

COMMERCIAL PLAN REVIEW FOR ENERGY CODE COMPLIANCE QUICK REFERENCE GUIDE

Plan review for compliance with the commercial provisions of the International Energy Conservation Code can be conducted quickly and efficiently. The U.S. Department's COMcheck-EZ Compliance Software is designed to create simplified compliance certificates that can be easily reviewed by enforcement personnel. The Quick Reference Guide will take you, step-by-step, through a typical plan review of a COMcheck submittal.

There are three basic steps for conducting a building energy code plan review:

- Step 1: Verify the documentation has been correctly prepared.
- Step 2: Verify the levels of efficiency shown on the plans meet or exceed that shown in the documentation.
- Step 3: Verify all information to conduct a field inspection is included in the plans or documentation for the inspector to use on site.

Remember, your role is verification not preparing the documentation. The applicant is responsible for completing the documentation correctly and ensuring that the inputs are correct. This Quick Guide will take you through the important elements of the plan review process.

Permit Number

Checked By/Date

Envelope Compliance Certificate 2003 IECC

COMcheck-EZ Software Version 3.0 Release 1

Data filename: C:\Program Files\Check\COMcheck-EZ\301\example.cck

Section 1: Project Information

Project Name: COMcheck-EZ Example Building
10th Street, Concord, NH
Designer/Contractor: Fine Engineering
Document Author: Mr. Fine

Step One: Verify the **Project Information** matches the information on the building plans. The city, state, code year and construction type will impact energy code compliance.

Section 2: General Information

Building Location (for weather data): Concord, New Hampshire
Climate Zone: 15
Heating Degree Days (base 65 degrees F): 7554
Cooling Degree Days (base 65 degrees F): 328
Project Type: New Construction
Window / Wall Ratio: 0.23

Step Two: Verify the building **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.

Activity Type(s)

Office
Convention, Conference or Meeting Center
Corridor, Restroom, Support Area
Storage, Industrial and Commercial
Industrial Work, < 20 ft Ceiling Height
Lobby - Other

Floor Area

4520
420
1400
2520
2700
600

Section 3: Requirements Checklist

- | | | |
|-------|--|--|
| Bldg. | | |
| Dept. | | |
| Use | | |
| | | Air Leakage, Component Certification, and Vapor Retarder Requirements |
| [] | | 1. All joints and penetrations are caulked, gasketed, weather-stripped, or otherwise sealed. |
| [] | | 2. Windows, doors, and skylights certified as meeting leakage requirements. |
| [] | | 3. Component R-values & U-factors labeled as certified. |
| [] | | 4. Stair, elevator shaft vents, and other dampers integral to the building envelope are equipped with motorized dampers. |
| [] | | 5. Cargo doors and loading dock doors are weather sealed. |
| [] | | 6. Recessed lighting fixtures are: (i) Type IC rated and sealed or gasketed; or (ii) installed inside an appropriate air-tight assembly with a 0.5 inch clearance from combustible materials and with 3 inches clearance from insulation material. |
| [] | | 7. Building entrance doors have a vestibule and equipped with closing devices.
Exceptions:
Building entrances with revolving doors.
Doors that open directly from a space less than 3000 sq. ft. in area. |
| [] | | 8. Vapor retarder installed. |

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

Step Four: Verify the **Gross Area or Perimeter** values represent the proposed project. Verify window area is correct by using rough opening as shown on the plans.

Step Five: 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.

Step Six: Verify the window and door U-factors shown on the building plans meet or exceed what is shown.

Climate-Specific Requirements

Component Name/Description

Roof 1: Non-Wood Joist/Rafter/Truss
 Skylight 1: Metal Frame, Double Pane, Tinted, SHGC 0.80
 Exterior Wall 1: Solid Concrete or Masonry <= 8"
 Furring: Metal
 Door 1: Glass, Clear, SHGC 0.58
 Window 1: Metal Frame, Double Pane with Low-E
 Tinted, SHGC 0.63
 Window 2: Metal Frame, Double Pane, Clear, SHGC 0.72
 Door 2: Overhead
 Door 3: Solid
 Interior Wall 2: Metal Frame, 16" o.c.
 Basement Wall 1: Solid Concrete or Masonry <= 8"
 Furring: None, Wall Ht 12.5, Depth B.G. 7.0
 Floor 1: Slab-On-Grade:Unheated, Vertical 2 ft.

