Residential Energy Code- 1322

Commercial Energy Code-1323

Presented by
Building Codes and Standards Unit
Construction Codes and Licensing Division

Which energy code?

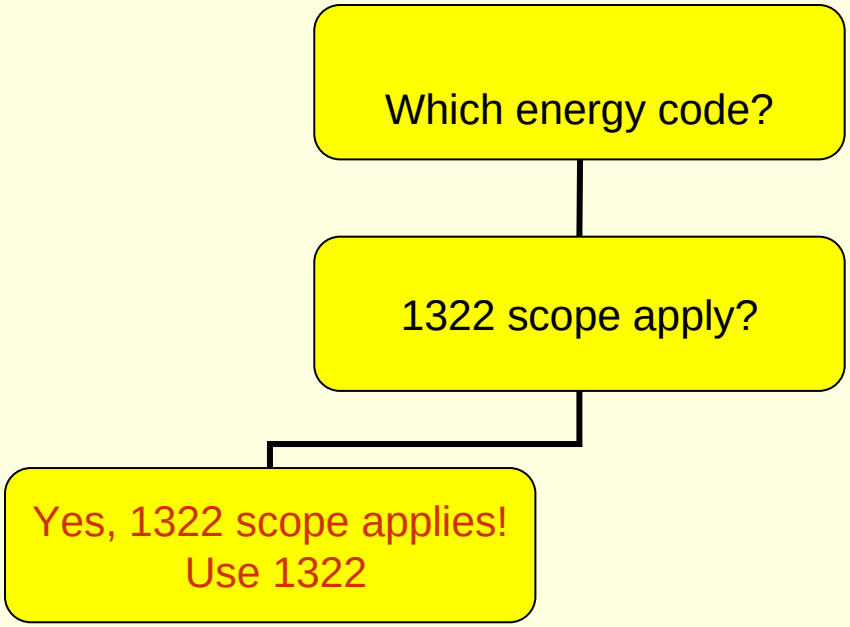
1322? OR

1323?

Which energy code?

1322? OR

1323?

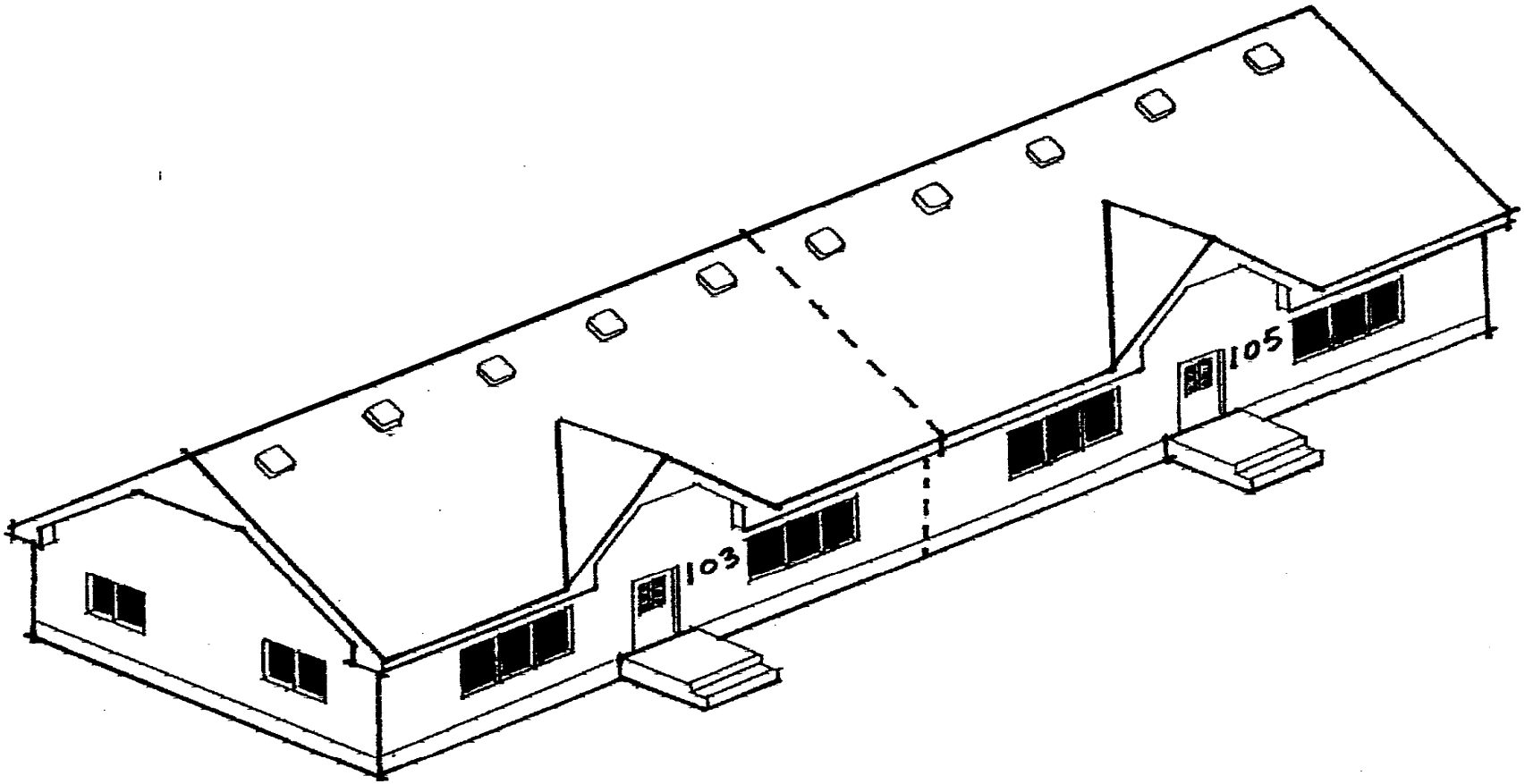

Which energy code?
1322 scope apply?
Yes, 1322 scope applies!
Use 1322

When is 1322 applicable?

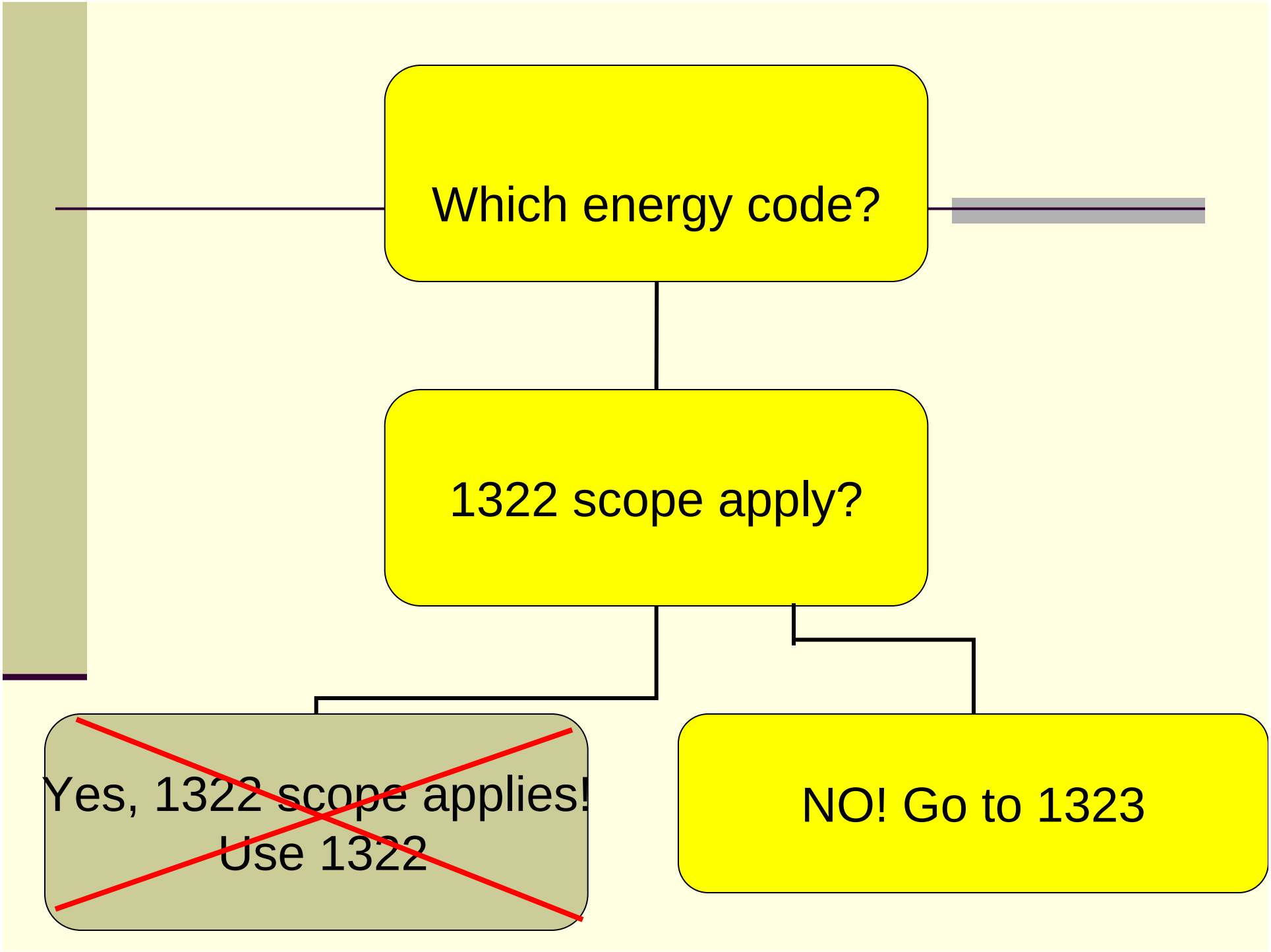
- Scope of 1322 :
  - Not more than three stories in height
  - Contain no conditioned common space that is shared between dwellings
  - Each dwelling contains a separate means of egress.

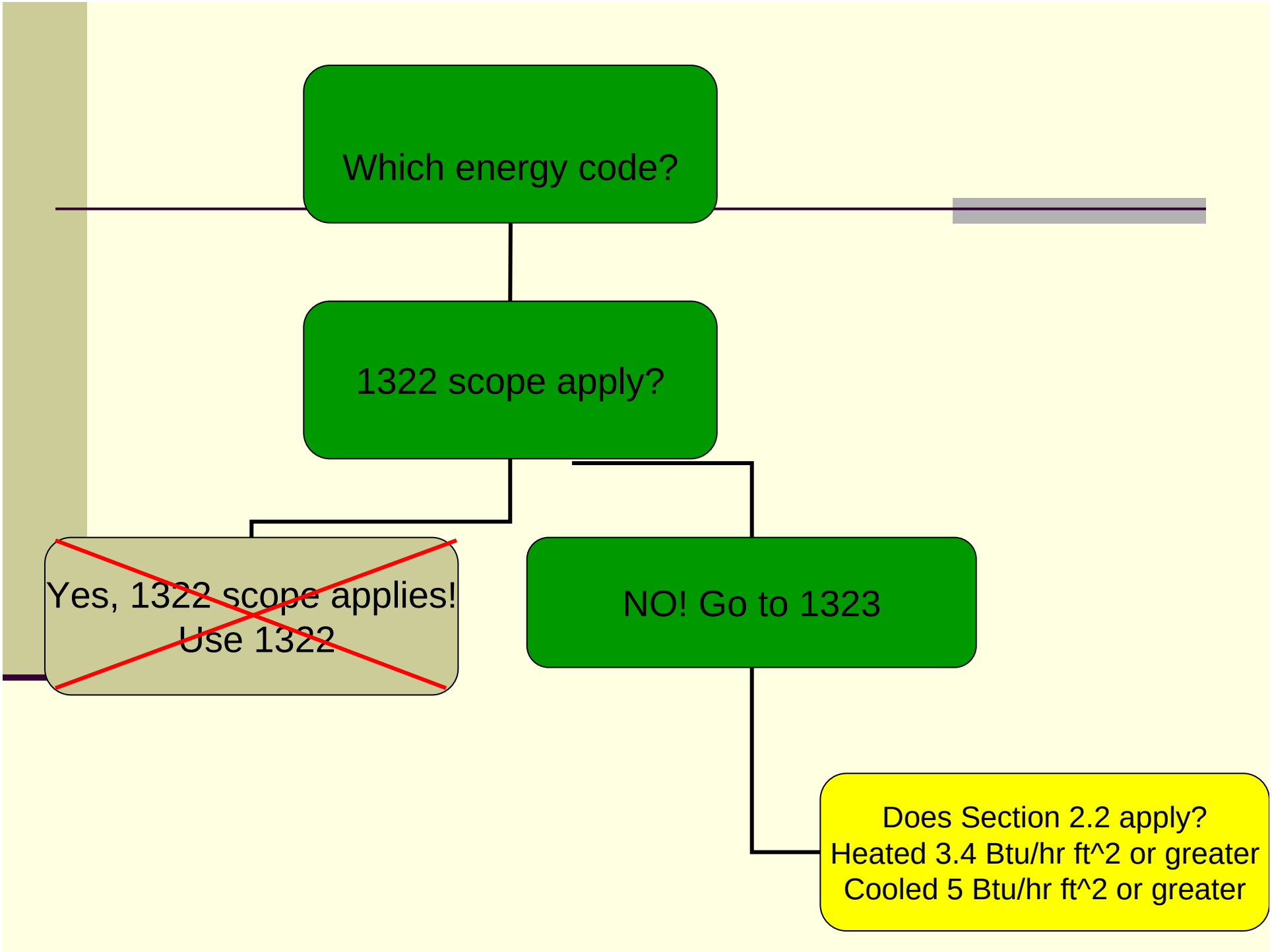
Single Family Dwellings

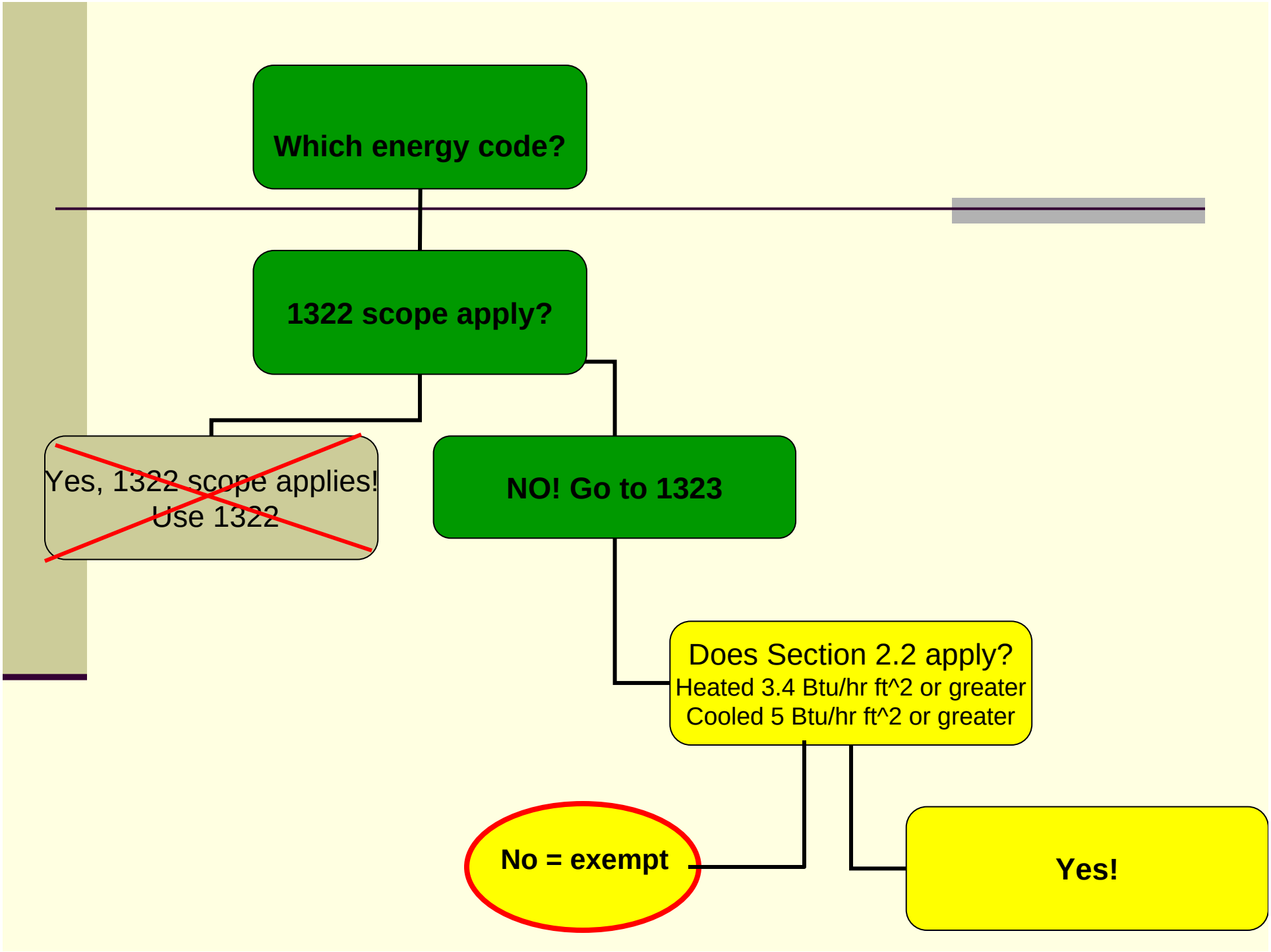
Two Family Dwellings

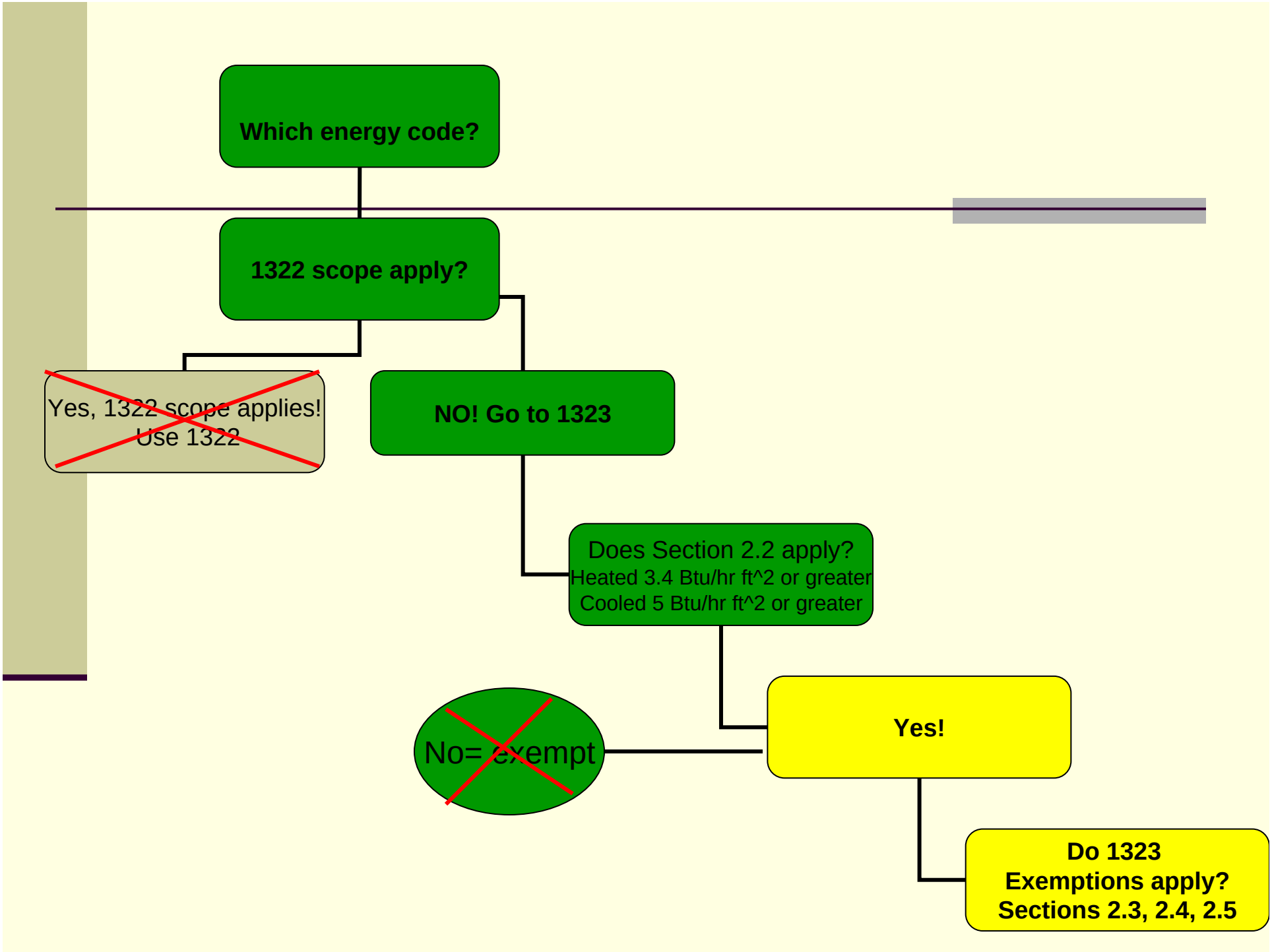


Townhouses


Which energy code?
1322 scope apply?
Yes, 1322 scope applies! Use 1322
NO! Go to 1323


Which energy code?
1322 scope apply?
Yes, 1322 scope applies!
Use 1322
NO! Go to 1323
Does Section 2.2 apply?
Heated 3.4 Btu/hr ft^2 or greater
Cooled 5 Btu/hr ft^2 or greater


Which energy code?
1322 scope apply?
Yes, 1322 scope applies!
Use 1322
NO! Go to 1323
Does Section 2.2 apply?
Heated 3.4 Btu/hr ft^2 or greater
Cooled 5 Btu/hr ft^2 or greater
No = exempt
Yes!


Which energy code?
1322 scope apply?
Yes, 1322 scope applies! Use 1322
NO! Go to 1323
Does Section 2.2 apply?
Heated 3.4 Btu/hr ft^2 or greater
Cooled 5 Btu/hr ft^2 or greater
No= exempt
Yes!
Do 1323
Exemptions apply?
Sections 2.3, 2.4, 2.5

When is 1323 applicable?

- **Exemptions in scope of 1323:**
  - **Single-family houses, multi-family structures of three stories or fewer above grade as well as manufactured houses (2.3).**
  - **Buildings that don't use electricity or fossil fuel (2.3).**
  - **Equipment and portions of building systems that use energy for industrial, manufacturing, or commercial purposes (2.3).**

  - **Certain other buildings or elements of buildings shall be exempt (2.4). HUH?**

Certain other buildings or building components (2.4):

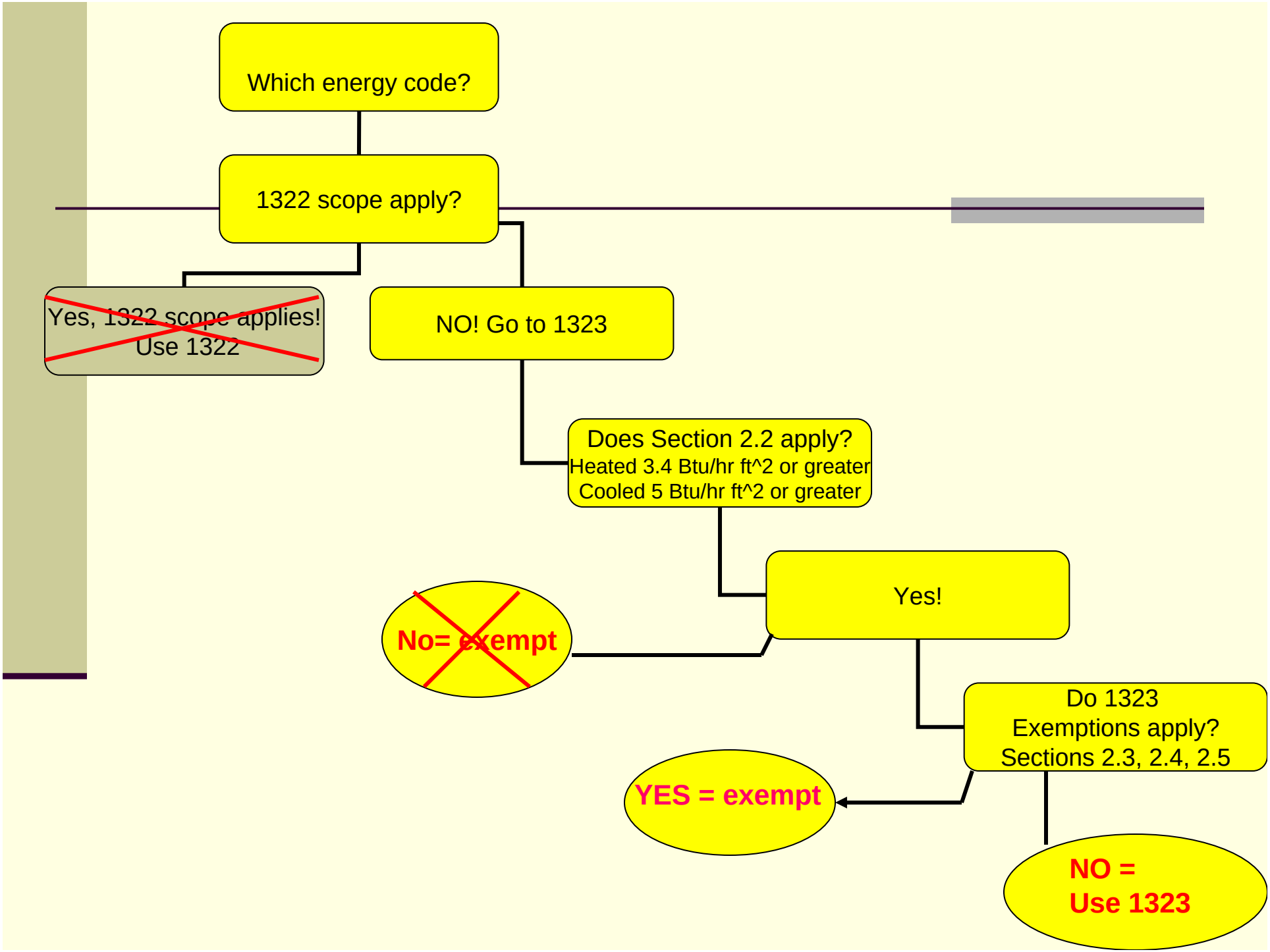
Example:

a. A manufacturing lab where airflow is supplied to meet the process loads- exempt

b. A lab used for research purpose in a university- not exempt

When is 1323 applicable?

- **Exemptions in scope of 1323:**
  - **Single-family houses, multi-family structures of three stories or fewer above grade as well as manufactured houses (2.3).**
  - **Buildings that don't use electricity or fossil fuel (2.3).**
  - **Equipment and portions of building systems that use energy for industrial, manufacturing, or commercial purposes (2.3).**
  - **Certain other buildings or elements of buildings shall be exempt (2.4).**
  - **This standard shall not be used to circumvent any safety, health, or environmental requirements (2.5).**

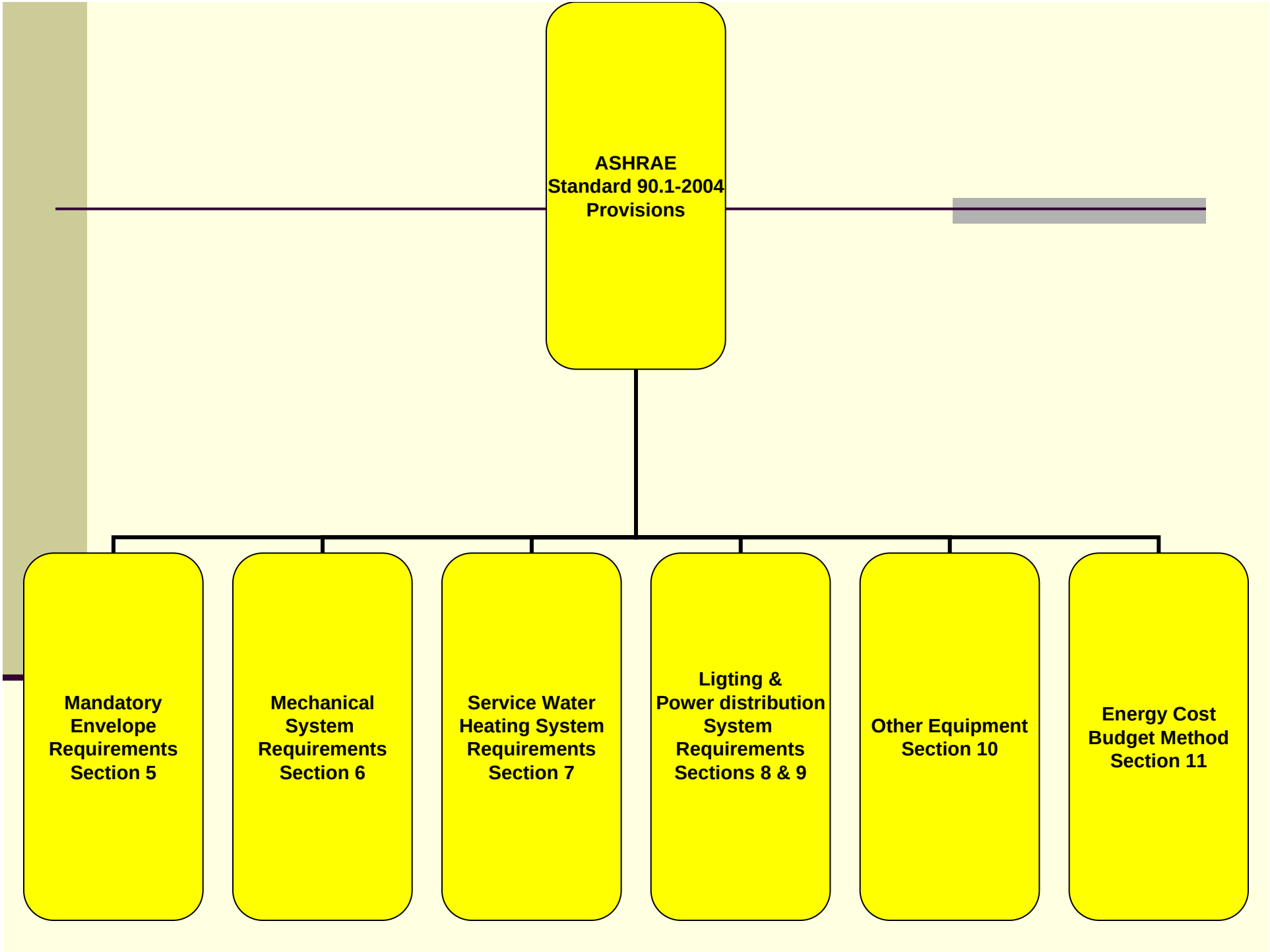

Which energy code?
1322 scope apply?
Yes, 1322 scope applies! Use 1322
NO! Go to 1323
Does Section 2.2 apply?
Heated 3.4 Btu/hr ft^2 or greater
Cooled 5 Btu/hr ft^2 or greater
Yes!
No= exempt
Do 1323
Exemptions apply?
Sections 2.3, 2.4, 2.5
YES = exempt
NO =
Use 1323

1323
Commercial Energy Code

is comprised of:

ASHRAE 90.1-2004,

and MN amendments


ASHRAE
Standard 90.1-2004
Provisions
Mandatory
Envelope
Requirements
Section 5
Mechanical
System
Requirements
Section 6
Service Water
Heating System
Requirements
Section 7
Ligting &
Power distribution
System
Requirements
Sections 8 & 9
Other Equipment
Section 10
Energy Cost
Budget Method
Section 11

Organization of Standard 90.1

1 **Purpose**
2 **Scope**
3 **Definitions**
4 **Administration and Enforcement**
5 **Building Envelope**
6 **Heating, Ventilating, and Air-Conditioning**
7 Service Water Heating
8 Power
9 Lighting
10 Other Equipment
11 Energy Cost Budget Method
12 Normative References
Appendices-

Appendices

NORMATIVE

A Rated R-value of Insulation and Assembly U-, C-, and F-Factor Determinations

B Building Envelope Climate Criteria

C Methodology for Building Envelope Trade-Off in Subsection 5.6

D Climatic Data

INFORMATIVE

E Informative References

F Addenda Description Information

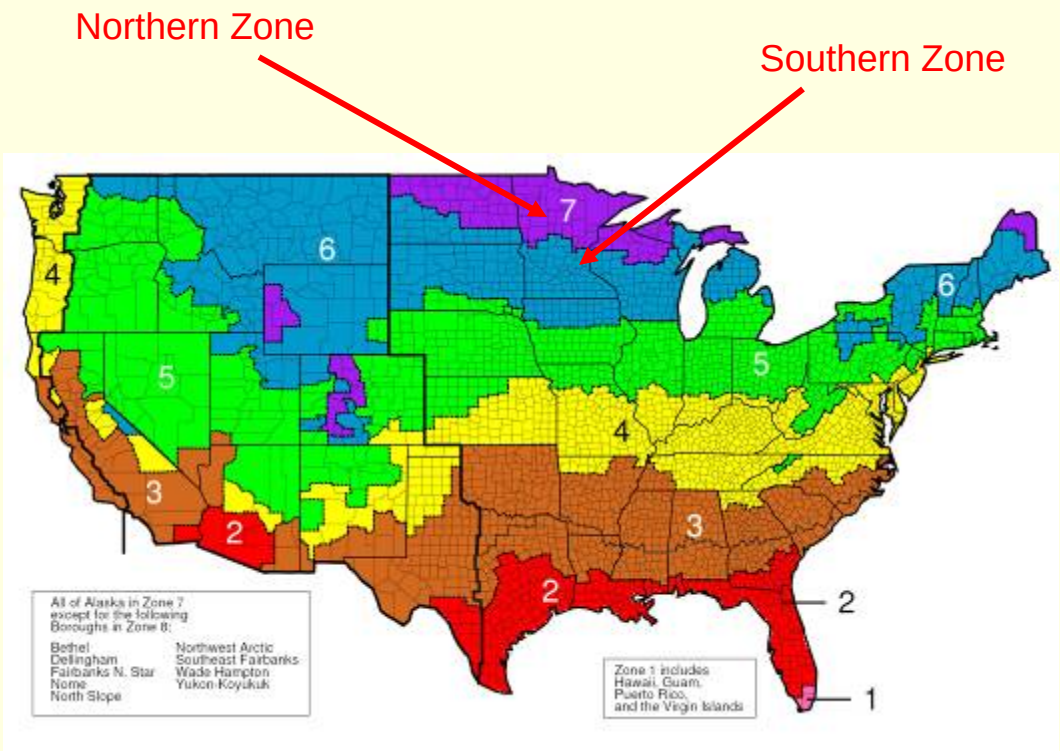
G Performance Rating Method

Key Features of Recent Versions of Standard 90.1-2004

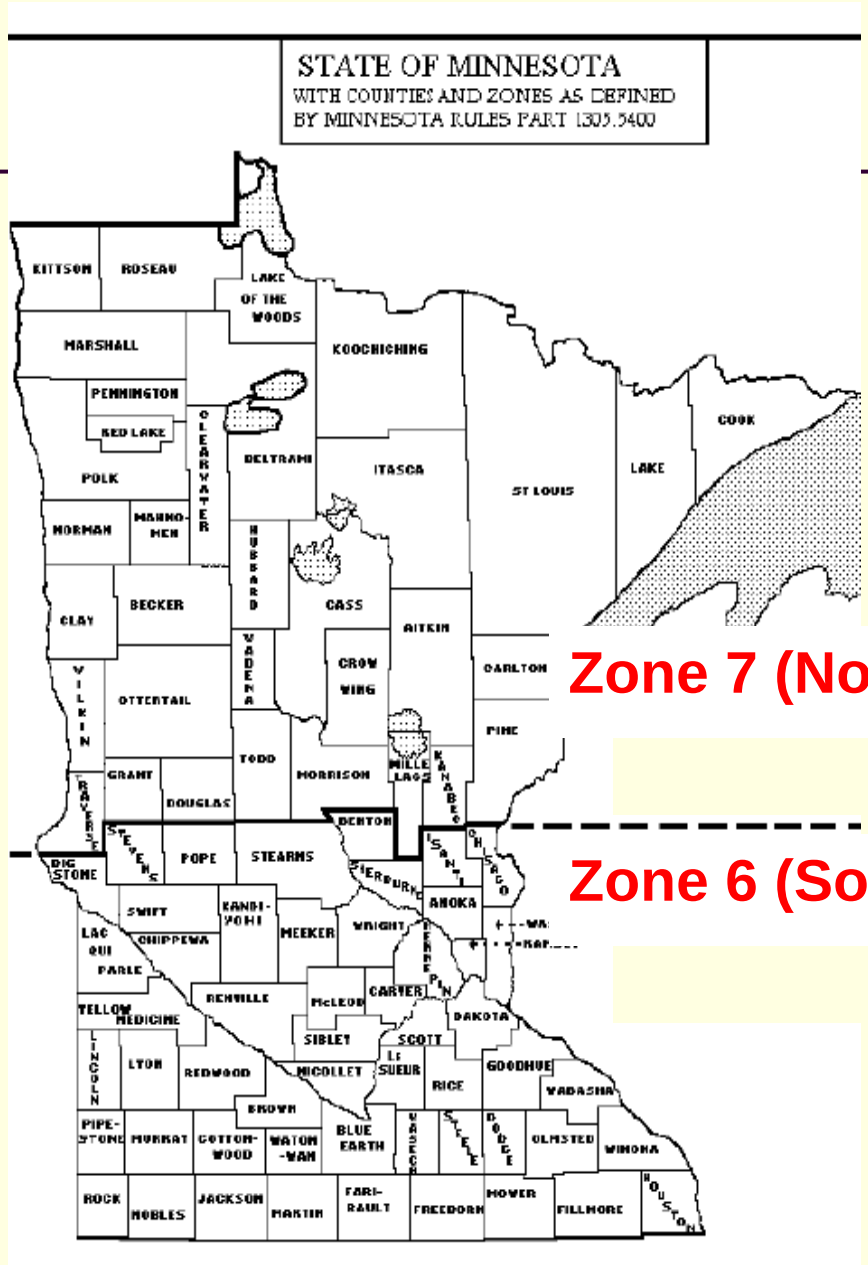
1. Mandatory, enforceable language
2. Based on life cycle costing
3. True prescriptive (vs performance) paths
4. Extensive treatment of retrofits and renovations
5. Explicit treatment of minimally conditioned buildings
6. Simplified climate zones

Climate

- Zones based on several climatic parameters and expressed in map shown in Figure B-1.

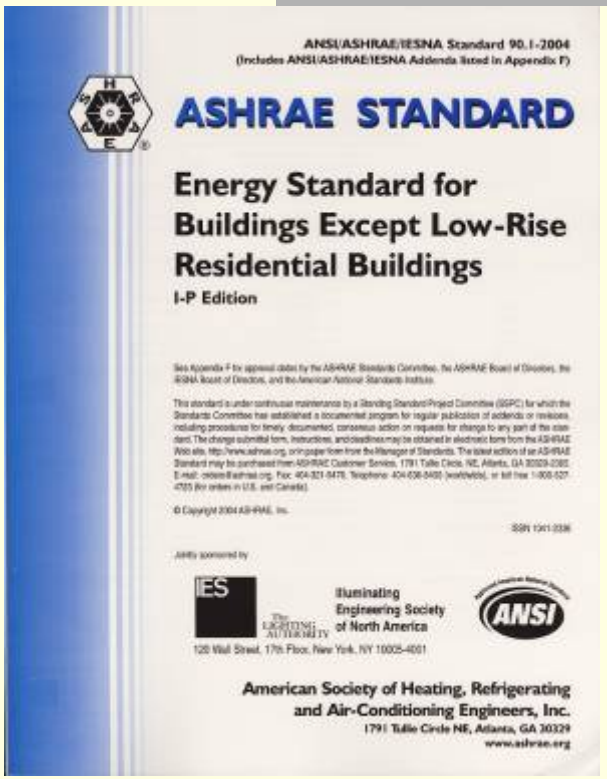


Climate Zones- Minnesota



Section 1 - Purpose

The purpose of this standard is to provide minimum requirements for the energy-efficient design of buildings except low-rise residential buildings


ANSI/ASHRAE/IESNA Standard 90.1-2004
(Includes ANSI/ASHRAE/IESNA Addenda listed in Appendix F)

ASHRAE STANDARD

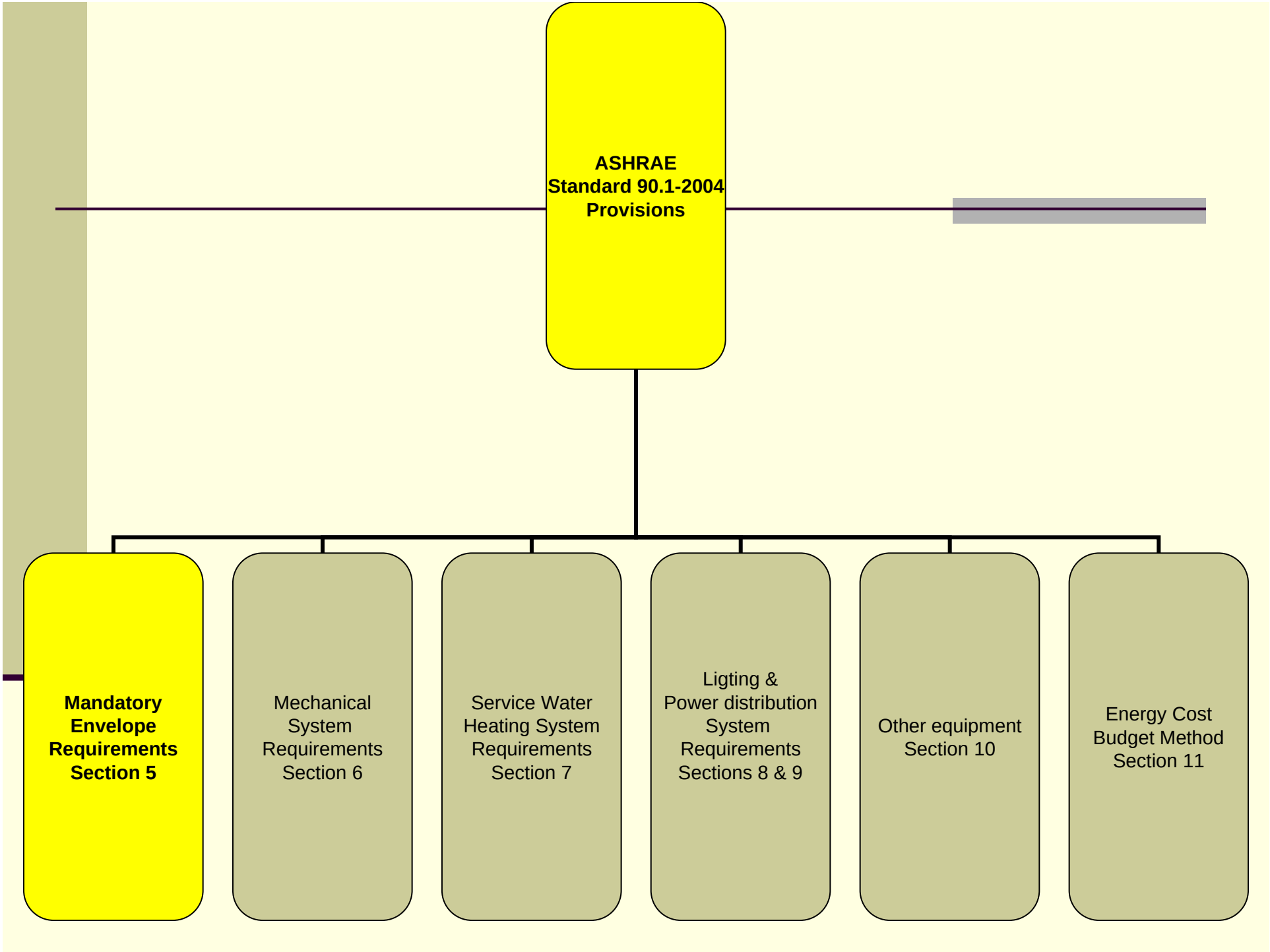
Energy Standard for Buildings Except Low-Rise Residential Buildings

I-P Edition

Jointly sponsored by

Illuminating Engineering Society of North America

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle NE, Atlanta, GA 30329
www.ashrae.org


ASHRAE
Standard 90.1-2004
Provisions
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Section 5
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Requirements
Section 7
Ligting &
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Requirements
Sections 8 & 9
Other equipment
Section 10
Energy Cost
Budget Method
Section 11

Section 2 - Scope

- New buildings and their systems
- New *portions* of buildings and their systems (additions)
- New systems and equipment in *existing* buildings (alterations)

Section 3: Definitions

- Provides over 11 pages of specifically defined terms, abbreviations, and acronyms
- These are definitions that are “above and beyond” ordinarily excepted meanings.
- Defined terms are noted in *italics* in the text of the standard.

Overview – Std 90.1 Building Envelope Requirements- Section 5

- **Specifies requirements of the *building envelope***
- **90.1-Section 5 explicitly does not address moisture control or provide guidance on moisture migration that may lead to condensation, mold, mildew, or insulation or equipment deterioration**
- **Where is moisture addressed in our codes?**

1323
Commercial Energy Code

is comprised of:

ASHRAE 90.1-2004,

and MN amendments

Overview – Std 90.1 Building Envelope Requirements- Section 5

- **1323 amendments: Section 5**
- **What are some of them?**

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Section 5 MN amendments:
  - 5.1.3 Envelope Alterations- Exceptions
    - 5.1.3 Envelope Alterations
      - 1. (e) Change-Removal of roof membrane

        (h) Added: Walls- back plastered, > 50% insulation filled, without framing cavities.

        (i) Added: Small openings- plumbing, electrical, etc.

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Section 5 MN amendments:
  - 5.1.3 Envelope Alterations- Exceptions
    - 5.1.3 Envelope Alterations
      - 1. (e) Change: Removal of roof membrane (<50%, etc)
        (h) Added: Walls- back plastered
        (i) Added: Small openings- plumbing, electrical, etc.
      - Added # 2. Vapor retarder not required if interior finish is not removed.

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Section 5 MN amendments:
  - 5.4.3 Air Leakage- Major Change
    - Air barrier 5.4.3.1
      - Sealed

Air Barrier Requirements 5.4.3.1

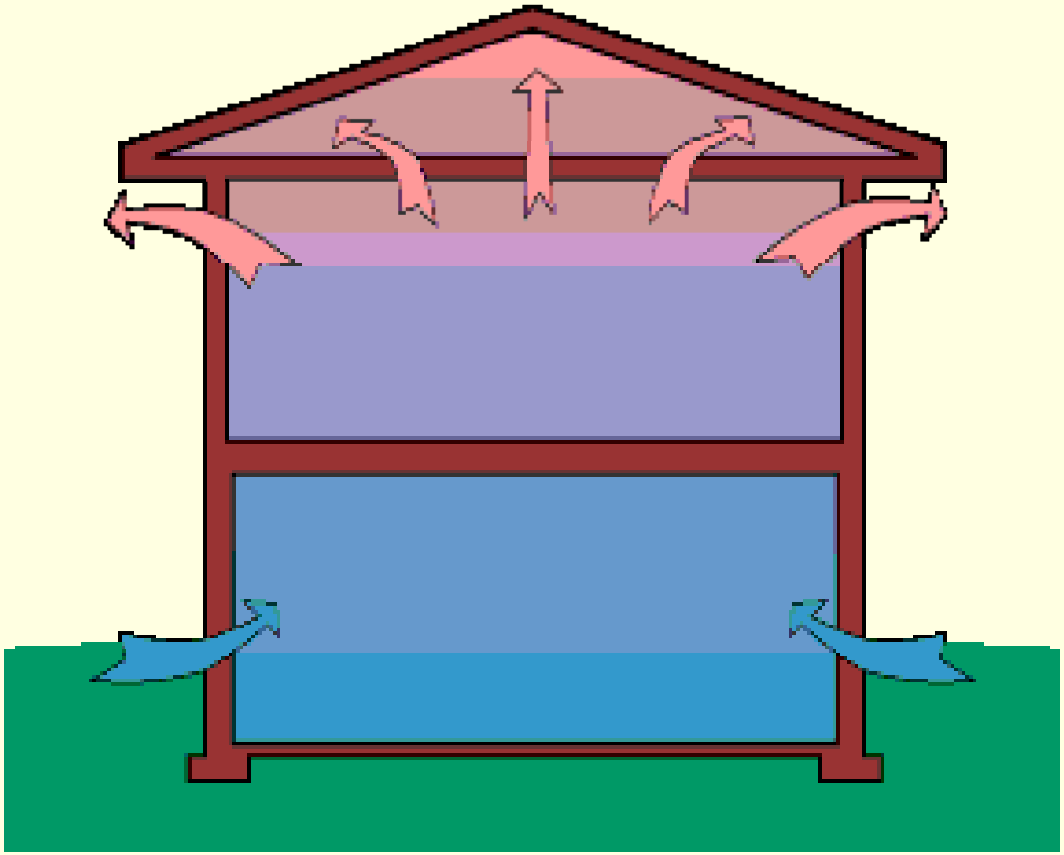
- The following areas of the building envelope shall be sealed in a permanent manner to minimize air leakage at all edges, joints, openings and penetrations:

- Joints around fenestration and door frames
- Junctions between walls
  - and foundations
  - at building corners
  - and structural floors or roofs
  - and roof or wall panels
- Openings for utility services through roofs, walls, and floors
- Site-built fenestration and doors
- Building assemblies used as ducts or plenums
- Joints, seams, and penetrations of vapor retarders

- across construction, control and expansion joints;
- across junctions between different building assemblies; and
- around all other penetrations through the building envelope.

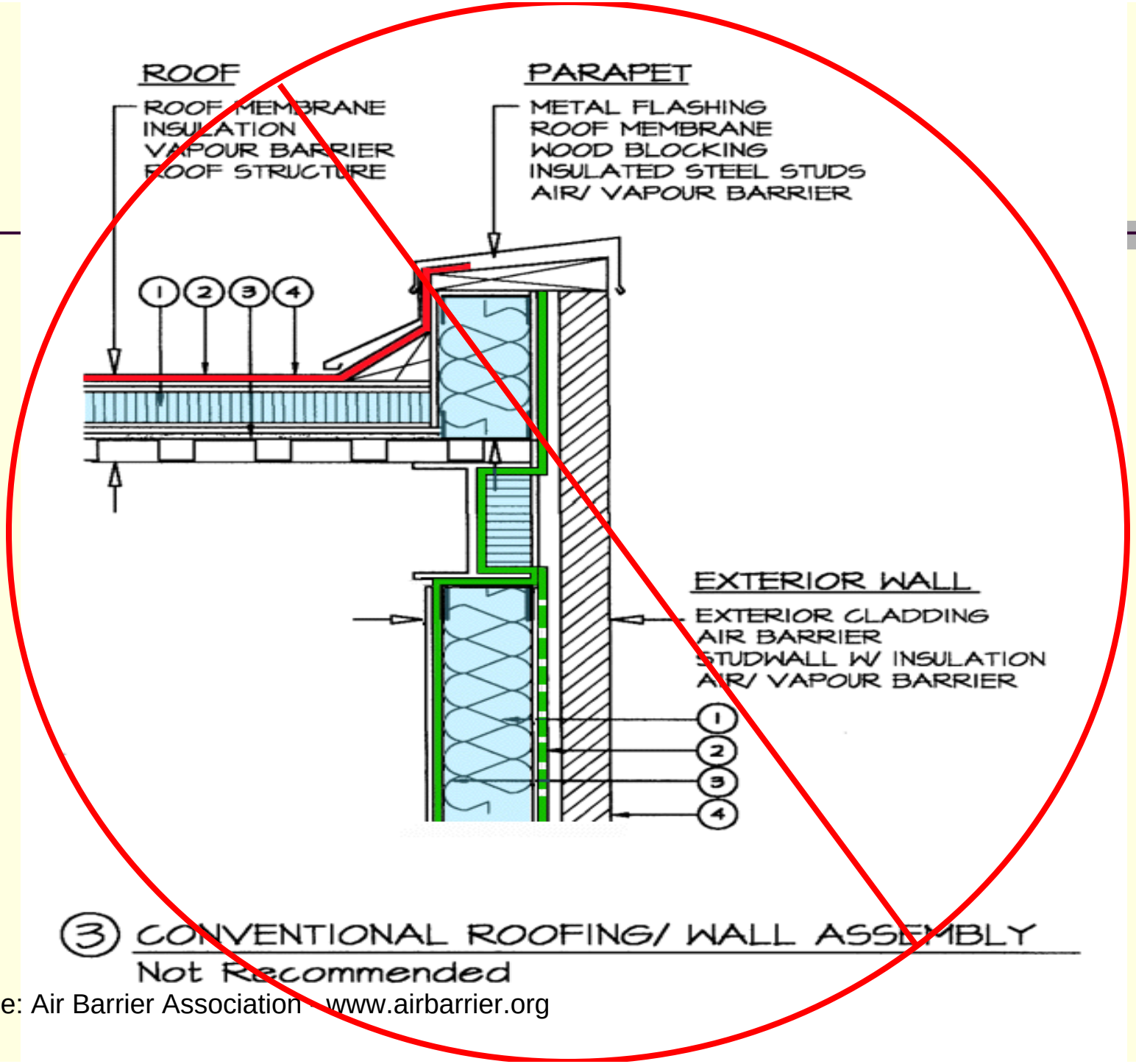
- Also note 5.4.3.1.1
- Location of air barrier
  - Between the warm-in-winter surface and winter design dew point location within the building component
  - EXCEPTION: integrally insulated concrete/ masonry

New Emphasis on Air Barrier
The Main Reason: Stack Effect



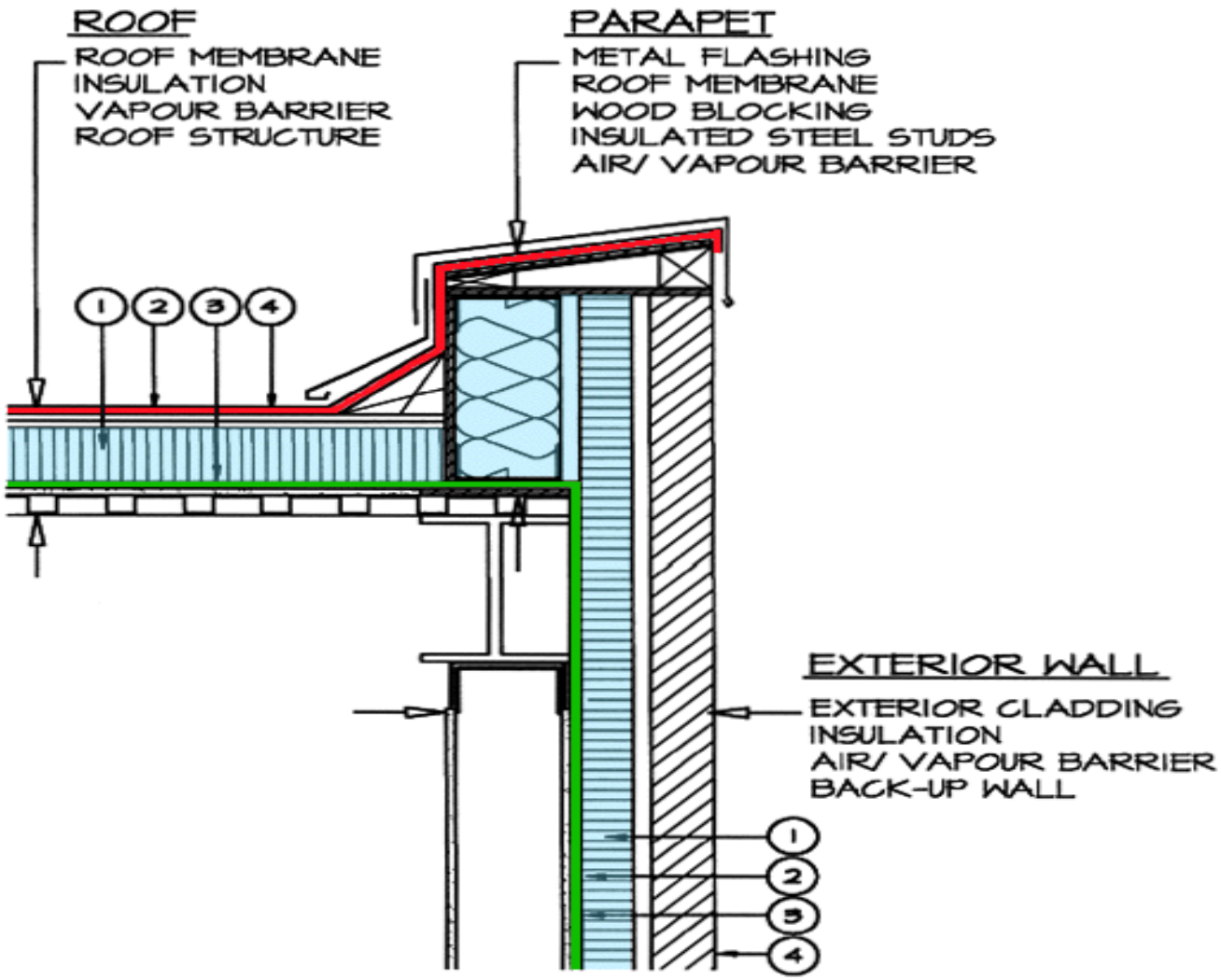
Air Barrier Requirements

- **5.4.3.1.2- "Drawings shall indicate the location of the air barrier system"**



3 CONVENTIONAL ROOFING/ WALL ASSEMBLY
Not Recommended

Source: Air Barrier Association - www.airbarrier.org



1 CONVENTIONAL ROOFING/ WALL ASSEMBLY
Recommended

Source: Air Barrier Association - www.airbarrier.org

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Section 5 MN amendments:
  - **5.4.3 Air Leakage**
    - **Air barrier 5.4.3.1**
      - **Sealed**
    - **Fenestration and doors 5.4.3.2**
      - **Removed exceptions for:**
        - **Field fabricated fenestration and doors**
        - **Garage door leakage requirements**

Overview – Std 90.1 Building Envelope Requirements- Section 5

- **Section 5 MN amendments:**
  - **5.4.3 Air Leakage**
    - **Air barrier 5.4.3.1**
      - **Sealed**
    - **Fenestration and doors 5.4.3.2**
      - **Removed exceptions for:**
        - **Field fabricated fenestration and doors**
        - **Garage door leakage requirements**
    - **Recessed lighting – 5.4.3.5**
      - **This is an amendment that Added a section to 90.1**
      - **Recessed luminaires in building thermal envelope shall be sealed to limit air leakage between conditioned and unconditioned spaces by being:**
        - **IC-rated and labeled with enclosures that are sealed….**
        - **IC-rated and labeled as meeting ASTM E 283…..**
        - **Located inside an airtight sealed box ……..**

Overview – Std 90.1 Building Envelope Requirements- Section 5

- **Section 5 MN amendments:**
  - **5.5.3.1 Roof insulation**
    - **Deleted Table 5.5.3.1**
      - **"Roof U-Factor Multipliers for exception 5.5.3.1."**
        - **MN Roof U Factor multiplier always = to 1.0 in MN zones 6 & 7.**
    - **and Exceptions to 5.5.3.1**

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Amended tables 5.5-6 and 5.5-7
  - MN zones
  - http://www.dli.mn.gov/CCLD/PDF/sbc_1323.pdf

Subp. 2. **Table 5.5-6.** ASHRAE Standard 90.1, Table 5.5-6, Building Envelope Requirements for the Southern Minnesota Climate Zone is amended to read:

TABLE 5.5-6 Building Envelope Requirements For Southern Minnesota Climate Zone (Zone 6)

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**
Roofs, Insulation						
Entirely Above Deck	U-0.043	R-23.0 ci	U-0.043	R-23.0 ci	U-0.06	R-16.6 ci
Metal Building	U-0.043	R-30.0	U-0.043	R-30.0	U-0.06	R-19.0
Attic and Other	U-0.027	R-30.0	U-0.027	R-30.0	U-0.06	R-19.0
Walls, Above Grade						
Mass	U-0.104	R-9.5 ci	U-0.09	R-11.4 ci	U-0.58	NR
Metal Building	U-0.113	R-13.0	U-0.057	R-13.0 + R-13.0	U-0.113	R-13.0
Steel Framed	U-0.084	R-13.0 ci + R-3.8 ci	U-0.064	R-13.0 + R-7.5 ci	U-0.124	R-13.0
Wood Framed and Other	U-0.089	R-13.0	U-0.064	R-13.0 + R-3.8 ci	U-0.089	R-13.0
Wall, Below Grade						
Below-Grade Wall	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci
Floors						
Mass	U-0.087	R-8.3 ci	U-0.064	R-12.5 ci	U-0.322	NR
Steel Joist	U-0.038	R-30.0	U-0.038	R-30.0	U-0.069	R-13.0
Wood Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-.0066	R-13.0
Slab-On-Grade Floors						
Unheated	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*
Heated	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Non-swinging	U-0.500		U-0.500		U-1.450	

Fene-stration	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)
Vertical Glazing, Percent of Wall						
0-10.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
10.1-20.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
20.1-30.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
30.1-40.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
40.1-50.0	U_{fixed}-0.46 U_{oper}-0.47	$SHGC_{all}$ -0.26 $SHGC_{north}$ -0.47	U_{fixed}-0.46 U_{oper}-0.47	$SHGC_{all}$ -0.26 $SHGC_{north}$ -0.49	U_{fixed}-0.98 U_{oper}-1.02	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
Skylight, Percent of Roof						
0-2.0	U_{all}-0.69	$SHGC_{all}$ -0.49	U_{all}-0.58	$SHGC_{all}$ -0.49	U_{all}-1.36	$SHGC_{all}$ -NR
Greater than 2.0 to 5.0	U_{all}-0.69	$SHGC_{all}$ -0.49	U_{all}-0.58	$SHGC_{all}$ -0.39	U_{all}-1.36	$SHGC_{all}$ -NR

* "To footing" means to the top of the footing if the insulation is on the exterior, or to the top of the slab if the insulation is on the interior.

Subp. 3. **Table 5.5-7.** ASHRAE Standard 90.1, Table 5.5-7, Building envelope requirements for the northern Minnesota climate zone is amended to read:

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**
Roofs, Insulation						
Entirely Above Deck	U-0.043	R-23.0 ci	U-0.043	R-23.0 ci	U-0.06	R-16.6 ci
Metal Building	U-0.043	R-23.0	U-0.043	R-23.0	U-0.06	R-16.6

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**
Attic and Other	U-0.043	R-30.0	U-0.043	R-30.0	U-0.06	R-19.0
Walls, Above Grade						
Mass	U-0.09	R-9.5 ci	U-0.08	R-13.0 + R-13.0 ci	U-0.58	NR
Metal Building	U-0.057	R-13.0	U-0.057	R-13.0 + R-13.0 ci	U-0.113	R-13.0
Steel Framed	U-0.064	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-7.5 ci	U-0.124	R-13.0
Wood Framed and Other	U-0.089	R-13.0	U-0.051	R-13.0 + R-7.5 ci	U-0.089	R-13.0
Wall, Below Grade						
Below-Grade Wall	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci
Floors						
Mass	U-0.087	R-8.3 ci	U-0.064	R-12.5 ci	U-0.137	R-4.2ci
Steel Joist	U-0.038	R-30.0	U-0.038	R-30.0	U-0.052	R-19.0
Wood Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-.0066	R-13.0
Slab-On-Grade Floors						
Unheated	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*
Heated	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*
Opaque Doors						
Swinging	U-0.70		U-0.50		U-0.70	
Non-swinging	U-0.50		U-0.50		U-1.45	

Fene-stration	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation/ North-Oriented)	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)
Vertical Glazing, Percent of Wall						
0-10.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
10.1-20.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
20.1-30.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
30.1-40.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
40.1-50.0	U_{fixed}-0.46 U_{oper}-0.47	$SHGC_{all}$ -0.36 $SHGC_{north}$ -0.64	U_{fixed}-0.46 U_{oper}-0.47	$SHGC_{all}$ -0.36 $SHGC_{north}$ -0.64	U_{fixed}-0.98 U_{oper}-1.02	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
Skylight, Percent of Roof						
0-2.0	U_{all}-0.69	$SHGC_{all}$ -0.68	U_{all}-0.69	$SHGC_{all}$ -0.64	U_{all}-1.36	$SHGC_{all}$ -NR
Greater than 2.0 to 5.0	U_{all}-0.69	$SHGC_{all}$ -0.64	U_{all}-0.69	$SHGC_{all}$ -0.64	U_{all}-1.36	$SHGC_{all}$ -NR

* "To footing" means to the top of the footing if the insulation is on the exterior, or to the top of the slab if the insulation is on the interior.

Only in 1323

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Section 5 MN amendments:
  - **5.6.2 COMCHECK OPTION:**

    Deemed to comply until August 2009

    NO LONGER DIRECTLY APPLICABLE

Overview – Std 90.1 Building Envelope Requirements- Section 5

- Section 5 MN amendments:
  - **5.8.1.5- Substantial Contact**
    - **Mainly addresses insulation permanently installed and in contact with either the air barrier materials ……. Etc.**

Envelope Compliance

Building System

- **Envelope**
- **HVAC**
- **SWH**
- **Power**
- **Lighting**
- **Other**

Mandatory Provisions

(required for most compliance options)

Compliance Options

- *Prescriptive Option*
- *Trade Off Option*
- *Energy Cost Budget*
- *Simplified*

Energy Code Compliance

Overview – Std 90.1 Building Envelope Requirements- Section 5

Compliance paperwork:

1. Can be found at www.dli.mn.gov
2. Specifically at:

http://www.ashrae.org/technology/page/97

(Look for 90.1-2004 paperwork)

3. MN Bookstore: 651-297-3000:

(Cost of Standard 90.1-2004 and Users Manual is $203.00 + tax)

Overview – Std 90.1 Building Envelope Requirements- Section 5

Compliance paperwork:

- **Mandatory paperwork (Part I) filled out for all Methods of Compliance**
- **Upcoming Part II paperwork = Prescriptive Option compliance**
- **Trade-Off Option = EnvStd Program**
  - **EnvStd Program strongly recommended for compliance**
  - **EnvStd not part of Standard – only the procedure**
    - **This allows new features to be added to the program as long as they used Appendix C procedures.**
- **Energy Cost Budget Method-Section 11**
  - **Programs: Energy Star and LEED perform better**

Overview – Std 90.1 Building Envelope Requirements- Section 5

Compliance paperwork:

Section 5 :

-Compliance Forms instructions

How to fill out forms

-Forms themselves

Part I

Part II, page 1- Prescriptive Option

Part II, page 2- "

Compliance forms are provided in the User's Manual to assist in understanding and documenting compliance with the building envelope requirements. Copies of the forms are provided both in printed and electronic form. Modifiable electronic versions are included on the CD distributed with the Manual, and also available for download from the ASHRAE website.

The building envelope forms are organized in two parts and on three pages. Part I should be used with all methods of compliance. Part II should be used only with the Prescriptive Building Envelope Option and should be completed separately for each space-conditioning category in the building.

- Part I has header information and a Mandatory Provisions checklist. This page should be filled out for all compliance methods, since the mandatory features apply to all compliance methods.
- Part II, Page 1 has header information that must be completed for each space-conditioning category and a schedule of constructions for opaque surfaces. The schedule is a simple listing of each unique construction type in the building. For each item in the list, you indicate the class of construction, the source of U-factor data, the proposed and criteria U-factor or R-value. Optionally,

Compliance Form instruction

Building Envelope Compliance Documentation

Part I

Project Name:		
Project Address:		Date:
Designer of Record:		Telephone:
Contact Person:		Telephone:
City:	Climate Zone:	Criteria Table:

Mandatory Provisions Checklist

Insulation (§ 5.4.1)

- ❑ Insulation Materials are installed in accordance with manufacturer's recommendations and in such a manner as to achieve rated R-value of insulation
  - ❑ Exception: for metal building roofs or metal building walls.
- ❑ Loose-fill insulation is not used in attic roof spaces when the slope of the ceiling is more than three in twelve.
- ❑ Attic eave vents have baffling to deflect the incoming air above the surface of the insulation.
- ❑ Insulation is installed in a permanent manner in substantial contact with the inside surface.
- ❑ Batt insulation installed in floor cavities is supported in a permanent manner by supports no greater than 24 in. o.c.
- ❑ Lighting fixtures, HVAC, and other equipment are not be recessed in ceilings in such a manner to affect the insulation thickness unless.

Exceptions:

- ❑ The recessed area is less than one percent.
- ❑ The entire roof, wall, or floor is covered with insulation to the full depth required.
- ❑ The effects of reduced insulation are included in calculations using an area weighted averages.

- ❑ Roof insulation is not installed over suspended ceiling with removable ceiling panels.
- ❑ Exterior insulation is covered with a protective material to prevent damage. Insulation is protected in attics and mechanical rooms where access is needed.
- ❑ Foundation vents do not interfere with the insulation.
- ❑ Insulation materials in ground contact have a water absorption rate no greater than 0.3 percent.

Amendment 1323.0581

e.g. 5.8.1.7

Fenestration and Doors (§ 5.4.2)

- ❑ U-factors are determined in accordance with NFRC 100. U-factors for skylights shall be determined for a slope of 20° above the horizontal.

Exceptions:

- ❑ U-factors are taken from A.8.1 for glazed wall systems in vertical fenestration and/or skylights.
- ❑ U-factors are taken from A.8.2 other fenestration products.
- ❑ U-factors are taken from A.7 for opaque doors.
- ❑ U-factors are derived from DASMA 105 for garage doors.

- ❑ Solar heat gain coefficient (SHGC) is determined in accordance with NFRC 200.

Exceptions:

- ❑ SHGC is determined by multiplying the shading coefficient (SC) by 0.86. Shading coefficient is determined using a spectral data file determined in accordance with NFRC 300.
- ❑ SHGC for the center of glass is used. SHGC is determined using a spectral data file determined in accordance with NFRC 300.
- ❑ SHGC is taken from § A8 for glazed wall systems in vertical fenestration and skylights.

- ❑ Visible light transmittance is determined in accordance with NFRC 200.

Air Leakage (§ 5.4.3)

- ❑ The *building envelope* is sealed, caulked, gasketed, and/or weather-stripped to minimize air leakage.
- ❑ Air leakage through fenestration and doors is less than 0.4 cfm/ft² (1.0 cfm/ft² for glazed swinging entrance doors and for revolving doors) when tested in accordance with NFRC 400.

~~Exceptions:~~

- ~~❑ Field fabricated fenestration and doors.~~
- ~~❑ For garage doors tested in accordance with DASMA 105.~~

See 1323.0543 (5.4.3.1)

See MN 1323.0543 (5.4.3.2)

- ❑ Cargo doors and loading dock doors are equipped with weatherseals in climates zones 3 through 8.
- ❑ Entrance doors have vestibules.

Exceptions:

- ❑ Climate zone 1 or 2
- ❑ Building is less than four stories.
- ❑ Doors not intended as building entrance.
- ❑ Doors open from dwelling unit(s).
- ❑ Doors open from spaces smaller than 3,000 ft².
- ❑ Building has revolving doors.
- ❑ Doors for vehicular movement or material handling.

Designers

- Specify
  - R-values for walls, floors, and roofs
  - U-factors for opaque doors
  - U-factor and SHGC for fenestration, OR
- Use
  - Pre-calculated assemblies from Appendix A

Building Envelope Compliance Documentation: Section 5

- **Part II, Page 1**
  - ***Opaque Surfaces:***
    - **Section 3, 90.1-2004**
      - **"Opaque: all areas in the building envelope, except fenestration and building service openings such as vents and grilles. (See building envelope and fenestration.)**
  - **Part II used with Prescriptive Building Envelope Option.**
  - **Project name, contact person and phone should be filled out.**

Building Envelope Compliance Documentation

Project Name:

Contact Person: Telephone:

Space Category	§ 5.5.4.4.1 Exceptions
Nonresidential	☐ North Oriented
Residential	☐ Overhangs
Semiheated	☑ Street Level Windows

Window-Wall Ratio	Total	North (Opt.)	Other (Opt.)
Gross Wall Area (ft^2):			
Window Area (ft^2):			
Window-Wall Ratio:			

Skylight-Roof Ratio	
Gross Roof Area (ft^2):	
Skylight Area:	
Skylight-Roof Ratio	

Opaque Surfaces

| Description/ Name | Class (Pick one) | | |

Building Envelope Compliance Documentation: Section 5

- **Part II, Page 1**
  - **Space category – one option is checked to indicate category (opaque and fenestration constructions) that follow.**
  - **A Part II form must be completed for each space-conditioning category in the building.**

Building Envelope Compliance Documentation

Project Name:

Contact Person: | Telephone:

Space Category	§ 5.5.4.4.1 Exceptions	Window-Wall Ratio	Total	North (Opt.)	Other (Opt.)	Skylight-Roof Ratio	
Nonresidential	☐ North Oriented	Gross Wall Area (ft^2):				Gross Roof Area (ft^2):	
Residential	☐ Overhangs	Window Area (ft^2):				Skylight Area:	
Semiheated	☑ Street Level Windows	Window-Wall Ratio:				Skylight-Roof Ratio	

Opaque Surfaces

| Description/ Name | Class (Pick one) | | | |

Building Envelope Compliance Documentation: Section 5

- **Part II, Page 1**
- ***5.5.4.4.1 (Users Manual says* 5.3.2.3)exceptions:**
  - **This section indicates which fenestration exception that is being used- IF ANY.**
    - **North-Oriented- window to wall ratio must be calculated separately for north-oriented and other oriented windows**
    - **Overhangs- when this exception is used the overhang shading effect can be used to adjust the proposed building's SHGC.**
    - **Street Level Windows (SLW)- when this exception is used street level windows are exempt from SHGC criteria provided that :**
      - **SLW do not exceed 75% of gross wall area**
      - **Street level floor to floor height does not exceed 20 feet, and**
      - **Street level fenestration is shaded by an overhang with a projection factor of at least 0.5**

Building Envelope Compliance Documentation

Project Name:

Contact Person: | Telephone:

Space Category	§ 5.5.4.4.1 Exceptions	Window-Wall Ratio	Total	North (Opt.)	Other (Opt.)	Skylight-Roof Ratio	
Nonresidential	☐ North Oriented	Gross Wall Area (ft^2):				Gross Roof Area (ft^2):	
Residential	☐ Overhangs	Window Area (ft^2):				Skylight Area:	
Semiheated	☑ Street Level Windows	Window-Wall Ratio:				Skylight-Roof Ratio	

Opaque Surfaces

| Description/ Name | Class (Pick one) | | | |

Building Envelope Compliance Documentation: Section 5

- **Part II, Page 1:**
  - **Window to Wall Ratio:**
    - **Are you taking a north-orientated exception?**
      - **If NO, then only the first column labeled Total needs to be completed.**
      - **If YES, The North and Other columns must be completed (Total column left blank).**
    - **Note this is only used in commercial buildings and is not used anymore in residential buildings built to 1322**

Building Envelope Compliance Documentation: Section 5

- Part II, Page 1:
  - **Window to Wall Ratio:**
    - **Gross Wall Area (ft^2)**
      - **Sums the gross exterior wall area for the space-conditioning category- only exterior walls and includes windows and doors**
    - **Window Area (ft^2)**
      - **Sum the window area (frame and glazed area) for the exterior walls in the space-conditioning category**
    - **Window-Wall Ratio**
      - **Divide the Window Area by the Gross Wall Area and enter the result in the box. When using the Prescriptive Option this ratio must be less that 0.50 (5.2.1 (a) #1).**

Building Envelope Compliance Documentation

Project Name:

Contact Person: | Telephone:

Space Category	§ 5.5.4.4.1 Exceptions
Nonresidential	☐ North Oriented
Residential	☐ Overhangs
Semiheated	☑ Street Level Windows

Window-Wall Ratio	Total	North (Opt.)	Other (Opt.)
Gross Wall Area (ft^2):			
Window Area (ft^2):			
Window-Wall Ratio:			

Skylight-Roof Ratio	
Gross Roof Area (ft^2):	
Skylight Area:	
Skylight-Roof Ratio	

Opaque Surfaces

Description/ Name	Class (Pick one)																Pick one		Pick one			Proposed Insulation R-Value, U-Factor, C-Factor or F-Factor	Criteria Insulation R-Value, U-Factor, C-Factor or F-Factor	Surface Area (ft^2) (optional)
	Roof			Wall					Floor				Slab		Door									
	Insulation Above Deck	Metal Buildling	Attic and Other	Mass	Metal Buildling	Steel-Framed	Wood-Framed / Other	Below-Grade Wall	Mass	Steel Joist	Wood-Framed / Other		Unheated	Heated	Swinging	Non-Swinging	R-value Option	U-factor Option	Appendix A Defaults	Calculations	High Reflectance/Emittance Roof			
	○	○	○	○	○	○	○	○	○	○	○		○	○	○	○	○	○	○	○	☐			
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Building Envelope Compliance Documentation: Section 5

- **Part II, Page 1:**
- **Skylight Roof Ratio**
  - **Only fill out IF the space-conditioning category has skylights.**
    - **If it does, then fill in:**
    - **Gross Roof Area- Sum the gross area of all exterior roofs for the space-conditioning category.**
    - **Skylight area- Sum the skylight area (includes area of frame) for the space-conditioning category.**
    - **Skylight Roof Ratio: Divide the skylight area by the gross roof area. When using Prescriptive Option this ratio must be less than .05 (5.2.1 (a) #2).**

Building Envelope Compliance Documentation

Project Name:

Contact Person:

Telephone:

Space Category	§ 5.5.4.4.1 Exceptions	Window-Wall Ratio	Total	North (Opt.)	Other (Opt.)	Skylight-Roof Ratio	
Nonresidential	☐ North Oriented	Gross Wall Area (ft^2):				Gross Roof Area (ft^2):	
Residential	☐ Overhangs	Window Area (ft^2):				Skylight Area:	
Semiheated	☑ Street Level Windows	Window-Wall Ratio:				Skylight-Roof Ratio	

Opaque Surfaces

| Description/ Name | Class (Pick one) | | | |

Building Envelope Compliance Documentation: Section 5

- **Part II, Page 1:**
- **Opaque Surfaces**
  - **This part summarizes all opaque construction types for the space-conditioning category.**
    - **Fill in description/name of opaque surface- if drawings/specificiations already have it then this description should be consistent with dwgs/specs.**
    - **Class- Choose column that fits- should be only one column filled out per class.**
    - **If Appendix A is source for U or C factor-mark column**
      - **F factors can ONLY come from Appendix A**
      - **If U and C (Appendix A) is not used, but calculated, then construction must be significantly different from Appendix A values.**
    - **High reflectance/Emmittance Roof- used only if roof has no attic**
    - **Proposed Value- E.G. If R value is used, fill in R-13 + R-13ci**
    - **Criteria Value- E.G. If R value is used, simply fill in R value from criteria table 5.5.6 or 5.5.7.**
    - **Surface Area- optional – if used, group surface areas together like roofs, north-oriented walls, etc.**

Building Envelope Compliance Documentation

Project Name:

Contact Person: | Telephone:

Space Category	§ 5.5.4.4.1 Exceptions	Window-Wall Ratio	Total	North (Opt.)	Other (Opt.)	Skylight-Roof Ratio	
Nonresidential	☐ North Oriented	Gross Wall Area (ft^2):				Gross Roof Area (ft^2):	
Residential	☐ Overhangs	Window Area (ft^2):				Skylight Area:	
Semiheated	☑ Street Level Windows	Window-Wall Ratio:				Skylight-Roof Ratio	

Opaque Surfaces

| Description/ Name | Class (Pick one) | | | |

Requirements for the Southern Minnesota Climate Zone is amended to read:

TABLE 5.5-6 Building Envelope Requirements For Southern Minnesota Climate Zone (Zone 6)

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**
Roofs, Insulation						
Entirely Above Deck	U-0.043	R-23.0 ci	U-0.043	R-23.0 ci	U-0.06	R-16.6 ci
Metal Building	U-0.043	R-30.0	U-0.043	R-30.0	U-0.06	R-19.0
Attic and Other	U-0.027	R-30.0	U-0.027	R-30.0	U-0.06	R-19.0
Walls, Above Grade						
Mass	U-0.104	R-9.5 ci	U-0.09	R-11.4 ci	U-0.58	NR
Metal Building	U-0.113	R-13.0	U-0.057	R-13.0 + R-13.0	U-0.113	R-13.0
Steel Framed	U-0.084	R-13.0 ci + R-3.8 ci	U-0.064	R-13.0 + R-7.5 ci	U-0.124	R-13.0
Wood Framed and Other	U-0.089	R-13.0	U-0.064	R-13.0 + R-3.8 ci	U-0.089	R-13.0
Wall, Below Grade						
Below-Grade Wall	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci
Floors						
Mass	U-0.087	R-8.3 ci	U-0.064	R-12.5 ci	U-0.322	NR
Steel Joist	U-0.038	R-30.0	U-0.038	R-30.0	U-0.069	R-13.0
Wood Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-.0066	R-13.0
Slab-On-Grade Floors						
Unheated	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*
Heated	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*	F-0.520	R-10.0 to footing*
Opaque Doors						
Swinging	U-0.700		U-0.500		U-0.700	
Non-swinging	U-0.500		U-0.500		U-1.450	

Fene-stration	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)	Assembly Max. U (Fixed/ Operable)	Assembly Max. SHGC (All Orientation /North-Oriented)
Vertical Glazing, Percent of Wall						
0-10.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.49 $SHGC_{north}$ -0.64	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
10.1-20.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
20.1-30.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
30.1-40.0	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-0.57 U_{oper}-0.67	$SHGC_{all}$ -0.39 $SHGC_{north}$ -0.49	U_{fixed}-1.22 U_{oper}-1.27	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
40.1-50.0	U_{fixed}-0.46 U_{oper}-0.47	$SHGC_{all}$ -0.26 $SHGC_{north}$ -0.47	U_{fixed}-0.46 U_{oper}-0.47	$SHGC_{all}$ -0.26 $SHGC_{north}$ -0.49	U_{fixed}-0.98 U_{oper}-1.02	$SHGC_{all}$ -NR $SHGC_{north}$ -NR
Skylight, Percent of Roof						
0-2.0	U_{all}-0.69	$SHGC_{all}$ -0.49	U_{all}-0.58	$SHGC_{all}$ -0.49	U_{all}-1.36	$SHGC_{all}$ -NR
Greater than 2.0 to 5.0	U_{all}-0.69	$SHGC_{all}$ -0.49	U_{all}-0.58	$SHGC_{all}$ -0.39	U_{all}-1.36	$SHGC_{all}$ -NR

* "To footing" means to the top of the footing if the insulation is on the exterior, or to the top of the slab if the insulation is on the interior.

Subp. 3. **Table 5.5-7.** ASHRAE Standard 90.1, Table 5.5-7, Building envelope requirements for the northern Minnesota climate zone is amended to read:

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**
Roofs, Insulation						
Entirely Above Deck	U-0.043	R-23.0 ci	U-0.043	R-23.0 ci	U-0.06	R-16.6 ci
Metal Building	U-0.043	R-23.0	U-0.043	R-23.0	U-0.06	R-16.6

	Nonresidential		Residential		Semiheated	
Opaque Elements	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**	**Assembly Max.**	**Insulation Min. R-Value**
Attic and Other	U-0.043	R-30.0	U-0.043	R-30.0	U-0.06	R-19.0
Walls, Above Grade						
Mass	U-0.09	R-9.5 ci	U-0.08	R-13.0 + R-13.0 ci	U-0.58	NR
Metal Building	U-0.057	R-13.0	U-0.057	R-13.0 + R-13.0 ci	U-0.113	R-13.0
Steel Framed	U-0.064	R-13.0 + R-3.8 ci	U-0.064	R-13.0 + R-7.5 ci	U-0.124	R-13.0
Wood Framed and Other	U-0.089	R-13.0	U-0.051	R-13.0 + R-7.5 ci	U-0.089	R-13.0
Wall, Below Grade						
Below-Grade Wall	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci	C-0.085	R-10.0 ci
Floors						
Mass	U-0.087	R-8.3 ci	U-0.064	R-12.5 ci	U-0.137	R-4.2ci
Steel Joist	U-0.038	R-30.0	U-0.038	R-30.0	U-0.052	R-19.0
Wood Framed and Other	U-0.033	R-30.0	U-0.033	R-30.0	U-.0066	R-13.0
Slab-On-Grade Floors						
Unheated	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*
Heated	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*	F-0.52	R-10.0 to footing*
Opaque Doors						
Swinging	U-0.70		U-0.50		U-0.70	
Non-swinging	U-0.50		U-0.50		U-1.45	

Building Envelope Compliance Documentation

Part II, Page 2

Project Name:

Contact Person: | Telephone:

Fenestration

Description/ Name	Class (Pick one)									Proposed Fenestration							Criteria	
	Window, North, Operable	Window, North, Fixed	Window, Other, Operable	Window, Other, Fixed	Skylight, Curb, Glass	Skylight, Curb, Plastic	Skylight, No Curb	NFRC Rating	Appendix A Defaults	Area	U-Factor	Solar Heat Gain Coefficient (SHGC)	Overhang	Projection Factor	Overhang Multiplier	Adjusted Solar Heat Gain Coefficient (SHGC)	U-Factor	Solar Heat Gain Coefficient (SHGC)
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Source of Data:
NFRC or APPENDIX A

Building Envelope Compliance Documentation: Section 5

- **Part II, Page 2:**
- **Fenestration:**
  - **Used for each fenestration type- E.G. skylights vs windows**
  - **If taking overhang exception- SHGC needs to be calculated and separate entries must be made for each window with different overhang dimensions.**
  - **Description**
  - **Class**
  - **Source of Data: Performance data must either come from RFRC ratings or from Appendix A**
  - **Proposed Fenestration-**
    - **Area- should include frame and glazing area**
    - **U-Factor and SHGC – use either NFRC or Table A8.1A or A8.2**
    - **Overhang- check only if overhang shades the window**
    - **Projection Factor and Overhang Multiplier- used only if overhang shades window (Projection factor is calculated, overhang multiplier seen in 90.1-2004 table 5.5.4.4.1)**
    - **Adjusted SHGC- Multiply SHGC of unshaded window by overhang multiplier.**

Building Envelope Compliance Documentation

Project Name:

Contact Person: | Telephone:

Fenestration

Description/ Name	Class (Pick one)									Proposed Fenestration							Criteria	
	Window, North, Operable	Window, North, Fixed	Window, Other, Operable	Window, Other, Fixed	Skylight, Curb, Glass	Skylight, Curb, Plastic	Skylight, No Curb	NFRC Rating	Appendix A Defaults	Area	U-Factor	Solar Heat Gain Coefficient (SHGC)	Overhang	Projection Factor	Overhang Multiplier	Adjusted Solar Heat Gain Coefficient (SHGC)	U-Factor	Solar Heat Gain Coefficient (SHGC)
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Building Envelope Compliance Documentation: Section 5

- **Part II, Page 2:**
- **Fenestration:**
  - **Used for each fenestration type- E.G. skylights vs windows**
  - **If taking overhang exception- SHGC needs to be calculated and separate entries must be made for each window with different overhang dimensions.**
  - **Description**
  - **Class**
  - **Source of Data: Performance data must either come from RFRC ratings or from Appendix A**
  - **Proposed Fenestration-**
    - **Area- should include frame and glazing area**
    - **U-Factor and SHGC – use either NFRC or Table A8.1A or A8.2**
    - **Overhang- check only if overhang shades the window**
    - **Projection Factor and Overhang Multiplier- used only if overhang shades window**
    - **Adjusted SHGC- Multiply SHGC of unshaded window by overhang multiplier.**

  - **Criteria (data taken from Table 5.5.6 or 5.5.7 in MN):**
    - **U-Factor and SHGC depends on window-wall ratio for windows and skylights. Check for north-oriented window.**

Building Envelope Compliance Documentation

Project Name:

Contact Person: | Telephone:

Fenestration

Description/ Name	Class (Pick one)									Proposed Fenestration							Criteria	
	Window, North, Operable	Window, North, Fixed	Window, Other, Operable	Window, Other, Fixed	Skylight, Curb, Glass	Skylight, Curb, Plastic	Skylight, No Curb	NFRC Rating	Appendix A Defaults	Area	U-Factor	Solar Heat Gain Coefficient (SHGC)	Overhang	Projection Factor	Overhang Multiplier	Adjusted Solar Heat Gain Coefficient (SHGC)	U-Factor	Solar Heat Gain Coefficient (SHGC)
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Building Envelope Compliance Documentation: Section 5

- **Part II, Page 2:**
- **Fenestration:**
  - **The proposed fenestration value is compared to the Criteria value for compliance.**
    - **E.G. #1: If the U- factor proposed is = .52 and the criteria U-factor is .57 (table 5.5.6 or 5.5.7) does that U factor comply?**
    - **E.G. #2: If the proposed SHGC is .55 and the criteria SHGC is .39, does the SHGC comply?**
      - **Design alternatives:**
        - **Put in an overhang: determine projection factor (table 5.5.4.4.1) in the .4 to .5 range so that the overhang multiplier is .67. Then .67 x .55 = .37. Now the .37 is less than the criteria of .39**

Closing thoughts

- **Please fill out evaluations and place them on the table near your certificates as you leave.**
- **Thanks for coming.**
  - **Don and I will be around if you have comments or questions**
- **Have a great day**