equal to the design duct pressure class rating

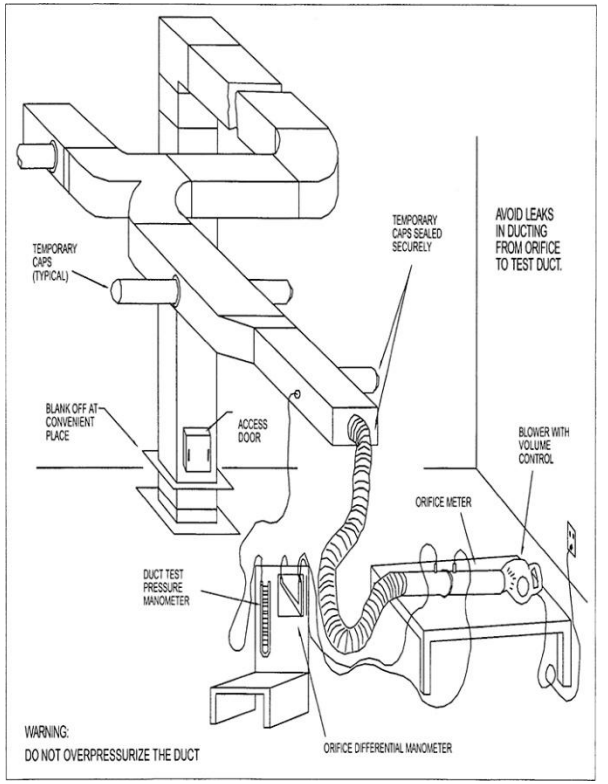


Image Source: SMACNA HVAC Air Duct Leakage Test Manual

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Site Assembled Walk-in Coolers and Freezers

- Automatic door closers
- Strip curtains, spring-hinged doors, or other way to minimize infiltration when doors are open
- Wall, ceiling, floor and door insulation
- Electronically commutated, PSC, or three-phase motors for fractional horsepower condenser fan motors
- Electronically commutated or three-phase motors for fractional horsepower evaporator fan motors
- Light sources with efficacy ≥ 40 lm/W (including any ballast losses)
- Multi-paned glazing for transparent reach-in doors and in-door windows
- Modulating antisweat heater control with power draw limits
- Primary temperature-based defrost termination control with a secondary time limit

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Site Assembled Walk-in Cooler and Freezer Doors and Systems

Table 6.8.1-18 Walk-in Cooler & Freezer Display Door Efficiency Requirements

Class Descriptor	Class	Max kWh/day
Display Door, Med. Temp	DD, M	0.04 x A_{dd} + 0.41

Table 6.8.1-19 Walk-in Cooler & Freezer Non-Display Door Efficiency Requirements

Class Descriptor	Class	Max kWh/day
Passage Door, Med. Temp	DD, M	0.05 x A_{nd} + 1.7

Table 6.8.1-20 Walk-in Cooler & Freezer System Efficiency Requirements

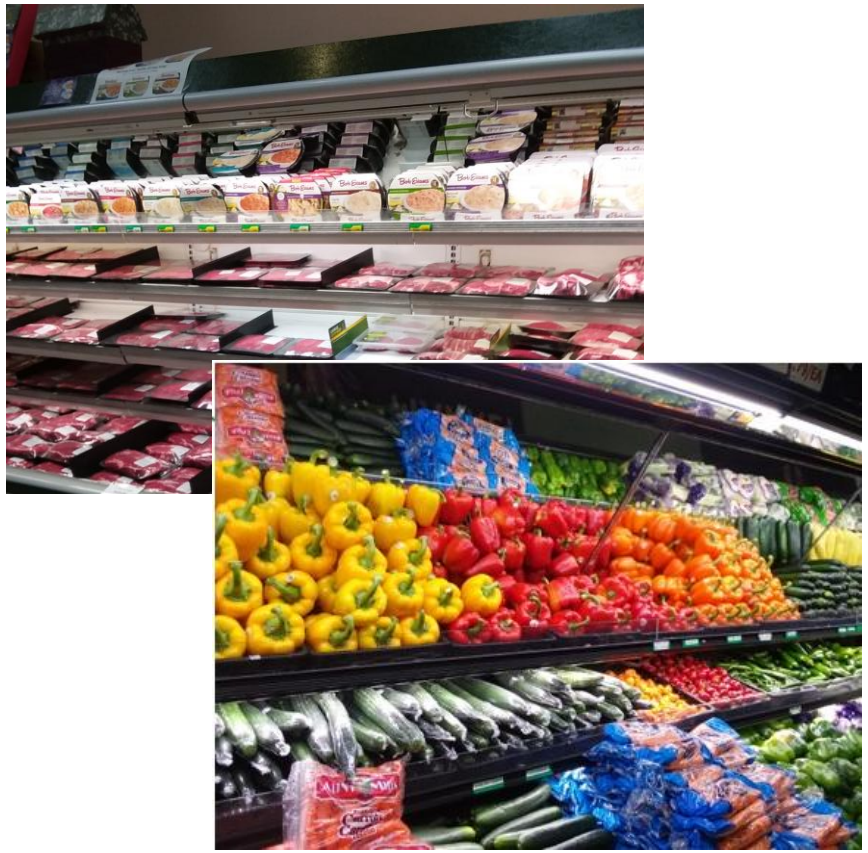
Class Descriptor	Class	Min AWEF, Btu.Wh
Dedicated Condensing, Med Temp, Indoor System	DC.M.I	5.61
Dedicated Condensing, Med Temp, Outdoor System	DC.M.O	7.60
Unit Cooler, Low Temp, net capacity < 15.5 BH	UC.L < 15.5 BH	1.575 x 10^{-5} x q_{net} +3.91
Unit Cooler, Low Temp, net capacity ≥ 15.5 MBH	UC.L ≥ 15.5 BH	

Data Source: ASHRAE 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

No Criteria Changes for Refrigerated Display Cases

- Meet equipment efficiency requirements
- Lighting to be controlled by one of:
  - automatic time-switch to turn off lights during non-business hours with timed overrides to turn lights on for ≤ 1 hr
  - Motion sensors that reduce lighting power by ≥ 50% within 3 minutes after sensor area is vacated
- Low-temperature cases to have primary temperature-based defrost termination control with secondary time-limit termination.
- Antisweat heater controls to reduce energy use of antisweat heater as function of RH in air outside the door or to condensation on inner class pane



Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

New Criteria for Liquid-to-Liquid Heat Changers

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Coffee Break

Changes to Section 6.5
HVAC Prescriptive Provisions

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Criteria for Economizers

ASHRAE 90.1-2013

Table 6.5.1-1 Minimum Fan Cooling Unit Size for which an Economizer is Required in Comfort Cooling	
Climate Zone	Cooling Capacity Threshold
5a, 6a, 7	≥ 54 MBH

