



**RULE MAKING ORDER**

**(RCW 34.05.360)**

**CR-103 (710/97)**

Agency: **State Building Code Council**

- Permanent Rule
- Emergency Rule
- Expedited Adoption
- Expedited Repeal

(1) Date of Adoption: **November 17, 2000**

(2) Purpose:

To make changes to the Washington State Ventilation and Indoor Air Quality Code, Chapter 51-13 WAC.

(3) Citation of existing rules affected by this order:

Repealed:

Amended: WAC 51-13 Sections 101, 301, 302, 303, 304, 503

Suspended:

(4) Statutory authority for adoption: RCW 19.27.190, 19.27.020

Other authority:

**PERMANENT RULE ONLY (Including EXPEDITED ADOPTION)**

Adopted under notice filed as WSR 00-18-016 on Aug 28, 2000 (date).

Describe any changes other than editing from proposed to adopted version: The proposed amendments to the following sections were **not** adopted: (302.2.1 and 303.3.1), 303.4.2.1, (503.2.6 and new section 503.4), 503.2.8 and 503.3. In addition, the proposal to amend Section 503.2.4 relocating the soil-gas retarder membrane from "directly under the slab" to "directly on top of the aggregate and under a two inch layer of sand gravel" was altered to allow two options so either construction method will comply with the rule.

**EMERGENCY RULE ONLY**

Under RCW 34.05.350 the agency for good cause finds:

- (a) That immediate adoption, amendment, or repeal of a rule is necessary for the preservation of the public health, safety, or general welfare, and that observing the time requirements of notice and opportunity to comment upon adoption of a permanent rule would be contrary to the public interest.
- (b) That state or federal law or federal rule or a federal deadline for state receipt of federal funds requires immediate adoption of a rule.

Reasons for this finding:

**EXPEDITED REPEAL ONLY**

Under Preproposal Statement of Inquiry filed as WSR \_\_\_\_\_ on \_\_\_\_\_ (date).

(5.3) Any other findings required by other provisions of law as precondition to adoption or effectiveness of rule?

- Yes  No If Yes, explain:

(6) Effective date of rule:

**Permanent Rules or Expedited Rule Making**

- 31 days after filing
- Other (specify): **July 1, 2001\***

\*(If less than 31 days after filing, specific finding in 5.3 under RCW 34.05.380(3) is required)

**Emergency Rules**

- Immediately
- Later (specify)

NAME (TYPE OR PRINT)

**Jim Lewis**

SIGNATURE

*Jim Lewis for Jim Lewis*

TITLE

**Council Vice Chair**

DATE

**Jan 3, 2001**

CODE REVISER USE ONLY

CODE REVISER'S OFFICE  
STATE OF WASHINGTON  
FILED

JAN 3 2001

TIME 1:41 AM

WSR 01-02-099 PM

(COMPLETE REVERSE SIDE)

**NOTE: If any category is left blank, it will be calculated as zero.**

**No descriptive text.**

**Count by whole WAC sections only, from the WAC number through the history note.  
A section may be counted in more than one category.**

**The number of sections adopted in order to comply with:**

<b>Federal statute:</b>	<b>New</b>	<b>Amended</b>	<b>Repealed</b>
<b>Federal rules or standards:</b>	<b>New</b>	<b>Amended</b>	<b>Repealed</b>
<b>Recently enacted state statutes:</b>	<b>New</b>	<b>Amended</b>	<b>Repealed</b>

**The number of sections adopted at the request of a nongovernment entity:**

<b>New</b>	<b>Amended</b>	<b>6</b>	<b>Repealed</b>
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**The number of sections adopted on the agency's own initiative:**

<b>New</b>	<b>Amended</b>	<b>Repealed</b>
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**The number of sections adopted in order to clarify, streamline, or reform agency procedures:**

<b>New</b>	<b>Amended</b>	<b>Repealed</b>
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**The number of sections adopted using:**

<b>Negotiated rule making:</b>	<b>New</b>	<b>Amended</b>	<b>Repealed</b>	
<b>Pilot rule making:</b>	<b>New</b>	<b>Amended</b>	<b>Repealed</b>	
<b>Other alternative rule making:</b>	<b>New</b>	<b>Amended</b>	<b>6</b>	<b>Repealed</b>

AMENDATORY SECTION (Amending WSR 93-02-056, filed 1/6/93, effective 7/1/93)

**WAC 51-13-101 Scope and general requirements.**

101.1 Title: This Code shall be known as the Washington State Ventilation and Indoor Air Quality Code. It is herein referred to as "this Code".

101.2 Intent: The purpose of this Code is to provide minimum standards for the design and installation of mechanical ventilation systems, the selection of structural materials used within the conditioned space, and the construction of radon mitigation systems for new construction.

It is intended that these provisions provide flexibility to permit the use of innovative approaches and techniques. These provisions are structured to permit compliance with the intent of this Code by demonstration of performance through on site testing or through engineered design. This Code is not intended to abridge any safety or health requirements required under any other applicable codes or ordinances.

101.3 Scope: This Code sets forth minimum requirements for ventilation in all occupancies, including the design of new construction.

101.3.1 Application to Existing Buildings

101.3.1.1 Additions to Existing Buildings: Additions to existing buildings or structures may be made without making the entire building comply, provided that the new addition shall conform to the provisions of this Code.

EXCEPTIONS

1. Additions with less than 500 square feet of conditioned floor area are exempt from the requirements in this code for Whole House Ventilation Systems, Section 302.2.2.

2. Additions or alterations to existing buildings which do not require the construction of foundations, crawlspaces, slabs, or basements shall not be required to meet the requirements for radon protection.

101.3.1.2 Alterations and Repairs: All alterations and repairs may be made to existing or moved buildings built or permitted prior to the enforcement of this Code without making the entire building comply with the provisions of this Code, provided the alterations or repairs comply with this Code.

EXCEPTION: Air handling/conditioning equipment, which is being replaced without alteration or repair of the associated air distribution system is exempt from the requirements of this Code.

101.3.1.3 Historic Buildings: Historic buildings are exempt from this Code only to the extent necessary to preserve those features essential to their historical appearance or function.

101.4 Operating Instructions: Installers shall provide the manufacturer's installation, operating instructions, and a whole

house ventilation system operation description.

