



Ontario Building Code Energy Efficiency in Buildings

Presentation to the
London ASHRAE/OAA Chapter Meeting
March 26, 2012

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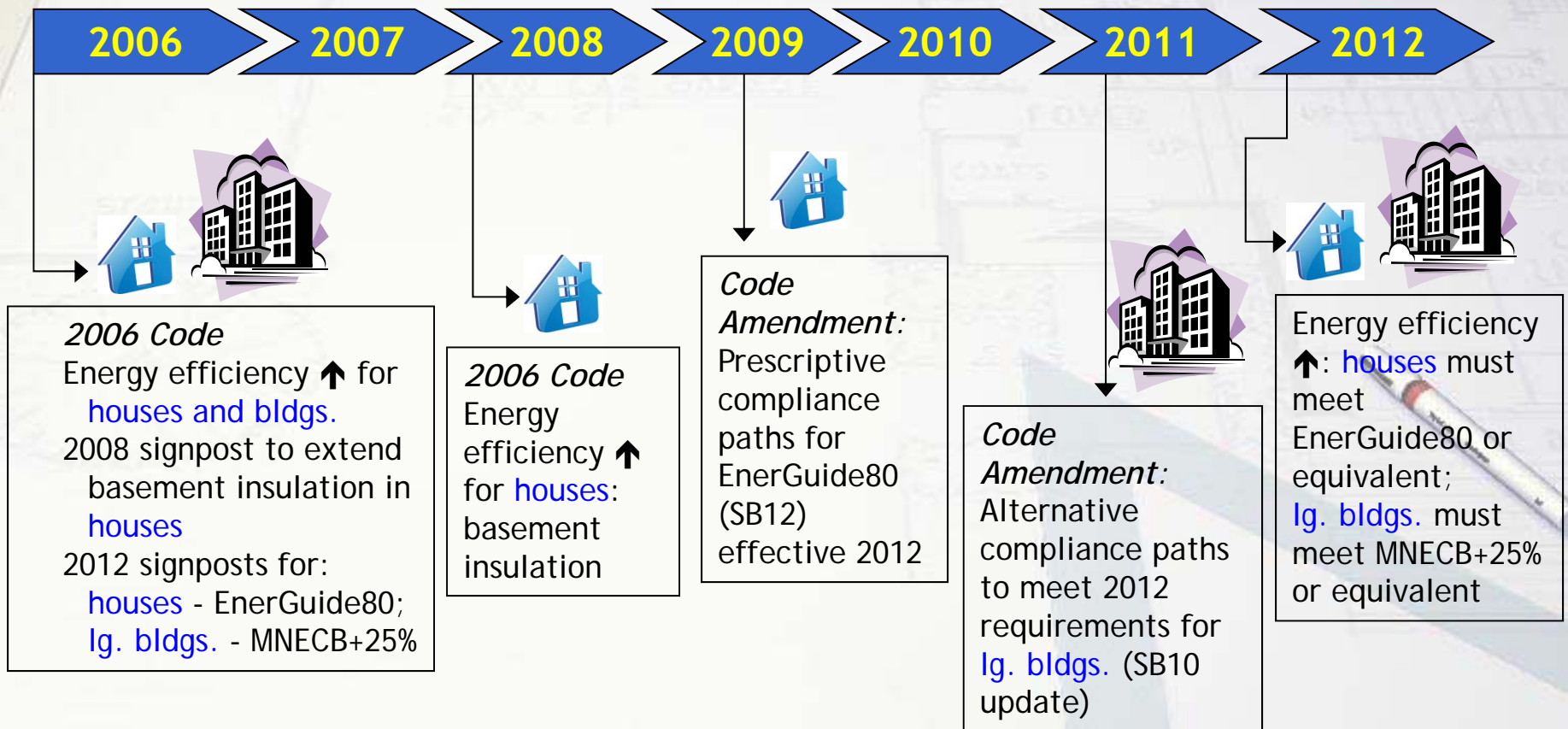


OVERVIEW

- Where the Building Code was in 2006
- Where the Building Code is in 2012
- Part 3 Options & Application Issues
- Impact on Overall Energy Utilization Intensity
- Where Will We Go for 2017