Table 6.5.1-2 Minimum Fan Cooling Unit Size for which an Economizer is Required in Computer Rooms	
Climate Zone	Cooling Capacity Threshold
5a, 6a, 7	≥ 135 MBH

ASHRAE 90.1-2019

Table 6.5.1-1 Minimum Fan Cooling Unit Size for which an Economizer is Required in Comfort Cooling	
Climate Zone	Cooling Capacity Threshold
5a, 6a, 7	≥ 54 MBH

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Additional Exception to Economizer Requirement

Not required with chilled water-cooling systems with:

- Total capacity of < 1,400 MBH; and either
- No fan; or
- Using induced airflow

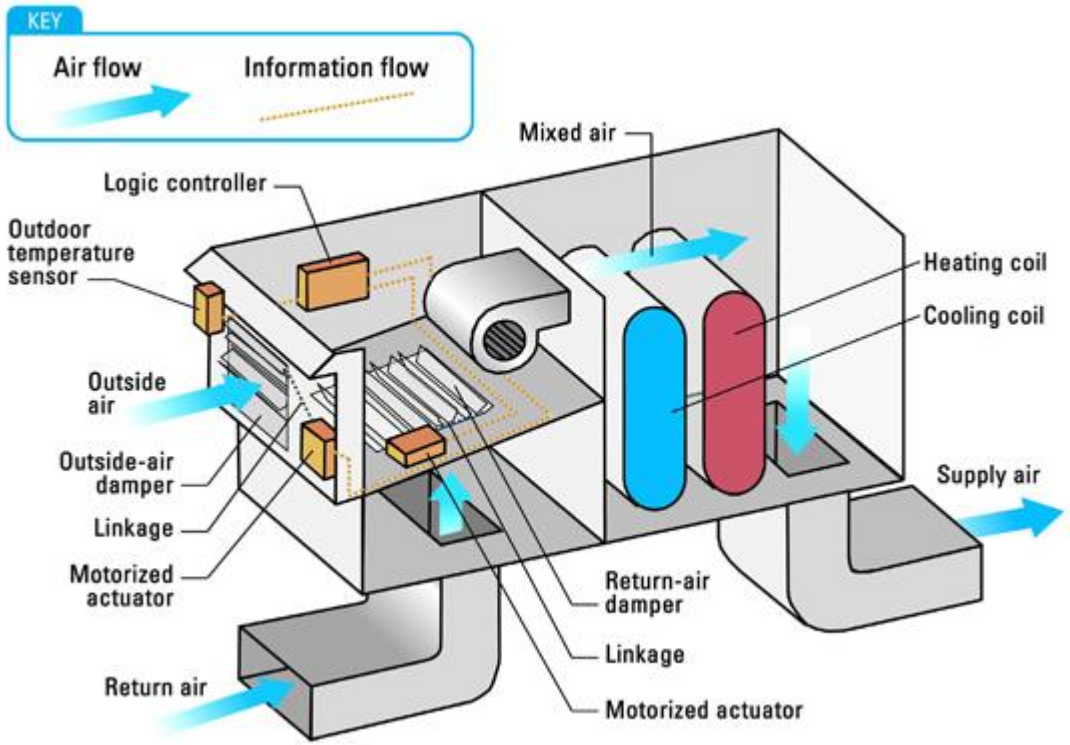


Image Credit: U.S. EPA/ Energy STAR

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Criteria to Economizer Dampers

Economizer exhaust, relief, and outdoor air dampers meet the requirements of Table 6.4.3.4.3. But return dampers are restricted to meeting criteria for **motorized** exhaust/relief dampers.

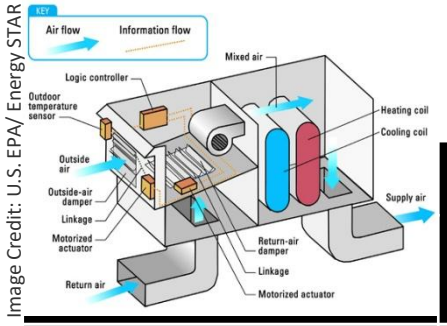


Image Credit: U.S. EPA/ Energy STAR

Table 6.4..3.4.3 Maximum Damper Leakage, cfm/ft² at 1 in.wc.

Building Height	Outdoor Air Intake		Exhaust/Relief	
	Motorized	Non-motorized	Motorized	Non-motorized
ASHRAE 90.1-013	< 3 Stories	NA	4	20	4
	≥ 3 Stories	NA	4	NA	4
ASHRAE 90.1-2019	< 3 Stories	**20**	4	20	4
	≥ 3 Stories	**20***	4	**20**	4

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Exceptions to Simultaneous Heating & Cooling Prohibitions

Under ASHRAE 90.1-2013, Simultaneous Heating and Cooling was allowed when:

- Volume of air being reheated, re-cooled or mixed was less than a defined threshold value
- Lab exhaust systems met the criteria of Section 6.5.7.3
- ≥ 75% of energy for simultaneous operation was from site-recovered energy or site-solar energy
- Zones with DDC met listed criteria

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Exceptions to Simultaneous Heating & Cooling Prohibitions

ASHRAE 90.1-2013 Zone DDC Criteria

Deadband airflow rate is less than the larger of:

- 20% of zone design peak supply rate
- Outdoor airflow rate required to meet ASHRAE 62.1
- Any higher rate demonstrated to reduce annual energy use by offsetting the reheat/recool losses through a reduction in outside air
- Airflow rate required to comply with applicable codes or accreditation standards

ASHRAE 90.1-2019 Zone DDC Criteria

Deadband airflow rate is less than the larger of:

- Minimum primary airflow rate required to meet the ASHRAE 62.1 Simplified Procedure ventilation requirements for the zone (may be the ASHRAE 62.1 average flow rate)
- Any higher rate demonstrated to reduce annual energy use by offsetting the reheat/recool losses through a reduction in outside air
- Airflow rate required to comply with applicable codes or accreditation standards

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Ventilation Air Heating Control

Units providing ventilation air to multiple zones and operating in conjunction with heating and cooling systems shall not us heating or heat recovery to warm supply air above 60°F when the majority of zones need cooling.

