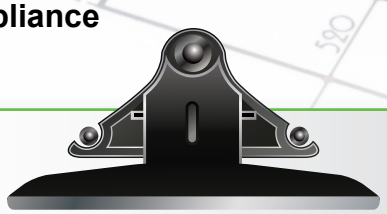
COMMERCIAL

Compliance



DOE's Building Energy Codes Program **(www.energycodes.gov)** and ICC **(www.iccsafe.org)** offer many resources for commercial code officials. Examples in this section include:

- An introduction to commercial compliance approaches and their corresponding tools
- **Help with plan review:** DOE's Case Study and Quick Reference Guide with sample COM*check*™ compliance certificates; excerpts from ICC's *2009 IECC Code and Commentary* and *2009 IECC Study Companion.*
- **Help with inspections:** DOE's new 2009 IECC and ASHRAE Standard 90.1-2007 commercial inspection checklists; ICC's *Energy Inspector's Guide*
- **Commercial Training and Support:** examples and where to go for more

What's in it FOR ME?

COMMERCIAL COMPLIANCE: Approaches and Tools

Commercial buildings must demonstrate compliance with the the jurisdiction's adopted commercial energy code, which is often a close variation of either the commercial chapter within the International Code Council's (ICC's) International Energy Conservation Code (IECC) or the ANSI/ASHRAE/IESNA[1] Standard 90.1 (Standard 90.1). The IECC is updated on a three year cycle (2006, 2009, 2012), as is Standard 90.1 (2004, 2007, 2010).

There are several ways to show compliance, but only one approach is necessary. Below are descriptions of the main three commercial compliance approaches and their corresponding tools, followed by compliance approaches Q&A.

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
Prescriptive Packages Approach	For the building envelope, a prescriptive packages approach would list the minimum R-value or maximum U-factor requirements for each building component, such as windows, walls, and roofs. For lighting systems, a prescriptive approach would simply list the allowable watts per square foot for various building types. For mechanical systems and equipment, a prescriptive approach would list the minimum required equipment efficiencies. This approach is quick and easy to use, but some may find the approach somewhat restrictive because the requirements typically are based on worst-case assumptions, and all requirements must be met exactly as specified.	Standard 90.1-2007 and the 2009 IECC contain information tables that can be applied directly to demonstrate compliance with the prescriptive approach.
Trade-off Approach	A trade-off approach allows you to trade enhanced energy efficiency in one component against decreased energy efficiency in another component. These trade-offs typically occur within major building systems: envelope, lighting, or mechanical. You can, for example, trade decreased wall efficiency (lower R-value) for increased window efficiency (lower U-factor), or increase the roof insulation and reduce or eliminate slab-edge insulation. For lighting systems, the trade-off typically would occur between proposed lighting fixture wattages in various spaces within a building. The only trade-off allowed for mechanical systems and equipment is found in Chapter 8 of the IECC. You may trade off higher cooling equipment efficiency against a requirement for an economizer. The trade-off approach is less restrictive than the prescriptive approach because you describe the actual building design in the trade-off approach and may adjust individual component requirements.	COMcheck™ **COM*check*™**, BECP's free-of-charge compliance software, automates this approach. Through inputs of a building project's features, a user can easily generate and print compliance certificates for each major building system. To download **COM*check*™** or begin using **COM*check-Web*™**, please visit: **www.energycodes.gov/software.stm**

[1] American National Standards Institute; American Society of Heating, Refrigerating and Air-Conditioning Engineers; Illuminating Engineering Society of North America

APPROACH	DESCRIPTION	COMPLIANCE TOOL(S)
Performance Approach	A performance approach (also known as a systems performance approach) allows you to compare your proposed design to a baseline or reference design and demonstrate that the proposed design is at least as efficient as the baseline in terms of annual energy use. This approach allows greater flexibility but requires considerably more effort. A performance approach is often necessary to obtain credit for special features, such as passive solar design, photovoltaic cells, thermal energy storage, and fuel cells. This approach requires an annual energy analysis for the proposed design and the reference design.	DOE's Building Technologies Program maintains a list of building energy software tools. Commercial energy simulation software tools (e.g., EnergyPlus) help users show compliance by the performance approach. See EnergyPlus and nearly 400 other software tools through the Building Energy Software Tools Directory: **http://apps1.eere.energy.gov/buildings/tools_directory/**

Q: Which approach is the best for a specific building?

A: The choice of approach depends on the complexity or uniqueness of the building, and the amount of time and money available for demonstrating compliance. The prescriptive approach allows quick review of the requirements. If these requirements are too restrictive, try a trade-off approach. For example, if the window area of a building exceeds that allowed by the prescriptive approach, a trade-off approach may be preferable. If nontraditional components are involved or if energy use trade-off between building systems (e.g., envelope, mechanical) is desired, try the performance approach.

Of course, not all building projects are new construction. Beyond minor repairs, renovations must also comply with the energy code, and approaches may vary by project. For example:

- Additions may use the prescriptive or trade-off approach.
- For alterations, the prescriptive approach is preferable; otherwise the entire building should be brought up to code.
- When an alteration includes a change of occupancy or converts unconditioned space to conditioned space, treat the project as new construction, for which any of the three approaches can be used.

Q: Do the three approaches produce different results?

A: Yes, they can. Performance approaches require a higher degree of detail so that an individual building can be designed to exactly meet the IECC requirements. Prescriptive approaches tend to be somewhat conservative and use worst-case default assumptions so the prescriptive packages will apply to all buildings. Although the prescriptive approach may result in a more energy-efficient building because of its conservative assumptions, this is not always the case. The prescriptive approach generally does not account for many of the features that affect energy use, such as the effect window orientation and external shading may have on solar heat gain. Trade-off approaches fall somewhere between the prescriptive and performance approaches in flexibility and complexity.

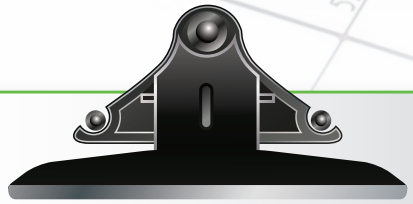
Q: Can I use both codes (the IECC and Standard 90.1) in one building?

A: No. If a building shows compliance with Standard 90.1-2007 in one building system (e.g., envelope, lighting, mechanical), then all systems must comply with 90.1-2007. The same rule applies with the IECC—mixing and matching provisions from the two commercial codes does not demonstrate a building's compliance.

Q: Is it possible to use all these approaches in my state?

A: The 1998, 2000, 2001, 2003, 2004, 2006, and 2009 IECC, and Standard 90.1-1989/1999/2001/2004/2007 contain requirements for all three approaches. If your state has adopted any of these codes directly, you may be allowed to use any of the three compliance approaches. However, if the code has been amended prior to adoption, there may be local variations in effect. It is always advisable for building owners and professionals to check which compliance approaches are available within their state or jurisdiction.

Commercial
Plan Review



What's in it FOR ME?

In this section you'll find:

- ☑ Commercial Case Study, complete with DOE's COM*check*™ *Commercial Plan Review Quick Reference Guide*
- ☑ ICC excerpt: *2009 IECC Code and Commentary*
- ICC excerpt: *2009 IECC Study Companion*

Commercial Case Study

This case study is of a three-story commercial building. These slides correspond to DOE's *Plan Review Quick Reference Guide* and sample COM*check*™ certificates, which immediately follow the presentation slides.
This case study is available within Building Energy Codes University (**www.energycodes.gov/becu**)

Envelope – Typical Wall Section

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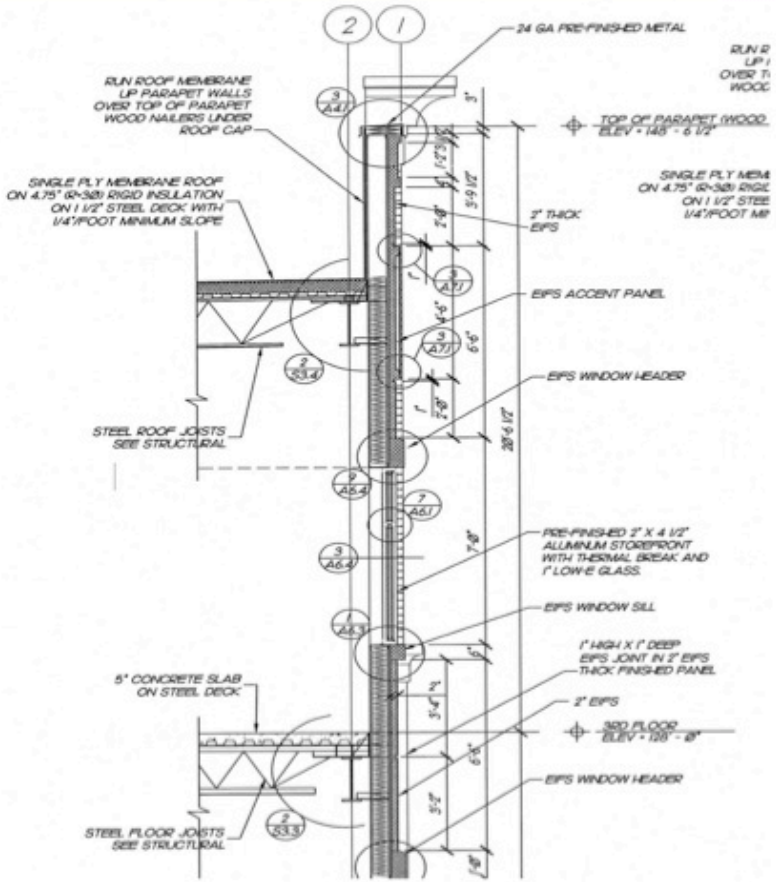

Identifies assembly type and insulation R-value

Wall and roof sections from the plans help identify the assembly type and proposed insulation value for the assembly. For example, the proposed wall type for this building is Steel frame, 16 o.c. with R21 cavity insulation. The roof is a single membrane roof with R-30 continuous insulation.

Envelope – COM*check*™ Exterior Wall Component Inputs

Define Assembly, Construction Details, Gross Area and insulation R-value

Case Study.cck - COMcheck 3.8.0 Code: 2009 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical

Roof | Skylight | Ext. Wall | Window | Door | Basement | Floor

	Component	Assembly	Construction Details	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value
	Building						
1	Roof 1	Insulation Entirely Above...		11570	ft2		30.0
2	Front Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0
3	Window 1	Metal Frame with Therma...	Glazing: Ti...	2185	ft2		
4	Storefront Window	Metal Frame:Double Pan...	Glazing: Ti...	46	ft2		
5	Entrance Door	Glass (> 50% glazing):M...	Type: Entr...	47	ft2		
6	Back Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0
7	Window 1	Metal Frame with Therma...	Glazing: Ti...	2183	ft2		
8	Storefront Window	Metal Frame:Double Pan...	Glazing: Ti...	27	ft2		
9	Entrance Door	Glass (> 50% glazing):M...	Type: Entr...	47	ft2		

Envelope – Window Schedule

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WINDOW SCHEDULE

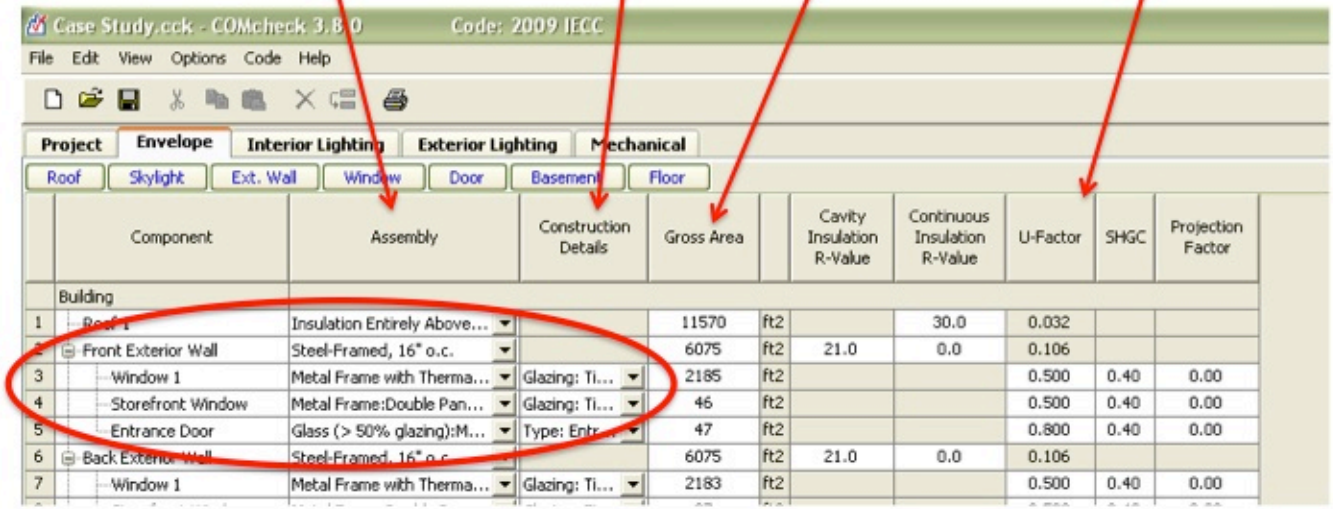
WINDOW TYPE	DIMENSIONS			DETAILS			GLAZING	REMARKS (P) FLOAT GLASS (T) TEMPERED GLASS (S) SPANDREL GLASS (A) FLOAT GLASS WITH INSERT
	WIDTH	HEIGHT	THICK'	HEAD	JAMB	SILL		
(A)	9'-5 1/2"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(B)	9'-0"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(C)	15'-0"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(D)	17'-10"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(E)	16-8"	6'-0"	4 1/2"	7/A6.4	3/A6.4	1/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(F)	9'-5 1/2"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(G)	9'-0"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(H)	15'-0"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(J)	12'-2"	8'-6"	4 1/2"	10/A6.4	4/A6.4	1/A6.4	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(K)	17'-10"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(L)	16'-8"	8'-6"	4 1/2"	9/A6.4	3/A6.4	2/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(M)	9'-5 1/2"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(N)	9'-0"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(P)	15'-0"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(Q)	12'-2"	6'-0"	4 1/2"	10/A6.4	7/A6.4	2/A6.4	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(R)	17'-10"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
(S)	16'-8"	6'-0"	4 1/2"	9/A6.4	5/A6.4	3/A6.3	1" INSULATED W/ LOW E	2" X 4 1/2" ALUM STOREFRONT W/ T-BREAK
( )								
( )								
( )								

Window schedule provides the type of windows (aluminum, thermal break with low e) and dimensions. Assembly type and total square footage (rough opening) are required inputs in COM*check*™. Window schedule can also provide fenestration values (U-factor and SHGC).

Envelope – COM*check*™ Window and Door Input

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Define Assembly, Construction Details, Gross Area, U-factor and SHGC



	Component	Assembly	Construction Details	Gross Area		Cavity Insulation R-Value	Continuous Insulation R-Value	U-Factor	SHGC	Projection Factor
	Building									
1	Roof 1	Insulation Entirely Above...		11570	ft2		30.0	0.032		
2	Front Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0	0.106		
3	Window 1	Metal Frame with Therma...	Glazing: Ti...	2185	ft2			0.500	0.40	0.00
4	Storefront Window	Metal Frame:Double Pan...	Glazing: Ti...	46	ft2			0.500	0.40	0.00
5	Entrance Door	Glass (> 50% glazing):M...	Type: Entr...	47	ft2			0.800	0.40	0.00
6	Back Exterior Wall	Steel-Framed, 16" o.c.		6075	ft2	21.0	0.0	0.106		
7	Window 1	Metal Frame with Therma...	Glazing: Ti...	2183	ft2			0.500	0.40	0.00

Envelope – COM*check*™ summary

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

BUILDING ENVELOPE SUMMARY			
Total Building Area	34,710 ft²		
Number of Floors	3		
Total Finished Out Area	2,014 ft²		
Assembly Type	**Description**	**Area**	**R-value**
Roof	Single Ply Membrane Roof on 4.75" Rigid Insulation on 1 ½" Steel Deck	11,570 ft²	R-30
Exterior Walls	6" Steel Studs @ 16" O.C. w/R-19 unfaced Batts	19,152 ft² (Gross)	R-19
Floor	Slab-on-grade – R-5 perimeter insulation down 2 ft.	447 Linear feet	R-5
Glazing	Storefront Window Metal Frame with Thermal Break, Double Glazed Low E	6,436 ft²	U-0.50 SHGC – 0.40
	Storefront Window Metal Frame with Thermal Break, Double Glazed Low E	294 ft²	U-0.50 SHGC – 0.40
Exterior Doors	All Glass Metal Frame Entrance Doors	188 ft²	U-0.80 SHGC – 0.40

This table provides the overall summary of building thermal envelope take offs that would be entered into COM*check*™ for compliance.

Mechanical – Rooftop Cooling Units

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Packaged Rooftop Unit Schedule

RTU-1

DESCRIPTION:	PACKAGED ROOFTOP MOUNTED VARIABLE AIR VOLUME AIR CONDITIONING UNIT COMPLETE WITH: INDOOR BLOWER WITH VARIABLE FREQUENCY DRIVE; 100% EXHAUST BLOWER WITH ADJUSTABLE V-BELT DRIVE; HIGH EFFICIENCY VFD COMPATIBLE MOTORS; INSULATED CABINET; PACKAGED DX REFRIGERATION COILS AND COMPRESSORS WITH MULTIPLE STEP LOADING / UNLOADING AND LOW AMBIENT OPERATION CAPABILITY; VAV CONTROLS; FILTER RACKS WITH FILTERS; FULL ECONOMIZER CAPABILITY WITH FIXED MINIMUM POSITION OUTSIDE AIR DAMPER; FACTORY ROOF MOUNTING CURB/FRAME. APPROX. OPERATING WEIGHT: 10,500 LB.
COOLING:	55.0 NOM. TONS. 721.4 MBH TOTAL COOLING CAPACITY; 586.1 GROSS SENSIBLE AT OUTPUT AT 80.0 DEG. F. ENT. D.B., 64 DEG. F. ENT. W.B., 91 DEG. F. AMB., 22,000 CFM AT 55.4 DEG. F. LDB; 53.6 DEG. F. LWB. ALL AT 4400 FT. ELEVATION. THREE 15 TON AND ONE 10 TON COMPRESSORS. 9.7 EER.
SUPPLY BLOWER:	22,000 CFM S.A., 2200 CFM MIN. O.A. AT 1.75 IN. WG. EXTERNAL, 3.6 IN. WG TOTAL STATIC. 1130 RPM VARIABLE SPEED BLOWER, 24.9 BHP, ALL AT 4400 FT. ELEV. 25.0 HP 460 V 3PH VFD COMPATIBLE BLOWER MOTOR.
EXHAUST BLOWER:	20,000 CFM EXHAUST AIR AT 0.75 IN. WG. EXTERNAL, 0.8 IN. WG TOTAL STATIC. 784 RPM BELT DRIVE BLOWER, 9.0 BHP, ALL AT 4400 FT. ELEV. 10.0 HP 460 V 3PH SINGLE SPEED BLOWER MOTOR.
UNIT WIRING:	396.6 MCA, 450 A. MINIMUM RECOMMENDED RDE FUSE AT 208 VOLTS, 3 PHASE
FILTERS:	20 - 20" X 25" X 2" DISPOSABLE PLEATED GLASS MEDIA FILTERS IN FRAME.
MANUFACTURER:	TRANE CO. MODEL SXHFC554 OR ENGINEER APPROVED EQUAL.

Packaged Rooftop Unit Schedule

RTU-2

DESCRIPTION:	PACKAGED ROOFTOP MOUNTED VARIABLE AIR VOLUME AIR CONDITIONING UNIT COMPLETE WITH: INDOOR BLOWER WITH VARIABLE FREQUENCY DRIVE; 100% EXHAUST BLOWER WITH ADJUSTABLE V-BELT DRIVE; HIGH EFFICIENCY VFD COMPATIBLE MOTORS; INSULATED CABINET; PACKAGED DX REFRIGERATION COILS AND COMPRESSORS WITH MULTIPLE STEP LOADING / UNLOADING AND LOW AMBIENT OPERATION CAPABILITY; VAV CONTROLS; FILTER RACKS WITH FILTERS; FULL ECONOMIZER CAPABILITY WITH FIXED MINIMUM POSITION OUTSIDE AIR DAMPER; FACTORY ROOF MOUNTING CURB/FRAME. APPROX. OPERATING WEIGHT: 6,190 LB.
COOLING:	30.0 NOM. TONS. 363.5 MBH TOTAL COOLING CAPACITY; 304.5 GROSS SENSIBLE AT OUTPUT AT 80.0 DEG. F. ENT. D.B., 64 DEG. F. ENT. W.B., 91 DEG. F. AMB., 12,000 CFM AT 56.1 DEG. F. LDB; 54.5 DEG. F. LWB. ALL AT 4400 FT. ELEVATION. TWO 15 TON COMPRESSORS. 9.8 EER.
SUPPLY BLOWER:	12,000 CFM S.A., 1500 CFM MIN. O.A. AT 1.75 IN. WG. EXTERNAL, 3.7 IN. WG TOTAL STATIC. 1230 RPM VARIABLE SPEED BLOWER, 13.5 BHP, ALL AT 4400 FT. ELEV. 15.0 HP 460 V 3PH VFD COMPATIBLE BLOWER MOTOR.
EXHAUST BLOWER:	11,000 CFM EXHAUST AIR AT 0.75 IN. WG. EXTERNAL, 0.8 IN. WG TOTAL STATIC. 845 RPM BELT DRIVE BLOWER, 3.8 BHP; ALL AT 4400 FT. ELEV. 5.0 HP 460 V 3PH SINGLE SPEED BLOWER MOTOR.
UNIT WIRING:	214.2 MCA, 250.0 A. MINIMUM RECOMMENDED RDE FUSE AT 208 VOLTS, 3 PHASE
FILTERS:	16 - 20" X 20" X 2" DISPOSABLE PLEATED GLASS MEDIA FILTERS IN FRAME.
MANUFACTURER:	TRANE CO. MODEL SXHFC304 OR ENGINEER APPROVED EQUAL.

COM*check*™ provides a mechanism to enter all HVAC, plant, and service water heating systems. The program does not calculate a pass or fail but provides a customized list of requirements based on the system(s) shown. The packaged rooftop unit (RTU) schedule will provide system type, capacity, and efficiency. In this example the RTU shown on the plans is a packaged variable air volume system.

