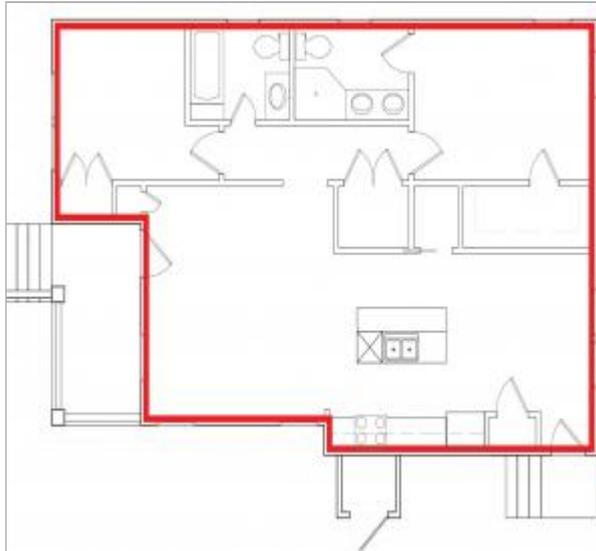


# 2012 IECC Code Level Insulation – DOE Zero Energy Ready Home Requirements

Last Updated: 05/09/2014

## Scope



Identify what materials will constitute the continuous air barrier around the building envelope.

Install ceiling, wall, and foundation insulation that meets or exceeds the requirements of the most recent International Energy Conservation Code.

### DOE Zero Energy Ready Home

The U.S. Department of Energy Zero Energy Ready Home [National Program Requirements](#) specify as a mandatory requirement (Exhibit 1, #2.2) that, for all labeled homes, whether prescriptive or performance path, ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels. See the Compliance tab for specific program details and exceptions.

### ENERGY STAR Certified Homes (Ver 3, Rev 07)

ENERGY STAR Certified Homes (Ver 3 Rev 07) requires that ceiling, wall, floor, and slab insulation levels meet or exceed those specified in the 2009 International Energy Conservation Code (IECC), with some exceptions. See the [ENERGY STAR 2009 IECC Code Level Insulation](#) guide for more information.

A version of the ENERGY STAR Certified Homes program requirements, Version 3.1, has been developed for homes in states that have adopted the 2012 IECC, or equivalent. In Version 3.1, the efficiency target has been made more rigorous, designed to save on average 15% or more relative to the 2012 IECC. EPA intends to implement the Version 3.1 program requirements for homes permitted starting one year after state-level implementation of 2012 IECC or an equivalent code. However, EPA will make a final determination of the implementation timeline on a state-by-state basis. For more information see the [ENERGY STAR Certified Homes Version 3.1 web page](#). Some states have adopted state or region-specific ENERGY STAR requirements that may require 2012 IECC insulation level requirements. See the [ENERGY STAR Certified Homes Regional Specifications web page](#).

## Description

The U.S. Department of Energy Zero Energy Ready Home Program specifies that all certified homes should meet the mandatory requirements listed in Exhibit 1 of the [DOE Zero Energy Ready Home National Program Requirements](#). Item 2.2 in the mandatory requirements requires that “ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels.”

Those requirements are listed in Table 1; the insulation requirements of the 2009 IECC are included for comparison.

**Table 1.** Minimum Insulation Levels for New Homes Required by the 2009 and 2012 IECC, Adapted from 2012 IECC Table Reference

R402.1.1 and 2009 IECC Table 402.1.1.  [https://basc.pnnl.gov/sites/all/themes/pnnl\\_btp/images/REF\\_icon.png](https://basc.pnnl.gov/sites/all/themes/pnnl_btp/images/REF_icon.png)

Climate Zone	Ceiling R-Value		Wood Frame Wall R-Value <sup>b</sup>		Mass Wall <sup>c</sup> R-Value		Floor R-Value <sup>d</sup>		Basement Wall <sup>e</sup> R-Value		Slab R-Value <sup>f</sup> and Depth		Crawlspace <sup>g</sup> Wall R-Value	
	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC
1	30	30	13	13	3/4	3/4	13	13	0	0	0	0	0	0
2	30	38	13	13	4/6	4/6	13	13	0	0	0	0	0	0
3	30	38	13	20/13+5 <sup>b,d</sup>	5/5	8/13	19	19	5/13 <sup>h</sup>	5/13 <sup>h</sup>	0	0	5/13	5/13
4 except Marine	38	49	13	20/13+5 <sup>b,d</sup>	5/10	8/13	19	19	10/13	10/13	10, 2 ft.	10, 2 ft.	10/13	10/13
5 and Marine	38	49	20/13+5 <sup>b,c</sup>	20/13+5 <sup>b,d</sup>	13/17	13/17	30 <sup>f</sup>	30 <sup>f</sup>	10/13	15/19	10, 2 ft.	10, 2 ft.	10/13	15/19
6	49	49	20/13+5 <sup>b,c</sup>	20+5/13+10 <sup>b,d</sup>	15/19	15/20	30 <sup>f</sup>	30 <sup>f</sup>	15/19	15/19	10, 4 ft.	10, 4 ft.	10/13	15/19
7 and 8	49	49	21	20+5/13+10 <sup>b,d</sup>	19/21	19/21	38 <sup>f</sup>	38 <sup>f</sup>	15/19	15/19	10, 4 ft.	10, 4 ft.	10/13	15/19