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Additional Criterion for Fan Power Limitation Pressure Drop Adjustment

Table 6.5.3.1.2 Power Limitation Pressure Drop Adjustment	
Device	**Adjustment**
Return or exhaust systems required by code or accreditation to be fully ducted; or systems required to maintain an air pressure differential between adjacent rooms	0.5 in.wc. except for laboratory and vivarium's 2.5 in.wc for laboratory and vivarium's

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Fan Motor Selection

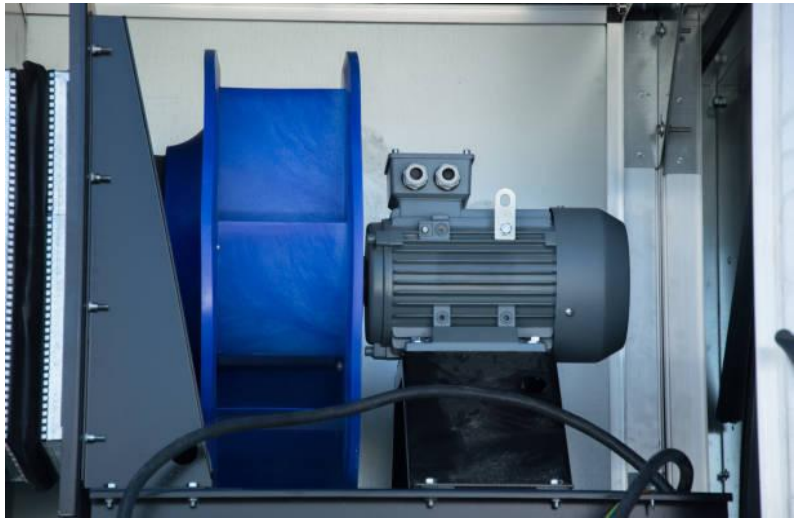
Selected fan motors shall be larger than the first available motor with a nameplate rating greater than M x bhp, where M is:

bhp	Multiplier
< 6	1.5
≥ 6	1.3

- Bhp must be listed on design documents

Exceptions:

- Motors with electronic speed control
- Systems complying with Table 6.5.3.1-1, Fan Power Limitations
- Fractional horsepower motors
- Fan with a fan nameplate input power < 0.89 kW



Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Fan Efficiency

$$FEI = \frac{Baseline\ Fan\ Electrical\ Input\ Power}{Actual\ Electrical\ Input\ Power}$$

bhp	Minimum FEI
Fan and Fan Arrays	1.00
VAV System Fans and Fan Arrays	0.95

Exceptions:

- Non-embedded fan with a motor nameplate hp < **1.0 hp or with a fan nameplate electrical input power < 0.89 kW**
- Embedded fans or arrays with combined motor nameplate hp ≤ 5 hp with fan system electrical input power ≤ 4.1 kW
- Embedded fans in equipment listed in Tables 6.8.1-1 through 6.8.1-20
- Embedded fans in equipment in equipment 3rd party certified and sealed for air or energy performance
- **Ceiling fans**
- **Fans for moving gases above 482°F**
- **Fans for operation in explosive environments**
- **Reversible fans used for tunnel ventilation**
- ~~Powered Roof Ventilators~~ → Deleted
- Fans Outside scope of AMCA 208
- Fans Intended to only operate during emergency conditions

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria VAV Setpoint Reset

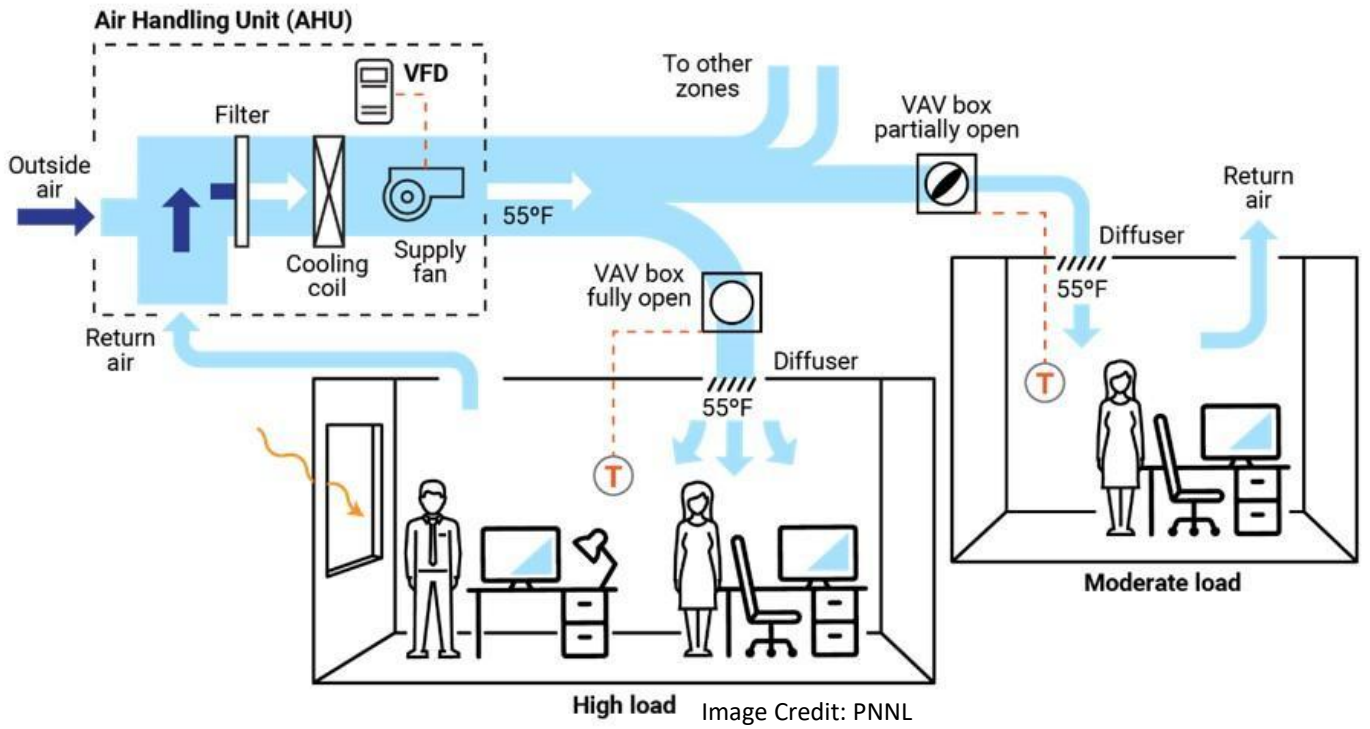


Image Credit: PNNL

Updated criterion to now apply to multizone VAV systems with a total fan system horsepower of **> 5 hp**

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Return and Relief Fan Control

Relief airflow rate controlled to maintain building pressure through differential supply/return airflow tracking; or for systems with constant speed or multispeed fans, control can be based on outdoor air damper position.

Fans must have variable speed or other control such that the total return/relief fan system demand is less than 30% at 50% of total airflow.

