



Additional Measures Required Options

This pamphlet is one in a series that describes residential energy conservation requirements of the Oregon Residential Specialty Code and Structural Specialty Code. Other pamphlets in this series may be downloaded from Oregon Department of Energy web site at <http://egov.oregon.gov/ENERGY/CONS/Codes/cdpub.shtm> or local building departments or from Oregon Building Codes Division.

Directions for selecting options

Prior to selecting one of the nine measures/options from Table N1101.1(2), one must either comply with the building envelope requirements of Tables N1101.1(1) or N1104.1(1).

If you are demonstrating building envelope compliance using Table N1104.1(1), other combinations of building envelope measures may be used to show that

this combination achieves the performance standard of the Standard Base Case.

You must carefully select an additional measure from Table N1101.1(2) when using Table N1104.1(1). It is simpler to select an additional measure that does not contain a building envelope improvement. If you select an additional measure that requires building envelope improvements, that improvement must be used as the Standard base case value, in lieu of that value. In addition to the modified calculation, any non-envelope measure must be installed.

See publication #12, *How to Do Residential Thermal Performance Calculations Using Table N1104.1(2)* for examples of how to incorporate building envelope Additional Measures into Table N1104.1(1) calculations.

1	High efficiency HVAC system: Gas-fired furnace or boiler with minimum AFUE of 90% ^a , or Air-source heat pump with minimum HSPF of 8.5 or Closed-loop ground source heat pump with minimum COP of 3.0
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Measure 1: High efficiency HVAC system

This option requires one of three different type of high efficiency (above code performance) HVAC systems.

The **gas-fired furnace** includes natural gas and propane furnaces. 90% AFUE is a minimum performance value; this unit may exceed this performance requirement.

78% AFUE is the minimum code requirement for gas-fired furnaces.

The **gas-fired boiler** includes natural gas and propane boilers. 90% AFUE is a minimum performance value; this unit may exceed this performance requirement.

80% AFUE is the minimum code requirement for gas-fired boilers. 75% AFUE is the minimum code requirement for gas-fired steam boilers.

Footnote a states that furnaces and boilers located within the building envelope shall have sealed combustion air installed. Combustion air must be ducted directly from the outdoors.

Air-source heat pump must have a minimum HSPF of 8.5; this unit may exceed this performance requirement.

7.7 HSPF and 13.0 SEER is the minimum code requirement for heat pumps.

Closed-loop ground source heat pumps must have a minimum efficiency of 3.0 COP.

Code does not have a minimum code efficiency requirement for closed-loop ground source heat pumps.



2	High efficiency duct sealing: Certified performance tested duct systems ^b or All ducts and air handler are contained within building envelope ^a
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Measure 2: High efficiency duct sealing

This option requires one of two different methods of improving HVAC duct efficiency (above code performance).

All HVAC ducts must be certified that performance tested through a process that demonstrates compliance with the Oregon Department of Energy’s Residential Energy Tax Credit duct performance standards. Documentation of this work being done to these standards must be provided to the Building Official upon completion of work.

Footnote b states that documentation of Performance Tested Ductwork shall be submitted to the Building

Official upon completion of work. This work shall be performed by a contractor that is certified by the Oregon Department of Energy’s (ODOE) Residential Energy Tax Credit program and documentation shall be provided that work demonstrates conformance to ODOE duct performance standards.

All ducts and air handler are located within the building envelope (conditioned space). Air handler shall have sealed combustion air installed. Combustion air must be ducted directly from the outdoors.

3	High efficiency building envelope: Replace corresponding Table N1101.1(1) components with all of the following: Wall above grade – U-0.047 / R-19+R-5 continuous, and Vaulted ceilings – U-0.033 / R-30A ^{c, d} , and Flat ceilings – U-0.025 / R-49, and Windows – U-0.32
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Measure 3: High efficiency building envelope

This option requires that all four building envelope measures exceed the Standard base case: wall insulation, vaulted and flat ceiling insulation, and windows.

Above grade wall insulation (including walls between the house and garage) performance requirement is U-0.047, which consists of R-24 (total) insulation in standard wood frame construction.

While R-19 batt insulation with R-5 rigid exterior insulation equals R-24, it does not comply unless the rigid insulation is applied in a “continuous” manner. Often, R-19 + R-5 (one-inch thick insulation) is only installed where exterior structural sheathing (one half-inch thickness) is not required. A sheet of one half-inch thick rigid insulation (R-2.5) is installed over the structural panel.

The overall U-factor of the above described R-19 + R-5 wall is not U-0.047 and does not comply. If the R-19 batt insulation is replaced with R-21 insulation, the overall U-factor will comply.