Gross Area	Cavity R-Value	Cont. R-Value	Proposed U-Factor	Budget U-Factor
6112	0.0	26.1	0.037	0.052
112	---	---	0.500	0.052
6000	22.0	0.0	0.114	0.074
42	---	---	0.700	0.520
1500	---	---	0.600	0.520
56	---	---	0.700	0.520
288	---	---	0.140	0.120
40	---	---	0.200	0.120
812	22.0	0.0	0.106	0.120
2000	---	10.8	0.082	0.098
160	---	10.8	---	---

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

Envelope PASSES: Design 5% better than code

Step Seven: Verify the Building Envelope complies with the code by +0% or greater.

Section 4: 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 2003 IECC requirements in COMcheck-EZ Version 3.0 Release 1 and to comply with the mandatory requirements in the Requirements Checklist.

Principal Envelope Designer-Name

Signature

Date

Permit Number

Checked By/Date

Lighting Compliance Certificate 2003 IECC

COMcheck-EZ Software Version 3.0 Release 1
Data filename: C:\Program Files\Check\COMcheck-EZ\301\example.cck

Section 1: Project Information

Project Name: COMcheck-EZ Example Building
10th Street, Concord, NH
Designer/Contractor: Fine Engineering
Document Author: Mr. Fine

Step One: Verify the **Project Information** matches the information on the building plans. The city, state, code year and construction type will impact energy code compliance.

Section 2: General Information

Building Use Description by: Activity Type
Project Type: New Construction

Step Two: Verify the **Building Use Description** is consistent with the project. Single occupancy buildings should always use the Whole Building Method unless each **Activity Type** within the building is identified separately.

Activity Type(s)

Office
Convention, Conference or Meeting Center
Corridor, Restroom, Support Area
Storage, Industrial and Commercial
Industrial Work, < 20 ft Ceiling Height
Lobby - Other

Floor Area

4520
420
1400
2520
2700
600

Section 3: Requirements Checklist

Step Three: Verify the proposed **Actual Wattage** is less than or equal to the **Allowed Wattage**.

Bldg. Dept. Use	Interior Lighting	Exterior Lighting	Controls, Switching, and Wiring						
[]	1. Total actual watts must be less than or equal to total allowed watts <table border="1"> <thead> <tr> <th>Allowed Watts</th> <th>Actual Watts</th> <th>Complies(Y/N)</th> </tr> </thead> <tbody> <tr> <td>12814</td> <td>12478</td> <td>YES</td> </tr> </tbody> </table>	Allowed Watts	Actual Watts	Complies(Y/N)	12814	12478	YES	2. Efficacy greater than 45 lumens/W <i>Exceptions:</i> Specialized lighting highlighting features of historic buildings; signage; safety or security lighting; or low-voltage landscape lighting.	3. Independent controls for each space (switch/occupancy sensor). <i>Exception:</i> Areas that must be continuously illuminated. 4. Master switch at entry to hotel/motel guest room. 5. Individual dwelling units separately metered. 6. Each space provided with a manual control to provide uniform light reduction capability. <i>Exceptions:</i> Only one luminaire in space; An occupant-sensing device controls the area; The area is a corridor, storeroom, restroom, or lobby; Areas that must be continuously illuminated; Areas greater than 250 sq.ft; Areas that use less than 0.6 Watts/sq.ft. 7. Photocell/astronomical time switch on exterior lights. <i>Exceptions:</i> Areas requiring lighting during daylight hours 8. Tandem wired one-lamp and three-lamp ballasted luminaires. <i>Exceptions:</i> Electronic high-frequency ballasts; Luminaires on emergency circuits or with no available pair.
Allowed Watts	Actual Watts	Complies(Y/N)							
12814	12478	YES							

Step Four: Verify the exterior lighting called out on the lighting plans meet the 45 lumens per watt requirement. Verify a photocell or time clock control is called out on the plans. If a time clock is identified, verify it meets the minimum requirements in Chapter 8 of the IECC.