Source: 2009 and 2012 IECC Tables 402.1.1

- R-values are minimums. When insulation is installed in a cavity which is less than the labeled design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table
- The first value is cavity insulation, the second value is continuous insulation or insulated siding, so “13+5” means R-13 cavity insulation plus R-5 continuous insulation or insulated siding.
- If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
- If structural sheathing covers 40% or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used – to maintain a consistent total sheathing thickness
- The second R-value applies when more than half the insulation is on the interior of the mass wall.
- Or insulation sufficient to fill the framing cavity, R-19 minimum.
- “15/19” means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. “15/19” shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. “10/13” means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- Basement wall insulation is not required in warm-humid locations as defined by 2009 and 2012 Figure 301.1 and Table 301.1.
- R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.

The DOE Zero Energy Ready Home program includes two paths: the prescriptive path and the performance path.

### How to follow the DOE Zero Energy Ready Home Prescriptive Path for 2012 Insulation Levels

First determine whether you are eligible to use the prescriptive path, as described in the [DOE Zero Energy Ready Home National Program Requirements](#). Eligibility is based on the number of bedrooms and overall square footage of the home; larger homes typically must use the performance path. If you are eligible to use the prescriptive requirements and choose to use this method, construct your home following the mandatory requirements of Exhibit 1 as well as the requirements of Exhibit 2. Both lists stipulate that insulation levels should meet or exceed 2012 IECC levels as listed in Table R402.1.1, with the following notes and exceptions:

- Steel-frame ceilings, walls, and floors shall meet the insulation requirements of the 2012 IECC – Table 402.2.6.
- For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in d) are used;
- For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof / ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 sq. ft. or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in d) are used;

- d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows: An assembly with a U-factor equal to or less than specified in 2012 IECC Table 402.1.3 complies. A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 also complies. The insulation levels of fenestration, ceilings, walls, floors, and slabs can be traded off using the UA approach under both the Prescriptive and the Performance Path. Also, note that while ceiling and slab insulation can be included in trade-off calculations, Items 4.1 through 4.3 of the ENERGY STAR for Homes V3 Thermal Enclosure System Rater Checklist shall be met regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

### **How to follow the DOE Zero Energy Ready Home Performance Path for 2012 Insulation Levels**

Builders following the Zero Energy Ready Home performance path must meet all of the mandatory requirements in Exhibit 1 and must also meet or exceed the overall HERS Index score generated for their home by modeling software, as defined by Exhibit 2. To determine a target HERS index, the home, as designed, is modeled using the requirements listed in Exhibit 1 and 2. The software creates a target HERS index based on the climate, HVAC, and water heating equipment selected, and other specifics about the home.

Exhibit 2 sets insulation target levels and requires builders to meet the 2012 IECC and achieve Grade 1 installation, per RESNET standards. For more on RESNET Grade 1 insulation installation, see [Insulation Installation \(RESNET Grade 1\)](#). Footnote 5 to Exhibit 2 notes that “State energy code specifications that exceed the DOE Zero Energy Ready Home National Program Requirements always take precedence and shall be used instead of DOE Zero Energy Ready Home specifications to determine DOE Zero Energy Ready Home compliance. In states where the residential provisions of the 2012 International Energy Conservation Code (IECC) have been adopted, the specifications of the 2015 IECC will become mandatory within 6 months of the 2015 IECC publication date. DOE will maintain a list of state-specific compliance requirements and timelines on the DOE Zero Energy Ready Home website.”

With regard to insulation requirements, those specified in the 2015 IECC are very similar to those listed in the 2012 IECC.

