

CC-1000 Updates 5/22

Continuous maintenance efforts to improve these standards are currently ongoing.



Read me

This work compilation contains a collection of proposed revisions that address administrative updates, improved clarity for some provisions and harmonization with other recent updates in soil gas mitigation standards.

Latest published versions of these standards are available for comparison at www.standards.aarst.org where all ANSI/AARST standards can be found for review at no charge and for purchase.

The current mitigation standards committee roster (consensus body) can be linked to from www.standards.aarst.org/public-review. The current work project includes (1) harmonization, where possible, for all portions of these documents to read the same for the same tasks; (2) update based on new experiences, and (3) renderings that are more conducive to stakeholders who are involved in compliance assessment.

Public Review: CC-1000 Updates 5-22
COMMENT DEADLINE: July 18th, 2022

REQUESTED PROCESS AND FORM FOR FORMAL PUBLIC REVIEW COMMENTS

Submittals (MS Word preferred) may be attached by email to StandardsAssist@gmail.com

- 1) Do not submit marked-up or highlighted copies of the entire document.
- 2) If a new provision is proposed, text of the proposed provision must be submitted in writing. If modification of a provision is proposed, the proposed text must be submitted utilizing the strikeout/underline format.
- 3) For substantiating statements: Be brief. Provide abstract of lengthy substantiation. (If appropriate, full text may be enclosed for project committee reference.)

REQUESTED FORMAT

Title of Public Review Draft: **CC-1000 Updates 5-22**

- **Name:** _____ **Affiliation:** _____
- **Clause or Subclause:** _____
- **Comment/Recommendation:** _____
- **Substantiating Statements:** _____
- ☐ Check here if your comment is supportive in nature and does not require substantive changes in the current proposal in order to resolve your comment.

Repeat the five bullet items above for each comment.

Requested registration of your contact information and copyright release.

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AARST Consortium on National Radon Standards

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The Consortium Consensus Process

The consensus process developed for the AARST Consortium on National Radon Standards and as accredited to meet essential requirements for American National Standards by the American National Standards Institute (ANSI) has been applied throughout the process of approving this document.

Continuous Maintenance

This standard is under continuous maintenance by the AARST Consortium on National Radon Standards for which the Executive Stakeholder Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard.

User Tools: User tools are posted online (www.standards.aarst.org/public-review) as they become available (such as templates for field notices, inspection forms, interpretations and approved addenda updates across time).

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Revisions Thread 1: Reconciling References, Training and Qualifications

SECTION 2: TERMS AND DEFINITIONS

Commentary/Rational—The following definitions were determined to be needed where clarifying requirements that apply specifically to hazardous soil gases that are not radon.

2.3 chemical of concern (COC), n— Chemicals in vapor, liquids or soil that have been identified at a site location to potentially pose health and safety hazards.

2.x hazardous soil gas, n—Soil gasses and vapors regulated by the jurisdiction having authority due to toxic, flammable or explosive hazards.

Commentary/Rationale: These definitions are to align with ANSI Essential Requirements 2021 where personal or product certifications or listings are required by a standard. The proposed additions are to further elaborate on what is meant by the term “equivalent programs” by using the benchmark established for 25 years by two competing national radon proficiency programs identified.

xx qualified mitigation professional, n—An individual that has demonstrated a minimum degree of appropriate technical knowledge and skills specific to radon or soil gas mitigation: a) as established in certification requirements of the National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB) or equivalent national program; and b) as required by statute, state licensure or certification program, where applicable for licensure or certification programs that evaluate individuals for radon or soil gas specific technical knowledge and skills.

Note—identification of two competing certification bodies is not an endorsement of either program.

xxx equivalent national program, n—A national program that evaluates and lists qualified individuals, training courses and other products or services, such as laboratory services, integral to achieving public health goals intended by this standard. Equivalent programs are programs with published policies that:

- (1) require persons to undergo education and an impartial examination process prior to granting personal certification or certificates of educational achievement;
- (2) have a written policy and means for receiving and adjudicating complaints against individuals who have been granted the credential; and
- (3) require surveillance of continued competence, not less than as demonstrated by continuing education in related technical knowledge and skills, prior to granting recertification or renewed certificates.

Certifications granted by *equivalent national programs* that qualify individuals as proficient in designing radon or soil gas *mitigation* systems require no less than 32 hours or more education, to include a focus on tasks required in ANSI/AARST SGM-SF *Soil Gas Mitigation Standards for Existing Homes*, and no less than 16 hours continuing education biennially prior to granting recertification.

SECTION 3: REQUIREMENT SUMMARY

Commentary/Rationale: These revisions address the observed need for training regarding design, inspection and in some cases, more elaborate training in diagnostic and fan choices (i.e., qualified mitigation profession).

3.1 General

Soil gas control **shall** be designed and constructed for all portions of foundation systems where there is enclosed space immediately above *crawl spaces* and slab-on-grade or basement slabs. The design and subsequent inspections of work in progress shall be conducted in coordination with an individual who is trained and qualified for design of systems that comply with this standard.