Step Five: Verify the switching for each interior space is shown on the lighting plans if applicable to the space. Each space with two light fixtures will have two switches unless an exception is taken. If one- or three-lamp magnetically ballasted fixtures are used verify they will be tandem wired.

Section 4: 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 2003 IECC, Chapter 8, requirements in COMcheck-EZ Version 3.0 Release 1 and to comply with the mandatory requirements in the Requirements Checklist.

Principal Lighting Designer-Name

Signature

Date

Lighting Application Worksheet 2003 IECC

COMcheck-EZ Software Version 3.0 Release 1

Step Six: Verify the **Fixture Description** shown in the documentation is consistent with that shown on the lighting plans/fixture schedule. Verify the **lamps per fixture** and ballast type is consistent with the lighting plans or information provided.

Step Seven: Verify the **Fixture Wattage** is correct. Use either the default value from COMcheck-EZ or manufacturers literature.

Section 1: Allowed Lighting Power Calculation

A Area Category	B Floor Area (ft ²)	C Total Allowed Watts (watts/ft ²)	D Allowed Watts (B x C)
Office	4520	1.1	4972
Convention, Conference or Meeting Center	420	1.3	546
Corridor, Restroom, Support Area	1400	0.9	1260
Storage, Industrial and Commercial	2520	0.8	2016
Industrial Work, < 20 ft Ceiling Height	2700	1.2	3240
Lobby - Other	600	1.3	780

Total Allowed Watts = 12814

Section 2: Actual Lighting Power Calculation

A Fixture ID	C Fixture Description / Lamp Description / Wattage Per Lamp / Ballast	C Lamps/ Fixture	D # of Fixtures	E Fixture Watt.	F (D x E)
A	2x4 Troffer, parabolic louver / 48" T8 32W / Electronic	3	51	95	4845
B	2x4 Troffer, parabolic louver / 48" T8 32W / Electronic	3	1	95	95
C	4 ft. Wall mount, wrap-around / 48" T8 32W / Electronic	2	4	65	260
D	4 ft. Strip, surface mount / 48" T8 32W / Electronic	1	4	32	128
E	8 ft. Industrial, pendant mount / 96" T8 75W / Electronic	2	30	130	3900
F	Down light, twin tube / Twin Tube 18W / Magnetic	2	31	46	1426
G	Recessed wall washer / Incandescent 150W	1	2	150	300
H	Accent track lighting / Incandescent 50W	1	5	50	250
I	Recessed metal halide down light / Metal Halide 50W / Magnetic	1	2	67	134
J	Low bay, pendant mount / High-Pressure Sodium 150W / Magnetic	1	6	190	1140

Total Actual Watts = 12478

Section 3: Compliance Calculation

If the *Total Allowed Watts* minus the *Total Actual Watts* is greater than or equal to zero, the building complies.

Total Allowed Watts = 12814
 Total Actual Watts = 12478
 Project Compliance = 336

Lighting PASSES: Design 3% better than code

Step Eight: Verify the **# of Fixtures** shown in the documentation is consistent with that shown on the lighting plans/fixture schedule.

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

Note: Because most requirements in the mechanical section of the energy code are mandatory, the Mechanical section of the software works somewhat differently from the Envelope and Lighting sections. Rather than generating a numerical compliance index, the Mechanical section generates a customized list of mandatory requirements applicable to the mechanical components the user has identified....

Permit Number _____

Checked By/Date _____

**Mechanical Compliance Certificate
2003 IECC**

COMcheck-EZ Software Version 3.0 Release 1
Data filename: C:\Program Files\Check\COMcheck-EZ\301\example.cck

Section 1: Project Information

Project Name: COMcheck-EZ Example Building
10th Street, Concord, NH
Designer/Contractor: Fine Engineering
Document Author: Mr. Fine

Step One: Verify the **Project Information** matches the information on the building plans. The city, state and code year and will impact energy code compliance.