Mechanical – VAV Terminal Unit

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

VAV Terminal Unit Schedule

UNIT TAG	TRANE CO. MODEL NO.	INLET DIA (IN.)	DSGN CLG FLOW (CFM)	MIN CLG FLOW (CFM)	MIN HTG FLOW (CFM)	PD @DESIGN CLG FLOW (IN.WG)	PRIM HTG FLOW (CFM)	UNIT HTG FLOW (CFM)	FAN FLOW (CFM)	FAN SPEED	FAN MOTOR POWER (HP)	COIL HEAT (MBH)[1]	WATER FLOW (GPM)	COIL WPD (FT)	B&G CIRC. SET.
V-101	VPWF-12035Q	12	1600	240	240	0.01	240	800	560	VAR	1/3 HP	36.05	2.88	2.55	1/2"
V-102	VPWF-10035Q	10	1200	180	180	0.03	180	600	420	VAR	1/3 HP	18.34	1.47	0.51	1/2"
V-103	VPWF-08025Q	8	800	120	120	0.14	120	500	380	VAR	1/8 HP	16.53	1.32	1.26	1/2"

NOTES:
1. FAN MOTORS FOR VAV BOXES SHALL BE 115 V. SINGLE PHASE
2. COIL HEAT CAPACITIES FOR FAN POWERED UNITS ARE BASED ON 175 DEG. EWT, 65 DEG. EAT. 105 DEG. LAT, APPROX 30 DEG. WTD. ALL COILS SHALL BE HIGH CAP.
3. COIL HEAT CAPACITIES FOR RE-HEAT UNITS ARE BASED ON 175 DEG. EWT, 55 DEG. EAT.
4. ALL CAPACITIES SHOWN ARE BASED ON ACTUAL AIR, DERATED FOR ALTITUDE

This is the schedule for the Variable Terminal Units proposed for the building. Hot water reheat is proposed for this building for the VAV boxes. A plan note will need to be included that describes when the reheat will be allowed to be used based on the IECC.

Mechanical – Heating Water Boiler Schedule

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Heating Water Boiler Schedule

PACKAGED ATMOSPHERIC PRESSURE, NATURAL GAS FIRED WATER TUBE STYLE HEATING WATER BOILER COMPLETE WITH: OPERATING CONTROLS; ATMOSPHERIC BURNERS; MAIN AND PILOT GAS COCKS; GAS PRESSURE REGULATOR(S); BAROMETRIC DAMPER; LOW WATER CUT-OFF; 60 LB. ASME RELIEF VALVE; HIGH LIMIT CONTROL; PRESSURE AND TEMPERATURE GAUGE.

1,250 MBH INPUT, 1,037.5 MBH OUTPUT AT SEA LEVEL, 850 MBH OUTPUT AT 4500 FT. ELEVATION. 73 GAL CAPACITY; 161 SQ.FT. HEATING SURFACE; RATED AT UP TO 2,075 GPH AT 60 DEG. F. TEMP RISE. 1-16" DIA. VENT COLLAR. APPROX. 3,510 LBS OPERATING WEIGHT.

120 VOLT CONTROL CIRCUIT.

AJAX CO. MODEL WRN-1250 OR ENGINEER APPROVED EQUAL.

The building will utilize hot water from a boiler for reheat in the VAV system. Boiler efficiency will need to be verified in addition to checking to see that the boiler either has temperature reset or multiple-staged pumps to increase the efficiency of the system for part load.

Lighting Schedule

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

LIGHT FIXTURE SCHEDULE				
TYPE	MANUFACTURER	CATALOG NUMBER	LAMPING	DESCRIPTION
A	DAY-BRITE LIGHTING	2LP3GS33236ALUNV-1/3-EB	(3) 32W T8	FLUORESCENT 2'X4' LAY-IN 18 CELL PARABOLIC LOUEVER
A-EM	DAY-BRITE LIGHTING	2LP3GS33236ALUNV-1/3-EB	(3) 32W T8	SAME AS A BUT WITH ONE LAMP ON EMERGENCY BATTERY PACK
B	CAPRI LIGHTING	CM6-FV26/32/42U-V65	(1) 26W CFM	COMPACT FLUORESCENT RECESSED DOWNLIGHT
B-EM	CAPRI LIGHTING	CM6-FV26/32/42UER-V65	(1) 26W CFM	SAME AS B BUT WITH AN EMERGENCY BATTERY PACK
C	DAY-BRITE LIGHTING	CAN32UNV-1/2-EB	(2) 32W T8	NARROW FLUORESCENT WRAPAROUND
D	T.B.D.	T.B.D.	T.B.D.	BATHROOM VANINTY LIGHT ($200.00 ALLOWANCE)
E	T.B.D.	T.B.D.	T.B.D. MIN EFFICACY: 60 LUMENS/WATT	CONTEMPORARY WALL SCONCE ($200.00 ALLOWANCE)
E-EM	T.B.D.	T.B.D.	T.B.D.	SAME AS E BUT WITH AN EMERGENCY BATTERY PACK
F	US ARCHITECTURAL LIGHTING	DSSHR-111250MH120XPDDBM	250W MH	PARKING AREA LIGHTS MOUNTED ON 20'-0" POLE
G	T.B.D.	T.B.D.	T.B.D.	LOBBY CEILING CHANDELIER ($300.00 ALLOWANCE)
EX1	DAY-BRITE LIGHTING	VEGWEM	LED	GREEN LED EMERGENCY EXIT LIGHT
EX2	DAY-BRITE LIGHTING	VEGWEM	LED	DOUBLE SIDED GREEN LED EMERGENCY EXIT LIGHT
EX3	DAY-BRITE LIGHTING	CCTXL1GWLH	LED	GREEN LED EMERGENCY EXIT LIGHT WITH EMERGENCY BUG LIGHTS

Lighting fixture schedule provides the type of lamps, number of fixtures, and fixture wattage. Interior lighting is calculated based on whole-building or space-by-space type total allowed wattage (watts/sq. ft.) based on the projects proposed wattage (watts/sq. ft.). Allowances and exemptions can also be identified using COM*check*™.

Lighting – Com*check*™ Interior Lighting Inputs

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Case Study.cck - COMcheck 3.8.0 Code: 2009 IECC

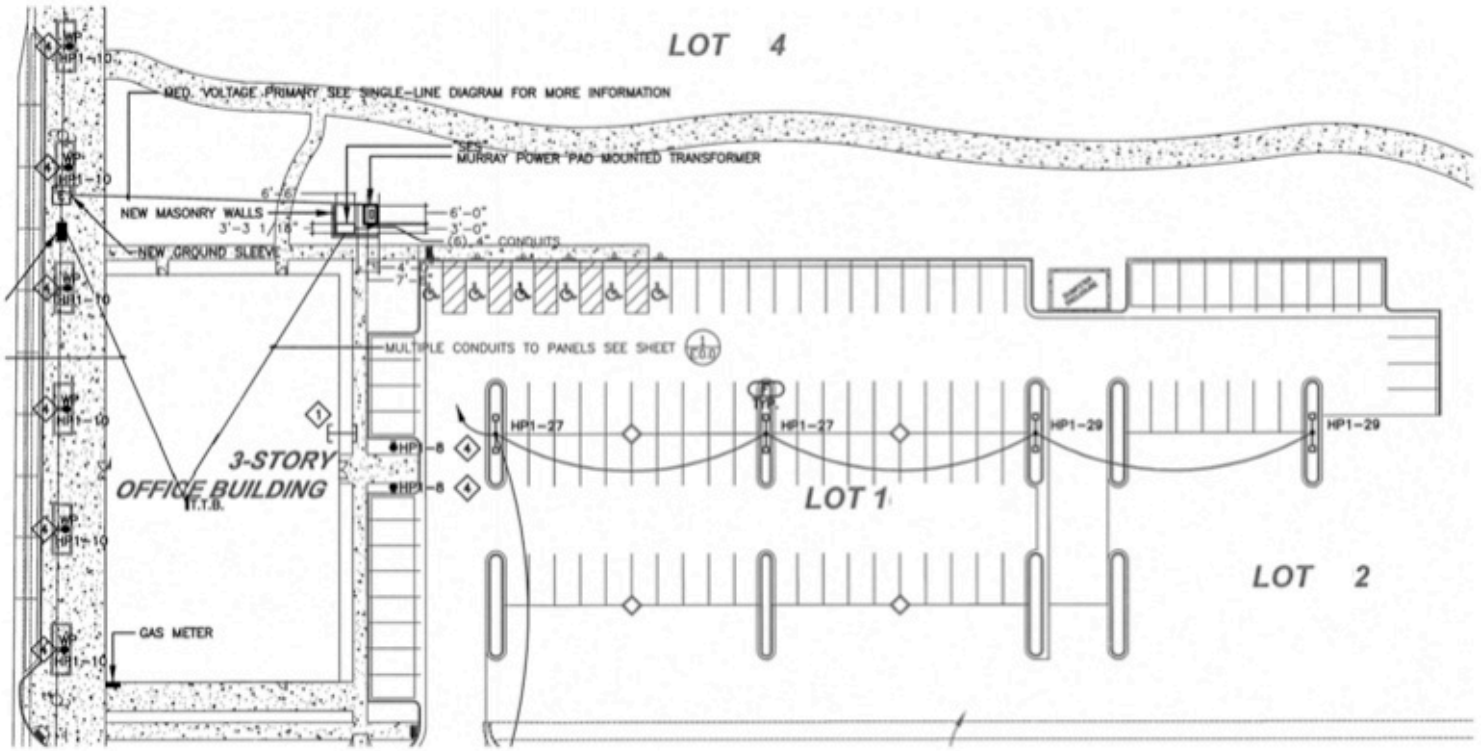
File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical

Linear Fluorescent | Compact Fluorescent | HID | Incandescent | Halogen | Track Lighting

	Component	Fixture ID	Fixture Description	Lamp Description/ Wattage Per Lamp	Ballast	Lamps Per Fixture	Number of Fixtures	Fixture Wattage	Track Lighting Wattage
	Building	Allowed wattage = 2014 Proposed wattage = 1765							
1	Office (2014 sq.ft.)	Allowed wattage = 2014 Proposed wattage = 1765							
2	Linear Fluorescent 2	Type A	32 W T8	48" T8 32W	Electronic	3	10	95	
3	Compact Fluorescent 1	Type B	CFL	Triple 4-pin 26W	Electronic	1	10	29	
4	Linear Fluorescent 1	Type C	32 W T8	48" T8 32W	Electronic	2	5	65	
5	Incandescent 1	Type D	Bathroom Fan Lighting	Incandescent 100W		1	2	100	

Lighting – Parking Lot



The exterior plans designate exterior lights that will need to be documented to determine compliance with the exterior lighting requirements. The light standards that are designated on the plans include a designation that links back to the light schedule. Lighting on the exterior of the building designated on the interior lighting plans will also need to be accounted for in the energy code documentation.

Exterior Lighting Applications

Description	Area
Uncovered Parking Areas - Parking Lots and Drives	40,360 ft^2
Building Grounds - Walkways (<10 ft wide)	355 ft
Building Grounds - Walkways (≥ 10 ft wide)	4,320 ft^2
Building Entrances - Main Entries	12 ft
Building Entrances – Other Doors	12 ft

Exterior lighting compliance is based on the application. The table summarized the exterior lighting applications for this case study.

Lighting – COM*check*™ Exterior Lighting Inputs

Case Study.cck - COMcheck 3.8.0 Code: 2009 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | **Exterior Lighting** | Mechanical

Linear Fluorescent | Compact Fluorescent | HID | Incandescent | Halogen

	Component	Fixture ID	Fixture Description	Lamp Description/ Wattage Per Lamp	Ballast	Lamps Per Fixture	Number of Fixtures	Fixture Wattage
	Exterior Lighting Areas:	Tradable Wattage: Allowed = 3754 Proposed = 3480 Supplemental wattage: 600 (see Help for details)						
1	Parking area (40360 ft2)	Tradable Wattage: Allowed = 2421 Proposed = 2040						
2	HID 1			Metal Halide 250W	Pulse start	1	8	255
3	Walkway < 10 feet wide (355 ft of wa	Tradable Wattage: Allowed = 248 Proposed = 320						
4	HID 2			Metal Halide 75W	Pulse start	1	4	80
5	Walkway >= 10 feet wide (4320 ft2)	Tradable Wattage: Allowed = 604 Proposed = 800						
6	HID 2 copy 1			Metal Halide 75W	Pulse start	1	10	80
7	Main entry (12 ft of door width)	Tradable Wattage: Allowed = 240 Proposed = 160						
8	HID 2 copy 2			Metal Halide 75W	Pulse start	1	2	80
9	Other door (not main entry) (12 ft of	Tradable Wattage: Allowed = 240 Proposed = 160						
10	HID 2 copy 3			Metal Halide 75W	Pulse start	1	2	80

COM*check*™ COMMERCIAL PLAN REVIEW *QUICK REFERENCE GUIDE*

Plan review for energy code compliance can be conducted quickly and efficiently. The U.S. Department of Energy's COM*check*™ Compliance Software is designed to create simplified compliance certificates that can be easily reviewed by enforcement personnel. The Quick Reference Guide identifies the objectives of plan review and code compliance responsibilities, and will take you step-by-step through a typical plan review of a COM*check*™ submittal.

Plan Review Objectives: There are three objectives in conducting a building energy code plan review; verify:

A. the documentation has been correctly prepared
B. the levels of efficiency shown on the plans meet or exceed that shown in the documentation
C. all information needed to conduct a field inspection is included in the plans or documentation for the inspector to use on site

Code Compliance Responsibilities: Successful compliance requires the cooperation of many individuals involved in a building project: designers, engineers, architects, building owners, etc. Compliance also requires the efforts of certain individuals to whom the code gives specific responsibilities:

- Applicant
- Building Official
- Plans Examiner or Special Plans Examiner
- Inspector or Special Inspector

Role of the Applicant: The applicant is the person named on the building permit. The applicant is ultimately responsible for meeting all requirements specific in the code. The applicant may be the owner, architect, engineer, contractor or any other authorized agent for the project owner who applies for the building permit.

Role of the Building Official: The building official is typically responsible for enforcing all provisions of the code. To carry out code enforcement, the building official may appoint technical officers and inspectors.

Role of the Plans Examiner or Special Plans Examiner: Plans examiners or Special Plans Examiners are typically responsible for verifying the plans for energy code compliance.

Role of the Inspector or Special Inspector: Inspectors and Special Inspectors are responsible for conducting field inspections for energy code compliance.

COM*check* Software Version 3.8.0

Envelope Compliance Certificate

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

2009 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Step 2: Verify the **Building Type** or **Activity Type(s)** and **Floor Area** match the project type. Verify the floor area does not exceed the project floor area shown on the building plans. Single occupancy buildings should always use Whole Building Method unless each **Activity Type** within the building is identified separately.

Section 2: General Information

Building Location (for weather data):	**Salt Lake City, Utah**
Climate Zone:	**5b**
Vertical Glazing / Wall Area Pct.:	**26%**

Activity Type(s)	Floor Area
Office	2014

Step 3: Verify the exterior building thermal envelope complies with the code by +0% or greater.

Step 4: Verify the construction assemblies listed under **Component Name/Description** match the construction assemblies shown on the plans.

Step 5: Verify the **Gross Area** or **Perimeter** values represent the proposed project. Verify the fenestration is calculated correctly (rough opening).

Section 3: Requirements Checklist

Envelope PASSES: Design 0.4% better than code.

Climate-Specific Requirements:

Component Name/Description	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor(a)
Roof 1: Insulation Entirely Above Deck	11570	---	30.0	0.032	0.048
Front Exterior Wall: Steel-Framed, 16" o.c.	6075	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	2185	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	46	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Back Exterior Wall: Steel-Framed, 16" o.c.	6075	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	2183	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	27	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Left Exterior Wall: Steel-Framed, 16" o.c.	3501	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	46	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	88	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Right Exterior Wall: Steel-Framed, 16" o.c.	3501	21.0	0.0	0.106	0.064
Window 1: Metal Frame with Thermal Break:Double Pane with Low-E, Tinted, SHGC 0.40	46	---	---	0.500	0.550
Storefront Window: Metal Frame:Double Pane with Low-E, Tinted, SHGC 0.40	133	---	---	0.500	0.550
Entrance Door: Glass (> 50% glazing):Metal Frame, Entrance Door, SHGC 0.40	47	---	---	0.800	0.800
Floor 1: Slab-On-Grade:Unheated, Vertical 2 ft.	447	---	5.0	---	---

(a) Budget U-factors are used for software baseline calculations ONLY, and are not code requirements.

Step 6: Verify the insulation R-values shown on the building plans meet or exceed the values in the **Cavity R-Value** and **Continuous R-Value** section. Verify the insulation will fit uncompressed in the framing cavity. Continuous R-values are for insulation installed over the face of framing; insulation installed with no thermal breaks.

Step 7: Verify the fenestration and door **U-Factors** shown meet or exceed what is provided on the building plans. If shown, **SHGC** and **Projection Factor (PF)** should also be verified.

WARNING: "Other" Assembly Components display only a **U-Factor** with no insulation values. Back-up documentation should be requested or provided on the specifications for the overall U-Factor shown. *No "other" assemblies are listed in this project.*

Air Leakage, Component Certification, and Vapor Retarder Requirements:

☐ 1. All joints and penetrations are caulked, gasketed or covered with a moisture vapor-permeable wrapping material installed in accordance with the manufacturer's installation instructions.

☐ 2. Windows, doors, and skylights certified as meeting leakage requirements.

☐ 3. Component R-values & U-factors labeled as certified.

☐ 4. No roof insulation is installed on a suspended ceiling with removable ceiling panels.

☐ 5. 'Other' components have supporting documentation for proposed U-Factors.

☐ 6. Insulation installed according to manufacturer's instructions, in substantial contact with the surface being insulated, and in a manner that achieves the rated R-value without compressing the insulation.

☐ 7. Stair, elevator shaft vents, and other outdoor air intake and exhaust openings in the building envelope are equipped with motorized dampers.

☐ 8. Cargo doors and loading dock doors are weather sealed.

☐ 9. Recessed lighting fixtures installed in the building envelope are Type IC rated as meeting ASTM E283, are sealed with gasket or caulk.

☐ 10. Building entrance doors have a vestibule equipped with closing devices.

Exceptions:

Building entrances with revolving doors.

Doors that open directly from a space less than 3000 sq. ft. in area.

Section 4: Compliance Statement

Compliance Statement: The proposed envelope design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed envelope system has been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

Project Notes:

Core and Shell Example. Energy Code Compliance is for the building envelope, mechanical system and lighting for the Floor 1 finished out core area.

Step 8: Checklist items: **Insulation, Fenestration and Doors, and Air Leakage and Component Certification** should be reviewed to ensure these mandatory requirements will be met or are exempt (not applicable). For example, review documentation as to whether a vestibule is required.

COM*check* Software Version 3.8.0

Interior Lighting Compliance Certificate

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

2009 IECC

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Step 2: Verify the **Building Type** or **Area Category(s)** and **Floor Area** match the project type. Verify the floor area does not exceed the project floor area shown on the building plans. Single occupancy buildings should always use Whole Building Method unless each **Area Category** within the building is identified separately.

Section 2: Interior Lighting and Power Calculation

A Area Category	B Floor Area (ft2)	C Allowed Watts / ft2	D Allowed Watts (B x C)
Office	2014	1	2014
Total Allowed Watts =			2014

Step 3: Verify the **Lighting Power Calculation** is consistent with the lighting plans.

Step 4: Verify the **Fixture Description, Lamps per Fixture, Ballast Type**, and **Number of Fixtures** shown in the documentation is consistent with the lighting plans/fixture schedule.

Step 5: Verify the **Fixture Wattage** is accurate. Default values can be used in COM*check* or from the manufacture literature. However, careful attention to overall wattage installed against the proposed should be reviewed.

Section 3: Interior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Office (2014 sq.ft.)				
Linear Fluorescent 2: Type A: 32 W T8 / 48" T8 32W / Electronic	3	10	95	950
Compact Fluorescent 1: Type B: CFL / Triple 4-pin 26W / Electronic	1	10	29	290
Linear Fluorescent 1: Type C: 32 W T8 / 48" T8 32W / Electronic	2	5	65	325
Incandescent 1: Type D: Bathroom Fan Lighting / Incandescent 100W	1	2	100	200
Total Proposed Watts =				1765

Step 6: Verify the **Proposed Wattage** is less than or equal to the **Allowed Wattage**.

Section 4: Requirements Checklist

Lighting Wattage:

☐ 1. Total proposed watts must be less than or equal to total allowed watts.

Allowed Watts	Proposed Watts	Complies
2014	1765	YES

Step 7: Verify all mandatory requirements have been met. For example, verify switching for each interior space is shown on the lighting plans and is applicable to the space type.

Controls, Switching, and Wiring:

☐ 2. Daylight zones under skylights more than 15 feet from the perimeter have lighting controls separate from daylight zones adjacent to vertical fenestration.

☐ 3. Daylight zones have individual lighting controls independent from that of the general area lighting.

Exceptions:
Contiguous daylight zones spanning no more than two orientations are allowed to be controlled by a single controlling device.
Daylight spaces enclosed by walls or ceiling height partitions and containing two or fewer light fixtures are not required to have a separate switch for general area lighting.

☐ 4. Independent controls for each space (switch/occupancy sensor).

Exceptions:
Areas designated as security or emergency areas that must be continuously illuminated.
Lighting in stairways or corridors that are elements of the means of egress.

☐ 5. Master switch at entry to hotel/motel guest room.

☐ 6. Individual dwelling units separately metered.

☐ 7. Medical task lighting or art/history display lighting claimed to be exempt from compliance has a control device independent of the control of the nonexempt lighting.

☐ 8. Each space required to have a manual control also allows for reducing the connected lighting load by at least 50 percent by either controlling all luminaires, dual switching of alternate rows of luminaires, alternate luminaires, or alternate lamps, switching the middle lamp luminaires independently of other lamps, or switching each luminaire or each lamp.

Exceptions:
Only one luminaire in space.
An occupant-sensing device controls the area.
The area is a corridor, storeroom, restroom, public lobby or sleeping unit.
Areas that use less than 0.6 Watts/sq.ft.

☐ 9. Automatic lighting shutoff control in buildings larger than 5,000 sq.ft.

Exceptions:
Sleeping units, patient care areas; and spaces where automatic shutoff would endanger safety or security.

☐ 10. Photocell/astronomical time switch on exterior lights.

Exceptions:
Lighting intended for 24 hour use.

☐ 11. Tandem wired one-lamp and three-lamp ballasted luminaires (No single-lamp ballasts).

Exceptions:
Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.

Interior Lighting PASSES: Design 12% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

Step 8: Verify the **Interior Lighting** complies with the code by +0% or greater.

COM*check* Software Version 3.8.0

Exterior Lighting Compliance Certificate

2009 IECC

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building
Exterior Lighting Zone: **2 (Neighborhood business district)**

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Step 2: Verify the lighting application(s) (**Exterior Area/Surface), Quantity**, and **Totals** match lighting specifications.

