Radon System Requirements in a Nutshell

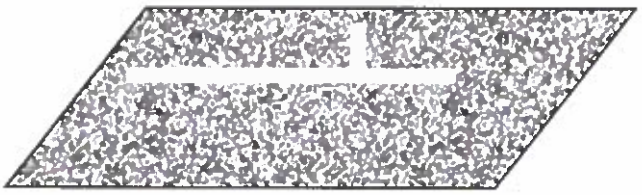
Radon Resistant New Construction (RRNC) is now required in new low-rise residential buildings (three stories or less/one unit or more) per the Maine Uniform Building and Energy Code, which is in effect Statewide. Towns under 4,000 population do not have to enforce it, but the Code is in effect in all Maine municipalities (if there is no code enforcement officer, then the builder and/or homeowner are required to build to code).

The radon standard that contains the installation requirements is ASTM E1465-08. We can provide you with an electronic copy of this standard. For a copy email to the following address Jonathan.dyer@maine.gov.

Below is a "Readers Digest" version of the standard:

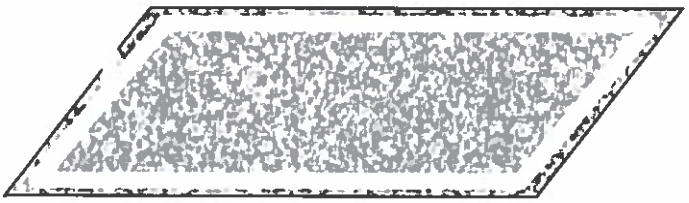
1. There are 2 options for the radon system's mode of operation:
   a. Passive Operation (without fan) – reduce radon concentrations up to 50%
   b. Active Operation (with fan) – reduce radon concentrations up to 99%
2. A typical radon removal system consists of:

   a. 4 in. rigid or flexible perforated PVC pipe 20 ft in length buried in a gas-permeable layer of crushed stone (1 to 1½-in.) which is 4 in. in depth [***6.4.2.1***]



4 in. Rigid or Flex Perforated Pipe 20 ft. Anywhere

   or a loop of 4 in. perforated pipe buried in a gas permeable layer of crushed stone (1 to 1½-in.) which is 4" in depth. The pipe shall follow the interior perimeter of the foundation [***6.4.2.2***] or a 4 in. perforated pipe buried in a 4 in. deep gas-permeable layer of crushed stone (1 to 1½- in.). The crushed stone shall be contained in a trench which is about 1 ft. wide. The pipe shall follow the interior perimeter of the foundation [***6.4.2.3***]

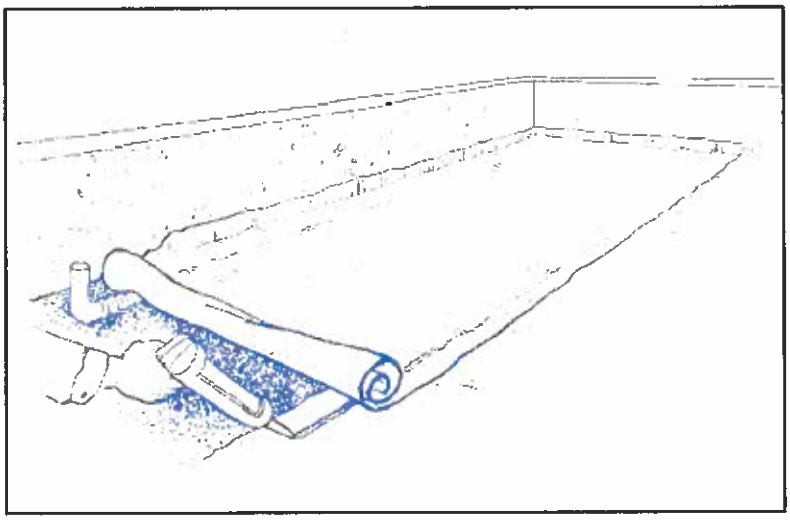


Loop Around Interior Perimeter

or a proprietary geo-textile mat with a minimum width of about 12 in. and a thickness of about 1 in. The mat shall follow the interior perimeter of the foundation [***6.4.2.4***]

