MINNESOTA RULES, CHAPTERS 1303, 1323 and 1305

Presented by

Presented by: Don Sivigny and Jerry Norman or Paul Heimkes

Minnesota Department of Labor and Industry

Construction Codes and Licensing Division

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY
CONSTRUCTION CODES AND LICENSING

AGENDA

2015 Fall Seminar Agenda

7:30 – 8:00	Registration
8:00 – 9:45	MN. Rules Chapt. 1303 Radon(R-Occ. In Cmcl. Bldgs.)
9:45 – 10:00	Morning Break
10:00 – 11:30	Introduction to Minnesota Rules Chapters 1323
11:30 – 12:30	Lunch Break
12:30 – 2:00	Highlights of the 2012 IBC Amendments
2:00 – 2:15	Afternoon Break
2:15 – 4:00	Highlights of the 2012 IBC Amendments
Approx. 4:00	Adjourn

SIGN-IN SHEETS

Name	License or Certification #	AM- Sign -In	PM sign- In
Don Sivigny	BO001234		
Rich Lockrem	BO004321		

Housekeeping Items

- Restrooms

Housekeeping Items

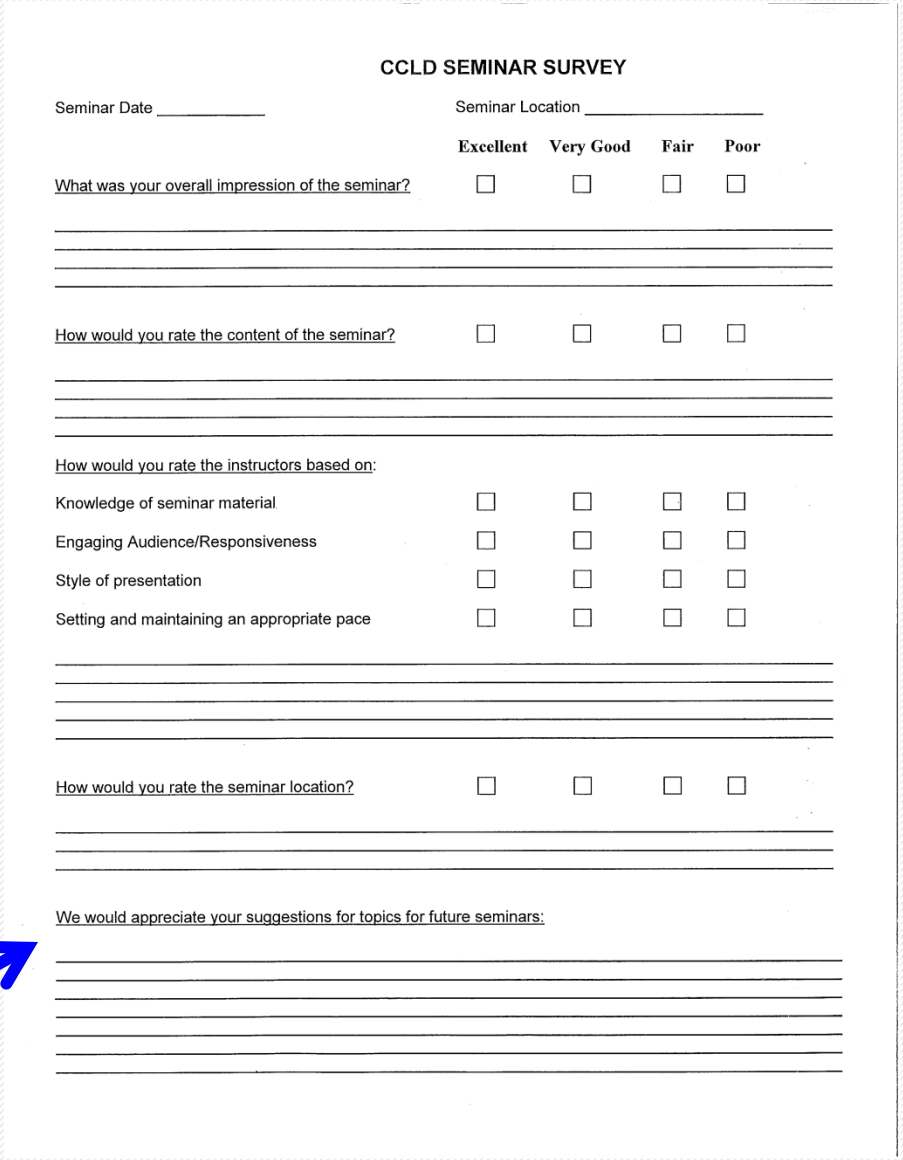
- Coffee Breaks

CELL PHONES, TABLETS, COMPUTERS…

SEMINAR EVALUATION FORMS

Constructive opinions are appreciated.

These subjects are considered when developing future seminars



CCLD SEMINAR SURVEY

Seminar Date _____ Seminar Location _____

	Excellent	Very Good	Fair	Poor
What was your overall impression of the seminar?	☐	☐	☐	☐
How would you rate the content of the seminar?	☐	☐	☐	☐
How would you rate the instructors based on:				
Knowledge of seminar material	☐	☐	☐	☐
Engaging Audience/Responsiveness	☐	☐	☐	☐
Style of presentation	☐	☐	☐	☐
Setting and maintaining an appropriate pace	☐	☐	☐	☐
How would you rate the seminar location?	☐	☐	☐	☐

We would appreciate your suggestions for topics for future seminars:

CERTIFICATES OF COMPLETION

CONTACT INFORMATION

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REQUIRED ATTENDEE NOTICE

This Seminar is recognized by the Minnesota Department of Labor & Industry as satisfying 8 Hours of education for Licensed Building Code Official license renewals.

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This Seminar is recognized by the Minnesota Department of Labor & Industry as satisfying 8 Hours of education for Licensed Building Code Official license renewals.

This course *does not* fulfill one hour of the energy education requirement needed for the Residential Construction Industry license renewals.

Disclaimer

Information in this seminar may contain code language which has been **paraphrased or summarized in order to provide more clarity for instruction purposes.** When inquiries arise in the field, reference must be made to the actual code language contained in the appropriate Rule Chapter of the Minnesota State Building Code.

DLI INFORMATION and RESOURCES

Visit http://www.dli.mn.gov/ccld/codes15.asp

View
or buy code books(available fall 2014)

2015 Minnesota Building Code Administration	View code	Purchase code book
2015 Minnesota Provisions to the State Building Code	View code	Purchase code book
2015 Minnesota Building Code	View code	Purchase code book
2015 Minnesota Elevator and Related Devices Code	View code	Purchase code book
2015 Minnesota Residential Code	View code	Purchase code book
2015 Minnesota Conservation Code for Existing Buildings	View code	Purchase code book
2015 Minnesota Energy Code	View code	Purchase code book
2015 Minnesota Accessibility Code	View code	Purchase code book
2015 Minnesota Mechanical and Fuel Gas Codes	View code	Purchase code book

Education and training

View the 2014-2015 education and training plan.

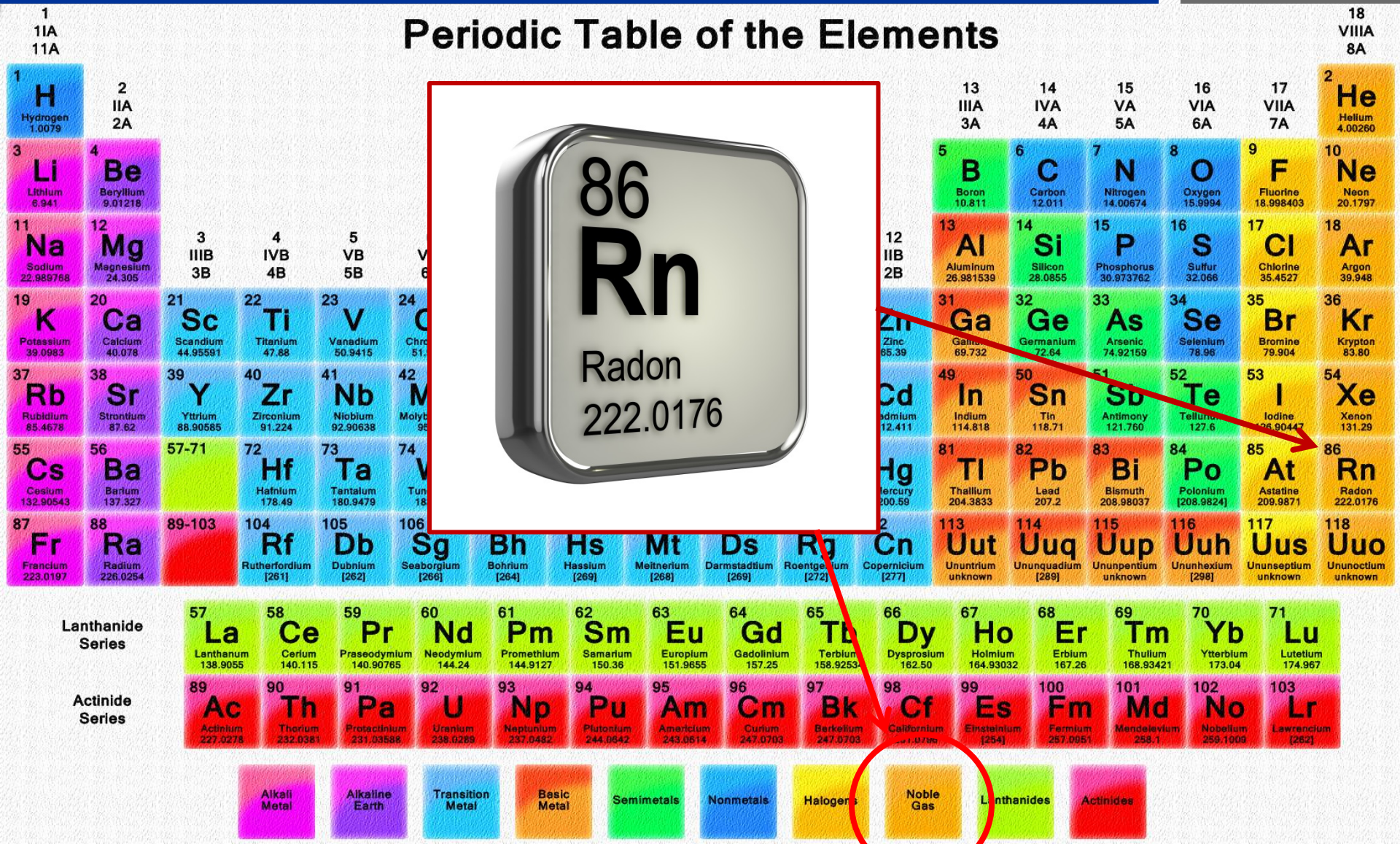
Commercial Buildings & Radon

When and what is required?

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY
CONSTRUCTION CODES AND LICENSING

Fall 2015

MN Rule 1303.2400- RADON



Minnesota Statute

326B.106 GENERAL POWERS OF COMMISSIONER OF LABOR AND INDUSTRY.

Subd. 6.Radon code.

The commissioner of labor and industry **shall** adopt rules for radon control as part of the State Building Code **for all new residential buildings.** These rules shall incorporate the radon control methods found in the International Residential Code appendix as the model language, with necessary amendments to coordinate with the other adopted construction codes in Minnesota.

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures.

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures.

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

A. One-family dwellings;

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

A) One-family dwellings;

MN Rule 1303.2400, Subpart 1. (A)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures.

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

A. One-family dwellings;
B. Two-family dwellings;

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

B) Two-family dwellings;

MN Rule 1303.2400, Subpart 1. (B)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures.

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

A. One-family dwellings;
B. Two-family dwellings;
C. Townhouses;

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

C) Townhouses;

MN Rule 1303.2400, Subpart 1. (C)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures.

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

A. One-family dwellings;
B. Two-family dwellings;
C. Townhouses;
D. Apartment buildings;

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

D) Apartment buildings;

MN Rule 1303.2400, Subpart 1. (D)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures.

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

A. One-family dwellings;
B. Two-family dwellings;
C. Townhouses;
D. Apartment buildings;
E. Condominiums;

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

E) Condominiums;

MN Rule 1303.2400, Subpart 1. (E)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures. (cont)

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

F. Multistory buildings that include any residential occupancy;

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

F) Multistory buildings that include residential occupancy;

MN Rule 1303.2400, Subpart 1. (F)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures. (cont)

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

F. Multistory buildings that include any residential occupancy;
G. Mixed-occupancy buildings that include any residential occupancy; and

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

G) Multistory Buildings which include Residential occupancy;

MN Rule 1303.2400, Subpart 1. (G)

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures. (cont)

The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

F. Multistory buildings that include any residential occupancy;
G. Mixed-occupancy buildings that include any residential occupancy; and
H. Any addition to an existing dwelling that currently has a radon control system incorporated into the existing building.

MN Rule 1303.2400, Subpart 1.

1303.2400 Purpose and Scope

H) Any addition to an existing dwelling that currently has a radon control system incorporated into the existing building.

MN Rule 1303.2400, Subpart 1. (H)

1303.2400 Purpose and Scope

Subp. 2. Applicability; design features.

The requirements in parts 1303.2400 to 1303.2402 shall apply to **any structure with a residential occupancy** identified in subpart 1, items A to H **(previous slides)**, if the structure is designed with any of the following features identified in items A to F:

1303.2400 Purpose and Scope

A. A basement concrete slab in contact with the earth;

MN Rule 1303.2400, Subpart 2.

1303.2400 Purpose and Scope

B. A crawl space within the building's conditioned space that has a concrete **or earth floor;**

MN Rule 1303.2400, Subpart 2.

1303.2400 Purpose and Scope

C. A wood floor system constructed **on or directly above the earth;**

MN Rule 1303.2400, Subpart 2.

1303.2400 Purpose and Scope

D. Slab on grade construction designs;

MN Rule 1303.2400, Subpart 2.

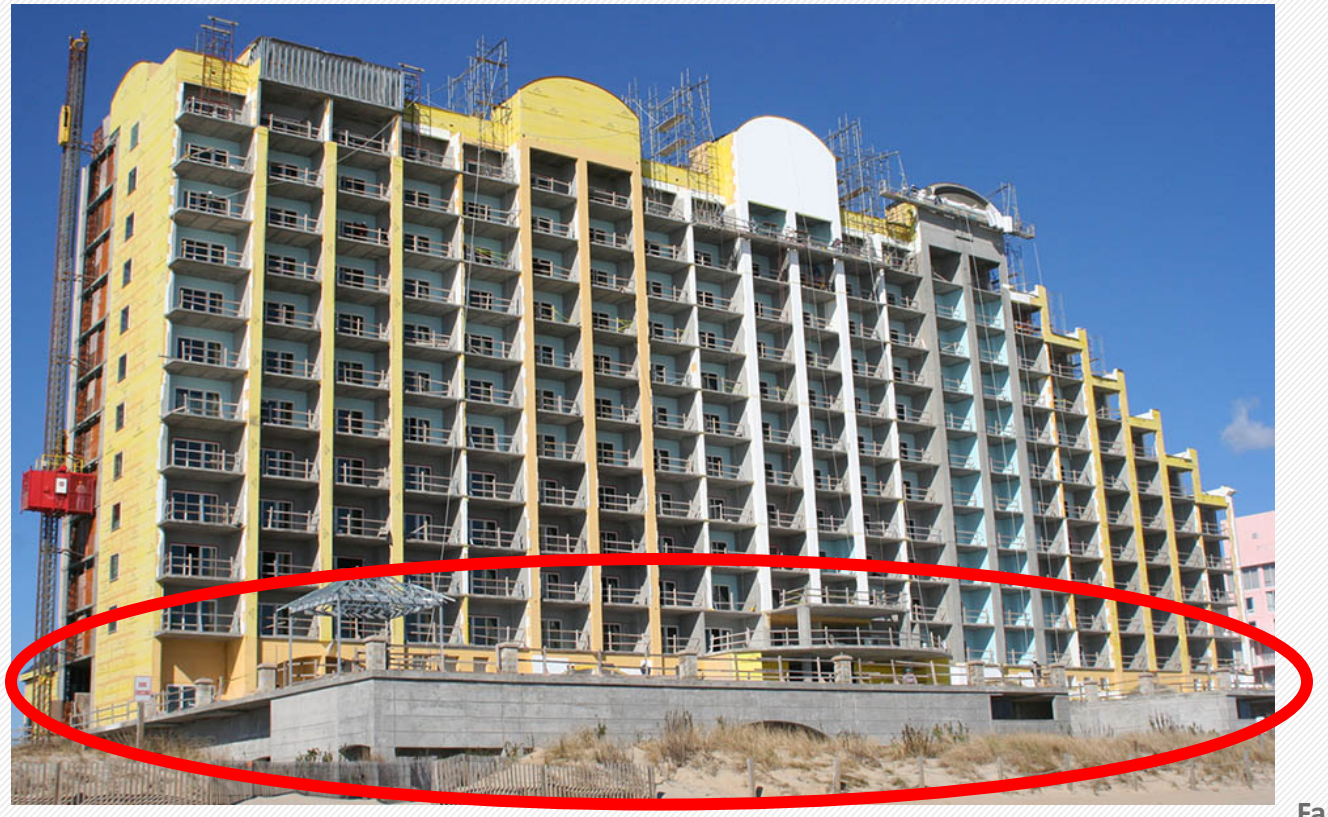
1303.2400 Purpose and Scope

E. **Attached or tuck-under garages,** unless the floor, wall, and ceiling assemblies separating the garage from the dwellings are sealed: and

MN Rule 1303.2400, Subpart 2.

1303.2400 Purpose and Scope

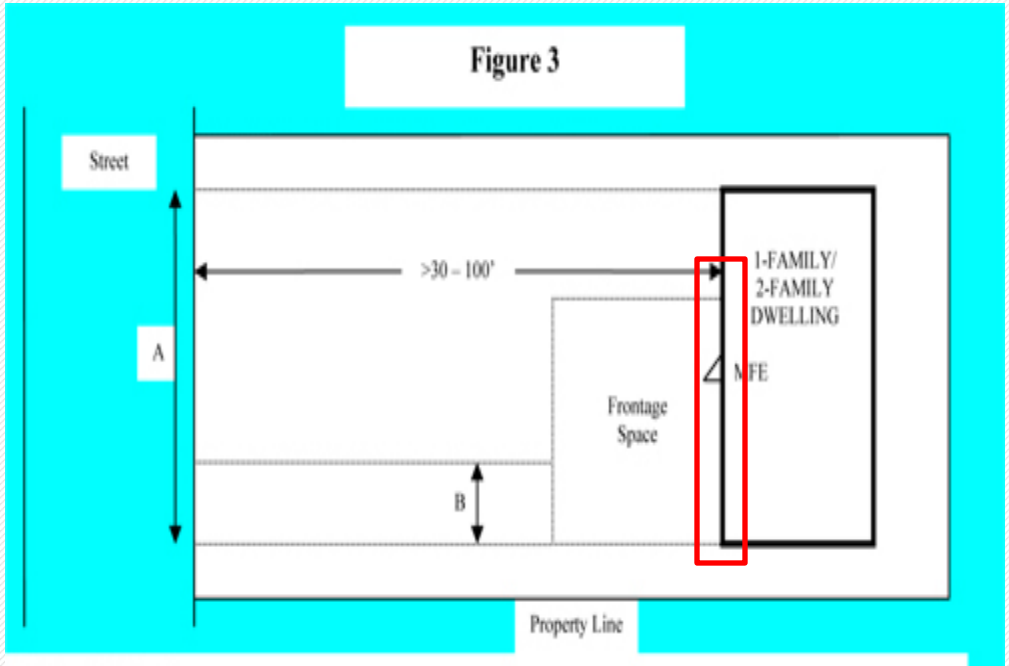
E. **Attached or tuck-under garages,** unless the floor, wall, and ceiling assemblies separating the garage from the dwellings are sealed: and



MN Rule 1303.2400, Subpart 2.

1303.2400 Purpose and Scope

F. **Any building configuration** that allows radon gas to enter the residential dwelling or dwelling unit.



MFE = main front entrance
Location of frontage space shown is illustrative only.
A: Fire apparatus access road required by FC503.2.1 (30' – 38' wide)
B: Driveway/FAAR alternative authorized by interim guidelines (width subject to DOB approval).

MN Rule 1303.2400, Subpart 2.

1303.2400 Purpose and Scope

Exceptions:

1. **Crawl spaces outside the conditioned space** of the residential dwelling, **when the crawl space is ventilated directly to the outside atmosphere** according to the IRC, IBC, Code of Federal Regulations, and Minnesota Rules, chapter 1350

MN Rule 1303.2400, Subpart 2. Exception 1

1303.2400 Purpose and Scope

Exceptions:

2. Hotels and motels.

MN Rule 1303.2400, Subpart 2. Exception 2

1303.2400 Purpose and Scope

Exceptions:

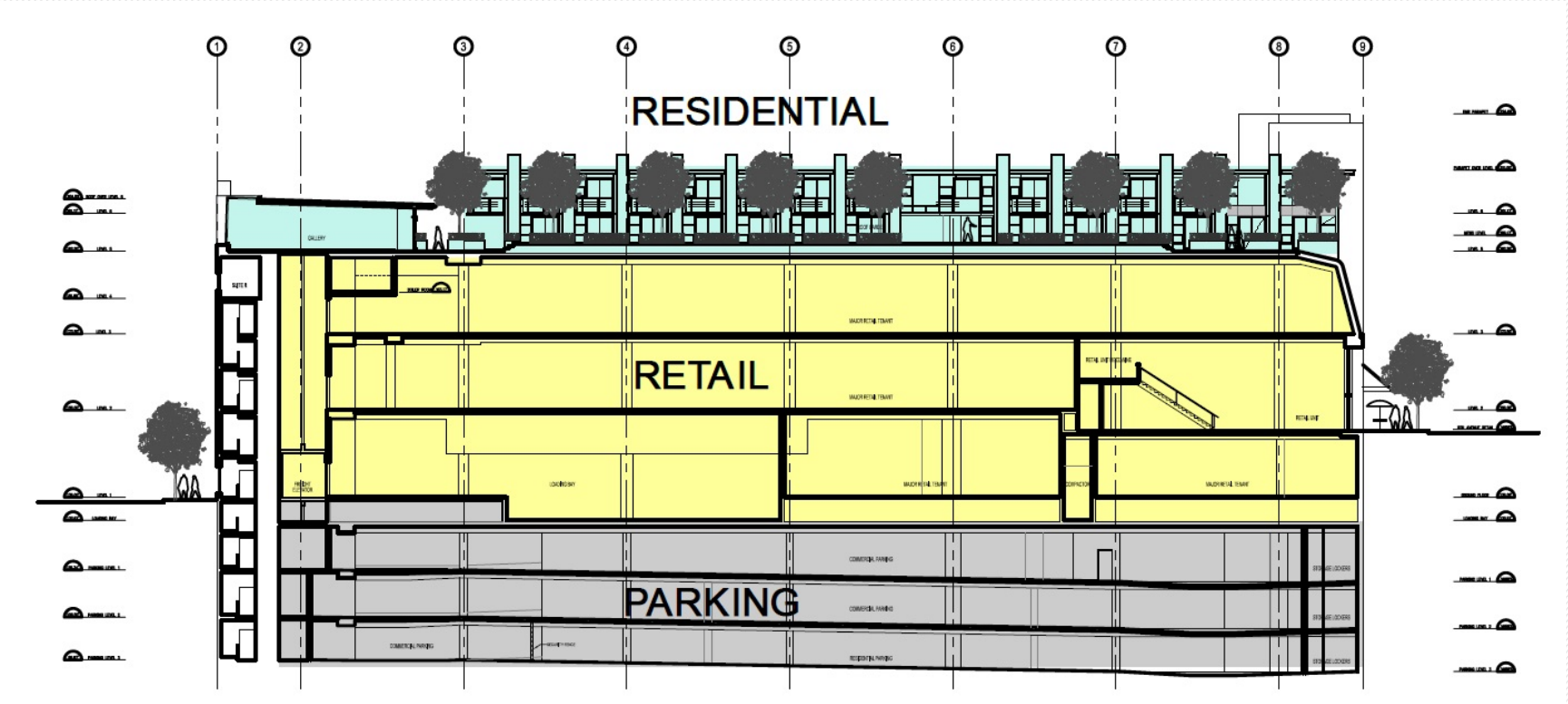
3. **Additions to existing dwellings that <u>do not</u> currently have** a radon control system incorporated into the existing dwelling.

MN Rule 1303.2400, Subpart 2. Exception 3

Let's look at in a cross sectional plan view.

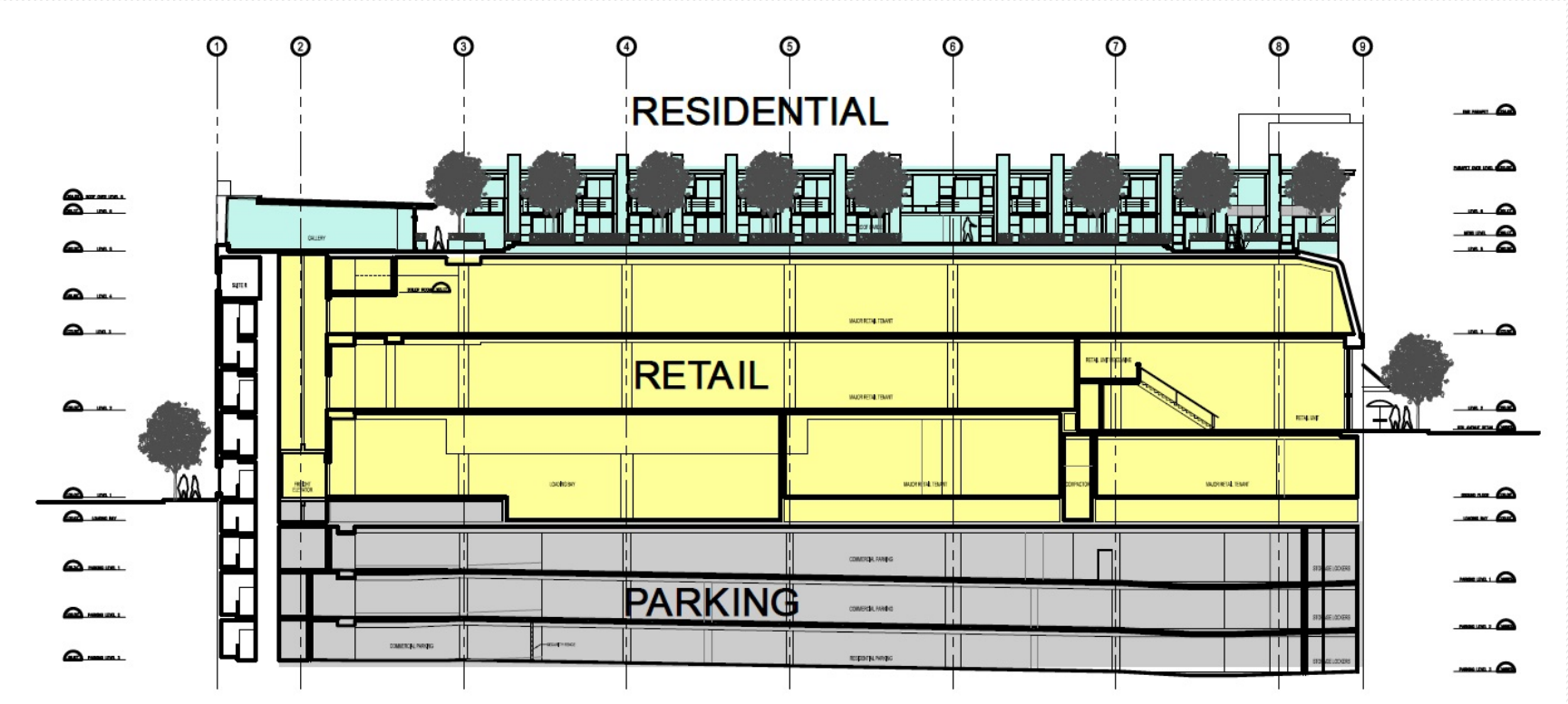
Is Radon Mitigation required?

(3 questions to ask yourself or the permit applicant)



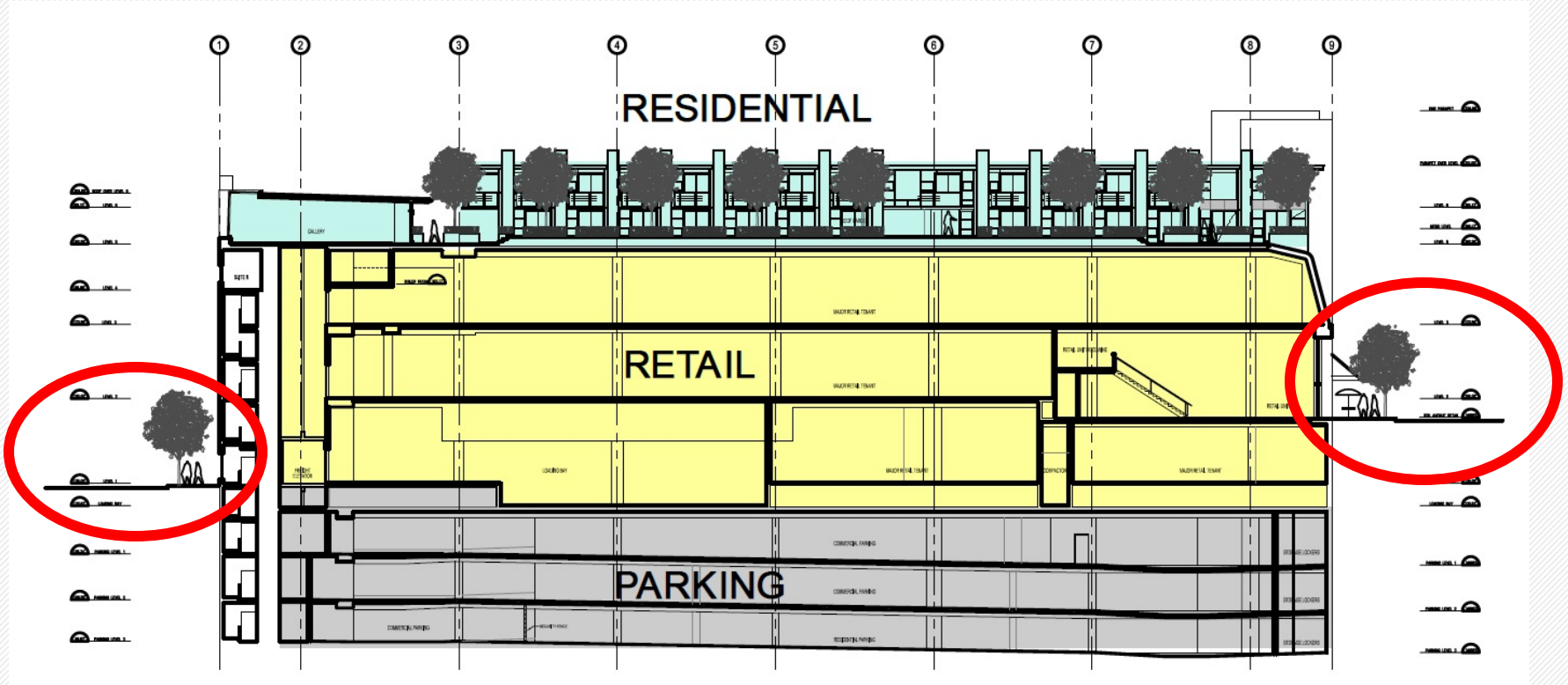
Is Radon Mitigation required?