Section 2: Exterior Lighting Area/Surface Power Calculation

A Exterior Area/Surface	B Quantity	C Allowed Watts / Unit	D Tradable Wattage	E Allowed Watts (B x C)	F Proposed Watts
Parking area	40360 ft2	0.06	Yes	2422	2040
Walkway < 10 feet wide	355 ft of walkway length	0.7	Yes	248	320
Walkway >= 10 feet wide	4320 ft2	0.14	Yes	605	800
Main entry	12 ft of door width	20	Yes	240	160
Other door (not main entry)	12 ft of door width	20	Yes	240	160
Total Tradable Watts* =				3755	3480
Total Allowed Watts =				3755	
Total Allowed Supplemental Watts** =				600	

* Wattage tradeoffs are only allowed between tradable areas/surfaces.
** A supplemental allowance equal to 600 watts may be applied toward compliance of both non-tradable and tradable areas/surfaces.

Step 3: Verify the **Fixture Description, Lamps per Fixture, Ballast Type**, and **Number of Fixtures** shown in the documentation is consistent with the lighting plans/fixture schedule.

Step 4: Verify the **Fixture Wattage** is accurate. Default values can be from COM*check* or from manufacture literature. However, careful attention to overall wattage installed against the proposed should be reviewed.

Section 3: Exterior Lighting Fixture Schedule

A Fixture ID : Description / Lamp / Wattage Per Lamp / Ballast	B Lamps/ Fixture	C # of Fixtures	D Fixture Watt.	E (C X D)
Parking area (40360 ft2): Tradable Wattage				
HID 1: Metal Halide 250W / Pulse start	1	8	255	2040
Walkway < 10 feet wide (355 ft of walkway length): Tradable Wattage				
HID 2: Metal Halide 75W / Pulse start	1	4	80	320
Walkway >= 10 feet wide (4320 ft2): Tradable Wattage				
HID 2 copy 1: Metal Halide 75W / Pulse start	1	10	80	800
Main entry (12 ft of door width): Tradable Wattage				
HID 2 copy 2: Metal Halide 75W / Pulse start	1	2	80	160
Other door (not main entry) (12 ft of door width): Tradable Wattage				
HID 2 copy 3: Metal Halide 75W / Pulse start	1	2	80	160
Total Tradable Proposed Watts =				3480

Step 5: Verify all mandatory requirements have been met.

Section 4: Requirements Checklist

Lighting Wattage:

☐ 1. Within each non-tradable area/surface, total proposed watts must be less than or equal to total allowed watts. Across all tradable areas/surfaces, total proposed watts must be less than or equal to total allowed watts.

Compliance: Passes.

Controls, Switching, and Wiring:

☐ 2. All exemption claims are associated with fixtures that have a control device independent of the control of the nonexempt lighting.

☐ 3. Lighting not designated for dusk-to-dawn operation is controlled by either a a photosensor (with time switch), or an astronomical time switch.

☐ 4. Lighting designated for dusk-to-dawn operation is controlled by an astronomical time switch or photosensor.

☐ 5. All time switches are capable of retaining programming and the time setting during loss of power for a period of at least 10 hours.

Exterior Lighting Efficacy:

☐ 6. All exterior building grounds luminaires that operate at greater than 100W have minimum efficacy of 60 lumen/watt.

Exceptions:

Lighting that has been claimed as exempt and is identified as such in Section 3 table above.
Lighting that is specifically designated as required by a health or life safety statue, ordinance, or regulation.
Emergency lighting that is automatically off during normal building operation.
Lighting that is controlled by motion sensor.

Exterior Lighting PASSES: Design 20% better than code.

Section 5: Compliance Statement

Compliance Statement: The proposed exterior lighting design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed lighting system has been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title | Signature | Date

Step 6: Verify the **Exterior Lighting** complies with the code by +0% or greater.

COM*check* Software Version 3.8.0

Mechanical Compliance Certificate

2009 IECC

Step 1: Verify the **Project Information** matches the information on the building plans. The code, location, and project type will impact compliance.

Section 1: Project Information

Project Type: **New Construction**
Project Title : Sample Office Building

Construction Site:
2222 Redwood Road
Salt Lake City, UT 22262
Permit No. 10-463
Permit Date: August 19, 2010

Owner/Agent:
ABC Property Company
1677 2nd Street
Salt Lake City, UT 22311

Designer/Contractor:
Designs Are Us
1453 McMinnion Street
Park City, UT 99422

Section 2: General Information

Building Location (for weather data): **Salt Lake City, Utah**
Climate Zone: **5b**

Step 2: Verify the Mechanical System(s) specified in Section 3 matches what is called out on the mechanical plans/specifications and the quantity and type of each unit are correct.

Section 3: Mechanical Systems List

Quantity	System Type & Description
1	HVAC System 1: Cooling: Cooling equipment (Rooftop Package Unit), Capacity Unknown, Efficiency: 12.10 , Evaporatively Cooled Condenser / Multiple-Zone
1	HVAC System 3: Cooling: Cooling equipment (Rooftop Package Unit), Capacity Unknown, Evaporatively Cooled Condenser / Multiple-Zone
1	Plant 1: Heating: Hot Water Boiler, Capacity 1038 kBtu/h, Gas, Efficiency: 75.00 % Et

Section 4: Requirements Checklist

Requirements Specific To: HVAC System 1 :

☐ 1. Equipment minimum efficiency: Rooftop Package Unit: 12.1 EER
☐ 2. Minimum one temperature control device per zone
☐ 3. Leak testing > 3 per in. static pressure - report submitted showing CL < 6.0
☐ 4. Balancing and pressure test connections on all hydronic terminal devices
☐ 5. Systems serving more than one zone must be VAV systems
Exception: Where pressure relationships must be maintained
Exception: Zones or supply air systems with at least 75% of reheating/recooling energy site recovered or site solar
Exception: Zones with humidity requirements for special processes
Exception: Zones with cfm <300 and flow rate <10% of total design flow rate
Exception: Outside air needed to meet IMC Chapter 4

☐ 6. Single-duct VAV terminals reduce primary air before reheating

☐ 7. Controls capable of resetting supply air temp (SAT) by 25% of SAT-room temp difference
Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: HVAC System 3 :

☐ 1. Equipment minimum efficiency: Rooftop Package Unit: 12.1 EER

☐ 2. Minimum one temperature control device per zone

☐ 3. Leak testing > 3 per in. static pressure - report submitted showing CL < 6.0

☐ 4. Balancing and pressure test connections on all hydronic terminal devices

☐ 5. Systems serving more than one zone must be VAV systems
Exception: Where pressure relationships must be maintained
Exception: Zones or supply air systems with at least 75% of reheating/recooling energy site recovered or site solar
Exception: Zones with humidity requirements for special processes
Exception: Zones with cfm <300 and flow rate <10% of total design flow rate
Exception: Outside air needed to meet IMC Chapter 4

☐ 6. Single-duct VAV terminals reduce primary air before reheating

☐ 7. Controls capable of resetting supply air temp (SAT) by 25% of SAT-room temp difference
Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: Plant 1 :

☐ 1. Equipment minimum efficiency: Boiler Thermal Efficiency 75% Et 80% Ec

☐ 2. Two-pipe changeover heating/cooling controls must have:
a) 15 degrees F deadband where boiler and chiller can not operate,
b) allow operation in either heating or cooling for at least 4 hrs. and
c) prevent difference between heating and cooling set points greater than 30 degrees F

☐ 3. Newly purchased heating equipment meets the efficiency requirements
- used equipment must meet 80% Et @ maximum capacity

☐ 4. Systems with multiple boilers have automatic controls capable of sequencing boiler operation

☐ 5. Hydronic heating systems comprised of a single boiler and >500 kBtu/h input design capacity
include either a multistaged or modulating burner

Generic Requirements: Must be met by all systems to which the requirement is applicable:

☐ 1. Plant equipment and system capacity no greater than needed to meet loads
Exception: Standby equipment automatically off when primary system is operating
Exception: Multiple units controlled to sequence operation as a function of load

☐ 2. Minimum one temperature control device per system

☐ 3. Minimum one humidity control device per installed humidification/dehumidification system

☐ 4. Load calculations per ASHRAE/ACCA Standard 183

☐ 5. Automatic Controls: Setback to 55°F (heat) and 85°F (cool); 7-day clock,
2-hour occupant override, 10-hour backup
Exception: Continuously operating zones
Exception: 2 kW demand or less, submit calculations

☐ 6. Outside-air source for ventilation; system capable of reducing OSA to required minimum

☐ 7. R-5 supply and return air duct insulation in unconditioned spaces
R-8 supply and return air duct insulation outside the building
R-8 insulation between ducts and the building exterior when ducts are part of a building assembly
Exception: Ducts located within equipment
Exception: Ducts with interior and exterior temperature difference not exceeding 15°F.

☐ 8. Mechanical fasteners and sealants used to connect ducts and air distribution equipment

☐ 9. Ducts sealed - longitudinal seams on rigid ducts; transverse seams on all ducts;
UL 181A or 181B tapes and mastics

☐ 10. Hot water pipe insulation: 1 in. for pipes <=1.5 in. and 2 in. for pipes >1.5 in.
Chilled water/refrigerant/brine pipe insulation: 1 in. for pipes <=1.5 in. and 1.5 in. for pipes >1.5 in.
Steam pipe insulation: 1.5 in. for pipes <=1.5 in. and 3 in. for pipes >1.5 in.
Exception: Piping within HVAC equipment.
Exception: Fluid temperatures between 55 and 105°F.
Exception: Fluid not heated or cooled with renewable energy.
Exception: Piping within room fan-coil (with AHRI440 rating) and unit ventilators (with AHRI840 rating).
Exception: Runouts <4 ft in length.

☐ 11. Operation and maintenance manual provided to building owner

☐ 12. Hot water distribution systems >=300 kBtu/h must have one of the following:
a) controls that reset supply water temperature by 25% of supply/return delta T
b) mechanical or electrical adjustable-speed pump drive(s)
c) two-way valves at all heating coils
d) multiple-stage pumps
e) other system controls that reduce pump flow by at least 50% based on load
- calculations required

Exception: Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems.
Exception: Hydronic systems that use variable flow to reduce pumping energy.

☐ 13. Balancing devices provided in accordance with IMC (2006) 603.17

☐ 14. Demand control ventilation (DCV) present for high design occupancy areas (>40 person/1000 ft2 in spaces >500 ft2) and served by systems with any one of 1) an air-side economizer, 2) automatic modulating control of the outdoor air damper, or 3) a design outdoor airflow greater than 3000 cfm.

Exception: Systems with heat recovery.
Exception: Multiple-zone systems without DDC of individual zones communicating with a central control panel.
Exception: Systems with a design outdoor airflow less than 1200 cfm.
Exception: Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.

☐ 15. Motorized, automatic shutoff dampers required on exhaust and outdoor air supply openings

Exception: Gravity dampers acceptable in buildings <3 stories
Exception: Gravity dampers acceptable in systems with outside or exhaust air flow rates less than 300 cfm where dampers are interlocked with fan

☐ 16. Automatic controls for freeze protection systems present

☐ 17. Three-pipe systems not used

☐ 18. Exhaust air heat recovery included for systems 5,000 cfm or greater with more than 70% outside air fraction or specifically exempted

Exception: Hazardous exhaust systems, commercial kitchen and clothes dryer exhaust systems that the International Mechanical Code prohibits the use of energy recovery systems.
Exception: Systems serving spaces that are heated and not cooled to less than 60°F.
Exception: Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
Exception: Heating systems in climates with less than 3600 HDD.
Exception: Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64°F.
Exception: Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
Exception: Laboratory fume hood exhaust systems that have either a variable air volume system capable of reducing exhaust and makeup air volume to 50 percent or less of design values or, a separate make up air supply meeting the following makeup air requirements: a) at least 75 percent of exhaust flow rate, b) heated to no more than 2°F below room setpoint temperature, c) cooled to no lower than 3°F above room setpoint temperature, d) no humidification added, e) no simultaneous heating and cooling.

Section 5: Compliance Statement

Compliance Statement: The proposed mechanical design represented in this document is consistent with the building plans, specifications and other calculations submitted with this permit application. The proposed mechanical systems have been designed to meet the 2009 IECC requirements in COM*check* Version 3.8.0 and to comply with the mandatory requirements in the Requirements Checklist.

Name - Title	Signature	Date

COM*check* Software Version 3.8.0

Mechanical Requirements Description

2009 IECC

The following list provides more detailed descriptions of the requirements in Section 4 of the Mechanical Compliance Certificate.

Requirements Specific To: HVAC System 1 :

1.The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Rooftop Package Unit: 12.1 EER

2.Each zone of a multiple-zone system must have its own temperature control device.

3.The specified distribution system is designed to operate at static pressure over 3 in. water column. The system must be leak tested in accordance with SMACNA standards. The contractor or engineer must submit a report to the enforcing jurisdiction documenting that a minimum of 25% of all duct surfaces have been tested and that tested ducts have a SMACNA rated air leakage class of under 6.0.

4.Hydronic heating and cooling coils must be equipped with a way to pressure test connections and measure and balance water flow and pressure.

5.Systems serving multiple thermostatic control zones must be variable-flow systems. Zone terminal controls must reduce the flow of primary supply air before reheating, recooling, or mixing air streams to one of the following:
a) 30% of the maximum supply air to each zone,
b) 300 cfm or less where the maximum flow rate is less than 10% of the total fan system supply airflow rate, or
c) minimum ventilation requirements of Chapter 4 of the International Mechanical Code.

Exception: VAV controls are not required for zones with special pressurization or cross-contamination requirements. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones or supply air systems where at least 75% of the reheating and recooling energy is made available through the use of site-recovered or site solar energy. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones with special humidity control requirements for specialized processes. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones that require less than 300 cfm of supply air provided the total airflow to these zones does not exceed 10% of the total design flow rate for the system.
Exception: VAV controls are not required where constant volume supply air is necessary to meet the minimum outside air requirements of Chapter 4 of the International Mechanical Code. These zones must be called out in the construction documents for easy identification during field inspection.

6.The specified multiple-zone system is equipped with single-duct VAV terminals. These terminals must be equipped with dampers, air valves, or other means to reduce the supply of primary supply air to a minimum prior to reheating.

7.Automatic controls capable of resetting supply-air temperature (within a range of 25 percent of the difference between supply-air and design air temperature) in response to building loads or outdoor air temperature exist on systems serving multiple zones.

Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: HVAC System 3 :

1.The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Rooftop Package Unit: 12.1 EER

2.Each zone of a multiple-zone system must have its own temperature control device.

3.The specified distribution system is designed to operate at static pressure over 3 in. water column. The system must be leak tested in accordance with SMACNA standards. The contractor or engineer must submit a report to the enforcing jurisdiction documenting that a minimum of 25% of all duct surfaces have been tested and that tested ducts have a SMACNA rated air leakage class of under 6.0.

4.Hydronic heating and cooling coils must be equipped with a way to pressure test connections and measure and balance

water flow and pressure.

5.Systems serving multiple thermostatic control zones must be variable-flow systems. Zone terminal controls must reduce the flow of primary supply air before reheating, recooling, or mixing air streams to one of the following:
a) 30% of the maximum supply air to each zone,
b) 300 cfm or less where the maximum flow rate is less than 10% of the total fan system supply airflow rate, or
c) minimum ventilation requirements of Chapter 4 of the International Mechanical Code.

Exception: VAV controls are not required for zones with special pressurization or cross-contamination requirements. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones or supply air systems where at least 75% of the reheating and recooling energy is made available through the use of site-recovered or site solar energy. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones with special humidity control requirements for specialized processes. These zones must be called out in the construction documents for easy identification during field inspection.
Exception: VAV controls are not required for zones that require less than 300 cfm of supply air provided the total airflow to these zones does not exceed 10% of the total design flow rate for the system.
Exception: VAV controls are not required where constant volume supply air is necessary to meet the minimum outside air requirements of Chapter 4 of the International Mechanical Code. These zones must be called out in the construction documents for easy identification during field inspection.

6.The specified multiple-zone system is equipped with single-duct VAV terminals. These terminals must be equipped with dampers, air valves, or other means to reduce the supply of primary supply air to a minimum prior to reheating.

7.Automatic controls capable of resetting supply-air temperature (within a range of 25 percent of the difference between supply-air and design air temperature) in response to building loads or outdoor air temperature exist on systems serving multiple zones.

Exception: Systems that prevent reheating, recooling or mixing of heated and cooled supply air
Exception: Seventy five percent of the energy for reheating is from site-recovered or site solar energy sources.
Exception: Zones with peak supply air quantities of 300 cfm (142 L/s) or less.

Requirements Specific To: Plant 1 :

1.The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Boiler Thermal Efficiency 75% Et 80% Ec

2.Two-pipe changeover heating/cooling controls must:
a) allow a deadband between changeover from one mode (heating/cooling) to the other of at least 15 degrees F outside temperatures
b) allow operation in one mode (heating/cooling) for at least 4 hours before changing over to the other mode
c) allow heating and cooling supply temperatures at the changeover point to be no more than 30 degrees F apart.

3.The specified heating equipment is covered by Federal minimum efficiency requirements. New equipment of this type can be assumed to meet or exceed ASHRAE 90.1 Code requirements for equipment efficiency. Used equipment must meet 80% Et @ maximum capacity.

4.Systems with multiple boilers have automatic controls capable of sequencing the operation of the boilers.

5.Hydronic heating systems comprised of a single boiler and >500 kBtu/h input design capacity include either a multistaged or modulating burner.

Generic Requirements: Must be met by all systems to which the requirement is applicable:

1.All equipment and systems must be sized to be no greater than needed to meet calculated loads. A single piece of equipment providing both heating and cooling must satisfy this provision for one function with the capacity for the other function as small as possible, within available equipment options.

Exception: The equipment and/or system capacity may be greater than calculated loads for standby purposes. Standby equipment must be automatically controlled to be off when the primary equipment and/or system is operating.
Exception: Multiple units of the same equipment type whose combined capacities exceed the calculated load are allowed if they are provided with controls to sequence operation of the units as the load increases or decreases.

2.Each heating or cooling system serving a single zone must have its own temperature control device.

3.Each humidification system must have its own humidity control device.

4.Design heating and cooling loads for the building must be determined using procedures in the ASHRAE Handbook of Fundamentals or an approved equivalent calculation procedure.

5.The system or zone control must be a programmable thermostat or other automatic control meeting the following criteria:
a) capable of setting back temperature to 55°F during heating and setting up to 85°F during cooling,
b) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedules,
c) have an accessible 2-hour occupant override,
d) have a battery back-up capable of maintaining programmed settings for at least 10 hours without power.

Exception: A setback or shutoff control is not required on thermostats that control systems serving areas that operate continuously.
Exception: A setback or shutoff control is not required on systems with total energy demand of 2 kW (6,826 Btu/h) or less.

6.The system must supply outside ventilation air as required by Chapter 4 of the International Mechanical Code. If the ventilation system is designed to supply outdoor-air quantities exceeding minimum required levels, the system must be

capable of reducing outdoor-air flow to the minimum required levels.

7.Air ducts must be insulated to the following levels:
a) Supply and return air ducts for conditioned air located in unconditioned spaces (spaces neither heated nor cooled) must be insulated with a minimum of R-5. Unconditioned spaces include attics, crawl spaces, unheated basements, and unheated garages.
b) Supply and return air ducts and plenums must be insulated to a minimum of R-8 when located outside the building.
c) When ducts are located within exterior components (e.g., floors or roofs), minimum R-8 insulation is required only between the duct and the building exterior.

Exception: Duct insulation is not required on ducts located within equipment.
Exception: Duct insulation is not required when the design temperature difference between the interior and exterior of the duct or plenum does not exceed 15°F.

8.Mechanical fasteners and seals, mastics, or gaskets must be used when connecting ducts to fans and other air distribution equipment, including multiple-zone terminal units.

9.All joints, longitudinal and transverse seams, and connections in ductwork must be securely sealed using weldments; mechanical fasteners with seals, gaskets, or mastics; mesh and mastic sealing systems; or tapes.
Tapes and mastics must be listed and labeled in accordance with UL 181A and shall be marked '181A-P' for pressure sensitive tape,
'181A-M' for mastic or '181A-H' for heat-sensitive tape. Tapes and mastics used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked '181B-FX' for pressure-sensitive tape or '181B-M' for mastic. Unlisted duct tape is not permitted as a sealant on any metal ducts.

10.All pipes serving space-conditioning systems must be insulated as follows:

Hot water piping for heating systems:
1 1/2 in. for pipes <=1 1/2-in. nominal diameter,
2 in. for pipes >1 1/2-in. nominal diameter.

Chilled water, refrigerant, and brine piping systems:
1 1/2 in. insulation for pipes <=1 1/2-in. nominal diameter,
1 1/2 in. insulation for pipes >1 1/2-in. nominal diameter.

Steam piping:
1 1/2 in. insulation for pipes <=1 1/2-in. nominal diameter,
3 in. insulation for pipes >1 1/2-in. nominal diameter.

Exception: Pipe insulation is not required for factory-installed piping within HVAC equipment.
Exception: Pipe insulation is not required for piping that conveys fluids having a design operating temperature range between 55°F and 105°F.
Exception: Pipe insulation is not required for piping that conveys fluids that have not been heated or cooled through the use of fossil fuels or electric power.
Exception: Piping within room fan-coil (with AHRI440 rating) and unit ventilators (with AHRI840 rating).
Exception: Pipe insulation is not required for runout piping not exceeding 4 ft in length and 1 in. in diameter between the control valve and HVAC coil.

11.Operation and maintenance documentation must be provided to the owner that includes at least the following information:
a) equipment capacity (input and output) and required maintenance actions
b) equipment operation and maintenance manuals
c) HVAC system control maintenance and calibration information, including wiring diagrams, schematics, and control sequence descriptions; desired or field-determined set points must be permanently recorded on control drawings, at control devices, or, for digital control systems, in programming comments
d) complete narrative of how each system is intended to operate.

12.Hot water space-heating systems with a capacity exceeding 300 kBtu/h supplying heated water to comfort conditioning systems must include controls that automatically reset supply water temperatures by representative building loads (including return water temperature) or by outside air temperature.

Exception: Where the supply temperature reset controls cannot be implemented without causing improper operation of heating, cooling, humidification, or dehumidification systems.
Exception: Hydronic systems that use variable flow to reduce pumping energy.

13.Balancing devices provided in accordance with IMC (2006) 603.17.

14.Demand control ventilation (DCV) required for high design occupancy areas (>40 person/1000 ft2 in spaces >500 ft2) and served by systems with any one of 1) an air-side economizer, 2) automatic modulating control of the outdoor air damper, or 3) a design outdoor airflow greater than 3000 cfm.