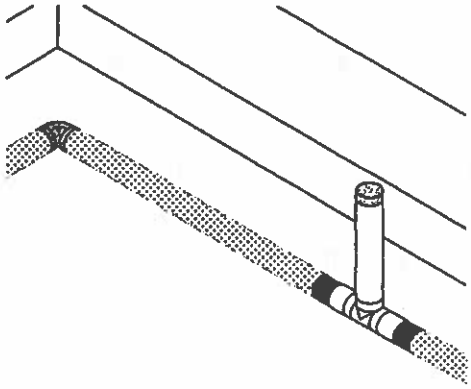
Sub-Slab Layer – Geotextile

or a loop of 4 in. perforated pipe placed on soil level and not buried in aggregate, shall be permitted with only membrane ground covers. The pipe shall be placed on leveled soil and shall follow the interior perimeter of the foundation [***6.4.2.5***].



Membrane Cover Over 4 in. Perforated Pipe

All the variations will be installed with a tee in them that comes up through the floor [***6.4.2***].



The interior foundation drainage piping can double as a radon collection pipe, if it runs into a sump with a check valve, before leaving the building [***6.2.4.2***].

b. A "soil gas retarder" (vapor barrier) is a 6-mil polyethylene plastic sheet and is laid over the crushed stone under the concrete slabs and under sealed crawl-space membranes [***6.2.3***].

c. "Ground cover" is a poured concrete floor slab or a sealed poly membrane plastic permitted in crawlspaces. [***6.2.1***].

d. The foundation drainage has to be designed so that the radon system cannot suck clean air from the outdoors through the foundation drainage system (called "sucking in the earth"). If the building has interior foundation drainage, that has to discharge into a sump pit in the floor of the basement or crawl space with a check valve in the discharge line, with a bolted, gasketed lid covering the sump pit [***6.2.4.2***].

Sump Covers Should Have Viewing Ports to Permit Inspection Without Removing Cover

The check valve should allow water to drain during depressurization. If the exterior drainage is being piped into an indoor sump to be pumped away (for flat sites where you can't daylight the end of the drainpipe), the same setup is required.

3. The radon system (also called the radon vent pipe) is a nonperforated 4 in. ID Schedule 40 PVC or ABS preferred or 3 in. ID Schedule 40 PVC or ABS minimum [***6.5.1***]. The pipe route is run through the building within the thermal envelope. The pipe route is run up through the roof with a space in the attic or above the roof for a fan to be added if needed. It is best to run the pipe route through a 6 in. plumbing wall, but it can go through the exterior wall. The pipe must be insulated in unconditioned spaces to reduce heat loss from the piping [***6.5.5***]. The vent stack pipe discharges above the roof at least 10 ft. above ground level, 12 in. above the edge of the roof, and at least 2 ft. above or 10 ft. away (horizontally) from any opening into conditioned or occupiable space in the building or the top of a chimney. The same separation requirements apply to adjacent buildings [***6.5.4***]. All pipe routes must drain condensation and precipitation back to the suction point without trapping it anywhere in the pipe run. Horizontal runs must be sloped 3/8" to 1½" per foot [***6.5.5***]. **NOTE – The system is to be under negative pressure where it passes through the house.**

