CHAPTER 3 [RE]

GENERAL REQUIREMENTS

SECTION R301
RESERVED

SECTION R302
DESIGN CONDITIONS

R302.1 Interior design conditions. The interior design temperatures used for heating and cooling load calculations shall be a maximum of 72°F (22°C) for heating and minimum of 75°F (24°C) for cooling.

R302.2 Climactic data. The following design parameters in Table R302.2 shall be used for calculations required under this code.

Adjustments may be made only in the following cases:

1. Winter heating design temperatures for projects either:
   i. Located at an elevation of 1,500 feet (457 m) or higher, or
   ii. Located in Caledonia, Essex or Orleans counties.
   iii. Adjustments shall be made as listed in the National Climate Data Center for the specific weather station: http://www.ncdc.noaa.gov/cdo-web/.
2. As approved by the *code official or authority having jurisdiction,* where one exists.

TABLE R302.2
THERMAL DESIGN PARAMETERS

CONDITION	VALUE
Winter[a], Design Dry-Bulb	-11°F
Summer[a], Design Dry-Bulb	84°F
Summer, Design Wet Bulb	69°F
Degree Days Heating[b]	7,771
Degree Days Cooling[b]	388

For SI: °C = [(°F) - 32]/1.8.

a. The outdoor design temperature is selected from the columns of 97-percent values for winter and 2-percent values for summer from tables in the ASHRAE *Handbook of Fundamentals*. Adjustments shall be permitted to reflect local climates which differ from the tabulated temperatures, or local weather experience determined by the code official or authority having jurisdiction, where one exists.

b. The degree days heating (base 65°F) and cooling (base 65°F) are from https://www.climate-zone.com/climate/united-states/vermont/burlington for 2022.

SECTION R303
MATERIALS, SYSTEMS AND EQUIPMENT

R303.1 Identification. Materials, systems and equipment shall be identified in a manner that will allow a determination of compliance with the applicable provisions of this code.

R303.1.1 Building thermal envelope insulation. An *R*-value identification mark shall be applied by the manufacturer to each piece of *building thermal envelope* insulation 12 inches (305 mm) or greater in width. Alternately, the insulation installers shall provide a certification listing the type, manufacturer and *R*-value of insulation installed in each element of the *building thermal envelope*. For blown or sprayed insulation (fiberglass and cellulose), the initial installed thickness, settled thickness, settled *R*-value, installed density, coverage area and number of bags installed shall be *listed* on the certification. For sprayed polyurethane foam (SPF) insulation, the installed thickness of the areas covered and *R*-value of installed thickness shall be *listed* on the certification. For *insulated siding*, the *R*-value shall be *labeled* on the product's package and shall be *listed* on the certification. The insulation installer shall sign, date and post the certification in a conspicuous location on the job site.

R303.1.1.1 Blown or sprayed roof and ceiling insulation. The thickness of blown-in or sprayed roof/ceiling insulation (fiberglass or cellulose) shall be written in inches (mm) on markers that are installed at least one for every 300 square feet (28 m^2) throughout the attic space. The markers shall be affixed to the trusses or joists and marked with the minimum initial installed thickness with numbers not less than 1 inch (25 mm) in height. Each marker shall face the attic access opening. Spray polyurethane foam minimum thickness and installed *R*-value shall be *listed* on certification provided by the insulation installer.

R303.1.2 Insulation mark installation. Insulating materials shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection. For insulation materials that are installed without an observable manufacturer's *R*-value mark, such as blown or draped products, an insulation certificate complying with Section R303.1.1 shall be left immediately after installation by the installer, in a conspicuous location within the building, to certify the installed *R*-value of the insulation material.

R303.1.3 Fenestration product rating. *U*-factors of *fenestration* products (windows, doors and *skylights*) shall be determined in accordance with NFRC 100.

Exception: Where required, garage door *U*-factors shall be determined in accordance with either NFRC 100 or ANSI/DASMA 105.

U-factors shall be determined by an accredited, independent laboratory, and *labeled* and certified by the manufacturer.