SECTION 5: PLENUM CONSTRUCTION

5.10 Prior to concrete slabs or soil gas retarders

5.10.2 *Inspect the open plenum*

An inspection shall be conducted prior to placement of concrete or soil gas retarders over a gas permeable layer to verify that all inlets and ducting are secured and that gas permeable layer materials and closed surroundings are compliant with this standard. The inspection shall be conducted by an individual who is trained and qualified for design of systems that comply with this standard. The inspection shall include items listed in Exhibit A-1. A record of the inspection(s) shall be retained in accordance with Section 12.

SECTION 6: CLOSE THE TOP OF THE PLENUM

6.4 Inspect for closure prior to indoor finishings

Prior to completion of indoor finishings in ground-contact and upper floor areas, an inspection shall be conducted to verify compliance with this standard and ensure a continuous sealed barrier has been constructed between *soil gas* and airspaces within the building. The inspection shall include the items listed in Exhibit A-2. A record of the inspection(s) shall be retained in accordance with Section 12. The inspection shall be conducted by an individual who is trained and qualified for design of systems that comply with this standard.

SECTION 7: PRESSURE FIELD EXTENSION (PFE) EVALUATION

7.1 General

After slabs have been cast or *soil gas retarders* in *crawl spaces* have been installed, an evaluation of air communication across newly constructed *soil gas collection plenums* shall be conducted by a qualified mitigation professional.

7.4 The PFE evaluation

If poor effectiveness or inconsistency is indicated, a *qualified mitigation professional* shall conduct an investigation to identify unclosed openings in the *soil gas collection plenums(s)* and any changes that may be needed for number and locations of *soil gas inlets* and *exhaust vent pipes*.

SECTION 9: EXHAUST LOCATIONS

9.10 Inspect the soil gas exhaust vent pipe prior to completion of indoor finishings

Prior to completion of indoor finishings that enclose exhaust piping, an inspection shall be conducted by an individual who is trained and qualified for design of systems that comply with this standard to verify compliance for *soil gas exhaust vent piping* in accordance with Sections 8 through 9. The inspection shall include items listed in Exhibit A-3 and be retained in records in accordance with Section 12.

SECTION 10: COMPLETION OF SYSTEMS

10.3.2 *Fan Installation*

ASD fan selections shall be determined by a *qualified ~~radon~~ mitigation professional* and installed in accordance with the manufacturer's instructions.

Revisions Thread 2: Deletion of opt-out options for jobsite inspections

Commentary/Rationale: The following proposed deletions identified in red cross-through text address confusion and system failures when work is not inspected because the option to not inspect the work was chosen.

While initially opening the door for this decision to be made by the jurisdiction having authority, the jurisdiction has the option anyway. Without the inspections, confusion and system failures are often witnessed.

SECTION 1: SCOPE

1.4 ~~Non-normative optional provisions~~

~~A choice of prudent protective options in addition to minimum requirements in this standard are provided in Annexes. Provisions not required unless specifically referenced in an adopted ordinance, contract or design requirements include: Annex A (Compliance inspections); Annex B (Active soil depressurization required); Annex C (Provide radon test kits); and Annex D (Conduct testing prior to occupancy).~~

~~ANNEX A (Non-Normative): Inspections for compliance.~~

~~Inspections for compliance are important at the following junctures for system success but shall not be required unless: a) required for exercising credit options in Section 4.3; or b) specifically referenced in the adopting ordinance, contract or design requirements.~~

~~Adoption:~~

~~To render these inspections as required, cite Annex A or any of the following individual provisions in the ordinance, contract or design specifications:~~

~~A-1 Inspection prior to closure over soil by concrete or soil gas retarders for design, materials and secure fastening:~~

~~Section 5.10.2: An inspection shall be conducted to verify all inlets and ducting are secured and that gas permeable layer materials and closed surroundings are compliant with this standard prior to placement of concrete or soil gas retarders over a gas permeable layer.~~

~~A-2 Inspection prior to completion of indoor finishings in ground contact areas to verify plenum sealing and closure:~~

~~Section 6.5: Prior to completion of indoor finishings, an inspection shall be conducted to verify a continuous sealed barrier has been constructed between soil gas and airspaces within the building.~~

~~A-3 Inspection prior to completion of indoor finishings to verify exhaust vent pipe compliance:~~

~~Section 9.6: Prior to completion of indoor finishings, an inspection shall be conducted to verify compliance for exhaust vent piping in accordance with Sections 8 through 9.~~

~~Inspection forms:~~

~~See exhibits A-1, A-2 and A-3 for examples of appropriate inspection forms~~

5.10 Prior to concrete slabs or soil gas retarders

5.10.2 Inspect the open plenum

An inspection shall be conducted prior to placement of concrete or soil gas retarders over a gas permeable layer to verify that all inlets and ducting are secured and that gas permeable layer materials and closed surroundings are compliant with this standard. The inspection shall be conducted by an individual who is trained and qualified for design of systems that comply with this standard. The inspection shall include items listed in Exhibit A-1. A record of the inspection(s) shall be retained in accordance with Section 12.