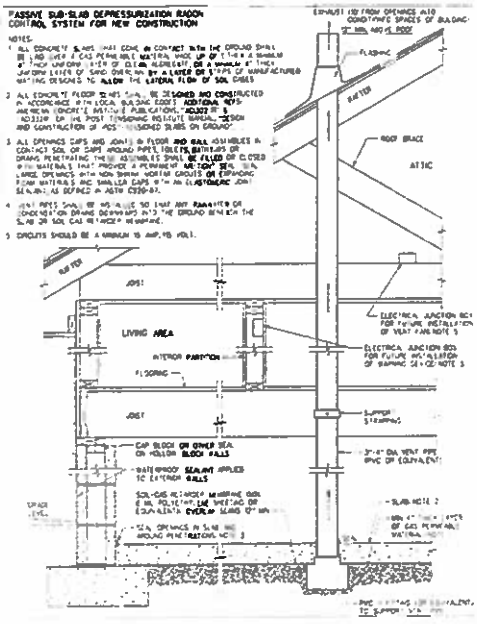


Diagram of a "Passive" Radon Mitigation System

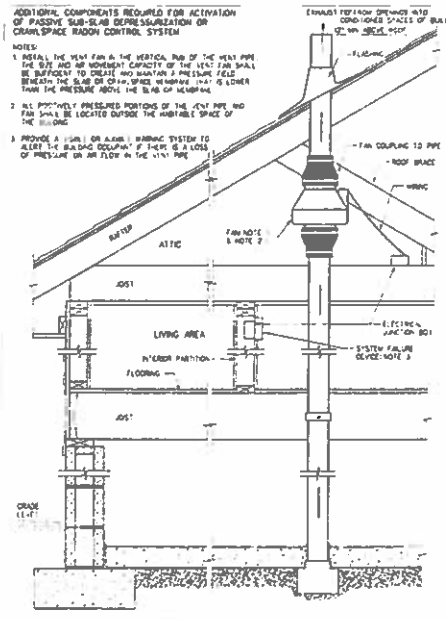
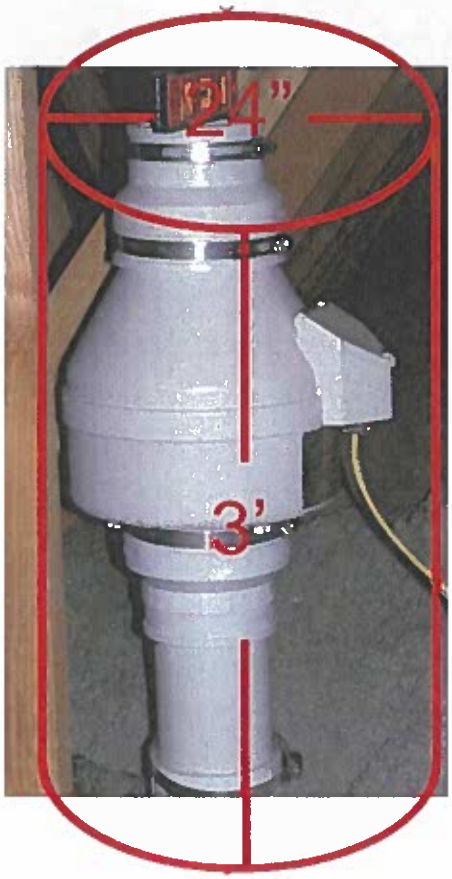


Diagram of an "Active" Radon Mitigation System

4. A fan is installed when the radon level is elevated (4.0 pCi/L or greater) [***6.5.9***]. The fan must be resistant to temperature and moisture, move at least 75cfm @ 0.75" WC static pressure [***6.5.10.2***]. Interior radon fan location – the fan must be located in an unconditioned area above an occupiable space (attic) and installed in a vertical section of

the vent stack pipe [***6.5.10.3***]. The vent stack shall be supported above and below the place where the fan will be installed (the fan takes up a 3 ft. by 2 ft. area). The vent stack pipe shall support the fan [***6.5.10.4(a)***]. **NOTE – There needs to be actual access to the fan location. Planning to put in a hatch if the radon fan is needed, doesn't work.** Exterior fan location - If there is no attic then the fan can be installed on the roof. With a shingled or pitched roof, the fan will be securely attached to the top of the vent stack by its bottom coupling, an 8 in. to 24 in. length of pipe shall be inserted into the fan's top coupling and firmly secured, the top of the pipe is attached to the roof with 2 horizontal weather-proofed rigid rods [***6.5.10.4(b)***]. For a flat roof the vent stack pipe shall be supported by a weatherproof structure that is firmly attached to the building's structure [***6.5.10.4(b)***].