Exceptions:

- Fans with motors ≤ 0.5 hp
- Relief fans with a minimum of 4 stages

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

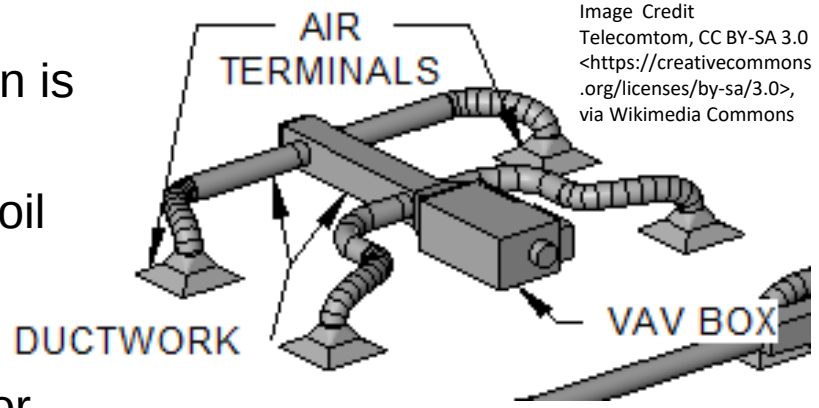
Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Parallel Flow Fan-Powered VAV Terminal Control

Automatic controls configured to:

- Turn OFF terminal fan except when space heating or ventilation is required
- Turn ON terminal fan as first heating stage BEFORE heating coil is activated
- Turn ON fan during heating for warm-up or set back either:
  1. Operate terminal fan and heating coil without primary air, or
  2. Reverse the terminal damper logic and provide heating from the central AHU



Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Ventilation Design

The required minimum outdoor air rate is the larger of the minimum outdoor air rate or the minimum exhaust air rate required by:

- ASHRAE 62.1
- ASHRAE 170
- applicable codes or accreditation standards

Outdoor ventilation system must meet one of the following:

- Design minimum system outdoor air is ≤135% of the required minimum outdoor air rate
- Dampers, ductwork, and controls allow the system to supply no more than the required minimum outdoor air rate with a single set-point adjustment
- The system includes exhaust air energy recovery complying with Section 6.5.6.1

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Occupied Standby Controls

occupied standby mode, *v*. when a zone is scheduled to be occupied but the occupant sensor indicates no occupants are within the zone

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Occupied Standby Controls

Zones that:

- serving only rooms required to have automatic partial OFF or automatic full OFF lighting controls;
- where ASHRAE 62.1 allows ventilation air to be reduced to 0 when space is in *occupied-standby mode;* and
- when using Ventilation Rate Procedure;

are required to meet the following within 5 minutes of all rooms in that zone entering *occupied-standby mode*

- Active heating setpoint is setback ≥1°F; and
- Active cooling setpoint is setup ≥1°F; and
- All supply air to the zone is shut OFF whenever space temperature is between active heating and cooling setpoints

Exception:

- Multiple zone systems without automatic zone flow control dampers

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Updated Criteria for Hydronic Variable Flow Systems

- Now includes **hot** water systems
- Designed for reduced flow rate of ≤ 50% of the design flowrate **or the minimum flow required by the equipment manufacturer**

25%

- Individual pumps on variable flow systems having motors > 5 hp must have controls to reduce motor demand to ≤ 30% at 50% design water flow.

≥ the tabulated value

Table 6.5.4.2 Pump Flow Control Requirements

Climate Zone for Chilled Water Pumps	Climate Zone for Hot Water Pumps	Threshold Motor Horsepower
	7	≥ 5 hp
5a, 6a		≥ 7.5 hp
7		≥ 15 hp

Exceptions:

- Differential setpoint not required when valve position complies with Section 6.5.4.4
- Variable flow control not required on heating pumps when electric boiler provides > 50% of heating
- Variable flow not required on primary pumps, preheat coils, or heat recovery runaround loops

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

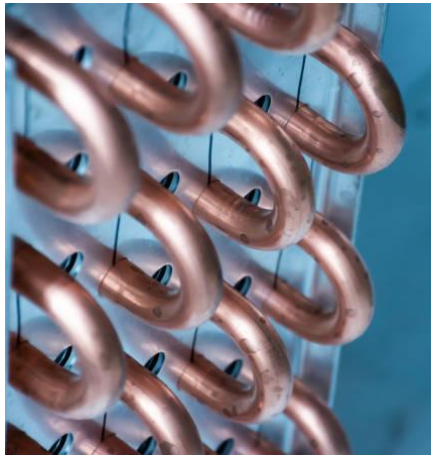
Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Chilled Water Coil Selection

Coil selected to provide

- ≥ 15°F temperature difference between EWT and LWT
- ≥ 57°F LWT at design conditions



Exceptions

- Coils with an air-side pressure drop > 0.70 in.wc when rated at 500 fpm and dry conditions
- Individual fan-cooling units with a design supply airflow rate ≤ 5000 cfm
- Constant-air-volume systems
- Coils selected at the maximum ΔT allowed by the chiller
- Passive coils (no mechanically supplied airflow)
- Coils with design EWT of ≥ 50°F
- Coils with design EAT of ≤ 65°F

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Buildings with High-Capacity Space Heating Gas Boilers

New buildings with gas hot-water boiler systems for space heating with a total system input of at least 1,000 MBH but not more than 10,000 MBH to comply with 6.5.4.8.1 and 6.5.4.8.2

Exceptions

- Where 25% of annual space heating requirement is provided by on-site renewable energy, site-recovered energy, or heat recovery chillers
- Space heating boilers installed in individual dwelling units
- Where 50% or more of design heating load is served using perimeter convective heating, radiant ceiling panels, or both
- Individual gas boilers with input capacity less than 300 MBH shall not be included in calculations of the total system input or total system efficiency

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Buildings with High-Capacity Space Heating Gas Boilers

6.5.4.8.1 Boiler Efficiency

Minimum boiler efficiency of 90%

6.6.4.8.2 Hot Water Distribution System Design

- Select coils and other heat exchanges for a hot water return temperature entering boilers of 120°F or less
- Under all operating conditions,
  - water temperature enter the boiler is ≤ 120°F; or
  - the flow rate of supply hot water that recirculates directly into return systems is ≤ 20% of design flow of the operating boilers

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Fan Speed Control on Heat Rejection Equipment

ASHRAE 90.1-2013

Motors ≥ 7.5 hp must be able to:

- operate at ≤ 2/3 full speed
- Automatically change fan speed to control leaving fluid temperature or head pressure

ASHRAE 90.1-2019

Motors or motor arrays ≥ 5 hp must have controls configured such that:

- the power demand is ≤ 30% of design power at 50% of rated airflow
- Automatically change fan speed to control leaving fluid temperature or head pressure

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Fan Speed Control on Heat Rejection Equipment

CURRENT MEC (ASHRAE 90.1-2013) EXHAUST AIR ENERGY RECOVERY REQUIREMENT						
Annual Run-Hours	% Outdoor Air at Design Flowrate	10% ≤ X ≤ 20%	20% ≤ X ≤ 30%	30% ≤ X ≤ 40%	40% ≤ X ≤ 50%	70% ≤ X ≤ 80%
< 8000	Climate Zone	Design Supply Fan Airflow Rate, cfm				
	5A, 6A	≥ 26,000	≥ 16,000	≥ 5,500	≥ 4,500	≥1,000
	7	≥ 4,500	≥ 4,000	≥ 2,500	≥ 1,000	> 0
≥ 8000	Climate Zone	Design Supply Fan Airflow Rate, cfm				
	5A, 6A, 7	> 0	> 0	> 0	> 0	> 0