~~Notice: This provision is strongly recommended but not mandatory unless:~~

- ~~a) it is required for exercising design options for larger soil gas collection plenums in accordance with Sections 4.3.2 and 4.3.3; or~~
- ~~b) it is specifically referenced in contract or local ordinance. See Annex A-1.~~

SECTION 6: CLOSE THE TOP OF THE PLENUM

6.4 Inspect for closure prior to indoor finishings

Prior to completion of indoor finishings in ground-contact and upper floor areas, an inspection **shall** be conducted to verify compliance with this standard and ensure a continuous sealed barrier has been constructed between *soil gas* and airspaces within the building. The inspection **shall** include the items listed in **Exhibit A-2**. A record of the inspection(s) **shall** be retained in accordance with **Section 12**. The inspection shall be conducted by an individual who is trained and qualified for design of systems that comply with this standard.

~~Notice: This provision is strongly recommended but not mandatory unless:~~

- ~~a) it is required for exercising design options for larger soil gas collection plenums in accordance with Sections 4.3.2 and 4.3.3; or~~
- ~~b) it is specifically referenced in contract or local ordinance. See Annex A-1.~~

SECTION 9: EXHAUST LOCATIONS

9.10 Inspect the soil gas exhaust vent pipe prior to completion of indoor finishings

Prior to completion of indoor finishings that enclose *exhaust* piping, an inspection **shall** be conducted by an individual who is trained and qualified for design of systems that comply with this standard to verify compliance for *soil gas exhaust vent piping* in accordance with **Sections 8** through **9**. The inspection **shall** include items listed in **Exhibit A-3** and be retained in records in accordance with **Section 12**.

~~Notice: This provision is strongly recommended but not mandatory unless specifically referenced in contract or local ordinance. See Annex A-1.~~

SECTION 4: SOIL GAS COLLECTION PLENUMS

Commentary/Rationale: This proposed Table 4.3 addresses needs to change descriptions when inspections are not optional. This Table 4.3 replaces Tables 4.3.1, 4.3.2, 4.3.3 and 4.3.4 previously published.

4.3 Soil gas vent systems per plenum size

An independent *soil gas vent system* with an exhaust pipe duct extended from the *soil gas collection plenum* to the roof shall be installed with exhaust pipe sizing no less than specified in **Table 4.3** for each individual plenum and combined set of joined *soil gas collection plenums*.

Table 4.3		
Nominal inside pipe diameter	Maximum size of Soil Gas Collection Plenum(s) per duct size	
	<u>Compliant plenum installation verified by inspection per Section 5.10.2</u>	<u>Size allowed for gas-tight plenum closure per Section 6.3.2</u>
3 inch (7.6 cm)	3,500 square feet (325 m ²)	4,000 square feet (372 m ²)
4 inch (10.2 cm)	6,200 square feet (575 m ²)	7,100 square feet (660 m ²)
6 inch (15.2 cm)	14,000 square feet (1,300 m ²)	16,000 square feet (1,486 m ²)
	<u>Where any plenum installation is not verified by inspection per Section 5.10.2</u>	<u>Penalty for non-compliant gas permeable layer per Section 5.5</u>
3 inch (7.6 cm)	2,500 square feet (232 m ²)	1250 square feet (116 m ²)
4 inch (10.2 cm)	4,500 square feet (418 m ²)	2250 square feet (209 m ²)
6 inch (15.2 cm)	10,000 square feet (929 m ²)	5,000 square feet (465 m ²)

Revisions Thread 3: Revisions To Enhance Design Clarity

Commentary/Rationale: Section 4.6 is moved to 4.3.1 due to confusion heard since the previous publication.

4.3.1 *Joined soil gas vent systems*

Multiple soil gas vent systems shall be permitted to join a larger primary trunk exhaust pipe for connecting to a single exhaust location. Primary trunk exhaust piping that joins multiple soil gas vent systems **shall** be not less than the combined nominal cross-sectional area for inner diameters of all joined exhaust pipes.

Exception: Smaller primary trunk exhaust piping is permitted if supported by prorated calculations for the cross-sectional equivalencies of duct pipe sizes relative to actual size of each plenum or if supported by diagnostic evaluations in accordance with **Section 7**.

4.3.2 *Equivalent sizes*

Cross-sectional equivalents for inside pipe diameter are permitted where achieved by multiple vent pipes.

Commentary/Rational—To reduce confusion witnessed, the exception for ventilated garages is moved here from the previously published location in Section 4.8. There reference section has been updated to revised location in the most current ANSI/ASHRAE 62.1.

3.2 **Soil gas vent systems required**

Soil gas vent systems shall be constructed for each ground contact portion of the building ~~except garages ventilated in accordance with Section 4.8~~. Each *soil gas vent system* shall include *exhaust* piping extended from *inlets* within *soil gas collection plenum(s)* to an *exhaust* location at the roof, in accordance with Sections 4 through 10.

Exception: Garages attached to a foundation system do not require *soil gas vent systems* if compliant with ANSI/ASHRAE 62.1, Sections 5.17 and 6.5 for ventilation and pressurization of enclosed spaces surrounding the garage

4.2 **Plenum size calculations**

4.2.1 *Divisions*

Commentary/Rational—Content from Section 5.3.4 was recrafted and moved for clarity to the point during design processes when it needs to be considered.