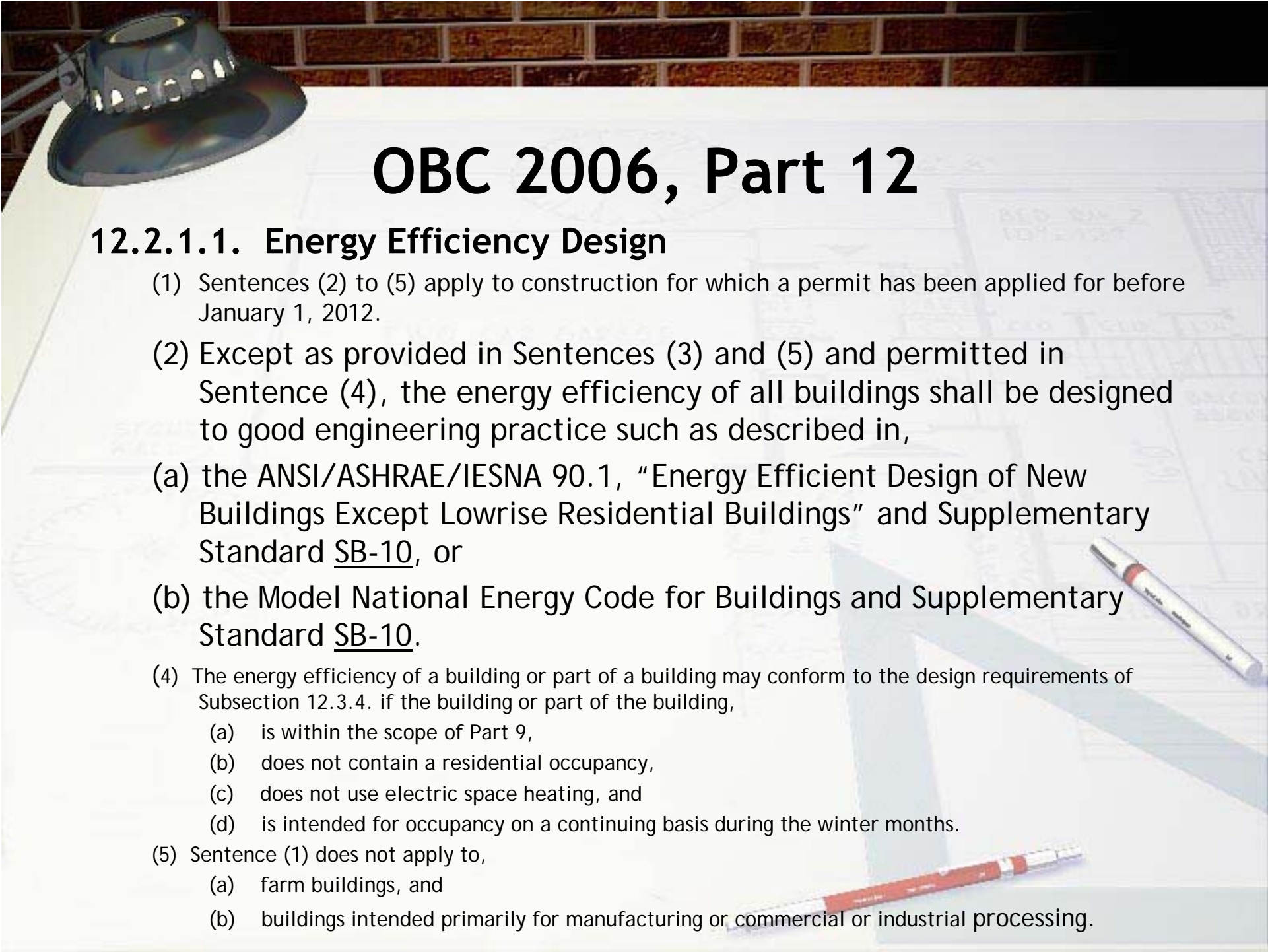
Current Requirements



A photograph of a desk with a brick wall background. On the desk is a large sheet of paper with a faint architectural floor plan. The plan includes labels such as 'TWO CAR GARAGE', 'FOYER', 'COATS', 'KITCHEN', 'DINING', 'LIVING', 'BED RM 2', and 'BATH'. A desk lamp is in the top left corner. A red pencil and a white marker are on the desk. A large blue L-shaped object is also visible.

Part 3 Buildings: Background

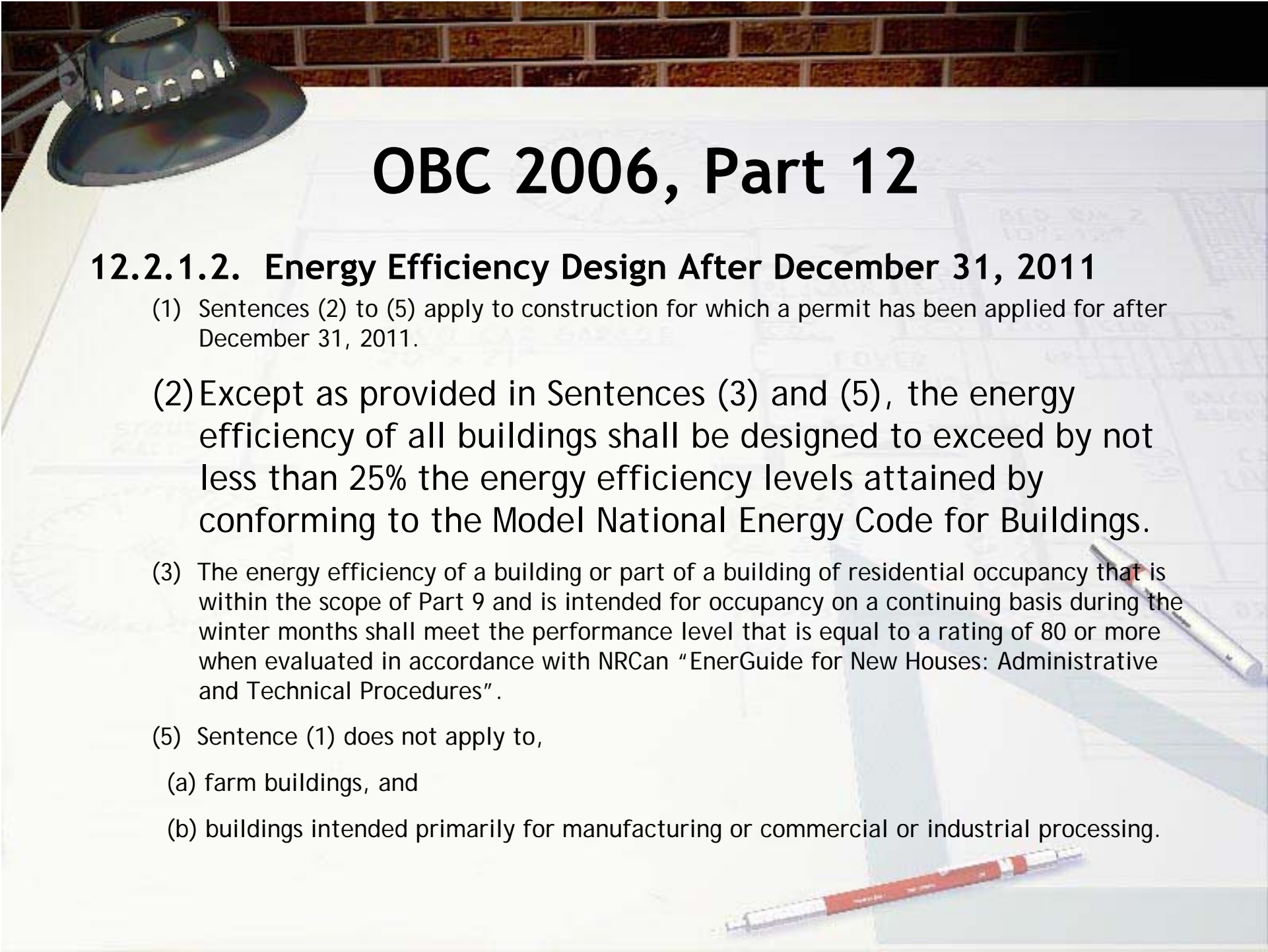




OBC 2006, Part 12

12.2.1.1. Energy Efficiency Design

- (1) Sentences (2) to (5) apply to construction for which a permit has been applied for before January 1, 2012.
- (2) Except as provided in Sentences (3) and (5) and permitted in Sentence (4), the energy efficiency of all buildings shall be designed to good engineering practice such as described in,
 - (a) the ANSI/ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings Except Lowrise Residential Buildings" and Supplementary Standard SB-10, or
 - (b) the Model National Energy Code for Buildings and Supplementary Standard SB-10.
- (4) The energy efficiency of a building or part of a building may conform to the design requirements of Subsection 12.3.4. if the building or part of the building,
 - (a) is within the scope of Part 9,
 - (b) does not contain a residential occupancy,
 - (c) does not use electric space heating, and
 - (d) is intended for occupancy on a continuing basis during the winter months.
- (5) Sentence (1) does not apply to,
 - (a) farm buildings, and
 - (b) buildings intended primarily for manufacturing or commercial or industrial processing.