## Ensuring Success

Insulation installation should be inspected by site supervisors before drywall is installed to confirm that specified amounts of insulation have been installed and that installation meets RESNET Grade 1 standards. It is important to consult the insulation requirements of the 2012 International Energy Conservation Code (IECC) to ensure the R-value (or U-value) requirements are met or exceeded. A table of these R-value requirements is provided in the [Description tab](#). Be sure to review the exceptions listed for ceilings as these can affect the required insulation levels.

# Climate

Climate-specific insulation level requirements are shown in Table 1, and discussed further in the [Description tab](#) of this guide.

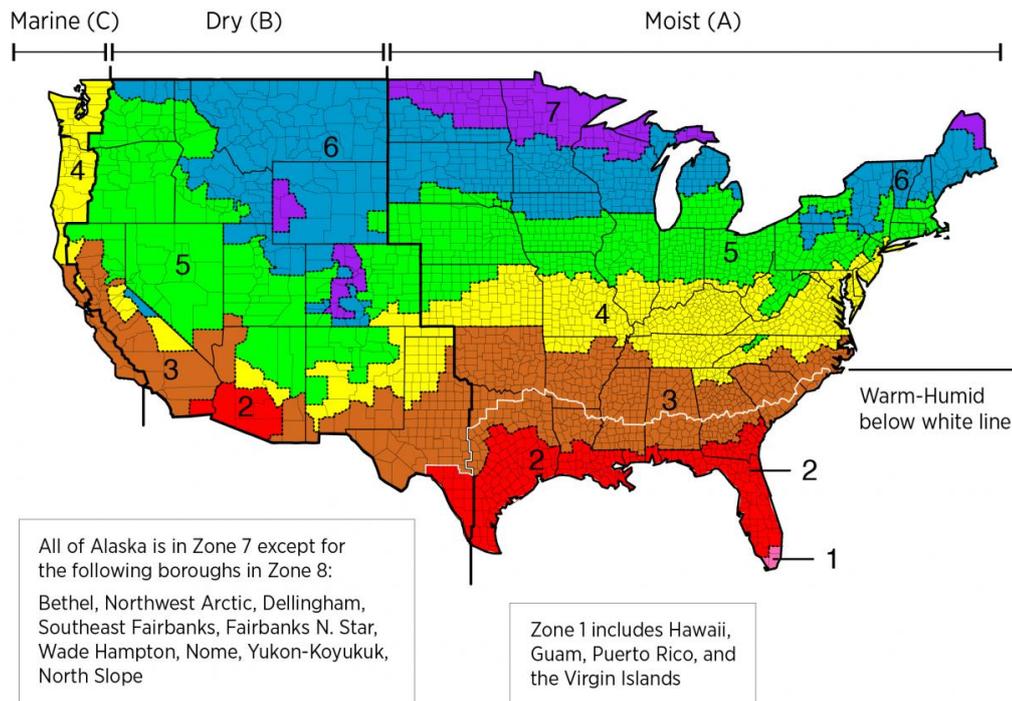
**Table 1.** Minimum Insulation Levels for New Homes Required by the 2009 and 2012 IECC, Adapted from 2012 IECC Table Reference

R402.1.1 and 2009 IECC Table 402.1.1.  [https://basc.pnnl.gov/sites/all/themes/pnnl\\_btp/images/REF\\_icon.png](https://basc.pnnl.gov/sites/all/themes/pnnl_btp/images/REF_icon.png)

Climate Zone	Ceiling R-Value		Wood Frame Wall R-Value <sup>b</sup>		Mass Wall <sup>c</sup> R-Value		Floor R-Value <sup>d</sup>		Basement Wall <sup>e</sup> R-Value		Slab R-Value <sup>f</sup> and Depth		Crawlspace <sup>g</sup> Wall R-Value	
	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC	2009 IECC	2012 IECC
1	30	30	13	13	3/4	3/4	13	13	0	0	0	0	0	0
2	30	38	13	13	4/6	4/6	13	13	0	0	0	0	0	0
3	30	38	13	20/13+5 <sup>b,d</sup>	5/5	8/13	19	19	5/13 <sup>h</sup>	5/13 <sup>h</sup>	0	0	5/13	5/13
4 except Marine	38	49	13	20/13+5 <sup>b,d</sup>	5/10	8/13	19	19	10/13	10/13	10, 2 ft.	10, 2 ft.	10/13	10/13
5 and Marine	38	49	20/13+5 <sup>b,c</sup>	20/13+5 <sup>b,d</sup>	13/17	13/17	30 <sup>f</sup>	30 <sup>f</sup>	10/13	15/19	10, 2 ft.	10, 2 ft.	10/13	15/19
6	49	49	20/13+5 <sup>b,c</sup>	20+5/13+10 <sup>b,d</sup>	15/19	15/20	30 <sup>f</sup>	30 <sup>f</sup>	15/19	15/19	10, 4 ft.	10, 4 ft.	10/13	15/19
7 and 8	49	49	21	20+5/13+10 <sup>b,d</sup>	19/21	19/21	38 <sup>f</sup>	38 <sup>f</sup>	15/19	15/19	10, 4 ft.	10, 4 ft.	10/13	15/19