AMENDATORY SECTION (Amending WSR 91-01-102, filed 12/18/90, effective 7/1/91)

**WAC 51-13-301** (~~(Design criteria.)~~) Compliance with this chapter.

301.1 General: The criteria of this chapter establish the design conditions upon which the minimum ventilation systems are to be based for all occupancies. Group R occupancies four (4) stories and less as defined by the Washington State Building Code shall comply with either Section 302 or 303. Section 304 applies to all other occupancies.

301.2 Testing: At the discretion of the building official, flow testing may be required to verify that the mechanical system(s) satisfies the requirements of this section. Flow testing may be performed using flow hoods measuring at the intake or exhaust points of the system, in-line pitot tube, or pitot-traverse type measurement systems in the duct, short term tracer gas measurements, or other means approved by the building official.

AMENDATORY SECTION (Amending WSR 95-01-128, filed 12/21/94, effective 6/30/95)

**WAC 51-13-302** (~~(Minimum ventilation criteria for all)~~) Mechanical ventilation criteria using performance or design methods for Group R occupancies four stories and less.

~~302.1 (General: This section shall apply to all Group R occupancies four (4) stories and less as defined by the Washington State Building Code. Residential structures greater than four (4) stories in height shall comply with Section 304, for outdoor air supply requirements. For source specific ventilation requirements, see Section 302.2.1. Compliance with this section shall be demonstrated through engineering calculations or performance testing. Documentation of calculations shall be submitted to the building official where required. Performance testing shall be conducted in accordance with recognized test methods.~~

~~302.1.2 Testing: At the discretion of the building official, flow testing may be required to verify that the mechanical system(s) satisfies the requirements of this section. Flow testing may be performed using flow hoods measuring at the intake or exhaust points of the system, in-line pitot tube, or pitot-traverse~~



~~type measurement systems in the duct, short term tracer gas measurements, or other means approved by the building official.))~~  
Applicability: Group R occupancies four (4) stories and less as defined by the Washington State Building Code shall comply with either this section or Section 303.

302.1.1 Compliance by Calculations or Testing: Compliance with this section shall be demonstrated through engineering calculation or performance testing. Documentation of calculations or performance test results shall be submitted to the building official. Performance testing shall be conducted in accordance with recognized test methods.

~~((302.2))~~ 302.1.2 Minimum Ventilation Performance: Each dwelling unit or guest room shall be equipped with source specific and whole house ventilation systems designed and installed to satisfy the ventilation requirements of this ((chapter)) section.

~~((EXCEPTION-))~~ All public corridors shall meet the ventilation requirements in section 1203.3 of the Uniform Building Code.

### 302.2 Source Specific Ventilation Requirements.

302.2.1 Source Specific Ventilation: Source specific exhaust ventilation ((shall be)) is required in each kitchen, bathroom, water closet, laundry room, indoor swimming pool, spa, and other rooms where excess water vapor or cooking odor is produced.

The minimum source specific ventilation effective exhaust capacity shall be not less than levels specified in Table 3-1.

302.2.2 Source Specific Ventilation Controls: Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means. Source specific ventilation system controls shall be readily accessible.

302.2.3 Source Specific Ventilation Ducts: Source specific ventilation ducts shall terminate outside the building. Exhaust ducts in systems which are designed to operate intermittently shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4. Terminal elements shall have at least the equivalent net free area of the duct work. Terminal elements for exhaust fan duct systems shall be screened or otherwise protected from entry by leaves or other material.

### 302.3 Requirements for Whole House Ventilation Systems.

~~((302.2.2))~~ 302.3.1 Whole House Ventilation Systems: Each dwelling unit shall be equipped with a whole house ventilation system which shall be capable of providing ((at least 0.35 air changes per hour, but not less than fifteen cubic feet per minute per bedroom plus an additional fifteen cubic feet per minute. Whole house ventilation systems shall be designed to limit ventilation to a level no greater than 0.5 air changes per hour)) the volume of outdoor air specified in Table 3-2 under normal ((operation)) operating conditions. ((Whole house ventilation systems shall supply outdoor air to all habitable rooms through

~~individual outdoor air inlets, forced-air heating system, ducting or equivalent means. Doors and operable lites in windows are deemed not to meet the outdoor air supply intake requirements.)~~

EXCEPTION: ~~((For dwelling units of no more than 1,400 square feet, the maximum ventilation rate shall be 0.65 air changes per hour:))~~ Maximum flow rates listed in Table 3-2 do not apply to heat recovery ventilation systems.

~~((302.3))~~ 302.3.2 Whole House Ventilation System Controls: All ventilation system controls shall be readily accessible. Controls for whole house ventilation systems shall be capable of operating the ventilation system without energizing other energy-consuming appliances.

~~((EXCEPTION: Continuously operated whole house ventilation systems switch shall not be readily accessible by the occupant.~~

~~302.3.1 Source Specific Ventilation Systems: Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means.~~

~~302.3.2 Intermittently Operated Whole House Ventilation Systems: The~~) Intermittently operated whole house ventilation systems shall be constructed to have the capability for continuous operation, and shall have a manual control and an automatic control, such as a clock timer. At the time of final inspection, the automatic control timer shall be set to operate the whole house fan for ~~((a minimum of))~~ at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

~~((302.4))~~ 302.3.3 Fan Noise: Whole house fans located four feet or less from the interior grille shall have a sone rating of 1.5 or less measured at 0.1 inches water gauge. Manufacturer's noise ratings shall be determined as per HVI 915 (October 1995). Remotely mounted fans shall be acoustically isolated from the structural elements of the building and from attached duct work using insulated flexible duct or other approved material.

EXCEPTION: Whole house ventilation systems which are integrated with forced-air heating systems or heat-recovery ventilation systems are exempt from the sone rating requirements of this section.

~~((302.5))~~ 302.3.4 Whole House Ventilation Ducts: All ducts shall terminate outside the building. Exhaust ducts in systems which are designed to operate intermittently shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4. All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

#### 302.3.5 Outdoor Air.

~~((302.6))~~ 302.3.5.1 Outdoor Air Supply: A mechanical system shall supply outdoor air as required in Section ((302.2.2)) 302.3.1. The mechanical system may consist of exhaust fans, supply fans, or both.