4.2.2 *Foundation drain systems*

Exterior foundation drain systems that connect to *soil gas collection plenums* under the building **shall** be calculated for size based on the area of wall and foundation surfaces that adjoin permeable materials constructed to enhance groundwater drainage. ~~See Section 5.3.4.~~ Portions of exterior foundation wall surfaces not required to be included in calculations are where walls adjoin soils that, due to low permeability, impede the volumetric flow of soil gas and water.

4.3 **Soil gas vent systems per plenum size**

Commentary/Rational—Previously published Section 4.7 is being replaced with previously published as Section 13.1 as a result of integrating vapor intrusion content across the standards rather than listing all VI content in a disjointed Section 13.

~~4.7~~ **Limiting plenum and vent system size**

~~Design considerations shall include conditions that can warrant restricting the size of certain *plenums*.~~

~~Note—Examples include for limiting unintended transport or distribution of toxic vapors or explosive gas, or to compartmentalize active soil gas control for specific occupied locations.~~

4.7 **Lines of evidence and collective expanses**

When lines of evidence indicate that the spatial distribution of a hazardous gas or *chemical of concern* may be limited to only one portion of a building, an evaluation shall be made for the appropriateness of limiting plenum sizes that are joined to each *soil gas vent system* (e.g., to less than 4,500 square feet [418 m²] expanses). The criteria for determining appropriate limits shall include the likely need of ASD fan control for areas where there is a known *soil gas concern*.

SECTION 5: PLENUM CONSTRUCTION

5.1 Close the bottom of the collection plenum(s)

Commentary/Rational—This sentence was edited to enhance clarity.

5.1.2 Grade drainage

Grading below gas permeable layers **shall be level or sloped** to prevent collected water from obstructing **gas permeable layers and** portions of *inlet piping*, suction pits or *inlet trunk networks* within *soil gas collection plenums*.

Commentary/Rational—This sentence was edited to enhance clarity. Informational notes are unnecessary.

5.4 Footings and joined plenums

A means shall be designed and constructed to prevent obstruction from poured concrete and collected water for openings or ducts that traverse structural supports, **such as** footings, grade beams and thickened slab areas.

~~*Informative notes—Commonly, a pipe sleeve is placed and secured prior to casting structural supports. When geotextile mats are used for ducting, the mat is commonly mounted to a flat surface to extend ducting across structural supports prior to casting concrete.*~~

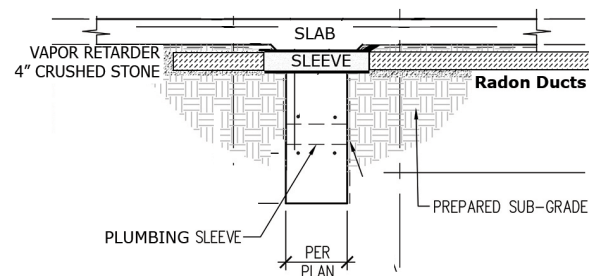
Commentary/Rational—This sentence was edited due to confusion over products that meet the intended need but do not precisely meet the specification

5.7.5 Geotextile mats and woven fabric products

5.7.5.1 Duct Opening

The void space within the mat that represents air *duct piping* **shall** comply with Section 5.6 including retention of **nominally equivalent** cross-sectional dimensions for *main trunk*, *secondary trunk* or *branch* ducting and transitions. *Soil gas inlet* surfaces or openings **shall** comply with Section 5.7.

Figure 5.4
Example of traversing structural supports



Informative—Table 5.6	
Cross-sectional area dimensions	
Pipe Inner Diameter (ID)	Cross-sectional Area
2-inch (50 mm)	3.1 sq. in. (20 cm ²)
3-inch (75 mm)	7.1 sq. in. (46 cm ²)
4-inch (100 mm)	12.6 sq. in. (81 cm ²)
6-inch (150 mm)	28.3 sq. in. (182 cm ²)

Revisions Thread 4: Active Alert Monitors

Commentary/Rationale: Updating to harmonize with AARST-CCAH 2020 and other AARST mitigation standards for requiring active alert monitors to warn occupants of system failure.

SECTION 10: COMPLETION OF SYSTEMS

~~10.3.6—ASD fan monitors required~~

~~Each ASD fan shall be provided with a system negative pressure monitor to indicate system operation. The fan monitor shall be simple to interpret and located in accordance with Section 8.9.5.~~

~~Exception: If telemetric indicators/remote monitors are integrated in the system or if the visual or audible monitor:~~

- ~~a) indicates when the fan(s) has no power; or~~
- ~~b) indicates when a fan is outside the intended performance range.~~

~~10.3.6.1 System Monitors—Vapor Intrusion~~

~~In addition to all requirements of Section 10.3.6 Fan Monitors, an evaluation shall be made prior to installation for situations where chemical hazards are present, such as those associated with immediate or short-term acute risk that could warrant additional monitoring such as:~~

- ~~a) pronounced visual or audible notification;~~
- ~~b) continuous gas monitoring as a trigger for the alarm system or for occupant monitoring; or~~
- ~~c) telemetric monitoring services.~~

~~10.3.6.2 Monitor durability~~

~~Fan monitors, including if located outside of a building, shall be protected from the elements and durable for the situation.~~

~~10.3.6.3 Automatic reset~~

~~Pressure activated electrical ASD system monitors, whether visual or audible, shall be supplied by unswitched electrical circuits and designed to reset automatically when power is restored after power supply failure. Battery operated monitoring devices shall not be used except where they are equipped with a low power warning feature.~~

10.3.6 ASD fan monitors required

Each ASD system shall be provided with system monitors to monitor fan performance and notify occupants or maintenance personnel of fan failure. The system monitors shall be connected to the fan piping and located in an area where the monitor status is readily observable by the occupants or maintenance personnel. Each ASD system shall include both:

- 1) Negative pressure meter, such as manometer type pressure gauge; and
- 2) Fan failure notification by audible or visual fan alarm or remote telemetry.