Section 2: General Information

Building Location (for weather data): Concord, New Hampshire
Climate Zone: 15
Heating Degree Days (base 65 degrees F): 7554
Cooling Degree Days (base 65 degrees F): 328
Project Type: New Construction

Step Two: Verify the HVAC system(s) specified in **Section 3** matches what is called out on the mechanical plans/schedule and the number and type of each unit is correct. If an economizer is specified in the checklist, verify it is listed on the mechanical plans/schedule.

Section 3: Mechanical Systems List

Quantity	System Type & Description
2	RT-2 & RT-3 - Pkg. gas/elec.: Heating: Central Furnace, Gas / Cooling: Field-Assembled DX System, Capacity >=90 - <135 kBtu/h, Air-Cooled Condenser / Single Zone
1	CU-1 - Condensing unit: Cooling: Field-Assembled DX System, Capacity >=90 - <135 kBtu/h, Air-Cooled Condenser / Single Zone
1	UH-1 - Gas unit heater: Heating: Unit Heater, Gas
1	F-1 - Gas furnace: Heating: Central Furnace, Gas / Single Zone

Section 4: Requirements Checklist

Bldg. Dept. Use	Requirements
[]	Requirements Specific To: RT-2 & RT-3 - Pkg. gas/elec.
[]	1. Newly purchased heating equipment meets the heating efficiency requirements
[]	2. Specified equipment consists of field-assembled components - efficiency documentation provided
[]	3. Integrated air economizer required
[]	Requirements Specific To: CU-1 - Condensing unit
[]	1. Specified equipment consists of field-assembled components - efficiency documentation provided
[]	2. Integrated air economizer required
[]	Requirements Specific To: UH-1 - Gas unit heater
[]	1. Equipment minimum efficiency: Unit Heater (Gas): 80% Ec
[]	Requirements Specific To: F-1 - Gas furnace
[]	1. Newly purchased heating equipment meets the heating efficiency requirements
[]	Generic Requirements: Must be met by all systems to which the requirement is applicable
[]	1. Load calculations per 1997 ASHRAE Fundamentals
[]	2. 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
[]	3. Minimum one temperature control device per system
[]	4. Minimum one humidity control device per installed humidification/dehumidification system
[]	5. Thermostatic controls has 5 deg. F deadband
[]	- Exception: Thermostats requiring manual changeover between heating and cooling
[]	6. Automatic Controls: Setback to 55 deg. F (heat) and 85 deg. F (cool); 7-day clock, 2-hour occupant override, 10-hour backup
[]	- Exception: Continuously operating zones
[]	- Exception: 2 kW demand or less, submit calculations
[]	7. Automatic shut-off dampers on exhaust systems and supply systems with airflow >3,000 cfm
[]	8. Outside-air source for ventilation; system capable of reducing OSA to required minimum

Step Three: Verify the HVAC load calculations have been provided.

- [] 9. 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 deg. F.
- [] 10. Ducts sealed - longitudinal seams on rigid ducts; transverse seams on all ducts;
 UL 181A or 181B tapes and mastics
 - Exception: Continuously welded and locking-type longitudinal joints and seams on ducts
operating at static pressures less than 2 inches w.g. pressure classification
- [] 11. Mechanical fasteners and sealants used to connect ducts and air distribution equipment
- [] 12. 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 deg. F
 - Exception: Fluid not heated or cooled
 - Exception: Runouts <4 ft in length
- [] 13. Operation and maintenance manual provided to building owner
- [] 14. Balancing devices provided in accordance with IMC 603.15
- [] 15. Stair and elevator shaft vents are equipped with motorized dampers

Step Four: Verify the duct insulation R-values are called out on the mechanical plans/schedule.

Step Five: Verify the approved duct sealing methods are specified on the mechanical plans/schedule.