~~((302.6.1))~~ 302.3.5.2 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by ~~((insects,))~~ leaves~~((,))~~ or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

a) Closer than ten feet from an appliance vent outlet, unless

such vent outlet is three feet above the outdoor air inlet.

- b) Where it will pick up objectionable odors, fumes, or flammable vapors.
- c) A hazardous or unsanitary location.
- d) A room or space having any fuel-burning appliances therein.
- e) Closer than ten feet from a vent opening of a plumbing drainage system unless the vent opening is at least three feet above the air inlet.
- f) Attic, crawl spaces, garages.

302.3.5.3 Outdoor Air Distribution: Outdoor air shall be distributed to each habitable room by means such as individual inlets, separate duct systems, or a forced-air system. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means where permitted by the Uniform Building Code. Doors shall be undercut to a minimum of one-half inch above the surface of the finish floor covering.

302.3.5.4 Doors and operable lites in windows are deemed not to meet the outdoor air supply intake requirements.

~~((302.6.2))~~ 302.3.5.5 Individual Room Outdoor Air Inlets: Where provided, individual room outdoor air inlets shall:

- a) have controllable and secure openings;
- b) be sleeved or otherwise designed so as not to compromise the thermal properties of the wall or window in which they are placed((7

c) provide not less than four square inches of net free area of opening for each habitable space. Any inlet or combination of inlets which provide 10 cfm at 10 Pascals as determined by the Home Ventilating Institute Air Flow Test Standard are deemed equivalent to four square inches net free area)).

~~((302.6.3))~~ 302.3.5.6 Ventilation Integrated with Forced-Air Systems: Where outdoor air is provided by a forced-air system, the outdoor air connection to the return air stream shall be located upstream of the forced-air system blower and shall not be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger.

~~((302.6.4 Distribution. Outdoor air shall be distributed to each habitable room by individual inlets, separate duct systems, or a forced-air system. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means where permitted by the Uniform Building Code. Doors shall be undercut to a minimum of one-half inch above the surface of the finish floor covering.))~~



WAC 51-13-303 Mechanical ventilation criteria (~~and minimum ventilation prescriptive requirements~~) using prescriptive methods for (all) Group R occupancies four stories and less.

303.1 (~~General~~) Applicability: Group R Occupancies 4 stories or less shall comply with this section or Section 302. This section establishes minimum prescriptive design requirements for intermittently operated systems. Continuously operated systems shall comply with section 302. (~~System characteristics not addressed in the following sections shall comply with section 302.~~) A system which meets the requirements of this section shall be deemed to satisfy the requirements of this chapter.

(~~303.1.1 Source Specific. Exhaust fans providing source specific ventilation shall have a minimum fan flow rating not less than fifty cfm at 0.25 inches water gauge for bathrooms, laundries, or similar rooms and one hundred cfm at 0.25 inches water gauge for kitchens. Manufacturers' fan flow ratings shall be determined as per HVI 916 (July 1989) or AMCA 210.~~)

EXCEPTION: Where a range hood or down draft exhaust fan is used to satisfy the source specific ventilation requirements for kitchens, the range hood or down draft exhaust shall not be less than 100 CFM at 0.10 inches water gauge.

303.1.2 Whole House: ~~Whole house ventilation systems may consist of whole house exhaust, integration with forced air systems or dedicated heat recovery ventilation systems. Whole house ventilation systems shall provide ventilation capacity as specified in Table 3-2 and meet the following requirements:~~

a) ~~Exhaust fans providing whole house ventilation shall have a flow rating at 0.25 inches water gauge as specified in Table 3-2. Manufacturer's fan flow ratings shall be determined as per HVI 916 (July 1989) or AMCA 210. Table 3-2 shall not be used for dwelling units with more than five bedrooms.~~

b) ~~Integrated forced-air ventilation systems shall have an outdoor air inlet duct connecting a terminal element on the outside of the building to the return air plenum of the forced-air system, at a point within 4 feet upstream of the air handler, and be equipped with one of the following:~~

1) ~~A motorized damper connected to the automatic ventilation control as specified in Section 302.3.2, or~~

2) ~~A damper installed and set to meet measured flow rates as specified in Table 3-2, by either field testing or following manufacturer's installation instructions based on site conditions, or~~

3) ~~An automatic flow regulated device with field measured or field calculated minimum negative pressure differential of 0.07 inches water gauge at the point where the outside air duct is connected to the return air plenum.~~

c) ~~Heat recovery ventilation systems: All duct work in heat~~



~~recovery ventilation systems shall be not less than six inch diameter. Balancing dampers shall be installed on the inlet and exhaust side. Flow measurement grids shall be installed on the supply and return. System minimum flow rating shall be not less than that specified in Table 3-2. Maximum flow rates in Table 3-2 do not apply to heat recovery ventilation systems.)~~

~~303.2 ((Source specific and whole house ventilation ducts: Exhaust ducts shall meet all requirements of section 302.5. Duct diameter, length, and number of elbows for exhaust fans shall be as specified in Table 3-3. Terminal elements for exhaust fan duct systems shall have at least the equivalent net free area of the duct work. Duct diameter, length, and number of elbows for integrated forced air systems shall be as specified in Table 3-5. Terminal elements for integrated systems shall be the same size as the connecting ductwork or 8 inches in diameter whichever is greater.))~~ Minimum Ventilation Performance: Each dwelling unit or guest room shall be equipped with source specific and whole house ventilation systems designed and installed to satisfy the ventilation requirements of this section. All public corridors shall meet the ventilation requirements in Section 1203.3 of the Uniform Building Code.

### 303.3 Source Specific Exhaust Ventilation Requirements.

303.3.1 Source Specific Ventilation: Source specific exhaust ventilation is required in each kitchen, bathroom, water closet, laundry room, indoor swimming pool, spa, and other rooms where excess water vapor or cooking odor is produced. The minimum source specific ventilation effective exhaust capacity shall be not less than levels specified in Table 3-1.

303.3.2 Source Specific Exhaust Fans: Exhaust fans providing source specific ventilation shall have a minimum fan flow rating not less than 50 cfm at 0.25 inches water gauge for bathrooms, laundries, or similar rooms and 100 cfm at 0.25 inches water gauge for kitchens. Manufacturers' fan flow ratings shall be determined as per HVI 916 (April 1995) or AMCA 210.