10.3.6.1 Electrical Power

System monitors that require electricity for indication of fan failure shall be on non-switched circuits separate from the circuit powering the radon fan unless loss of power triggers the alarm. Battery operated monitors shall be equipped with a low battery-power warning feature. Electrical ASD system monitors, whether visual or audible, shall be designed to reset automatically when power is restored after power outage.

10.3.6.2 Startup marking

ASD system negative pressure monitors shall be clearly marked to indicate the pressure that existed when the system was initially activated. The monitor device shall have a durable label on or in close proximity to it that describes how to interpret the monitor and what to do if the monitor indicates that system performance has changed.

Revisions Thread 5: Integration of post-construction testing for radon & VI

SECTION 12: DOCUMENTATION

12.1 Operation and maintenance plan

Commentary/Rationale: The following proposed revision to Section 12.3 speaks to retesting needs for both radon and where lines of evidence indicate concerns for chemical vapor intrusion or other hazardous soil gas.

12.3 OM&M manual – **Indoor air** testing

The following guidance statements in Sections 12.3.1 through 12.3.4, or equivalent statements, **shall** be included in the OM&M manual regarding *radon* testing and where lines of evidence indicate other hazardous vapors or gases may intrude into the building.

12.3.1 Indoor Radon and COC testing

- “It is recommended that the indoor air of all new buildings be tested within the first year after construction for radon gas and where lines of evidence indicate testing is warranted for other soil gas hazards.
- Testing is to be conducted in accordance with standard practices specified in national standards†, and as required by federal or state standards regardless of steps taken during building construction to reduce soil gas entry”;

12.3.2 Passive and non-ASD methods

- “Passive mitigation methods, including soil vent systems that are not activated with fans and those that rely on pressurization or dilution of indoor air, require additional seasonal testing to verify effectiveness. Repeat testing procedures to verify effectiveness is retained no less than under:
 1. Provide, in accordance with Table 12.3, the predominant normal occupied building operating condition for the building, or unique sector within a building, along with the annual average outdoor temperature for the climate zone; and
 2. Provide, in accordance with Table 12.3, the building operating condition that prevails for the second longest duration each year.

12.3.3 Elevated concentrations

- “If testing at any time indicates concentrations above the action level, conduct evaluations, corrections and further testing until testing indicates concentrations have been mitigated to below the action level.
- It is recommended that all buildings where elevated concentrations have been found and mitigated be routinely retested, such as every 2 years, in accordance with standard practices specified in national, federal or state standards or guidance.

† For radon testing, in accordance with ANSI/AARST MAMF/MALB: Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Non-residential and Mixed-Use Buildings.

Editor note: The following table to be editorially customized for clarity (e.g., instead of home/work it should be more clear to describe dwelling or 24/7 occupancies compared to only daytime occupancies).

Table 12.3

Annual Average Building Operating Conditions

This table provides annual average outdoor temperatures for various climate zones and the building conditions, in terms of heating and cooling system activity, that occur in response to these outdoor temperatures.

[illegible]

Note—Recommending a testing event at a time when the average temperature during the test is within 10° F (6° C) of the average low outdoor temperature across December, January and February may be prudent where lines of evidence indicate soil gas hazards could represent an acute or sub-chronic risk.

Climate zone temperatures based 30-year averages published online (e.g., the National Centers for Environmental Information-NOAA) for a major city located within each climate zone. Zone classifications reflect ASHRAE standards 90.1 / 90.2 (The American Society of Heating, Refrigerating and Air-Conditioning Engineers) <https://www.ashrae.org>.

12.3.4 Low concentrations

(Where testing indicates concentrations below the national action level initially or after fan activation.)

- Retest the building(s) at least every 5 years and in conjunction with any sale of a building.
- In addition, be certain to test again when any of the following circumstances occur:
 - ✓ A new addition is constructed or alterations for building reconfiguration or rehabilitation occur;
 - ✓ A ground contact area not previously tested is occupied;
 - ✓ Heating or cooling systems are altered with changes to air distribution or pressure relationships;
 - ✓ Ventilation is altered by extensive weatherization, changes to mechanical systems or comparable procedures;
 - ✓ Sizable openings to soil occur due to:
 - ground water or slab surface water control systems added or altered (e.g., sumps, perimeter drain tile, shower/tub retrofits, etc.); or
 - natural settlement causing major cracks to develop;
 - ✓ Earthquakes, construction blasting or formation of sink holes nearby; or
 - ✓ A mitigation system is altered or modified.

