mass save Energy Code Technical Support Program

Applying Energy Code to Existing Buildings

Massachusetts Energy Code Technical Support Program

PERFORMANCE SYSTEMS DEVELOPMENT We Speak Building

mass save Energy Code Technical Support Program

Who Is Mass Save®?

- Mass Save® is an initiative sponsored by Massachusetts' gas and electric utilities and energy efficiency service providers, including
  - -The Berkshire Gas Company
  - -Cape Light Compact
  - -Columbia Gas of Massachusetts
  - -Eversource Energy
  - -Liberty Utilities
  - -National Grid
  - -Unitil
- The Sponsors of Mass Save work closely with the Massachusetts Department of Energy Resources to provide a wide range of services, incentives, trainings, and information promoting energy efficiency that help residents and businesses manage energy use and related costs.

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PERFORMANCE SYSTEMS DEVELOPMENT

We Speak Building

Presented by:
Performance Systems Development

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Agenda

mass save Energy Code Technical Support Program

- Stretch Code vs Non-Stretch Code
- Types of Projects
  - Additions
  - Alterations
  - Repairs
  - Change of occupancy
- Summary & Questions

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Stretch Code vs Non Stretch Code

Energy Code Technical Support Program

Appendix AA:

Section AA104 Existing Buildings: For alterations, renovations, additions and repairs of existing buildings, energy efficiency requirements of 780 CMR 51.00 are applicable.

No special requirements for existing buildings in Stretch Code towns.

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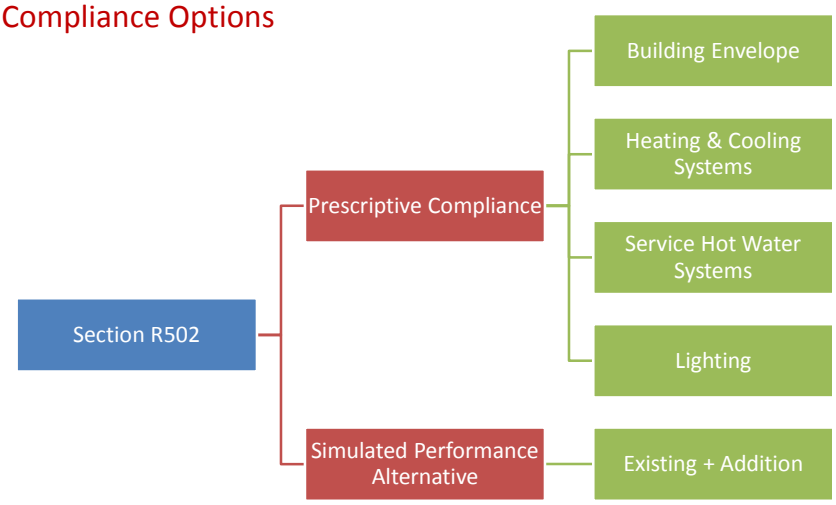
Additions, Alterations, Repairs & Change of occupancy

Energy Code Technical Support Program

Compliance Options



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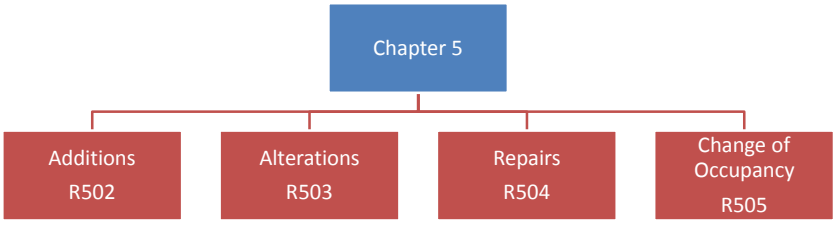
IECC 2015 Chapter 5

Existing Buildings

Energy Code Technical Support Program



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Example #1

Compliance paths for existing buildings

Energy Code Technical Support Program

What compliance paths are available for existing buildings?