ASHRAE 90.1-2019) EXHAUST AIR ENERGY RECOVERY REQUIREMENT						
Annual Run-Hours	% Outdoor Air at Design Flowrate	10% ≤ X ≤ 20%	20% ≤ X ≤ 30%	30% ≤ X ≤ 40%	40% ≤ X ≤ 50%	70% ≤ X ≤ 80%
< 8000	Climate Zone	Design Supply Fan Airflow Rate, cfm				
	5A, 6A	≥ 26,000	≥ 16,000	≥ 5,500	≥ 4,500	≥1,000
	7	≥ 4,500	≥ 4,000	≥ 2,500	≥ 1,000	≥ 100
≥ 8000	Climate Zone	Design Supply Fan Airflow Rate, cfm				
	5A, 6A, 7	> 200	> 130	> 100	> 80	> 50

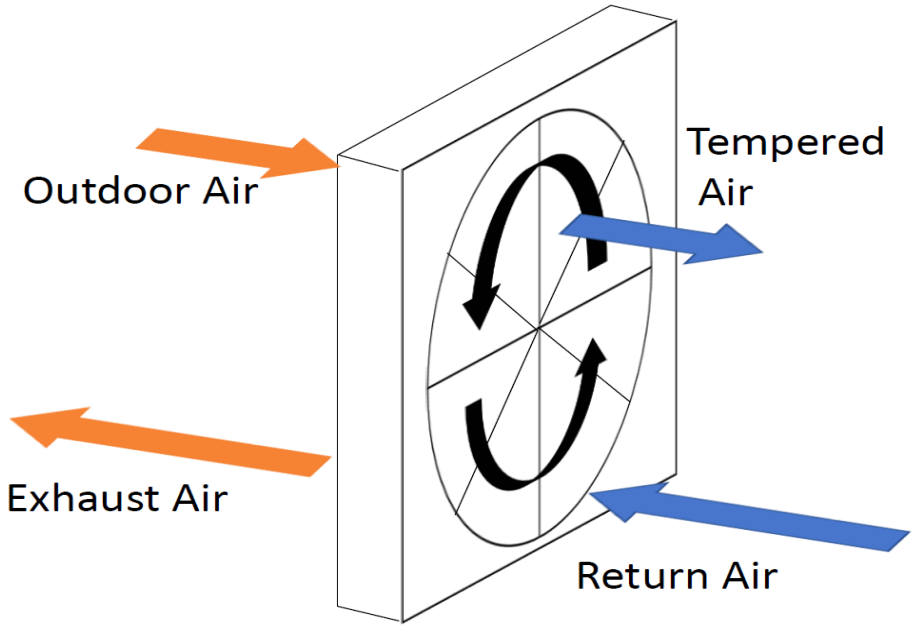
Data excerpted and adapted from 2015 IECC, 2021 IECC, ASHRAE 90.1-2013 and/or ASHRAE 90.1-2019. Exceptions may apply. See the source documents for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Updated

Criteria for Energy Recovery System

- **Heating energy recovery and cooling energy recovery replaced with enthalpy recovery ratio**



New and Revised Exceptions

- Not required for indoor pool dehumidifiers
- Not required where the sum of airflow rates exhausted **and relieved within 20 ft of each other** is > 75% of the design airflow rate, **excluding exhaust air that is:**
  - **Used for another energy recovery system**
  - **Not allowed by ASHRAE 170**
  - **Class 4 air, defined by ASHRAE 62.1**

Data excerpted and adapted from 2015 IECC, 2021 IECC, ASHRAE 90.1-2013 and/or ASHRAE 90.1-2019. Exceptions may apply. See the source documents for complete details.

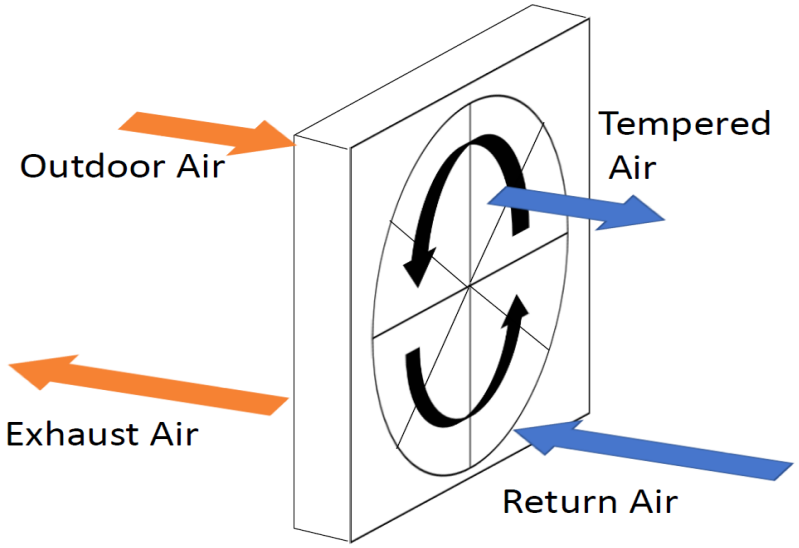
Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Energy Recovery for Non-Transient Dwelling Units

Enthalpy Recovery Ratio	
Cooling	Heating
≥ 50%	≥ 60%

Cooling requirement does NOT apply in Michigan Climate Zones



Data excerpted and adapted from 2015 IECC, 2021 IECC, ASHRAE 90.1-2013 and/or ASHRAE 90.1-2019. Exceptions may apply. See the source documents for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Space Conditioning Heat Recovery

For buildings that

- **Are an acute inpatient hospital, where building or portion of building is used on a 24-hour basis for inpatient medical, obstetric, or surgical care for patients**
- **Have a total design chilled-water capacity for acute inpatient hospital, either air cooled or water cooled, required at cooling design conditions > 300 tons of cooling**
- **Where heating water is used for space heating**
- **Simultaneous heating and cooling occurs above 60°F outdoor air temperature**

a condenser heat recovery system to be installed with a total heat recovery system to have cooling capacity at least 7% of total design chilled-water capacity of acute inpatient hospital at peak design conditions

Exceptions

- **Buildings that provide ≥ 60% of reheat energy from on-site renewable energy or site-recovered energy**
- **Buildings in Climate Zone 7**

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New

Criteria for Indoor Pool Dehumidifier Energy Recovery

Indoor pool dehumidifier serving natatoriums with heated indoor pool > 500 ft^2 to include one of the following:

- Exhaust air sensible energy recovery system with sensible energy recovery ratio of at least 50%
- Condenser heat recovery system configured to use 100% of heat generated through dehumidification to heat the pool water when there is a pool water heating load
- Exhaust air energy recovery system that results in an enthalpy recovery ratio of at least 50%

Exception

- Natatoriums heated by on-site renewable or site-recovered energy and configured to provide at least 60% of annual heating energy required

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

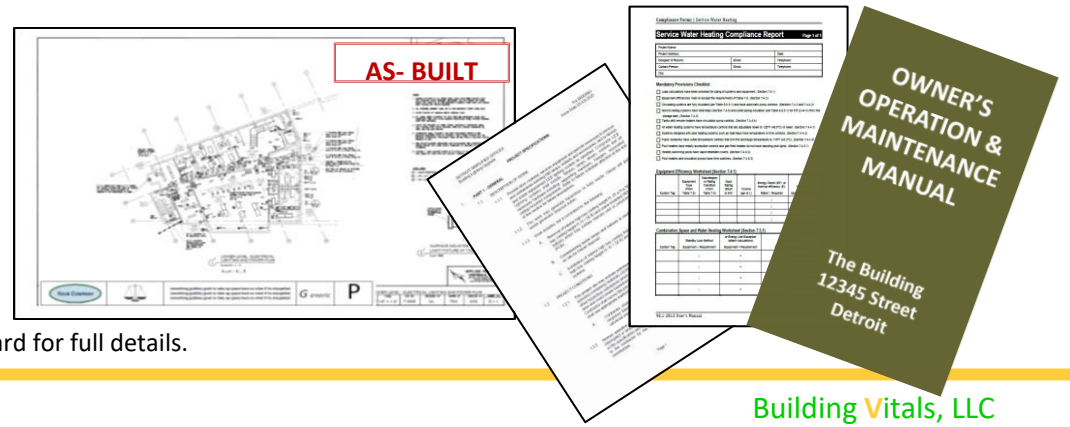
Construction Documents require the following to be supplied to owner within 90 days of acceptance :

Record Drawings including:

- Location and performance data for each piece of equipment
- General configuration of duct and pipe systems, including sizes
- Terminal airflow or water design flowrates
- Wiring Diagrams
- Schematics
- Controls with sequence of operation and setpoints recorded

Building O&M Manual including:

- Submittal Data
- Equipment O&M Manuals
- Name and address of service provider
- HVAC Control System Maintenance & Calibration Information with setpoints
- Narrative Sequence of Operation with setpoints



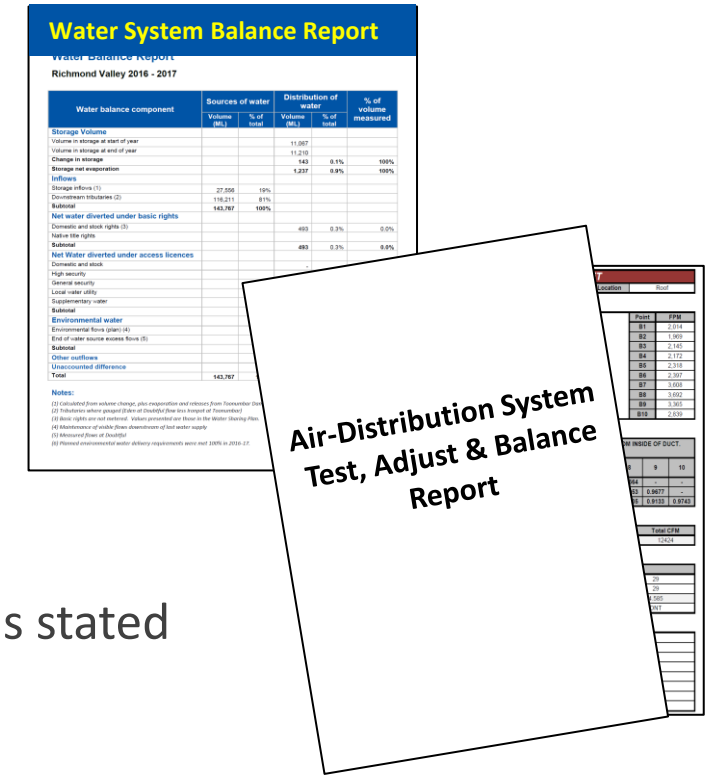
Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Commissioning Requirements

For ALL HVAC Systems:

- Air System Balancing is required
- Hydronic System Balancing is required



For HVAC Systems serving ≥ 5,000 ft² of conditioned area:

- Air System Balancing Report; and
- Hydronic System Balancing Report

must be provided to the Owner within 90 days of acceptance as stated in the Construction Documents

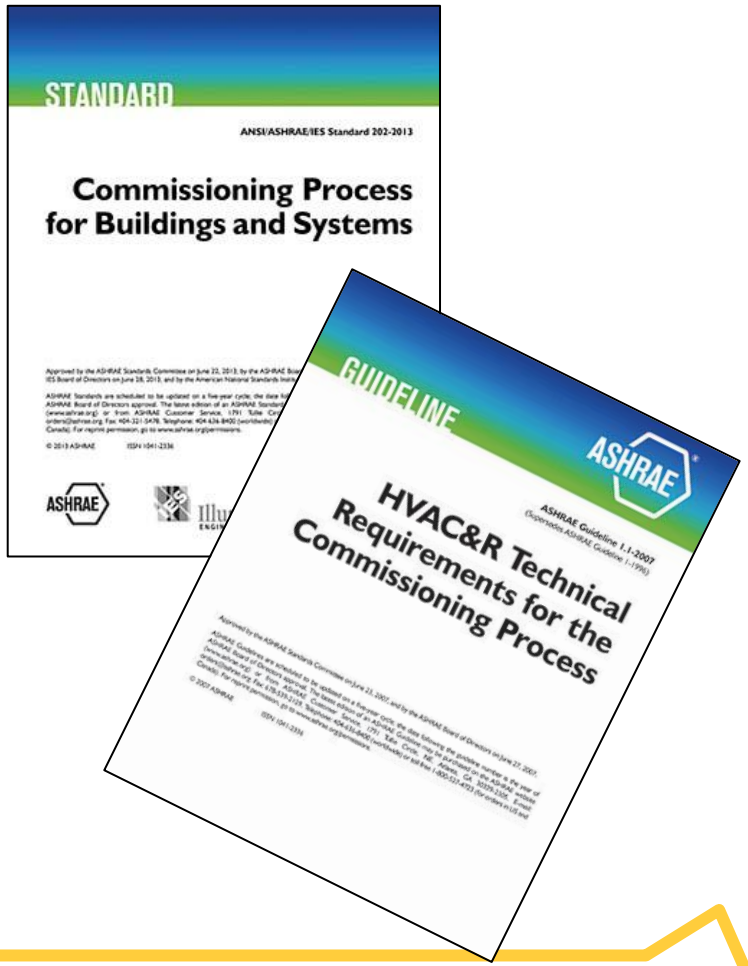
Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Commissioning Requirements