OBC 2006, Part 12

12.2.1.2. Energy Efficiency Design After December 31, 2011

- (1) Sentences (2) to (5) apply to construction for which a permit has been applied for after December 31, 2011.
- (2) Except as provided in Sentences (3) and (5), the energy efficiency of all buildings shall be designed to exceed by not less than 25% the energy efficiency levels attained by conforming to the Model National Energy Code for Buildings.
- (3) The energy efficiency of a building or part of a building of residential occupancy that is within the scope of Part 9 and is intended for occupancy on a continuing basis during the winter months shall meet the performance level that is equal to a rating of 80 or more when evaluated in accordance with NRCan "EnerGuide for New Houses: Administrative and Technical Procedures" .
- (5) Sentence (1) does not apply to,
 - (a) farm buildings, and
 - (b) buildings intended primarily for manufacturing or commercial or industrial processing.



Supplementary Standard SB-10

- Provides all energy efficiency requirements for Part 3 and Part 9 non-residential buildings
- Latest Edition:
 - Issued May 16, 2011; Revised June 27, 2011; Came into force July 1, 2011
- Division 1 replaces Article 12.1.1.2
- Division 2 applied before January 1, 2012
- Division 3 applies after December 31, 2011
- Division 4 provides an simplified prescriptive option for Part 9 non-residential buildings
- Available at:
<http://www.mah.gov.on.ca/AssetFactory.aspx?did=9227>

Research Undertaken for OBC 2006

Building Type	OBC Part	Floor Area, m ²	Energy Savings By Energy Code Over MNECB			Building Archetype Features
			ASHRAE 90.1-1989	ASHRAE 90.1-2004	Hybrid: Envelope - 90.1-1989; Balance - 90.1-2004	
High Rise Office	3	13,380	10.4%	5.3%	16.3%	HVAC - VAV
Low Rise Office	3	2,974	12.1%	15.9%	19.4%	Rooftop VAV c/w hydronic reheat
High Rise MURB	3	13,611	12.7%	-1.5%	16.0%	Water loop HP, central corridor vent.
Low Rise MURB	3	3,900	10.6%	-0.5%	12.9%	Gas hydronic & PAC
Office	9	485	N/A	N/A	16.9%	Rooftop Gas/Electric
Retail	9	485	N/A	N/A	26.2%	Rooftop Gas/Electric

Overview of SB-10

Effective January 1, 2012

Component/System	All Administrative/Climate Zones	
	MNECB 1997	ASHRAE 90.1-2004
Building Envelope	Supplementary Standard SB-10 (ASHRAE 90.1-1989)	Supplementary Standard SB-10 (ASHRAE 90.1-1989)
Lighting	Supplementary Standard SB-10 (ASHRAE 90.1-2004-9)	ASHRAE 90.1-2004 Section 9
Heating, Ventilating & Air Conditioning	Equipment - ASHRAE 90.1-2004-6; Systems - MNECB 1997 Part 5	ASHRAE 90.1-2004 Section 6
Service Water Heating	Equipment - ASHRAE 90.1-2004-7; Systems - MNECB 1997 Part 6	ASHRAE 90.1-2004 Section 7
Electrical Power	MNECB 1997 Part 7	ASHRAE 90.1-2004 Section 10
Performance Path	EE4-OBC SB-10 software (from NRCAN)	ASHRAE 90.1-2004 Section 11



Software for OBC 2006

- Building Envelope Tradeoff
 - MNECB - ENVSTD 23 or 24
 - ASHRAE 90.1-2004 - ENVSTD 23 or 24
- Performance Path
 - MNECB - EE4-OBC/SB10 (includes compliance "front end")
 - ASHRAE 90.1-2004 - none: specification only provided

Research Undertaken for OBC 2011

Energy Modelling Data for Archetype Buildings					
		Options to Meet Energy Efficiency for Part 3 Buildings			
OBC Part	Building Type	Exceed MNECB by 25%	ASHRAE 90.1-2010	90.1-2010 with SB-10 (enhanced Envelope from ASHRAE 189.1)	NECB (public review draft)
3	Office				
3	MURB				
3	Retail				
3	Education				
3	Wholesale Trade				
	Average	25%	21%	26%	26%

Overview of SB-10

Effective January 1, 2012

Component/System	All Administrative/Climate Zones			
	MNECB Plus 25%	ASHRAE 90.1-2010 Plus 5%	ASHRAE 90.1-2010 Hybrid	NECB 2011
Building Envelope	MNECB Part 3+	ASHRAE 90.1-2010 Sect 5+	Supplementary Std SB-10 (ASHRAE 189.1-2009)	NECB 2012 Part 3
Lighting	MNECB Part 4+	ASHRAE 90.1-2010 Sect 9 +	ASHRAE 90.1-2010 Sect 9	NECB 2012 Part 4
Heating, Ventilating & Air Conditioning	MNECB Part 5+	ASHRAE 90.1-2010 Sect 6+	ASHRAE 90.1-2010 Sect 6	NECB 2012 Part 5
Service Water Heating	MNECB Part 6+	ASHRAE 90.1-2010 Sect 7+	ASHRAE 90.1-2010 Sect 7	NECB 2012 Part 6
Electrical Power	MNECB Part 7+	ASHRAE 90.1-2010 Sect 8+	ASHRAE 90.1-2010 Sect 8	NECB 2012 Part 7
Performance Path	MNECB Part 8	ASHRAE 90.1-2010 Sect 11	ASHRAE 90.1-2010 Sect 11	NECB 2012 Part 8



Software for SB-10 (2012)

- Building Envelope Tradeoff
 - MNECB + 25% - BILDTRAD (not suitable for use)
 - ASHRAE 90.1-2010 + 5% - none available
 - ASHRAE 90.1-2010 Hybrid - under development
- Performance Path
 - MNECB - EE4-Code (must demonstrate EE level 25% better than the MNECB reference building)
 - ASHRAE 90.1-2010 - none: acceptable software specification only is provided; two simulations required
 - NECB - NRCAN has a program under development to (likely) be called CanQuest-OBC - availability is unknown

SB-10 Division 4 - Part 9 Non-Residential Buildings(2012)