Exception: Systems with heat recovery.
Exception: Multiple-zone systems without DDC of individual zones communicating with a central control panel.
Exception: Systems with a design outdoor airflow less than 1200 cfm.
Exception: Spaces where the supply airflow rate minus any makeup or outgoing transfer air requirement is less than 1200 cfm.

15.Outdoor air supply and exhaust systems must have motorized dampers that automatically shut when the systems or spaces served are not in use. Dampers must be capable of automatically shutting off during preoccupancy building warm-up, cool-down, and setback, except when ventilation reduces energy costs (e.g., night purge) or when ventilation must be supplied to meet code requirements.
Both outdoor air supply and exhaust air dampers must have a maximum leakage rate of 3 cfm/ft2 at 1.0 in w.g. when tested in accordance with AMCA Standard 500.

Exception: Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height.
Exception: Systems with a design outside air intake or exhaust capacity of 300 cfm (140 L/s) or less that are equipped with motor operated dampers that open and close when the unit is energized and de-energized, respectively.

16.All freeze protection systems, including self-regulating heat tracing, must include automatic controls capable of shutting off the systems when outside air temperatures are above 40°F or when the conditions of the protected fluid will prevent freezing. Snow- and ice-melting systems must include automatic controls capable of shutting off the systems when the pavement temperature is above 50°F and no precipitation is falling, and an automatic or manual control that will allow shutoff when the outdoor temperature is above 40°F.

17.Hydronic systems that use a common return system for both hot water and chilled water must not be used.

18.Individual fan systems with a design supply air capacity of 5000 cfm or greater and minimum outside air supply of 70 percent or greater of the supply air capacity must have an energy recovery system with at least a 50 percent effectiveness. Where cooling with outdoor air is required there is a means to bypass or control the energy recovery system to permit cooling with outdoor air.

Exception: Hazardous exhaust systems, commercial kitchen and clothes dryer exhaust systems that the International Mechanical Code prohibits the use of energy recovery systems.
Exception: Systems serving spaces that are heated and not cooled to less than 60°F.
Exception: Where more than 60 percent of the outdoor heating energy is provided from site-recovered or site solar energy.
Exception: Heating systems in climates with less than 3600 HDD.
Exception: Cooling systems in climates with a 1 percent cooling design wet-bulb temperature less than 64°F.
Exception: Systems requiring dehumidification that employ energy recovery in series with the cooling coil.
Exception: Laboratory fume hood exhaust systems that have either a variable air volume system capable of reducing exhaust and makeup air volume to 50 percent or less of design values or, a separate make up air supply meeting the following makeup air requirements: a) at least 75 percent of exhaust flow rate, b) heated to no more than 2°F below room setpoint temperature, c) cooled to no lower than 3°F above room setpoint temperature, d) no humidification added, e) no simultaneous heating and cooling.

IECC®

INTERNATIONAL ENERGY CONSERVATION CODE®

CODE AND COMMENTARY

2009

ICC
INTERNATIONAL CODE COUNCIL®

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PREFACE

The principal purpose of the Commentary is to provide a basic volume of knowledge and facts relating to building construction as it pertains to the regulations set forth in the 2009 *International Energy Conservation Code®*. The person who is serious about effectively designing, constructing and regulating buildings and structures will find the Commentary to be a reliable data source and reference to almost all components of the built environment.

As a follow-up to the *International Energy Conservation Code*, we offer a companion document, the *International Energy Conservation Code Commentary.* The basic appeal of the Commentary is thus: it provides in a small package and at reasonable cost thorough coverage of many issues likely to be dealt with when using the *International Energy Conservation Code*—and then supplements that coverage with historical and technical background. Reference lists, information sources and bibliographies are also included.

Throughout all of this, strenuous effort has been made to keep the vast quantity of material accessible and its method of presentation useful. With a comprehensive yet concise summary of each section, the Commentary provides a convenient reference for regulations applicable to the construction of buildings and structures. In the chapters that follow, discussions focus on the full meaning and implications of the code text. Guidelines suggest the most effective method of application and the consequences of not adhering to the code text. Illustrations are provided to aid understanding; they do not necessarily illustrate the only methods of achieving code compliance.

The format of the Commentary includes the full text of each section, table and figure in the code, followed immediately by the commentary applicable to that text. At the time of printing, the Commentary reflects the most up-to-date text of the 2009 *International Energy Conservation Code*. Each section's narrative includes a statement of its objective and intent and usually includes a discussion about why the requirement commands the conditions set forth. Code text and commentary text are easily distinguished from each other. All code text is shown as it appears in the *International Energy Conservation Code*, and all commentary is indented below the code text and begins with the symbol ❖.

Readers should note that the Commentary is to be used in conjunction with the *International Energy Conservation Code* and not as a substitute for the code. **The Commentary is advisory only;** the code official alone possesses the authority and responsibility for interpreting the code.

Comments and recommendations are encouraged, for through your input, we can improve future editions. Please direct your comments to the Codes and Standards Development Department at the Chicago District Office.

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Chapter 5:
Commercial Energy Efficiency

General Comments

Chapter 5 can be used to demonstrate compliance for the design and construction of most types of commercial buildings and residential buildings greater than three stories in height above grade [see Table 5(1)]. Residential buildings, townhouses and garden apartments three stories or less in height are covered in Chapter 4.

The thermal envelope requirements of this code do not apply to (see commentary, Section 101.5.2):

1. Very low energy use buildings (less than 3.4 Btu per hour per square foot or 1 watt per square foot of floor area); and
2. Buildings or portions of buildings that are neither heated nor cooled.

While the code will also exempt the applicability of some or all provisions of the code (see Section 101.4) to:

- Continued use of existing buildings;
- Historic buildings; and
- Additions, alterations, renovations or repairs.

A building designed and constructed to meet the requirements of this chapter generally meets or exceeds the energy-efficiency level of a similar building constructed to meet ASHRAE/IES 90.1-2004 requirements.

The provisions of Chapter 5 simplify and clarify energy code requirements specific to commercial buildings. Chapter 5 is presented in a different format than ASHRAE 90.1. Redundant provisions and those having no impact on overall energy performance have been removed for the utility of the user.

Purpose

Chapter 5 contains several options to address the energy efficiency of commercial buildings. The options are most clearly shown in Section 501.1 where compliance with either ASHRAE/IESNA 90.1 or the remaining provi-

Table 5(1)
EXAMPLES OF BUILDING TYPES COVERED BY CHAPTER 5

Airports	Indoor sporting facilities
Apartment buildings and condominiums ≥ four stories	Industrial work buildings
Assembly and conference areas	Laboratories
Banks	Libraries
Barber shops and beauty parlors	Museums and galleries
Bowling alleys	Nursing homes
Churches, synagogues and chapels	Offices
Commercial or industrial warehouses	Police and fire houses
Convention centers	Restaurants
Dormitories (more than three stories)	Retail, grocery and wholesale stores
Exhibit halls	Schools
Gymnasiums	Shopping malls
Health clubs	Shops (nonindustrial)
High-rise residential (over three stories)	Sporting arenas
Hospitals	Theaters and auditoriums
Hotels and motels	Warehouses and storage facilities

Note: This table includes only examples of building types covered by the code. It is not intended to be an exhaustive list. Other building types may be covered, even though they are not listed.

sions of Chapter 5.

ASHRAE 90.1 is intended to promote the application of cost-effective design practices and technologies that minmize energy consumption without sacrificing either the comfort or productivity of the occupants. The 2006 edition of the code adopts ASHRAE 90.1 by reference in Chapter 5 as an alternative to the remaining portions of Chapter 5.

The Energy Policy Act of 1992 (EPAct 92) requires state and local governments to update their commercial building energy-efficiency codes to be at least as stringent as the ASHRAE 90.1 or successor. Unlike residential codes, states do not have the option of determining whether it is appropriate to update the energy-efficiency provisions of their commercial building code. To meet this requirement, many states are expected to adopt the code as the principal benchmark of energy policy for commercial buildings or to have otherwise developed unique state codes that meet or exceed the level of stringency in ASHRAE 90.1. The U.S. Department of Energy (DOE) provides incentive funding and technical assistance to states to update and implement their building energy codes to meet or exceed the model codes determined to improve energy efficiency.

Besides adopting the ASHRAE 90.1 standard by reference, Chapter 5 contains a set of requirements for the energy-efficient design of commercial buildings that are easier to use and that provide an alternative way to show compliance for structures or systems based on ASHRAE 90.1 (see commentary, Section 501.1). The options outlined in Sections 502 through 506 are reasonably equivalent to ASHRAE 90.1. The principal difference is that the code has removed redundant requirements and those having no impact in overall energy performance. Moreover, those portions of Chapter 5 are written in code language. The advice and recommendations contained in ASHRAE 90.1 are eliminated.

The alternative methodology and prescriptive requirements in Chapter 5 were initially approved by the IECC Code Development Committee during the 1997 code development cycle to meet the needs of designers, builders and regulatory officials involved in the construction of commercial buildings who had requested a more easily understandable, usable and enforceable commercial energy conservation code.

This chapter was developed by Pacific Northwest National Laboratory (PNNL) on behalf of the U.S. DOE and is intended to promote the application of cost-effective design practices and technologies that minimize energy consumption without sacrificing either the comfort or productivity of the occupants. The EPAct 92 requires state and local governments to update their commercial building energy-efficiency codes to be at least equivalent to ASHRAE 90.1-1989 or successor. To meet this requirement, many states are expected to adopt the simplified and usable provisions of the 2006 code instead of the more complex and technically sophisticated provisions of ASHRAE 90.1. In reality, adopting the code does meet the requirements of EPAct 92 because the code does include ASHRAE 90.1 by reference.

SECTION 501
GENERAL

501.1 Scope. The requirements contained in this chapter are applicable to commercial buildings, or portions of commercial buildings. These commercial buildings shall meet either the requirements of ASHRAE/IESNA Standard 90.1, *Energy Standard for Buildings Except for Low-Rise Residential Buildings*, or the requirements contained in this chapter.

❖ In Chapter 5, the requirements address the design of all building systems that affect the visual and thermal comfort of the occupants, including:

- Wall, roof and floor insulation;
- Windows and skylights;
- Cooling equipment (air conditioners, chillers and cooling towers);
- Heating equipment (boilers, furnaces and heat pumps);
- Pumps, piping and liquid circulation systems;
- Heat rejection equipment (fan cooling towers, air cooled condensers);
- Service water heating (kitchens, lavatories and pools); and
- Electrical power and lighting systems (lighting types, densities, zones and controls).

Chapter 5 applies to new commercial and high-rise residential buildings and also additions, repairs and alterations to existing buildings. “High rise” in this context is defined to include buildings four or more stories in height. Chapter 5 does not apply to low-rise residential buildings such as single-family homes, duplexes and garden apartments three stories or less in height. However, these building types are covered by comparable provisions in Chapter 4.

Just as the code does not regulate or control the energy used by things such as office equipment and computers, the code does not limit or regulate the energy use intended primarily for manufacturing, commercial or industrial processing. Although the energy for the manufacturing and processing is excluded, the building’s envelope, mechanical systems, service water heating, and electrical power and lighting systems are regulated. Chapter 5 includes a total building performance evaluation as a compliance option. This option includes a requirement for documentation, and a listing of software tools to determine the total building performance.

501.2 Application. The *commercial building* project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Electrical power and lighting

systems) in its entirety. As an alternative the *commercial building* project shall comply with the requirements of ASHRAE/IESNA 90.1 in its entirety.

Exception: Buildings conforming to Section 506, provided Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied.

❖ Because Chapter 5 applies to such a wide variety of buildings in various climate zones (see Tables 502.1.2 and 502.2(1), there must be flexibility in its application. The goal is to achieve energy-efficient building performance. When possible, this goal is achieved without requiring specific measures or products. Flexibility is offered at the prescriptive and systems' levels, and at the whole building level based on total building performance (see Figure 501.2). The building designer must select which commercial building compliance path he or she is going to use to design the entire building—Chapter 5 of the code or ASHRAE Standard 90.1.

Flexibility is achieved at the prescriptive level by specifying criteria in terms of component performance. The criterion for the roof component, for instance, is stated in terms of the *R*-value. Any construction assembly or method may be used as long as its *R*-value meets this criterion. For the overall building envelope, however, no flexibility is offered through an area-weighted average as allowed in Section 402.1.4 or the fenestration provisions of Section 402.3.1. For example, each portion of the building envelope must meet or exceed the criteria requirement on its own without the benefit of area-weighted averages.

Lighting control requirements can be satisfied with multiple switches, occupant sensors, time clocks or dimmers but must be satisfied on a space-by-space basis. Lighting power requirements can be satisfied by any combination of equipment as long as the total connected interior lighting power is less than the total permitted lighting power from Section 505.5.2. The total exterior lighting power allowance for all exterior building applications is determined using the lighting zones information in Table 505.6.2(1) and the lighting power allowances in Table 505.6.2(2). HVAC equipment and water heaters can be manufactured in a variety of ways as long as each piece of equipment meets the applicable overall criterion of energy efficiency: the energy efficiency ratio (EER). Averaging equipment efficiencies is not acceptable.

For the building envelope, Chapter 5 has prescriptive tables that give wall, floor and roof *R*-values, window *U*-factors, solar heat gain coefficient (SHGC), opaque doors, etc. that satisfy the requirements for the specific climate zone. This is the easiest approach to meet the building envelope criteria. Where the prescriptive tables do not offer enough flexibility, an alternative method approved by the code official may be used. Generally, such approved alternatives allow consideration of window area and orientation; thermal mass; insulation position (on the inside or outside of

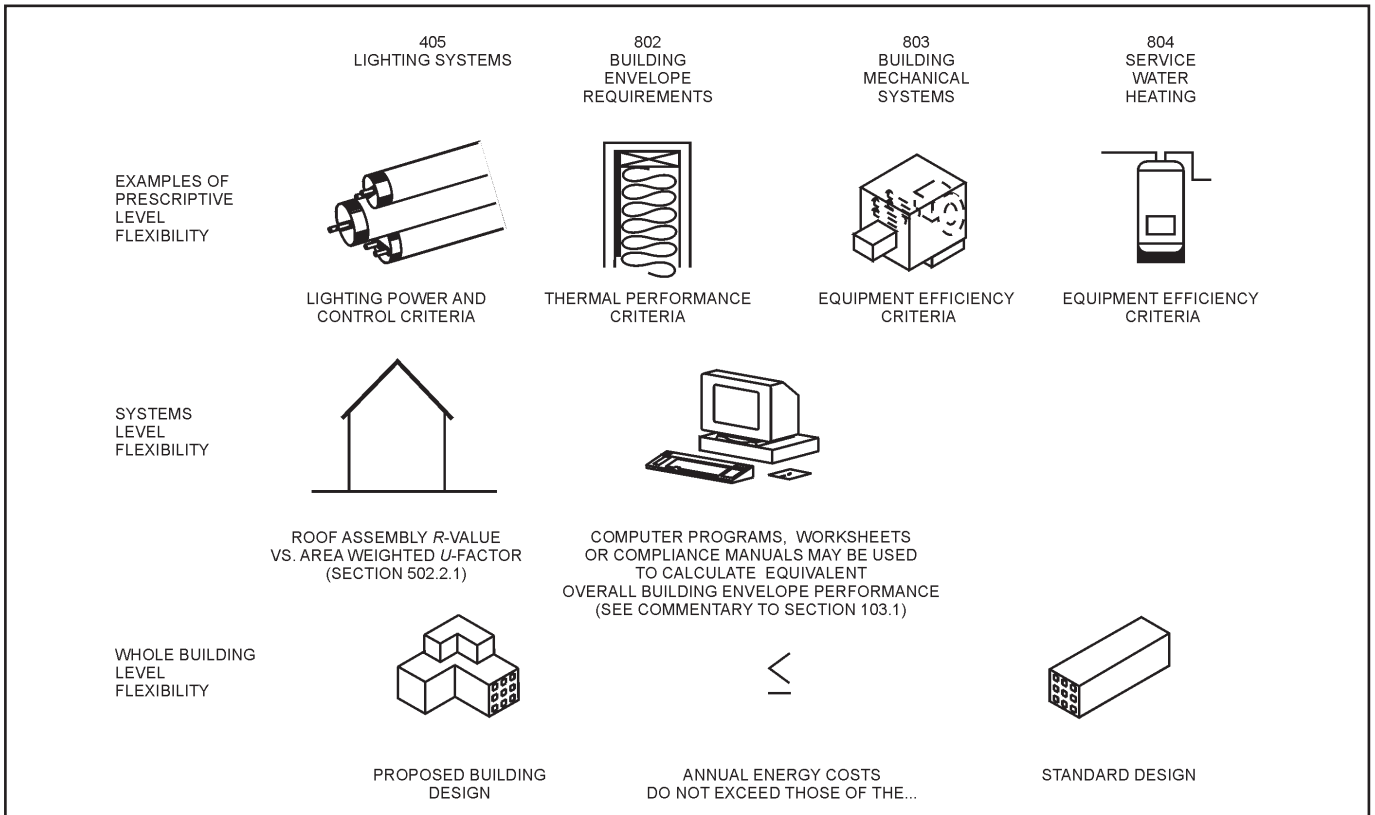

Figure 501.2
DESIGN FLEXIBILITY PROVIDED BY CHAPTER 5

the wall); daylighting; and internal gains from lights, equipment and people. Evaluation of such alternatives can be obtained by using a calculation software tool as listed in Section 506.6, worksheets and/or compliance manuals where approved by the authority having jurisdiction (see commentary, Sections 101.3 and 101.5 or 103.1).

The greatest flexibility is achieved at the whole building level under the ASHRAE Standard 90.1 or Section 506 as referenced by the exception. Section 506 permits the comparative evaluation of annual energy costs to assess total building performance compliance. As long as the estimated annual energy cost of the proposed design is less than or equal to the estimated annual energy cost of the standard design, the proposed design meets the code. More information to determine the total building performance is in the commentary for Section 506. When this evaluation is complete, the compliance calculations must be certified by a registered architect and/or licensed professional engineer.

SECTION 502
BUILDING ENVELOPE REQUIREMENTS

502.1 General (Prescriptive).

❖ This section of the code references acceptable methods and procedures for compliance evaluation for the insulation *R*-value of building envelope components and the fenestration *U*-factors for doors, windows and skylights [see Figure 502.1(1)].

The building envelope is important to building energy efficiency. When it is cold outside, heat loss and air leakages through the building envelope add to the heating load. On hot days, solar gains through windows contribute to the air-conditioning (cooling) load. The building envelope requirements of Section 502 are intended to reduce heat gains and losses through the building envelope.

Determining the right amount and type of fenestration and optimizing the levels of insulation is a detailed process that depends on climate, occupancy, schedules of operation, internal gains and other factors. The code sets minimum levels of thermal performance for all components of the building envelope and limits fenestration solar gain. While these limits ensure a minimum level of performance, they do not necessarily result in an optimum design. The designer is encouraged to use the code as a starting point; minimum compliance may not be the optimum solution.

The prescriptive building envelope requirements apply only to buildings where the window and glazed door area is not greater than 40 percent of the gross above-grade wall area and the building is conditioned (heating or cooling). Understanding the occupancy requirements for the commercial building is necessary in using the correct values for the *U*-factor, *C*-factor or *F*-factor of the building envelope requirements listed in Tables 502.1.2 and 502.2(1). The definition of "Conditioned space" is important (see Section 101.5.1, Item 2 and definition in Chapter 2). Notice that based on Section 101.5.2, Item 1, any building or portion of a building that uses more than 3.4 Btu/h · ft^2 (10.7 W/m^2) or 1.0 watt/ft^2 (10.7 W/m^2) for "space conditioning purposes" would be required to comply with the building envelope requirements.

Because the thermal envelope requirements do not apply to buildings that are neither heated nor cooled (Section 101.5.2), shell buildings present a special problem. Shell buildings are built before it is known how they will be used or even whether they will be heated or cooled. Although the code official has discretion in dealing with shell buildings, a common approach is to postpone compliance until a permit application is filed for a heating or cooling system. At that time, the permit applicant documents compliance with the building envelope requirements as well as the HVAC requirements. It may be necessary to upgrade the building envelope for those areas that are heated or cooled; for example, by installing additional insulation. In colder climates, however, some code officials may want to assume that heating will always be installed for freeze protection and, therefore, require insulation during the initial construction of shell buildings. This most often applies to ceiling insulation based on the rationale that it is more costly to add insulation after the roof is finished.

Even with shell buildings, the designer should consider the requirements of the code to avoid problems at the time of future tenant improvements. It would be best to assume that the entire building will be heated or cooled, and to establish a plan for upgrading the building envelope in the event that it is. While it may be easy to insulate the inside of tilt-up concrete walls at a later time, windows should be carefully sized and selected [*U*-factor, projection factor (PF) and solar heat gain coefficient (SHGC)] to reasonably achieve compliance.

502.1.1 Insulation and fenestration criteria. The *building thermal envelope* shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate *zone* specified in Chapter 3. Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *R*-values from the "Group R" column of Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall use the *R*-values from the "All other" column of Table 502.2(1). Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.

❖ This section provides the initial references to the prescriptive envelope requirements. The opaque portions of the envelope (walls, roofs, floors and opaque doors) must comply with the requirements of Table 502.2(1) while the fenestration (windows, glazed wall systems and skylights) must comply with Table 502.3. Commercial buildings or portions thereof enclosing Group R occupancies shall use the *R*-values from the "Group

R "column. Otherwise the "All other" column shall be used for the *R*-values to determine the correct building thermal envelope. According to the *International Building Code*® (IBC®) the Residential Group R includes the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the *International Residential Code*® (IRC®). Group R includes the use of a building or structure, or a portion thereof, including R-1, R-2, R-3 and R-4 as defined in the IBC.

Some of the envelope requirements are based on surface area. For instance, glazing area is limited to a percentage of the gross exterior wall area above grade and skylight area is limited to a percentage of the gross roof area. The rules for measuring surface areas are summarized in Figure 502.1.1.

The fenestration area is the entire window and glazed door area including the frame. For premanufactured windows and doors, this area must be considered as the rough frame opening.

Windows located in interior walls adjacent to unconditioned space would need to be included when determining the percentage of fenestration. Although these openings do not have a solar heat gain coefficient (SHGC) concern, they would still need to comply with the appropriate *U*-factor from Table 502.3 and would represent a reduction from the wall insulation levels required in Table 502.2(1). Therefore, it is appropriate that their size be included in the 40-percent limit on the amount of fenestration openings.