Area needed in attic for Radon Fan Install

5. Fan in attic – junction box with receptacle 6' or less from fan location wired to dedicated non-switched circuit. Fan on roof – junction box under roof wired to non-switch circuit with fan hard wired to junction box, disconnect above roof, near fan per code [***6.8.2 &***

6.8.3]. The circuit list shall be posted on the circuit breaker [*6.8.4*]. All wiring shall comply with applicable codes, including, "disconnecting means" for the radon fan [*6.8.5 & 6.8.6*].

Picture of Junction Box in Relation to Radon Fan

6. The suction pressure check is performed by in stalling a manometer (differential pressure gauge) on the section of radon pipe in the basement (first floor if slab-on-grade or crawl space) [*6.13.4*].

Examples of Radon Fan Manometers

7. Radon Measurements – are all conducted by an independent party [***6.10.5***]. In this case the radon measurement shall be performed by a Maine Radon Registered Service Provider (MRRSP). The only exception is if the occupant has moved in and are performing their own measurement.

   The radon measurement duration is 48 to 72 hours using a device approved by the Maine Racon Control Program. The protocols [***6.10.1***] are as follows:

   - **Fan-powered (active) and passive systems must have operated at least 24 hours immediately prior to starting the radon test.**
   - **"Closed House Conditions" must have been maintained for 12 hours immediately before the radon test is started and must be maintained during the testing period.**

   Testing Buildings with a **Fan-Powered** Pipe Route [***6.10.2***]:

   a. Conduct measurements using "Initial Radon Test Protocols" (i.e. without fan operating)
   b. If Step "**a's**" test result is equal to or greater than the maximum "acceptable radon concentration" (4.0 pCi/L), install a fan and monitor.
   c. Conduct measurements using "Post-Mitigation Test Protocol" (i.e. with fan operating).
   d. If Step "**c's**" test result is equal to or less than 4.0 pCi/L, no further construction is needed. If it still exceeds the maximum acceptable radon concentration, diagnostics shall be performed to determine the system malfunction.

   Testing Buildings with a Passive System [***6.10.3***]:

   a. Conduct measurements using "Post-Mitigation Radon Test Protocols" (i.e. with passive system operating).
   b. If Step "**a's**" test result is equal to or greater than the maximum "acceptable radon concentration" (4.0 pCi/L), install a fan and monitor.
   c. Conduct measurements using "Post-Mitigation Test Protocol" (i.e. with fan operating).
   d. If Step "**c's**" test result is equal to or less than 4.0 pCi/L, no further construction is needed. If it still exceeds the maximum acceptable radon concentration, diagnostics shall be performed to determine the system malfunction.

   Documented evidence of the acceptable radon concentrations is required before occupancy [***6.10.6***].