Section 5: 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 2003 IECC requirements in COMcheck-EZ Version 3.0 Release 1 and to comply with the mandatory requirements in the Requirements Checklist.

Principal Mechanical Designer-Name

Signature

Date

Mechanical Requirements Description

2003 IECC

COMcheck-EZ Software Version 3.0 Release 1

Data filename: C:\Program Files\Check\COMcheck-EZ\301\example.cck

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

Requirements Specific To: RT-2 & RT-3 - Pkg. gas/elec.

1. 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.
2. The specified cooling system consists of field-assembled components. Documentation must be submitted showing the system meets ASHRAE 90.1 Code equipment efficiency requirements for a comparable package equipment type and capacity range.
3. An integrated air economizer is required for individual cooling systems over 65 kBtu/h in the selected climate. An integrated economizer allows simultaneous operation of outdoor-air and mechanical cooling.

Requirements Specific To: CU-1 - Condensing unit

1. The specified cooling system consists of field-assembled components. Documentation must be submitted showing the system meets ASHRAE 90.1 Code equipment efficiency requirements for a comparable package equipment type and capacity range.
2. An integrated air economizer is required for individual cooling systems over 65 kBtu/h in the selected climate. An integrated economizer allows simultaneous operation of outdoor-air and mechanical cooling.

Requirements Specific To: UH-1 - Gas unit heater

1. The specified heating and/or cooling equipment is covered by the ASHRAE 90.1 Code and must meet the following minimum efficiency: Unit Heater (Gas): 80% Ec

Requirements Specific To: F-1 - Gas furnace

1. 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.

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

1. Design heating and cooling loads for the building must be determined using procedures equivalent to those in Chapters 27 and 28 of the ASHRAE Handbook of Fundamentals or an approved equivalent calculation procedure.
2. 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.
3. Each heating or cooling system serving a single zone must have its own temperature control device.
4. Each humidification system must have its own humidity control device.
5. Thermostats controlling both heating and cooling must be capable of maintaining a 5 degree F deadband (a range of temperature where no heating or cooling is provided).
 - Exception: Deadband capability is not required if the thermostat does not have automatic changeover capability between heating and cooling.
6. 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 degree F during heating and setting up to 85 degree F during coolingb) capable of automatically setting back or shutting down systems during unoccupied hours using 7 different day schedulesc) have an accessible 2-hour occupant override) 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.
7. Outdoor-air supply systems with design airflow rates >3,000 cfm of outdoor air and all exhaust systems must have dampers that are automatically closed while the equipment is not operating.
8. 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.
9. 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 degree F.
10. 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 or UL 181B.
 - Exception: Continuously welded and locking-type longitudinal joints and seams on ducts operating at static pressures less than 2 inches w.g. pressure classification.
11. 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.
12. All pipes serving space-conditioning systems must be insulated as follows:
 - Hot water piping for heating systems:
 - 1 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 in. insulation for pipes $\leq 1\frac{1}{2}$ -in. nominal diameter
- 1 1/2 in. insulation for pipes $> 1\frac{1}{2}$ -in. nominal diameter.

Steam piping:

- 1 1/2 in. insulation for pipes $\leq 1\frac{1}{2}$ -in. nominal diameter
- 3 in. insulation for pipes $> 1\frac{1}{2}$ -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 degrees F and 105 degrees 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: 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.
13. 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.
 14. Each supply air outlet or diffuser and each zone terminal device (such as VAV or mixing box) must have its own balancing device. Acceptable balancing devices include adjustable dampers located within the ductwork, terminal devices, and supply air diffusers.
 15. Stair and elevator shaft vents must be equipped with motorized dampers capable of being automatically closed during normal building operation and interlocked to open as required by fire and smoke detection systems. All gravity outdoor air supply and exhaust hoods, vents, and ventilators must be equipped with motorized dampers that will automatically shut when the spaces served are not in use.
Exceptions:
 - Gravity (non-motorized) dampers are acceptable in buildings less than three stories in height above grade.
 - Ventilation systems serving unconditioned spaces.