EXCEPTION: Where a range hood or down draft exhaust fan is used to satisfy the source specific ventilation requirements for kitchens, the range hood or down draft exhaust shall not be less than 100 cfm at 0.10 inches water gauge.

303.3.3 Source Specific Ventilation Controls: Source specific ventilation systems shall be controlled by manual switches, dehumidistats, timers, or other approved means. Source specific ventilation system controls shall be readily accessible.

303.3.4 Source Specific Ventilation Ducts: Source specific ventilation ducts shall terminate outside the building. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4. Terminal elements shall have at least the equivalent net free area of the duct work. Terminal elements for exhaust fan duct systems shall be screened or otherwise protected from entry by leaves or other material.

303.4 Prescriptive Whole House Ventilation Systems: Whole

house ventilation shall be provided by a system that meets the requirements of either Section 303.3.1, 303.3.2, 303.3.3, or 303.3.4. A system which meets all of the requirements of one of these sections shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.1 Intermittent Whole House Ventilation Using Exhaust Fans: This section establishes minimum prescriptive requirements for intermittent whole house ventilation systems using exhaust fans. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.1.1 Whole House Ventilation Fans: Exhaust fans providing whole house ventilation shall have a flow rating at 0.25 inches water gauge as specified in Table 3-2. Manufacturers' fan flow ratings shall be determined according to HVI 916 (April 1995) or AMCA 210.

303.4.1.2 Fan Noise: Whole house fans located four feet or less from the interior grille shall have a sone rating of 1.5 or less measured at 0.1 inches water gauge. Manufacturer's noise ratings shall be determined as per HVI 915 (October 1995). Remotely mounted fans shall be acoustically isolated from the structural elements of the building and from attached duct work using insulated flexible duct or other approved material.

303.4.1.3 Fan Controls: The whole house ventilation fan shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation fan without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house fan for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.1.4 Exhaust Ducts: All exhaust ducts shall terminate outside the building. Exhaust ducts shall be equipped with back-draft dampers. All exhaust ducts in unconditioned spaces shall be insulated to a minimum of R-4.

303.4.1.5 Outdoor Air Inlets: Outdoor air shall be distributed to each habitable room by individual outdoor air inlets. Where outdoor air supplies are separated from exhaust points by doors, provisions shall be made to ensure air flow by installation of distribution ducts, undercutting doors, installation of grilles, transoms, or similar means where permitted by the Uniform Building Code. Doors shall be undercut to a minimum of one-half inch above the surface of the finish floor covering.

Individual room outdoor air inlets shall:  
a. Have controllable and secure openings;  
b. Be sleeved or otherwise designed so as not to compromise the thermal properties of the wall or window in which they are

placed;

c. Provide not less than four square inches of net free area of opening for each habitable space. Any inlet or combination of inlets which provide 10 cfm at 10 Pascals as determined by the Home Ventilating Institute Air Flow Test Standard (HVI 901 (November 1996)) are deemed equivalent to four square inches net free area.

Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.

b. Where it will pick up objectionable odors, fumes or flammable vapors.

c. A hazardous or unsanitary location.

d. A room or space having any fuel-burning appliances therein.

e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.

f. Attic, crawl spaces, or garages.

EXCEPTION: Exhaust only ventilation systems do not require outdoor air inlets if the home has a ducted forced air heating system that communicates with all habitable rooms and the interior doors are undercut to a minimum of one-half inch above the surface of the finish floor covering.

303.4.2 Prescriptive Requirements for Intermittent Whole House Ventilation Integrated with a Forced-Air System: This section establishes minimum prescriptive requirements for intermittent whole house ventilation systems integrated with forced-air ventilation systems. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.2.1 Integrated Whole House Ventilation Systems: Integrated Whole House Ventilation Systems shall provide outdoor air at the rates specified in Table 3-2. Integrated Forced-Air Ventilation Systems shall distribute outdoor air to each habitable room through the forced-air system ducts. Integrated Forced-Air Ventilation Systems shall have an outdoor air inlet duct connecting a terminal element on the outside of the building to the return air plenum of the forced-air system, at a point within four (4) feet upstream of the air handler. The outdoor air inlet duct connection to the return air stream shall be located upstream of the forced-air system blower and shall not be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger. The outdoor air inlet duct shall be prescriptively sized in accordance with Table 3-5. The system will be equipped with one of the following:

1. A motorized damper connected to the automatic ventilation control as specified in Section 303.3.2.2; or

2. A damper installed and set to meet minimum flow rates as specified in Table 3-2, by either field testing or following manufacturer's installation instructions based on site conditions;

or

3. An automatic flow regulated device with field measured or



field calculated minimum negative pressure of 0.07 inches water gauge at the point where the outside air duct is connected to the return air plenum.

303.4.2.2 Ventilation Controls: The whole house ventilation system shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the forced air system blower and if applicable the automatic damper. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.2.3 Ventilation Duct Insulation: All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

303.4.2.4 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
- b. Where it will pick up objectionable odors, fumes or flammable vapors.
- c. A hazardous or unsanitary location.
- d. A room or space having any fuel-burning appliances therein.
- e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
- f. Attic, crawl spaces, or garages.

303.4.3 Prescriptive Requirements for Intermittent Whole House Ventilation Using a Supply Fan: This section establishes minimum prescriptive requirements for intermittent whole house ventilation systems using an inline supply fan. A system which meets all the requirements of this section shall be deemed to satisfy the requirements for a whole house ventilation system.

303.4.3.1 Outdoor Air: Supply Fan Ventilation Systems shall distribute outdoor air to each habitable room through the forced-air system ducts or through dedicated ducts to each habitable room. Supply fans shall have the capacity to provide the amount of outdoor air specified in Table 3-2 at 0.4 inches water gauge as per HVI 916 (April 1995). The outdoor air must be filtered before it is delivered to habitable rooms. The filter may be located at the intake device, inline with the fan, or, in the case of a connection to the return plenum of the airhandler, using the furnace filter. An outdoor air inlet shall be connected to either the supply or return air stream.