Additions

- Prescriptive Compliance
- Simulated Performance Alternative

Alterations

- Prescriptive compliance
- Exceptions: storm windows, roof recover, construction where roof, wall or floor cavities not exposed, etc.

Repairs

- Prescriptive compliance for glass-only replacements, roof repairs, lighting replacement.

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Energy Code Technical Support Program

ADDITIONS

Energy Code Technical Support Program

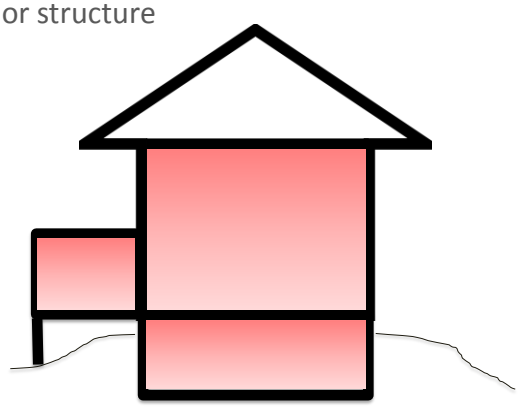
Additions

Types of additions

Chapter 2 definition:

ADDITION. An extension or increase in the conditioned floor area or height of a building or structure

- Conditioning of existing unconditioned space
- Adding of new conditioned floor area



Additions
General

Energy Code Technical Support Program

Three options for compliance:

a) The addition taken as a **separate unit** complies with the code

b) The **addition + existing building** complies with the code as a single building (RES*check*)

c) The addition + existing building uses no more energy than existing building (performance path)

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Additions
General

Energy Code Technical Support Program

- Prescriptive compliance
  - Addition meets prescriptive requirements for new homes
- Performance alternative
  - Existing home plus addition energy use is less than existing home
  - Using Simulated Performance Alternative (Section 405)

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Additions

Prescriptive compliance - Envelope

Only new building assemblies (not the remainder of the house) needs to comply with prescriptive building envelope requirements of new buildings.

Exception:

Where non-conditioned space is changed to conditioned space and the UA of existing building + additions is less than or equal to UA of existing building, the addition complies with the code.

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Additions

Prescriptive compliance - Envelope

The addition must meet:

- General requirements (prescriptive R-values)
- Specific insulation requirements (e.g. attic hatches and doors)
- Maximum area-weighted fenestration U-factor and SHGC
- Air leakage requirements

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Additions

Prescriptive compliance – Heating & Cooling Systems

Energy Code Technical Support Program

New heating and cooling systems that are part of the additions need to comply with

- Controls
- Duct insulation
- Duct sealing
- Duct testing
- Duct leakage

Exception to duct leakage testing:

Where ducts from an existing heating and cooling system are extended to an addition, duct systems with less than 40 linear feet in unconditioned space are not required to be tested.

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Additions

Prescriptive compliance – Service hot water systems

Energy Code Technical Support Program

New Service hot water systems that are part of additions need to meet requirements of Section R403.4.

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R403.4 Mechanical System Piping Insulation (Mandatory)

Energy Code Technical Support Program

Mechanical system piping capable of carrying fluids above 105^0 F or below 55^0 F shall be insulated to a minimum of R-3.

- Heat Pumps and central AC systems
  - Components
- Boilers/Water Heaters for Hydronic Systems

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R403.4 Mechanical System Piping Insulation (Mandatory)

Energy Code Technical Support Program

- Insulate refrigerant lines (R-3)

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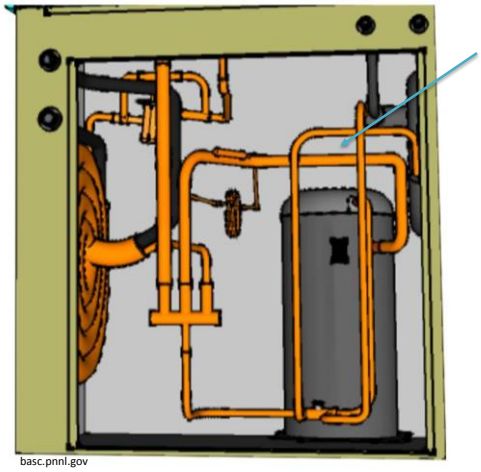
R403.4 Mechanical System Piping Insulation (Mandatory)

Energy Code Technical Support Program



basc.pnnl.gov

Ground source heat pump

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R403.5.1 Heated Water Circulation and Temperature(Mandatory)

Energy Code Technical Support Program

Circulation Systems

The following controls are required:

- Controls for the pumps shall start/turn off based on demand for hot water.
- When the desired temperature is reached the controls shall turn off the pump automatically.