502.1.2 *U*-factor alternative. An assembly with a *U*-factor, *C*-factor, or *F*-factor equal or less than that specified in Table 502.1.2 shall be permitted as an alternative to the *R*-value in Table 502.2(1). Commercial buildings or portions of commercial buildings enclosing Group R occupancies shall use the *U*-factor, *C*-factor, or *F*-factor from the "Group R" column of Table 502.1.2. Commercial buildings or portions of commercial buildings enclosing occupancies other than Group R shall

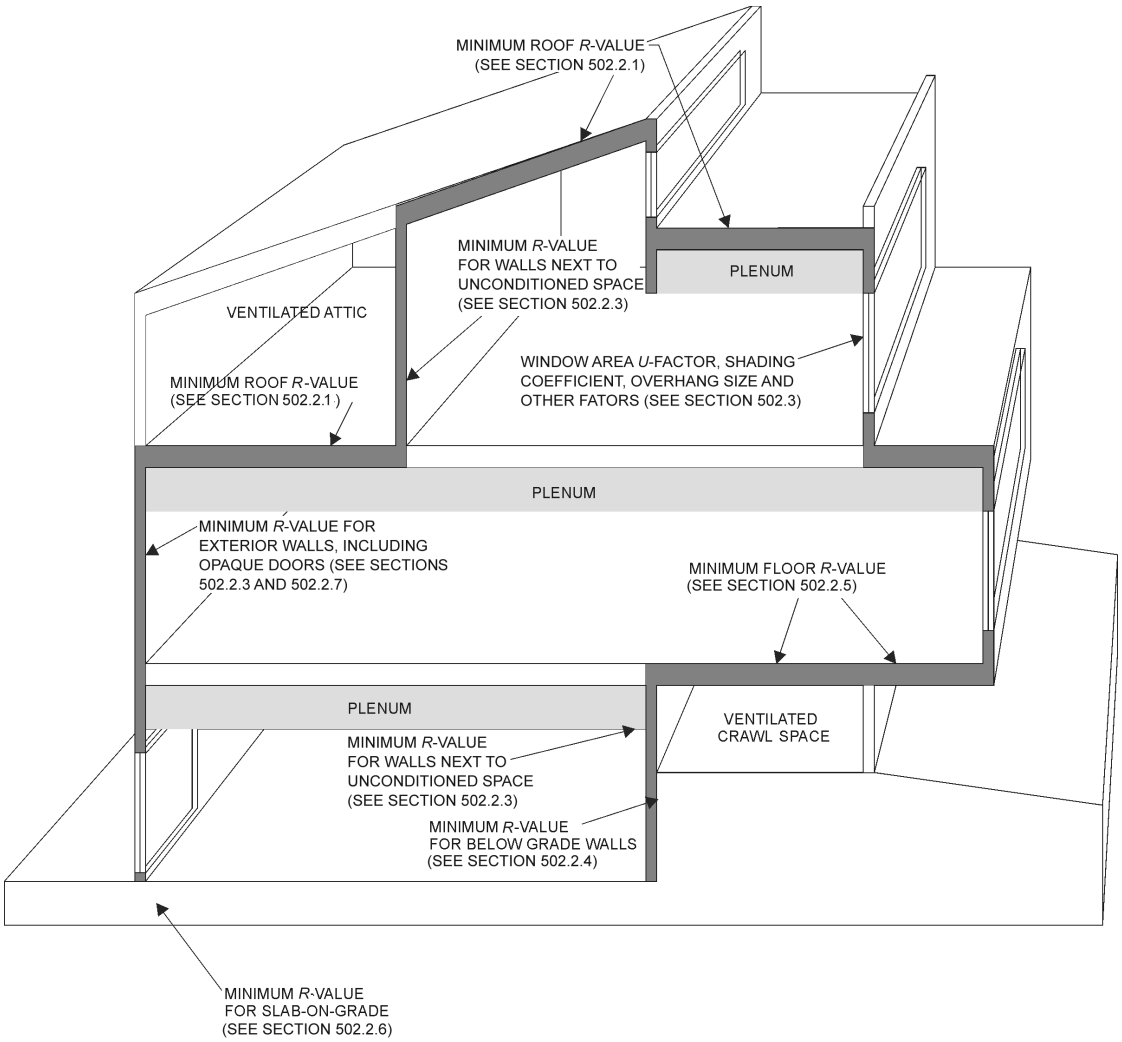

Figure 502.1(1)
GRAPHIC SUMMARY OF ENVELOPE REQUIREMENTS
(Courtesy of U.S. Department of Energy, Office of Building Technology State and Community Programs, www.energycodes.org)

2009 International Energy Conservation Code®

Study Companion

ICC
INTERNATIONAL CODE COUNCIL®

2009 International Energy Conservation Code

Study Companion

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TABLE OF CONTENTS

INTRODUCTION

This study companion provides practical learning assignments for independent study of the provisions of the 2009 *International Energy Conservation Code*® (IECC®). The independent study format affords a method for the student to complete the study program in an unregulated time period. Progressing through the workbook, the learner can measure his or her level of knowledge by using the exercises and quizzes provided for each study session.

The workbook is also valuable for instructor-led programs. In jurisdictional training sessions, community college classes, vocational training programs and other structured educational offerings, the study guide and the IECC can be the basis for code instruction.

All study sessions begin with a general learning objective, the specific sections or chapters of the code under consideration, and a list of questions summarizing the key points of study. Each session addresses selected topics from the IECC and includes code text, a commentary on the code provisions, and illustrations representing the provisions under discussion. Quizzes are provided at the end of each study session. Before beginning the quizzes, the student should thoroughly review the referenced IECC provisions—particularly the key points.

The workbook is structured so that after every question the student has an opportunity to record his or her response and the corresponding code reference. The correct answers are located in the back of the workbook in the answer key.

This study companion was developed by the Britt/Makela Group, Inc. Eric Makela has provided energy code and conservation support for the building, design and enforcement community since 1986. He has trained or presented on energy codes in over 22 states with sessions focused on residential and commercial building energy codes. Eric holds ICC certifications for both Commercial and Residential Energy Codes Plans Examination.

Questions or comments concerning this workbook are encouraged. Please direct your comments to ICC at *studycompanion@iccsafe.org*.

About the International Code Council

The International Code Council® (ICC®) is a nonprofit membership association dedicated to protecting the health, safety and welfare of people by creating better buildings and safer communities. The mission of ICC is to provide the highest quality codes, standards, products and services for all concerned with the safety and performance of the built environment. ICC is the publisher of the family of International Codes® (I-Codes®), a single set of comprehensive and coordinated model codes. This unified approach to building codes enhances safety, efficiency and affordability in the construction of buildings. The Code Council is also dedicated to innovation, sustainability and energy efficiency. Code Council subsidiary ICC Evaluation Service issues Evaluation Reports for innovative products and reports of Sustainable Attributes Verification and Evaluation (SAVE).

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Study Session

6

2009 IECC Sections 501 and 502 (partial)

Commercial Energy Efficiency—Part I

OBJECTIVE: To obtain an understanding of the building envelope requirements for the opaque envelope contained in Chapter 5, Commercial Energy Efficiency.

REFERENCE: Chapter 5, Sections 501 and 502 (partial), 2009 *International Energy Conservation Code*

KEY POINTS:

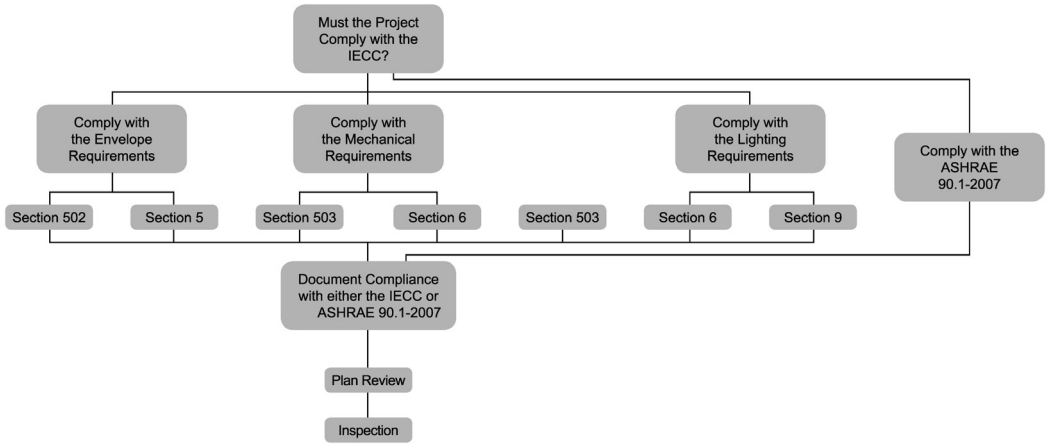
- Which compliance options are available for demonstrating compliance with the IECC for commercial buildings? When should one be utilized instead of the other for the building envelope?
- Which parts of the building envelope are covered under Chapter 5?
- What two parameters must be determined before the thermal requirements for the building envelope can be selected?
- What are the different wall types addressed in Chapter 5?
- Where can roof insulation be installed to meet the envelope requirements? What are the requirements for metal roof systems?
- How does the IECC apply to metal wall systems?
- Which options are available for insulated framed wall systems? Which options are available for insulated concrete or concrete masonry unit wall systems?
- Which options are available when the design includes more than 3 percent of the roof area in skylights?
- How should slab edge insulation be installed to meet the code requirements? Below grade walls?

Topic: Application
Reference: IECC 501.2

Category: Commercial Energy Efficiency
Subject: General

Code Text: *The commercial building project shall comply with the requirements in Sections 502 (Building envelope requirements), 503 (Building mechanical systems), 504 (Service water heating) and 505 (Electrical power and lighting systems) in its entirety.* See exception for those buildings that conform to Section 506 (total building performance method), where Sections 502.4, 503.2, 504, 505.2, 505.3, 505.4, 505.6 and 505.7 are each satisfied. *As an alternative, the commercial building project shall comply with the requirements of ASHRAE/IESNA 90.1 in its entirety.*

Discussion and Commentary: Compliance for a commercial building can be demonstrated by using Chapter 5 to individually evaluate the building envelope, mechanical, service water heating and lighting systems. As an alternative, ASHRAE/IESNA Standard 90.1-2007 can be used to demonstrate compliance with the IECC. ASHRAE 90.1 is also to be used when the building system is not covered under Chapter 5.



Chapter 5 is prescriptive in nature. Because of this, there are no trade-offs between the envelope, lighting, service water and mechanical systems. The project may be made to comply by using either IECC Chapter 5 or ASHRAE 90.1, but not a combination of both. Typically, compliance with ASHRAE 90.1 will be selected because the proposed system falls out of the scope of IECC Chapter 5. IECC Section 506 allows trade-offs between levels of efficiency in the building envelope, mechanical and lighting systems.

Topic: General
Reference: IECC 502.1.1

Category: Commercial Energy Efficiency
Subject: Building Envelope Compliance

Code Text: *The building thermal envelope shall meet the requirements of Tables 502.2(1) and 502.3 based on the climate zone specified in Chapter 3. Buildings with a vertical fenestration area or skylight area that exceeds that allowed in Table 502.3 shall comply with the building envelope provisions of ASHRAE/IESNA 90.1.*

Discussion and Commentary: The opaque envelope provisions contain specific requirements addressing two types of buildings: 1) those Group R buildings defined as commercial buildings by Chapter 2, and (2) all other commercial buildings. Typically, the insulation requirements for Group R occupancies defined as *commercial* are more stringent than for other commercial buildings so as to be more consistent with the insulation requirements for Group R buildings defined as *residential*.

TABLE 502.2(1)
BUILDING ENVELOPE REQUIREMENTS - OPAQUE ASSEMBLIES

	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
CLIMATE ZONE	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R	All other	Group R
Roofs																
Insulation entirely above deck	R-15ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci
Metal buildings (with R-5 thermal blocks[a, b])	R-19	R-19	R-13 + R-13	R-13 + R-13	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-13	R-19	R-13 + R-19	R-19	R-13 + R-19	R-19 + R-10	R-11 + R-19	R-19 + R-10
Attic and other	R-30	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R- 38	R-38	R-38	R-38	R-38	R-38	R-49	R-49
Walls, Above Grade																
Mass	NR	R-5.7ci[c]	R-5.7ci[c]	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3 ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building[b]	R-16	R-16	R-16	R-16	R-19	R-19	R-19	R-19	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-13 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci	R-19 + R-5.6ci
Metal framed	R-13	R-13	R-13	R-13+ 7.5ci	R-13 + R-3.8ci	R-13 + R-7.5ci	R-13 + R-7.5	R-13 + R-7.5ci	R-13 + R-7.5 ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-15.6ci	R-13 + R-7.5 ci	R-13 + R-18.8ci
Wood framed and other	R-13	R-13	R-13	R-13	R-13	R-13	R-13	R-13+ R-3.8ci	R-13 + R-3.8ci	R-13 + R-3.8	R-13 + R-7.5	R-13 + R-7.5	R-13+ R-7.5ci	R-13 +7.5ci	R-13 + R-15.6ci	R-13 + 15.6ci

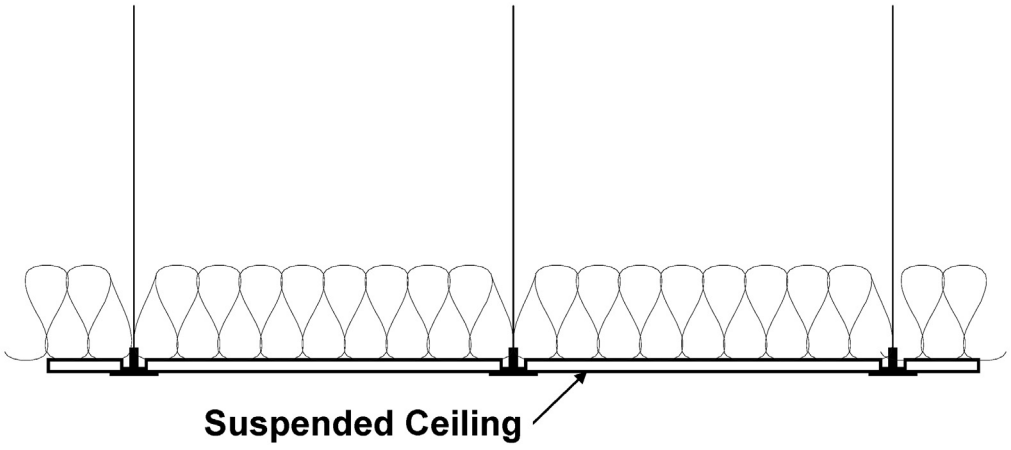
(continued)

Typically, insulation requirements for metal-framed walls are more stringent than for wood-framed wall systems because of the increased heat transfer in metal. For example, in Climate Zone 3, metal wall systems must be provided with continuous insulation in addition to the required insulation installed between the framing members. A wood-framed wall in the same Climate Zone is only required to have insulation installed between the framing members.

Topic: Roof Assembly	**Category:** Commercial Energy Efficiency
Reference: IECC 502.2.1	**Subject:** Building Envelope Compliance

Code Text: *The minimum thermal resistance (*R-*value) of the insulating material installed either between the roof framing or continuously on the roof assembly shall be as specified in Table 502.2(1), based on construction materials used in the roof assembly.* See exception for continuously insulated roof assemblies where the insulation thickness varies by no more than 1 inch and the area-weighted *U*-factor is equivalent to the same assembly, with the *R*-value specified in Table 502.2(1). *Insulation installed on a suspended ceiling with removable ceiling tiles shall not be considered part of the minimum thermal resistance of the roof insulation.*

Discussion and Commentary: The insulation requirements for a roof/ceiling assembly will vary depending on how the roof is constructed and where the insulation is placed. Three different roof assemblies are listed. Based on the roof type, insulation is required to be placed between framing or be continuous (ci). For example, in most Climate Zones a vented attic space will be required to have a minimum R-38 insulation installed between framing.



Insulation installed on top of a suspended ceiling system cannot contribute toward the ceiling insulation requirement. Insulation must be installed at the same location as the air barrier. A suspended ceiling cannot be considered an air barrier, unless each ceiling tile is individually sealed.

Study Session

7

2009 IECC Sections 502 (partial) and 503 (partial) Commercial Energy Efficiency—Part II

OBJECTIVE: To obtain an understanding of Chapter 5, Commercial Energy Efficiency, requirements for fenestration, and Section 503, Building Mechanical Systems, mandatory requirements through the energy recovery ventilation systems.

REFERENCE: Sections 502 (partial) and 503 (partial), 2009 *International Energy Conservation Code*

KEY POINTS:

- What two requirements apply to vertical glazing? How can an overhang affect one of the requirements?
- When are vestibules required on commercial buildings?
- When does the code apply to HVAC systems? How does the code apply to systems installed to handle process loads?
- What types of HVAC systems fall under the simple system category? What system types are classified as complex systems?
- What are the requirements for sizing heating and cooling systems? When can systems be oversized?
- What are the minimum efficiency requirements for heating and cooling systems?
- What are the minimum capability requirements for thermostats? How many systems may a thermostat control?
- When is an energy recovery ventilation system required?

Topic: Fenestration
Reference: IECC 502.3.2
Category: Commercial Energy Efficiency
Subject: Building Envelope Compliance

Code Text: *For vertical fenestration, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3, based on the window projection factor. For skylights, the maximum U-factor and solar heat gain coefficient (SHGC) shall be as specified in Table 502.3.*

Discussion and Commentary: The *U*-factor is a measure of how well the assembly conducts heat. The lower the number, the better the assembly performs as an insulator. This information should be listed in the window schedule on the approved building plans, with the manufacturer's data on the window label or on the documentation. Glazing must be rated by the National Fenestration Rating Council (NFRC). The solar heat gain coefficient (SHGC) is a measure of how much solar radiation is transmitted through the window. The lower the number, the lower the amount of solar radiation that passes through the glazing, and the lower the solar heat gain. SHGC is part of a system for rating window performance used by the NFRC. The SHGC requirement is affected by the projection factor (PF) of qualifying overhangs. The projection factor is calculated by measuring the horizontal distance from the window surface to the farthermost edge of the overhang and dividing that by the vertical distance from the bottom of the window to the lowest point of the overhang.

TABLE 502.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration (40% maximum of above-grade wall)								
***U*-factor**								
Framing materials other than metal with or without metal reinforcement or cladding								
U-factor	1.20	0.75	0.65	0.40	0.35	0.35	0.35	0.35
Metal framing with or without thermal break								
Curtain wall/storefront *U*-factor	1.20	0.70	0.60	0.50	0.45	0.45	0.40	0.40
Entrance door *U*-factor	1.20	1.10	0.90	0.85	0.80	0.80	0.80	0.80
All other *U*-factor[a]	1.20	0.75	0.65	0.55	0.55	0.55	0.45	0.45
SHGC-all frame types								
SHGC: PF < 0.25	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
SHGC: 0.25 ≤ PF < 0.5	0.33	0.33	0.33	NR	NR	NR	NR	NR
SHGC: PF ≥ 0.5	0.40	0.40	0.40	NR	NR	NR	NR	NR
Skylights (3% maximum)								
U-factor	0.75	0.75	0.65	0.60	0.60	0.60	0.60	0.60
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

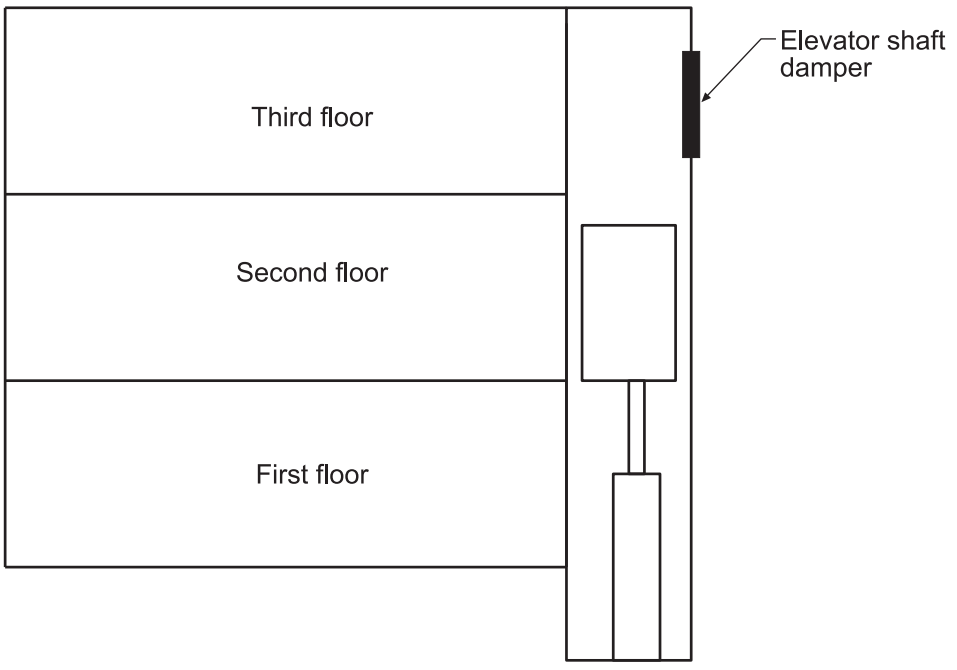
NR = No requirement.
PF = Projection factor (see Section 502.3.2).
a. All others includes operable windows, fixed windows and nonentrance doors.

The building design must have a SHGC that does not exceed that in the prescriptive package. The greater the projection factor, the better the window is shaded, and a window with a higher SHGC value can be used to comply with the IECC.

Topic: Outdoor Air Intake and Exhaust Openings **Category:** Commercial Energy Efficiency
Reference: IECC 502.4.5 **Subject:** Building Envelope Compliance

Code Text: *Stair and elevator shaft vents and other outdoor air intakes and exhaust openings integral to the building envelope shall be equipped with not less than a Class I motorized, leakage-rated damper with a maximum leakage rate of 4 cfm per square foot (6.8 L/s•Cm^2) at 1.0 inch water gauge (w.g.) (1250 Pa) when tested in accordance with AMCA 500D.* See exception for use of gravity (nonmotorized) dampers in one- and two-story buildings.

Discussion and Commentary: All vents installed in the building must be equipped with either a motorized damper or, for buildings less than three stories, a gravity damper.



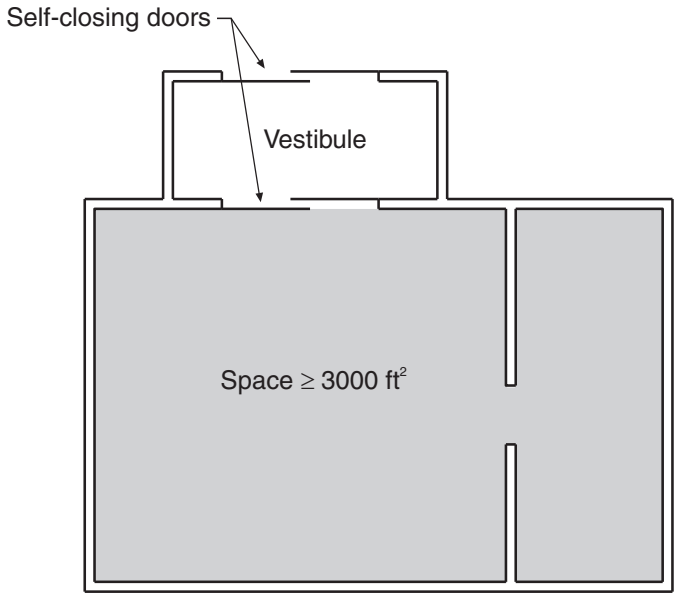
The use of a damper eliminates air infiltration into the building through the vent when the vent does not need to be open.