Opaque Elements	Zone 1 Less Than 5000 Degree-Days		Zone 2 5000 or More Degree-Days	
	Assembly Max. U-Value(1)	Insulation Min. RSI-Value	Assembly Max. U-Value(1)	Insulation Min. RSI-Value
	Roofs			
Without Attic Space-Insulation Above Deck	U-0.181	5.28 ci	U-0.158	6.16 ci
With Attic Space and Other	U-0.119	8.8	U-0.096	10.56
Walls, Above Grade	U-0.312	2.28 + 1.76 ci	U-0.312	2.28 + 1.76 ci
Wall, Below Grade	C-0.522	1.76 ci	C-0.522	1.76 ci
Exposed Floors, Lightweight framing	U-0.181	6.69	U-0.181	6.69
Mass	U-0.323	2.57 ci	U-0.244	3.52 ci
Slab-On-Grade Floors (perimeter+below slab)				
Unheated		2.64 for 600 mm		2.64 for 600 mm + 0.88 ci below
Heated		2.64 for 900 mm + 0.88 ci below		3.52 for 900 mm + 0.88 ci below
Fenestration	Assembly Max. U-Value	Assembly Max. SHGC	Assembly Max. U-Value	Assembly Max. SHGC
Vertical Fenestration, 0% - 40% of Wall	U-1.987	0.4	U-1.703	0.45
Skylight with Curb, % of Roof 0% to 5%	U-3.917	0.49	U-3.917	0.50
Skylight without curb, % of Roof 0% to 5%	U-2.555	0.46	U-2.555	0.46

Future Considerations for Energy Efficiency – HPNC/BBP-NC Results

Region	Total Number of Buildings	Eastern Ontario	Greater Toronto Area	Toronto	Southwest Ontario	Northern Ontario
Postal Code Zone	Ontario	K	L	M	N	P
College/University	30	7	9	7	5	2
Government	28	2	14	6	5	1
Healthcare	11	2	2	2	1	4
Hotel/Motel	1	1	0	0	0	0
Multi-Residential	108	3	22	81	2	0
Office	68	5	22	33	8	0
Other Commercial	13	4	7	0	1	1
Recreation	23	6	9	7	1	0
Retail	60	7	18	33	2	0
School	42	12	19	2	6	3
Warehouse	5	1	4	0	0	0
Other Industrial	13	0	5	7	0	1
Transportation	1	0	1	0	0	0
Total	403	50	132	178	31	12

Future Considerations for Energy Efficiency – HPNC/BBP-NC Results

Building Type	Total Number of Buildings	Benchmark Efficiency Level			Size Range, ft ²	
		1	2	3	Min	Max
College/University	30	17%	61%	22%	6,000	300,000
Government	28	17%	50%	33%	10,000	300,000
Healthcare	11	40%	50%	10%	45,000	970,000
Hotel/Motel	1	100%	0%	0%	N/A	N/A
Multi-Residential	108	41%	41%	17%	37,000	280,000
Office	68	16%	70%	14%	5,300	600,000
Other Commercial	13	38%	31%	25%	5,400	364,000
Recreation	23	19%	75%	6%	7,000	185,000
Retail	60	61%	32%	7%	25,000	417,000
School	42	10%	56%	34%	15,000	209,000
Warehouse	5	50%	50%	0%	125,000	508,000
Other Industrial	13	33%	67%	0%	20,000	375,000
Transportation	1	0%	100%	0%		227,664
Total	403					

Gains in Energy Utilization Intensity

Code, Standard, or Program	Floorspace & Occupancy Type Weighted Average Performance Increment	Typical EUI, kWh/ft ² /yr
MNECB	0% (baseline)	25.0
Ontario Building Code		
OBC 2006 (above MNECB)	17%	20.8
OBC 2011 (above MNECB)	25%	18.8
Toronto Green Standard		
TGS Tier 1 (above MNECB)	25%	18.8
TGS Tier 1 (above MNECB)	35%	16.3
Current Incentive Program - HPNC/BBP-NC		
Tier 1 (maximum performance level above OBC 2006 within tier)	25%	15.6
Tier 2 (maximum performance level above OBC 2006 within tier)	50%	10.4
Tier 3 (minimum performance level above OBC 2006 within tier)	50%+	< 10.4
Proposed Incentive Program - HPNC/BBP-NC		
Tier 1 (maximum performance level above OBC 2012 within tier)	25%	14.1
Tier 2 (maximum performance level above OBC 2012 within tier)	50%	9.4
Tier 3 (minimum performance level above OBC 2012 within tier)	50%+	< 9.4

A desk with a lamp, blueprints, and pens. The background is a brick wall. A desk lamp is on the left. Blueprints are spread across the desk. Two pens are visible: one red and one silver. The title 'Next Edition of the Building Code (2012?)' is centered in bold black text.

Next Edition of the Building Code (2012?)

- Details about the date of issue have not been finalized, or at least made public. Expect mid to late 2012.
- Energy Efficiency requirements will remain unchanged in the near term, with the exception of a possible change from MNECB +25% to NECB.
- There may be other interim Part 12 changes during the code cycle.



Subsequent Edition of the Building Code (2017?)

- Details have not yet been finalized, including the date of issue.
- Expect incremental gain in efficiency to be at least 12 to 15% - this will be stated in OBC 2012.
- Anticipate adoption of ASHRAE 90.1-2013 or -2016, possibly a hybrid.
- Plans are being formulated by the CCBFC to update the NECB. This may be adopted depending on timing and acceptability by Ontario.



Compliance Issues

- Compliance forms for building permit applications for the Prescriptive Path of the ASHRAE 90.1-2010 Hybrid have been released by MMAH. How many municipalities will adopt these is unknown.
- Currently municipal building departments do not have the capability to review Performance Path applications. This is only just beginning to change, but very slowly.
- When the NECB is adopted, new compliance forms will likely be prepared.