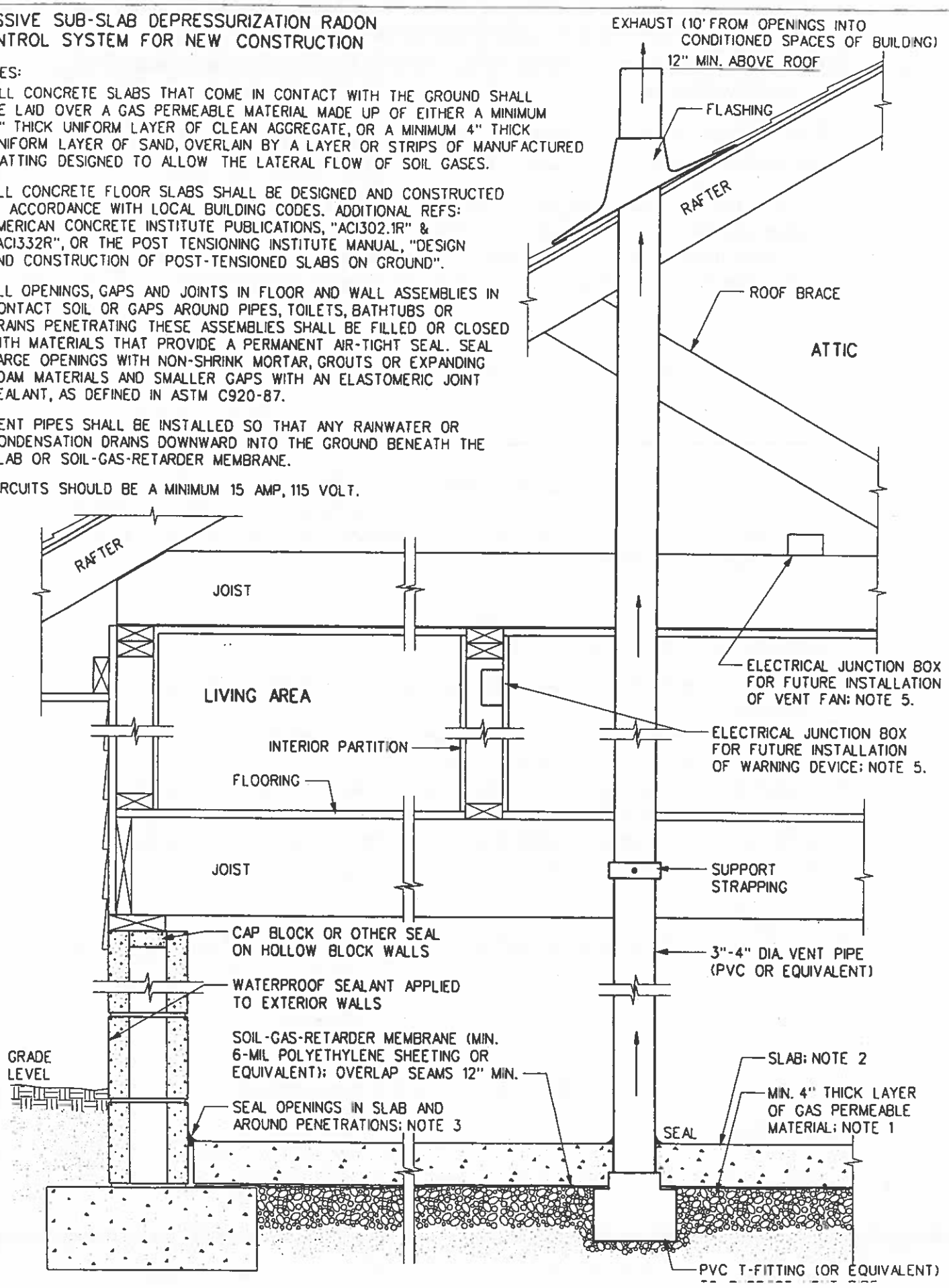
For more information, see the Maine CDC:

https://www1.maine.gov/dhhs/mecdc/services/maine-public-health-laboratory/environmental-chemistry/radiochemistry-and-radon-testing/radon

PASSIVE SUB-SLAB DEPRESSURIZATION RADON CONTROL SYSTEM FOR NEW CONSTRUCTION

NOTES:

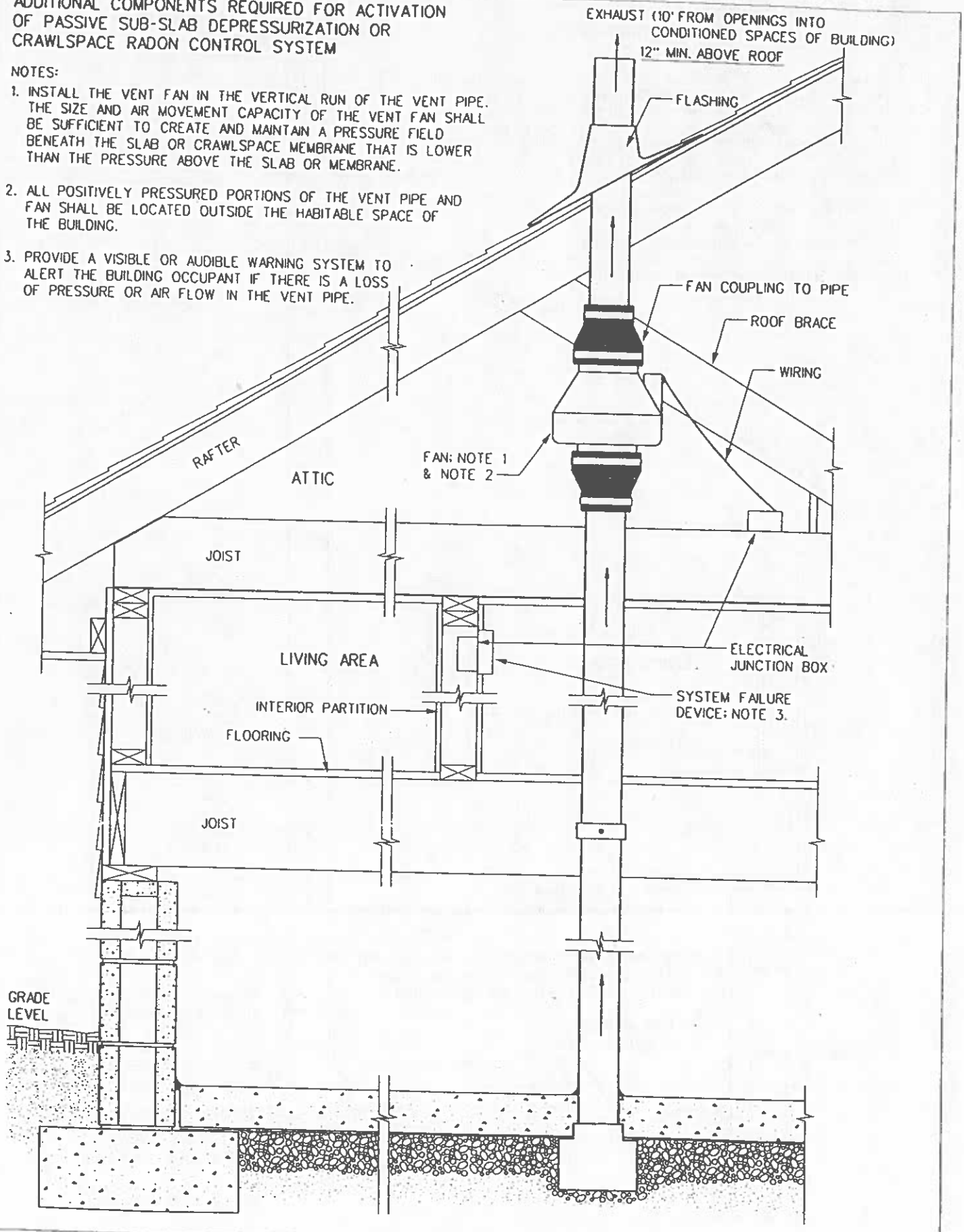
1. ALL CONCRETE SLABS THAT COME IN CONTACT WITH THE GROUND SHALL BE LAID OVER A GAS PERMEABLE MATERIAL MADE UP OF EITHER A MINIMUM 4" THICK UNIFORM LAYER OF CLEAN AGGREGATE, OR A MINIMUM 4" THICK UNIFORM LAYER OF SAND, OVERLAIN BY A LAYER OR STRIPS OF MANUFACTURED MATTING DESIGNED TO ALLOW THE LATERAL FLOW OF SOIL GASES.
2. ALL CONCRETE FLOOR SLABS SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH LOCAL BUILDING CODES. ADDITIONAL REFS: AMERICAN CONCRETE INSTITUTE PUBLICATIONS, "ACI302.1R" & "ACI332R", OR THE POST TENSIONING INSTITUTE MANUAL, "DESIGN AND CONSTRUCTION OF POST-TENSIONED SLABS ON GROUND".
3. ALL OPENINGS, GAPS AND JOINTS IN FLOOR AND WALL ASSEMBLIES IN CONTACT SOIL OR GAPS AROUND PIPES, TOILETS, BATHTUBS OR DRAINS PENETRATING THESE ASSEMBLIES SHALL BE FILLED OR CLOSED WITH MATERIALS THAT PROVIDE A PERMANENT AIR-TIGHT SEAL. SEAL LARGE OPENINGS WITH NON-SHRINK MORTAR, GROUTS OR EXPANDING FOAM MATERIALS AND SMALLER GAPS WITH AN ELASTOMERIC JOINT SEALANT, AS DEFINED IN ASTM C920-87.
4. VENT PIPES SHALL BE INSTALLED SO THAT ANY RAINWATER OR CONDENSATION DRAINS DOWNWARD INTO THE GROUND BENEATH THE SLAB OR SOIL-GAS-RETARDER MEMBRANE.
5. CIRCUITS SHOULD BE A MINIMUM 15 AMP, 115 VOLT.