303.4.3.2 Ducts: An outdoor air inlet duct connection to the supply air stream shall be located downstream of the forced-air



system blower. An outdoor air inlet duct connection to the return air stream shall be located at least four feet upstream of the forced-air system blower and its filter. Neither type of duct shall be connected directly into a furnace cabinet to prevent thermal shock to the heat exchanger. The outdoor air inlet duct shall be prescriptively sized in accordance with Table 3-6. The terminal element on the outside of the building shall be sized two inches in diameter larger than the outdoor air inlet duct.

303.4.3.3 Dampers: The system shall be equipped with a back-draft damper and one of the following:

1. A calibrated manual volume damper installed and set to meet the measured flow rates specified in Table 3-2 by field testing with a pressure gauge and/or following manufacturer's installation instructions, or

2. A manual volume damper installed and set to meet the measured flow rates specified in Table 3-2 by field testing with a flow hood or a flow measuring station; or

3. An automatic flow-regulating device sized to the specified flow rates in Table 3-2 which provides constant flow over a pressure range of 0.2 to 0.6 inches water gauge.

303.4.3.4 Ventilation Controls: The whole house ventilation system shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the inline supply fan. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.3.5 Ventilation Duct Insulation: All supply ducts in the conditioned space shall be insulated to a minimum of R-4.

303.4.3.6 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.

b. Where it will pick up objectionable odors, fumes or flammable vapors.

c. A hazardous or unsanitary location.

d. A room or space having any fuel-burning appliances therein.

e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.

f. Attic, crawl spaces, or garages.

303.4.4 Prescriptive Requirements for Intermittent Whole House Ventilation Using a Heat Recovery Ventilation System: This section establishes minimum prescriptive requirements for intermittent

whole house ventilation using a heat recovery ventilation system.

303.4.4.1 Heat Recovery Ventilation Systems: All duct work in heat recovery ventilation systems shall be not less than six inch diameter. Balancing dampers shall be installed on the inlet and exhaust side. Flow measurement grids shall be installed on the supply and return. System minimum flow rating shall be not less than that specified in Table 3-2. Maximum flow rates in Table 3-2 do not apply to heat recovery ventilation systems.

303.4.4.2 Ventilation Controls: The whole house ventilation system shall be controlled by a 24 hour clock timer with the capability of continuous operation, manual and automatic control. This control will control the inline supply fan. The 24-hour timer shall be readily accessible. The 24 hour timer shall be capable of operating the whole house ventilation system without energizing other energy-consuming appliances. At the time of final inspection, the automatic control timer shall be set to operate the whole house system for at least eight hours a day. A label shall be affixed to the control that reads "Whole House Ventilation (see operating instructions)."

303.4.4.3 Ventilation Duct Insulation: All supply ducts in the conditioned space installed upstream of the heat exchanger shall be insulated to a minimum of R-4.

303.4.4.4 Outdoor Air Inlets: Inlets shall be screened or otherwise protected from entry by leaves or other material. Outdoor air inlets shall be located so as not to take air from the following areas:

- a. Closer than 10 feet from an appliance vent outlet, unless such vent outlet is 3 feet above the outdoor air inlet.
- b. Where it will pick up objectionable odors, fumes or flammable vapors.
- c. A hazardous or unsanitary location.
- d. A room or space having any fuel-burning appliances therein.
- e. Closer than 10 feet from a vent opening of a plumbing drainage system unless the vent opening is at least 3 feet above the air inlet.
- f. Attic, crawl spaces, or garages.

AMENDATORY SECTION (Amending WSR 95-01-128, filed 12/21/94, effective 6/30/95)

**WAC 51-13-304 Mechanical ventilation criteria and minimum ventilation performance for all other occupancies not covered in sections 302 and 303.**

**304.1 Ventilation:** The minimum requirements for operable area to provide natural ventilation are specified in the Uniform Building Code (UBC) as adopted by the state of Washington.

Where a mechanical ventilation system is installed, the mechanical ventilation system shall be capable of supplying ventilation air to each zone with the minimum outdoor air quantities specified in Table 3-4.

EXCEPTION: Where occupancy density is known and documented in the plans, the outside air rate may be based on the design occupant density. Under no circumstance shall the occupancies used result in outside air less than one-half that resulting from application of Table 3-4 estimated maximum occupancy values.

The outdoor air shall be ducted in a fully enclosed path directly to every air handling unit in each zone not provided with sufficient operable area for natural ventilation.

EXCEPTION: Ducts may terminate within 12 inches of the intake to an HVAC unit provided they are physically fastened so that the outside air duct is directed into the unit intake.

In all parking garages, other than open parking garages as defined in UBC 311.9, used for storing or handling of automobiles operating under their own power and on all loading platforms in bus terminals, ventilation shall be provided at 1.5 cfm per square foot of gross floor area. The building official may approve an alternate ventilation system designed to exhaust a minimum fourteen thousand cfm for each operating vehicle. Such system shall be based on the anticipated instantaneous movement rate of vehicles but not less than 2.5 percent (or one vehicle) of the garage capacity. Automatic carbon monoxide sensing systems may be submitted for approval.

In all buildings used for the repair of automobiles, each repair stall shall be equipped with an exhaust extension duct, extending to the outside of the building, which if over ten feet in length, shall mechanically exhaust three hundred cfm. Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

Combustion air requirements shall conform to the requirements of Chapter 7 of the UMC.

Mechanical refrigerating equipment and rooms storing refrigerants shall conform to the requirements of Chapter 11 of the UMC.