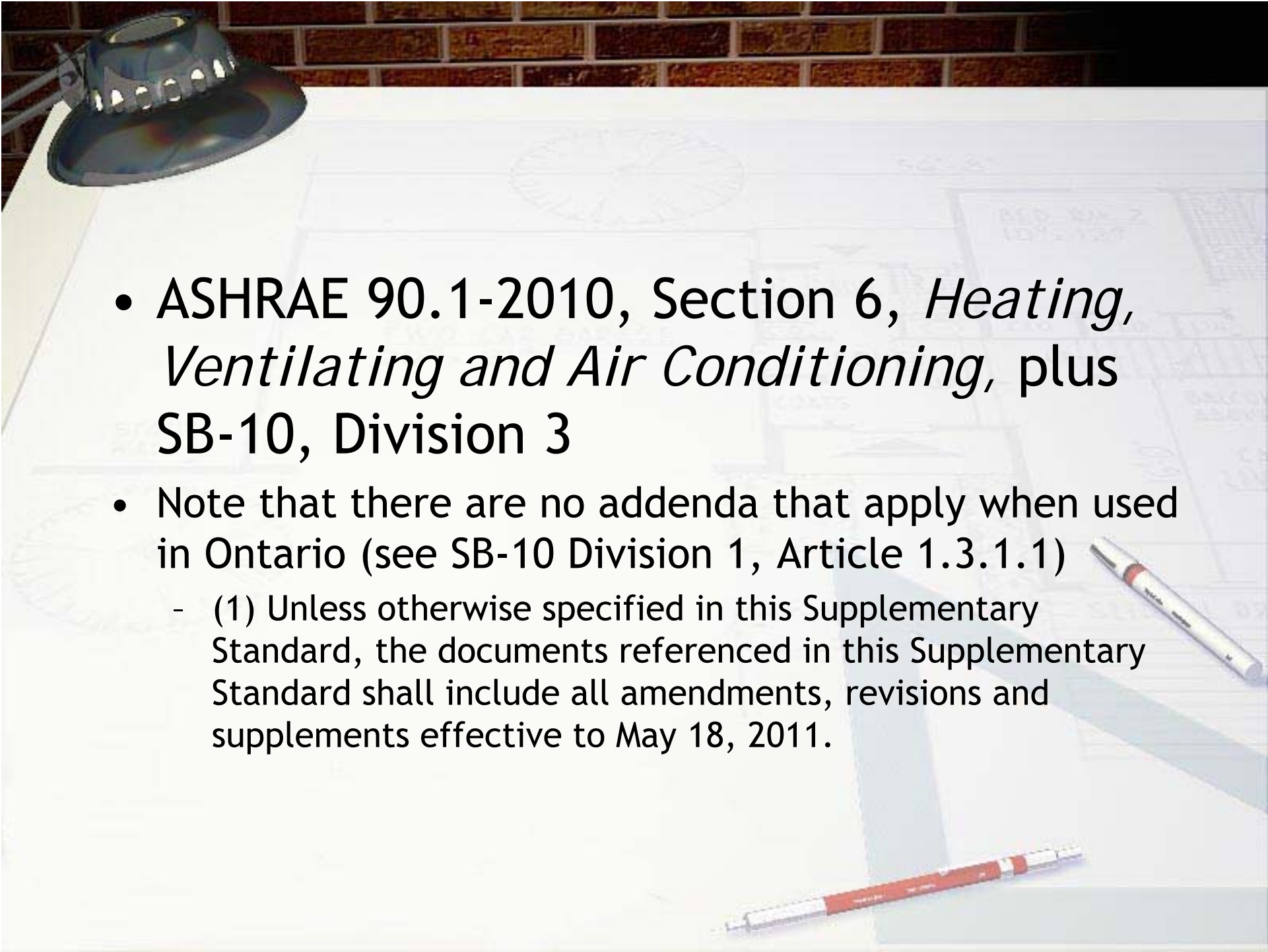
SB-10, Division 3, Article 1.1.1.4

- 1.1.1.4. Heating Ventilation and Air Conditioning Equipment - **Test Procedures**
- (1) Article 6.4.1.A. shall be added to Section 6 “Heating Ventilation and Air Conditioning Equipment” of ANSI/ASHRAE/IESNA Standard 90.1.
- 6.4.1.A. Testing procedures for Minimum Equipment Efficiency - Ontario Regulations
- (1) Where the **test procedure** of equipment listed in Tables 6.8.1A to 6.8.1G of is regulated by an **Ontario Regulation**, **compliance** with the applicable test procedure listed in Column 5 of Table 6.4.1.A.2. **shall be deemed** to be compliance with the **test procedures given in Tables 6.8.1A to 6.8.1G**.
- (2) Where the test procedure of equipment is not regulated by an Ontario Regulation, the applicable test procedure is permitted to be selected from Column 4 (*US*) or Column 5 (*ON*) of Table 6.4.1.A.2.
- Note: Article 1.1.1.5 for service water heating equipment is similar.

SB-10, Division 3, Table 5A, Climate Zones

Zone Number	Thermal Criteria	Typical Locations
Zone 5	$\text{HDD}_{18} < 4000^{\circ}\text{C}$	Windsor, St. Catharines
Zone 6	$4000^{\circ}\text{C} \leq \text{HDD}_{18} < 5000^{\circ}\text{C}$	London, Toronto, Ottawa
Zone 7	$\text{HDD}_{18} \geq 5000^{\circ}\text{C}$	Sudbury, North Bay

Note: All climates in Ontario are Sub-category A (moist)

- 
- ASHRAE 90.1-2010, Section 6, *Heating, Ventilating and Air Conditioning*, plus SB-10, Division 3
 - Note that there are no addenda that apply when used in Ontario (see SB-10 Division 1, Article 1.3.1.1)
 - (1) Unless otherwise specified in this Supplementary Standard, the documents referenced in this Supplementary Standard shall include all amendments, revisions and supplements effective to May 18, 2011.