Revisions Thread 6: Harmonize Exhaust Requirements

Commentary/Rational—The following replacement for Section 9 has multiple minor sentence changes that result from harmonization with ANSI/AARST RMS-MF and RMS-LB 12/20 revisions. This includes relaxation from 30ft to 20ft above grade when meeting related requirements for exhausting below the roof.

SECTION 9: EXHAUST LOCATIONS

9.1 General

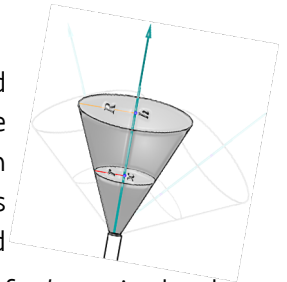
9.1.1 Measuring distances

Distances shall be measured between the closest point of the exhaust opening to the closest point of all location requirements specified in Section 6.4 using the shortest distance, as if a string were stretched between them.

9.1.2 Related definitions

Definitions a), b), c) and d) of this Section 9.1.1 shall apply to all exhaust requirements in Section 9:

- a) *Openings in structure* The openings created in structural walls or roofs for the purpose of mounting windows, skylights, doors or other assemblies that might open to outdoor air;
- b) *Operable openings* The operable or constantly open portion of windows, skylights, doors and other openings designed to readily operate for increasing ventilation with outdoor air. Portions of a window specifically designed to temporarily open for cleaning are not considered readily operable for increasing ventilation with outdoor air;
- c) *Exhaust trajectory* The angle of the pipe or elbow at the *point of exhaust*.
The angle of the exhaust trajectory from the open end of the pipe or elbow is geometrically defined as the straight- or center-line axis that extends outward from the geometric center of the exhaust opening and is perpendicular to the plane of the exhaust opening; and
- d) *Exhaust spread* The exhaust spread extends outward from the *point of exhaust* in the shape of a circular cone. The tip or apex of the cone is at the geometric center of the exhaust opening and the cone profile grows larger as distance from the *point of exhaust* increases.
Note—The total directional spread of the exhaust or cone is defined in degrees by the offset-axis angle of the cone profile compared to the cone's center-line axis. Expanding outward from the *point of exhaust*:
 - An exhaust spread radius of 45° equals an exhaust spread diameter of 90°.
 - An exhaust spread radius of 11° equals an exhaust spread diameter of 22°.



9.2 Outdoors

The *point of exhaust* for all soil gas vent systems shall be located outdoors.

9.3 Directional spread (restrictions)

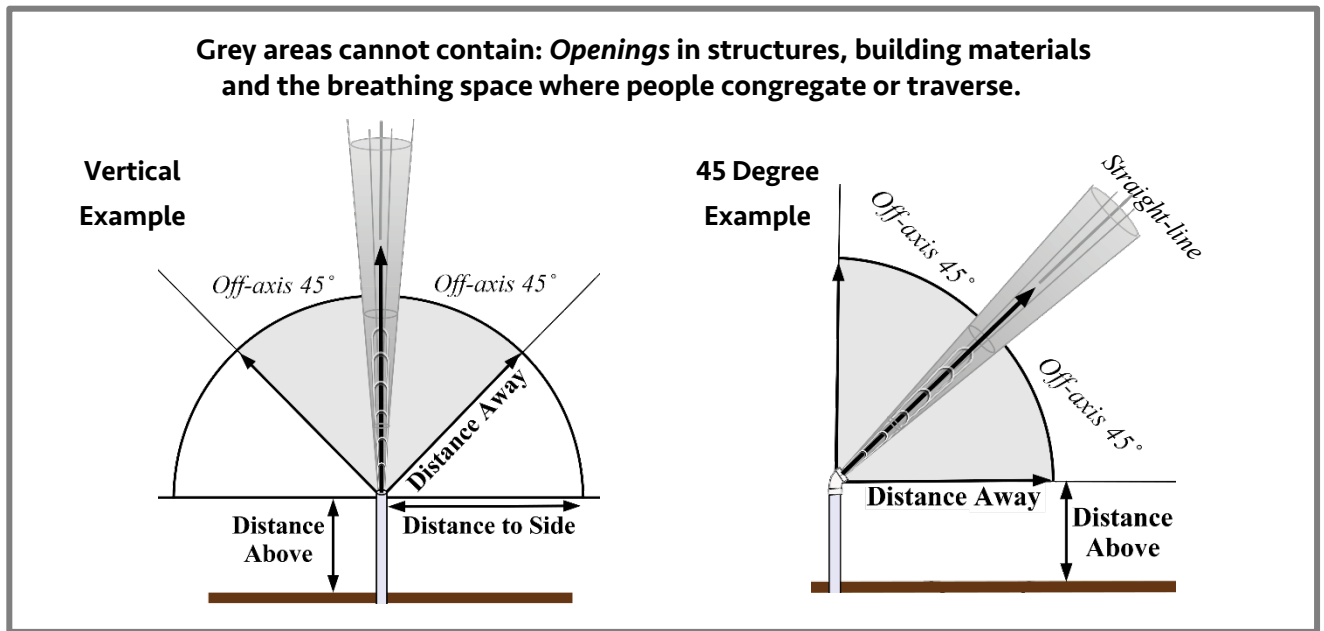
The *exhaust trajectory* with an *exhaust spread radius* of 45° shall not encounter *openings* in any structures, building materials or the breathing space where individuals congregate or traverse within 10 feet (3 m) from the *point of exhaust*.