304.2 Alternate Systems: Alternate systems designed in accordance with ASHRAE Standard 62.1.1999 shall be permitted.

TABLE 3-1  
Minimum Source Specific Ventilation Capacity  
Requirements

	Bathrooms	Kitchens
Intermittently operating	50 cfm	100 cfm
Continuous operation	20 cfm	25 cfm

(TABLE 3-2  
Whole House Ventilation Flow Requirements\*

Bedrooms	CFM	
	Minimum	Maximum

2 or less	50	75
3	80	120
4	100	150
5	120	180

†. This table shall not be used for dwelling units containing more than 5 bedrooms:))

**TABLE 3-2**  
**Ventilation Rates For All Group R occupancies four (4) stories and less\***  
**Minimum and Maximum Ventilation Rates: Cubic Feet Per Minute (CFM)**

Floor Area, ft <sup>2</sup>	Bedrooms													
	2 or less		3		4		5		6		7		8	
	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.	Min.	Max.
<500	50	75	65	98	80	120	95	143	110	165	125	188	140	210
501-1000	55	83	70	105	85	128	100	150	115	173	130	195	145	218
1001-1500	60	90	75	113	90	135	105	158	120	180	135	203	150	225
1501-2000	65	98	80	120	95	143	110	165	125	188	140	210	155	233
2001-2500	70	105	85	128	100	150	115	173	130	195	145	218	160	240
2501-3000	75	113	90	135	105	158	120	180	135	203	150	225	165	248
3001-3500	80	120	95	143	110	165	125	188	140	210	155	233	170	255
3501-4000	85	128	100	150	115	173	130	195	145	218	160	240	175	263
4001-5000	95	143	110	165	125	188	140	210	155	233	170	255	185	278
5001-6000	105	158	120	180	135	203	150	225	165	248	180	270	195	293
6001-7000	115	173	130	195	145	218	160	240	175	263	190	285	205	308
7001-8000	125	188	140	210	155	233	170	255	185	278	200	300	215	323
8001-9000	135	203	150	225	165	248	180	270	195	293	210	315	225	338
>9000	145	218	160	240	175	263	190	285	205	308	220	330	235	353

\*For residences that exceed 8 bedrooms, increase the minimum requirement listed for 8 bedrooms by an additional 15 CFM per bedroom. The maximum CFM is equal to 1.5 times the minimum.

**TABLE 3-3**  
**Prescriptive Exhaust Duct Sizing**

Fan Tested CFM @ 0.25 W.G.	Minimum Flex Diameter	Maximum Length Feet	Minimum Smooth Diameter	Maximum Length Feet	Maximum Elbows <sup>1</sup>
50	4 inch	25	4 inch	70	3
50	5 inch	90	5 inch	100	3
50	6 inch	No Limit	6 inch	No Limit	3
80	4 inch <sup>2</sup>	NA	4 inch	20	3
80	5 inch	15	5 inch	100	3
80	6 inch	90	6 inch	No Limit	3
100	5 inch <sup>2</sup>	NA	5 inch	50	3
100	6 inch	45	6 inch	No Limit	3
125	6 inch	15	6 inch	No Limit	3
125	7 inch	70	7 inch	No Limit	3

1. For each additional elbow subtract 10 feet from length.
2. Flex ducts of this diameter are not permitted with fans of this size.



TABLE 3-4  
Outdoor air requirements for ventilation<sup>1</sup>  
Occupancies not subject to sections 302 and 303

Application	Estimated Maximum <sup>2</sup> Occupancy P/1000 ft <sup>2</sup> or 100 m <sup>2</sup>	Outdoor Air Requirements cfm/person
<b>Dry Cleaners, Laundries<sup>3</sup></b>		
Commercial laundry	10	25
Commercial dry cleaner	30	30
Storage, pick up	30	35
Coin-operated laundries	20	15
Coin-operated dry cleaner	20	15
<b>Dwelling Units In Buildings Greater Than Four Stories or Attached to I-Occupancy Facilities</b>		
Bedroom & living area <sup>24</sup>		15
<b>Food and Beverage Service</b>		
Dining rooms	70	20
Cafeteria, fast food	100	20
Bars, cocktail lounges <sup>4</sup>	100	30
Kitchens (cooking) <sup>23</sup>	20	15
<b>Garages, Repair, Service Stations</b>		
Enclosed parking garage <sup>5</sup>		1.50 cfm/ft.sq.
Auto repair rooms		1.50 cfm/ft.sq.
<b>Hotels, Motels, Resorts, Congregate Residences with More Than Four Stories<sup>6</sup></b>		
Bedrooms		30 cfm/room
Living Rooms		30 cfm/room
Bath <sup>7</sup>		35 cfm/room
Lobbies	30	15
Conference rooms	50	20
Assembly rooms	120	15
Gambling casinos <sup>4</sup>	120	30
<b>Offices</b>		
Office space <sup>9</sup>	7	20
Reception area	60	15
Telecommunication centers and data entry areas	60	20
Conference rooms	50	20
<b>Public Spaces</b>		
Corridors and utilities		0.05 cfm/ft.sq.
Public restroom, cfm/wc or urinal <sup>10</sup>		50
Lockers and dressing rooms		0.50 cfm/ft.sq.
Smoking lounge <sup>11</sup>	70	60
Elevators <sup>12</sup>		1.0 cfm/ft.sq.
<b>Retail Stores, Sales Floors, and Show Room Floors</b>		
Basement and street	30	0.30 cfm/ft.sq.
Upper floors	20	0.20 cfm/ft.sq.
Storage rooms	15	0.15 cfm/ft.sq.
Dressing rooms		0.20 cfm/ft.sq.
Malls and arcades	20	0.20 cfm/ft.sq.
Shipping and receiving	10	0.15 cfm/ft.sq.
Smoking lounge <sup>11</sup>	70	60
Warehouses	5	0.05 cfm/ft.sq.

Application	Estimated Maximum <sup>2</sup> Occupancy P/1000 ft <sup>2</sup> or 100 m <sup>2</sup>	Outdoor Air Requirements cfm/person
<b>Specialty Shops</b>		
Barber	25	15
Beauty	25	25
Reducing salons	20	15
Florists <sup>13</sup>	8	15
Clothiers, furniture		0.30 cfm/ft.sq.
Hardware, drugs, fabric	8	15
Supermarkets	8	15
Pet shops		1.00 cfm/ft.sq.
<b>Sports and Amusement<sup>14</sup></b>		
Spectator areas	150	15
Game rooms	70	25
Ice arenas (playing areas)		0.50 cfm/ft.sq.
Swimming Pools (pool and deck area) <sup>15</sup>		0.50 cfm/ft.sq.
Playing floor (gymnasium)	30	20
Ballrooms and discos	100	25
Bowling alleys (seating areas)	70	25
<b>Theaters<sup>16</sup></b>		
Ticket booths	60	20
Lobbies	150	20
Auditorium	150	((+5)) 20
Stages, studios	70	15
<b>Transportation<sup>17</sup></b>		
Waiting rooms	100	15
Platforms	100	15
Vehicles	150	15
<b>Workrooms</b>		
Meat processing <sup>18</sup>	10	15
Photo studios	10	15
Darkrooms	10	0.50 cfm/ft.sq.
Pharmacy	20	15
Bank vaults	5	15
Duplicating, printing <sup>19</sup>		0.50 cfm/ft.sq.
<b>INSTITUTIONAL FACILITIES</b>		
<b>Education</b>		
Classroom	50	15
Laboratories <sup>20</sup>	30	20
Training shop	30	20
Music rooms	50	15
Libraries	20	15
Locker rooms		0.50 cfm/ft.sq.
Corridors		0.10 cfm/ft.sq.
Auditoriums	150	15
Smoking lounges <sup>11</sup>	70	60
<b>Hospitals, Nursing and Convalescent Homes</b>		
Patient rooms <sup>21</sup>	10	25
Medical procedure	20	15
Operating rooms	20	30
Recovery and ICU	20	15
Autopsy rooms <sup>22</sup>		0.50 cfm/ft.sq.