Integrated Energy Efficiency Ratio

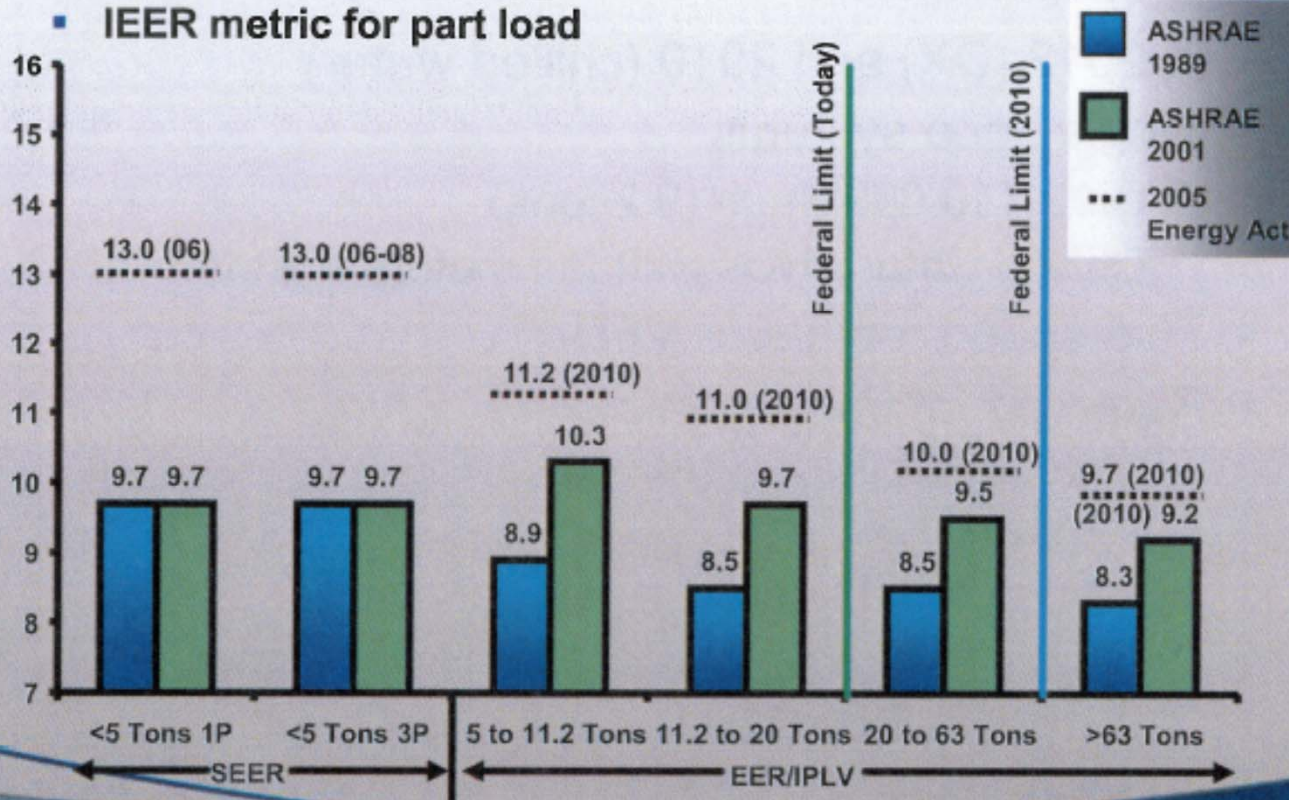
- IEER replaces IPLV for Unitary products.
- Designed to encourage better real world part load, i.e. manufacturers are rewarded for designs that save energy, but were not reflected in the IPLV metric.
- $IEER = 0.02A + 0.617B + 0.238C + 0.125 D$
 - A = EER at AHRI standard rating condition
 - B = EER at 75% net capacity, reduced ambient
 - C = EER at 50% net capacity, reduced ambient
 - D = EER at 25% net capacity, reduced ambient