Products lacking such a *labeled U*-factor shall be assigned a default *U*-factor from Table R303.1.3(1) or R303.1.3(2). The *solar heat gain coefficient* (SHGC) and *visible transmittance* (VT) of glazed *fenestration* products (windows, glazed doors and *skylights*) shall be determined

in accordance with NFRC 200 by an accredited, independent laboratory, and *labeled* and certified by the manufacturer. Products lacking such a *labeled* SHGC or VT shall be assigned a default SHGC or VT from Table R303.1.3(3).

TABLE R303.1.3(1)
DEFAULT GLAZED WINDOW, GLASS DOOR AND SKYLIGHT *U*-FACTORS

FRAME TYPE	WINDOW AND GLASS DOORS		SKYLIGHT	
	SINGLE PANE	DOUBLE PANE	Single	Double
Metal	1.20	0.80	2.00	1.30
Metal with Thermal Break	1.10	0.65	1.90	1.10
Nonmetal or Metal Clad	0.95	0.55	1.75	1.05
Glazed Block	0.60			

TABLE R303.1.3(2)
DEFAULT DOOR *U*-FACTORS

DOOR TYPE	OPAQUE *U*-FACTOR
Uninsulated Metal	1.20
Insulated Metal	0.60
Wood	0.50
Insulated, nonmetal edge, max 45% glazing, any glazing double pane	0.35

TABLE R303.1.3(3)
DEFAULT GLAZED FENESTRATION SHGC AND VT

	SINGLE GLAZED		DOUBLE GLAZED		GLAZED BLOCK
	Clear	Tinted	Clear	Tinted	
SHGC	0.8	0.7	0.7	0.6	0.6
Visible Transmission (VT)	0.6	0.3	0.6	0.3	0.6

R303.1.4 Insulation product rating. The *thermal resistance, R*-value, of insulation shall be determined in accordance with Part 460 of US-FTC CFR Title 16 in units of $h \cdot ft^2 \cdot °F/Btu$ at a mean temperature of 75°F (24°C).

R303.1.4.1 Insulated siding. The *thermal resistance* (*R*-value) of *insulated siding* shall be determined in accordance with ASTM C1363. Installation for testing shall be in accordance with the manufacturer's instructions.

R303.1.5 Air-impermeable insulation. Insulation having an air permeability not greater than 0.004 cubic feet per minute per square foot [0.002 $L/(s \times m^2)$] under pressure differential of 0.3 inch water gauge (75 Pa) when tested in accordance with ASTM E2178 shall be determined *air-impermeable insulation*.

R303.2 Installation. Materials, systems and equipment shall be installed in accordance with the manufacturer's instructions and the *International Building Code* or the *International Residential Code*, as applicable.

R303.2.1 Protection of exposed foundation insulation. Insulation applied to the exterior of basement walls, crawlspace walls and the perimeter of slab-on-grade floors shall have a rigid, opaque and weather-resistant protective covering to prevent the degradation of the insulation's thermal performance. The protective covering shall cover the exposed exterior insulation and extend not less than 6 inches (153 mm) below grade.

R303.3 Maintenance information. Maintenance instructions shall be furnished for equipment and systems that require preventive maintenance. Required regular maintenance actions shall be clearly stated and incorporated on a readily accessible label. The label shall include the title or publication number for the operation and maintenance manual for that particular model and type of product.

SECTION R304
DESIGN CRITERIA FOR RESIDENTIAL VENTILATION SYSTEMS

R304.1 Scope. This section shall govern ventilation of the dwelling unit(s) within Type R-1 *residential buildings*, Type R-2 *residential buildings,* multiple single-family attached dwellings (townhouses) and *multifamily buildings* not more than three stories in height.

R304.1.1 Compliance. Compliance with Section 304 shall be achieved by installing a *whole house balanced ventilation system* with minimum 75 *sensible recovery efficiency (SRE)* and 1.2 CFM/watt, determined in accordance with HVI Publication 920 and listed in HVI Publication 911, while also meeting compliance with Sections R304.2 through R304.11 or demonstrating compliance with one of the following alternatives:

1. ASHRAE Standard 62.2—2019 (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings).
2. Passive house ventilation requirements (PHI or PHIUS).