Application	Estimated Maximum <sup>2</sup> Occupancy P/1000 ft <sup>2</sup> or 100 m <sup>2</sup>	Outdoor Air Requirements cfm/person
Physical Therapy	20	15
Correctional Facilities		
Cells	20	20
Dining halls	100	15
Guard station	40	15

1. Derived from ASHRAE Standard 62-1989.
2. Net occupiable space.
3. Dry-cleaning process may require more air.
4. Supplementary smoke-removal equipment may be required.
5. Distribution among people must consider worker location and concentration of running engine; stands where engines are run must incorporate systems for positive engine exhaust withdrawal. Contaminant sensors may be used to control ventilation.
6. Independent of room size.
7. Installed capacity for intermittent use.
8. See also food and beverage service, merchandising, barber and beauty shops, garages.
9. Some office equipment may require local exhaust.
10. Mechanical exhaust with no recirculation is recommended.
11. Normally supplied by transfer air, local mechanical exhaust; with no recirculation recommended.
12. Normally supplied by transfer air.
13. Ventilation to optimize plant growth may dictate requirements.
14. When internal combustion engines are operated for maintenance of playing surfaces, increased ventilation rates may be required.
15. Higher values may be required for humidity control.
16. Special ventilation will be needed to eliminate special stage effects.
17. Ventilation within vehicles may require special considerations.
18. Spaces maintained at low temperatures (-10°F. to+ 50°F.) are not covered by these requirements unless the occupancy is continuous. Ventilation from adjoining spaces is permissible. When the occupancy is intermittent, infiltration will normally exceed the ventilation requirements.
19. Installed equipment must incorporate positive exhaust and control of undesirable contaminants.
20. Special contamination control systems may be required for processes or functions including laboratory animal occupancy.
21. Special requirements or codes and pressure relationships may determine minimum ventilation rates and filter efficiency. Procedures generating contaminants may require higher rates.
22. Air shall not be recirculated into other spaces.
23. Makeup air for hood exhaust may require more ventilating air.
24. Occupant loading shall be based on the number of bedrooms as follows: first bedroom, two persons; each additional bedroom, one person. Where higher occupant loadings are known, they shall be used.

TABLE 3-5  
Prescriptive Integrated Forced Air Supply Duct Sizing

((Number of Bedrooms	Minimum Smooth-Duct Diameter	Minimum Flexible-Duct Diameter	Maximum Length <sup>†</sup>	Maximum Number of Elbows <sup>‡</sup>
2 or less	6"	7"	20'	3
3	7"	8"	20'	3

<u>4 or more</u>	<u>8"</u>	<u>9"</u>	<u>20'</u>	<u>3))</u>
<u>Required Flow (CFM) Per Table 3-2</u>	<u>Minimum Smooth Duct Diameter</u>	<u>Minimum Flexible Duct Diameter</u>	<u>Maximum Length<sup>1</sup></u>	<u>Maximum Number of Elbows<sup>2</sup></u>
<u>50-80</u>	<u>6"</u>	<u>7"</u>	<u>20'</u>	<u>3</u>
<u>80-125</u>	<u>7"</u>	<u>8"</u>	<u>20'</u>	<u>3</u>
<u>115-175</u>	<u>8"</u>	<u>10"</u>	<u>20'</u>	<u>3</u>
<u>170-240</u>	<u>9"</u>	<u>11"</u>	<u>20'</u>	<u>3</u>

1. For lengths over 20 feet increase duct diameter 1 inch.
2. For elbows numbering more than 3 increase duct diameter 1 inch.

**TABLE 3-6  
Prescriptive Supply Fan Duct Sizing**

<u>Supply Fan Tested CFM At 0.4" WG</u>		
<u>Specified volume from Table 3-2</u>	<u>Minimum Smooth Duct Diameter</u>	<u>Minimum Flexible Duct Diameter</u>
<u>50-90 CFM</u>	<u>4 inch</u>	<u>5 inch</u>
<u>90-150 CFM</u>	<u>5 inch</u>	<u>6 inch</u>
<u>150-250 CFM</u>	<u>6 inch</u>	<u>7 inch</u>
<u>250-400 CFM</u>	<u>7 inch</u>	<u>8 inch</u>

AMENDATORY SECTION (Amending WSR 93-02-056, filed 1/6/93, effective 7/1/93)

**WAC 51-13-503 Radon prescriptive requirements.**

503.1 Scope: This section applies to those counties specified in section 501.2.2. This section establishes prescriptive construction requirements for reducing the potential for radon entry into all Group R occupancies, and for preparing the building for future mitigation if desired.

In all crawlspaces, except crawlspace plenums used for providing supply air for an HVAC system, a continuous air barrier shall be installed between the crawlspace area and the occupied area to limit air transport between the areas. If a wood sheet subfloor or other material is utilized as an air barrier, in addition to the requirements of section 502.1.6.2 of the Washington state energy code, all joints between sheets shall be sealed.

**503.2 Floors in Contact with the Earth**

503.2.1 General: Concrete slabs that are in direct contact with the building envelope shall comply with the requirements of this section.

EXCEPTION: Concrete slabs located under garages or other than Group R occupancies need not comply with this chapter.



503.2.2 Aggregate: A layer of aggregate of four inch minimum thickness shall be placed beneath concrete slabs. The aggregate shall be continuous to the extent practical.

503.2.3 Gradation: Aggregate shall:

a) Comply with ASTM Standard C-33 Standard Specification for Concrete Aggregate and shall be size No. ((67)) 8 or larger size aggregate as listed in Table 2, Grading Requirements for Coarse Aggregate; or

b) Meet the 1988 Washington State Department of Transportation specification 9-03.1 (3) "Coarse Aggregate for Portland Cement Concrete", or any equivalent successor standards. Aggregate size shall be of Grade ((5)) 8 or larger as listed in section 9-03.1 (3) C, "Grading"; or

c) Be screened, washed (~~(, and)~~) pea gravel free of deleterious substances in a manner consistent with ASTM Standard C-33 with one hundred percent (~~(of the gravel)~~) (100%) passing a one-half (1/2) inch sieve and less than (~~(two)~~) five percent (5%) passing a (~~(four-inch)~~) No. 16 sieve. Sieve characteristics shall conform to those acceptable under ASTM Standard C-33.

EXCEPTION: Aggregate shall not be required if a substitute material or system, with sufficient load bearing characteristics, and having approved capability to provide equal or superior air flow, is installed.

503.2.4 Soil-Gas Retarder Membrane: A soil-gas retarder membrane, consisting of at least one layer of virgin polyethylene with a thickness of at least six mil, or equivalent flexible sheet material, shall be either placed directly under all concrete slabs so that the slab is in direct contact with the membrane, or on top of the aggregate with two inches (2") minimum of fine sand or pea gravel installed between the concrete slab and membrane. The flexible sheet shall extend to the foundation wall or to the outside edge of the monolithic slab. Seams shall overlap at least twelve inches. The membrane shall also be fitted tightly to all pipes, wires, and other penetrations of the membrane and sealed with an approved sealant or tape. All punctures or tears shall be repaired with the same or approved material and similarly lapped and sealed.

((EXCEPTION: If the membrane is not in direct contact with the bottom of the concrete slab, all overlapping seams shall be sealed with an approved tape or sealant, and the material shall be sealed to the foundation wall in a permanent manner. The membrane shall also be fitted tightly to all pipes, wires, and other penetrations of the membrane and sealed with an approved sealant or tape. All punctures or tears shall be repaired with the same or approved material and similarly lapped and sealed. In no case shall the membrane be installed below the aggregate.))

503.2.5 Sealing of Penetrations and Joints: All penetrations and joints in concrete slabs or other floor systems and walls below grade shall be sealed by an approved sealant to create an air barrier to limit the movement of soil-gas into the indoor air.

Sealants shall be approved by the manufacturer for the intended purpose. Sealant joints shall conform to manufacturer's specifications. The sealant shall be placed and tooled in accordance with manufacturer's specifications. There shall be no gaps or voids after the sealant has cured.

503.2.6 Radon Vent: One continuous sealed pipe shall run from a point within the aggregate under each concrete slab to a point outside the building. Joints and connections shall be permanently gas tight. The continuous sealed pipe shall interface with the aggregate in the following manner, or by other approved equal method: The pipe shall be permanently connected to a "T" within the aggregate area so that the two end openings of the "T" lie within the aggregate area. A minimum of five feet of perforated drain pipe of three inches minimum diameter shall join to and extend from the "T."

The perforated pipe shall remain in the aggregate area and shall not be capped at the ends. The "T" and its perforated pipe extensions shall be located at least five feet horizontally from the exterior perimeter of the aggregate area.

The continuous sealed pipe shall terminate no less than twelve inches above the eave, and more than ten horizontal feet from a woodstove or fireplace chimney, or operable window. The continuous sealed pipe shall be labeled "radon vent." The label shall be placed so as to remain visible to an occupant.

The minimum pipe diameter shall be three inches unless otherwise approved. Acceptable sealed plastic pipe shall be smooth walled, and may include either PVC schedule 40 or ABS schedule of equivalent wall thickness.

The entire sealed pipe system shall be sloped to drain to the sub-slab aggregate.

The sealed pipe system may pass through an unconditioned attic before exiting the building; but to the extent practicable, the sealed pipe shall be located inside the thermal envelope of the building in order to enhance passive stack venting.

EXCEPTION:

A fan forced sub-slab depressurization system includes:

- 1) Soil-gas retarder membrane as specified in section 503.2.4;
- 2) Sealing of penetrations and joints as specified in section 503.2.5;
- 3) A three-inch continuous sealed radon pipe shall run from a point within the aggregate under each concrete slab to a point outside the building;
- 4) Joints and connections may be gas tight, and may be of either PVC schedule 40 or ABS schedule of equivalent in wall thickness;
- 5) A label of "radon vent" shall be placed on the pipe so as to remain visible to the occupant;
- 6) Fan circuit and wiring as specified in section 503.2.7 and a fan.

If the sub-slab depressurization system is exhausted through the concrete foundation wall or rim joist, the exhaust terminus shall be a minimum of six feet from operable windows or outdoor air intake vents and shall be directed away from operable windows and outdoor air intake vents to prevent radon re-entrainment.

503.2.7 Fan Circuit and Wiring and Location: An area for location of an in-line fan shall be provided. The location shall be as close as practicable to the radon vent pipe's point of exit from the building, or shall be outside the building shell; and shall be located so that the fan and all downstream piping is isolated from the indoor air.

Provisions shall be made to allow future activation of an in-line fan on the radon vent pipe without the need to place new wiring. A one hundred ten volt power supply shall be provided at a junction box near the fan location.

503.2.8 Separate Aggregate Areas: If the four-inch aggregate area underneath the concrete slab is not continuous, but is separated into distinct isolated aggregate areas by a footing or other barrier, a minimum of one radon vent pipe shall be installed into each separate aggregate area.

EXCEPTION: Separate aggregate areas may be considered a single area if a minimum three-inch diameter connection joining the separate areas is provided for every thirty feet of barrier separating those areas.

503.2.9 Concrete Block Walls: Concrete block walls connected to below grade areas shall be considered unsealed surfaces. All openings in concrete block walls that will not remain accessible upon completion of the building shall be sealed at both vertical and horizontal surfaces, in order to create a continuous air barrier to limit the transport of soil-gas into the indoor air.