Topic: Vestibules
Reference: IECC 502.4.7

Category: Commercial Energy Efficiency
Subject: Building Envelope Compliance

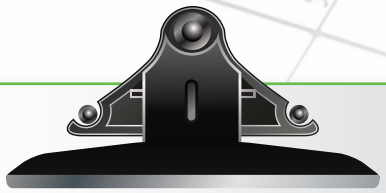
Code Text: *A door that separates conditioned space from the exterior shall be protected with an enclosed vestibule, with all doors opening into and out of the vestibule equipped with self-closing devices. Vestibules shall be designed so that in passing through the vestibule it is not necessary for the interior and exterior doors to open at the same time.* See exceptions for (1) buildings in Climate Zones 1 and 2, (2) doors not intended to be used as a building entrance door, (3) doors opening directly from a sleeping unit or dwelling unit, (4) doors that open directly from a space less than 3,000 square feet in area, (5) revolving doors and (6) doors used primarily to facilitate vehicular movement or material handling and adjacent personnel doors.

Discussion and Commentary: Enclosed vestibules are often required to reduce air infiltration at doors that lead from the building to the outdoors. The provisions only apply to doors that are considered entrance doors to the building. The doors leading into and out of the vestibule must have self-closing devices. In addition, the doors must be designed so that it is not necessary to open the doors leading into and out of the vestibule simultaneously to enter and exit the space.



"Entrance doors" are defined in Chapter 2 as *fenestration products used for ingress, egress and access in nonresidential buildings, including, but not limited to, exterior entrances that utilize latching hardware and automatic closers and contain over 50-percent glass specifically designed to withstand heavy use and possibly abuse.*

Commercial
Inspection



What's in it FOR ME?

In this section you'll find:

- 2009 IECC commercial inspection checklist
- ASHRAE Standard 90.1-2007 inspection checklist
- *ICC Energy Inspector's Guide: Based on the 2009 International Energy Conservation Code® and ASHRAE/IESNA 90.1-2007 (cover and URL)*

Instructions for the Commercial Building Data Collection Checklist 2009 International Energy Conservation Code

Use of these instructions with the commercial checklist assumes a comprehensive understanding of the provisions of Chapter 5 of the 2009 International Energy Conservation Code (2009 IECC) and key concepts and definitions applicable to those provisions. Consult the 2009 IECC about particular items in the checklist, each of which contains the corresponding code section(s) for quick reference. While most of the code provisions are included in the checklists, there are a few requirements that are deemed administrative and/or without significant impact, and these are not included. The checklist was developed specifically for use in addressing Recovery Act and State Energy Program requirements, both of which are focused on saving energy. However, it is a useful inspection tool for all code officials in jurisdictions that have adopted the commercial provisions in the 2009 IECC, noting that slight modifications may be necessary for jurisdictions that amended the code prior to adoption.

The checklists are divided into stages corresponding to traditional building inspection stages. A building may require more than one field visit to gather compliance data during each stage of construction. Multiple buildings can be used to derive a single building evaluation. This may occur where multiple buildings are being simultaneously constructed, with construction in varying stages occurring at the same time (e.g., a housing subdivision, condominium or apartment complex, or commercial office park). In these cases, the same building must be used for at least one complete inspection stage (i.e., plan review, foundation, framing, plumbing, mechanical, electrical, insulation, or final inspection). Additionally, the buildings must be of the same building type. Another approach may use a primary building for completing most of the evaluation, but separate buildings may be inspected for capturing compliance on checklist items that could not be evaluated for this primary building. A companion document, *Measuring Energy Code Compliance*[1], describes these approaches for using multiple buildings to derive a single evaluation.

Completing the General Information Section. All inputs at the top of the first page of the checklist should be completed. Some of these inputs are repeated on the beginning of each construction stage. Where a single building is being evaluated for each stage of construction, the duplicate inputs can be ignored. Where different buildings are used for completing different stages of construction, the top portion of each checklist stage must be completed for each different building evaluated.

- Compliance Approach: Compliance with the energy code can be demonstrated by the prescriptive, trade-off, or performance approach. In evaluating building compliance, the prescriptive approach should be assumed unless documentation is obtained from the building department or responsible authority demonstrating compliance with either the trade-off or performance approach. The 2009 IECC contains the prescriptive requirements which must be met under the prescriptive approach. If a trade-off or performance approach is used to demonstrate compliance, the buildings may NOT comply with these prescriptive values and yet may still be deemed to comply with the code (and therefore should be marked as compliant for the given checklist item) on the basis that some other aspect of the building exceeds the code. For example, assume a trade-off approach was used and a valid worksheet or software report was submitted showing a compliant building in Climate Zone 3B with R-30 attic insulation. In Climate Zones 3A, B, and C, the prescriptive insulation R-value requirement for attics is listed as R-38 (Table 502.2(1) in 2009 IECC). In this example, the attic insulation should be marked as compliant even though it does not meet the prescriptive requirement. If the trade-off submission is valid, there will be some other building component that exceeds code requirements and offsets the non-compliant attic insulation.

[1] Pacific Northwest National Laboratory. 2010. *Measuring Energy Code Compliance*. PNNL-19281. http://www.energycodes.gov/arra/compliance_evaluation.stm

Complies Column. Each checklist item must be selected as compliant (Y), not compliant (N), or not applicable (N/A). Some examples of where a checklist item might be considered N/A include basement requirements for a building that has a slab-on-grade foundation. When evaluating a renovation or addition, it is also appropriate to select N/A for code provisions that do not apply. N/A should ***not*** be selected for cases where the code provision cannot be inspected because it has been covered or can't be observed. If necessary, a different building of the same type but in a different stage of construction would have to be used to complete a checklist stage in order to inspect these items.

It should be noted that state or local government may amend the 2009 IECC and/or enforcing authorities (code officials and inspectors) may have developed localized interpretations of the code that might result in minor modifications to code requirements where energy usage is not negatively impacted.

Verified Values Column. The checklists are used to collect information about the building as well as to determine compliance. Provide the observed value (R-value, U-factor, depth of insulation, equipment efficiency, etc) in the *Verified Value* column. In many cases, you may observe more than one value, in which case all values observed should be recorded. The *Comments/Notes/Findings* column may be used if additional space is needed. For example, windows in the building may have a different U-factor than sliding glass doors. In another case, the checklist asks for the efficiency of all HVAC equipment, which might require multiple entries with differing units of measurement. How compliance is determined when multiple values are found may vary depending on the compliance approach:

- Prescriptive Approach – Insulation R-values: All insulation R-values must be equal to or greater than the prescriptive code value. Enter all observed R-values into the *Verified Value* column. If any are less than the prescriptive code value, this checklist item is deemed to fail.

- Prescriptive Approach – Fenestration U-factors and SHGC: Enter all observed U-factors into the *Verified Value* column. If all values are less than or equal to the code value, the checklist item is deemed to pass. Alternatively, if the area-weighted average glazing U-factor is less than or equal to the prescriptive code value, then the checklist item is deemed to pass. Where multiple U-factors are observed, and some are above and some below the code value, it may be necessary to check the area-weighted average, which will require glazing areas. The areas, U-factors, and calculations can be provided in the *Comments/Notes/Findings* area of the checklist or on a separate worksheet. A similar approach should be taken for fenestration SHGC.

- Trade-Off and Performance Approaches: Under alternative approaches, the values and areas to be verified are those on the compliance documentation. Where multiple values are observed, enter the observed R-values, U-factors, and their corresponding areas into the *Verified Value* column if space permits. Where space does not allow this, use the *Comments/Notes/Findings* area of the checklist or a separate worksheet.

Commercial Building Data Collection Checklist*

2009 International Energy Conservation Code

KEY	[1]	High Impact (Tier 1)	[2]	Medium Impact (Tier 2)	[3]	Low Impact (Tier 3)	C	Complex Mechanical

Building ID:_____ Climate Zone: _____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

State:_____ County:_____ Jurisdiction:_____

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

Building Use: ☐ Office ☐ Retail/Mercantile ☐ Warehouse/Storage ☐ Education/School ☐ Lodging/Hotel/Motel

☐ Restaurant/Dining/Fast Food ☐ Public Assembly/Religious ☐ Healthcare ☐ High-Rise Residential ☐ Other

Building Ownership: ☐ State-owned ☐ Local government-owned ☐ National account ☐ Speculative ☐ Private ☐ Other

Project Type: ☐ New Building ☐ Existing Building Addition ☐ Existing Building Renovation Valuation (If Renovation): $_____

2009 IECC Section #	Plan Review	Complies			Comments/Assumptions
		Y	N	N/A	
103.2 [PR1][1]	Plans and/or specifications provide all information with which compliance can be determined for the **building envelope** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
103.2 [PR2][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **mechanical systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
103.2 [PR3][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **service water heating systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
103.2 [PR4][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **lighting and electrical systems and equipment** and delineate and document where exceptions to the standard are claimed. Information provided should include interior and exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐	☐	☐	

Additional Comments/Assumptions: _____

*This example checklist is still being refined through pilot studies in several states. Make sure to get the latest checklist for your climate zone at **www.energycodes.gov/arra/compliance_evaluation.stm**

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Footing / Foundation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
502.2.4 [FO1][2]	Below-grade wall insulation R-value.	R-_____	☐	☐	☐	
303.2 [FO2][2]	Below-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.6 [FO3][2]	Slab edge insulation R-value.	R-_____ ☐ Unheated ☐ Heated	☐	☐	☐	
303.2 [FO4][2]	Slab edge insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.6 [FO5][2]	Slab edge insulation depth/length.	_____ ft				
303.2.1 [FO6][1]	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities and should extend >=6 in. below grade.		☐	☐	☐	
503.2.7 [FO8][1]	Piping, ducts and plenum are insulated and sealed when installed in or under a slab.	R-_____	☐	☐	☐	
503.2.4.5 [FO9][3]	Freeze protection and snow/ice melting system sensors for future connection to controls.		☐	☐	☐	
504.5 [FO10][1]	Any recirculating SWH piping in or under slab is insulated.	R-_____	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Framing / Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
502.4.1, 502.4.2 [FR1][3]	Fenestration meets maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
502.4.1, 502.4.2 [FR2][3]	Doors meet maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
502.4.1, 502.4.2 [FR3][3]	Fenestration and doors labeled for air leakage.		☐	☐	☐	
502.4.7 [FR4][3]	Vestibules installed per approved plans.		☐	☐	☐	
502.2.1 [FR5][1]	Roof insulation R-value.	R-_____ ☐ Above deck ☐ Metal ☐ Attic	☐	☐	☐	
303.2 [FR6][1]	Roof insulation R-value installed per manufacturer's instructions.		☐	☐	☐	
502.3.1, 502.1.1 [FR7][1]	Performance compliance approach submitted for vertical fenestration area >40% or skylight area >3%.		☐	☐	☐	
502.3.2 [FR8][1]	Vertical fenestration U-Factor.	U-_____	☐	☐	☐	
502.3.2 [FR9][1]	Skylight fenestration U-Factor.	U-_____	☐	☐	☐	
502.3.2 [FR10][1]	Vertical fenestration SHGC value.	SHGC: _____	☐	☐	☐	
502.3.2 [FR11][1]	Skylight SHGC value.	SHGC: _____	☐	☐	☐	
303.1.3 [FR12][2]	Fenestration products rated in accordance with NFRC.		☐	☐	☐	
303.1.3 [FR13][1]	Fenestration products are certified as to performance. Labels or certificates provided.		☐	☐	☐	
502.3.2, 502.4.1, 502.4.2 [FI4][2]	U-factor of opaque doors associated with the building thermal envelope meets requirements.	U-_____ ☐ Swinging ☐ Nonswinging	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Plumbing Rough-In Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
504.5 [PL1][2]	Piping for recirculating and non-recirculating service hot-water systems insulated.	☐	☐	☐	
504.3 [PL2] [3]C	Temperature controls installed on service water heating systems <=110 ºF for intended use serving dwelling units and <=90 ºF serving other occupancies.	☐	☐	☐	
504.6 [PL3][1]	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	☐	☐	☐	
[504.4 [PL4][3]	Heat traps installed on non-circulating storage water tanks.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
503.2.3 [ME1][2]	HVAC equipment efficiency verified.	Efficiency: _____	☐	☐	☐	
Table 503.2.3(3) [ME2][3]	PTAC and PTHP with sleeves 16 in by 42 in. labeled for replacement only.		☐	☐	☐	
502.4.5 [ME3][3]	Stair and elevator shaft vents have motorized dampers that automatically close.		☐	☐	☐	
502.4.5, 503.2.4.4 [ME4][3]	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.		☐	☐	☐	
503.2.5.1 [ME6][1]	Demand control ventilation provided for spaces >500 ft^2 and >40 people/1000 ft^2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow >3,000 cfm.		☐	☐	☐	
503.2.7 [ME8][2]	HVAC ducts and plenums insulated.	R-_____	☐	☐	☐	
503.2.8 [ME9][2]	HVAC piping insulation thickness.	_____ in.	☐	☐	☐	
503.2.7.1 [ME10][2]	Ducts and plenums sealed based on static pressure and location.		☐	☐	☐	
503.2.7.1.3 [ME11][3] C	Ductwork operating >3 in. water column is air leakage tested.		☐	☐	☐	
503.3.1, 503.4.1 [ME12][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.		☐	☐	☐	
502.4.5, 503.2.4.4 [ME13][2]	Return air and outdoor air dampers meet minimum air leakage requirements.		☐	☐	☐	
503.3.1 [ME14][1]	Means provided to relieve excess outside air.		☐	☐	☐	
503.4.5 [ME17][1]	Zone controls can limit simultaneous heating and cooling and sequence heating and cooling to each zone.		☐	☐	☐	
503.4.3.3 [ME18][2] C	Hydronic heat pump systems connected to a common water loop meet heat rejection and heat addition requirements.		☐	☐	☐	

2009 IECC Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
503.2.9.1 [ME41iecc][3]	Air outlets and zone terminal devices have means for air balancing.		☐	☐	☐	
503.2.9.2 [ME42iecc][3]	HVAC hydronic heating and cooling coils have means to balance and have pressure test connections.		☐	☐	☐	
503.2.10.1 [ME40iecc][1]	HVAC fan systems >5 hp meet fan power limitation.		☐	☐	☐	
503.2.10.2 [ME21] [2]	HVAC fan motors not larger than the first available motor size greater than the bhp.	bhp: _____	☐	☐	☐	
503.4.2 [ME22] [2]C	VAV fan motors ≥10 hp to be driven by mechanical or electrical variable speed drive, or have a vane-axial fan with variable pitch blades, or have controls or devices to limit fan motor demand to ≤30% of design wattage at 50% design air volume at static pressure of 1/3 total rated static pressure of the fan.	☐ VSD ☐ Vane axial fan ☐ Other	☐	☐	☐	
503.4.2 [ME24] [2]C	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.		☐	☐	☐	
503.4.3.5 [ME26] [3]C	Reduce flow in pumping systems of any size to multiple chillers or boilers when others are shut down.		☐	☐	☐	
503.4.3.4 [ME27] [3]C	Temperature reset by representative building loads in pumping systems >10 hp for chiller and boiler systems > 300,000 Btu/h.		☐	☐	☐	
503.4.3.3.3 [ME28] [3] C	Two-position automatic valve interlocked to shut off water flow when hydronic heat pump with pumping system >10 hp is off.		☐	☐	☐	
503.4.4 [ME29] [3]C	Fan systems with motors ≥7.5 hp associated with heat rejection equipment to have capability to operate at 2/3 of full-speed and auto speed controls to control the leaving fluid temp or condensing temp/pressure of heat rejection device.		☐	☐	☐	
503.2.6 [ME30][1]	Exhaust air energy recovery on systems ≥ 5,000 cfm and 70% of design supply air.		☐	☐	☐	
503.4.6 [ME31] [3]C	Condenser heat recovery system that can heat water to 85 ºF or provide 60% of peak heat rejection is installed for preheating of service hot water in 24/7 facility, water cooled systems reject >6 MMBtu, SHW load ≥1 MMBtu.		☐	☐	☐	
503.2.11 [ME34] [3]	Unenclosed spaces that are heated use only radiant heat.		☐	☐	☐	
502.4.4 [ME35][1] C	Hot gas bypass on cooling systems limited to: ≤240 kBtu/h – 50% >240 kBtu/h – 25%		☐	☐	☐	
504.2 [ME36][2]C	Service water heating equipment meets efficiency requirements.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Rough-In Electrical Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
505.2.2.2 [EL3] [2]	Automatic lighting control to shut off all building lighting installed in buildings >5,000 ft^2.	☐	☐	☐	
505.2.1 [EL4] [2]	Independent lighting control installed per approved lighting plans and all manual control readily accessible and visible to occupants.	☐	☐	☐	
505.2.4 [EL5] [2]	Automatic lighting controls for exterior lighting installed.	☐	☐	☐	
505.2.3 [EL6] [1]	Verify separate lighting control devices for specific uses installed per approved lighting plans.	☐	☐	☐	
505.3 [EL7] [3]	Ballasted one and three lamp fixtures with >30 W/lamp have two lamp tandem wired ballasts when ≥2 fixtures in same space on same control.	☐	☐	☐	
505.4 [EL8] [1]	Exit signs do not exceed 5 watts per face.	☐	☐	☐	
505.6.1 [EL9] [1]	Exterior grounds lighting over 100 W provides >60 lm/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Insulation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
502.4.3 [IN1][1]	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed, weather stripped or wrapped with moisture vapor-permeable wrapping material to minimize air leakage.		☐	☐	☐	
502.2.1 [IN2][1]	Roof insulation R-value.	R-_____	☐	☐	☐	
303.2 [IN3][1]	Roof insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.3 [IN6][1]	Above-grade wall insulation R-value.	R-_____ ☐ Mass ☐ Metal ☐ Steel ☐ Wood	☐	☐	☐	
303.2 [IN7][1]	Above-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
502.2.5 [IN8][2]	Floor insulation R-value.	R-_____ ☐ Mass ☐ Steel ☐ Wood	☐	☐	☐	
303.2 [IN9][2]	Floor insulation installed per manufacturer's instructions.		☐	☐	☐	
303.1.1, 303.1.1.1 [IN10][2]	Building envelope insulation is labeled with R-value or insulation certificate providing R-value and other relevant data.		☐	☐	☐	
303.2.1 [IN14][2]	Exterior insulation is protected from damage with a protective material.		☐	☐	☐	
502.2.1 [IN17][3]	Insulation intended to meet the roof insulation requirements not installed on top of a suspended ceiling.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

2009 IECC Section #	Final Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
502.4.6 [FI1] [1]	Weatherseals installed on all loading dock cargo doors in all zones.	☐	☐	☐	
503.2.4.1 [FI2] [2]	Heating and cooling to each zone is controlled by a thermostat control.	☐	☐	☐	
503.2.4.2, 503.2.4.3 [FI3] [2]	Temperature controls have the following features: dead band controls, setpoint overlap restrictions, off-hour controls, automatic shutdown, setback controls.	☐	☐	☐	
503.2.4.1.1 [FI5] [3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐	☐	☐	
502.4.8 [FI20iecc] [3]	Recessed luminaires in thermal envelope to limit infiltration and be IC rated and labeled. Seal between interior finish and liminare housing.	☐	☐	☐	
503.2.2 [FI21iecc] [3]	HVAC systems and equipment capacity does not exceed calculated loads.	☐	☐	☐	
504.3 [FI11] [3]	Public lavatory faucet water temperature not greater than 110 °F.	☐	☐	☐	
504.5 [FI19iecc] [2]	Insulate automatic circulating hot water systems and 1st eight feet of non-circulating systems without integral heat traps.	☐	☐	☐	
504.7.1 [FI13] [3]C	Pool heaters are equipped with on/off switch and no continuous burning pilot light.	☐	☐	☐	
504.7.3 [FI4] [2]C	Pool covers are provided for heated pools and pools heated to >90˚F have a cover ≥R-12.	☐	☐	☐	
504.7.2 [FI15] [3]C	Time switches are installed on all pool heaters and pumps.	☐	☐	☐	
503.2.9.3 [FI17] [3]	Furnished O&M instructions for systems and equipment to the building owner or designated representative.	☐	☐	☐	
505.5, 505.6 [FI18] [1]	Installed lamps and fixtures are consistent with what is shown on the approved lighting plans.	☐	☐	☐	

Additional Comments: _____

KEY	[1]	High Impact (Tier 1)	[2]	Medium Impact (Tier 2)	[3]	Low Impact (Tier 3)	C	Complex Mechanical

Evaluator Assessment
Please provide a general description of what was discovered during the onsite evaluation, and a professional estimate of what you feel the compliance rating should be, regardless of the individual metrics scored above. Include your assessment of the most impactful energy requirements for this particular building.

Instructions for the Commercial Building Data Collection Checklist ANSI/ASHRAE/IESNA Standard 90.1-2007

Use of these instructions with the commercial checklist assumes a comprehensive understanding of the provisions of the ANSI/ASHRAE/IESNA Standard 90.1–2007 (90.1-2007) and key concepts and definitions applicable to those provisions. Consult 90.1-2007 about particular items in the checklist, each of which contains the corresponding code section(s) for quick reference. While most of the code provisions are included in the checklists, there are a few requirements that are deemed administrative and/or without significant impact, and these are not included. The checklist was originally developed specifically for use in addressing Recovery Act and State Energy Program requirements, both of which are focused on saving energy. However, it is a useful inspection tool for all code officials in jurisdictions that have adopted 90.1-2007, noting that slight modifications may be necessary for use in jurisdictions that amended the standard prior to adoption.

The checklists are divided into stages corresponding to traditional building inspection stages. A building may require more than one field visit to gather compliance data during each stage of construction. Multiple buildings can be used to derive a single building evaluation. This may occur where multiple buildings are being simultaneously constructed, with construction in varying stages occurring at the same time (e.g., a housing subdivision, condominium or apartment complex, or commercial office park). In these cases, the same building must be used for at least one complete inspection stage (i.e., plan review, foundation, framing, plumbing, mechanical, electrical, insulation, or final inspection). Additionally, the buildings must be of the same building type. Another approach may use a primary building for completing most of the evaluation, but separate buildings may be inspected for capturing compliance on checklist items that could not be evaluated for this primary building. A companion document, *Measuring Energy Code Compliance*[1], describes these approaches for using multiple buildings to derive a single evaluation.