HVAC Unitary Equipment Efficiency

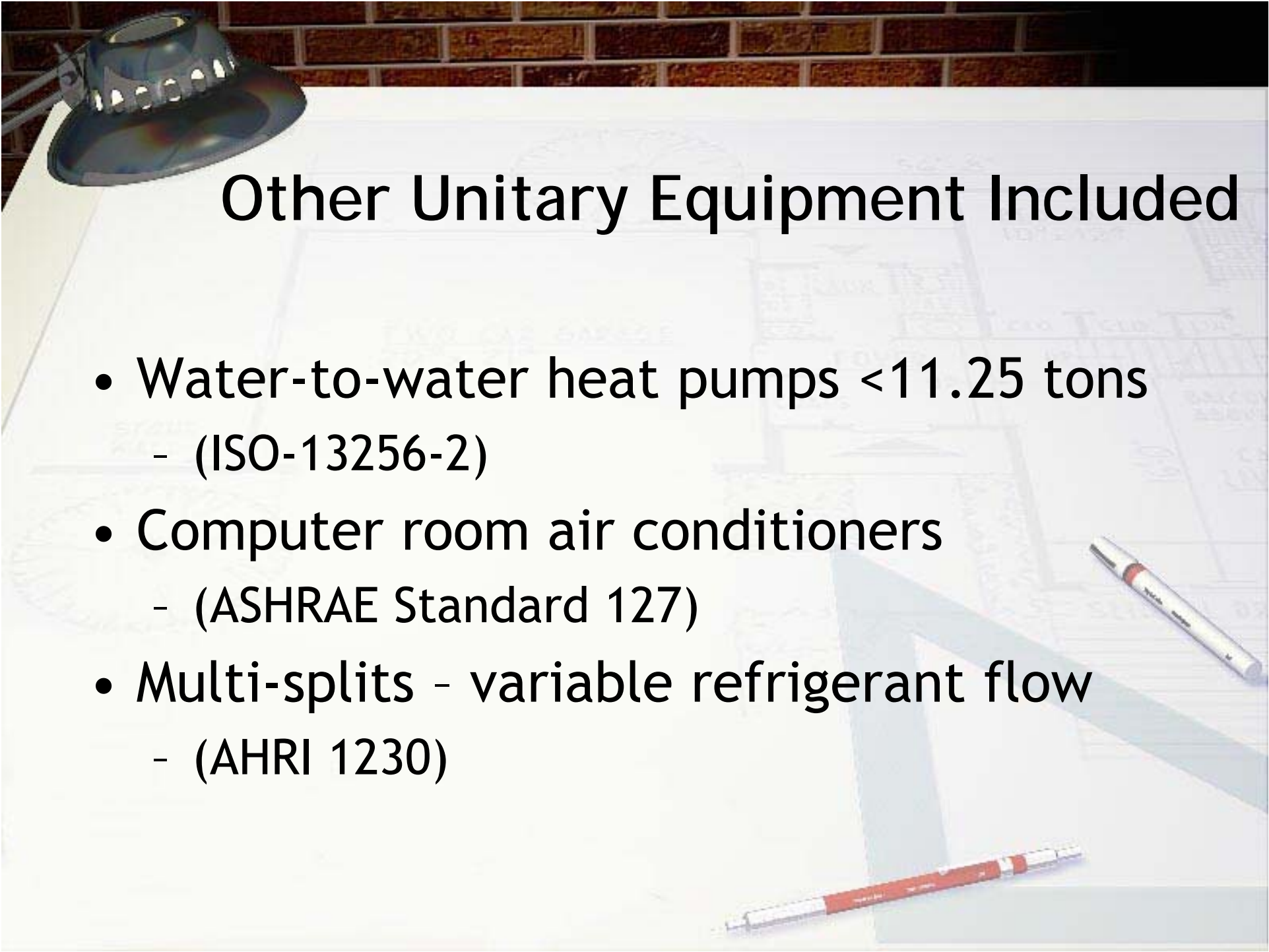
equipment efficiency Unitary

- AC and HP – air cooled
- IEER metric for part load

2010 Unitary addenda:
S, K, N, Y, AO, S, T, BG,
BU, BW, CO, CP

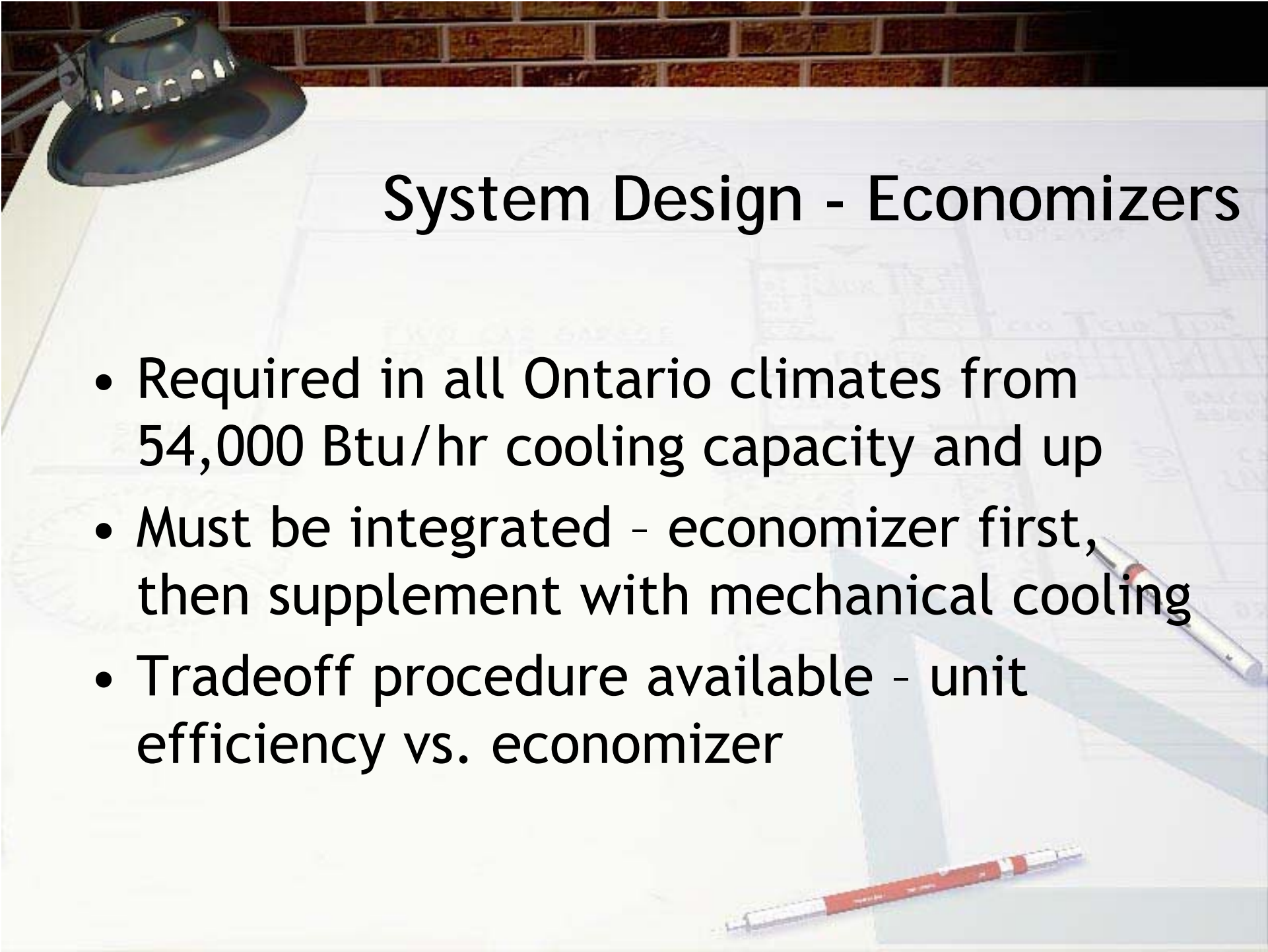


Compared to 1999, there's about a 17% EER improvement in larger sizes, about 30% in the 5 to 20 ton category, and 34% on a SEER basis for small, less than 5 ton equipment.



Other Unitary Equipment Included

- Water-to-water heat pumps <11.25 tons
 - (ISO-13256-2)
- Computer room air conditioners
 - (ASHRAE Standard 127)
- Multi-splits - variable refrigerant flow
 - (AHRI 1230)

A desk lamp with a blue shade is positioned in the upper left corner, casting light on a large blueprint spread across a desk. The background is a brick wall. The blueprint contains faint architectural drawings and text. Two red pens are visible on the desk, one near the bottom right and another near the middle right.

System Design - Economizers

- Required in all Ontario climates from 54,000 Btu/hr cooling capacity and up
- Must be integrated - economizer first, then supplement with mechanical cooling
- Tradeoff procedure available - unit efficiency vs. economizer

System Design - Energy Recovery

Zone	Percent Outdoor Air at Full Design Airflow Rate					
	≥ 30% and < 40%	≥ 40% and < 50%	≥ 50% and < 60%	≥ 60% and < 70%	≥ 70% and < 80%	≥ 80%
	Design Supply Fan Airflow Rate (cfm)					
5A, 6A	≥ 5500	≥ 4500	≥ 1500	≥ 2000	≥ 1000	> 0
7	≥ 2500	≥ 1000	> 0	> 0	> 0	> 0

- Applies to each fan system
- Must have an energy recovery effectiveness $\geq 50\%$

A desk lamp with a blue shade is positioned in the upper left corner, casting light on a large architectural blueprint spread across a table. The blueprint features various technical drawings, including floor plans and structural elements. A red pen and a silver pen are visible on the right side of the table, resting on the blueprint. The background wall is made of dark brown bricks.

Demand Control Ventilation (DCV)

6.4.3.9 Required at zone level if:

- Larger than 500 ft²
- Design occupant density greater than 40 people per 1,000 ft²
- Served by systems with one or more of the following:
 - An air-side economizer
 - Automatic modulating control of the outdoor air damper, or
 - A design outdoor airflow greater than 3,000 cfm

The background of the slide is a photograph of a desk. In the top left corner, there is a silver desk lamp with a glass shade. The desk surface is covered with architectural blueprints. A red pen and a white marker are lying on the blueprints. The top edge of the image shows a brick wall. The title 'Demand Control Ventilation (DCV)' is centered in the upper half of the image.