Vaulted ceilings must have a minimum performance of U-0.033 or R-30 insulation in advance framed wood construction. A two-by-ten wood rafter with high density batt insulation is U-0.033. A standard wood scissors truss with R-30 (U-0.046) or R-38 (U-0.042) does not comply with this requirement. An advance framed wood scissors truss with R-30 insulation (U-0.32) complies with this requirement.

The area of vaulted ceiling at U-0.033 is limited to 50 percent of the total heated space floor area. The area in excess of 50 percent must be insulated to U-0.025. See Table N1104.1(2) for default U-factors of assemblies that meet U-0.025.

Flat ceilings must have a minimum performance of U-0.025 or R-49 insulation in standard wood framed construction.

Windows, including sliding glass doors (SGD) must have a maximum U-0.32 value.

4	<p>Zonal electric, ductless furnace or ductless heat pumps: 75 percent of permanently installed lighting fixtures as CFL or linear fluorescent or a min efficacy of 40 lumens per watt, or Windows – U-0.32, or Flat ceilings – U-0.025 / R-49 and vaulted ceilings – U-0.033 / R-30A or Exterior walls – U-0.047 / R-19+R-5 continuous</p>
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Measure 4: Zonal electric, ductless furnace, or ductless heat pumps

This option requires that **one** of the following bulleted measures is installed. Only homes, or dwelling units with either zonal electric (hydronic, zoned hot water does not qualify), ductless furnace, or ductless heat pump qualify for this option. The applicant may have one of these types of heat sources and choose to select a different option if they desire to do so.

- A minimum of **75 percent of the permanently installed lighting fixtures** must be either compact fluorescent, linear fluorescent, or have a minimum efficacy of 40 lumens per watt.

Note: 75 percent of the permanently installed lighting fixtures includes fixtures in the garage and attached to the outside of the building. Screw-in compact fluorescent lamps may be used in incandescent fixtures. Fixtures must be able to accept screw-in lamps and lamps must be the appropriate type for the application.

Recessed down lights take a special compact fluorescent lamp as well as fixtures located outdoors or in cold areas such as the garage and those controlled by a dimmer.

- **Windows, including sliding glass doors (SGD)** must have a maximum U-0.32 value.
- **Flat ceilings** must have a minimum performance of U-0.025 or R-49 insulation in standard wood framed construction.

Vaulted ceilings must have a minimum performance of U-0.033 or R-30 insulation in advance framed wood construction. A two-by-ten wood rafter with high density batt insulation is U-0.033. A standard wood scissors truss with R-30 (U-0.046) or R-38 (U-0.042) **does not comply** with this requirement. An *advance framed* wood scissors truss with R-30 insulation (U-0.32) complies with this requirement.

The area of vaulted ceiling at U-0.033 is limited to 50 percent of the total heated space floor area. The area in excess of 50 percent must be insulated to U-0.025. See Table N1104.1(2) for default U-factors of assemblies that meet U-0.025.

- **Above grade wall insulation** (including walls between the house and garage) performance requirement is U-0.047, which is based on R-19 batt plus R-5 continuous rigid (R-24 total) insulation in standard wood frame construction.

While R-19 batt insulation with R-5 rigid exterior insulation equals R-24, it does not comply unless the rigid insulation is applied in a “continuous” manner. Often, R-19 + R-5 (one-inch thick insulation) is only installed where exterior structural sheathing (one half-inch thickness) is not required. A sheet of one half-inch thick rigid insulation (R-2.5) is installed over the structural panel.

The overall U-factor of the above described R-19 + R-5 wall is not U-0.047 and does not comply. If the R-19 batt insulation is replaced with R-21 insulation, the overall U-factor will comply.

5	<p>High efficiency ceilings & windows/lighting: Replace corresponding Table N1101.1(1) components with all of the following: Vaulted ceilings – U-0.033 / R-30A^{c, d}, and Flat ceilings – U-0.025 / R-49, and Windows – U-0.32, and 75 percent of permanently installed lighting fixtures as CFL or linear fluorescent or a min efficacy of 40 lumens per watt</p>
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Measure 5: High efficiency ceilings, windows and lighting

This option requires that **all** of the following measures are installed.

Vaulted ceilings must have a minimum performance of U-0.033 or R-30 insulation in advance framed wood construction. A two-by-ten wood rafter with high density batt insulation is U-0.033. A standard wood scissors truss with R-30 (U-0.046) or R-38 (U-0.042) **does not comply** with this requirement. An *advance framed* wood scissors truss with R-30 insulation (U-0.32) complies with this requirement.

The area of vaulted ceiling at U-0.033 is limited to 50 percent of the total heated space floor area. The area in excess of 50 percent must be insulated to U-0.025. See Table N1104.1(2) for default U-factors of assemblies that meet U-0.025.

Flat ceilings must have a minimum performance of U-0.025 or R-49 insulation in standard wood framed construction.

Windows, including sliding glass doors (SGD) must have a maximum U-0.32 value.

A minimum of **75 percent of the permanently installed lighting fixtures** must be either compact fluorescent, linear fluorescent, or have a minimum efficacy of 40 lumens per watt.

Note: 75 percent of the permanently installed lighting fixtures includes fixtures in the garage and attached to the outside of the building. Screw-in compact fluorescent lamps may be used in incandescent fixtures. Fixtures must be able to accept screw-in lamps and lamps must be the appropriate type for the application.

Recessed down lights take a special compact fluorescent lamp as well as fixtures located outdoors or in cold areas such as the garage and those controlled by a dimmer.

6	High efficiency ceilings & windows / water heating: Replace corresponding Table N1101.1(1) components with all of the following: Vaulted ceilings – U-0.033 / R-30A ^{c, d} , and Flat ceilings – U-0.025 / R-49, and Windows – U-0.32, and Natural gas/propane, on-demand water heating with min EF of 0.80
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Measure 6: High efficiency ceilings, windows and water heating

This option requires that **all** of the following measures are installed.

Vaulted ceilings must have a minimum performance of U-0.033 or R-30 insulation in advance framed wood construction. A two-by-ten wood rafter with high density batt insulation is U-0.033. A standard wood scissors truss with R-30 (U-0.046) or R-38 (U-0.042) **does not comply** with this requirement. An *advance framed* wood scissors truss with R-30 insulation (U-0.32) complies with this requirement.

The area of vaulted ceiling at U-0.033 is limited to 50 percent of the total heated space floor area. The area in

excess of 50 percent must be insulated to U-0.025. See Table N1104.1(2) for default U-factors of assemblies that meet U-0.025.

Flat ceilings must have a minimum performance of U-0.025 or R-49 insulation in standard wood framed construction.

Windows, including sliding glass doors (SGD) must have a maximum U-0.32 value.

On-demand, tank-less, gas-fired water heater must have a minimum EF of 0.80.

7	High efficiency water heating / lighting: Natural gas/propane, on-demand water heating with min EF of 0.80 75 percent of permanently installed lighting fixtures as CFL or linear fluorescent or a min. efficacy of 40 lumens per watt
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Measure 7: High efficiency water heating and lighting

This option requires that **all** of the following measures are installed.

On-demand, tank-less, gas-fired water heater must have a minimum EF of 0.80.

A minimum of **75 percent of the permanently installed lighting fixtures** must be either compact fluorescent, linear fluorescent, or have a minimum efficacy of 40 lumens per watt.

Note: 75 percent of the permanently installed lighting fixtures includes fixtures in the garage and attached to the outside of the building. Screw-in compact fluorescent lamps may be used in incandescent fixtures. Fixtures must be able to accept screw-in lamps and lamps must be the appropriate type for the application.

Recessed down lights take a special compact fluorescent lamp as well as fixtures located outdoors or in cold areas such as the garage and those controlled by a dimmer.

8	Solar photovoltaic: Minimum 1 Watt / sq ft. conditioned floor space ^e
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Measure 8: Solar photovoltaic

This option requires a solar photovoltaic system size to include documentation indicating that Total Solar Resource Fraction is not less than 75%.

Total Solar Resource Fraction is the fraction of usable solar energy that is received by the solar panel/collector throughout the year. This accounts for the impacts due to external shading, collector tilt and collector orientation.

9	Solar water heating: Minimum of 40 ft ² of gross collector area ^f
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Measure 9: Solar water heating

This option requires a solar water heating panels shall be Solar Rating and Certification Corporation (SRCC) Standard OG-300 certified and labeled, with documentation indicating that Total Solar Resource Fraction is not less than 75%.

Total Solar Resource Fraction is the fraction of usable solar energy that is received by the solar panel/collector throughout the year. This accounts for the impacts due to external shading, collector tilt and collector orientation.

Information presented in this publication supports the Oregon Residential Specialty Code. This publication does not include all code requirements. Refer to the code and check with your code official for additional requirements. If information in this publication conflicts with code or your local officials, follow requirements of code and your local officials.

For more information about the residential energy code, call the Building Codes Division at (503) 378-4133 or the Oregon Dept of Energy (503) 378-4040 in Salem or toll-free, 1-800-221-8035.

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Building Codes Division



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