Completing the General Information Section. All inputs at the top of the first page of the checklist should be completed. Some of these inputs are repeated on the beginning of each construction stage. Where a single building is being evaluated for each stage of construction, the duplicate inputs can be ignored. Where different buildings are used for completing different stages of construction, the top portion of each checklist stage must be completed for each different building evaluated.

- Compliance Approach: Compliance with the energy code can be demonstrated by the prescriptive, trade-off, or performance approach. In evaluating building compliance, the prescriptive approach should be assumed unless documentation is obtained from the building department or responsible authority demonstrating compliance with either the trade-off or performance approach. 90.1-2007 contains the prescriptive requirements which must be met under the prescriptive approach. If a trade-off or performance approach is used to demonstrate compliance, the buildings may NOT comply with these prescriptive values and yet may still be deemed to comply with the code (and therefore should be marked as compliant for the given checklist item) on the basis that some other aspect of the building exceeds the code. For example, assume a trade-off approach was used and a valid worksheet or software report was submitted showing a compliant building in Climate Zone 3B with R-30 attic insulation. In Climate Zones 3A, B, and C, the prescriptive insulation R-value requirement for attics is listed as R-38 (Table 5.5-3 in 90.1-2007). In this example, the attic insulation should be marked as compliant even though it does not meet the prescriptive requirement. If the trade-off submission is valid, there will be some other building component that exceeds code requirements and offsets the non-compliant attic insulation.

[1] Pacific Northwest National Laboratory. 2010. *Measuring Energy Code Compliance*. PNNL-19281. http://www.energycodes.gov/arra/compliance_evaluation.stm

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Commercial Building Data Collection Checklist*

ANSI/ASHRAE/IESNA Standard 90.1-2007

KEY	[1]	High Impact (Tier 1)	[2]	Medium Impact (Tier 2)	[3]	Low Impact (Tier 3)	C	Complex Mechanical

Building ID:_____ Climate Zone: _____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

State:_____ County:_____ Jurisdiction:_____

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

Building Use: ☐ Office ☐ Retail/Mercantile ☐ Warehouse/Storage ☐ Education/School ☐ Lodging/Hotel/Motel

☐ Restaurant/Dining/Fast Food ☐ Public Assembly/Religious ☐ Healthcare ☐ High-Rise Residential ☐ Other

Building Ownership: ☐ State-owned ☐ Local government-owned ☐ National account ☐ Speculative ☐ Private ☐ Other

Project Type: ☐ New Building ☐ Existing Building Addition ☐ Existing Building Renovation Valuation (If Renovation): $_____

90.1-2007 Section #	Plan Review	Complies			Comments/Assumptions[1]
		Y	N	N/A	
4.2.2 [PR1][1]	Plans and/or specifications provide all information with which compliance can be determined for the **building envelope** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
4.2.2, 6.4.2 [PR2][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **mechanical systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
4.2.2, 7.4.1 [PR3][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **service water heating systems and equipment** and delineate and document where exceptions to the standard are claimed.	☐	☐	☐	
4.2.2, 8.4.1.1, 8.4.1.2 [PR4][1]	Plans, specifications, and/or calculations provide all information with which compliance can be determined for the **lighting and electrical systems and equipment** and delineate and document where exceptions to the standard are claimed. Information provided should include interior and exterior lighting power calculations, wattage of bulbs and ballasts, transformers and control devices.	☐	☐	☐	
6.7.2.4 [PR5][1]	Detailed instructions for HVAC systems commissioning included on the plans or specifications for ≥50,000 ft^2.	☐	☐	☐	
8.4.1.1 [PR6][2]	Feeder connectors sized in accordance with approved plans.	☐	☐	☐	
8.4.1.2 [PR7][2]	Branch circuits sized for maximum drop of 3%.	☐	☐	☐	

Additional Comments/Assumptions: _____

*This example checklist is still being refined through pilot studies in several states. Make sure to get the latest checklist for your climate zone at **www.energycodes.gov/arra/compliance_evaluation.stm**

[1] Use Comments/Assumptions to document code requirements that pass due to exceptions, and specify the exception. Also use Comments/Assumptions to document multiple values observed for a given code requirement, such as multiple equipment efficiencies.

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Footing / Foundation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
5.5.3.3 [FO1][2]	Below-grade wall insulation R-value.	R-_____	☐	☐	☐	
5.8.1.2 [FO2][2]	Below-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.3.5 [FO3][2]	Slab edge insulation R-value.	R-_____ ☐ Unheated ☐ Heated	☐	☐	☐	
5.8.1.2 [FO4][2]	Slab edge insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.3.5 [FO5][2]	Slab edge insulation depth/length.	_____ ft	☐	☐	☐	
5.8.1.7 [FO6][1]	Exterior insulation protected against damage, sunlight, moisture, wind, landscaping and equipment maintenance activities.		☐	☐	☐	
5.8.1.7.3 [FO7] [1]	Insulation in contact with the ground has ≤0.3% water absorption rate per ASTM C272.		☐	☐	☐	
6.3.2, 6.4.4.1, 6.4.4.2 [FO8][1]	Piping, ducts and plenum are insulated and sealed when installed in or under a slab.	R-_____	☐	☐	☐	
6.4.3.8 [FO9][3]	Freeze protection and snow/ice melting system sensors for future connection to controls.		☐	☐	☐	
6.5.8.2, 7.4.3 [FO10][1]	Any SWH piping in or under slab is insulated.	R-_____	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Framing / Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
5.4.3.2 [FR1][3]	Fenestration meets maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
5.4.3.2 [FR2][3]	Doors meet maximum air leakage requirements.	_____ cfm/ ft^2	☐	☐	☐	
5.4.3.2 [FR3][3]	Fenestration and doors labeled for air leakage.		☐	☐	☐	
5.4.3.4 [FR4][3]	Vestibules installed per approved plans.		☐	☐	☐	
5.5.3.1 [FR5][1]	Roof insulation R-value.	R-_____ ☐ Above deck ☐ Metal ☐ Attic	☐	☐	☐	
5.8.1.2 [FR6][1]	Roof insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.4.2.1, 5.5.4.2.2 [FR7][1]	Performance compliance approach submitted for vertical fenestration area >40% or skylight area >5%.		☐	☐	☐	
5.5.4.3a [FR8][1]	Vertical fenestration U-Factor.	U-_____	☐	☐	☐	
5.5.4.3b [FR9][1]	Skylight fenestration U-Factor.	U-_____	☐	☐	☐	
5.5.4.4.1 [FR10][1]	Vertical fenestration SHGC value.	SHGC: _____	☐	☐	☐	
5.5.4.4.2 [FR11][1]	Skylight SHGC value.	SHGC: _____	☐	☐	☐	
5.8.2.1 [FR12][2]	Fenestration products rated in accordance with NFRC.		☐	☐	☐	
5.8.2.2 [FR13][1]	Fenestration products are certified as to performance labels or certificates provided.		☐	☐	☐	
5.8.2.3, 5.5.3.6 [FR14][2]	U-factor of opaque doors associated with the building thermal envelope meets requirements.	U-_____ ☐ Swinging ☐ Nonswinging	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Plumbing Rough-In Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
7.4.3 [PL1][2]	Piping for recirculating and non-recirculating service hot-water systems insulated.	☐	☐	☐	
7.4.4.1 [PL2][3]C	Temperature controls installed on service water heating systems (≤120 ºF to max temp for intended use).	☐	☐	☐	
7.4.4.2 [PL3][1]	Automatic time switches installed to automatically switch off the recirculating hot-water system or heat trace.	☐	☐	☐	
7.4.6 [PL4][3]	Heat traps Installed on non-circulating storage water tanks.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
6.4.1.4, 6.4.1.5 [ME1][2]	HVAC equipment efficiency verified. Non-NAECA HVAC equipment labeled as meeting 90.1.	Efficiency: _____	☐	☐	☐	
6.4.1.5.2 [ME2][3]	PTAC and PTHP with sleeves 16 in by 42 in. labeled "for replacement only".		☐	☐	☐	
6.4.3.4.1 [ME3][3]	Stair and elevator shaft vents have motorized dampers that automatically close.		☐	☐	☐	
6.4.3.4.2, 6.4.3.4.3, 6.4.3.4.4 [ME4][3]	Outdoor air and exhaust systems have motorized dampers that automatically shut when not in use and meet maximum leakage rates. Check gravity dampers where allowed.		☐	☐	☐	
6.4.3.4.5 [ME5][3]C	Ventilation fans >0.75 hp have automatic controls to shut off fan when not required.		☐	☐	☐	
6.4.3.9 [ME6][1]	Demand control ventilation provided for spaces >500 ft^2 and >40 people/1000 ft^2 occupant density and served by systems with air side economizer, auto modulating outside air damper control or design airflow >3,000 cfm.		☐	☐	☐	
6.4.4.1.1 [ME7][3]	Insulation exposed to weather protected from damage. Insulation outside of the conditioned space and associated with cooling systems is vapor retardant.		☐	☐	☐	
6.4.4.1.2 [ME8][2]	HVAC ducts and plenums insulated.	R-_____	☐	☐	☐	
6.4.4.1.3 [ME9][2]	HVAC piping insulation thickness.	_____ in.	☐	☐	☐	
6.4.4.2.1 [ME10][2]	Ducts and plenums sealed based on static pressure and location.		☐	☐	☐	
6.4.4.2.2 [ME11][3]C	Ductwork operating >3 in. water column requires air leakage testing.		☐	☐	☐	
6.5.1, 6.5.1.1.1, 6.5.1.1.2, 6.5.1.1.3, 6.5.1.3 [ME12][1]	Air economizers provided where required, meet the requirements for design capacity, control signal, and high-limit shut-off and integrated economizer control.		☐	☐	☐	
6.5.1.1.4 [ME13][2]	Return air and outdoor air dampers meet minimum air leakage requirements.		☐	☐	☐	
6.5.1.1.5 [ME14][1]	Means provided to relieve excess outside air.		☐	☐	☐	
6.5.1.2,	Water economizers provided where required,		☐	☐	☐	

90.1-2007 Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
6.5.1.2.1, 6.5.1.2.2, 6.5.1.3 [ME15][1] C	meet the requirements for design capacity, maximum pressure drop and integrated economizer control and heating system impact.					
6.5.1.4 [ME16][1]	Economizer operation will not increase heating energy use during normal operation.		☐	☐	☐	
6.5.2.1 [ME17] [1]	Zone controls can limit simultaneous heating and cooling and sequence heating and cooling to each zone.		☐	☐	☐	
6.5.2.2.3 [ME18] [2] C	Hydronic heat pump systems connected to a common water loop meet heat rejection and heat addition requirements.		☐	☐	☐	
6.5.2.3 [ME19] [3]C	Dehumidification controls provided to prevent reheating, recooling, mixing of hot and cold airstreams or concurrent heating and cooling of the same airstream.		☐	☐	☐	
6.5.2.4 [ME20] [3]C	Water economizer specified on hydronic cooling and humidification systems designed to maintain inside humidity at > 35 ºF dewpoint if an economizer is required.		☐	☐	☐	
6.5.3.1.2 [ME21] [2]	HVAC fan motors not larger than the first available motor size greater than the bhp.	bhp: _____	☐	☐	☐	
6.5.3.2.1 [ME22] [2] C	VAV fan motors ≥10 hp to be driven by mechanical or electrical variable speed drive, or have a vane-axial fan with variable pitch blades, or have controls or devices to limit fan motor demand to ≤30% of design wattage at 50% design air volume at static pressure of 1/3 total rated static pressure of the fan.	☐ VSD ☐ Vane axial fan ☐ Other	☐	☐	☐	
6.5.3.2.2 [ME23] [2] C	VAV fans have static pressure sensors positioned so setpoint ≤1/3 total design pressure.		☐	☐	☐	
6.5.3.2.3 [ME24] [2] C	Reset static pressure setpoint for DDC controlled VAV boxes reporting to central controller based on the zones requiring the most pressure.		☐	☐	☐	
6.5.4.1 [ME25] [3]C	HVAC pumping systems >10 hp designed for variable fluid flow.		☐	☐	☐	
6.5.4.2 [ME26] [3]C	Reduce flow in pumping systems >10 hp. to multiple chillers or boilers when others are shut down.		☐	☐	☐	
6.5.4.3 [ME27] [3]C	Temperature reset by representative building loads in pumping systems >10 hp for chiller and boiler systems > 300,000 Btu/h.		☐	☐	☐	
6.5.4.4 [ME28] [3]C	Two-position automatic valve interlocked to shut off water flow when hydronic heat pump with pumping system >10 hp is off.		☐	☐	☐	
6.5.5.2 [ME29] [3]C	Fan systems with motors ≥7.5 hp associated with heat rejection equipment to have capability to operate at 2/3 of full-speed and auto speed controls to control the leaving fluid temp or condensing temp/pressure of heat rejection device.		☐	☐	☐	
6.5.6.1 [ME30][1]	Exhaust air energy recovery on systems ≥5,000 cfm and 70% of design supply air.		☐	☐	☐	

90.1-2007 Section #	Mechanical Rough-In Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
6.5.6.2, 6.5.6.2.1, 6.5.6.2.2 [ME31] [3]C	Condenser heat recovery system that can heat water to 85 ºF or provide 60% of peak heat rejection is installed for preheating of service hot water in 24/7 facility, water cooled systems reject >6 MMBtu, SHW load ≥1 MMBtu.		☐	☐	☐	
6.5.7.1 [ME32] [2]	Kitchen hoods >5K cfm have make up air ≥50% of exhaust air volume.		☐	☐	☐	
6.5.7.2 [ME33][1]C	Fume hoods exhaust systems ≥15,000 cfm have VAV hood exhaust and supply systems, direct make-up air or heat recovery.		☐	☐	☐	
6.5.8.1 [ME34] [3]	Unenclosed spaces that are heated use only radiant heat.		☐	☐	☐	
6.5.9 [ME35][1] C	Hot gas bypass limited to: ≤240 kBtu/h – 50% >240 kBtu/h – 25%		☐	☐	☐	
7.4.2 [ME36][2]C	Service water heating equipment meets efficiency requirements.		☐	☐	☐	
7.5.1 [ME37][2] C	Combined space and water heating system not allowed unless standby loss less than calculated maximum. AHJ has approved or combined connected load <150 KBtu/h.		☐	☐	☐	
7.5.2 [ME38][2] C	Service water heating equipment used for space heating complies with the service water heating equipment requirements.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Rough-In Electrical Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
9.4.1.1 [EL1] [2]	Automatic lighting control to shut off all building lighting installed in buildings >5,000 ft^2.	☐	☐	☐	
9.4.1.2 [EL2] [2]	Independent lighting control installed per approved lighting plans and all manual control readily accessible and visible to occupants.	☐	☐	☐	
9.4.1.3 [EL3] [2]	Automatic lighting controls for exterior lighting installed.	☐	☐	☐	
9.4.1.4 [EL4] [1]	Verify separate lighting control devices for specific uses installed per approved lighting plans.	☐	☐	☐	
9.4.2 [EL5] [3]	Ballasted one and three lamp fixtures with >30 W/lamp have two lamp tandem wired ballasts when ≥2 fixtures in same space on same control.	☐	☐	☐	
9.4.3 [EL6] [1]	Exit signs do not exceed 5 watts per face.	☐	☐	☐	
9.4.4 [EL7] [1]	Exterior grounds lighting over 100 W provides >60 m/W unless on motion sensor or fixture is exempt from scope of code or from external LPD.	☐	☐	☐	
9.6.2 [EL8] [1]	Additional interior lighting power allowed for special functions per the approved lighting plans and is automatically controlled and separated from general lighting.	☐	☐	☐	
10.4.1 [EL9] [2]	Electric motors meet requirements where applicable.	☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____

Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Insulation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
5.4.3.1 [IN1][1]	All sources of air leakage in the building thermal envelope are sealed, caulked, gasketed or weather stripped to minimize air leakage.		☐	☐	☐	
5.5.3.1 [IN2][1]	Roof insulation R-value.	R-_____	☐	☐	☐	
5.8.1.2, 5.8.1.3 [IN3][1]	Roof insulation installed per manufacturer's instructions. Blown or poured loose-fill insulation is installed only where the roof slope is ≤3 in 12.		☐	☐	☐	
5.5.3.1 [IN4][3]	Skylight curbs insulated to the level of roofs with insulation above deck or R-5.	R-_____	☐	☐	☐	
5.5.3.1.1 [IN5][3]	High-albedo roofs meet solar reflectance of 0.70 and thermal emittance of 0.75 or SRI of 82.	SR: _____ SRI: _____	☐	☐	☐	
5.5.3.2 [IN6][1]	Above-grade wall insulation R-value.	R-_____ ☐ Mass ☐ Metal ☐ Steel ☐ Wood	☐	☐	☐	
5.8.1.3 [IN7][1]	Above-grade wall insulation installed per manufacturer's instructions.		☐	☐	☐	
5.5.3.4 [IN8][2]	Floor insulation R-value.	R-_____ ☐ Mass ☐ Steel ☐ Wood	☐	☐	☐	
5.8.1.3 [IN9][2]	Floor insulation installed per manufacturer's instructions.		☐	☐	☐	
5.8.1.1 [IN10][2]	Building envelope insulation is labeled with R-value or insulation certificate providing R-value and other relevant data.		☐	☐	☐	
5.8.1.4 [IN11][2]	Eaves are baffled to deflect air to above the insulation.		☐	☐	☐	
5.8.1.5 [IN12][2]	Insulation is installed in substantial contact with the inside surface separating conditioned space from unconditional space.		☐	☐	☐	
5.8.1.6 [IN13][2]	Recessed equipment installed in building envelope assemblies does not compress the adjacent insulation.		☐	☐	☐	
5.8.1.7 [IN14][2]	Exterior insulation is protected from damage with a protective material.		☐	☐	☐	
5.8.1.7.1 [IN15][2]	Attics and mechanical rooms have insulation protected where adjacent to attic or equipment		☐	☐	☐	

90.1-2007 Section #	Insulation Inspection	Verified Value	Complies			Comments/Assumptions
			Y	N	N/A	
	access.					
5.8.1.7.2 [IN16] [2]	Foundation vents do not interfere with insulation.		☐	☐	☐	
5.8.1.8 [IN17] [3]	Insulation intended to meet the roof insulation requirements not installed on top of a suspended ceiling.		☐	☐	☐	

Additional Comments/Assumptions: _____

General building information only required if different than above Building ID:_____
Date:_____ Name of Evaluator(s): _____

Building Contact: Name:_____ Phone:_____ Email:_____

Building Name & Address:_____ Conditioned Floor Area:_____ ft^2

Compliance Approach (check all that apply): ☐ Prescriptive ☐ Trade-Off ☐ Performance

Compliance Software (if used):_____ Green/Above-Code Program: _____

90.1-2007 Section #	Final Inspection	Complies			Comments/Assumptions
		Y	N	N/A	
5.4.3.3 [FI1] [1]	Weatherseals installed on all loading dock cargo doors in Climate Zones 4-8.	☐	☐	☐	
6.4.3.1.1 [FI2] [2]	Heating and cooling to each zone is controlled by a thermostat control.	☐	☐	☐	
6.4.3.1.2, 6.4.3.2, 6.4.3.3, 6.4.3.3.1, 6.4.3.3.2 [FI3] [2]	Temperature controls have the following features: dead band controls, setpoint overlap restrictions, off-hour controls, automatic shutdown, setback controls.	☐	☐	☐	
6.4.3.3.3 [FI4] [2]	Systems with air capacity >10,000 cfm include optimum start controls.	☐	☐	☐	
6.4.3.5 [FI5] [3]	Heat pump controls prevent supplemental electric resistance heat from coming on when not needed.	☐	☐	☐	
6.4.3.7 [FI6] [3]C	When humidification and dehumidification is provided to a zone simultaneous operation is not possible.	☐	☐	☐	
6.7.2.1 [FI7] [3]	Furnish HVAC "as-built" drawings submitted within 90 days of system acceptance.	☐	☐	☐	
6.7.2.2 [FI8] [3]	Furnish O&M manual for HVAC systems.	☐	☐	☐	
6.7.2.3 [F9] [1]C	An air and/or hydronic system balancing report is provided for HVAC systems serving zones >5,000 ft^2 of conditioned area.	☐	☐	☐	
6.7.2.4 [FI0] [1]C	Verify HVAC control systems have been tested to ensure proper operation, calibration and adjustment of controls.	☐	☐	☐	
7.4.4.3 [FI11] [3]	Public lavatory faucet water temperature not greater than 110 ^{o}F.	☐	☐	☐	
7.4.4.4 [FI12] [3]	Controls are installed that limit the operation of a recirculation pump installed to maintain temperature of a storage tank.	☐	☐	☐	
7.4.5.1 [FI13] [3]C	Pool heaters are equipped with on/off switch and no continuous burning pilot light.	☐	☐	☐	
7.4.5.2 [FI14] [2]C	Pool covers are provided for heated pools and pools heated to >90˚F have a cover ≥R-12.	☐	☐	☐	
7.4.5.3 [FI15] [3]C	Time switches are installed on all pool heaters and pumps.	☐	☐	☐	
8.7.1 [FI16] [3]	Furnished as-built drawings for electric power systems.	☐	☐	☐	
8.7.2 [FI17] [3]	Furnished O&M manual for electrical power systems and equipment.	☐	☐	☐	
9.1.3 [FI8] [1]	Installed lamps and fixtures are consistent with what is shown on the approved lighting plans.	☐	☐	☐	

Additional Comments/Assumptions: _____

Evaluator Assessment

Please provide a general description of what was discovered during the onsite evaluation, and a professional estimate of what you feel the compliance rating should be, regardless of the individual metrics scored above. Include your assessment of the most impactful energy requirements for this particular building.