Exceptions:

1. *Whole house balanced ventilation systems* that are controlled using user-settable closed-loop feedback based on pollutant levels (e.g., carbon dioxide or volatile organic compounds) are not subject to run-time ventilation rate minimums in the standards referenced above, or Section 304.6.1.1.
2. *Tiny houses* may install an exhaust-only ventilation system.

R304.2 Local ventilation. Ventilation fans in bathrooms containing a bathtub, shower, spa or similar bathing fixture and not included in the *whole house ventilation system* shall be sized to provide 50 CFM intermittent or 20 CFM continuous exhaust capacity. Whole house ventilation fans serving both localized and whole house ventilation functions shall be sized to meet the net capacity rates as required by Section R304.6 and must meet all other requirements listed in Section R304.3, as applicable.

TABLE R304.2
MINIMUM REQUIRED LOCAL EXHAUST

OCCUPANCY CLASSIFICATION	MECHANICAL EXHAUST CAPACITY (CFM)
Bathrooms	50 CFM intermittent or 20 CFM continuous

R304.3 Reserved.

R304.4 Whole house air circulation. Provisions shall be made to allow air flow to all finished living spaces by installation of distribution ducts, undercutting doors, installation of grilles, transoms or equivalent means. Door undercuts shall be at least $^1/_2$ inch (12.7 mm) above the surface of the finished floor covering.

R304.5 Fan motor requirements. Fans installed for the purpose of providing whole house ventilation must meet the minimum requirements as specified in this section.

R304.5.1 Fan durability. Whole house ventilation fan motors shall be rated for "continuous duty" and have manufacturer flow ratings as listed in HVI 911.

R304.6 Net capacity requirements. *Whole house ventilation system* fans shall be installed according to the manufacturer's installation instructions and shall have the manufacturer's fan flow ratings as listed in accordance with HVI 911. Unless the whole house system is tested according to procedures in Section R304.6.1, the minimum continuous flow rate that the ventilation system must be capable of supplying during its operation shall be based on the rate per bedroom as specified in Table R304.6.

TABLE R304.6
PRESCRIPTIVE FAN CAPACITY REQUIREMENTS FOR WHOLE HOUSE SYSTEMS

NUMBER OF BEDROOMS	MINIMUM NOMINAL RATED TOTAL FAN CAPACITY[a] (at 0.1 inches w.g.)
1	50 CFM
2	75 CFM
3	100 CFM
4	125 CFM
5	150 CFM
Homes > 3,000 ft^2	CFM = 0.05 · ft^2

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s \cdot m^2)$.

a. Represents the total installed rated capacity of all fans designed for whole house ventilation.

R304.6.1 Testing option. Testing may be done for Points to verify that the *whole house ventilation system* satisfies the ventilation requirements of this section in accordance with Sections R304.6.1.1 and R304.6.1.2.

R304.6.1.1 Minimum outdoor air. *Automatic* operation of the ventilation system shall not reduce the minimum continuous ventilation rate below 15 CFM of outdoor air per bedroom plus 15 CFM during occupancy.

Exception: Whole house approach in accordance with using one of the compliance alternatives in Section R304.1.1.

R304.6.1.2 Performance verification. In-field measurements of exhaust fan flows shall be conducted using a manufactured flow-measuring device in accordance with the manufacturer's instructions. Acceptable devices include a calibrated orifice combined with a digital manometer or a flow hood. All measuring devices shall be accurate to within 10 percent of measured flow.

R304.7 Ventilation required during periods of occupancy. Ventilation shall be provided continuously or intermittently during the period that the building is occupied.

R304.8 Controls. *Whole house ventilation systems* shall be capable of being set remotely for continuous operation or shall be provided with an *automatic* control for intermittent operation. All whole house ventilation controls shall be readily accessible.