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R403.5.3 Hot Water Pipe insulation (Prescriptive)

Energy Code Technical Support Program

IECC 2015 Hot Water Pipe Insulation of R-3 required for
1) hot water piping ¾ inch nominal diameter and larger
2) for piping serving more than one dwelling unit
3) Piping located outside conditioned space
4) Piping from water heater to distribution manifold
5) Piping located under a floor slab
6) Buried ~~in~~ piping Correction per ICC errata
7) Supply and Return piping in recirculation systems other than demand recirculation systems

Piping located outside conditioned space should be insulated even if the nominal diameter is less than ¾ in.

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Additions

Energy Code Technical Support Program

Prescriptive compliance – Lighting

New lighting systems installed in additions need to meet the code without exceptions.

This means, 75% of lamps in permanently installed lighting fixtures shall be high-efficacy lamps

or

At least 75% of all permanently installed lighting fixtures shall contain only high-efficacy lamps.

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Additions

Prescriptive compliance – Lighting

Energy Code Technical Support Program

High-efficacy lamps:

- Compact fluorescent lamps
- Linear Fluorescent lamps T-8 or smaller (<1 inch diameter)
- LED Lamps

Courtesy of the Department of Energy's Building America Solution Center (http://basc.energy.gov)

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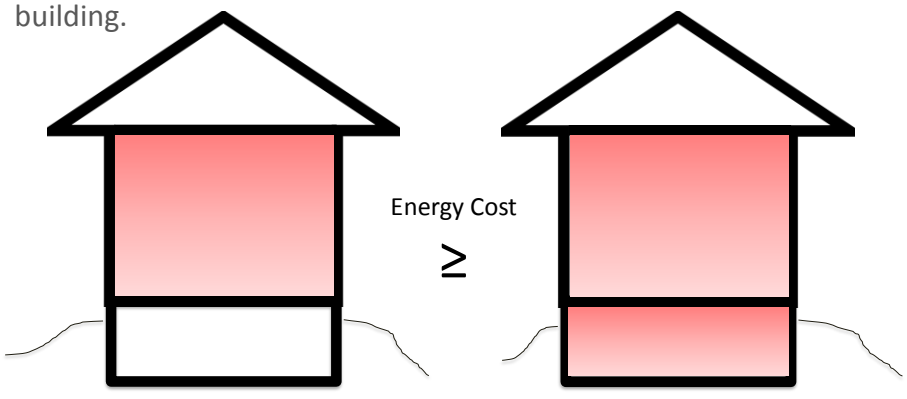
Additions

Simulated Performance Alternative (R502.1.2)

Energy Code Technical Support Program

Where non-conditioned space is converted to conditioned space, the annual energy cost of the existing building plus addition should be less than the annual energy cost of the existing building.



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Additions

Example – Garage Conversion

Energy Code Technical Support Program

An unconditioned garage is being converted into a living space.

- The garage has 2x4 walls and two windows.
- There will be an unconditioned attic above
- The existing HVAC system will be extended to heat and cool the garage.

What is required by the energy code?

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Additions

Example – Garage Conversion

Energy Code Technical Support Program

- Exterior 2x4 walls must be insulated to R-20 or 13+5
- Window U-factors must be ≤ 0.30
- Garage ceiling must be insulated to ≥ R-49
- Building envelope per Air Barrier and Insulation Installation criteria (Table R402.4.1.1)
- HVAC
  - New ductwork must be sealed
  - Testing is not required (unless ≥ 40 linear feet of duct are in unconditioned space)
- Blower door test?