FOR ALL HVAC Systems:

- HVAC **control system** commissioning is required
- Commissioning Report for controls systems indicating control elements are:
  - Properly calibrated
  - Properly located
  - Properly adjusted
  - Properly programmed
  - Working in accordance with construction documents and manufacturers' instructions



Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

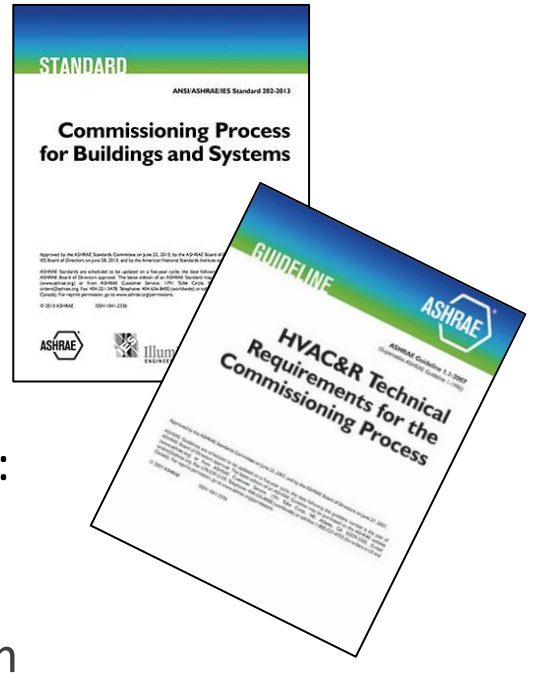
Updated

Commissioning Requirements

ASHRAE 90.1-2013

For projects > 50,000 ft^2, detailed commissioning instructions must be included in the plans and specifications, except for:

- Warehouses
- Semi-heated spaces



ASHRAE 90.1-2019

HVAC **mechanical system performance** commissioning is required **Except** for:

- Buildings, additions, or alterations with < 10,000 ft^2 of conditioned space and a combined HVAC and SWH installed capacity of 960 MBH
- Building or portions of buildings using the Simplified Approach for HVAC system compliance
- Dwelling Units
- Non-refrigerated Warehouses

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

Ideal Commissioning Documentation Includes:

A. Executive Summary
B. Design & Construction
    1. Owner's Project Requirements
    2. Basis of Design
    3. Record Documents
C. Building, Systems, & Assemblies
    1. Specifications
    2. Approved Submittals
    3. Manufacturer's O&M Data
    4. Warranties
    5. Contractor/Supplier Directory
D. Operations
    A. Operating Plan
    B. Maintenance Procedures, Checklists, and Sample Record-keeping Forms
    C. Maintenance Schedules
    D. (*If used*) On-going Commissioning Procedures
    E. Janitorial and Cleaning Procedures
    F. Utility Measurement & reporting

D. Staff Training
    1. How to Use the Systems Manual for Training
    2. Approved Training Agendas
    3. Training Materials (in Specification Order)
    4. Where to Find Additional Training Materials
    5. Training Records (schedules and sign-in sheets)
F. Final Commissioning Report and Commissioning Record
    1. Cx Plan
    2. Cx Design and Submittal Review Reports
    3. Cx Test Reports
    4. Factory Test Reports
    5. Completed Validation Checklists
    6. Cx Progress Reports
    7. Issues and Resolutions Log
    8. Resolution Plan for Remaining Open Items
G. System Manual Maintenance and Control

Data Source: ASHRAE 202-2013. Exceptions may apply. See Standard for full details.

HVAC in Section 10 – OTHER EQUIPMENT

Michigan Energy Code Update: ASHRAE 90.1-2019

Michigan Energy Code Update: ASHRAE 90.1-2019

Criteria for Elevator HVAC

- Ventilation fan power for cabs without cooling, to be ≤ 0.33 W/cfm
- When stopped and unoccupied with doors closed for ≥15 minutes, cab ventilation to de-energize
- Design Documentation
  - ISO 25745-2 Use Category
  - ISO 25745-2 Energy Efficiency Class

New

Data Source: ASHRAE 90.1-20013 and 90.1-2019. Exceptions may apply. See Standard for full details.

Michigan Energy Code Update: ASHRAE 90.1-2019

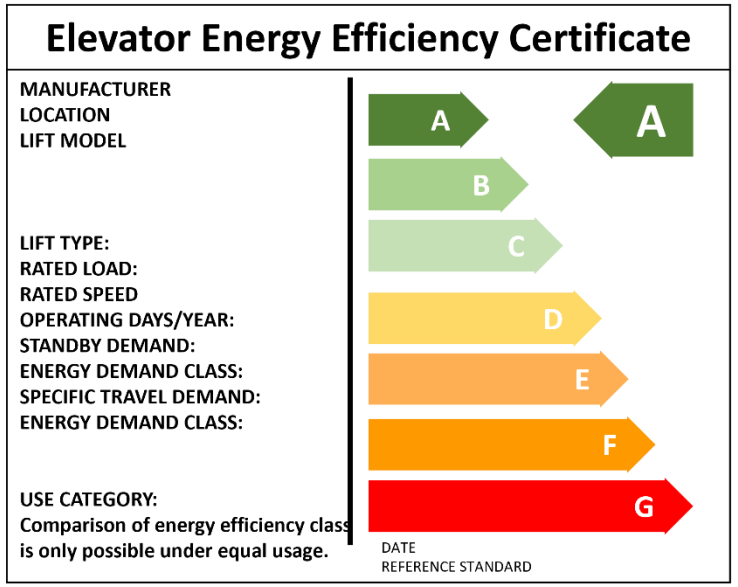
New

Design Documentation Criteria for Elevators

Use Category

Use Category	Use Intensity	Trips per Day
1	Very Low	<75
2	Low	75 ≤ X < 200
3	Medium	200 ≤ X < 500
4	High	500 ≤ X < 1000
5	Very High	1000 ≤ X < 2000
6	Extremely High	≥ 200