Exception: Fans installed expressly for *local ventilation* purposes.

R304.8.1 Intermittent operation. Intermittently operated *whole house ventilation systems* shall be capable of being set remotely for continuous operation; or shall be provided with an automatic control capable of operating without the need for occupant intervention, such as a time switch or some other control device. Twist or crank-style timers are prohibited as control devices for *whole house ventilation systems.* Operation controlled solely by a humidity sensor (humidistat or dehumidistat) does not qualify.

R304.8.2 Continuous operation. Continuously operated *whole house ventilation systems* shall not be provided with local controls unless that control only operates the *whole house ventilation system* both intermittently at high speed and continuously at low speed.

R304.8.2.1 On/off switch for continuous operation. An on/off switch for continuously operated *whole-house ventilation systems* shall be remotely installed and appropriately labeled.

R304.9 Installation requirements. Ventilation equipment shall be installed according to the manufacturer's instructions and in accordance with Sections R304.9.1 through R304.9.8.

R304.9.1 Fan housings. Fan housings for single-port exhaust only systems must be sealed to the ceiling or wall.

R304.9.2 Inlet grills. Inlet grills for multiport exhaust ventilation systems or *whole house balanced ventilation systems* must be sealed to the ceiling or wall.

R304.9.3 Ducts. Smooth wall ducts (for example, metal or composite) must be used for all duct runs longer than 8 feet (2438 mm). All ducts and distribution components shall be located within the conditioned building envelope/space.

R304.9.4 Fasteners. Mechanical fasteners must be used to connect all ducts to the fan(s) without impeding the operation of the fan or any internal backdraft damper.

R304.9.5 Joints and connections. All joints, seams and connections shall be mechanically fastened and sealed with welds, gaskets, o-rings, mastics (adhesives), mastic embedded fabric systems or approved tapes.

R304.9.6 Noise abatement. Remote whole house ventilation fans shall be acoustically isolated from the structural elements of the building and from attached ducts using at least 1 foot (305 mm), but not more than 2 feet (610 mm) of insulated flexible duct.

R304.9.7 Intake openings. Mechanical and gravity outside air intake openings for *whole house balanced ventilation systems*, integrated supply systems or *heat recovery ventilating systems* that are installed in accordance with Section 304 shall be located a minimum of 10 feet (3048 mm) from any hazardous or noxious contaminant, such as vents, chimneys, plumbing vents, fuel fills and vents, streets, alleys, parking lots and loading docks, except as otherwise specified in this code.

The bottom of the intake termination shall be located at least 12 inches (305 mm) above the normally expected snow accumulation level.

R304.9.8 Outside opening protection. Air exhaust and intake openings located in *exterior walls* shall be protected with corrosion-resistant screens, louvers or grilles having a minimum opening size of $^1/_4$ inch (6.4 mm) and a maximum opening size of $^1/_2$ inch (12.7 mm), in any dimension. Openings shall be protected against local weather conditions.

R304.9.9 Exhaust dampers. Dampers with positive closures shall be installed to keep outside air from entering the exhaust duct when the system is not operating.

Exception: Mechanical ventilation systems designed for continuous operation.

R304.10 Clothes dryer exhaust. Clothes dryers shall be exhausted in accordance with the manufacturer's instructions. Dryer exhaust systems shall be independent of all other systems and shall convey the moisture and any products of combustion to the outside of the building.

Exception: This section shall not apply to listed and labeled condensing (ductless) clothes dryers.

R304.11 Makeup air required. Exhaust hood systems and clothes dryers capable of exhausting in excess of 400 cubic feet per minute (0.19 m^3/s) shall be provided with makeup air at a rate approximately equal to the exhaust air rate. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

SECTION R305
COMBUSTION SAFETY (MANDATORY)

R305.1 General. The provisions of this section shall govern the requirements for combustion and dilution air for fuel-burning appliances in every new home built to *Vermont Residential Building Energy Standards* (RBES), whenever a new heating system is installed, or whenever alteration, renovation or repair work creates *unusually tight construction* as defined in NFPA 54 and NFPA 31.