Exception: EPDM, composite or otherwise layered water-tight roofing materials.

9.4 Straight-line trajectory (restrictions)

The *straight-line exhaust trajectory* with an *exhaust spread radius* of 11° shall not encounter *openings* in any structures, attic ventilation openings, building materials or the breathing space where individuals congregate or traverse within 20 feet (6 m) from the *point of exhaust*.

Figure 9



9.5 Elevation above grade

The *point of exhaust* shall be located not less than 10 feet (3 m) above grade nearest to the *point of exhaust* and shall be compliant with **Section 9.3 Directional spread** and **Section 9.4 Straight-line trajectory**.

9.6 Separation from operable openings in structures

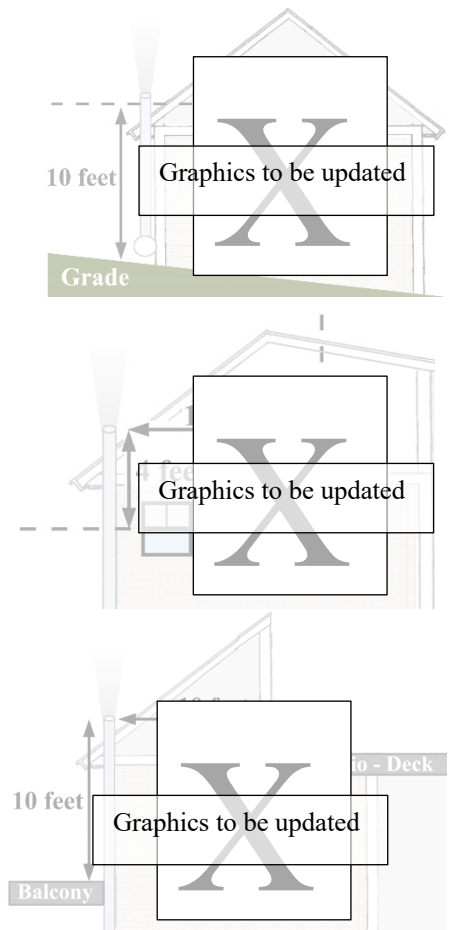
The *point of exhaust* shall be compliant with **Section 9.3 Directional spread** and located either:

- not less than 10 feet (3 m) horizontally to the side *operable openings* in structures; and
- not less than 4 feet (120 cm) away from *operable openings* in structures that are below the *point of exhaust*.

9.7 Separation from people

In relationship to exterior flooring surfaces such as decking, patios, sidewalks and exterior corridors where individuals congregate or traverse, the *point of exhaust* shall be:

- not less than 10 feet (3 m) above or horizontally to the side of exterior flooring surfaces; and
- compliant with **Section 9.3 Directional spread** for an elevation of not less than 10 feet (3 m) above exterior flooring surfaces.



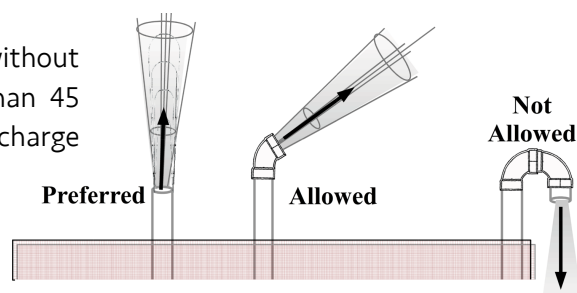
9.8 Equipment Wells and Parapet roofs

The *point of exhaust* relative to open equipment well airspaces or parapet roof construction, where areas are enclosed by more than two walls, shall comply with **Section 9.3 Directional spread**, to include the breathing space where individuals conduct maintenance.

9.9 Angled Trajectories

The *point of exhaust* shall be directed upward without obstruction at an angle that does not deviate more than 45 degrees from a vertical exhaust trajectory. The exhaust discharge shall not exhaust downward.

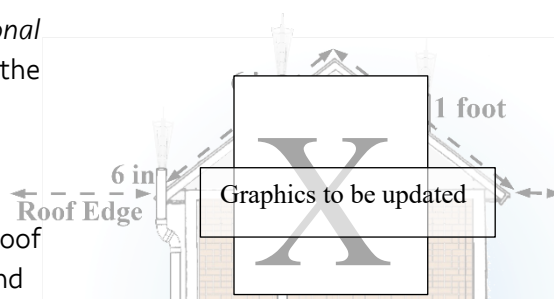
Exceptions: 90 degree horizontal exhausts shall comply with requirements in **Section 9.12**



9.10 Roof

The *point of exhaust* shall comply with **Section 9.3 Directional spread** and, unless all requirements of **Section 9.11** are met, the *point of exhaust* shall be:

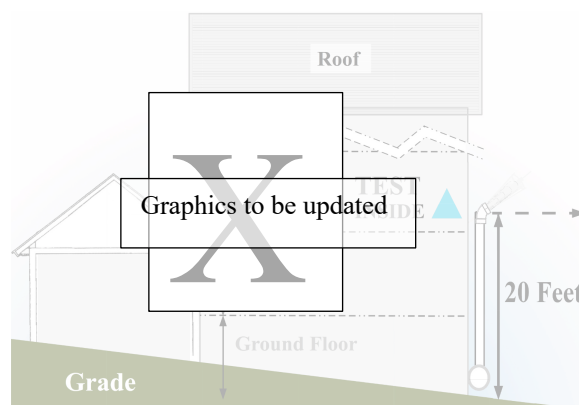
- not less than 1 foot (30 cm) above a pitched roof at the point penetrated;
- not less than 6 inches (15 cm) above the edge of the roof when ASD piping is attached to the side of a building; and
- not less than 18 inches (46 cm) above a flat roof; and
- not less than 4 feet (120 cm) horizontally away from a vertical wall that extends above the roof edge.



9.11 Below the roof

The *point of exhaust* shall be permitted to be located below the edge of the roof if the configuration complies with all requirements of **Section 9** and requirements of a), b), and c) of this **Section 9.11**:

- The justification for not locating the exhaust above the edge of the roof shall be recorded in the operations and maintenance plan and shall be based upon either:
 - the inability to comply with other requirements of **Section 9** if the *point of exhaust* were located above the roof; or
 - the edge of the roof exceeds 20 feet (6 m) above grade nearest to the *point of exhaust*;
- The *point of exhaust* shall be: compliant with **Section 9.3 Directional spread**; not less than 20 feet (6m) above grade nearest to the *point of exhaust*; and not less than 4 feet (120 cm) away from *operable openings* that are above the *point of exhaust*; and
- If activated with an ASD fan, testing shall be conducted within the occupiable area that immediately adjoins the 45° *Directional spread* required in **Section 9.3**. This testing is required no later than in conjunction with the initial post-mitigation test and shall be recommended for inclusion in all future post-mitigation tests.



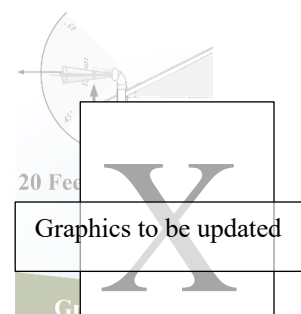
9.12 Horizontal trajectory

While it is best practice to avoid horizontal trajectories, 90 degree horizontal exhaust trajectories are permitted if compliant with all other distances required in [Section 9](#) and [Section 9.12.1](#) or [Section 9.12.2](#).

9.12.1 90-Degree horizontal discharges

If passing the edge of the roof, the *point of exhaust* for a 90-Degree horizontal discharge shall not be less than 20 feet (7.5 m) above grade nearest to the *point of exhaust*. The *point of exhaust* shall comply with [Section 6.4.3 Directional spread](#) including for distances above the breathing space where individuals congregate or traverse as stipulated in [Section 6.4.7](#).

Where "T" style rain caps are configured for 90-Degree horizontal discharge in two directions, both discharge trajectories shall meet these requirements.



9.12.2 Diffused horizontal discharges and rain caps

Where allowed, the *point of exhaust* for diffused horizontal discharges shall not be less than 15 feet (4.6 m) above grade nearest to the *point of exhaust* and not less than 4 feet (120 cm) above or 15 feet (4.6 m) away from *operable openings* into the structures, such as windows, skylights and doors.

Commentary/Rational—The following provisions 9.13, 9.14 and 9.15 are mostly unchanged relative to previous publication.

9.13 Protection From Debris

Where not installing an ASD fan, wire mesh or equivalent rodent/insect screen mesh not smaller than 1/2 inch [13 mm] shall be provided at the *point of exhaust* to prevent debris or small animals from entering *exhaust* piping.

9.14 Protection Against Obstructed Exhaust

Obstructions in the path of *exhaust* air, to include rain caps that can collect ice, shall not be permitted unless conditions of pervasive torrential rain or pervasive blockage from falling debris can be documented as known to exist.

9.15 Increased distances for large capacity systems

When the ASD system is designed for larger airflow capacities with duct piping larger than 4-inch (100-mm), distances shall be increased beyond what is required in [Section 9](#) to comply with [Table 9.15](#).

Table 9.15			
Pipe ID <i>As in Section 6.4</i> 3"- 4" Pipe (10 cm)	Distance Away Directional spread <i>As in Section 6.4.3</i> 10 ft (3 m)	Distance Away Straight-line <i>As in Section 6.4.4</i> 20 ft (6 m)	Distance Above, Below or To Side Grade, <i>Operable Openings</i> and People <i>Sections 6.4.5, 6.4.6, 6.4.7, 6.4.10,</i> <i>6.4.11 and 6.12</i>
For Larger Pipe ID	Increase to	Increase to	Increase distances by another:
6" (15 cm)	12 ft (3.6 m)	25 ft (7.6 m)	2 ft (1.8 m)
8" (20 cm)	18 ft (5.5 m)	30 ft (9 m)	4 ft (2.4 m)
10" (25 cm)	20 ft (6 m)	40 ft (12 m)	6 ft (1.8 m)
For pipe larger than 10" (25 cm)	Shall be increased to meet or exceed ASHRAE 62.1 2016, Appendix B, Separation of Exhaust Outlets and Outdoor Air Intakes		