Question #1: Where is the grade line?



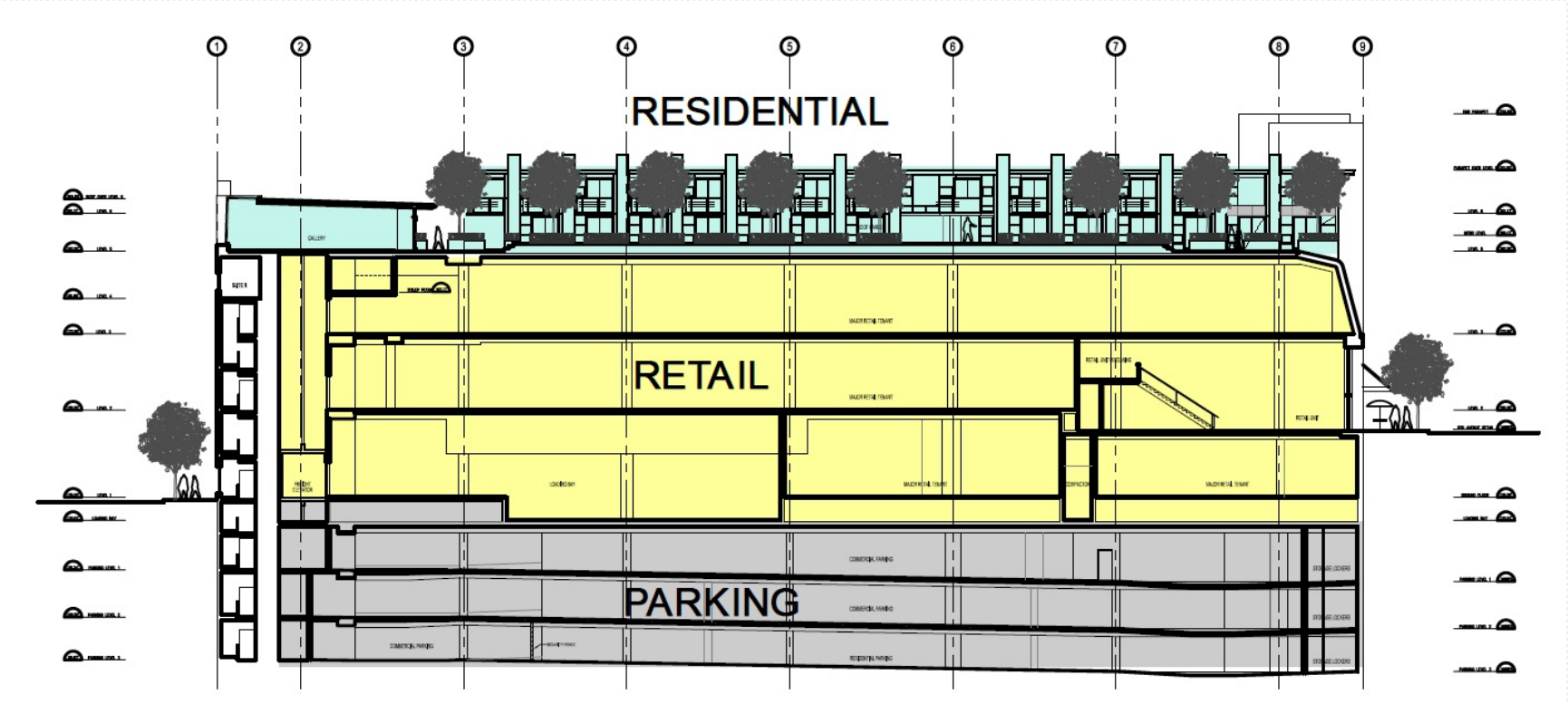
Is Radon Mitigation required?

Answer: Where is the grade line?



Is Radon Mitigation required?

Question #2: Where is the Residential Occupancy?

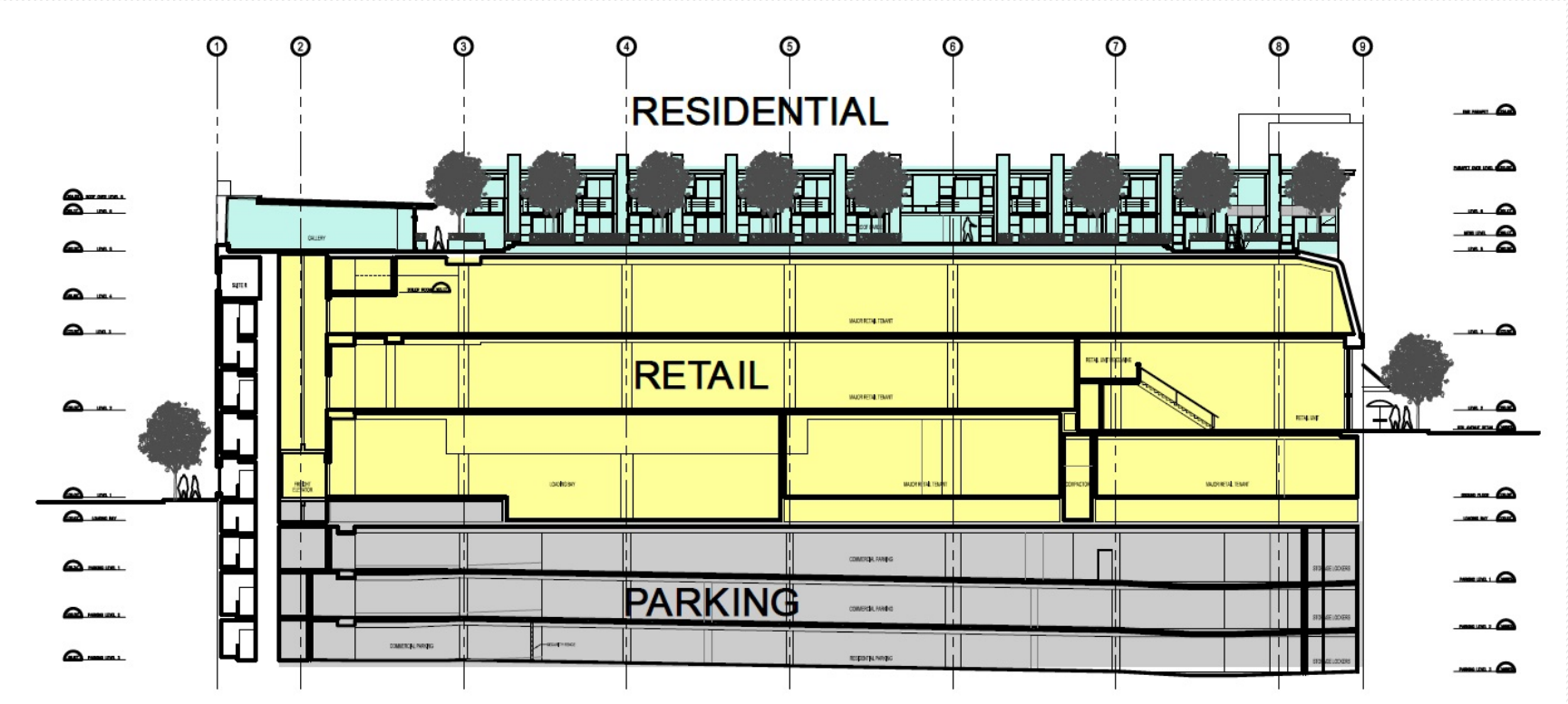


Is Radon Mitigation required?

Answer: Where is the Residential Occupancy?

Is Radon Mitigation required?

Question #3: <u>Is the assembly sealed</u> between the Residential occupancy and the grade?

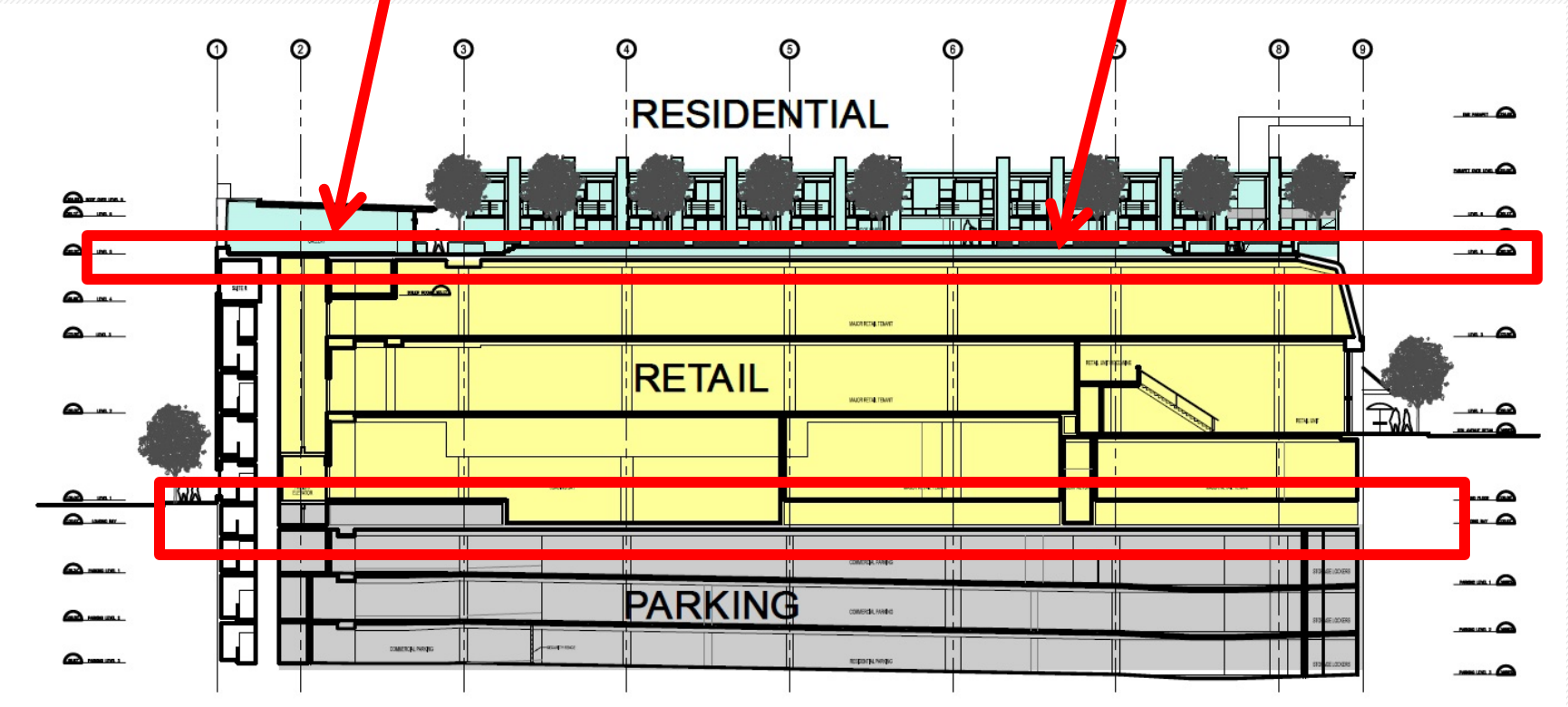


Is Radon Mitigation required?

Answer: Is the assembly sealed between the Residential occupancy and the grade?

Is Radon Mitigation required?

The primary seal to look for is the one that separates the retail space from the residential space



1303.2400 Purpose and Scope

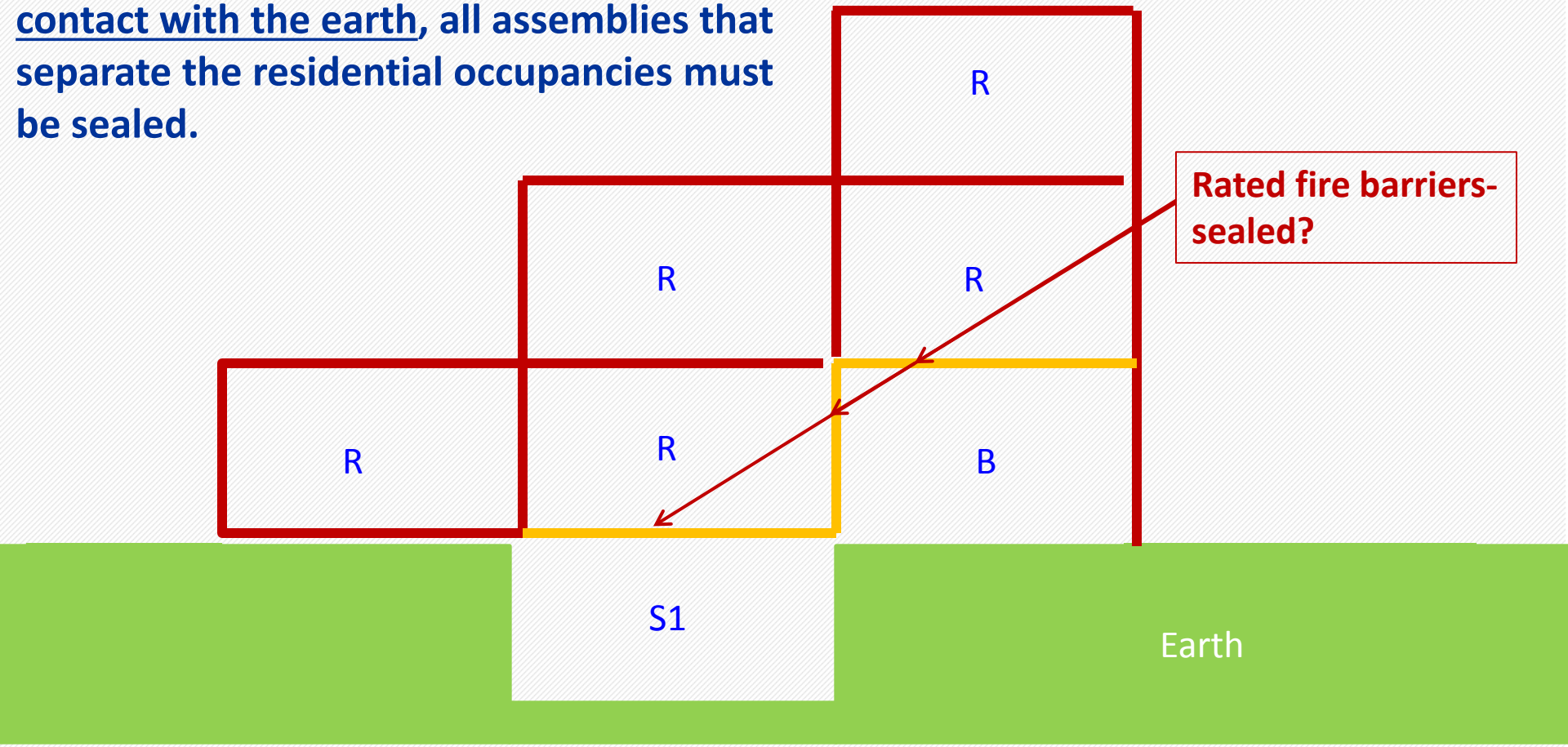
Subp. 3. Mixed occupancy or multistory mixed occupancy buildings.

When the <u>non-residential occupancy is in contact</u> with the earth, all assemblies that separate the occupancies must be sealed to prevent the movement of air and airborne gases between the nonresidential and residential occupancies

MN Rule 1303.2400, Subpart 3

1303.2400 Purpose and Scope

<u>When the nonresidential occupancy is in contact with the earth</u>, all assemblies that separate the residential occupancies must be sealed.



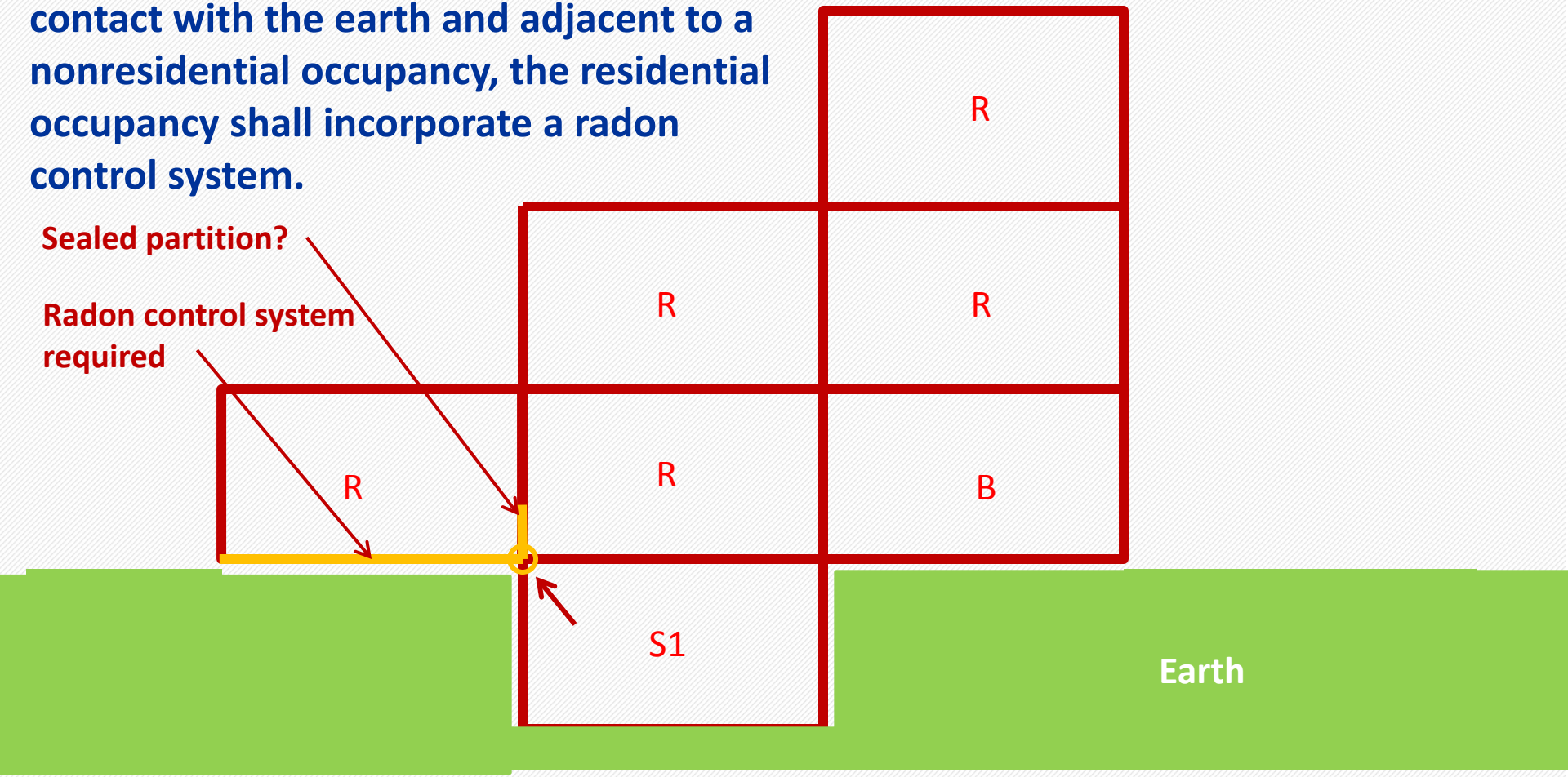
1303.2400 Purpose and Scope

Subp. 3. Mixed occupancy or multistory mixed occupancy buildings.

When the residential occupancy is in contact with the earth and adjacent to a nonresidential occupancy, the residential occupancy shall incorporate a radon control system and all assemblies that separate the nonresidential and residential occupancy shall be sealed to prevent the movement of air or airborne gases.

1303.2400 Purpose and Scope

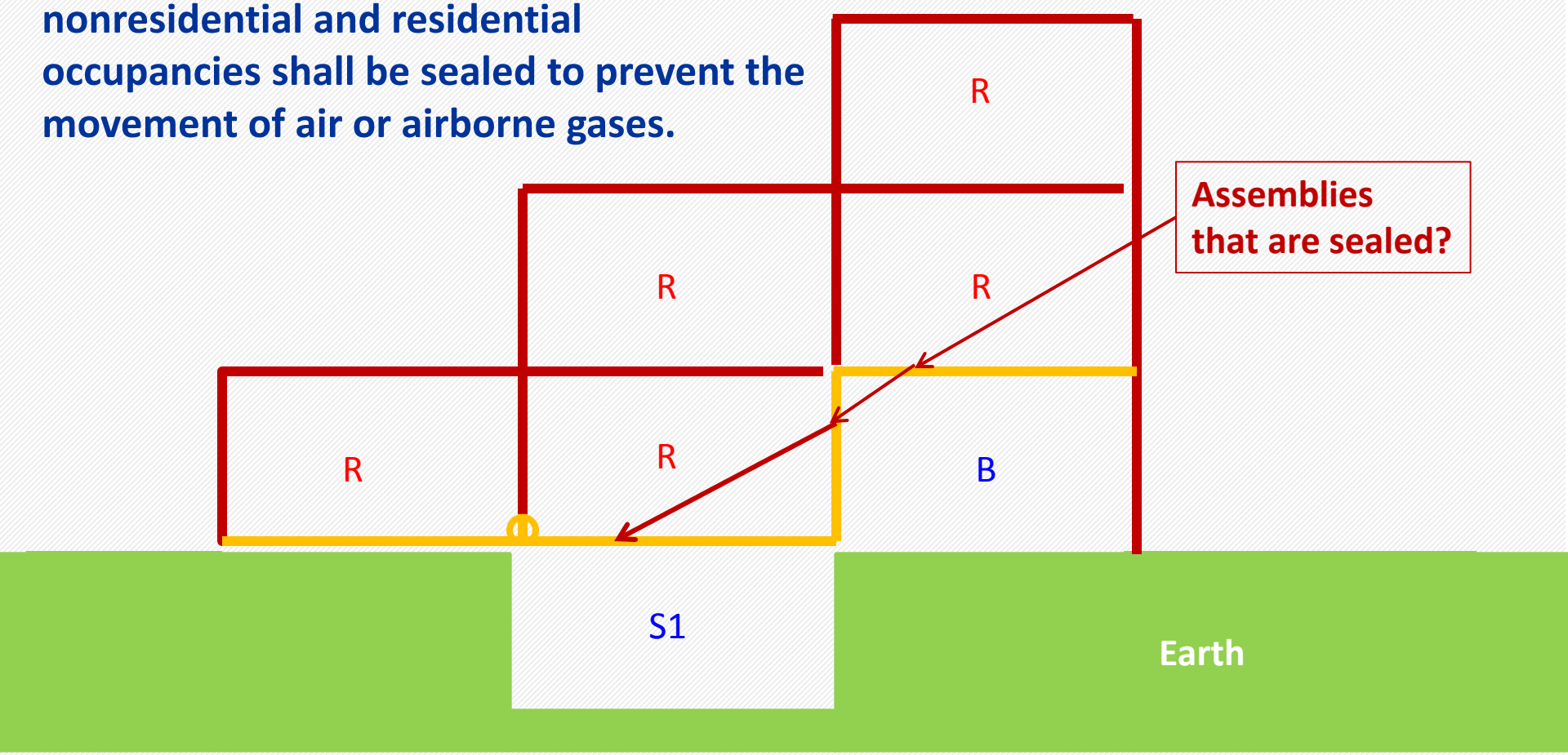
When the residential occupancy is in contact with the earth and adjacent to a nonresidential occupancy, the residential occupancy shall incorporate a radon control system.



MN Rule 1303.2400, Subpart 3.

1303.2400 Purpose and Scope

All assemblies that separate the nonresidential and residential occupancies shall be sealed to prevent the movement of air or airborne gases.



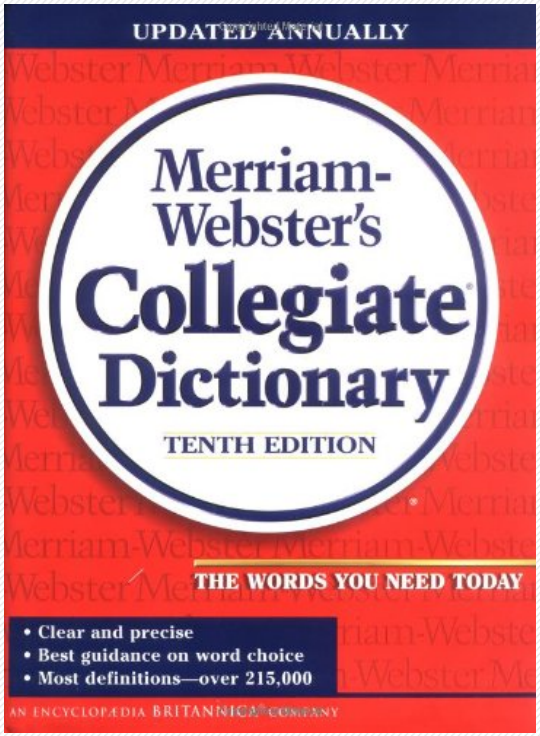
MN Rule 1303.2400, Subpart 3

Radon System Requirements

1303.2401 Definitions

Subpart 1. Terms not defined.

For the purposes of parts 1303.2400 to 1303.2403, where terms are not defined in parts this 1303.2400 to 1303.2403, Merriam–Webster's Collegiate Dictionary, available at www.m-w.com shall be considered as providing ordinarily accepted meanings.



1303.2401 Definitions

Active Radon Control System:

Means a system designed to achieve lower air pressure below the soil-gas membrane relative to the indoor air pressure, **by use of a fan** that has been added to a passive radon control system.

1303.2401 Definitions

Approved:

Means **approval by the building official,** according to the Minnesota State Building Code, **by reason of inspection, investigation, or testing; accepted principals; computer simulations; research reports; or testing performed by either a licensed engineer or a local or nationally recognized laboratory.**

1303.2401 Definitions

Gas Permeable Material:

A "Gas Permeable Material" means **any of the *following*** *and shall be placed on the prepare*d subgrade under all floor systems.

1303.2401 Definitions

Gas Permeable Material:

A "Gas Permeable Material" means any of the following:

1) **A uniform layer of clean aggregate, a minimum of 4 inches thick. The aggregate material must pass through a 2 inch sieve but be retained by a ¼ inch sieve.**

1303.2401 Definitions

Gas Permeable Material:

A "Gas Permeable Material" means any of the following:

2) **A uniform layer of sand, native or fill, a minimum of 4 inches thick, overlain by a layer or strips of geotextile drainage matting to allow the lateral flow of soil gases.**

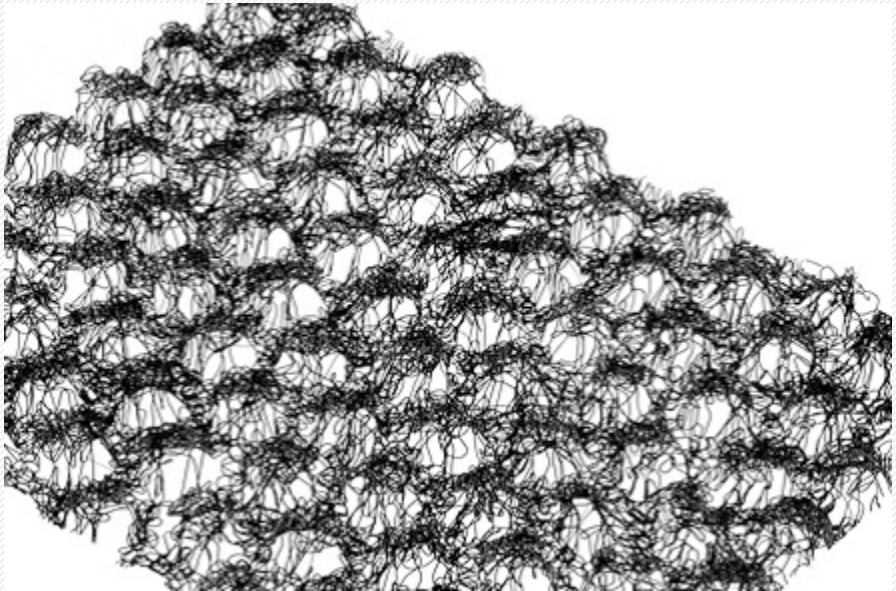
MN Rule 1303.2401, Subpart 2

1303.2401 Definitions

Gas Permeable Material:

A "Gas Permeable Material" means any of the following:

3) Other materials, systems, or floor designs, if the material, systems, or floor designs is professionally engineered to provide depressurization under the entire soil-gas membrane.