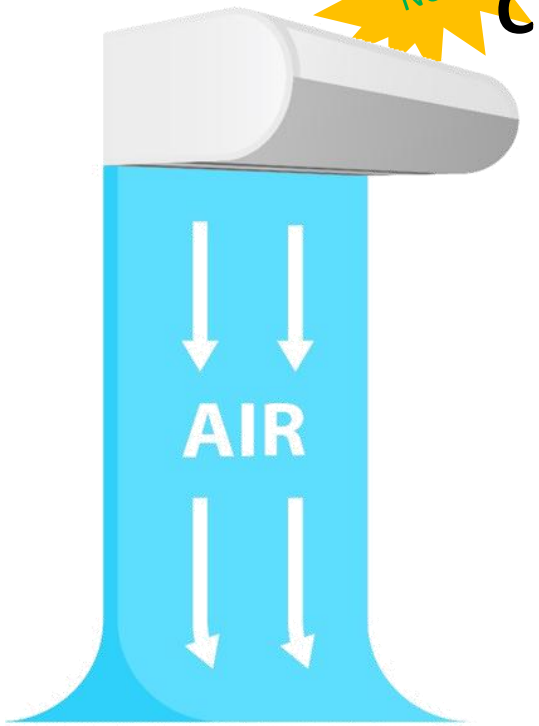
Energy Efficiency Class

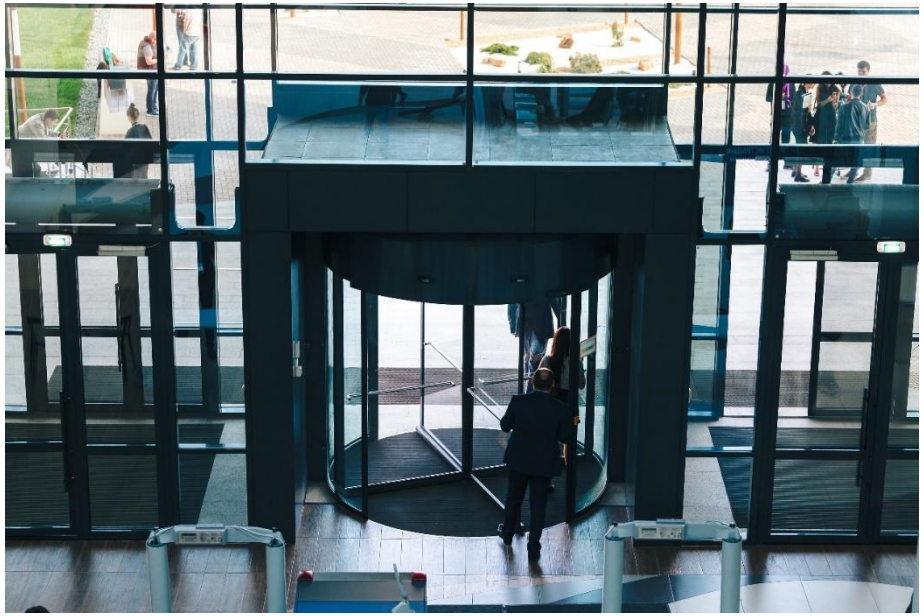


Data Source: ASHRAE 90.1-2019 and ISO 25745-2. Exceptions may apply. See Standards for complete details.

Michigan Energy Code Update: ASHRAE 90.1-2019

New Criteria for Air Curtains





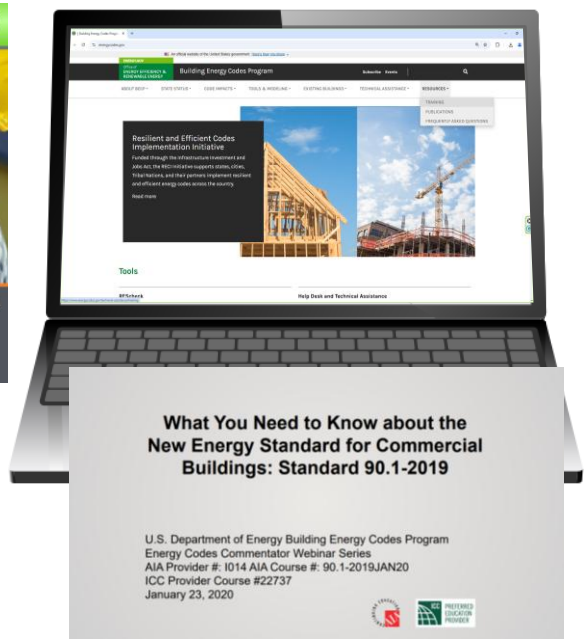
Air Curtains can be used in lieu of vestibules or revolving doors for buildings with:

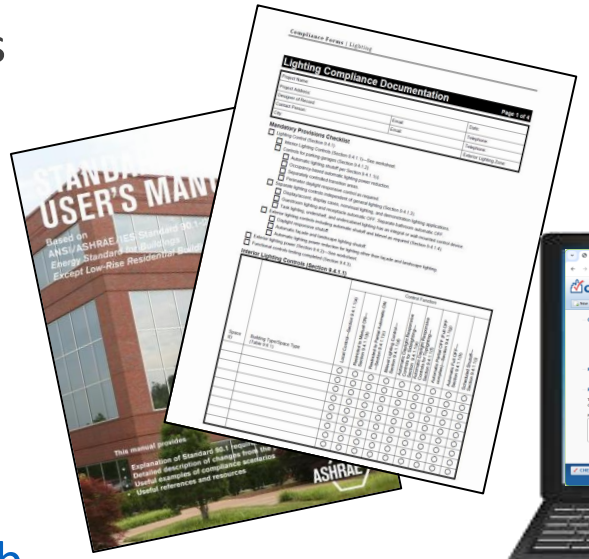
- Self-closing doors
- ≤15 stories
- Design Jet Velocity of 6.6 ft/s
- Angle to door < 20 deg
- Automatic controls
- Commissioned

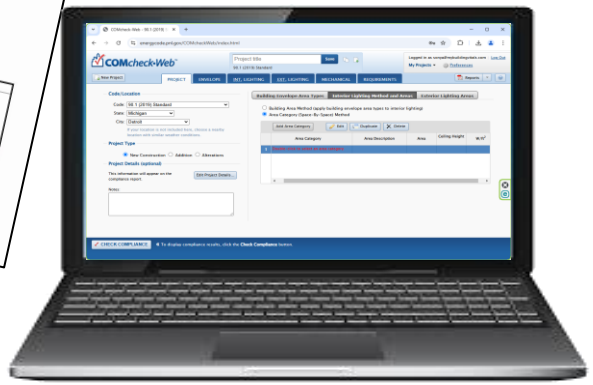
Data excerpted and adapted from 2015 IECC, 2021 IECC, ASHRAE 90.1-2013 and/or ASHRAE 90.1-2019. Exceptions may apply. See the source documents for complete details.

Resources

- www.ashrae.org
- ASHRAE Standard 90.1-2019
- ASHRAE Standard 90.1-2019 User's Manual
- ASHRAE Standard 90.1-2019 Compliance Checklists
- ASHRAE Read-Only Standards & Guidelines
- ASHRAE 90.1 Lighting Compliance Tool
- www.energycodes.gov
- Recorded webinars
- Presentations
- Publications
- Building Energy Codes Resource Hub
- https://energycode.pnl.gov/COMcheckWeb
- www.icc.org
- ICC Learning Center







Questions

Thank You

For additional information, contact: