



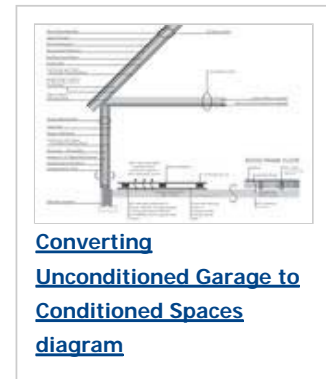
Article #1704 -

Converting Unconditioned Garage to Conditioned Space - Code Notes

[2009 IECC]

Requirements

Converting an existing unconditioned garage to conditioned space is a popular strategy for increasing the living space of a house. Typically, the conversion or remodeling must be done in compliance with construction codes in force at the time the remodel permit is issued. Compliance shall be demonstrated by meeting the requirements of the 2009 International Energy Conservation Code (IECC). The IECC offers both prescriptive and performance compliance approaches. The prescriptive compliance approach uses either the R-value of insulating materials for each component (Sections 402.1.1 and 402.1.2 and Table 402.1.1) or the U-factor for each assembly (Section 402.1.3 and Table 402.1.3). Section 402.1.4 is an alternative to the prescriptive approach--the total building thermal envelope UA is less than or equal to the total UA resulting from using the U-factors in Table 402.1.3. The U.S. Department of Energy's REScheck software allows trade-offs among levels of energy efficiency of components to demonstrate compliance using this UA approach. Section 405 offers a simulated performance alternative compliance approach that requires the proposed residence be shown to have an annual energy cost less than or equal to the annual energy cost of the standard reference design.



Applications

The insulation and glazing solutions proposed below are options that can be considered in demonstrating compliance with the 2009 IECC when converting an unconditioned garage to conditioned space. A table provides the code requirement for each climate zone followed by solutions proposed for both a prescriptive compliance approach and the alternative REScheck software overall UA approach which allows trade-offs among levels of component efficiency. The performance approach of Section 405—a computer software simulated comparison of annual energy costs—offers the opportunity to avoid high cost strategies in some areas by exceeding code minimums in others and trading-off the difference.

Mandatory for all Climate Zones (CZ) - Air leakage

The IECC requires certain Mandatory requirements be met regardless of insulation R-values and glazing U-factors. Reducing air leakage into the building envelope is important to reduce energy use in the space. The building thermal envelope shall be durably sealed to limit infiltration. Caulk, gasket, weatherstrip or otherwise seal with an air barrier material, suitable film or solid material all accessible sources of infiltration and air leakage including plate penetrations; plate / sheathing junctures; plate / floor junctures; plate / drywall junctures; sheathing seams, joints, and penetrations; seal and insulate the rim joist; and verify by blower door test result of <7air changes per hour (7ACH at 50p) or field verified by a code official-approved party. Duct tightness test (duct blaster) is not required if the air handler and all ducts are located within conditioned space.

The Prescriptive requirements for the building envelope are presented in Table 1. The assemblies that are presented in this table are typically encountered when converting an unconditioned garage to a conditioned space.

| Climate Zone | Fenestration U-Factor | Glazed Fenestration SHGC | Ceiling R-Value | Wood-Frame Wall R-Value | Floor R-Value | Slab R-Value and Depth |
|-----------------|-----------------------|--------------------------|-----------------|-------------------------|---------------|------------------------|
| 1 | 1.2 | 0.30 | 30 | 13 | 13 | 0 |
| 2 | 0.65 | 0.30 | 30 | 13 | 13 | 0 |
| 3 | 0.50 | 0.30 | 30 | 13 | 19 | 0 |
| 4 except Marine | 0.35 | NR | 38 | 13 | 19 | 10,2 ft |
| 5 and Marine 4 | 0.35 | NR | 38 | 20 or 13+5 | 30 | 10, 2 ft |
| 6 | 0.35 | NR | 49 | 20 or 13+5 | 30 | 10,4 ft |

Table 1: IECC Table 402.1.1 abridged; see un-abridged for specific conditions.

Compliance Solutions for Walls

The following insulation options will meet the requirements for walls listed in Table 1

- R-13 in exterior wood-frame wall with exposed stud cavities: R-13 cavity-fill unfaced batts or blown or foamed-in insulation prior to gypsum board or other vapor-permeable (VP) finishing material
- R-13 in exterior wood-frame wall with unexposed stud cavities: R-13 cavity-fill blown or foamed-in insulation behind existing gypsum board or other VP finishing material. Compliance with other code requirements (e.g., electrical wiring, receptacles, switches, lighting, air leakage, etc.) would likely necessitate removal of any existing finish on interior of wall
- R-13 + 5 means R-13 cavity PLUS R-5 insulated sheathing: See R-13 above PLUS R-5 VP insulated sheathing. R-13 +5 would typically require full exposure of wood-frame wall cavities by removal of finish on the interior of the wall. Compliance with other code requirements (e.g., electrical wiring, receptacles, switches, lighting, air leakage) would likely necessitate removal of any existing finish on interior of wall
- R-20 in exterior wood-frame wall with exposed stud cavities: R-13 cavity-fill unfaced batts or blown or foamed-in insulation PLUS R-7 VP insulated sheathing prior to gypsum board or other VP finishing material. Insulating material R-values are summed—the cavity-fill R-value added to the insulated sheathing R-value must meet the code R-value . R-15 (high density) cavity-fill unfaced batts or blown or foamed-in insulation PLUS R-5 VP insulated sheathing prior to gypsum board or other VP finishing material meets this R-20 requirement
- R-21 in exterior wood-frame wall with exposed stud cavities: : R-15 cavity-fill unfaced batts or blown or foamed-in insulation PLUS R-6 VP insulated sheathing prior to gypsum board or other VP finishing material. Another solution is R-15 (high density) unfaced batts or blown or foamed-in insulation PLUS R-5 VP insulated sheathing prior to gypsum board or other VP finishing material

Compliance Solutions for Ceilings

The following ceiling insulation strategies will meet the requirements for ceilings listed in Table 1

- R-30 in ceiling / attic floor assembly: R-30 blown insulation at ceiling / floor assembly
- R-30 in vented cathedral ceiling / roof assembly: R-30C batt (8.25" batt and 1+" vent space for 10" rafters or R-38C batt (10 ¼" batt with 1+" vent space for 12" rafters)
- R-30 unvented cathedral ceiling / roof assembly: R-25 foamed-in-place insulation against underside of roof sheathing PLUS R-5 continuous layer of VP insulated sheathing fastened to top chord PLUS gypsum board
- R-38 in ceiling / attic floor assembly: R-38 blown insulation at ceiling / floor assembly

- R-38 in vented cathedral ceiling / roof assembly: R-30C batt (8.25" batt and 1+" vent space for 10" rafters plus ?R-8 VP insulated sheathing or R-38C batt (10 ¼" batt with 1+" vent space for 12" rafters)
- R-38 in unvented cathedral ceiling / roof assembly: R-25 foamed-in-place insulation against underside of roof sheathing PLUS R-13 continuous layer of VP insulated sheathing fastened to top chord PLUS gypsum board
- R-49 in ceiling / attic floor assembly: R-49 blown insulation at ceiling / floor assembly
- R-49 in vented cathedral ceiling / roof assembly: R-38C batt (10 ¼ " batt and 1+"vent space for 12" rafters, plus ?R-11 continuous layer of VP insulated sheathing fastened to face of rafter.
- R-49 in unvented cathedral ceiling / roof assembly: Furring strips fastened to face of rafter / top chord to accommodate 5 ¾" R-35 foamed-in insulation against underside of roof sheathing, PLUS R-14 continuous layer of VP insulated sheathing fastened to face of furring strip, PLUS gypsum board

Compliance Solutions for Slab Floor – R-Value , Depth

The following slab floor insulation strategies will meet the requirements for ceilings listed in Table 1. Note that no insulation will be required on the slab edge if a floor assembly is built over the slab.

- R-0: R-0. (R-5 shall be added to required R-values for heated slabs. For heated slabs insulation depth to lesser of depth of footing or 24)
- R-10, 24": R-10 insulation applied at slab edge not adjacent to conditioned space and extended 24" below top of slab. (Add R-5 if heated slab)
- R-10, 48": R-10 insulation applied at slab edge not adjacent to conditioned space and extended 48" below top of slab. (Add R-5 if heated slab)

Compliance Solutions for Raised Wood-Frame Floor

The insulation strategies can be used if a floor assembly is built on top of the slab floor. In this case no slab edge insulation is required.

- R-13: R-13 cavity-fill unfaced batt
- R-19: R-19 cavity-fill unfaced batt in 2"X6" minimum floor joist cavity
- R-30: R-30 cavity-fill unfaced batt or insulation sufficient to fill framing cavity , R-19 minimum

Compliance Solutions for Fenestrations

- Fenestration U-factor: Table U-factors are maximums
- Glazed Fenestration SHGC: Table SHGC are maximums

Plan Review

Ensure the drawings detail the layering of insulating materials—the individual and total R-values of insulating materials comprising the building thermal envelope.

Field Inspection

Verify proper installation and layering of insulation materials and effective measures to minimize air leakage.

Code Citations*

The building thermal envelope shall be durably sealed to limit infiltration. (2009 IECC Section 402.4)

Insulation material used in layers, such as framing cavity insulation and insulating sheathing, shall be summed to compute the component R-value. (2009 IECC Section 402.1.2)

R-values are minimums. U-factors and SHGC are maximums. R-19 batts compressed into a nominal 2"x6" framing cavity such that the R-value is reduced by R-1 or more shall be marked with the compressed batt R-value in addition to the full thickness R-value. (2009 IECC Table 402.1.1)


More Information

[Insulation and Air Sealing](#) 

[Renovation and Insulation](#) 

[Insulated Sheathing](#) 

References

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PNNL-SA-83069

Last Modified: 2011-12-15