MN Rule 1303.2401, Subpart 2

1303.2401 Definitions

<u>IBC:</u> Means the International Building Code incorporated by reference except as qualified and amended in **Minnesota Rule chapter 1305.**

1303.2401 Definitions

<u>IRC:</u> Means the International Residential Code incorporated by reference except as qualified and amended in **Minnesota Rule chapter 1309.**

MN Rule 1303.2401, Subpart 2

1303.2401 Definitions

Passive Radon Control System:

Means a system **designed to achieve a lower air pressure below the soil-gas membrane** relative to the indoor air pressure **by use of a vent pipe that relies on stack effect** to provide an upward flow of air from beneath the soil-gas membrane.

1303.2401 Definitions

Radon Gas:

Means a **naturally occurring, chemically inert, radioactive gas.**

1303.2401 Definitions

Sealed:

Means **to prevent the movement of air or airborne gasses** through a floor, wall or ceiling assembly.

MN Rule 1303.2401, Subpart 2

1303.2401 Definitions

Soil-gas membrane:

Means a continuous membrane of **6-mil polyethylene, or 3-mill cross-laminated polyethylene**

MN Rule 1303.2401, Subpart 2

1303.2402 Requirements for Passive Radon Control Systems

Subpart 2. Soil-gas membrane installation.

A soil-gas membrane **shall be place <u>on top of the gas-permeable material</u> prior to placing a floor on top of or above the soil.**

1303.2402 Requirements for Passive Radon Control Systems

Subpart 2. Soil-gas membrane installation.

A soil-gas membrane shall be place on top of the gas-permeable material prior to placing a floor on top of or above the soil.

The soil-gas membrane **shall cover the entire floor area.** Separate sections of membrane **must be lapped at least 12 inches.**

1303.2402 Requirements for Passive Radon Control Systems

Subpart 2. Soil-gas membrane installation.

A soil-gas membrane shall be place on top of the gas-permeable material prior to placing a floor on top of or above the soil.

The soil-gas membrane shall cover the entire floor area. Separate sections of membrane must be lapped at least 12 inches.

The membrane **shall fit closely around any penetration of the membrane** to reduce the leakage of soil gases.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 2. Soil-gas membrane installation. (cont)

All punctures or tears in the soil-gas membrane **shall be repaired by sealing and patching the soil-gas membrane with the same kind of material, maintaining a minimum 12-inch lap.**

1303.2401 Definitions

Vent Pipe:

Means a **3 inch or 4 inch diameter ABS or PVC pipe used to vent subsoil gases that have collected under the soil-gas membrane** to the exterior of the dwelling.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 3. "T" fitting.

A "T" fitting shall be **installed beneath the soil-gas membrane with a minimum of 10 feet of perforated pipe connected to <u>any two openings of the "T"</u> fitting, <u>or by</u> connecting the two openings to the interior drain tile system.**

MN Rule 1303.2402, Subpart 3

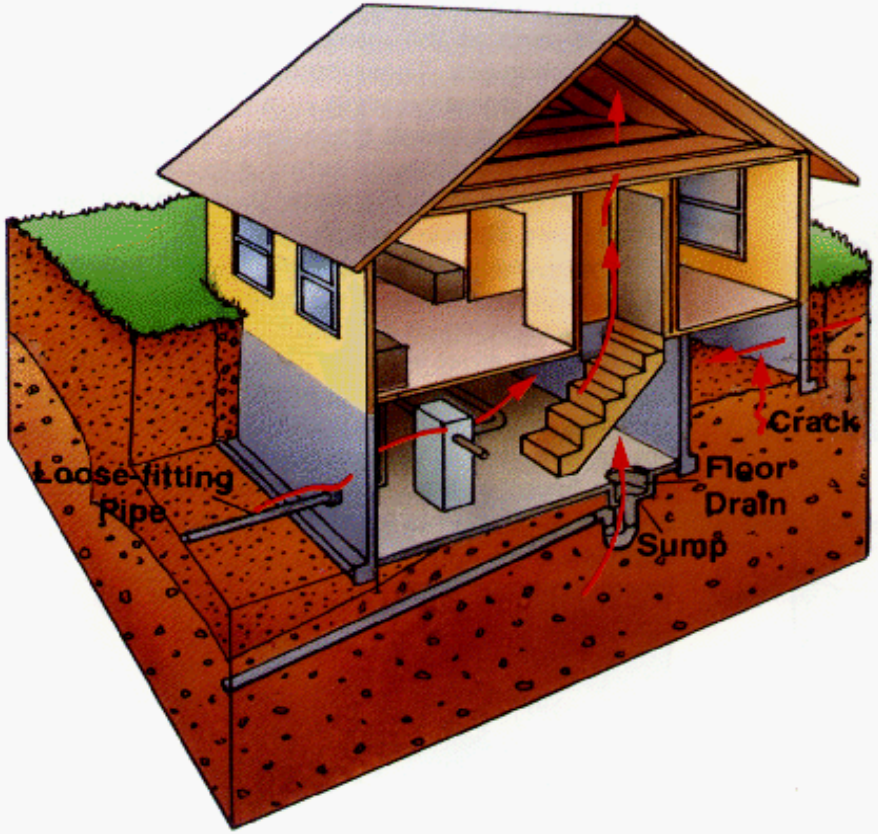
1303.2402 Requirements for Passive Radon Control Systems

The third opening of the "T" fitting shall be connected to the vent pipe. The perforated pipe or drain tile shall be the same size as the "T" fitting and the vent pipe. All connections to the "T" fitting and the vent pipe shall be tight fitting.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 4. Potential entry points.

Potential entry points for radon gas shall be sealed according to this subpart, as applicable.



Radon can enter a house through many paths.

1303.2402 Requirements for Passive Radon Control Systems

A. Floor openings.

Floor openings **around bathtubs, showers, pipes, wires, or other objects** that penetrate the soil-gas membrane and the concrete slab or other floor system **shall be sealed.**

1303.2402 Requirements for Passive Radon Control Systems

B. Concrete joints.

All control joints, isolation joints, construction joints, or any other joints in the concrete slab, such as the joint between the concrete slab and a foundation wall, shall be sealed. All gaps and joints shall be cleared of loose material prior to sealing.

1303.2402 Requirements for Passive Radon Control Systems

C. Foundation walls.

Penetrations of all foundation wall types shall be sealed.

Joints, cracks, or other openings around all penetrations of both exterior and interior surfaces of the foundation shall be sealed.

1303.2402 Requirements for Passive Radon Control Systems

(1) Hollow block masonry foundations walls shall be constructed with either:

(a) continuous course of solid masonry at or above the exterior ground surface;

MN Rule 1303.2402, Subpart 4

1303.2402 Requirements for Passive Radon Control Systems

(b) one course of masonry grouted solid at or above the exterior ground surface;

MN Rule 1303.2402, Subpart 4

1303.2402 Requirements for Passive Radon Control Systems

(c) a solid concrete beam at or above the finished exterior ground surface.

MN Rule 1303.2402, Subpart 4

1303.2402 Requirements for Passive Radon Control Systems

(2) When a brick veneer or other masonry ledge is installed, the masonry course immediately below the veneer or ledge shall be solid or filled.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 4. Unconditioned crawl spaces.

All penetrations through floors or walls into unconditioned crawl spaces shall be sealed.

Crawl space ventilation shall be provided according to part 1303.2400.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 4. Unconditioned crawl spaces.

Access doors into unconditioned spaces shall be gasketed.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 4. Sumps.

A sump connected to interior drain tile may serve as the termination point for the vent pipe, if the sump cover is sealed or gasketed and designed to accommodate the vent pipe.

The sump pump water discharge pipe shall have a backflow preventer installed

1303.2402 Requirements for Passive Radon Control Systems

Subpart 4. Sumps.

A sump connected to interior drain tile may serve as the termination point for the vent pipe, if the sump cover is sealed or gasketed and designed to accommodate the vent pipe.

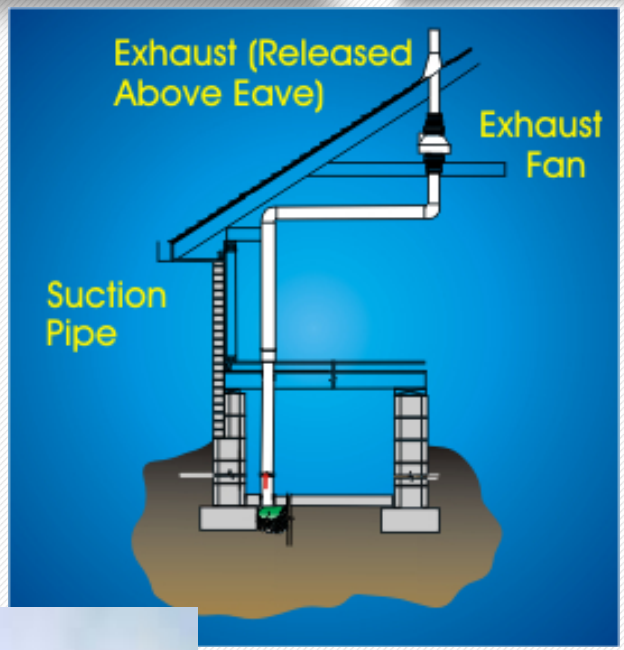
The sump pump water discharge pipe shall have a backflow preventer installed.

1303.2402 Requirements for Passive Radon Control Systems

Subpart 5. Vent pipes.

A. Single vent pipe.

The vent pipe **shall be primed and glued at all fittings and shall extend up from the radon control system's collection point to a point terminating a minimum, of 12 inches above the roof.**



1303.2402 Requirements for Passive Radon Control Systems

The vent pipe shall be located at least 10 feet away from any window or other opening into conditioned spaces of the building.

MN Rule 1303.2402, Subpart 5

1303.2402 Requirements for Passive Radon Control Systems

Vent pipe routed through unconditioned spaces shall be insulated with a minimum R-4 insulation.

1303.2402 Requirements for Passive Radon Control Systems

Vent pipes within the conditioned envelope of the building **shall not be insulated.**

1303.2402 Requirements for Passive Radon Control Systems

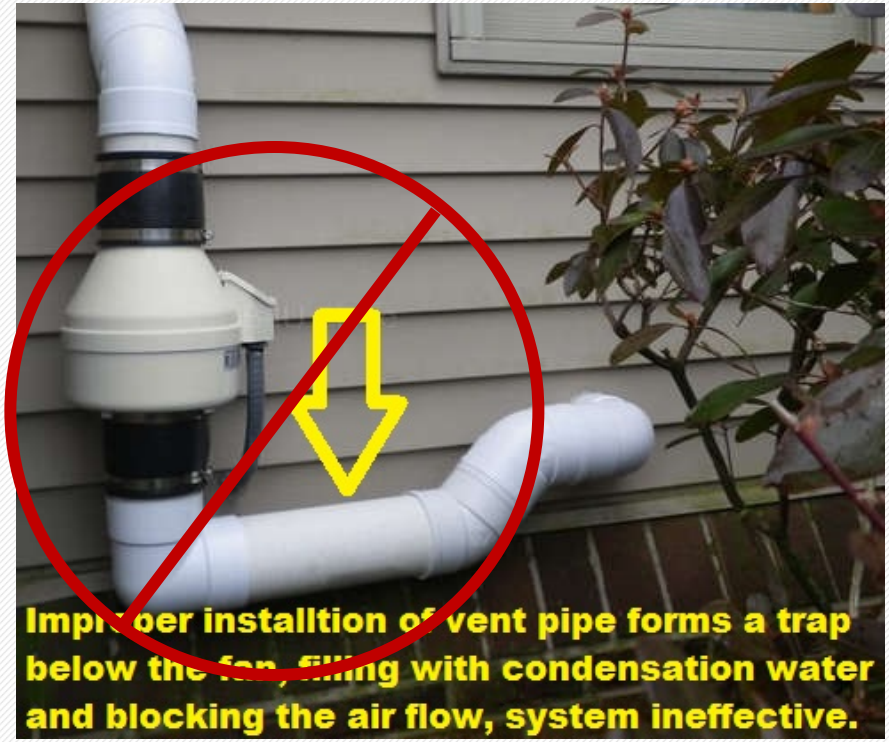
B. Multiple vent pipes.

In buildings where interior footings or other barriers separate the gas-permeable material into two or more areas, each area shall be fitted with an individual radon control system in accordance with item A, or connected to a single radon gas vent pipe terminating above the roof in accordance with item A.

1303.2402 Requirements for Passive Radon Control Systems

C. Vent pipe drainage.

All components of the radon gas vent pipe system shall be installed to **provide drainage** to the ground beneath the soil-gas membrane.



1303.2402 Requirements for Passive Radon Control Systems

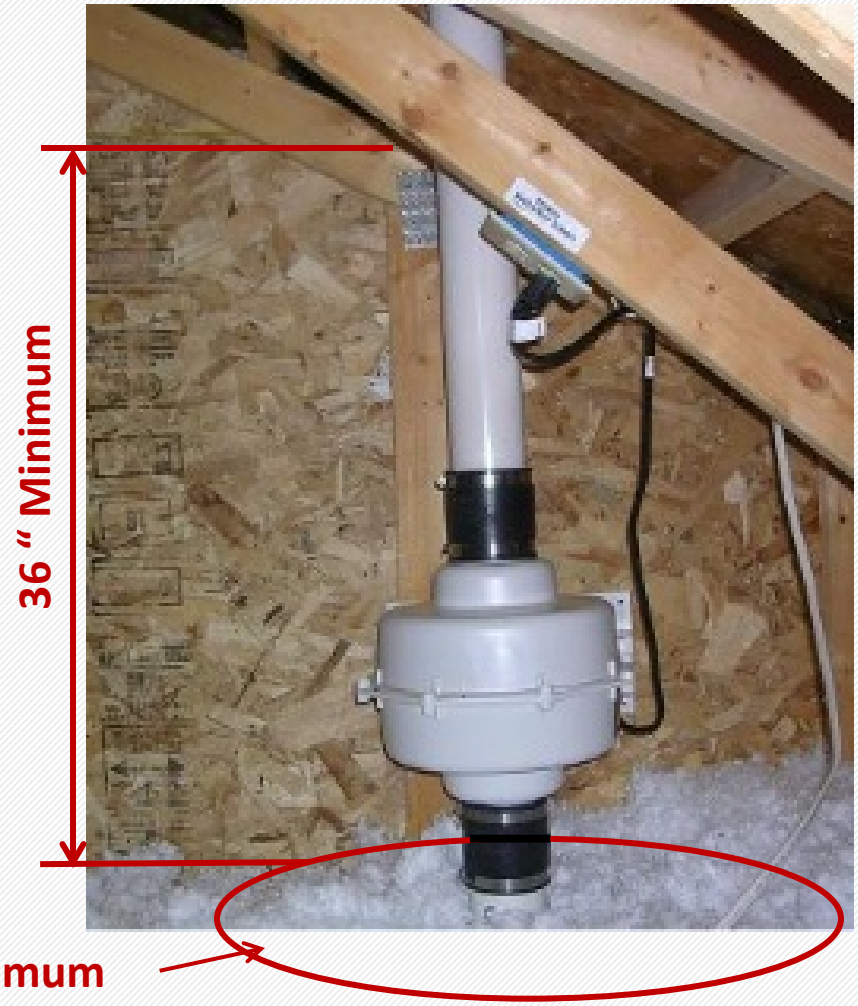
D. Vent pipe accessibility.

Radon gas vent pipes shall be provided with space around the vent pipe for future installation of a fan.

1303.2402 Requirements for Passive Radon Control Systems

D. Vent pipe accessibility.

The space required for the future fan installation **shall be a minimum of 24 inches in diameter, centered on the axis of the vent pipe, and shall extend a minimum distance of 3 vertical feet.**



MN Rule 1303.2402, Subpart 5

1303.2402 Requirements for Passive Radon Control Systems

D. Vent pipe accessibility.

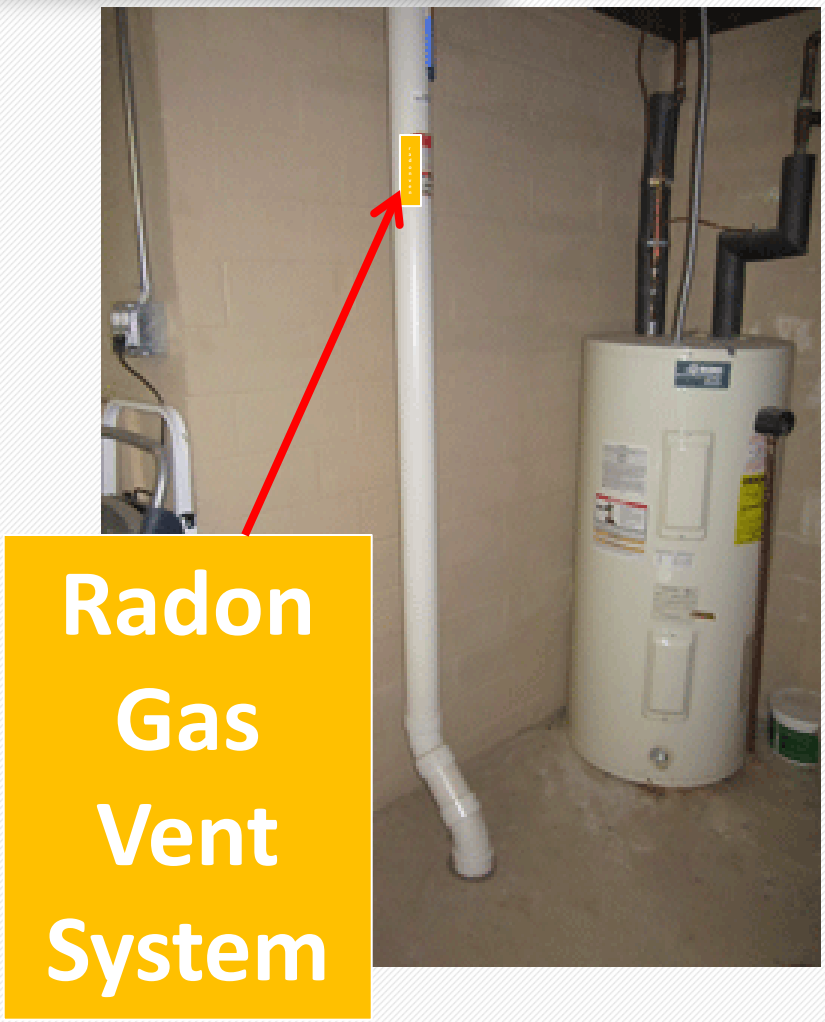
Exception: Accessibility to the radon gas vent pipe is not required if the future fan installation is above the roof system and there is an approved rooftop electrical supply provided.

1303.2402 Requirements for Passive Radon Control Systems

E. Vent pipe identification.

All radon gas vent pipes shall be identified **with at least 1 label on each story and in attics and crawl spaces.**

The label shall read:
"Radon Gas Vent System."



1303.2402 Requirements for Passive Radon Control Systems

F. **Combination foundations.**

Each radon gas vent pipe shall terminate above the roof or shall be connected to a single vent pipe that terminates above the roof.

1303.2402 Requirements for Passive Radon Control Systems

Combination basement/crawl space or slab-on grade/crawl space foundations shall have separate radon gas vent pipes installed in each type of foundation area.

MN Rule 1303.2402, Subpart 5

1303.2402 Requirements for Passive Radon Control Systems

Subpart 6. Power source.

A power source consisting of an **electrical circuit terminating in an approved electrical box shall be installed** during construction **in the anticipated location of the vent pipe fan to allow for future installation of a fan** into a passive radon control system.

The power source **shall not** be installed in any conditioned space, basement, or crawl space.

MN Rule 1303.2402, Subpart 6

1303.2400 Purpose and Scope

Subp. 1. Applicability; residential structures. (cont)

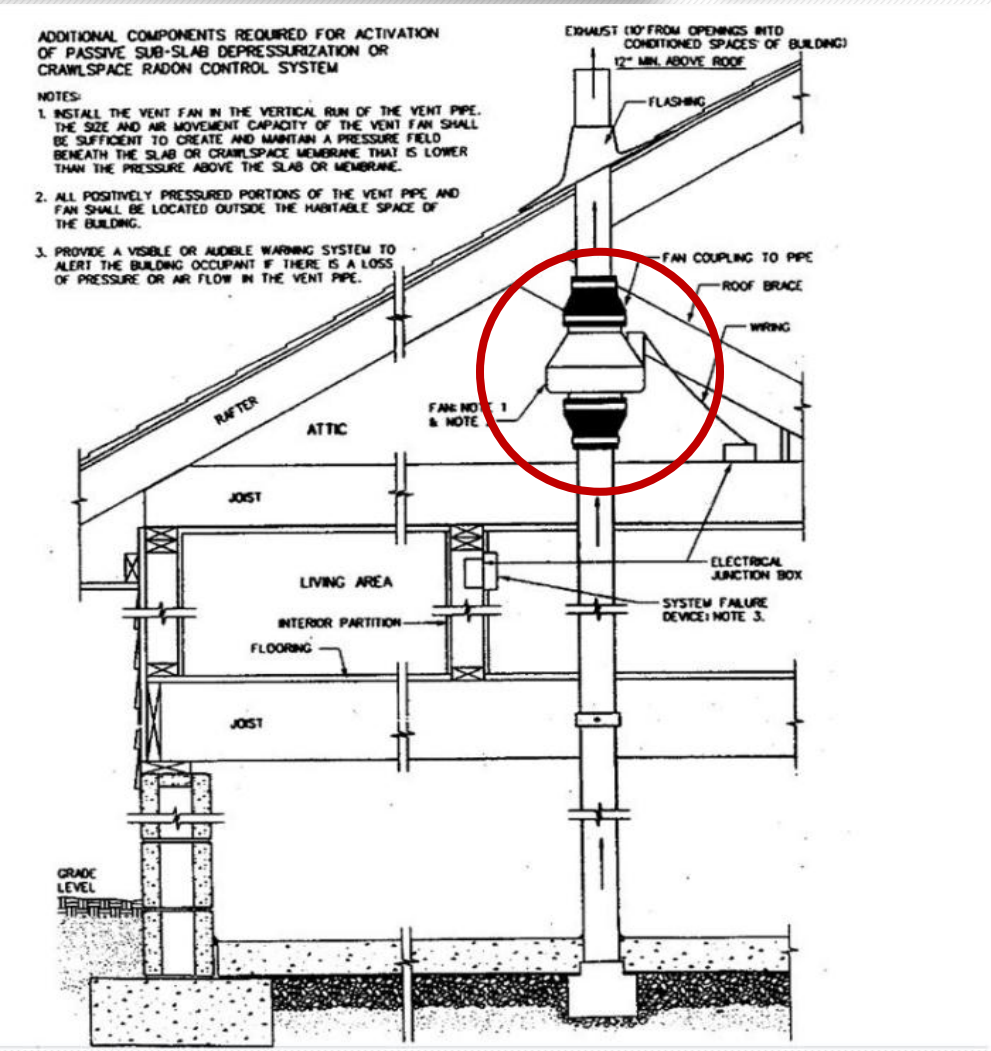
The purpose of 1303.2400 to 1303.2402 is to establish minimum requirements for passive radon control systems that apply to all new residential structures listed in items A to H:

If a fan is installed in a passive radon control system, this creates an active radon control system that must comply with the requirements of parts 1303.2400 to 1303.2403.

MN Rule 1303.2400, Subpart 1.

1303.2403 Requirements for Active Radon Control Systems

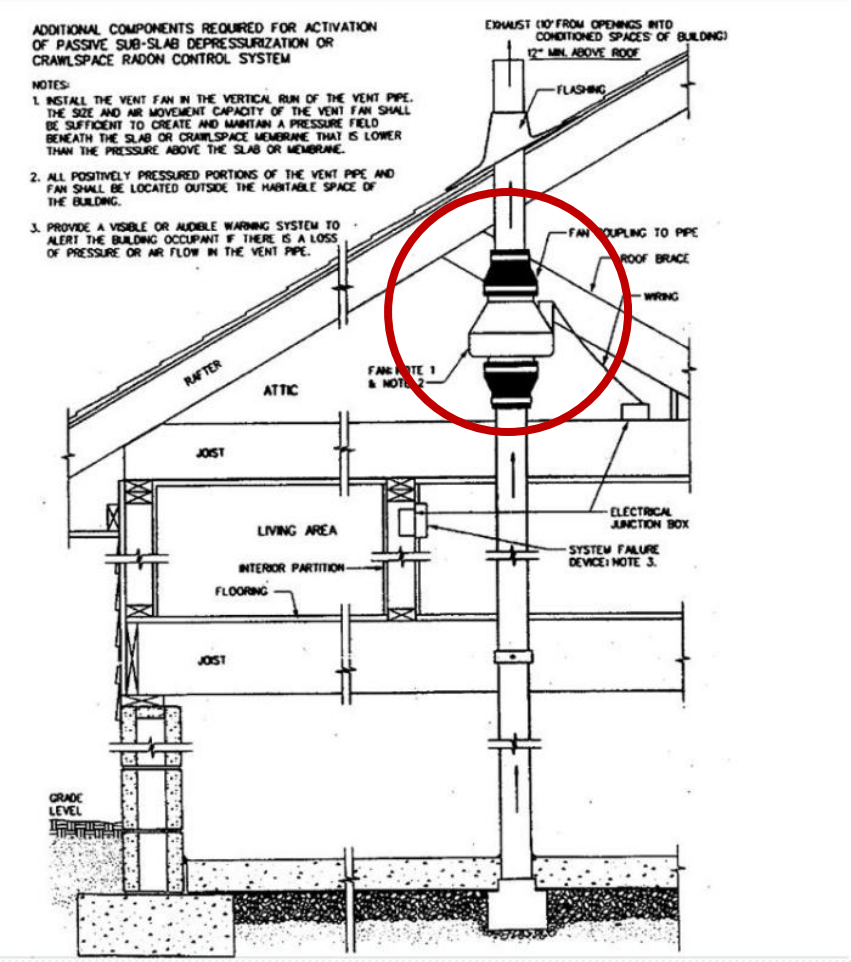
When an active radon control system is installed, **all the requirements for the passive radon control system** in parts 1303.2400 to 1303.2402 **shall be met.**



1303.2403 Requirements for Active Radon Control Systems

When an active radon control system is installed, all the requirements for the passive radon control system in parts 1303.2400 to 1303.2402 shall be met.

In addition, an active radon control system shall incorporate items A to C in this part.



1303.2402 Requirements for Active Radon Control Systems

A radon gas vent pipe fan manufactured for radon control systems and rated for continuous operation that provides a minimum measurement of 50 cubic feet per minute at ½-inch water column shall be installed in the vertical vent pipe.

MN Rule 1303.2403 (A)

1303.2402 Requirements for Active Radon Control Systems

A.

The fan shall be attached to a radon gas vent pipe that connects the air below the soil-gas membrane with outdoor air and relies on the fan to provide upward air flow in the vent pipe.

1303.2402 Requirements for Active Radon Control Systems

The radon gas vent pipe fan <u>shall not be</u> installed in conditioned spaces of a building, basement, or crawl space.

MN Rule 1303.2403 (A)

1303.2402 Requirements for Active Radon Control Systems

The radon gas vent pipe fan shall not be located where it positively pressurizes any portion of the vent pipe that is located inside conditioned space.

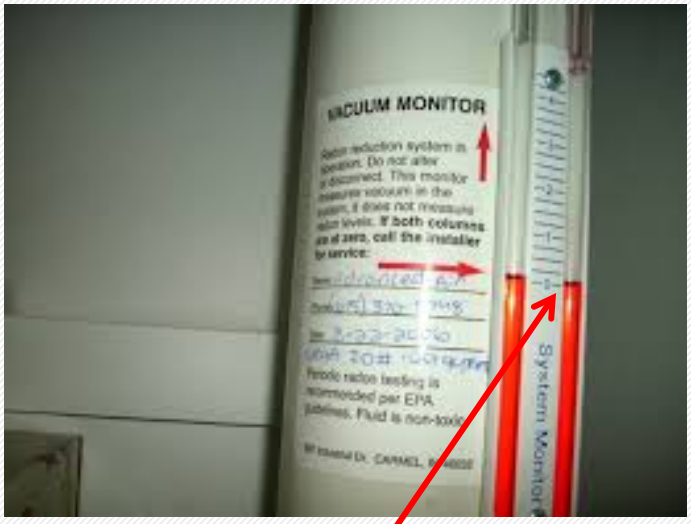
MN Rule 1303.2403 (A)

1303.2402 Requirements for Active Radon Control Systems

B. System monitoring device.

An audible alarm, a manometer, or other similar device shall be installed to indicate when the fan is not operating

Fan on



Fan off

MN Rule 1303.2403 (b)

1303.2402 Requirements for Active Radon Control Systems

C. Luminaire and receptacle outlet.

A switch-controlled luminaire and the electrical circuit near the fan shall be installed according to the *Minnesota Electrical Code*.

2014 Edition

MN Rule 1303.2403 (C)

1303.2402 Requirements for Active Radon Control Systems

C. Luminaire and receptacle outlet.

<u>The requirements of the International Mechanical Code, Section 306, do not apply</u> for access to equipment and catwalks or service platforms.

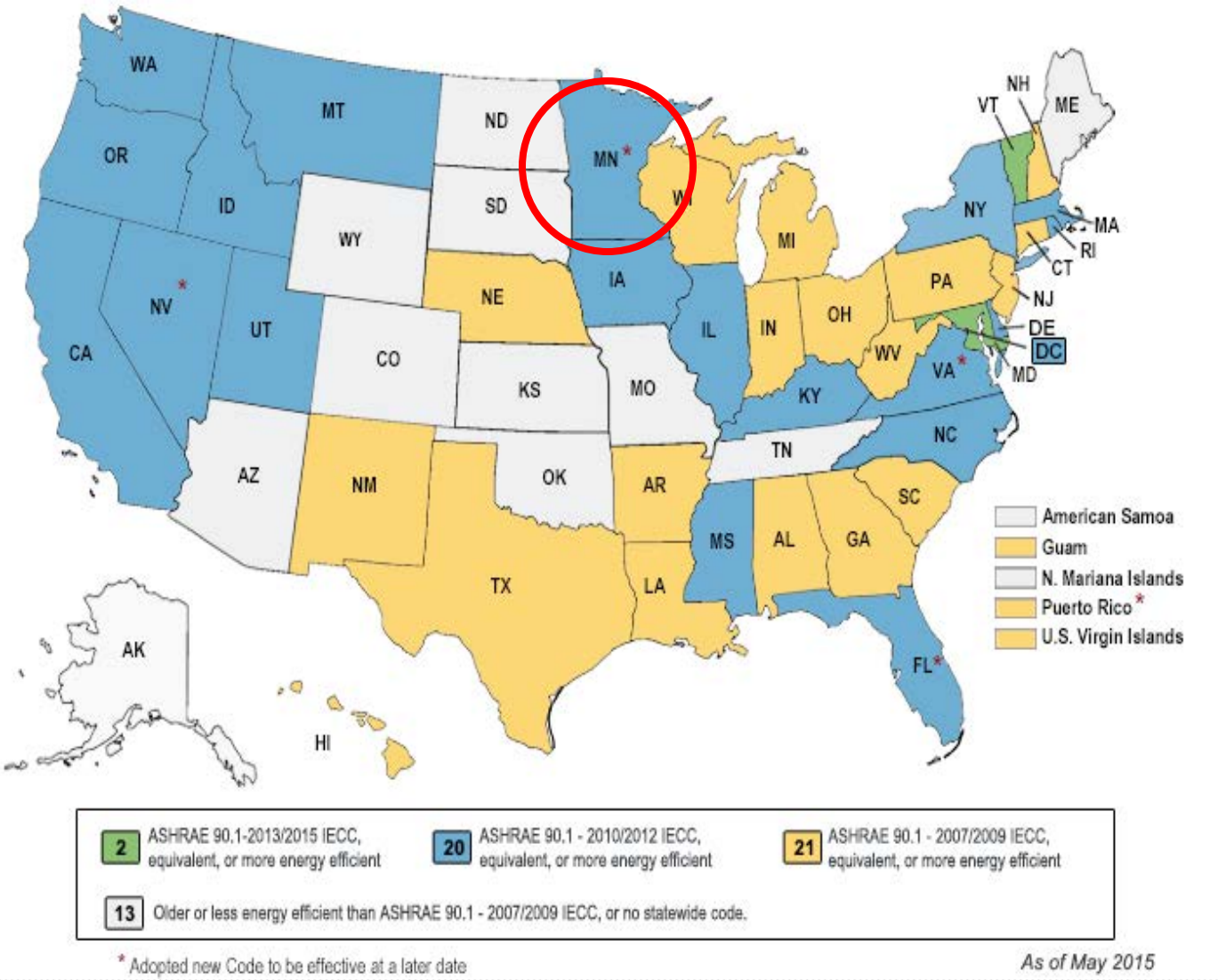
The 2012 IECC or the AHHREA Standard 90.1-2010

An introduction to the Envelope Basics and the Key Differences.

Comparing the 2012 IECC to ASHRAE Standard 90.1-2010

Status of Code Adoption: Commercial

Overview of the currently adopted commercial energy code in each state



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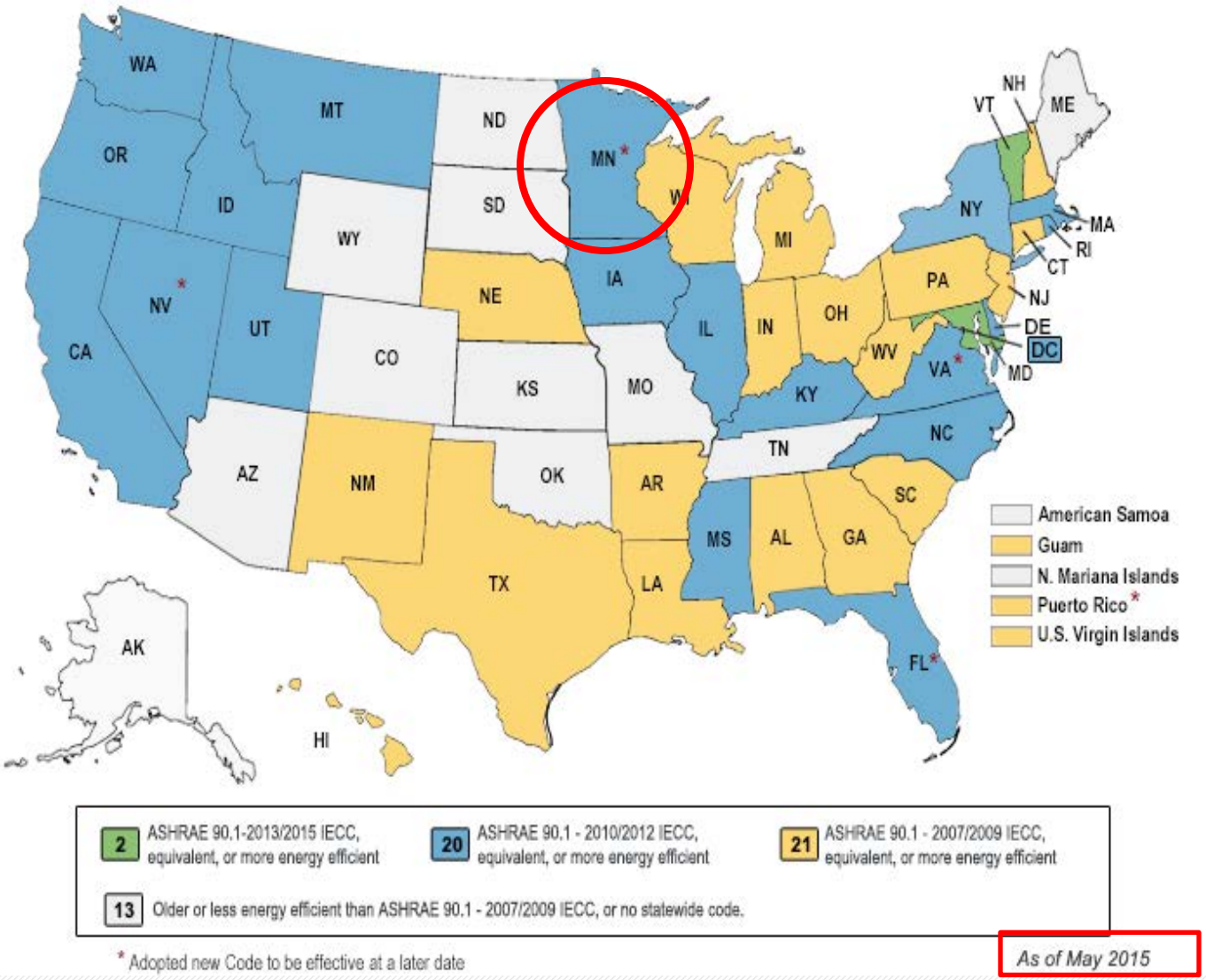

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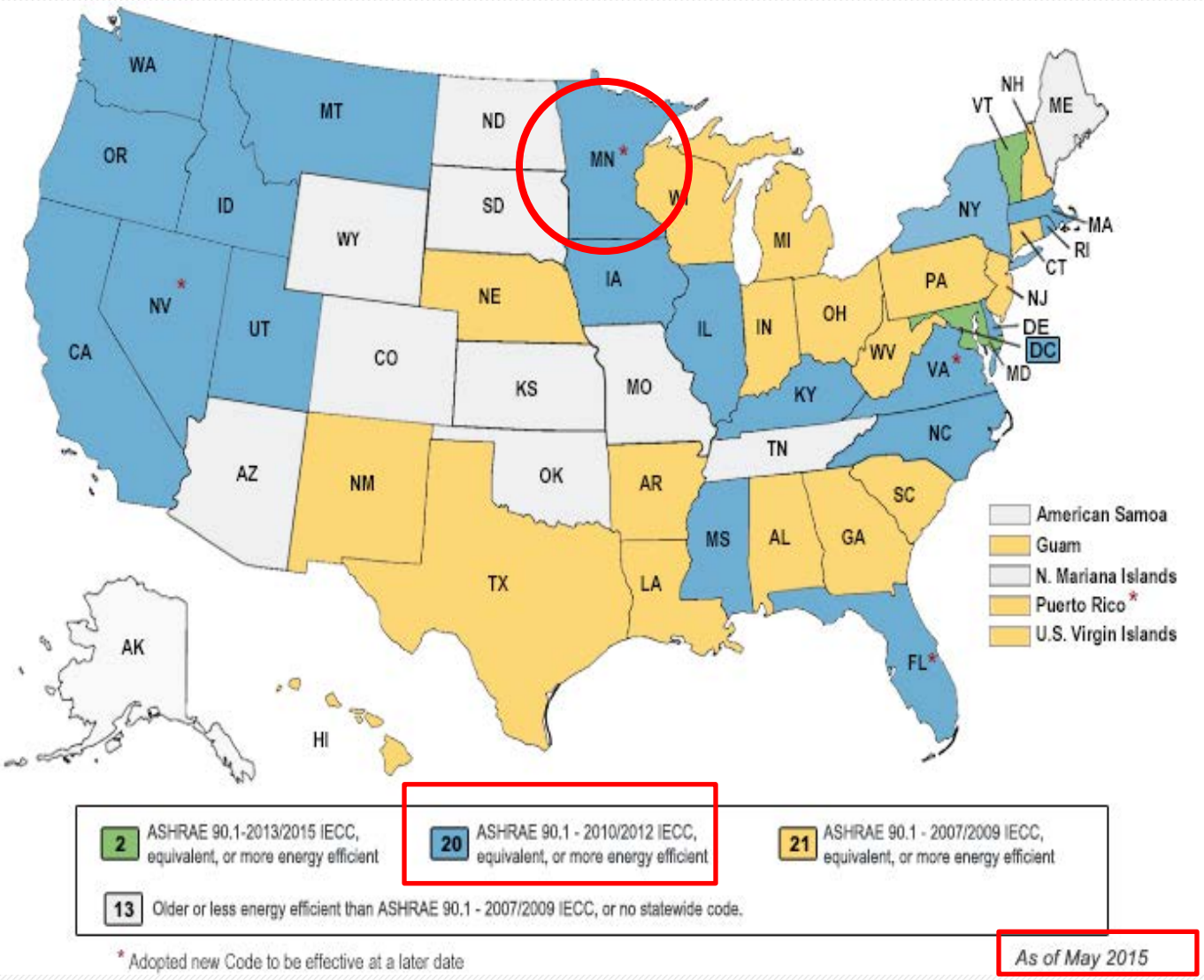
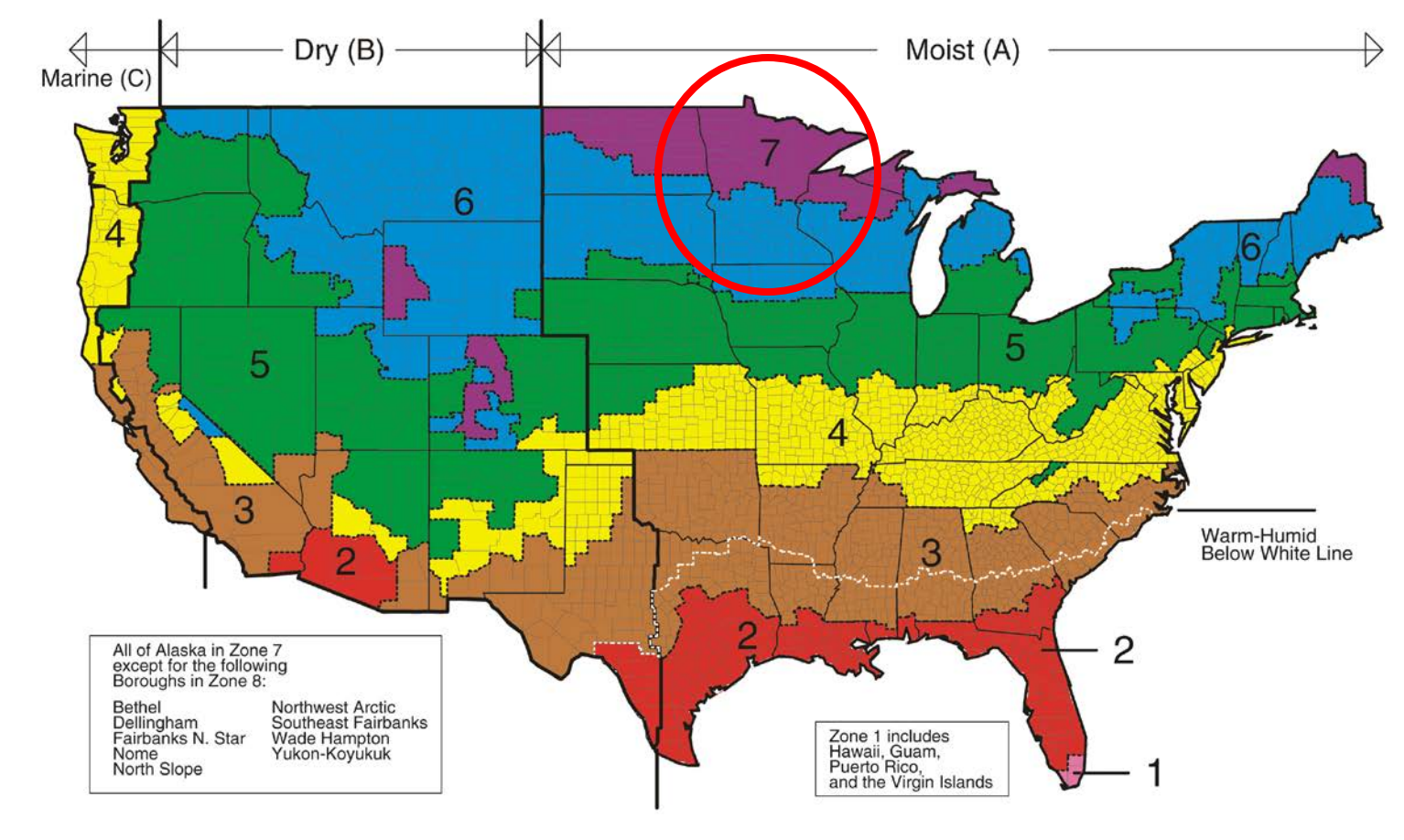


Climate Zones

- **Three separate moisture regimes overlay the eight climate zones.**



Definition of a Residential Building

- **Residential buildings (IECC)**: Includes detached on- and two- family dwellings and multiple single family dwelling buildings (townhouses) as well as Group R-2, R-3, and R-4 Buildings, **three stories or less in height.**

Definition of a Residential Building

- **Residential buildings (IECC)**: Includes detached on- and two- family dwellings and multiple single family dwelling buildings (townhouses) as well as Group R-2, R-3, and R-4 Buildings, **three stories or less in height.**

- **Residential buildings (ASHRAE):** Spaces in building used primarily for living and sleeping, including but not limited to, dwelling units, **hotel/motel guest rooms,** dormitories, nursing homes, **patient rooms in hospitals,** lodging houses, fraternity/sorority houses, hostels, prisons and fire stations.

Example

- **ASHRAE defines patient rooms in hospitals and hotel/motels as residential where as the 2012 IECC would consider these rooms as commercial.**

Example

- ASHRAE defines patient rooms in hospitals and hotel/motels as residential where as the 2012 IECC would consider these rooms as commercial.

- **Thus in some instances (like these) a building built to the 2012 IECC would have more rigorous thermal envelope requirements than one built to ASHREA**

Definition of a Commercial Building

- **Commercial buildings (IECC)** : All buildings not included in the definition of a residential building.

Definition of a Commercial Building

- **Commercial buildings (IECC)**: All buildings not included in the definition of a residential building.

- **Commercial Buildings (ASHRAE):** ASHRAE does not give a definition of commercial buildings. **(See Scoping provisions Section 2.2)** for what this standard does not apply to.

Section 2 – Scope Exception

What does not apply:

- ✓Too little heating or cooling
- ✓**Single-family, multifamily of three stories or less, manufactured or modular homes**
- ✓Buildings that don't use electricity or fossil fuel

ASHREA Section 5 – 5.5.1

TABLE 5.5-6 Building Envelope Requirements For Climate Zone 6

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-10.0 c.i.
Metal Buildings	U-0.049	R-13.0 + R-19.0	U-0.049	R-13.0 + R-19.0	U-0.072	R-16.0
Attic and Other	U-0.027	R-38.0	U-0.027	R-38.0	U-0.034	R-30.0
Mass	U-0.064	R-12.5 c.i.	U-0.057	R-14.6 c.i.	U-0.137	R-4.2 c.i.
Steel-Joist	U-0.038	R-30.0	U-0.032	R-38.0	U-0.052	R-19.0
Wood-Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-0.051	R-19.0
Slab-On-Grade Floors						
Unheated	F-0.540	R-10 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
Heated	F-0.860	R-15 for 24 in.	F-0.688	R-20 for 48 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-0.500		U-0.500		U-1.450	

Reference Table 5.5-6

Determining energy use by defining the space.

- **Conditioned Space: Greater than 3.5 Btu's or 1 watt of energy use per square foot for space conditioning purposes.**

Determining energy use by defining the space.

- **Conditioned Space: Greater than 3.5 Btu's or 1 watt of energy use per square foot for space conditioning purposes.**

- **Unconditioned space: Uses less then 3.4 Btu's or 1 watt per Square foot for space conditioning purposes**

Determining energy use by defining the space.

- **Conditioned Space: Greater than 3.5 Btu's or 1 watt of energy use per square foot for space conditioning purposes.**

- **Unconditioned space: Uses less then 3.4 Btu's or 1 watt per Square foot for space conditioning purposes**

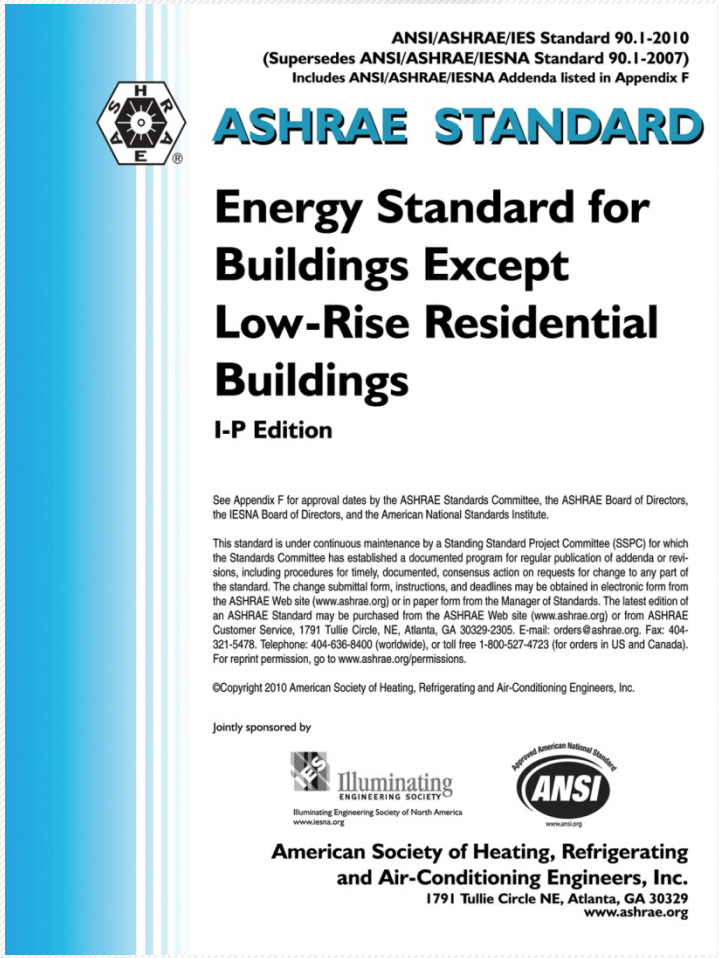
- **Semi Conditioned Space: (ASHREA only) is energy use of between 3.4- Btu's and 20 Btu's of energy use for Space conditioning purposes**

Arrangement and format of the 2012 IECC

- **IECC Commercial Provisions, Chapters CE 1-5, contain provisions for residential buildings <u>four stories or greater in height.</u>**

IECC section C401 General

- The section has been revised for clarity. **Compliance with ANSI/ASHRAE/IESNA 90.1 is still an acceptable alternative.**



ANSI/ASHRAE/IES Standard 90.1-2010
(Supersedes ANSI/ASHRAE/IESNA Standard 90.1-2007)
Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F

ASHRAE STANDARD

Energy Standard for Buildings Except Low-Rise Residential Buildings

I-P Edition

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

This standard is under continuous maintenance by a Standing Standard Project Committee (SSPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site (www.ashrae.org) or in paper form from the Manager of Standards. The latest edition of an ASHRAE Standard may be purchased from the ASHRAE Web site (www.ashrae.org) or from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada). For reprint permission, go to www.ashrae.org/permissions.

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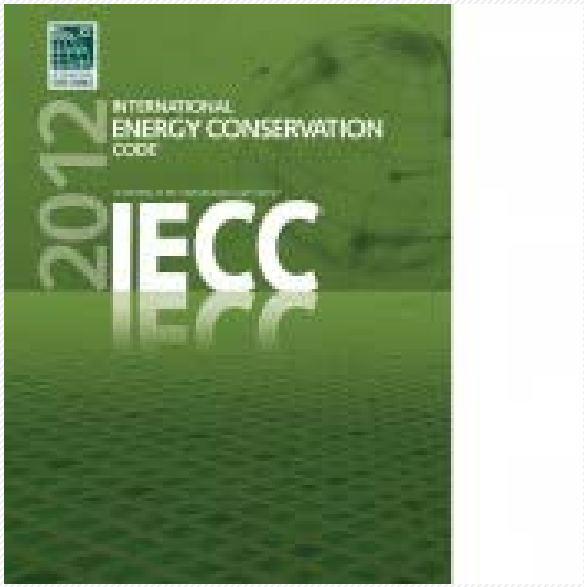
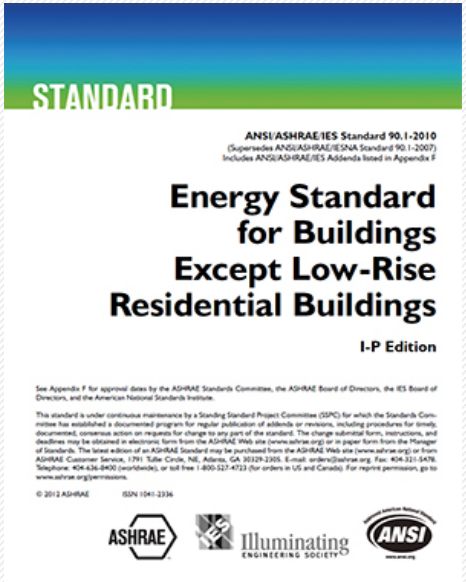
Intent

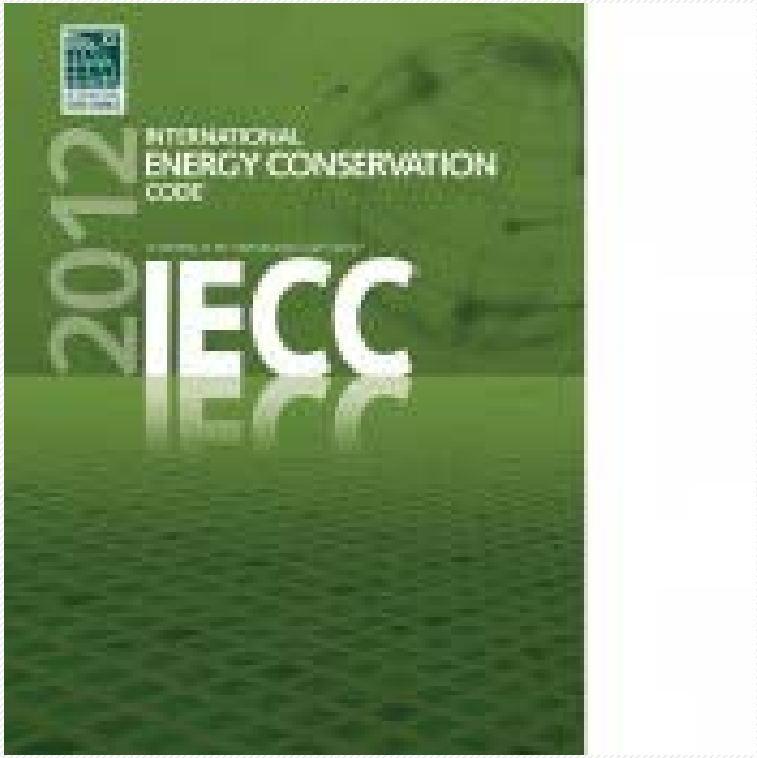
- **Life safety, health and environmental requirements take precedence over energy provisions.**



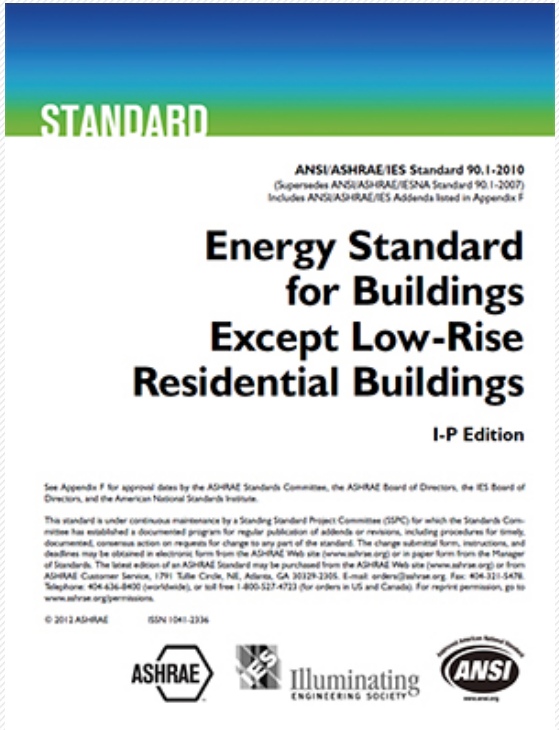


Which choice will <u>they</u> make?

2012 IECC

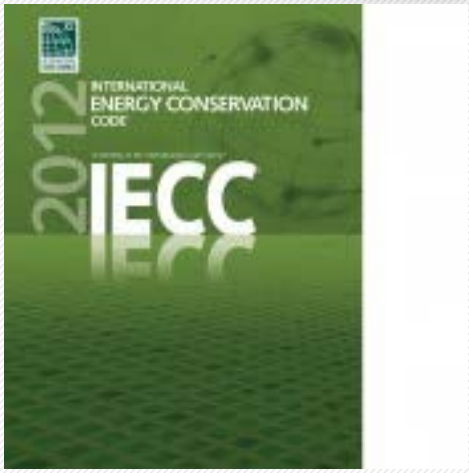


2010 ASHRAE Standard 90.1

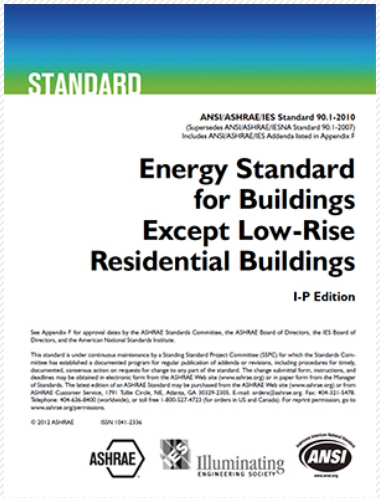


Which commercial code did they use for their Building

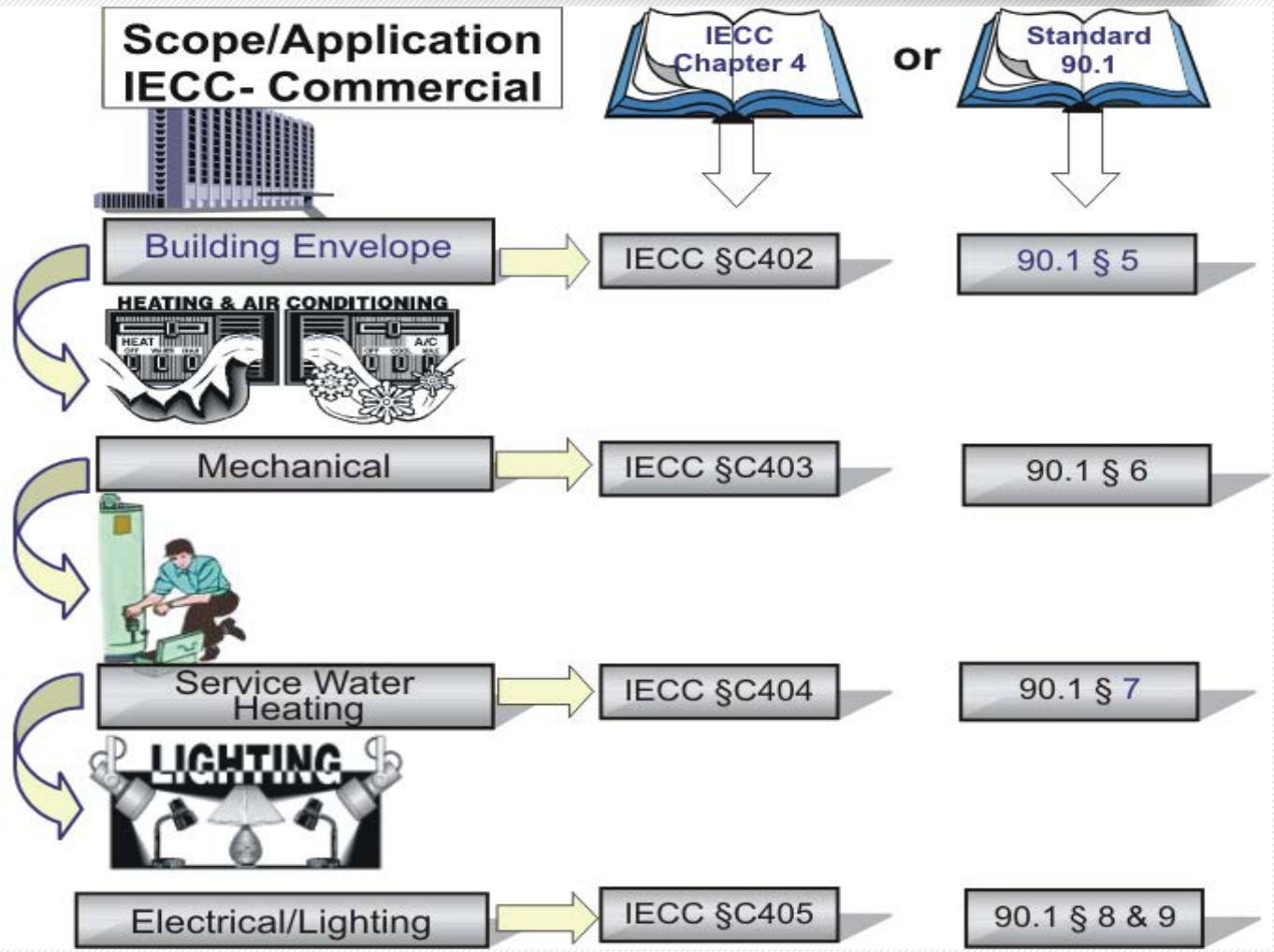
- **2012 IECC chapters CE1-CE5:**
  - **Prescriptive approach, or;**
  - **Performance approach**



- **ASHREA Standard 90.1-2010**



Highlighting the Key differences



Choose a Commercial Path
"All-In!"

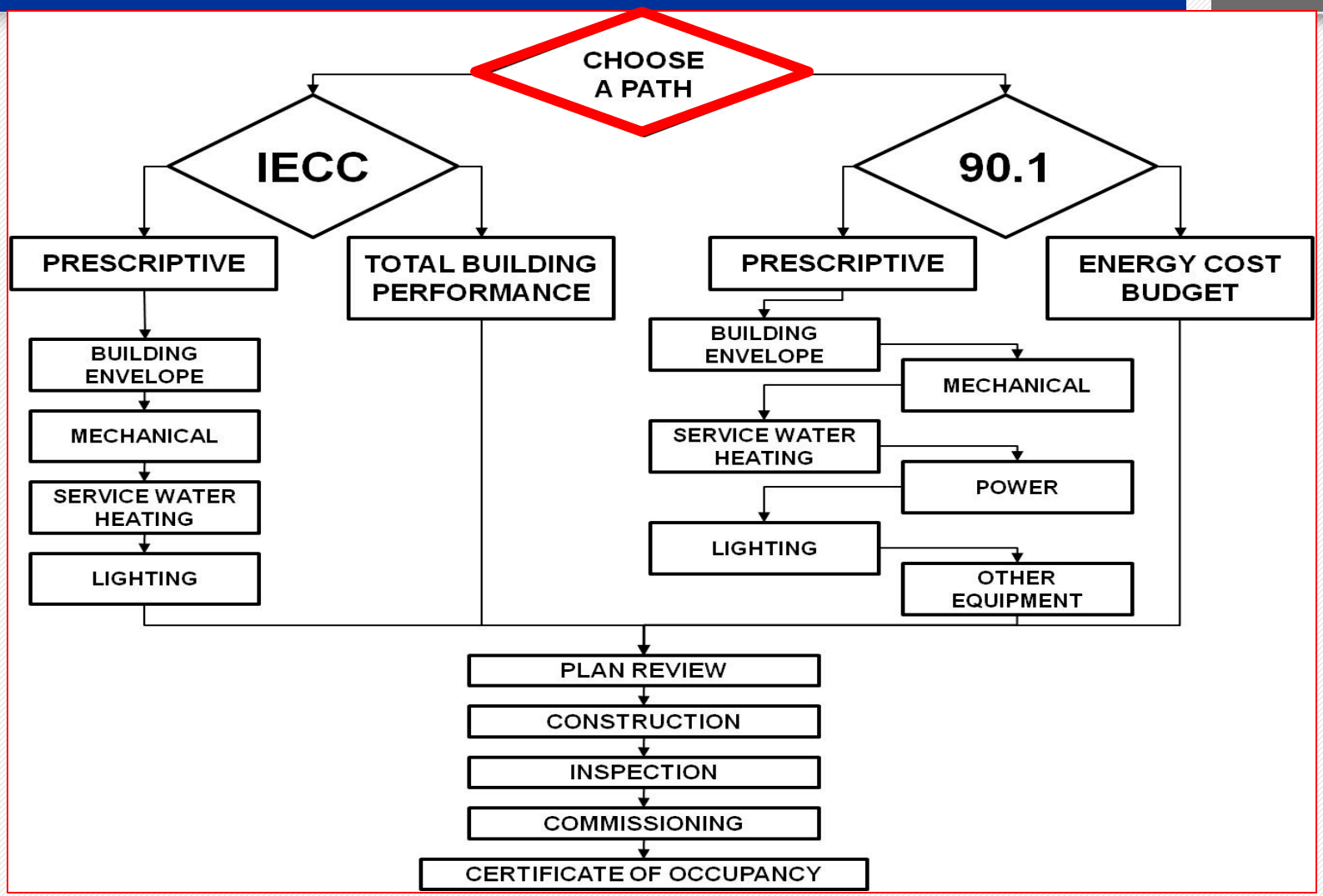
2012 IECC

1. Scope & Administration
2. Definitions
3. General Requirements
4. Commercial
   - 402) ENV
   - 403) MECH
   - 404) SWH
   - 405) LTG
   - 406) HIGH EFF MEASURES
   - 407) PERFORMANCE
   - 408) Cx
5. Referenced Standards

ASHRAE 90.1-2010

1. Purpose
2. Scope
3. Definitions & Abbreviations
4. Administration & Enforcement
5. ENV
6. HVAC
7. SWH
8. PWR
9. LTG
10. EQUIPMENT
11. ECB
12. Normative References

Commercial Energy Code Compliance Process 2012 IECC vs. ASHRAE 90.1-2010



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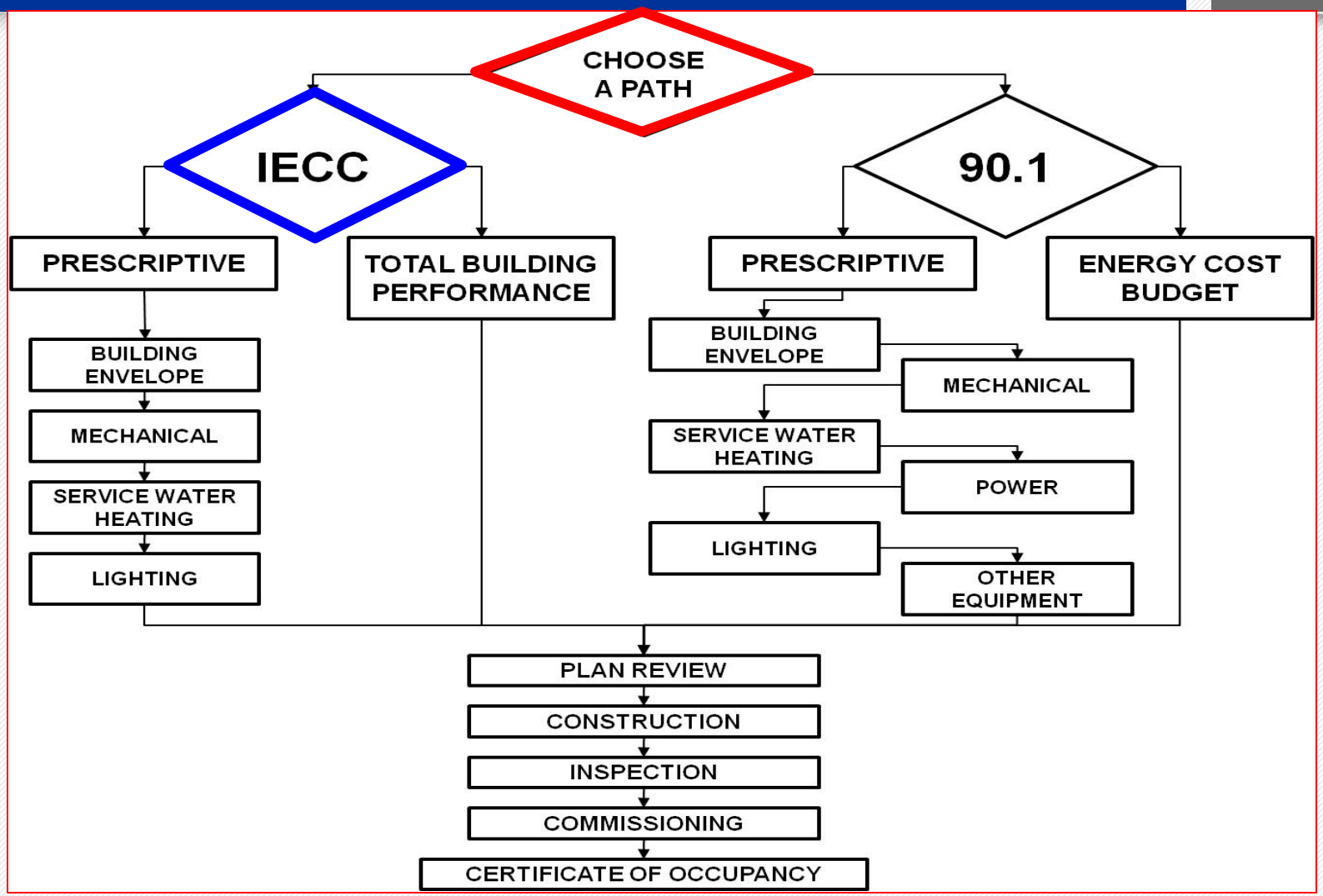

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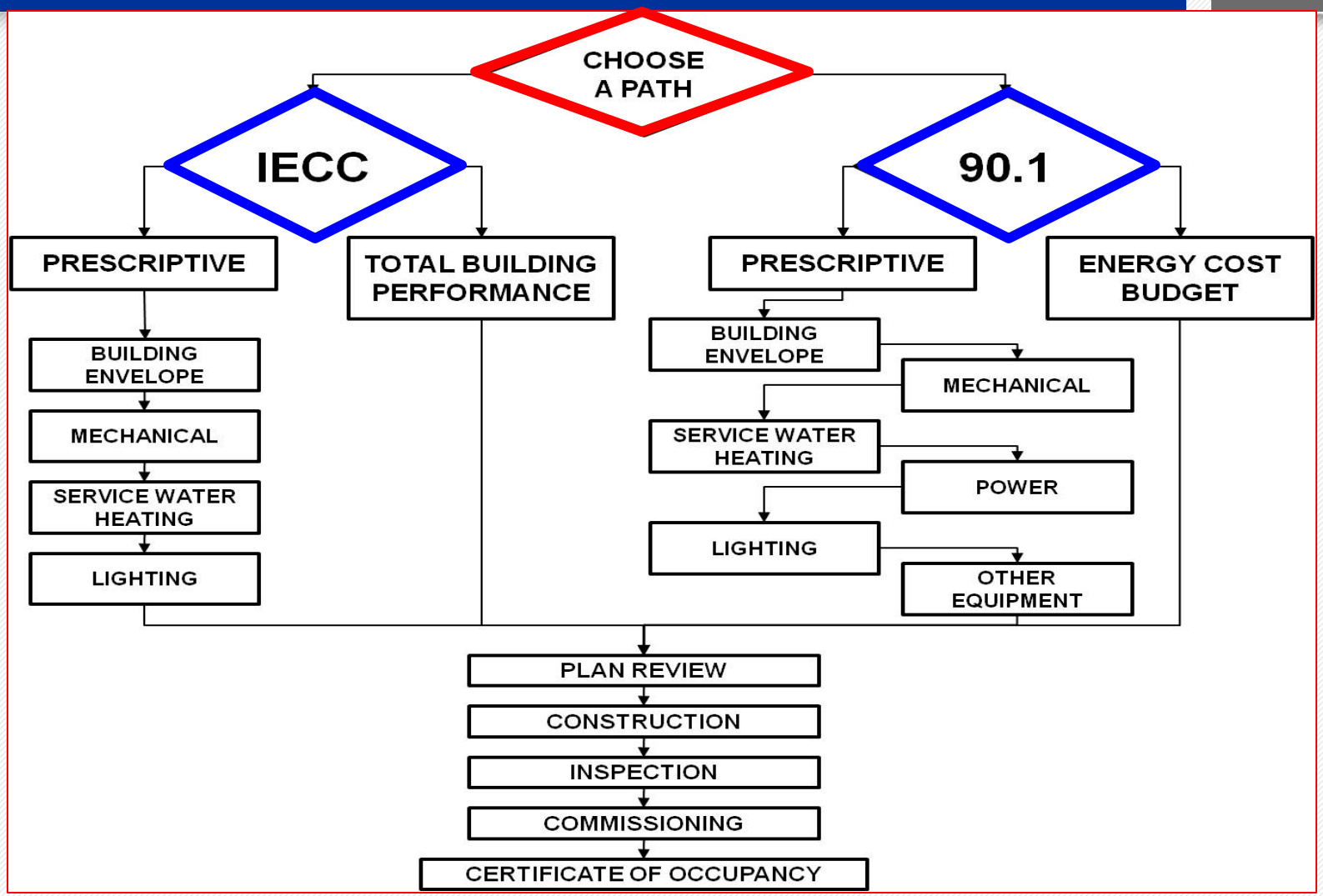

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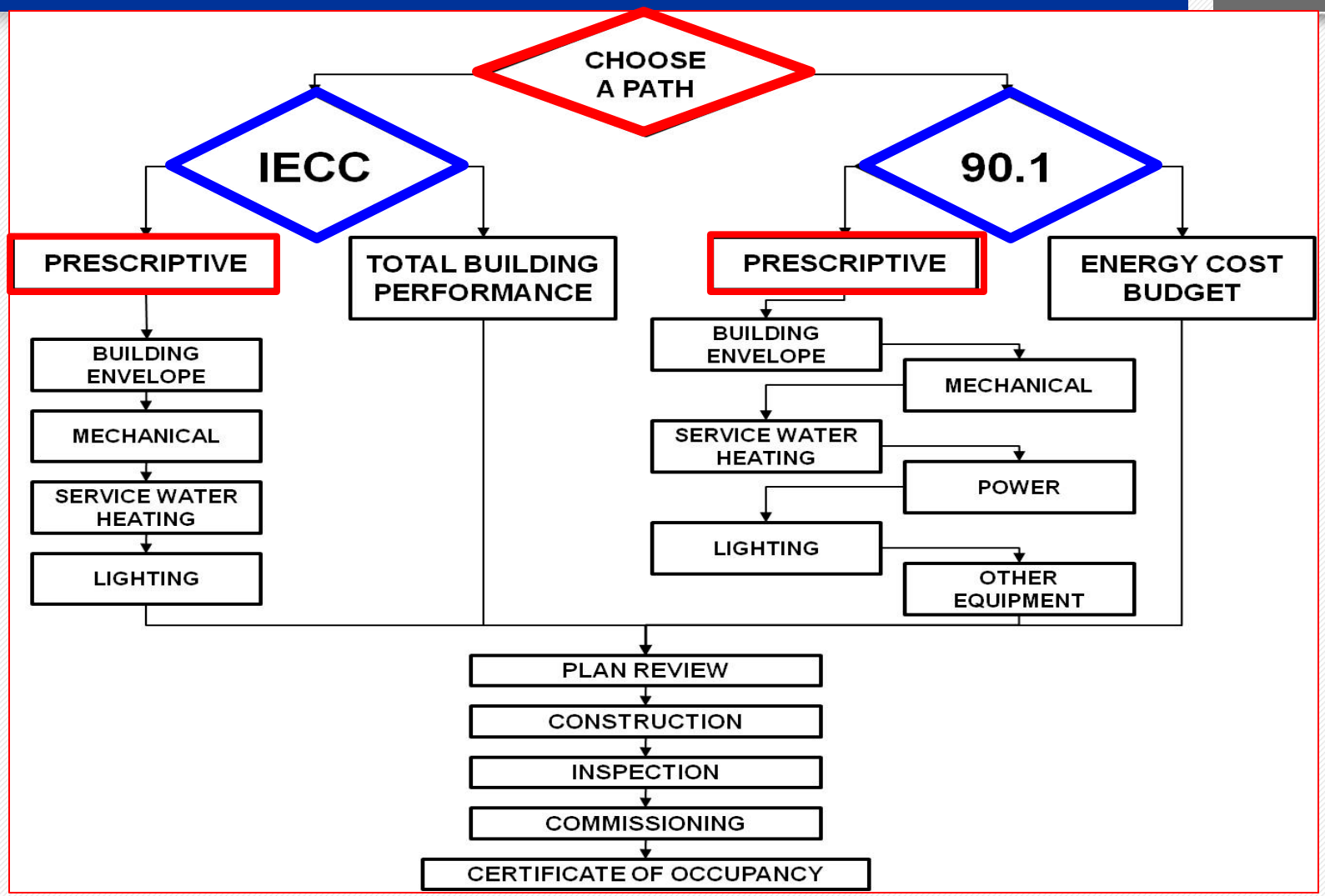

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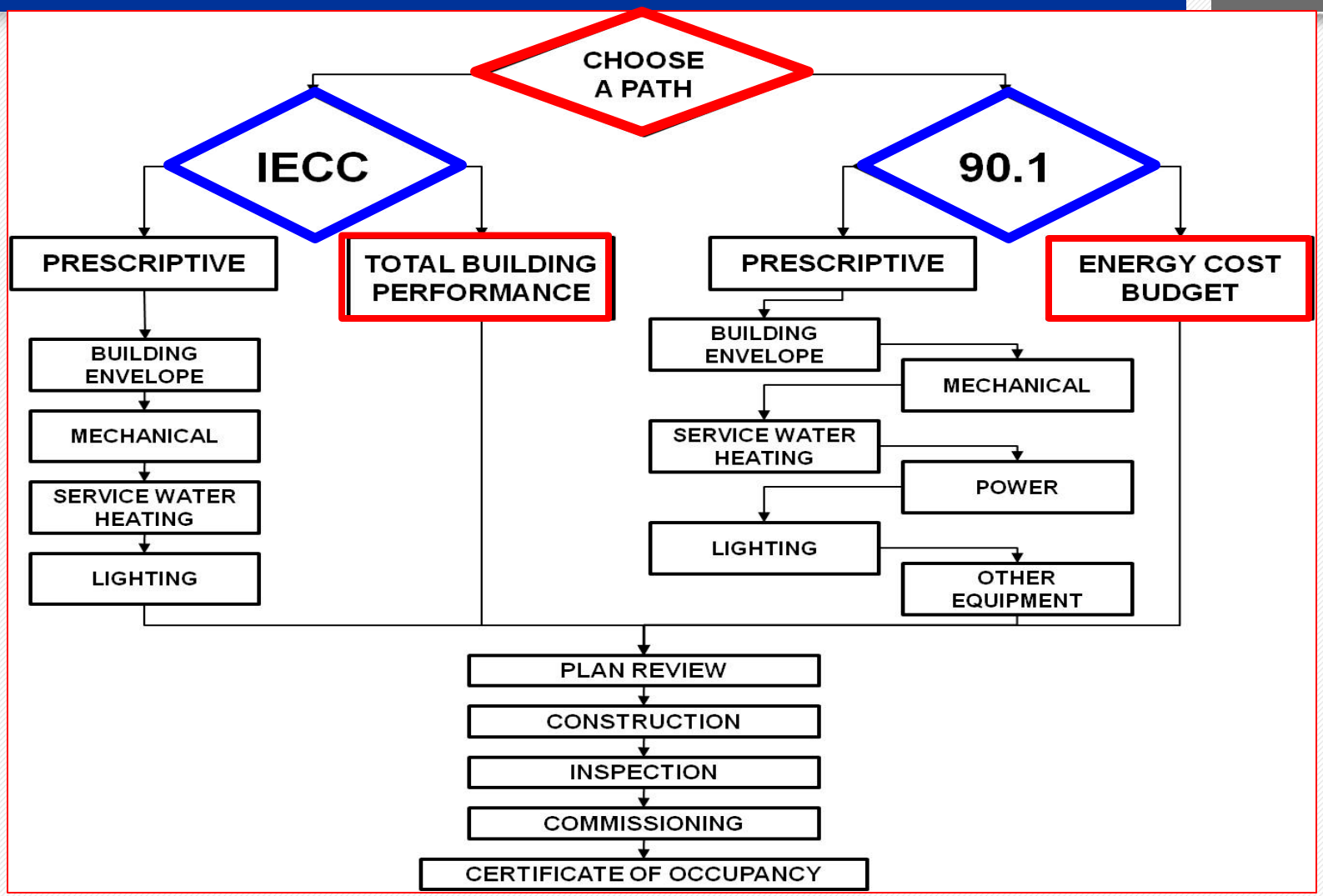
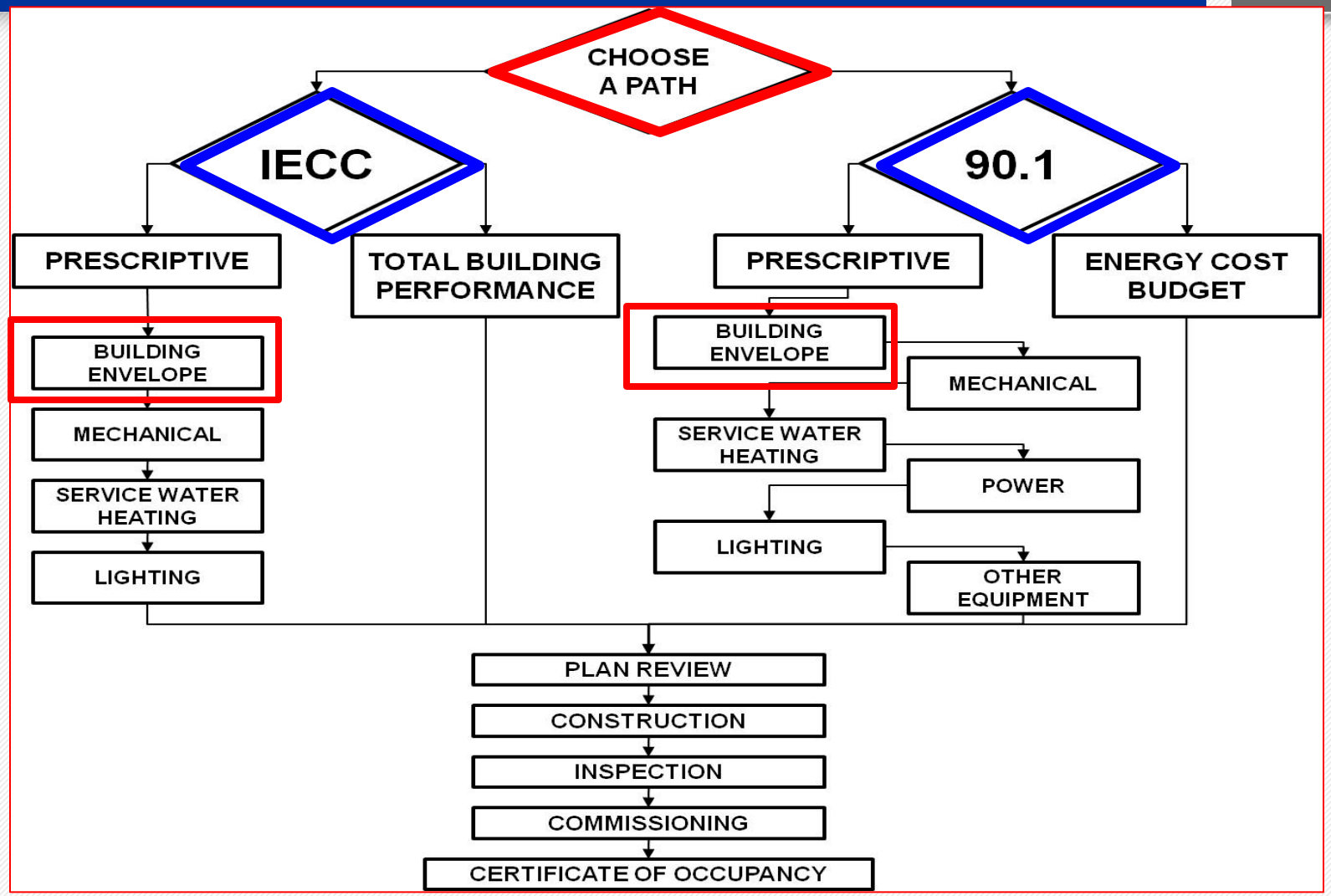


Commercial Energy Code Compliance Process 2012 IECC vs. ASHRAE 90.1-2010



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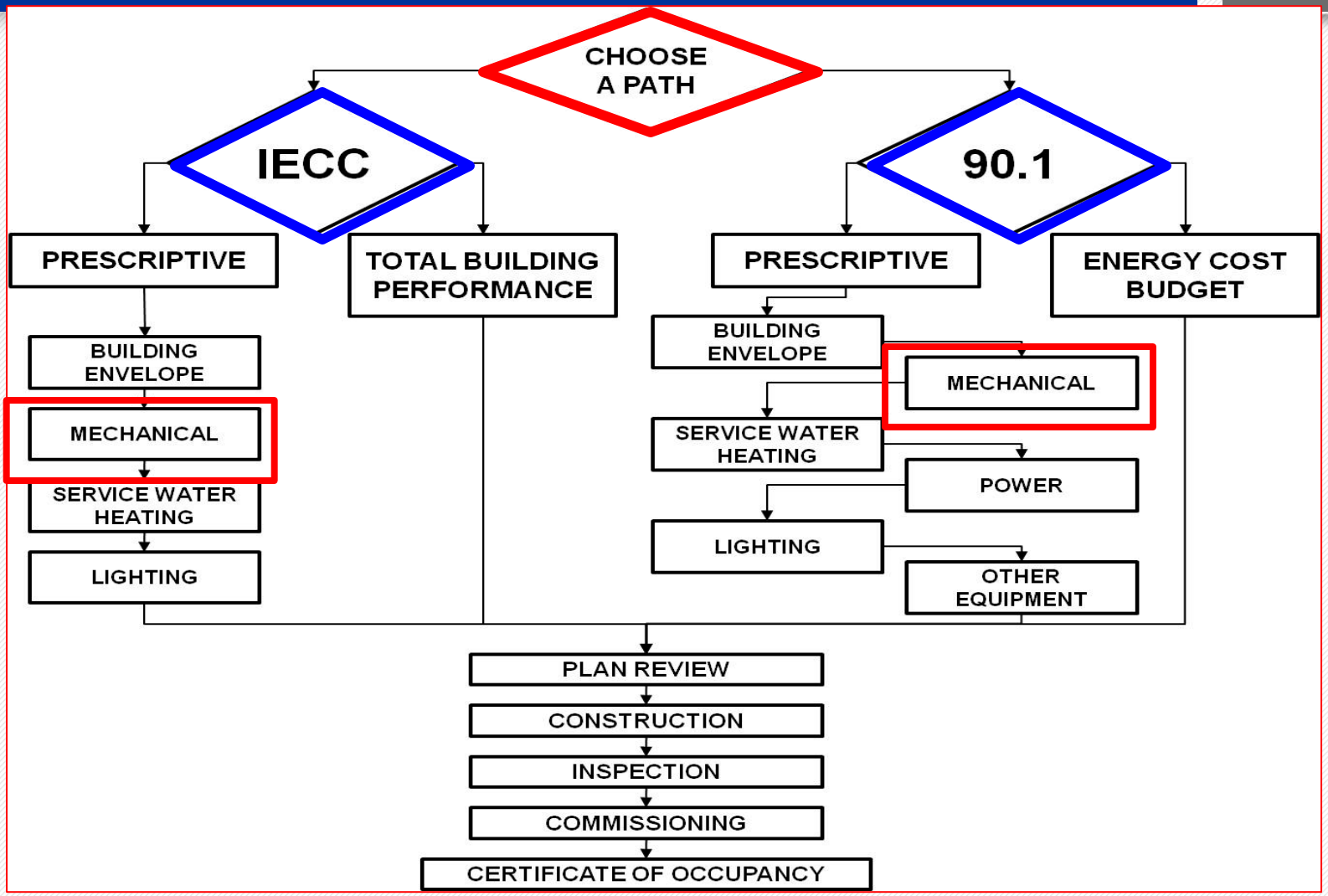

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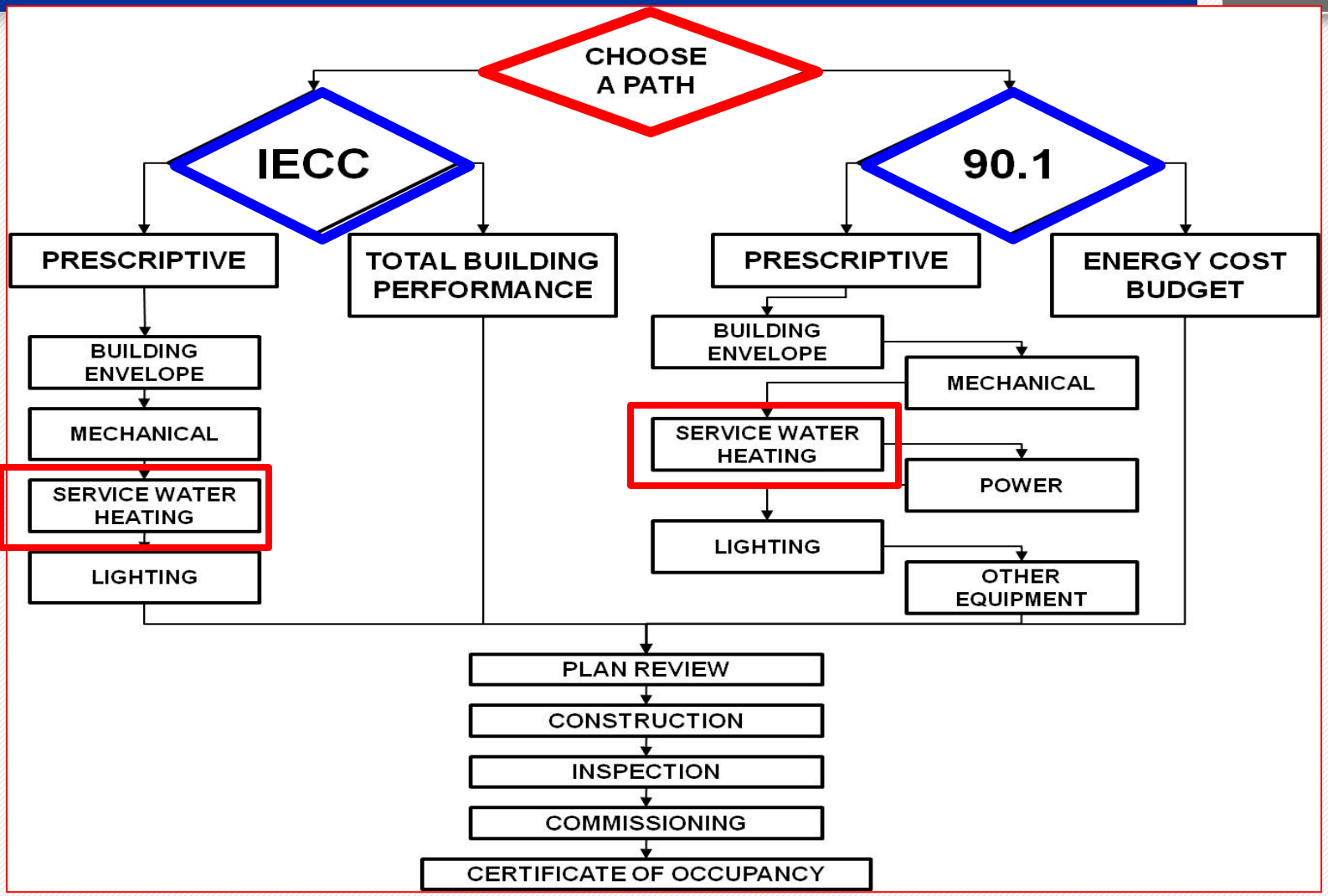

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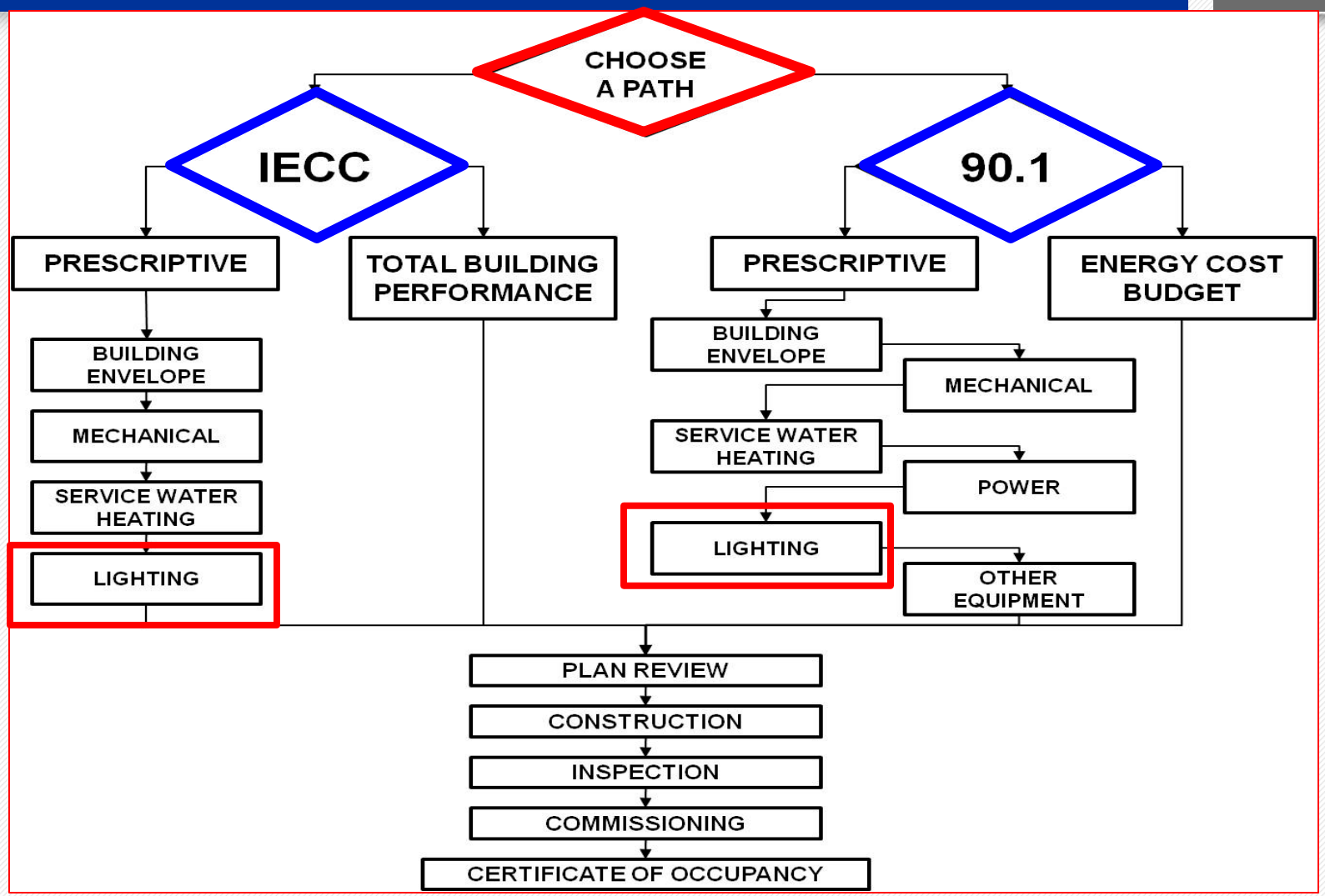

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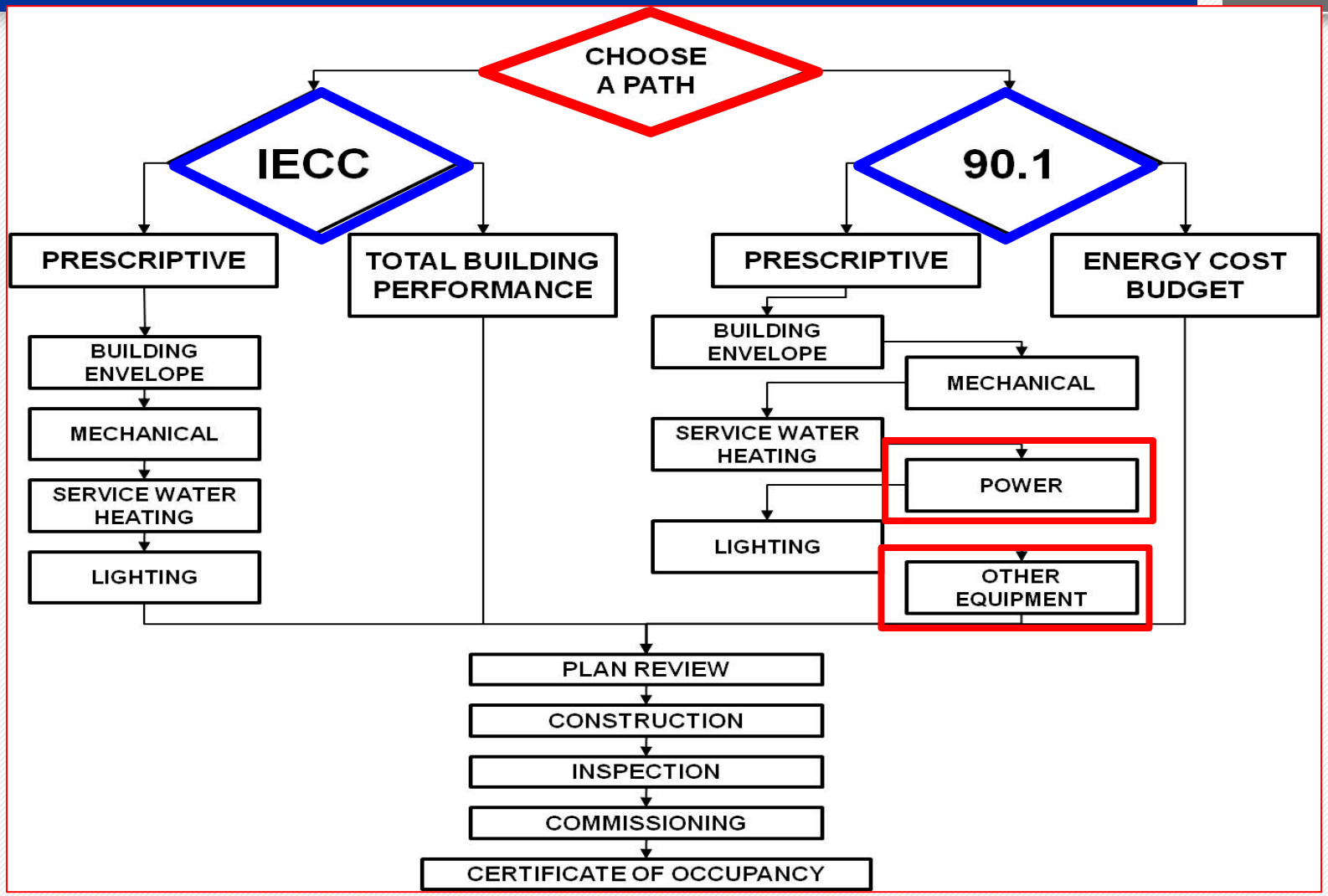

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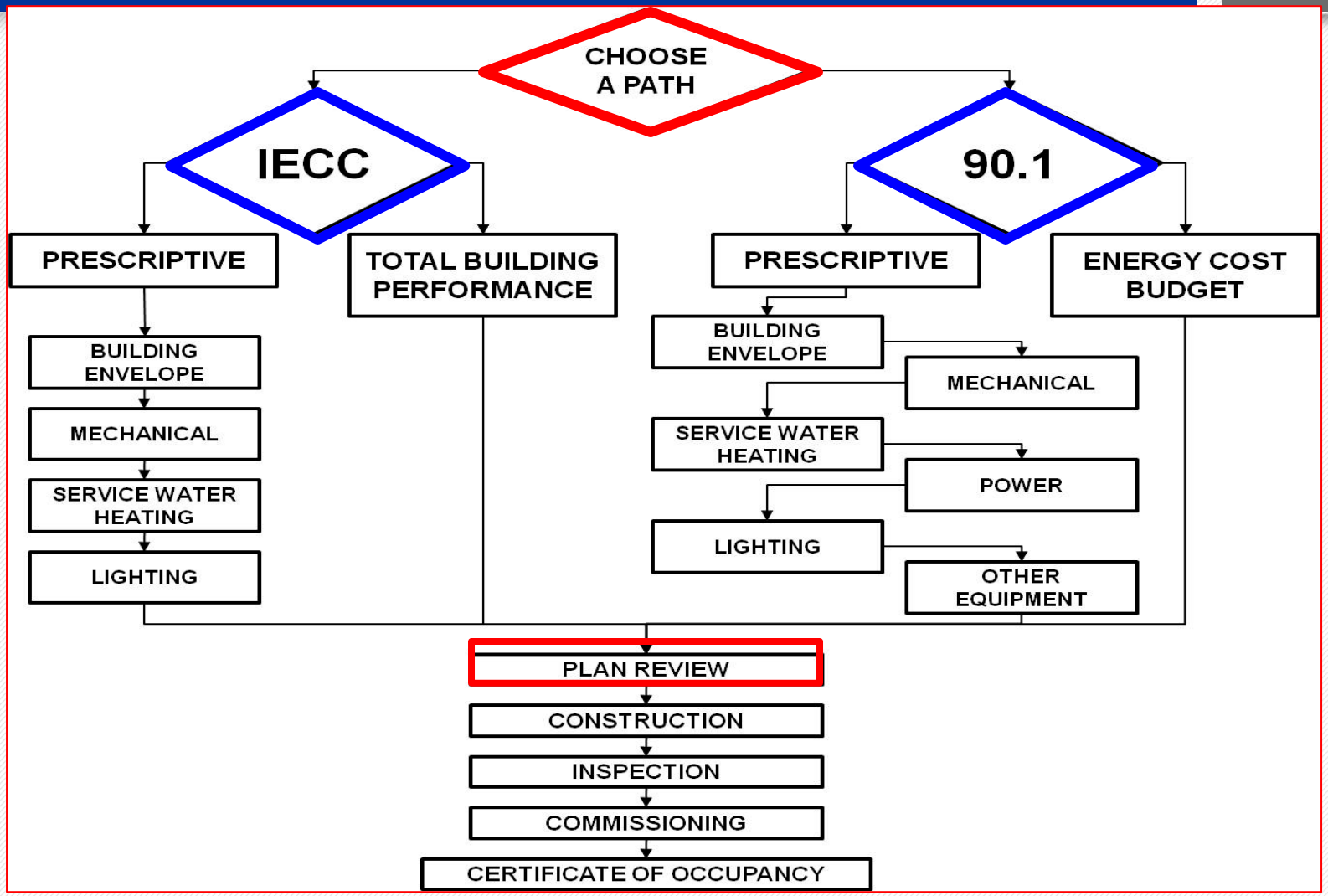

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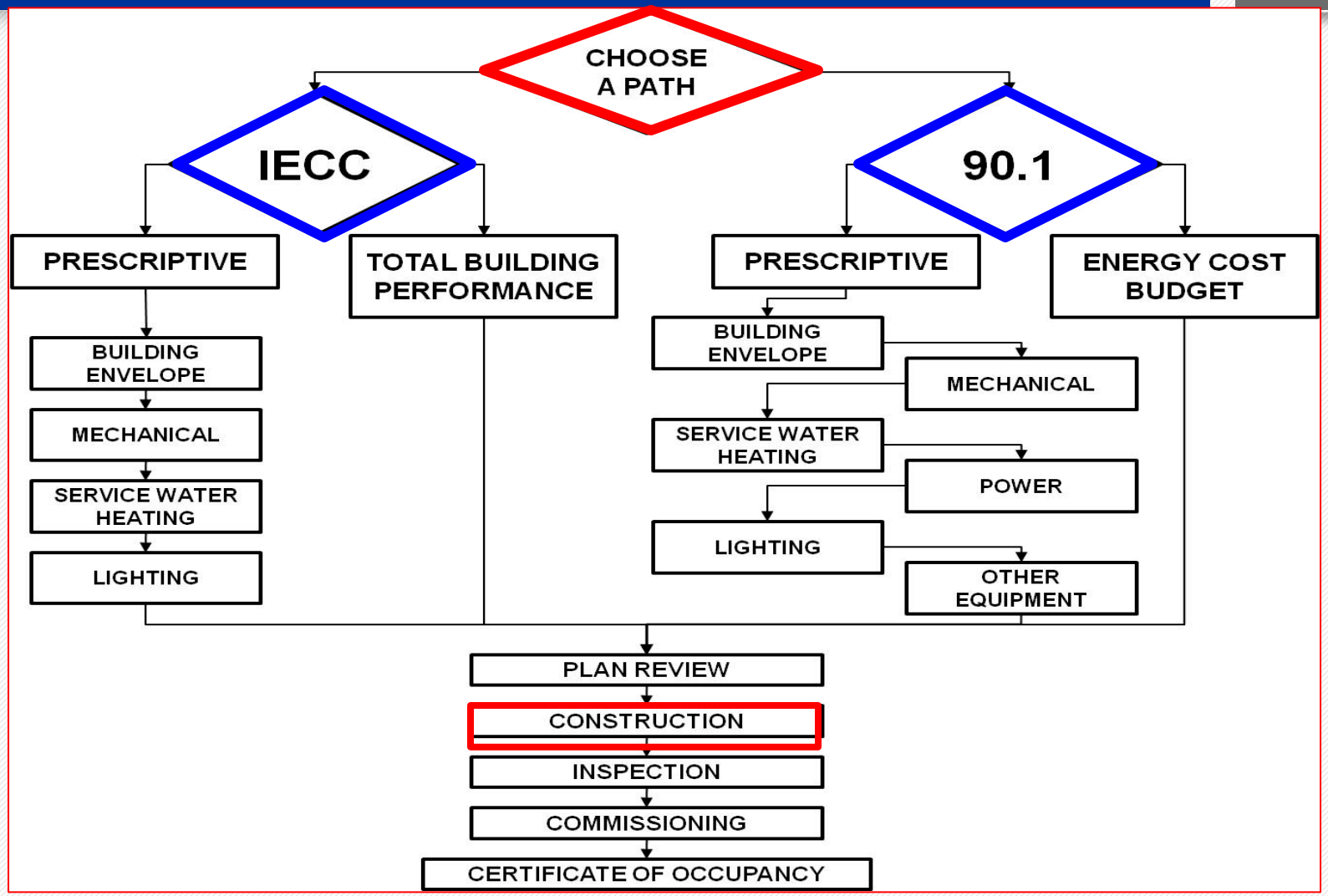
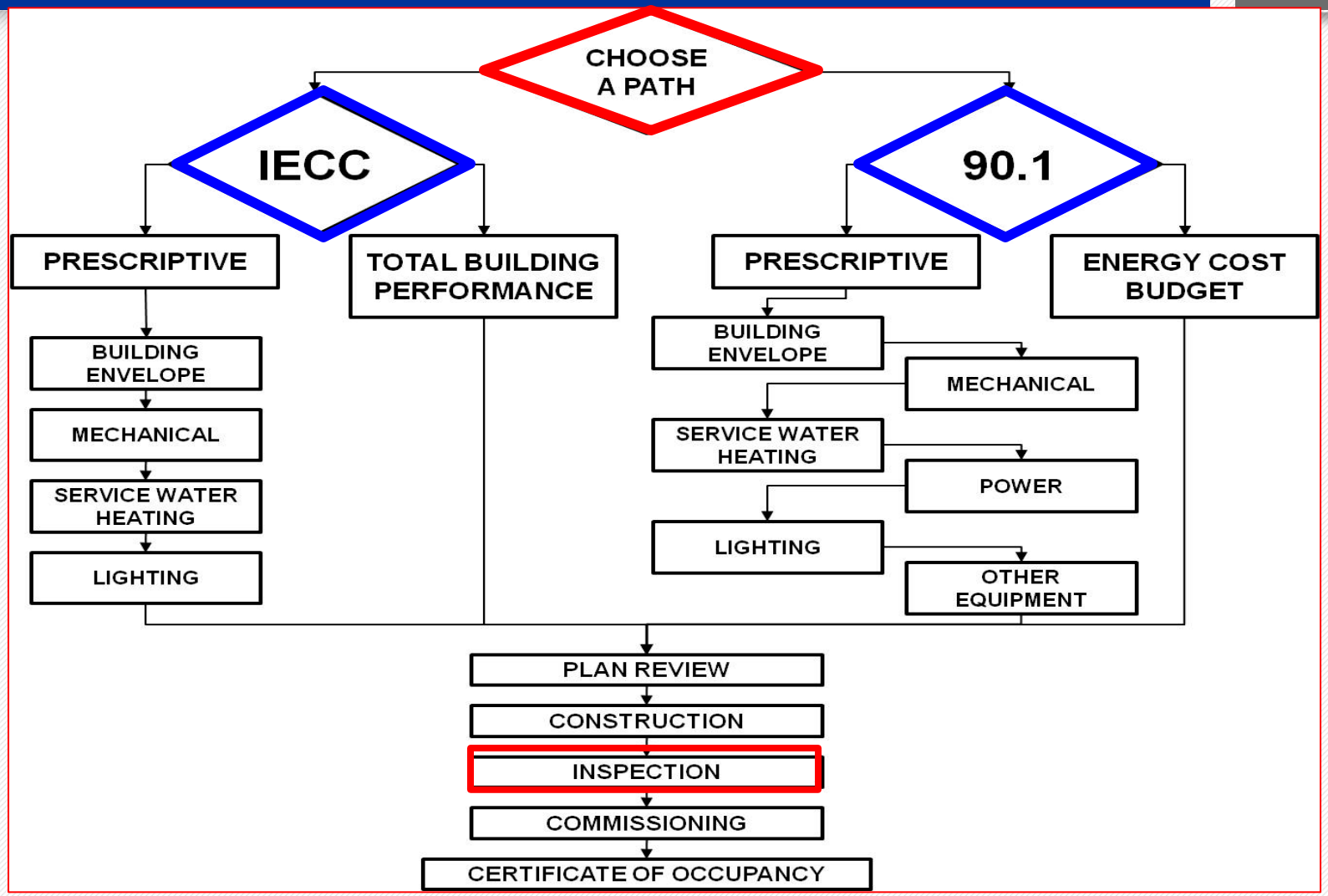
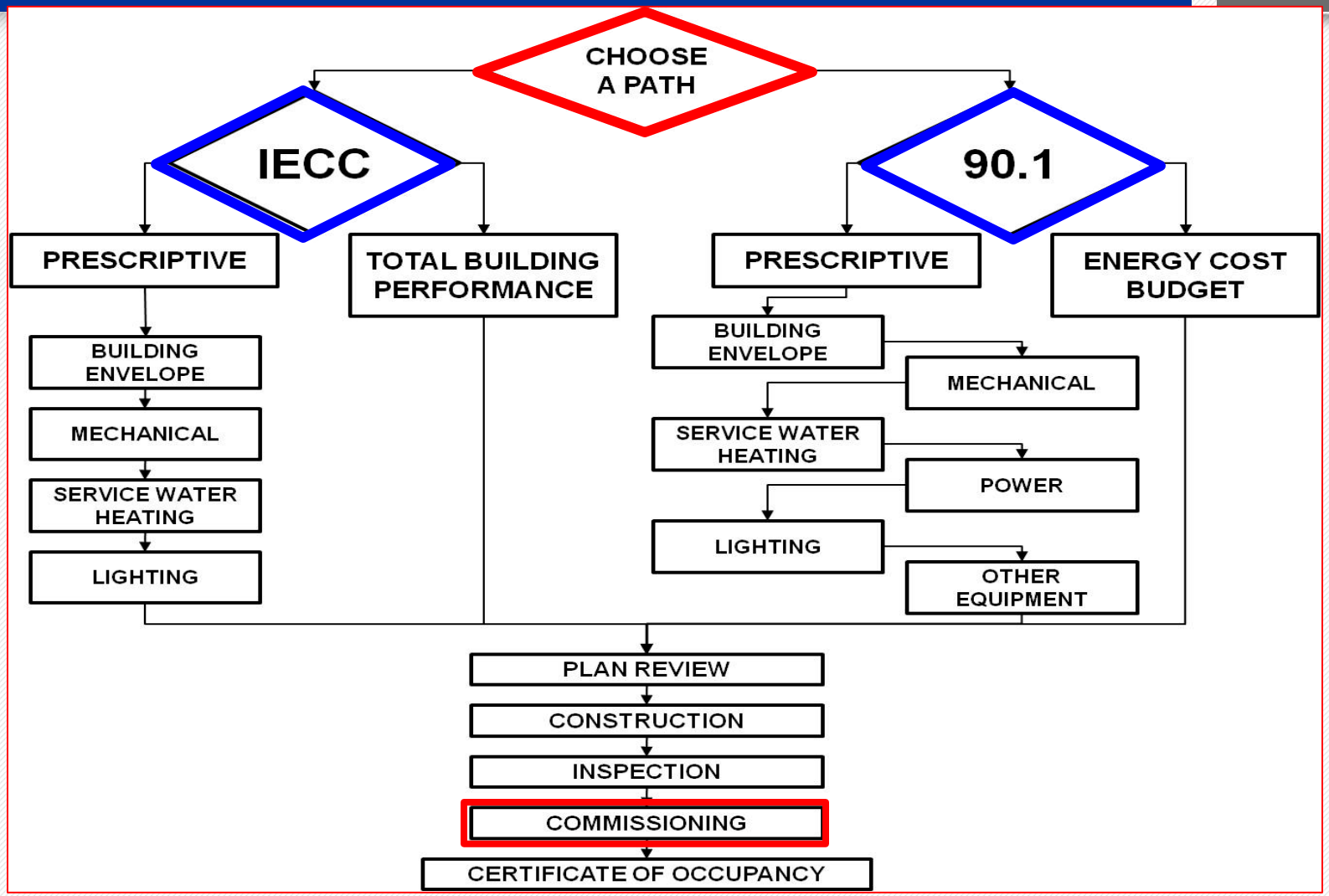


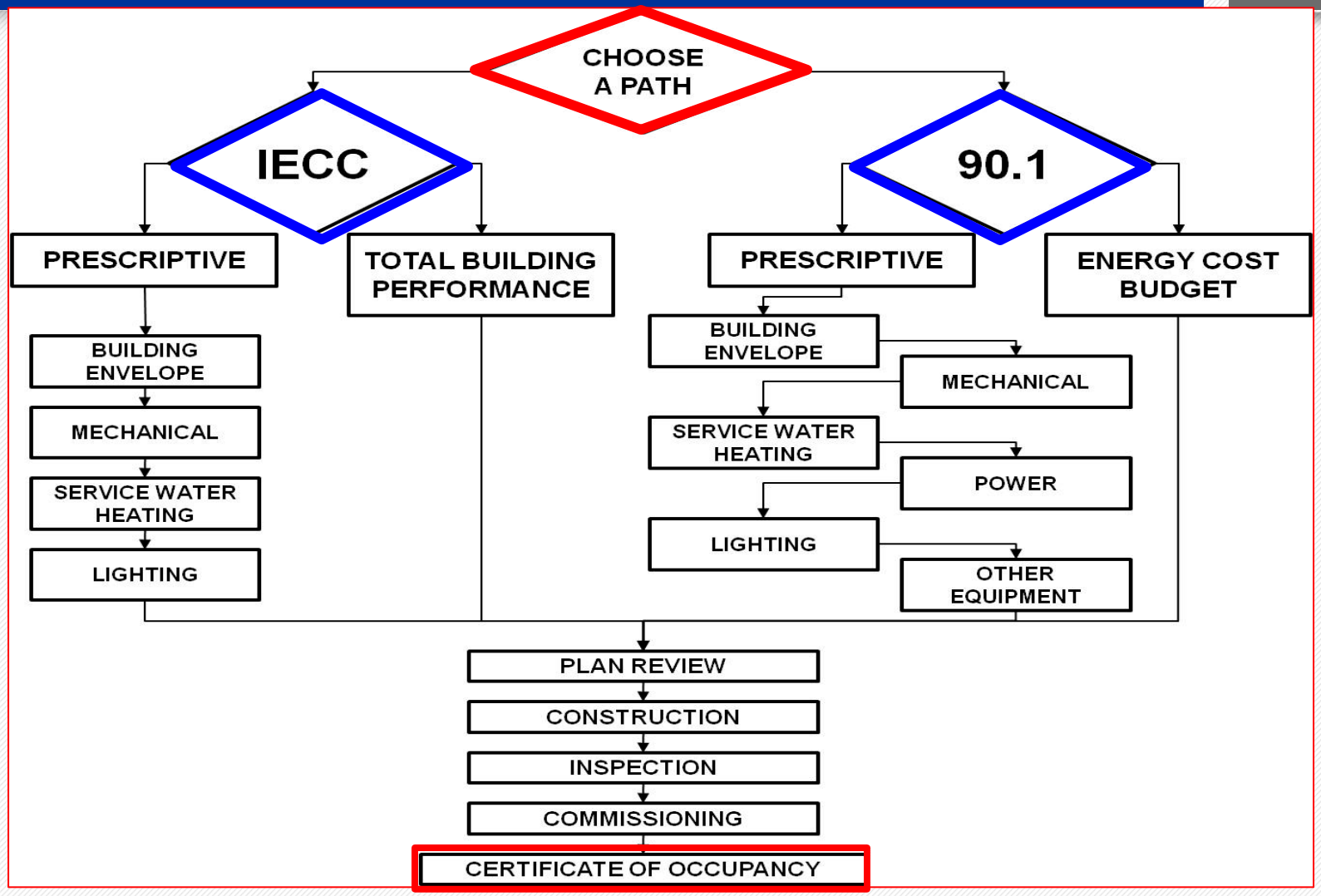
Commercial Energy Code Compliance Process 2012 IECC vs. ASHRAE 90.1-2010



Commercial Energy Code Compliance Process 2012 IECC vs. ASHRAE 90.1-2010



Commercial Energy Code Compliance Process 2012 IECC vs. ASHRAE 90.1-2010



Compliance Options – IECC

1

- 90.1-2010

OR

2

2012 IECC

- C402 - Envelope
- C403 - Mechanical
- C404 - SWH
- C405 - Lighting

OR

- COMcheck™

AND

- Pick One:
  - C406.2 – Eff. HVAC Performance

  or
  - C406.3 – Eff. Lighting Systems

  or
  - C406.4 – On-site Renewable Energy

OR

3

2012 IECC

- C407 – Total Building Performance
- C402.4 – Air Leakage
- C403.2 – Provisions applicable to all mechanical systems
- C404 – SWH
- Lighting Mandatory Sections
  - C405.2, C405.3, C405.4
  - C405.6, C405.7
- Energy **cost to be ≤ 85%** of Reference Building

Compliance Options – 90.1-2010

4

- 2012 IECC

OR

5

90.1-2010

- § 5 - Envelope
- § 6 - Mechanical
- § 7 - SWH
- § 8 - Power
- § 9 - Lighting
- § 10 - Elevators & Motors

OR

- COMcheck™

OR

- Normative Appendix 'G'

OR

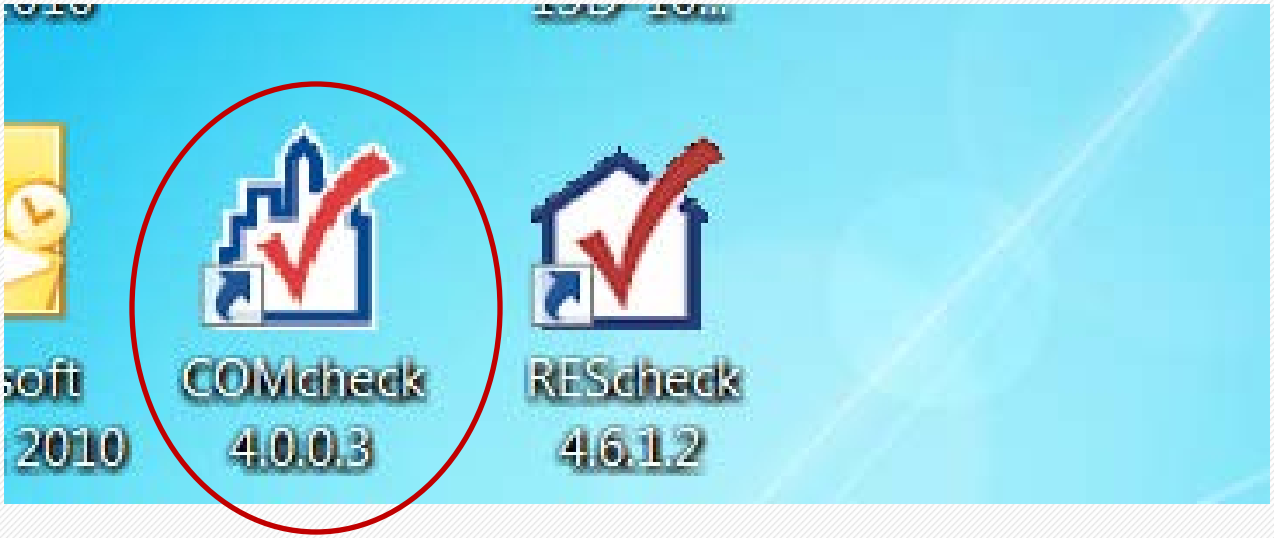
6

90.1-2010

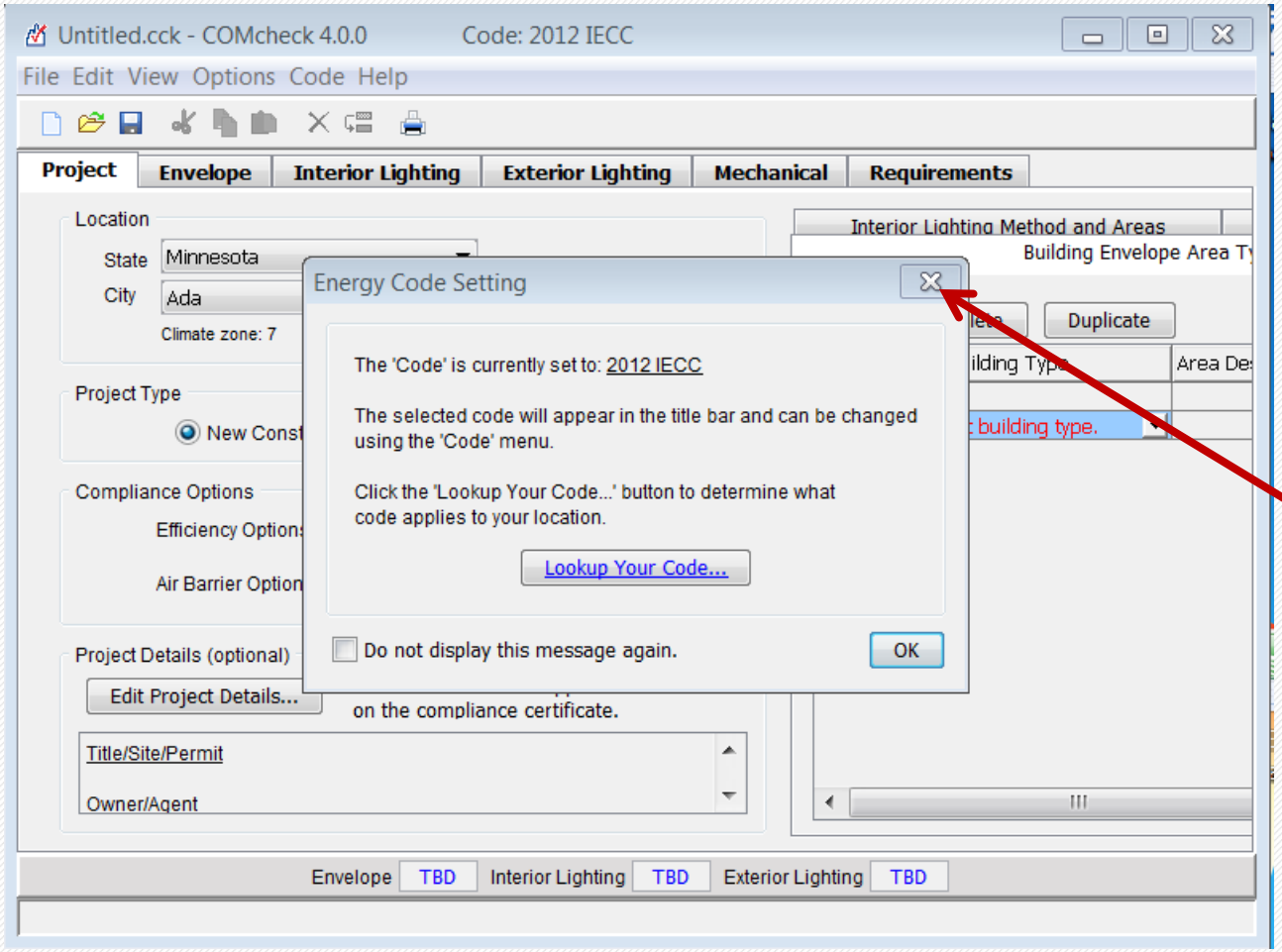
- § 11 - Energy Cost Budget
- § 5.4 - Air Leakage
- § 6.4 - Provisions applicable to all mechanical systems
- § 7.4 - SWH
- § 8.4 - Power
- § 9.4 - Lighting Mandatory Provisions
- § 10 - Elevators & Motors
- Energy cost of Proposed to **be ≤** of Reference Building

As Promised, Com-Check is back

- **Download COMcheck from Doe website: Energycodes.gov**



No Need to select a State:



Click to close window

Untitled.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Location

State: Minnesota

City: Ada

Climate zone: 7

Project Type

New Construction | Addition | Alterations

Compliance Options

Efficiency Options: Unspecified Help...

Air Barrier Options: Unspecified Help...

Project Details (optional)

Edit Project Details... This information will appear on the compliance certificate.

Title/Site/Permit

Owner/Agent

Designer/Contractor

Notes

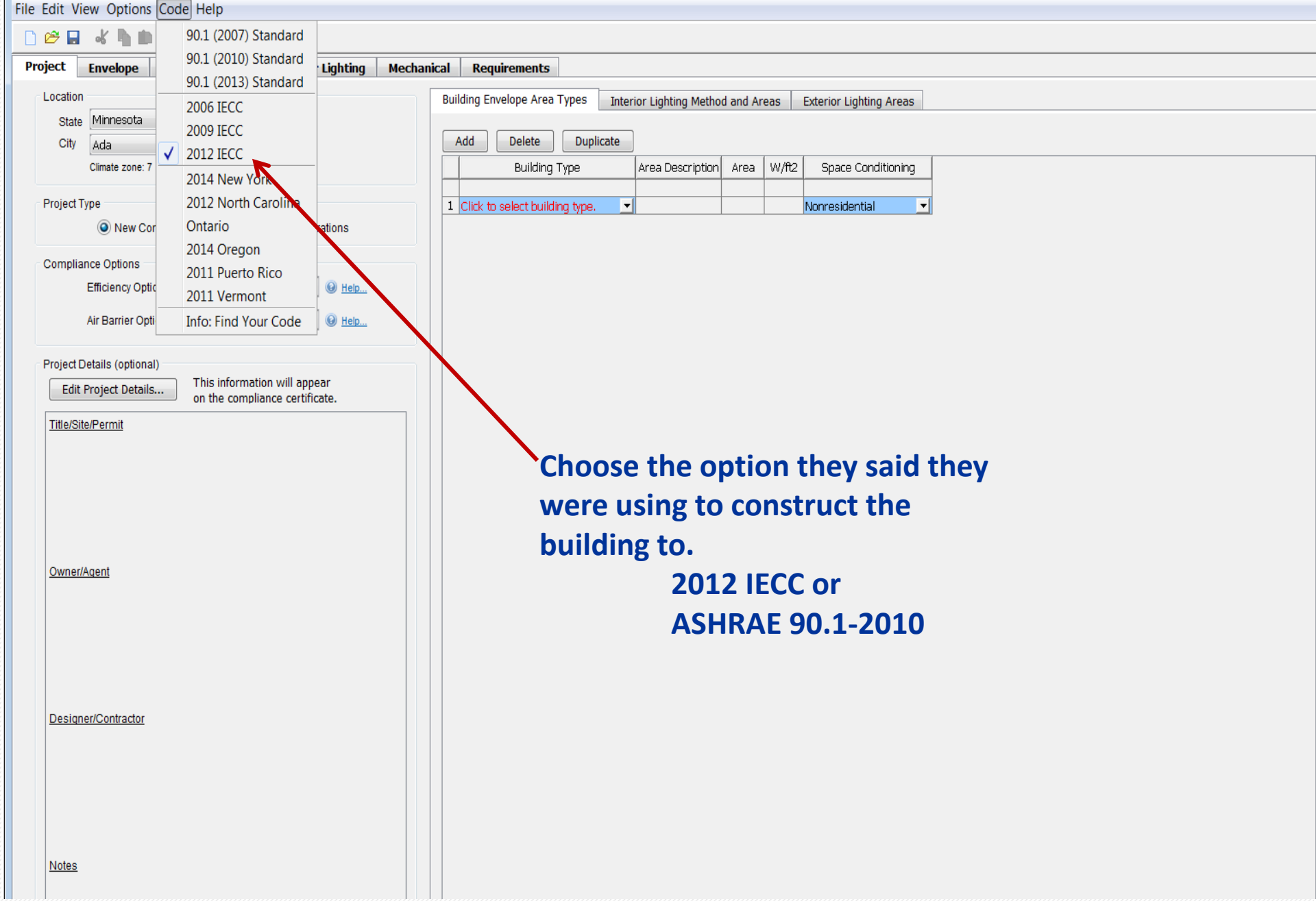
Building Envelope Area Types | Interior Lighting Method and Areas | Exterior Lighting Areas

Add | Delete | Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.				Nonresidential

Click on the word "Code" for dropdown window on options.

Envelope TBD | Interior Lighting TBD | Exterior Lighting TBD



Choose the option they said they were using to construct the building to.

2012 IECC or

ASHRAE 90.1-2010

Untitled.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Location

State: Minnesota

City: Ada

Climate zone: 7

Project Type

New Construction | Addition | Alterations

Compliance Options

Efficiency Options: Unspecified Help...

Air Barrier Options: Unspecified Help...

Project Details (optional)

Edit Project Details... This information will appear on the compliance certificate.

Title/Site/Permit

Owner/Agent

Designer/Contractor

Notes

Building Envelope Area Types | Interior Lighting Method and Areas | Exterior Lighting Areas

Add | Delete | Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.				Nonresidential

Click on State and City

Envelope TBD | Interior Lighting TBD | Exterior Lighting TBD

Untitled.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Location

State: Minnesota

City: Ada

Climate zone: 7

Project Type

New Construction | Addition | Alterations

Compliance Options

Efficiency Options: Unspecified Help...

Air Barrier Options: Unspecified Help...

Project Details (optional)

Edit Project Details... This information will appear on the compliance certificate.

Title/Site/Permit

Owner/Agent

Designer/Contractor

Notes

Building Envelope Area Types | Interior Lighting Method and Areas | Exterior Lighting Areas

Add | Delete | Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.				Nonresidential

Click on New Construction, Addition or Remodel

Envelope TBD | Interior Lighting TBD | Exterior Lighting TBD

Untitled.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Location

State: Minnesota

City: Ada

Climate zone: 7

Project Type

New Construction | Addition | Alterations

Compliance Options

Efficiency Options: Unspecified Help...

Air Barrier Options: Unspecified Help...

Project Details (optional)

Edit Project Details... This information will appear on the compliance certificate.

Title/Site/Permit

Owner/Agent

Designer/Contractor

Notes

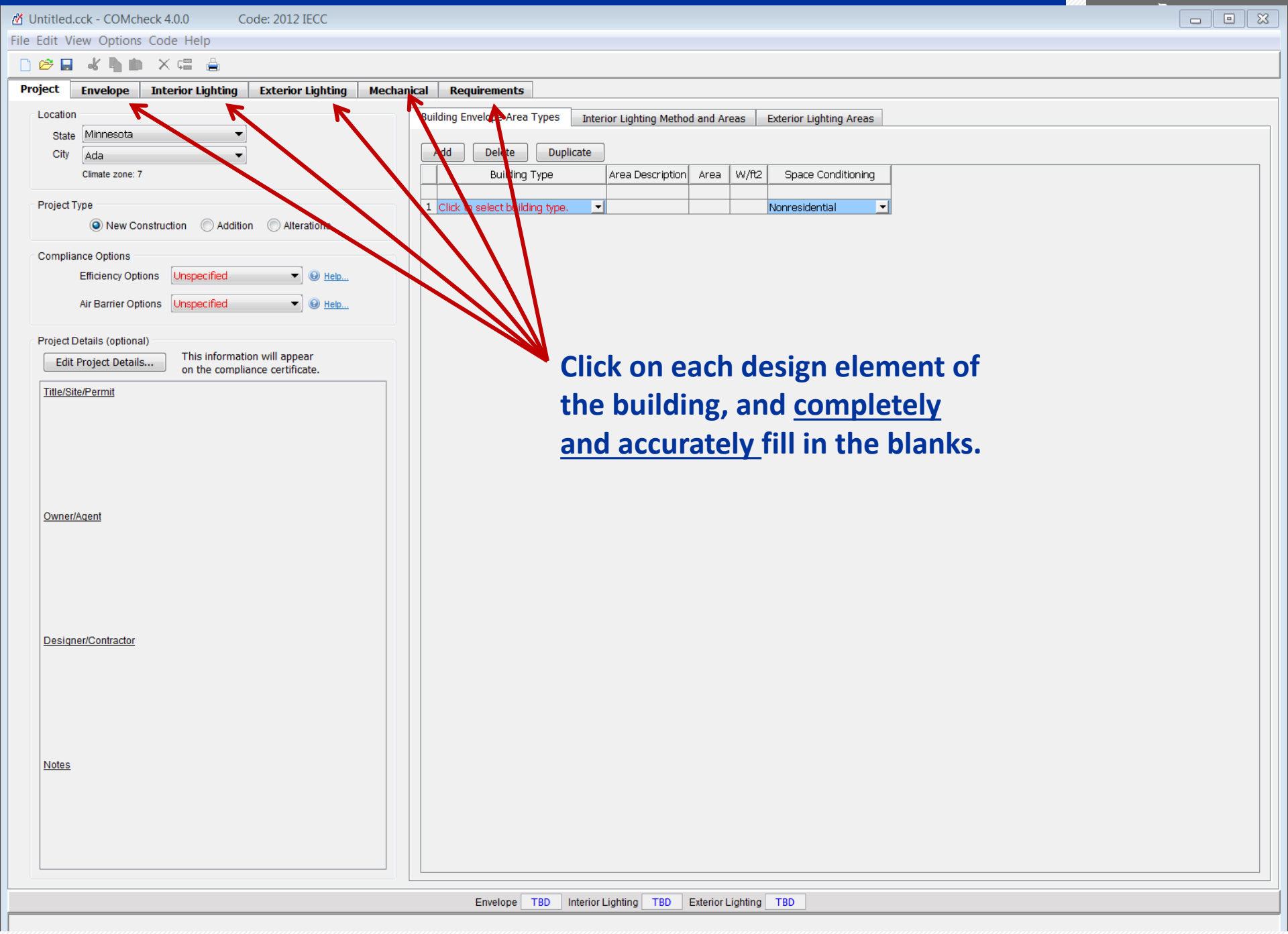
Building Envelope Area Types | Interior Lighting Method and Areas | Exterior Lighting Areas

Add | Delete | Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.				Nonresidential

Click on Additional energy features they selected as required in IECC Section C406.

Envelope TBD | Interior Lighting TBD | Exterior Lighting TBD



Click on each design element of the building, and <u>completely and accurately</u> fill in the blanks.

Untitled.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Location

State: Minnesota

City: Ada

Climate zone: 7

Project Type

New Construction | Addition | Alterations

Compliance Options

Efficiency Options: Unspecified Help...

Air Barrier Options: Unspecified Help...

Project Details (optional)

Edit Project Details... This information will appear on the compliance certificate.

Title/Site/Permit

Owner/Agent

Designer/Contractor

Notes

Building Envelope Area Types | Interior Lighting Method and Areas | Exterior Lighting Areas

Add | Delete | Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.				Nonresidential

Watch the bottom of the page for compliance percentages for Envelope, interior lighting and exterior lighting.

Envelope TBD | Interior Lighting TBD | Exterior Lighting TBD

Untitled.cck - COMcheck 4.0.0 Code: 2012 IECC

File Edit View Options Code Help

Project | Envelope | Interior Lighting | Exterior Lighting | Mechanical | Requirements

Location

State: Minnesota

City: Ada

Climate zone: 7

Project Type

New Construction | Addition | Alterations

Compliance Options

Efficiency Options: Unspecified Help...

Air Barrier Options: Unspecified Help...

Project Details (optional)

Edit Project Details... This information will appear on the compliance certificate.

Title/Site/Permit

Owner/Agent

Designer/Contractor

Notes

Building Envelope Area Types | Interior Lighting Method and Areas | Exterior Lighting Areas

Add | Delete | Duplicate

	Building Type	Area Description	Area	W/ft2	Space Conditioning
1	Click to select building type.				Nonresidential

Note: COM check does not calculate the mechanical equipment into the process. It is only there as a means of documenting what equipment is being installed

Envelope TBD | Interior Lighting TBD | Exterior Lighting TBD

Key Differences

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY
CONSTRUCTION CODES AND LICENSING

Building Envelope- Walls

ASHRAE Standard 90.1-2010

- **Specific designation for semi-heated spaces that are less vigorous than those for heated spaces**

Building Envelope- Walls

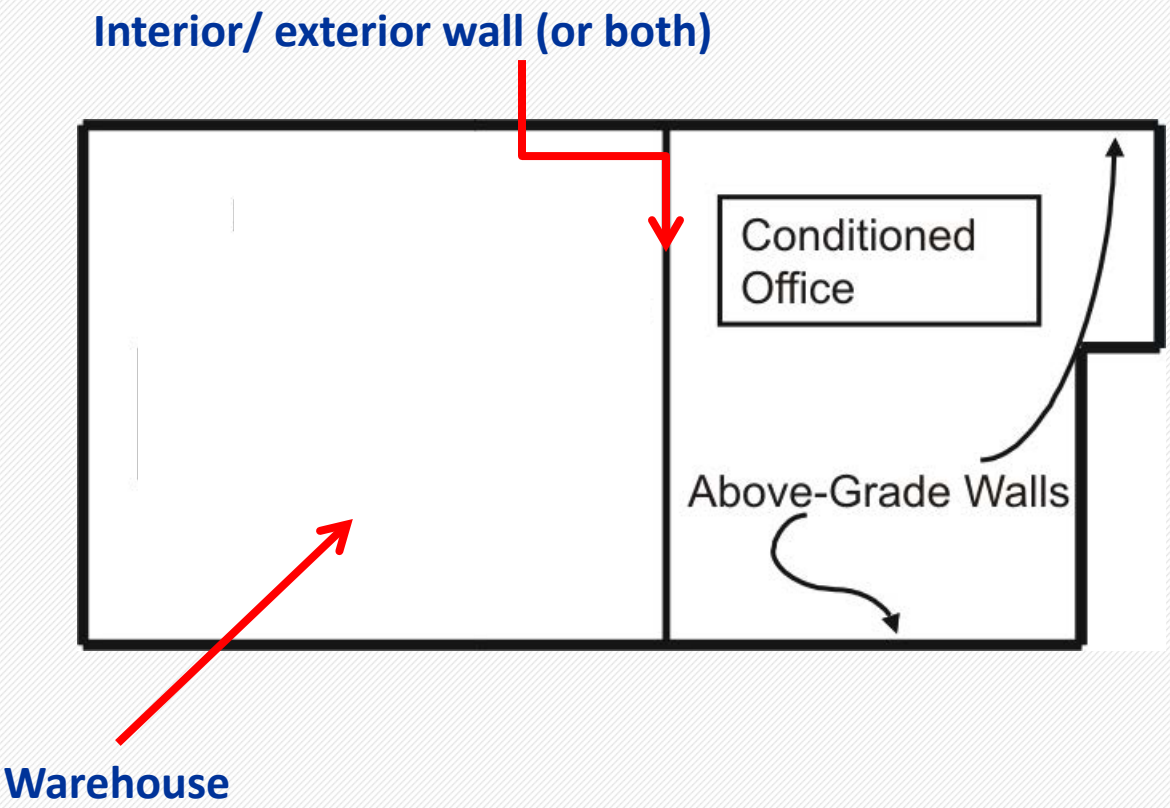
2012 IECC

- **No such designation and therefore treats all semi heated spaces as heated spaces**

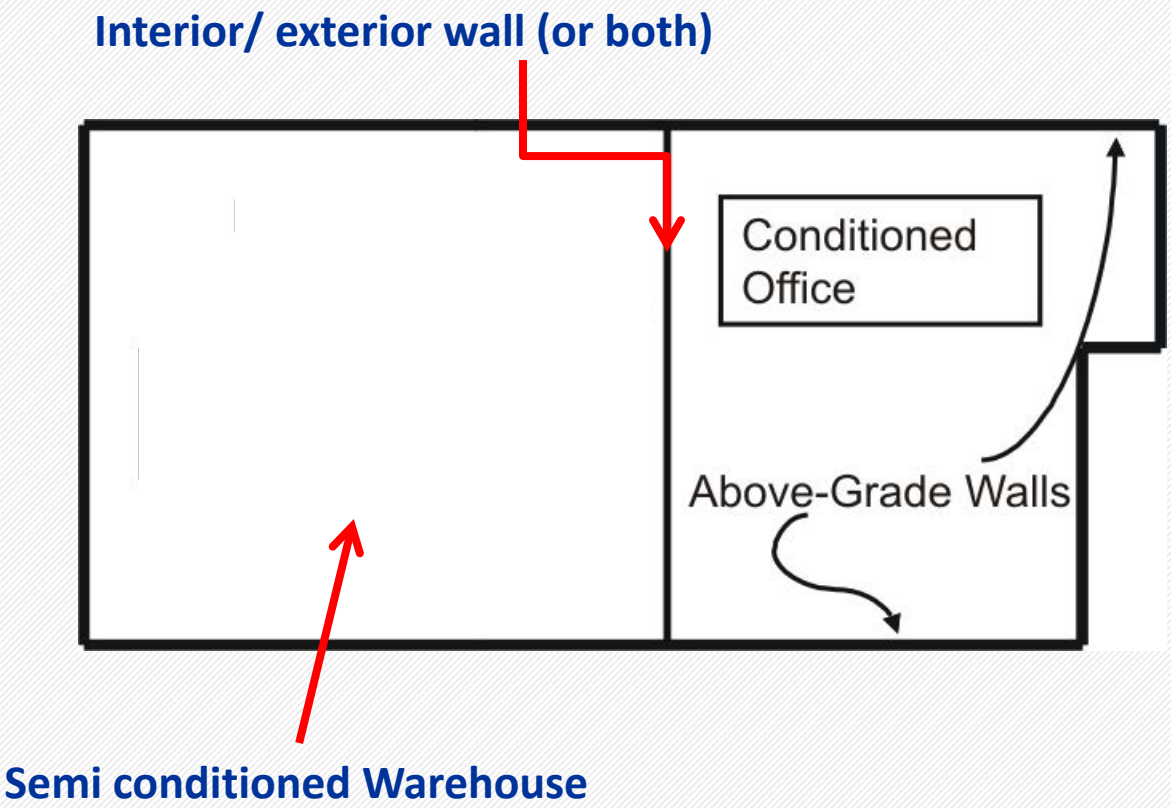
ASHRAE Standard 90.1-2010

- Specific designation for semi-heated spaces that are less vigorous than those for heated spaces

Example


Interior/ exterior wall (or both)
Conditioned Office
Above-Grade Walls
Warehouse

Example


Interior/ exterior wall (or both)
Conditioned Office
Above-Grade Walls
Semi conditioned Warehouse

Building envelope- Fenestration

ASHRAE Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights as roof area

Building envelope- Fenestration

2012 IECC

- **Allows up to 30% window to wall ratio.**
  - **Wall is defined as above grade only**
- **Allows up to 3% skylights to roof ratio.**

ASHRAE Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights to roof ratio.

Building envelope- Fenestration

2012 IECC

- **Allows up to 30% window to wall ratio.**
  - **Wall is defined as above grade only**
- **Allows up to 3% skylights to roof ratio.**
- **Because of the wall consideration for above grade only, the IECC is more likely to reach these limitations then one built to ASHRAE 90.1**
- **Maybe……**

ASHRAE Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights to roof ratio.

Building envelope- Fenestration

2012 IECC

- **Allows up to 30% window to wall ratio.**
  - **Wall is defined as above grade only**
- **Allows up to 3% skylights to roof ratio.**
- **However, the IECC will allow up to 40% of vertical fenestration in no less than 50% of the conditioned floor areas in a zone dedicated as using daylighting features and controls. (C 402.3.1.1)**
- **AHSRAE does not have this provision**

ASHRAE Standard 90.1-2010

- Allows up to 40% window to wall ratio.
  - Wall is defined as above or below grade
- Allows up to 5% skylights to roof ratio.

Building envelope- Fenestration

2012 IECC

ASHRAE Standard 90.1-2010

- **Limits the fenestration area** on the **east and West sides** of the building **by requiring the southern most side to have a greater fenestration area** than that of the East or West sides

Building envelope- Fenestration

2012 IECC

- **No provisions as these appear in the IECC**

ASHRAE Standard 90.1-2010

- Limits the fenestration area on the east and West sides of the building by requiring the southern most side to have a greater fenestration area than that of the East or West sides

Inspection of specific items

ASHRAE Standard 9.01-2010

- **This document is more specific in the details and what needs to be inspected**

Inspection of specific items

2012 IECC

- **Not as many details to inspect**

ASHRAE Standard 9.01-2010

- **This document is more specific in the details and what needs to be inspected**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ **Wall insulation after the insulation and vapor retarder are in place but before concealment**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ **Roof/ceiling insulation after roof/insulation is in place but before concealment**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ **Slab/foundation wall after slab/foundation insulation is in place but before concealment**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ **Fenestration after all glazing materials are in place**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ Fenestration after all glazing materials are in place
- ✓ **Continuous air barrier after installation but before concealment**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ Fenestration after all glazing materials are in place
- ✓ Continuous air barrier after installation but before concealment
- ✓ **Mechanical systems and equipment and insulation after installation but before concealment**

Building Envelope
Inspection of specific items

ASHRAE Standard 90.1-2010

- ✓ Wall insulation after the insulation and vapor retarder are in place but before concealment
- ✓ Roof/ceiling insulation after roof/insulation is in place but before concealment
- ✓ Slab/foundation wall after slab/foundation insulation is in place but before concealment
- ✓ Fenestration after all glazing materials are in place
- ✓ Continuous air barrier after installation but before concealment
- ✓ Mechanical systems and equipment and insulation after installation but before concealment
- ✓ **Electrical equipment and systems after installation but before concealment**

- **Sometimes the opaque assemblies are not consistent between the two documents even though the climate zone remains the same.**

- **Here are some examples:**

IECC- Roof insulation entirely above deck

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	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-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[a,b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	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-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-20 for 24″ below
Heated slabs[d]	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-7.5 for 12″ below	R-10 for 24″ below	R-10 for 24″ below	R-15 for 24″ below	R-15 for 24″ below	R-15 for 36″ below	R-15 for 36″ below	R-15 for 36″ below	R-20 for 48″ below	R-20 for 24″ below	R-20 for 48″ below	R-20 for 48″ below	R-20 for 48″ below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

IECC Roofs

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	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-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[a,b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	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-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below
Heated slabs[d]	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 36" below	R-15 for 36" below	R-15 for 36" below	R-20 for 48" below	R-20 for 24" below	R-20 for 48" below	R-20 for 48" below	R-20 for 48" below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

ASHRAE Section 5 – 5.5.1

TABLE 5.5-6 Building Envelope Requirements For Climate Zone 6

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-10.0 c.i.
Metal Buildings	U-0.049	R-13.0 + R-19.0	U-0.049	R-13.0 + R-19.0	U-0.072	R-16.0
Mass	U-0.064	R-12.5 c.i.	U-0.057	R-14.6 c.i.	U-0.137	R-4.2 c.i.
Steel-Joist	U-0.038	R-30.0	U-0.032	R-38.0	U-0.052	R-19.0
Wood-Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-0.051	R-19.0
Slab-On-Grade Floors						
Unheated	F-0.540	R-10 for 24 in.	F-0.520	R-15 for 24 in.	F-0.730	NR
Heated	F-0.860	R-15 for 24 in.	F-0.688	R-20 for 48 in.	F-1.020	R-7.5 for 12 in.
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Nonswinging	U-0.500		U-0.500		U-1.450	

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-10.0 c.i.
Metal Building	U-0.049	R-13.0+R-19.0	U-0.049	R-13.0+R-19.0	U-0.072	R-16.0
Attic and Other	U-0.027	R-38.0	U-0.027	R-38.0	U-0.034	R-30.0

Reference Table 5.5-6 on page 41 in 90.1-2010

IECC Roofs

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
	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-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-20ci	R-25ci	R-25ci	R-25ci	R-25ci	R-30ci	R-30ci	R-35ci	R-35ci	R-35ci	R-35ci
Metal buildings (with R-5 thermal blocks)[a,b]	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-19 + R-11 LS	R-25 + R-11 LS	R-25 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS	R-30 + R-11 LS
Attic and other	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-38	R-49	R-49	R-49	R-49	R-49	R-49	R-49
Walls, Above Grade																
Mass	R-5.7ci	R-5.7ci	R-5.7ci	R-7.6ci	R-7.6ci	R-9.5ci	R-9.5ci	R-11.4ci	R-11.4ci	R-13.3ci	R-13.3ci	R-15.2ci	R-15.2ci	R-15.2ci	R-25ci	R-25ci
Metal building	R-13+ R-6.5ci	R-13 + R-6.5ci	R13 + R-6.5ci	R-13 + R-13ci	R-13 + R-6.5ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13 + R-13ci	R-13+ R-19.5ci	R-13 + R-13ci	R-13+ R-19.5ci
Metal framed	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	R-13 + R-7.5ci	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-7.5ci	R-13+ R17.5ci
Wood framed and other	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-3.8ci or R-20	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-7.5ci or R-20 + R-3.8ci	R-13 + R-15.6ci or R-20 + R-10ci	R-13 + R-15.6ci or R-20 + R-10ci
Walls, Below Grade																
Below-grade wall[d]	NR	NR	NR	NR	NR	NR	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-7.5ci	R-10ci	R-10ci	R-10ci	R-12.5ci
Floors																
Mass	NR	NR	R-6.3ci	R-8.3ci	R-10ci	R-10ci	R-10ci	R-10.4ci	R-10ci	R-12.5ci	R-12.5ci	R-12.5ci	R-15ci	R-16.7ci	R-15ci	R-16.7ci
Joist/framing	NR	NR	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30	R-30[e]	R-30[e]	R-30[e]	R-30[e]	R-30[e]
Slab-on-Grade Floors																
Unheated slabs	NR	NR	NR	NR	NR	NR	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 24" below	R-20 for 24" below
Heated slabs[d]	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-7.5 for 12" below	R-10 for 24" below	R-10 for 24" below	R-15 for 24" below	R-15 for 24" below	R-15 for 36" below	R-15 for 36" below	R-15 for 36" below	R-20 for 48" below	R-20 for 24" below	R-20 for 48" below	R-20 for 48" below	R-20 for 48" below
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

LS = Liner System—A continuous membrane installed below the purlins and uninterrupted by framing members. Uncompressed, unfaced insulation rests on top of the membrane between the purlins.

a. Assembly descriptions can be found in ANSI/ASHRAE/IESNA Appendix A.

b. Where using *R*-value compliance method, a thermal spacer block shall be provided, otherwise use the *U*-factor compliance method in Table C402.1.2.

c. R-5.7ci is allowed to be substituted with concrete block walls complying with ASTM C 90, ungrouted or partially grouted at 32 inches or less on center vertically and 48 inches or less on center horizontally, with ungrouted cores filled with materials having a maximum thermal conductivity of 0.44 Btu-in/h-f^2 °F.

d. Where heated slabs are below grade, below-grade walls shall comply with the exterior insulation requirements for heated slabs.

e. Steel floor joist systems shall be insulated to R-38.

ASHRAE Section 5 – 5.5.1

TABLE 5.5-7 Building Envelope Requirements For Climate Zone 7

Opaque Elements	Nonresidential		Residential		Semiheated	
	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value	Assembly Maximum	Insulation Min. R-Value
Roofs						
Insulation Entirely above Deck	U-0.048	R-20.0 c.i.	U-0.048	R-20.0 c.i.	U-0.093	R-10.0 c.i.
Metal Building	U-0.049	R-13.0+R-19.0	U-0.049	R-13.0+R-19.0	U-0.072	R-16.0
Attic and Other	U-0.027	R-38.0	U-0.027	R-38.0	U-0.034	R-30.0

Reference Table 5.5-7 on page 32 in 90.1-2010

Building envelope- Above Grade Wall Insulation

2012 IECC

- **Does not define wall types in the document. We need to look to ASHREAE Standard 90.1 for those definitions.**

ASHRAE Standard 90.1-2010

- **Four types of walls are defined**

Building envelope- Above Grade Wall Insulation

ASHRAE Standard 90.1-2010

- **Four types of walls are defined**
  - ✓ **Mass walls**
    - – **heat capacity determined from Table A3.1B or A3.1C**

Building envelope- Above Grade Wall Insulation

ASHRAE Standard 90.1-2010

- **Four types of walls are defined**
  - ✓ **Mass walls**
    - heat capacity determined from Table A3.1B or A3.1C
    - **R-value is for continuous insulation or when uninterrupted by framing other than metal clips no closer than 24 in. o.c. horizontally and 16 in. o.c. vertically**

Building envelope- Above Grade Wall Insulation

ASHRAE Standard 90.1-2010

- **Four types of walls are defined (cont.)**
  - ✓ **Metal building** wall R-value
    - for insulation compressed between metal wall panels and the steel structure

Building envelope- Above Grade Wall Insulation

ASHRAE Standard 90.1-2010

- **Four types of walls are defined (cont.)**
  - ✓ **Metal building** wall R-value
    - for insulation compressed between metal wall panels and the steel structure
  - ✓ **Steel-framed** wall R-value
    - for uncompressed insulation installed in the cavity between steel studs

Building envelope- Above Grade Wall Insulation

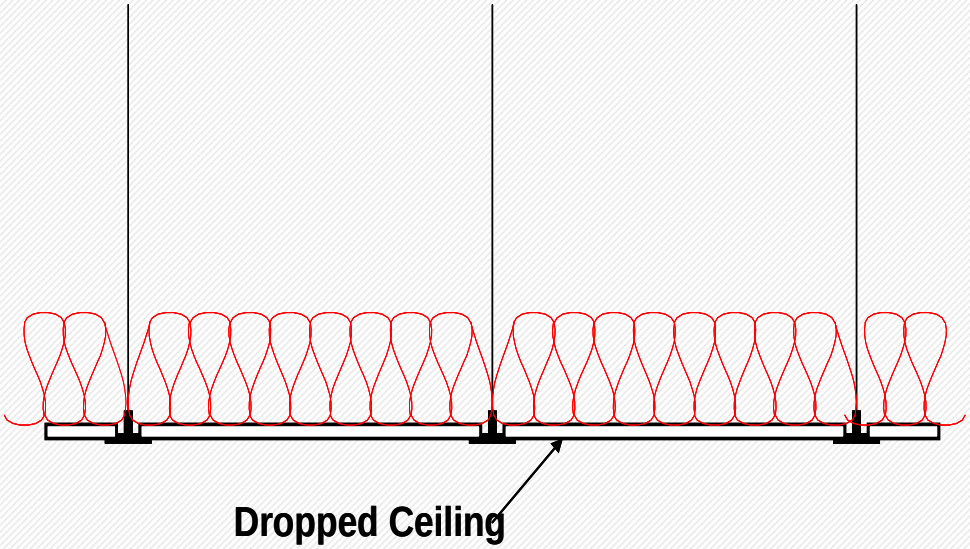
ASHRAE Standard 90.1-2010

- **Four types of walls are defined (cont.)**
  - ✓ **Metal building** wall R-value
    - for insulation compressed between metal wall panels and the steel structure
  - ✓ **Steel-framed** wall R-value
    - for uncompressed insulation installed in the cavity between steel studs
  - ✓ **Wood-framed and other** R-value

    for uncompressed insulation installed in the cavity between wood studs; also acceptable to be continuous insulation uninterrupted by studs

C402.2.1 – Insulating Suspended Ceilings with Removable Ceiling Tiles

- **Will not count for code compliance**
- **Not considered part of the minimum thermal resistance of the roof insulation**



C303.1.3 -Fenestration product rating

Fenestration product rating:

"Label or Table"

NFRC

National Fenestration Rating Council

CERTIFIED

World's Best Window Co.

Millennium 2000+ Casement

Vinyl-Clad Wood Frame
Double Glaze • Argon Fill • Low E

ENERGY Performance

- Energy savings will depend on your specific climate, house and lifestyle
- For more information, call [manufacturer's phone number] or visit NFRC's web site at www.nfrc.org

Technical Information

	U-Factor	Solar Heat Gain Coefficient	Visible Transmittance	Air Leakage
Res	.32	.45	.58	.3
Non-Res	.31	.45	.60	.3

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product energy performance. NFRC ratings are determined for a fixed set of environmental conditions and specific product sizes.

Default table C 303.1.3(1)

Fenestration product rating:

"Label or Table"

FRAME TYPE	SINGLE PANE	DOUBLE PANE	SKYLIGHT	
			Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

C402.3 – Fenestration Prescriptive Compliance

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \leq PF < 0.5$	1.1	1.2
$PF \leq 0.5$	1.2	1.6

C402.3 – Fenestration Prescriptive Compliance

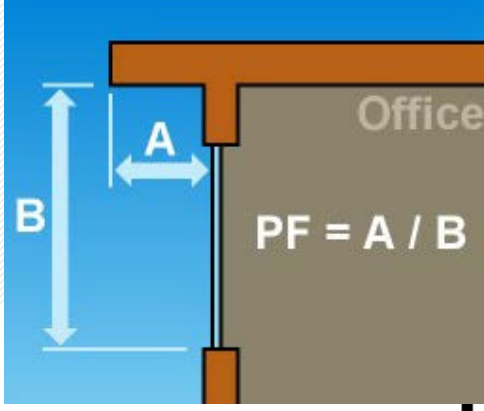


TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \leq PF < 0.5$	1.1	1.2
$PF \leq 0.5$	1.2	1.6

C402.3 – Fenestration Prescriptive Compliance

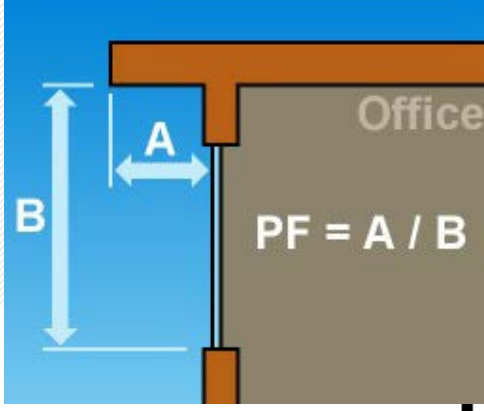


TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

C402.3 – Fenestration Prescriptive Compliance

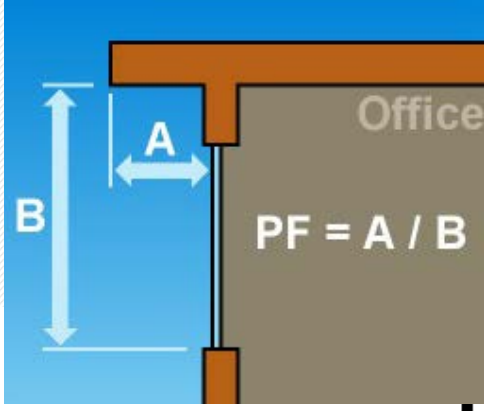


TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

TABLE C402.3
BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
Vertical fenestration								
U-factor								
Fixed fenestration	0.50	0.50	0.46	0.38	0.38	0.36	0.29	0.29
Operable fenestration	0.65	0.65	0.60	0.45	0.45	0.43	0.37	0.37
Entrance doors	1.10	0.83	0.77	0.77	0.77	0.77	0.77	0.77
SHGC								
SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
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$PF \le 0.5$	1.2	1.6

Current SHGC requirement = 0.40 (or) 0.45
South-Facing Fenestration (PF = 0.33) (2/6)

C402.3 – Fenestration Prescriptive Compliance

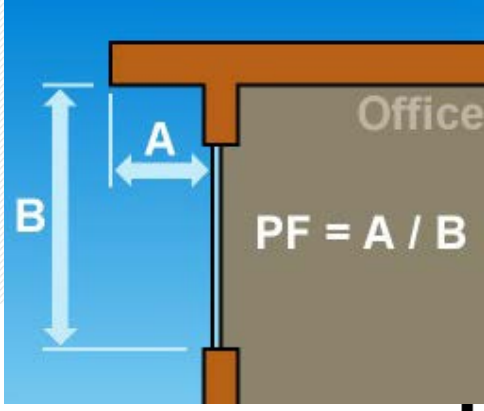

TABLE C402.2
OPAQUE THERMAL ENVELOPE REQUIREMENTS[a]

CLIMATE ZONE	1		2		3		4 EXCEPT MARINE		5 AND MARINE 4		6		7		8	
Opaque Doors																
Swinging	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.61	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37	U-0.37
Roll-up or sliding	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75	R-4.75

For SI: 1 inch = 25.4 mm. ci = Continuous insulation. NR = No requirement.

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BUILDING ENVELOPE REQUIREMENTS: FENESTRATION

CLIMATE ZONE	1	2	3	4 EXCEPT MARINE	5 AND MARINE 4	6	7	8
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SHGC	0.25	0.25	0.25	0.40	0.40	0.40	0.45	0.45
Skylights								
U-factor	0.75	0.65	0.55	0.50	0.50	0.50	0.50	0.50
SHGC	0.35	0.35	0.35	0.40	0.40	0.40	NR	NR

NR = No requirement.

TABLE C402.3.3.1
SHGC ADJUSTMENT MULTIPLIERS

PROJECTION FACTOR	ORIENTED WITHIN 45 DEGREES OF TRUE NORTH	ALL OTHER ORIENTATION
$0.2 \le PF < 0.5$	1.1	1.2
$PF \le 0.5$	1.2	1.6

Current SHGC requirement = 0.40 (or) 0.45

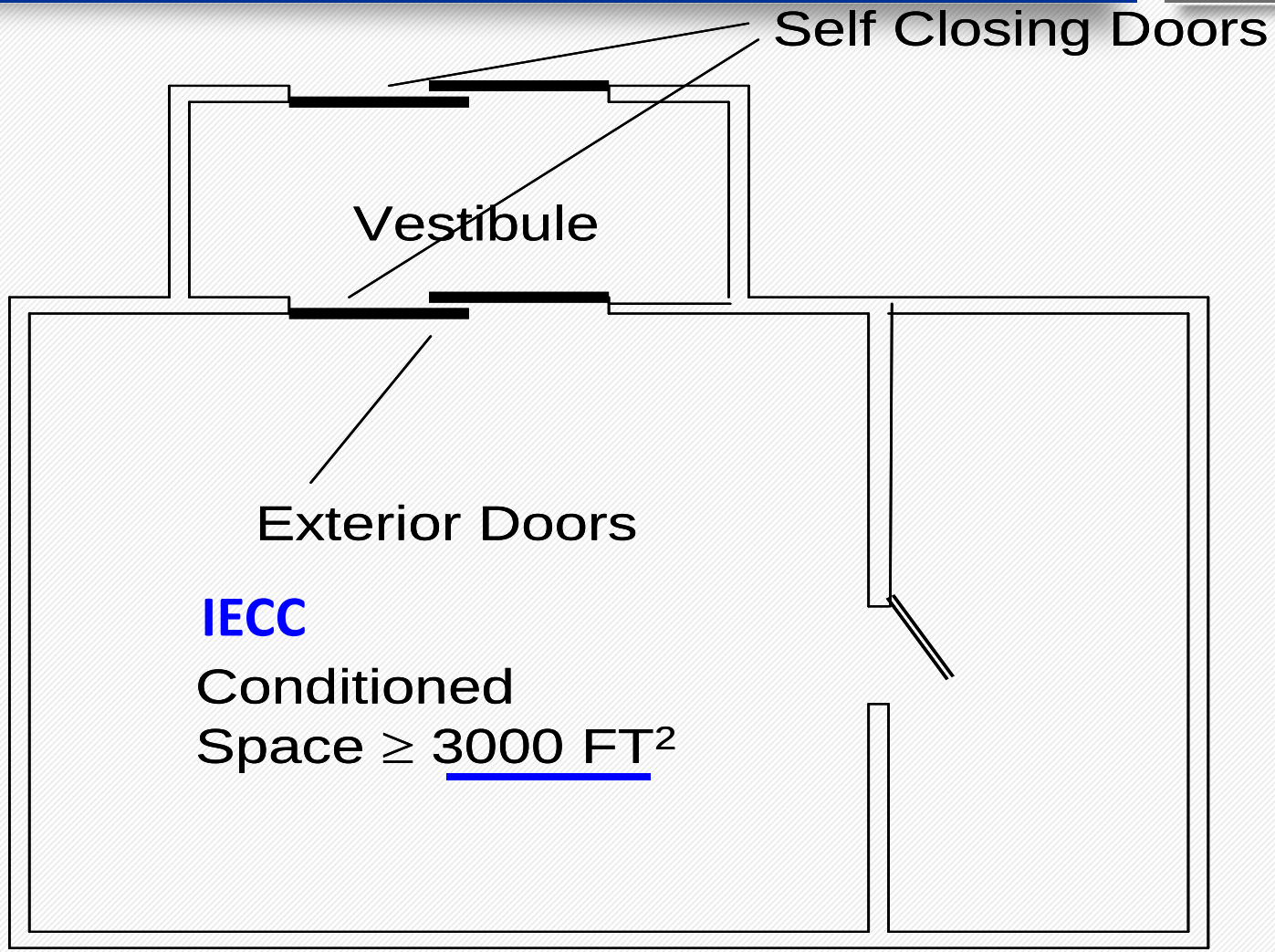
South-Facing Fenestration (PF = 0.33) (2/6)

Adjustment = 0.40 x 1.2 = 0.48 (Zone 6)

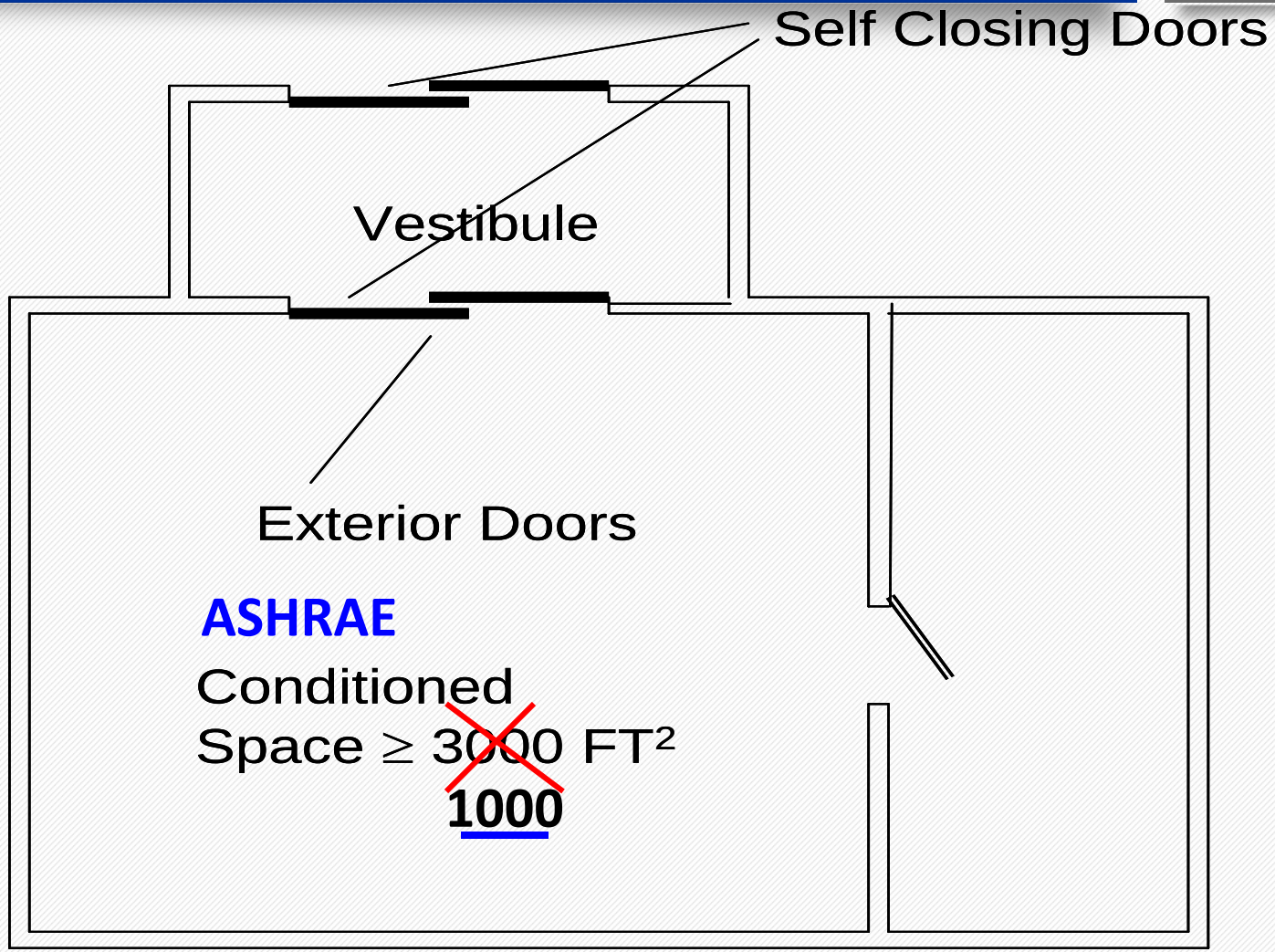
(or)

= 0.45 x 1.2 = 0.54 (Zone 7)

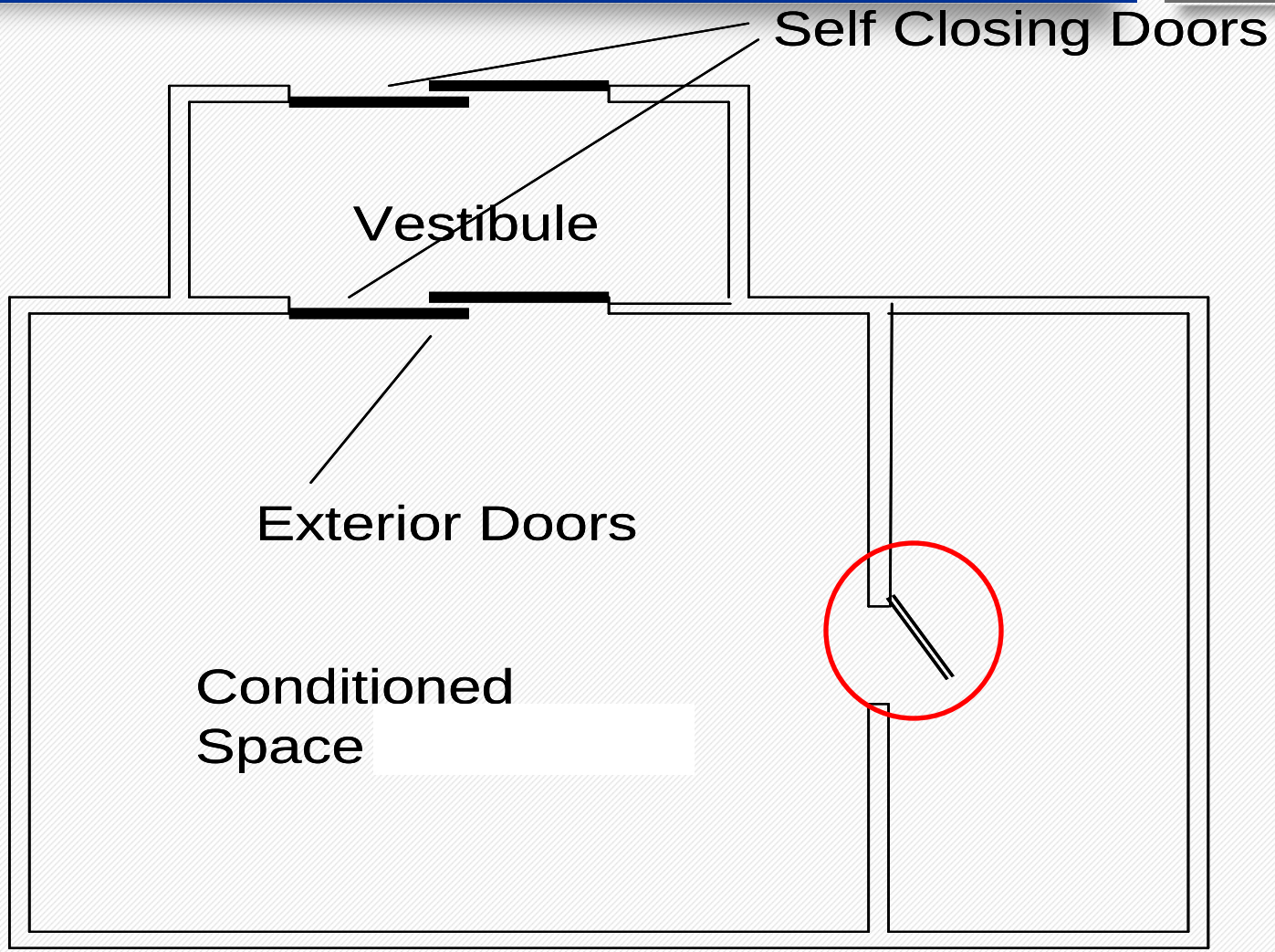
Vestibules


Self Closing Doors
Vestibule
Exterior Doors
IECC
Conditioned
Space ≥ 3000 FT²

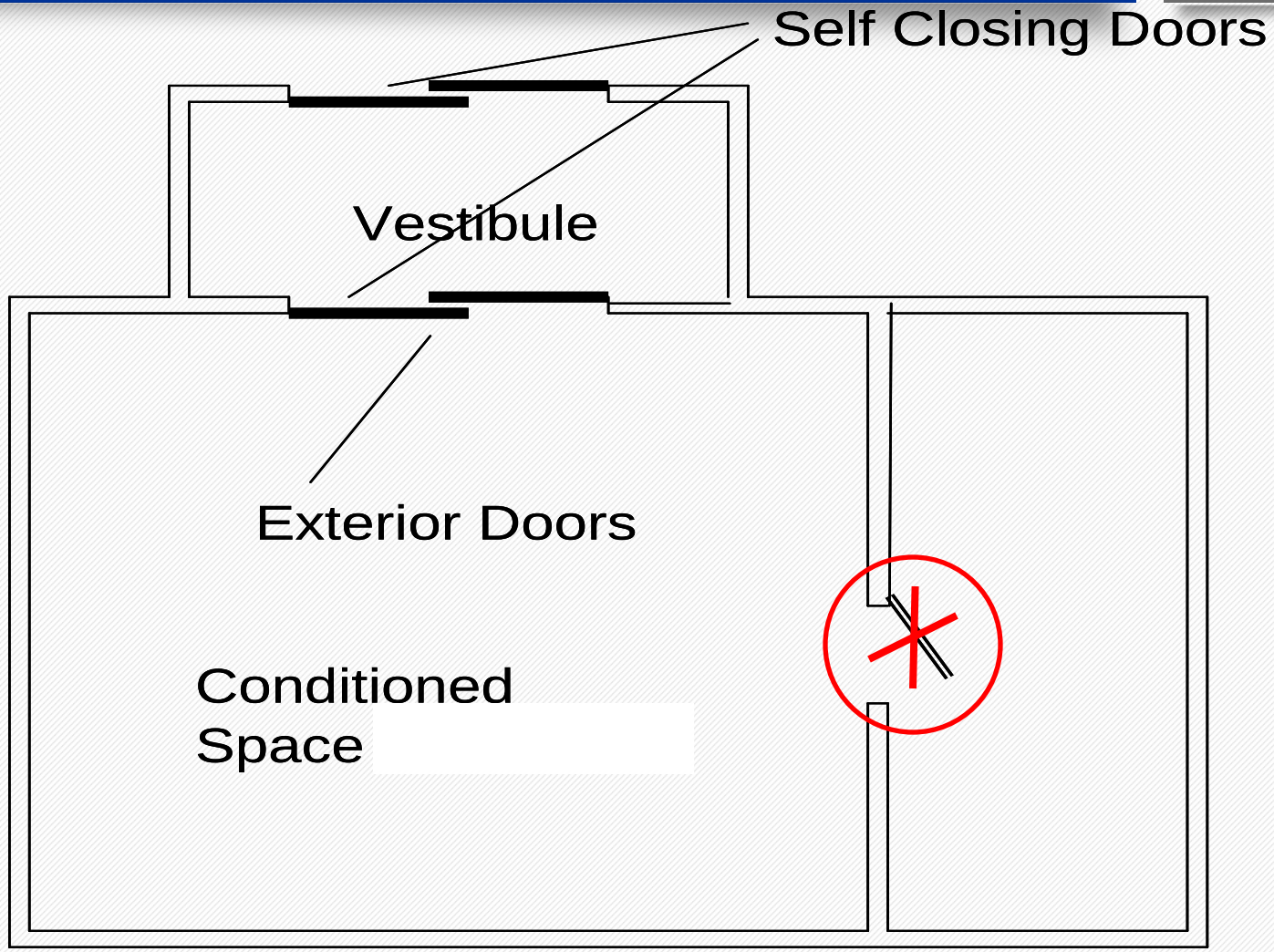
Vestibules


Self Closing Doors
Vestibule
Exterior Doors
ASHRAE
Conditioned
Space ≥ 3000 FT²
1000

Space and storage area.
Do I keep a door or an opening?



Space and storage area.
Do I keep a door or an opening?



IECC/ ASHRAE Sections we have not discussed today

- **Lighting (includes)**
  - Building area method
  - Space by space method
  - Interior lighting & controls
    - Tradeable surfaces
  - Exterior lighting & controls
    - Exterior lighting Zones
  - Daylighting (natural light)
  - Controls
    - Including daylight areas
- **Power (includes)**
  - Voltage drop
  - Transformer regulations
- **Mechanical (includes)**
  - Simple system
  - Complex systems
  - Commissioning
    - Commissioning reports
  - Functional performance testing
  - Economizers
  - Heating systems
  - Cooling systems
  - System controls
  - System designs
- **Service Water Heating**

Questions or Comments
Or
Comments before lunch?

MINNESOTA DEPARTMENT OF
LABOR & INDUSTRY
CONSTRUCTION CODES AND LICENSING