Source: 2009 and 2012 IECC Tables 402.1.1

- a. R-values are minimums. When insulation is installed in a cavity which is less than the labeled design thickness of the insulation, the installed R-value of the insulation shall not be less than the R-value specified in the table
- b. The first value is cavity insulation, the second value is continuous insulation or insulated siding, so "13+5" means R-13 cavity insulation plus R-5 continuous insulation or insulated siding.
- c. If structural sheathing covers 25 percent or less of the exterior, insulating sheathing is not required where structural sheathing is used. If structural sheathing covers more than 25 percent of exterior, structural sheathing shall be supplemented with insulated sheathing of at least R-2.
- d. If structural sheathing covers 40% or less of the exterior, continuous insulation R-value shall be permitted to be reduced by no more than R-3 in the locations where structural sheathing is used - to maintain a consistent total sheathing thickness
- e. The second R-value applies when more than half the insulation is on the interior of the mass wall.
- f. Or insulation sufficient to fill the framing cavity, R-19 minimum.
- g. "15/19" means R-15 continuous insulated sheathing on the interior or exterior of the home or R-19 cavity insulation at the interior of the basement wall. "15/19" shall be permitted to be met with R-13 cavity insulation on the interior of the basement wall plus R-5 continuous insulated sheathing on the interior or exterior of the home. "10/13" means R-10 continuous insulated sheathing on the interior or exterior of the home or R-13 cavity insulation at the interior of the basement wall.
- h. Basement wall insulation is not required in warm-humid locations as defined by 2009 and 2012 Figure 301.1 and Table 301.1.
- i. R-5 shall be added to the required slab edge R-values for heated slabs. Insulation depth shall be the depth of the footing or 2 feet, whichever is less in Zones 1 through 3 for heated slabs.



IECC Climate Zone Map

# Training

## Right and Wrong Images



Display Image: [ES\\_TESRC\\_2.2\\_PG52\\_16b\\_102811\\_2.jpg](#)

Reference: [Thermal Enclosure System Rater Checklist Guidebook](#)

Author(s): EPA

Organization(s): EPA

*Guide describing details that serve as a visual reference for each of the line items in the Thermal Enclosure System Rater Checklist.*



Display Image: [ES\\_TESRC\\_2.2\\_PG52\\_16b\\_102811\\_2.jpg](#)

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Author(s): EPA

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Author(s): EPA

Organization(s): EPA

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# CAD

None Available

# Compliance

The Compliance tab contains both program and code information. Exact code language is copyrighted and may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

## [ENERGY STAR Certified Homes \(Ver 3, Rev 07\)](#)

ENERGY STAR for Homes requires that ceiling, wall, floor, and slab insulation levels meet or exceed those specified in the 2009 International Energy Conservation Code (IECC), or with some exceptions. See the guide [2009 IECC Code Level Insulation – ENERGY STAR Requirements](#) for more information.

## [DOE Zero Energy Ready Home](#)

The U.S. Department of Energy Zero Energy Ready Home [National Program Requirements](#) specify as a mandatory requirement (Exhibit 1, #2.2) that for all labeled homes, whether prescriptive or performance path, ceiling, wall, floor, and slab insulation shall meet or exceed 2012 IECC levels.

(12) Insulation levels in a home shall meet or exceed the component insulation requirements in the 2012 International Energy Conservation Code (IECC) - Table R402.1.1. The following notes and exceptions apply:

- a. Steel-frame ceilings, walls, and floors shall meet the insulation requirements of the 2012 IECC – Table 402.2.6.
- b. For ceilings with attic spaces, R-30 shall satisfy the requirement for R-38 and R-38 shall satisfy the requirement for R-49 wherever the full height of uncompressed insulation at the lower R-value extends over the wall top plate at the eaves. This exemption shall not apply if the alternative calculations in d) are used;
- c. For ceilings without attic spaces, R-30 shall satisfy the requirement for any required value above R-30 if the design of the roof / ceiling assembly does not provide sufficient space for the required insulation value. This exemption shall be limited to 500 sq. ft. or 20% of the total insulated ceiling area, whichever is less. This exemption shall not apply if the alternative calculations in d) are used;
- d. An alternative equivalent U-factor or total UA calculation may also be used to demonstrate compliance, as follows: An assembly with a U-factor equal or less than specified in 2012 IECC Table 402.1.3 complies. A total building thermal envelope UA that is less than or equal to the total UA resulting from the U-factors in Table 402.1.3 also complies. The insulation levels of fenestration, ceilings, walls, floors, and slabs can be traded off using the UA approach under both the Prescriptive and the Performance Path. Also, note that while ceiling and slab insulation can be included in trade-off calculations, Items 4.1 through 4.3 of the ENERGY STAR for Homes V3 Thermal Enclosure System Rater Checklist shall be met regardless of the UA tradeoffs calculated. The UA calculation shall be done using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials. The calculation for a steel-frame envelope assembly shall use the ASHRAE zone method or a method providing equivalent results, and not a series-parallel path calculation method.

Builders following the Zero Energy Ready Home performance path must determine a target HERS score by modelling their designed home. The home must meet the mandatory requirements shown in Exhibit 1 of the DOE Zero Energy Ready Home National Program Requirements as well as the overall target HERS index as defined by Exhibit 2.

Exhibit 2 sets the insulation target at the 2012 IECC and requires Grade 1 installation, per RESNET standards.

Footnote 5 to Exhibit 2 notes that State energy code specifications that exceed the DOE Zero Energy Ready Home National Program Requirements always take precedence and shall be used instead of DOE Zero Energy Ready Home specifications to determine DOE Zero Energy Ready Home compliance. In states where the residential provisions of the 2012 International Energy Conservation Code (IECC) have been adopted, the specifications of the 2015 IECC will be required within 6 months of the 2015 IECC publication date. DOE will maintain a list of state-specific compliance requirements and timelines on the DOE Zero Energy Ready Home website.

## More Info.

Access to some references may require purchase from the publisher. While we continually update our database, links may have changed since posting. Please contact our webmaster if you find broken links.

### Case Studies

1. [DOE Zero Energy Ready Home Case Study: Garbett Homes, Herriman, Utah](#)

**Author(s):** PNNL

**Organization(s):** PNNL

**Publication Date:** September, 2013

*Case study of a DOE Zero Energy Ready Home in Herriman, UT, that scored HERS 40 without PV, -1 with PV. This 4,111 ft<sup>2</sup> production home has R-23 advanced framed walls, and a vented attic with R-60 blown fiberglass.*

2. [DOE Zero Energy Ready Home Case Study: Weiss Building & Development, Downers Grove, Illinois](#)

**Author(s):** PNNL

**Organization(s):** PNNL

**Publication Date:** September, 2013

*Case study of a DOE Zero Energy Ready Home in Downers Grove IL that scored HERS 35 without PV. This 3,600 ft<sup>2</sup> custom home has advanced framed walls with R-23 dense-packed fiberglass plus R-13 rigid polyiso, a sealed attic with open-cell spray foam, a pier foundation, and 95% efficient gas furnace.*

### References and Resources\*

1. [Building America Best Practices Series Volume 17: Insulation, A Guide for Contractors to Share with Homeowners](#)

**Author(s):** Baechler, Adams, Hefty, Gilbride, Love

**Organization(s):** PNNL, ORNL

**Publication Date:** May, 2012

*Guide to help contractors and homeowners identify ways to make homes more comfortable, more energy efficient, and healthier to live in.*

2. [DOE Zero Energy Ready Home National Program Requirements](#)

**Author(s):** DOE

**Organization(s):** DOE

**Publication Date:** August, 2015

*Standard requirements for DOE's Zero Energy Ready Home national program certification.*

3. [ENERGY STAR Certified Homes, Version 3 \(Rev. 07\) Inspection Checklists for National Program Requirements](#)

**Author(s):** EPA

**Organization(s):** EPA

**Publication Date:** June, 2013

*Standard document containing the rater checklists and national program requirements for ENERGY STAR Certified Homes, Version 3 (Rev. 7).*

4. [ENERGY STAR Certified Homes, Version 3 \(Rev. 07\) National Program Requirements](#)

**Author(s):** EPA

**Organization(s):** EPA

**Publication Date:** June, 2013

*Document outlining national program requirements for ENERGY STAR Certified Homes, Version 3 (Rev. 7).*

\*Publication dates are shown for formal documents. Dates are not shown for non-dated media. Access dates for referenced, non-dated media, such as web sites, are shown in the measure guide text.

### Contributors to this Guide

None Available