R305.2 Unusually tight construction. For the purpose of applying the provisions of Section R305 to fuel gas, kerosene and oil-burning equipment, *buildings* constructed in compliance with RBES shall be considered of *unusually tight construction* as defined in NFPA 54 and NFPA 31.

R305.3 Fuel gas, kerosene and oil-burning equipment. Every new home built to RBES that contains Category I or II natural draft venting fuel-burning appliances shall be provided with combustion and dilution air as required by NFPA 54 for fuel-gas utilization equipment or NFPA 31 for oil-burning equipment. *Direct vent appliances* that do not draw combustion air from inside of the building are not required to be considered in the determination of the combustion and dilution air requirements.

Exception: Where all combustion devices in the home have a *sealed combustion venting system*, a mechanical draft venting system or are *direct-vent appliances*, then the combustion and dilution air requirements of this section do not apply.

R305.3.1 Crawl space and attic space. For the purposes of applying the provisions of Section 305, an opening to a naturally ventilated crawl space or attic space is not considered equivalent to an opening outdoors and is therefore prohibited for the purposes of supplying combustion and dilution air.

R305.3.2 Unvented room heaters. Unvented fuel-fired heaters, including room heaters and unvented fireplaces are prohibited.

R305.4 Solid fuel-burning appliances and fireplaces. All solid fuel-burning appliances and fireplaces shall meet the provisions of this section.

R305.4.1 Gasketed doors. All solid fuel-burning appliances and fireplaces shall have tight-fitting (defined as gasketed doors with compression closure or compression latch system) metal, glass or ceramic doors.

Exception: Any home certified to have passed the Appendix RA–Recommended Procedure for Worst-Case Testing of Atmospheric Venting Systems is not required to have tight-fitting doors.

R305.4.2 Spillage testing. All chimney-vented equipment shall establish complete draft without spillage under "worst-case" conditions within two minutes. If any chimney-vented equipment fails this requirement, mechanically induced pressure relief shall be provided such that the requirement is met.

R305.4.3 Exterior air supply requirements. Solid fuel-burning appliances and fireplaces shall be equipped with an exterior air supply according to the provisions of Sections R305.4.3.1 through R305.4.3.7. Factory-built fireplaces, masonry fireplaces and solid fuel-burning appliances that list exterior air supply ducts as optional or required for proper installation are permitted to be installed with those exterior air supply ducts according to the manufacturer's installation instructions in place of Sections R305.4.3.1 through R305.4.3.7. This is not an exemption from the exterior air supply requirements.

R305.4.3.1 Combustion air shall not be taken from within the garage, attic, or basement.

R305.4.3.2 The exterior air inlet shall not terminate to the exterior higher than the firebox and the combustion air duct shall not rise vertically within 18 inches of the firebox.

Exception: Where woodstove or fireplace is installed below grade (in a basement), air intake is permitted to terminate above the firebox if the combustion air supply point is below the firebox and the combustion air intake point is greater than 15 feet (4.57 m) below the top of the chimney.

R305.4.3.3 The exterior air intake must deliver combustion air to the firebox.

Exception: For older woodstoves and cookstoves where direct connection of combustion air is not possible, combustion air may be delivered within 24 inches (610 mm) of the stove's air intake opening.

R305.4.3.4 The air inlet shall be screened with $^1/_4$ inch (6 mm) mesh.

R305.4.3.5 The air inlet shall be closable and designed to prevent debris from dropping into the air intake.

R305.4.3.6 The exterior air inlet shall be installed so as to remain free of obstruction from snow.

R305.4.3.7 Passageway. The combustion air passageway for unlisted exterior air supply ducts shall be a minimum of 6 square inches (3870 mm^2) and not more than 55 square inches (0.035 m^2). The passageway shall be non-combustible, masonry or 30 gauge (or thicker) metal, have 1 inch clearance to combustibles for the length of the combustion air intake. Combustion air systems for listed fireplaces shall be constructed according to the fireplace manufacturer's instructions.