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Additions

Energy Code Technical Support Program

Is a blower door test required for additions?

R402.4.1.2
"The **building or dwelling unit** shall be tested…"

Is an addition **"a building"?** Just part of a building?

Is it a "dwelling unit"?

R202. Dwelling unit. A single unit providing complete independent living facilities for one or more persons including provisions for living, **sleeping, eating, cooking and sanitation**"

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Additions

Energy Code Technical Support Program

ERI Path

It might be possible for certain types of whole-house renovations (e.g. gut rehab) or additions (separate HVAC and door opening to addition for blower door test).

Table R406.4.1 (N1106.4.1): Max. HERS index with onsite renewable energy systems

Renewable Energy Source	Maximum HERS Index	
	New Construction	Whole House Renovations; Additions
None	55	65
1 Renewable System: Solar PV > 2.5 kW, or Renewable primary heating system	60	70
2 Renewable Systems: Solar PV + Solar thermal DHW, or Renewable primary heating + solar thermal DHW	62	72

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Energy Code Technical Support Program

ALTERATIONS

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Alterations
Section R503

Energy Code Technical Support Program

Any construction, retrofit or renovation to an existing structure other than repair or addition that requires a permit.

Also, a change in a building, electrical, gas, mechanical or plumbing system that involves an extension, addition or change to the arrangement, type or purpose of the original installation that requires a permit.

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Alterations

Prescriptive compliance – Building envelope

Energy Code Technical Support Program

Building envelope assemblies part of the alteration shall comply with requirements for new construction.

Exceptions:

- Storm windows installed over existing fenestration
- Existing ceiling, wall or floor cavities exposed during construction provided they are filled with insulation
- Construction where existing roof, wall or floor cavities are not exposed
- Roof recover
- Surface-applied window film installed on existing glass to reduce SHGC

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Alterations

Prescriptive compliance – Replacement Fenestration

Energy Code Technical Support Program

If existing fenestration is replaced, the new fenestration has to meet the code required U value of 0.30 (per MA Amendment).

- Applies regardless of existing frame being replaced or not.
- Fenestration also includes doors. So a replacement door should also meet the requirement

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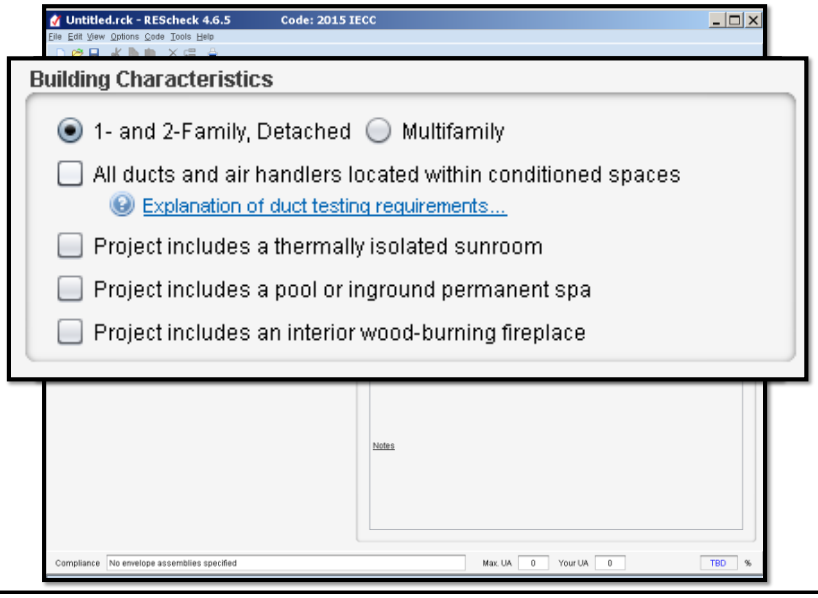
REScheck
Alterations

Energy Code Technical Support Program



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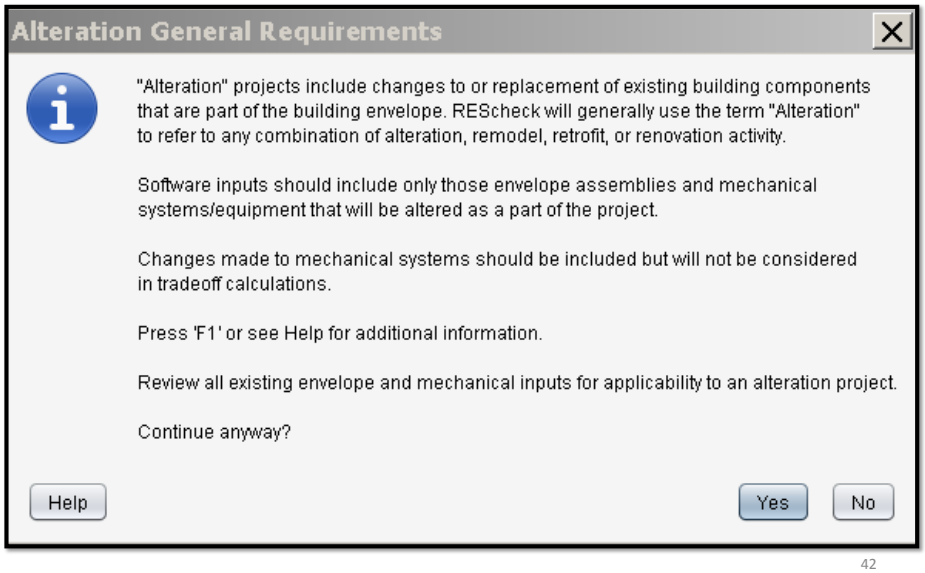
REScheck
Alterations

Energy Code Technical Support Program



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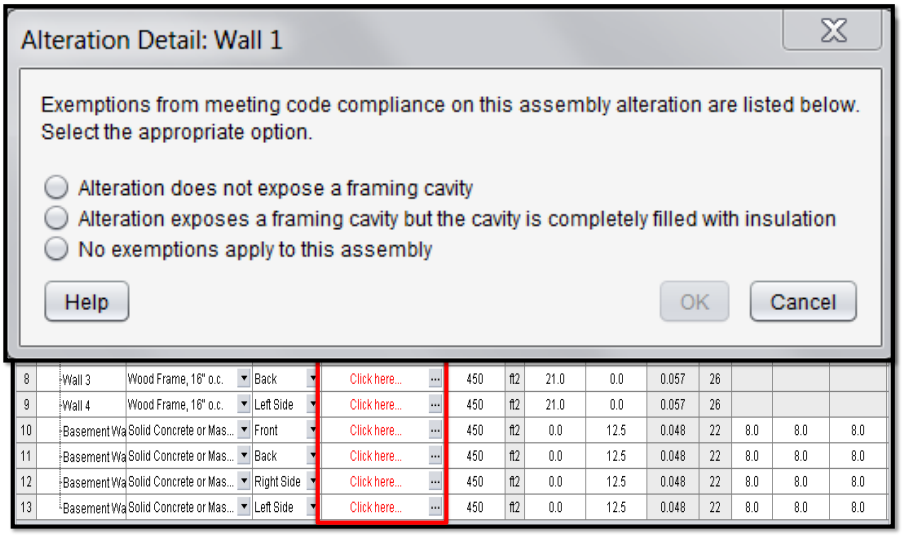
REScheck
Alterations

Energy Code Technical Support Program



8	Wall 3	Wood Frame, 16" o.c.	Back	Click here...	450	ft2	21.0	0.0	0.057	26			
9	Wall 4	Wood Frame, 16" o.c.	Left Side	Click here...	450	ft2	21.0	0.0	0.057	26			
10	Basement Wa	Solid Concrete or Mas...	Front	Click here...	450	ft2	0.0	12.5	0.048	22	8.0	8.0	8.0
11	Basement Wa	Solid Concrete or Mas...	Back	Click here...	450	ft2	0.0	12.5	0.048	22	8.0	8.0	8.0
12	Basement Wa	Solid Concrete or Mas...	Right Side	Click here...	450	ft2	0.0	12.5	0.048	22	8.0	8.0	8.0
13	Basement Wa	Solid Concrete or Mas...	Left Side	Click here...	450	ft2	0.0	12.5	0.048	22	8.0	8.0	8.0

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REScheck
Alterations

Energy Code Technical Support Program

REScheck Software Version 4.6.5

Compliance Certificate

Project North Meadows Development

Energy Code:	**2015 IECC**
Location:	**Boston, Massachusetts**
Construction Type:	**Single-family**
Project Type:	**Alteration**
Orientation:	**Bldg. faces 0 deg. from North**
Climate Zone:	**5 (5641 HDD)**
Permit Date:	**3/17/00**
Permit Number:	

Construction Site: Owner/Agent: Designer/Contractor:

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REScheck
Alterations

Energy Code Technical Support Program

Compliance: Passes using prescriptive requirements for alteration projects

Envelope Assemblies

Assembly	Gross Area or Perimeter	Cavity R-Value	Cont. R-Value	U-Factor	UA
Ceiling 1: Flat Ceiling or Scissor Truss Exemption: Framing cavity not exposed.	---	---	---	---	---
Wall 1: Wood Frame, 16" o.c. Orientation: Front Exemption: Framing cavity not exposed.	---	---	---	---	---
Door 1: Glass Orientation: Front	84			0.250	21
Window 1: Vinyl Frame, Double Pane with Low-E Orientation: Front	204			0.280	57
Door 2: Solid Orientation: Front	20			0.250	5
Wall 2: Wood Frame, 16" o.c. Orientation: Right side	450	21.0	0.0	0.057	25
Door 3: Solid Orientation: Right side	18			0.250	5
Wall 3: Wood Frame, 16" o.c. Orientation: Back	450	21.0	0.0	0.057	26
Wall 4: Wood Frame, 16" o.c. Orientation: Left side Exemption: Framing cavity not exposed.	---	---	---	---	---
Basement Wall 1: Solid Concrete or Masonry Orientation: Front Wall height: 8.0' Depth below grade: 8.0' Insulation depth: 8.0' Exemption: Framing cavity not exposed.	---	---	---	---	---

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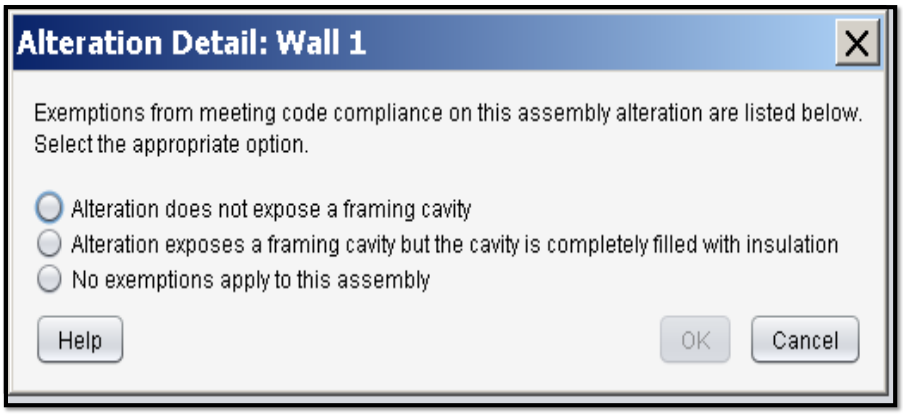
REScheck
Alterations

Energy Code Technical Support Program



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Alterations

Prescriptive compliance – Heating & Cooling systems

Energy Code Technical Support Program

New heating, cooling & duct systems that are part of the alterations need to comply with

- Controls
- Ducts
  - Insulation
  - Sealing
  - Testing

Exception:

Where ducts from an existing heating and cooling system are extended to an addition, duct systems with **less than 40 linear feet in unconditioned space** are not required to be tested.