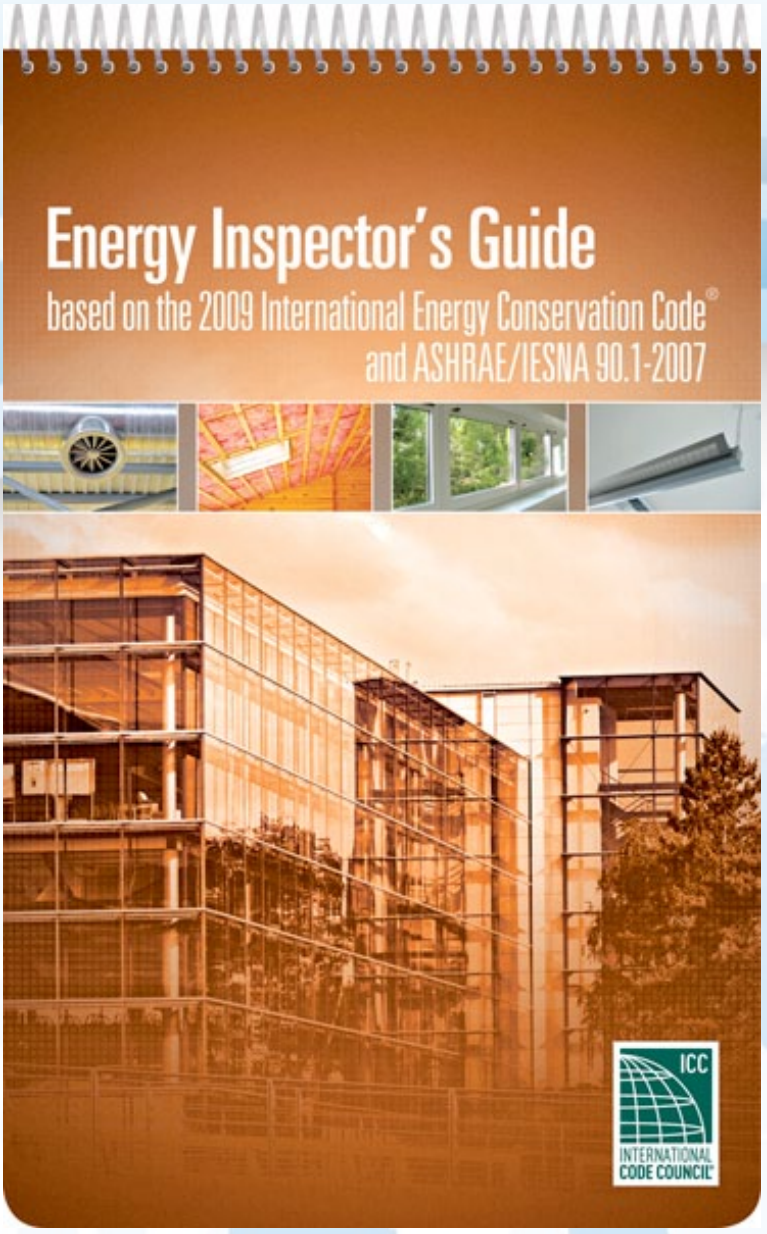
_____

KEY	1	High Impact (Tier 1)	2	Medium Impact (Tier 2)	3	Low Impact (Tier 3)	C	Complex Mechanical

ICC ENERGY INSPECTOR'S GUIDE

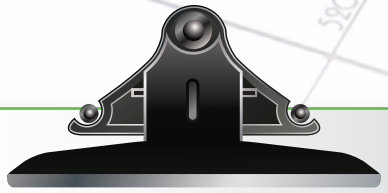
Your ideal resource for effective, accurate, consistent, and complete commercial and residential energy provisions. This handy pocket guide is organized in a manner consistent with the inspection sequence and process for easy use on site. Increase inspection effectiveness by focusing on the most common issues relevant to energy conservation.

You can find this product at **www.iccsafe.org/DOEreferences**.



Commercial

Training and Support



What's in it FOR ME?

In this section you'll find:

- ☑ Examples of training for commercial code officials, and where to find more
- ☑ Where to go for energy codes solutions and technical support
- ☑ Commercial energy codes FAQ
- ☑ Two examples of DOE's "Code Notes"

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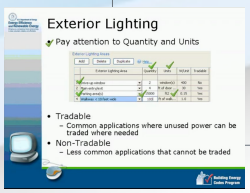

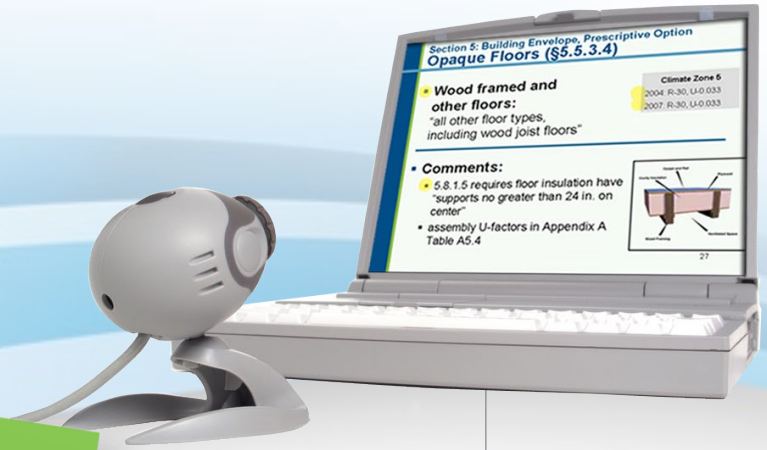

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Training Seminars

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"This seminar introduces participants to the major changes from the 2006 IECC to the 2009 IECC. Participants will discuss the changes, reasons for the changes, and take part in knowledge review activities. Information presented will allow participants to apply these new code requirements to design, plan review, and/or inspection. This seminar emphasizes the increase in energy efficiency improvements."

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Online Certification Practice Course
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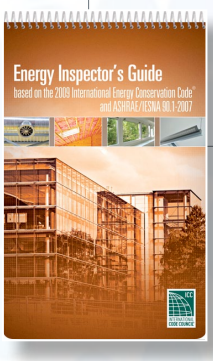

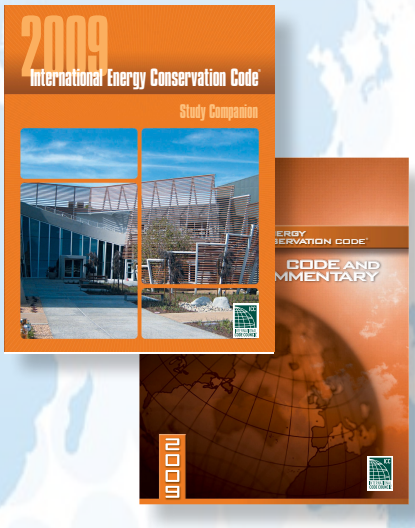

Find more at
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SUPPORT FOR CODE OFFICIALS

Whether you're looking for published resources, frequently asked questions, or technical support, **BECP's Solutions and Help Center** will point you in the right direction.

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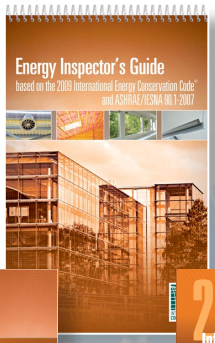
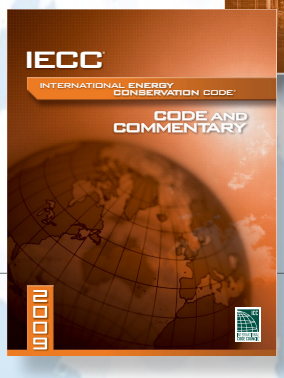
Commercial SUPPORT

Energy Inspector's Guide: Easy to use pocket guide based on the 2009 International Energy Conservation Code® and ASHRAE/IESNA 90.1-2007



2009 International Energy Conservation Code® and Commentary



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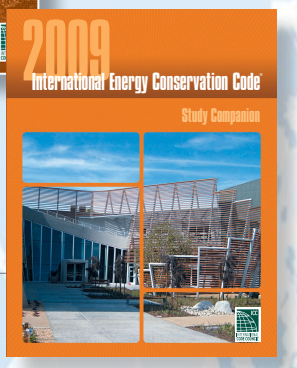


2009 International Energy Conservation Code® ***Study Companion***

COMMERCIAL CODES
Examples of Frequently Asked Questions (FAQs)

Q: What code do I need to comply with?

A: Visit the **BECP Status of State Codes** page at www.energycodes.gov to find out which commercial energy code your state has adopted. Often, commercial buildings must comply with a certain version of either the International Code Council's (ICC's) International Energy Conservation Code (IECC) or ASHRAE Standard 90.1 – *Energy Standard for Buildings Except Low-Rise Residential Buildings*. However, local jurisdictions and municipalities sometimes have codes in place other than the state adopted code.

Q: How do I create an energy code compliance report to get my building permit?

A: **Download COM*check*™ software** at no charge, or simply launch COM*check*-Web™ (both are available at www.energycodes.gov/software.stm). You will fill out forms with information about your project, such as square footage of the floors, walls, and ceilings, insulation levels, information about your windows and heating and cooling system. The menu-driven software will show you when the building has complied with the energy code. At that point, owners can print out the reports to submit for the building permit.

Q: Where can I get a copy of the energy code?

A: Copies of the IECC can be purchased from the ICC website **(**www.iccsafe.org**)**. ASHRAE Standard 90.1 can be purchased from the ASHRAE website (www.ashrae.org). With new DOE funding, the 2009 IECC and Standard 90.1-2007 is now available in an electronic version for free at http://www.iccsafe.org/store/pages/doeregistration.aspx.

Q: What are the minimum insulation and window requirements for my building?

A: Minimum insulation levels and window requirements depend on your climate zone, whether you are complying with the IECC or ASHRAE 90.1. In the IECC you will need the information from Table 502.2 (1) and Table 502.3. In ASHRAE 90.1 the information is found in Table 5.5-1-8, insulation levels for high albedo roofs can be found in Table 5.5.3.1, and SHGC multipliers for permanent projections is in Table 5.5.4.4.1 They are several ways to get this information:

- Call, or stop by, your local building department and ask them.
- Obtain a copy of the code book (see above).
- Submit your question to **BECP Technical Support (techsupport@becp.pnl.gov).** Please include your state and local jurisdiction so we can determine your climate zone.

Q: My project has both businesses and homes; is it residential or commercial?

A: For mixed-use buildings that are three stories or less and have residential and commercial space, the way to determine if the entire building can shown to meet code under residential or commercial is the percentage of the space types. If the residential is 10% or less of the overall building then the entire building can fall under commercial. It is always easier to show compliance for the entire exterior thermal building envelope instead of breaking the building apart. If using COM*check*™, the apartments would be multi-family under the space-types option and the other areas should also be designated according to their activities. Remember, if the building is four stories or greater, it is commercial.

Q: Do the last IECC versions reference the ASHRAE Standard in such a way as to require the commissioning work described in them?

A: ASHRAE Standards 90.1-2004 and 90.1-2007 require plans and specs to include detail descriptions for commissioning of HVAC systems and their controls in buildings with conditioned space greater than 50,000 square feet.

- The 2009 IECC allows a code user to use either 90.1-2007 in its entirety (including the HVAC requirements) or to use the requirements in Chapter 5 of the 2009 IECC. Chapter 5 of the 2009 IECC does not have any specific commissioning requirements. There are air system and hydronic system balancing requirements, but nothing specifically labeled "commissioning" or "functional testing". Commissioning requirements have been proposed for the IECC before and will be discussed for the 2012 IECC.

COM*check*™-specific FAQs

Q: Can I use COMcheck™ in my state?

A: COM*check*™ can be used in most states and local municipalities. Please see the **States that can use COM*check*™ for Compliance** page on www.energycodes.gov.

Q: What is a performance approach?

A: A performance approach (also known as a systems performance approach) allows you to compare your proposed design to a baseline or reference design and demonstrate that the proposed design is at least as efficient as the baseline in terms of annual energy use. This approach allows greater flexibility but requires considerably more effort. A performance approach is often necessary to obtain credit for special features, such as passive solar design, photovoltaic cells, thermal energy storage, and fuel cells. This approach requires an annual energy analysis for the proposed design and the reference design. We do not offer commercial software products at this time to comply using this approach, but future versions of the COM*check*™ software will include the DOE-2 energy analysis engine to perform the necessary calculations needed to determine compliance. Samples of performance software available are listed in the **Building Energy Software Tools Directory** on the **Building Technologies Program** website (www.eere.energy.gov/buildings).

Q: How do I show compliance with additions or alterations?

A: One of the keys to showing compliance for additions and alterations is to remember you are only considering the new space, or the new walls, etc. You have the option of showing compliance for the entire space, but this is not necessary or typical. Using COM*check*™, you will indicate "addition" or "alteration" on the project information tab, and need to enter the following information, as it applies to your project:

- Ceiling – gross area (ft^2) and insulation R-value of new ceiling,
- Exterior walls – gross area (ft^2) of new exterior walls and insulation R-value (the existing exterior wall(s) that will become interior wall(s) once the addition is built are to be considered interior walls and should not be entered as part of the addition wall area.
- Windows/Doors – gross area (ft^2) of windows and/or doors with U-factor from NFRC label or default table in the help section of COM*check*™.
- Floor – gross area (ft^2) of addition and insulation R-value. If the floor is a slab, the length of the exterior slab edge should be entered in linear feet.

Q: How do I show compliance for only lighting (or mechanical, or envelope)?

A: COM*check*™ will calculate compliance for your project as you define it. For example, if your project is a tenant improvement with new interior lighting, new exterior lighting and mechanical, you would not need to fill in the envelope tab. Conversely, if your project is new construction of an unoccupied commercial shell and there is no interior lighting or mechanical system, you would not fill out those tabs.

Q: Please explain how to use different wattage luminaire and comply with the code.

A: For example, does my lighting comply, if my building that is using a Halo H71CT 6" ceiling insulated Recessed Housing which accepts a R-30 type bulb, the bulb specified is a "15 Watt CFL, Light Bulb - 65 W Equal-Warm White 27000K - R30 Reflector - Energy Miser FE-R30-15W-27k", can this information be input into the COM*check*™ Compliance Software as 15 Watt CFL, instead of a 65 Watt incandescent to show that it is in compliance?

- The 2006 IECC requires that screw-based luminaries be counted for compliance based on the rated wattage of the luminaire. The basis for this requirement is that after occupancy and initial lamp burnout, any wattage lamp could be put in and the maximum luminaire wattage rating most reasonably represents true lighting application. This can make compliance difficult if a lower wattage lamp is intended to be used. This is why some designers contract with manufacturers to label luminaries with a lower wattage rating that ensures that future lamp replacements are limited to this maximum wattage. COM*check*™ is a tool that follows the adopted codes; therefore, the labeled wattage of the luminaire is the appropriate input for code compliance and the COM*check*™ tool.

Code Notes

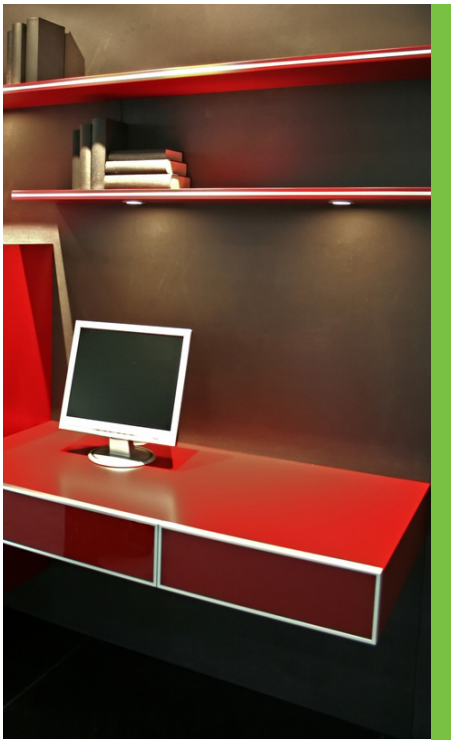
Task Lighting in Offices

[ASHRAE 90.1-2007, 2009 IECC].

Defining task lighting. The appropriate treatment of task lighting for energy code compliance has always been a potentially confusing issue. The intent of ANSI/ASHRAE/IESNA Standard 90.1-2007 (as well as previous versions back to 1999) and the International Energy Conservation Code® (IECC) (including versions back to 2003) is for task lighting to be included in compliance calculations when it is part of the lighting design. This applies to office spaces where task lighting is common as well as other spaces where task lighting may appear in various forms.

Current office lighting design trends are evolving to incorporate more task and less overhead ambient lighting. These designs provide more flexibility and may require less installed power. The power density requirements in Standard 90.1 and IECC accommodate this design trend by requiring compliance for the entire lighting design, including task lighting. The wording in the definition of installed interior lighting power (in ASHRAE 90.1-2007) clearly notes that "…all permanently installed general, task, and furniture lighting systems and luminaires" must be included as part of the lighting power density for compliance. The IECC does not have a similar specific definition that relates to task lighting, but the intent and expected application are the same.

Current office lighting design trends are evolving to incorporate more task and less overhead ambient lighting.



Furniture-mounted task lighting

Furniture-mounted task lighting is often used in office spaces. In some cases, this furniture-mounted lighting is a planned element of the overall lighting design and by definition should be included for compliance. In other cases, furniture is a future tenant responsibility and the complete space lighting design is composed of typical overhead and other permanent luminaires only. Any lighting that was not part of the overall design and is brought in later by tenants, whether it is furniture mounted or portable, would not be included as part of energy compliance.

When considering code compliance for renovations, similar compliance guidelines would apply. Furniture or task lighting that is part of the design for the new lighting after renovations needs to comply with the Standard's guidelines for task lighting. Note that Standard 90.1 requires that all task lighting be separately controlled from general lighting. Standard 90.1-2007 and IECC 2009 both include an exception to counting the wattage of furniture-mounted task lighting as part of the lighting power density compliance when the task lighting is controlled by occupancy sensing or similar automatic shutoff.

Plan Review

1. Verify that the lighting schedule specifies all designed lighting. For task lighting that is considered part of the overall design, but not yet specified (for example, undershelf task lighting that will be brought in as part of furniture systems by a tenant), the compliance documentation should provide an accounting or estimate of this lighting as part of the complete space design.
2. Verify that the manufacturer's data on furniture and other equipment that incorporates task lighting, and which is part of the lighting design of the space, specify how the task lighting will be shut off. It should be shut off either by an integral control device or other accessible control visible to the occupant within the intended space.
3. Verify that any supplemental task lighting being claimed under the exemption is controlled with an automatic sensor.

Field Inspection

1. Verify that installed supplemental lighting has an integral control device. For furniture-mounted task lighting that is being exempted, the control must be automatic, such as an occupancy sensor.
2. Verify that non-exempted task lighting can be manually switched on and off either within the equipment/furniture or in a location accessible by the occupant.

Code Citations*

- ASHRAE 90.1-2007, 3.2 Installed Interior Lighting Power.
  - The power in watts of all permanently installed general, task, and furniture lighting systems and luminaires.
- ASHRAE 90.1-2007, 9.4.1.4 Additional Controls.
  - d. *Task Lighting* - supplemental task lighting, including permanently installed undershelf or undercabinet lighting shall have a control device integral to the luminaires or be controlled by a wall-mounted control device provided that the control device is readily accessible and located so that the occupant can see the controlled lighting.
- IECC 2009, Section 505.5.1 Total connected interior lighting power.
  - The total connected interior lighting power (watts) shall be the sum of the watts of all interior lighting equipment.
- IECC 2009, Section 505.5.1.3 Other Luminaires.
  - The wattage of all other lighting equipment shall be the wattage of the lighting equipment verified through data furnished by the manufacturer or other approved sources.

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Furniture-mounted task lighting

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Code Notes

Automatic Lighting Shutoff for Tenant Spaces (Located at: www.energycodes.gov/help/notes.stm)

[ASHRAE 90.1-2007, 2009 IECC]. Automatic shutoff capability for all interior building lighting (with exceptions) is required by ANSI/ASHRAE/IESNA Standard 90.1-2007 (as well as previous versions back to 1999) and the 2009 International Energy Conservation Code® (IECC) (including versions back to 2003) for buildings over 5,000 square feet. The energy-saving intent of the requirement is to be sure that unnecessary lights are turned off, such as those not needed after the end of the business day. The requirement itself ensures that the control is available so that occupants can set up automatic shutoff of lighting.

The requirement does have important exceptions including: lighting intended for 24-hour operation, lighting in spaces where patient care is rendered, and lighting in spaces where automatic shutoff would endanger the safety or security of the room or occupants. The IECC has a specific exception for sleeping units within hotels, motels, boarding houses, and similar buildings, while Standard 90.1 considers these spaces exempted under the 24-hour-operation exemption.

Retail strip mall with several types of occupants. Each type of occupant will have different lighting needs.

The size threshold issue and tenant spaces

The 5,000-square-foot threshold was originally included because of the potential impracticality and relative high cost of whole-building control systems for smaller buildings. This threshold is easy to apply for single-tenant buildings and for buildings with structured or uniform operating hours because the building schedule can be easily programmed into a whole-building system.

However, some building types with multiple tenant occupancies do not lend themselves to practical application of whole-building control. One classic example is the typical retail strip mall. If a strip mall is over 5,000 square feet in total, the code language (as written in the controls section) technically requires complete, automatic shutoff for the building as a whole. Because each retail business will typically have different operating schedules, it is difficult and often impractical to apply a whole-building control system.

Typically, individual tenant businesses (such as those in a strip mall structure) will have separate electrical feeds and firewalls between adjoining tenants, effectively making them separate business entities. In these cases, the whole building automatic shutoff is intended to be applied on a tenant business basis; those individual businesses less than 5,000 square feet would not have to comply with the automatic lighting shutoff requirement. The intent in both ASHRAE 90.1 and the IECC code is to apply this requirement in a practical manner. ASHRAE 90.1 interpretations and IECC staff opinions are likely to focus on the uniqueness of business schedules and separate electrical services in determining appropriate application of the 5,000-square-foot threshold. It is anticipated that future versions of Standard 90.1 (2010 and beyond) and IECC (2012 and beyond) will eliminate the 5,000-square-foot exception because costs have come down on whole-building controls and the requirement already offers an alternative in the form of individual space occupancy sensors or other automatic controls.

Plan Review

1. Verify that the lighting and/or electrical control plans specify controls to be installed that meet the provisions of the code, including the control area limitations. Check individual tenant space sizes for an applicable exemption.

2. Verify from the design submission (plans and specifications) that the control has appropriate scheduling capability in sufficient detail for the intended use of the space or building. An appropriate scheduling control should be capable of maintaining the type of day (weekday or weekend) and appropriate lighting schedule for that day type.

Field Inspection

1. Verify that controls installed meet the capabilities and requirements as shown on the plans.

2. Verify the automatic control device will shut off during the designated or programmed times as scheduled for each day of the week.

Code Citations*

ASHRAE Standard 90.1-2007, Section 9.4.1.1 and 2009 IECC, Section 505.2.2.2, Automatic Lighting Shutoff

Interior lighting in buildings larger than 5000 ft^2 shall be controlled with an automatic control device to shut off building lighting in all spaces. This automatic control device shall function on either

1. A scheduled basis using a time-of-day operated control device that turns lighting off at specific programmed times—an independent program schedule shall be provided for areas of no more than 25,000 ft2 but not more than one floor or
2. An occupant sensor that shall turn lighting off within 30 minutes of an occupant leaving a space or
3. A signal from another control or alarm system that indicates the area is unoccupied.

The following shall not require an automatic control device:

1. Lighting intended for 24-hour operation
2. Lighting in spaces where patient care is rendered
3. Lighting in spaces where an automatic shutoff would endanger the safety or security of the room or building occupant(s).

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