Demand Control Ventilation (DCV)

Control methods:

- Occupancy Sensors
- Occupancy Schedules
- CO₂ Sensors
- Each method is appropriate for specific types of zones



SB-10, Division 4: Part 9 Non-residential Buildings

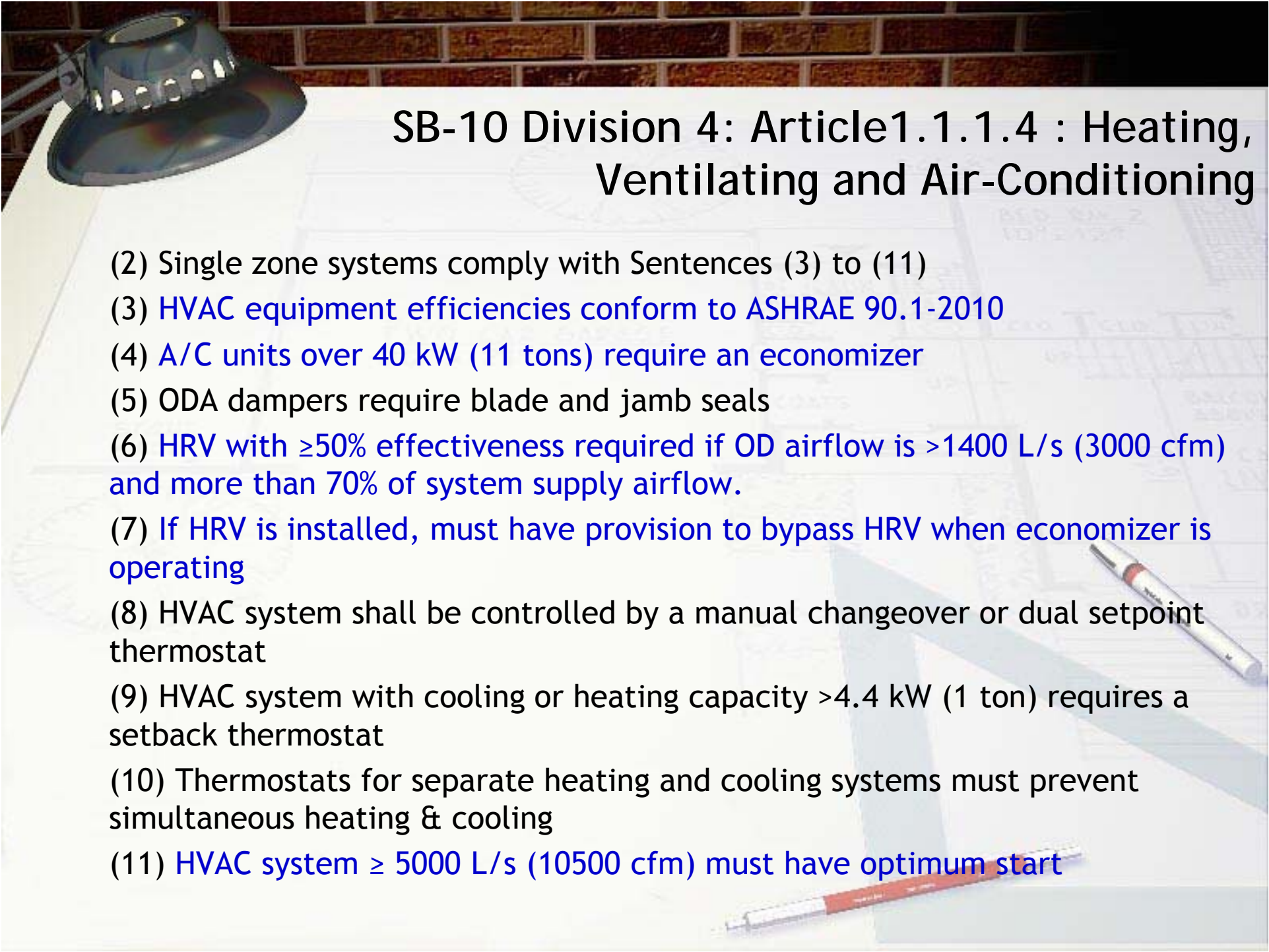
1.1.1.1. Application

(1) Except as provided in Sentences 2 and (3), this Division applies to the energy efficiency of *buildings* or parts of *buildings* where the *building*

- (a) is within the scope of Part 9 of Division B of the Building Code,
- (b) does not contain a *residential occupancy*,
- (c) does not use *electric space heating*, and
- (d) is intended for *occupancy* on a continuing basis during the winter months.

(2) If the fenestration to the gross area exceeds 40%, or the ratio of the gross skylight areas to gross ceiling area exceeds 5%, the *building* envelope shall comply with Article 1.1.2.1. of Chapter 1 of Division 3.

(3) *Buildings* are exempt from compliance with this Division where they meet the exemptions described in Article 1.2.1.1. of Chapter 1 of Division 3.



SB-10 Division 4: Article 1.1.1.4 : Heating, Ventilating and Air-Conditioning

- (2) Single zone systems comply with Sentences (3) to (11)
- (3) HVAC equipment efficiencies conform to ASHRAE 90.1-2010
- (4) A/C units over 40 kW (11 tons) require an economizer
- (5) ODA dampers require blade and jamb seals
- (6) HRV with $\geq 50\%$ effectiveness required if OD airflow is > 1400 L/s (3000 cfm) and more than 70% of system supply airflow.
- (7) If HRV is installed, must have provision to bypass HRV when economizer is operating
- (8) HVAC system shall be controlled by a manual changeover or dual setpoint thermostat
- (9) HVAC system with cooling or heating capacity > 4.4 kW (1 ton) requires a setback thermostat
- (10) Thermostats for separate heating and cooling systems must prevent simultaneous heating & cooling
- (11) HVAC system ≥ 5000 L/s (10500 cfm) must have optimum start



Websites of interest

- ASHRAE 90.1-2010 overview
- ww.tranehk.com/eng_news/vol39_3.pdf
- <http://www.trane.com/commercial/dna/view.aspx?i=2628>
- Supplementary Standard SB-10
- <http://www.mah.gov.on.ca/AssetFactory.aspx?did=9227>
- ASHRAE 90.1-2010 Purchase
- http://www.techstreet.com/standards/ashrae/90_1_2010_i_p?product_id=1739526
- NECB Purchase
- <http://www.nationalcodes.nrc.gc.ca/eng/necb/index.shtml>

A photograph of a desk with a brick wall background. On the desk is a large sheet of paper with architectural drawings. A desk lamp is in the top left corner. A ruler and two pens are in the bottom right corner. The word "Questions?" is written in the center of the page.

Questions?



An architectural floor plan is spread out on a white table. The drawing includes a 'TWO CAR GARAGE' measuring 20' x 31', a 'LAUNDRY' room, a 'FOYER' with a 'COATS' closet, and a 'BED RM 2' measuring 10' x 12'. Other labels include 'STONE WALL', 'CLO', 'CLO', 'BALCONY ABOVE', and 'SLIP'. A large, faint 'SBC' logo is visible in the background. In the foreground, there are drafting tools: a silver desk lamp in the top left, a pair of compasses, a yellow folding ruler, and three markers (green, blue, and red).

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SUSTAINABLE BUILDINGS CANADA