ADDITIONAL COMPONENTS REQUIRED FOR ACTIVATION OF PASSIVE SUB-SLAB DEPRESSURIZATION OR CRAWLSPACE RADON CONTROL SYSTEM

NOTES:

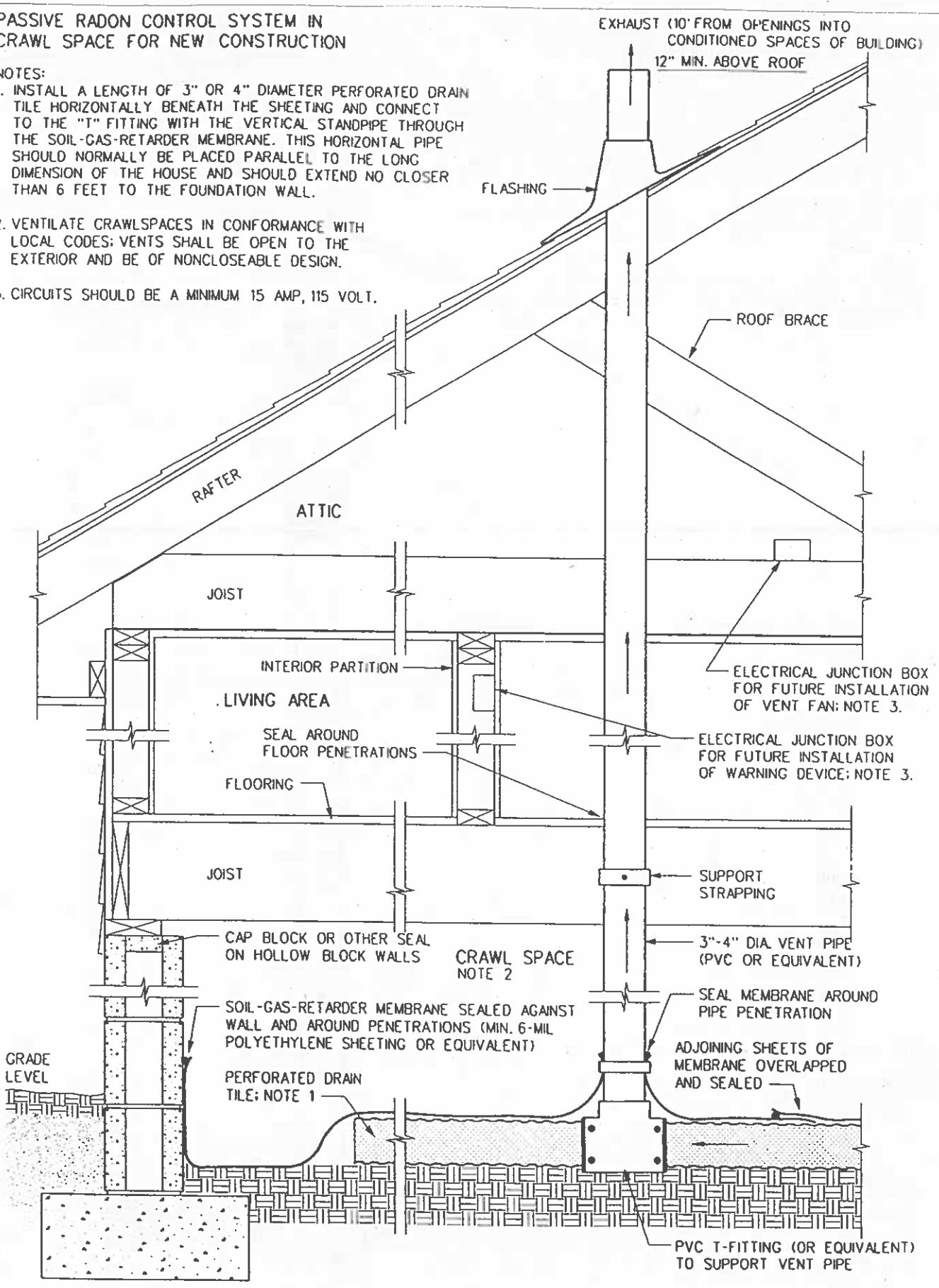
1. INSTALL THE VENT FAN IN THE VERTICAL RUN OF THE VENT PIPE. THE SIZE AND AIR MOVEMENT CAPACITY OF THE VENT FAN SHALL BE SUFFICIENT TO CREATE AND MAINTAIN A PRESSURE FIELD BENEATH THE SLAB OR CRAWLSPACE MEMBRANE THAT IS LOWER THAN THE PRESSURE ABOVE THE SLAB OR MEMBRANE.
2. ALL POSITIVELY PRESSURED PORTIONS OF THE VENT PIPE AND FAN SHALL BE LOCATED OUTSIDE THE HABITABLE SPACE OF THE BUILDING.
3. PROVIDE A VISIBLE OR AUDIBLE WARNING SYSTEM TO ALERT THE BUILDING OCCUPANT IF THERE IS A LOSS OF PRESSURE OR AIR FLOW IN THE VENT PIPE.



PASSIVE RADON CONTROL SYSTEM IN CRAWL SPACE FOR NEW CONSTRUCTION

NOTES:

1. INSTALL A LENGTH OF 3" OR 4" DIAMETER PERFORATED DRAIN TILE HORIZONTALLY BENEATH THE SHEETING AND CONNECT TO THE "T" FITTING WITH THE VERTICAL STANDPIPE THROUGH THE SOIL-GAS-RETARDER MEMBRANE. THIS HORIZONTAL PIPE SHOULD NORMALLY BE PLACED PARALLEL TO THE LONG DIMENSION OF THE HOUSE AND SHOULD EXTEND NO CLOSER THAN 6 FEET TO THE FOUNDATION WALL.

2. VENTILATE CRAWLSPACES IN CONFORMANCE WITH LOCAL CODES; VENTS SHALL BE OPEN TO THE EXTERIOR AND BE OF NONCLOSEABLE DESIGN.

3. CIRCUITS SHOULD BE A MINIMUM 15 AMP, 115 VOLT.