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Alterations

Prescriptive compliance – Service hot water systems

Energy Code Technical Support Program

Service water heating systems that are part of the alterations must meet the code provisions for new construction

- Pipe insulation
- Circulating system controls

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Alterations

Energy Code Technical Support Program

Prescriptive compliance – Lighting (R503.1.4)

Not less than 75% of all lamps in installed lighting fixtures as part of alterations must be high-efficacy fixtures.

Exception:

Alterations that replace **less than 50% of the luminaires** in a space provided that such alterations **do not increase the installed interior lighting power**.

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Alterations

Energy Code Technical Support Program

Prescriptive compliance – Change in space conditioning

Any unconditioned or low-energy space converted to a conditioned space needs to be brought to full compliance with the code either by using

- Prescriptive option, or
- Simulated performance option

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Alterations
Kitchen Remodeling example

Energy Code Technical Support Program

A kitchen in an existing home is being remodeled. Including:

- New drywall
- New plumbing with ¾" copper piping
- Replacement of a window
- All new lighting fixtures

What code requirements apply?

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Alterations
Kitchen Remodeling example

Energy Code Technical Support Program

- Exposed wall cavities must be filled with insulation
- Hot water pipes insulated to R-3
- New window U-factor ≤ 0.30
- 75% of lamps must be high-efficacy

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Alterations
Reroofing

Energy Code Technical Support Program

- A an existing home is getting a new roof and there is no insulation in the roof cavities.
- The cavities are not exposed during reroofing but the sheathing is exposed.

What does the energy code require with respect to insulating the roof?

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Alterations
Reroofing

Energy Code Technical Support Program

- **Section R503.1.1** – If roofs without insulation in the cavity and where the sheathing or insulation is exposed during reroofing shall be insulated above or below the sheathing.

Note: This only applies if the roof is part of the thermal envelope!

Courtesy of the Department of Energy's Building America Solution Center (http://basc.energy.gov)

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Alterations
Basement remodeling

Energy Code Technical Support Program

A conditioned basement in an existing home is being remodeled. During remodeling, 2x4 wall cavities were exposed but they were already filled with insulation.

Do the walls have to meet prescriptive minimum R-values (R-20 or 13+5)?

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Alterations
Basement remodeling

Energy Code Technical Support Program

There is no minimum R-value requirement provided the cavity is filled with insulation.

Note: If the cavity is only partially filled, the remaining space should be filled with insulation.

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Energy Code Technical Support Program

CHANGE IN SPACE CONDITIONING

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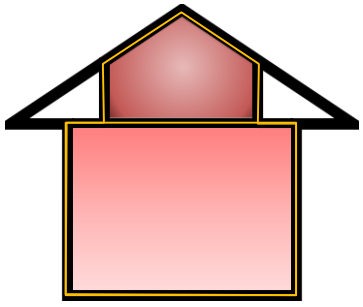
Change in space conditioning
Unconditioned to conditioned attic

Energy Code Technical Support Program

An unconditioned attic is being changed into a bedroom.

What energy code requirements apply?



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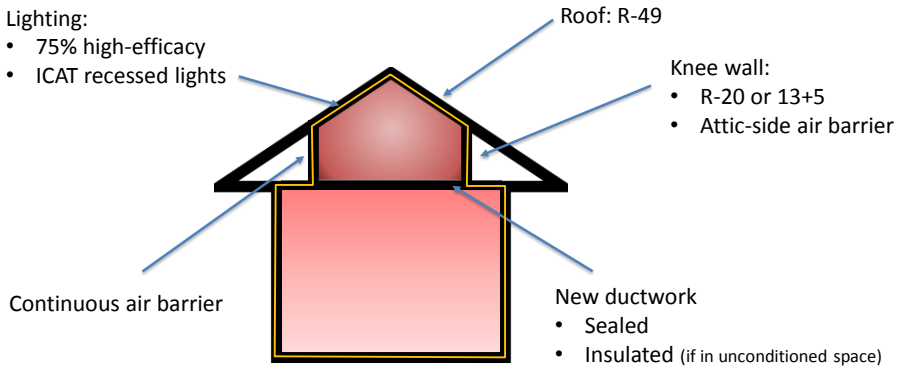
Change in space conditioning
Unconditioned to conditioned attic

Energy Code Technical Support Program

R503.2 Any low-energy or non-conditioned space being converted to a conditioned space shall be **brought to full compliance**



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Energy Code Technical Support Program

REPAIRS

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Repairs
Section R504

Energy Code Technical Support Program

- Routine maintenance and ordinary repairs are not subject to energy code requirements
- Repairs include:
  - Glass-only replacements in an existing sash and frame
  - Roof repairs
  - Bulb-only and/or ballast-only replacements within existing luminaires, provided that the replacement does not increase the installed interior lighting power

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Energy Code Technical Support Program

CHANGE OF OCCUPANCY OR SPACE USE

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Change of Occupancy or Use
Section R505

Energy Code Technical Support Program

Change in occupancy that results in an increase in demand for fossil fuels or electricity **shall comply with this code**.

Example:

R-3
Occupants are primarily permanent and not included in R-1, R-2, R-4 or I

Care facility providing accommodations for five or fewer persons

R-2
Sleeping units or more than two dwelling units where occupants are primarily permanent

Remodeled to a 15-unit apartment building

Likely to increase demand

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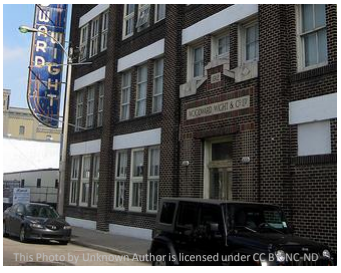
Change of Occupancy or Use
Office to Apartments

Energy Code Technical Support Program

505.2 Any space that is converted to a dwelling unit or portion thereof from another use or occupancy shall comply with this code.



Exception: When using simulated performance option, annual energy cost may be 110% of the reference design

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Change of Occupancy or Use

Energy Code Technical Support Program

Warehouse to apartment

50% of an existing warehouse is being converted into retail space and the other 50% is being converted into residential.

Which spaces must comply with which code?

Residential spaces – Residential IECC (full compliance)

Retail spaces – Commercial IECC (full compliance)

Note: Change in tenant ≠ Change in occupancy

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Summary

Energy Code Technical Support Program

- Stretch and non-Stretch Code requirements are the same for existing buildings
- RES*check* can be used to show UA compliance in alterations
- Either prescriptive or simulated performance path can be selected for additions and change in space conditioning
- Wherever cavity is exposed in walls, and no insulation is found, the cavity must be filled.
- There are a lot of exceptions for existing buildings. Make sure to check for these exceptions.

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Energy Code Support

Energy Code Technical Support Program

Questions about the energy code?

Energy Code Support Hotline:

855-757-9717

Energy Code Support Email:

energycodesma@psdconsulting.com

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Residential New Construction

Incentives for energy efficient building and renovating

Energy Code Technical Support Program

- **Low-Rise New Construction**
  - Performance Path – based upon Electric and Fuel savings, plus a % adder as compared to MA baseline – incentives up to $10,000
- **High-Rise New Construction and all Master Metered Natural Gas**
  - Incentives based upon modeling by Program Manager

Incentives also offered for existing buildings.
Visit **www.MassSave.com** for the details.

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Residential New Construction – Incentives

Energy Code Technical Support Program

Blended Savings Approach (BSA)

Single Family BSA Incentive Calculation	
A	Electric Savings * $0.35 / kWh
B	Fuel Savings * $35 / MMBtu
C	Percent Savings * $3,000
Participant Incentive	A +B +C
Rater Incentive	$350

Multifamily BSA Incentive Calculation	
A	Electric Savings * $0.35 / kWh
B	Fuel Savings * $35 / MMBtu
C	Percent Savings * $2,000
Participant Incentive	A +B +C
Rater Incentive	$100

Details at:
www.masssave.com/en/saving/residential-rebates/new-construction

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Thanks!

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