

Frost Protected Shallow Foundations 2015 MSBC Chapter 1309

Rev 170310

This handout is intended only as a guide and is based in part on the 2015 Minnesota State Building Code as adopted by the City of Bemidji as well as good building practice. While every attempt has been made to insure the correctness of this handout, no guarantees are made to its accuracy or completeness. Responsibility for compliance with applicable codes and ordinances falls on the owner or contractor. To obtain a copy of the 2015 Minnesota State Building Code, go to: <http://www.dli.mn.gov/ccld/codes15.asp>

All residential construction projects must be placed on foundation systems that are correct for the soil type of the building site. The various foundation types and construction methods may vary but all are covered in Chapter 4 of the residential code. Along with providing the typical requirements for foundation materials, types of footings, foundation and retaining walls construction, foundation drainage and water and dampproofing, there are special provisions for Frost Protected Shallow Foundations.



2015 Minnesota State Building Code Chapter 1309.R403.3

The design of FPSF use insulation to prevent frost heaving in cold climates. It is specific to slab-on-grade foundations on residential homes but may also be used on heated garages/ sheds.

The proper specification of insulation products is paramount to the success of an FPSF application. Few insulation products are able to maintain a dry R-value in moist, below ground environment over any great length of time. Insulation products specified for an FPSF must be rated with an effective R-value that can be maintained in such an environment for the expected life of the structure. Because some insulation materials resist water absorption less effectively than others, which in-turn degrades their thermal resistance (R-values), insulation material should be specified carefully.

The following specifications detail the prescriptive design and insulation detail for FPSF installation, where adjacent to outside, in locations with an air freezing index of 4000, Bemidji for example.

XPS= Extruded Polystyrene Insulation- some common colors include: pink, blue, green, orange
EPS= Expanded Polystyrene Insulation- common color includes white

The following code excerpt outlines the construction materials and installations that are required for a code compliant passive radon control system:

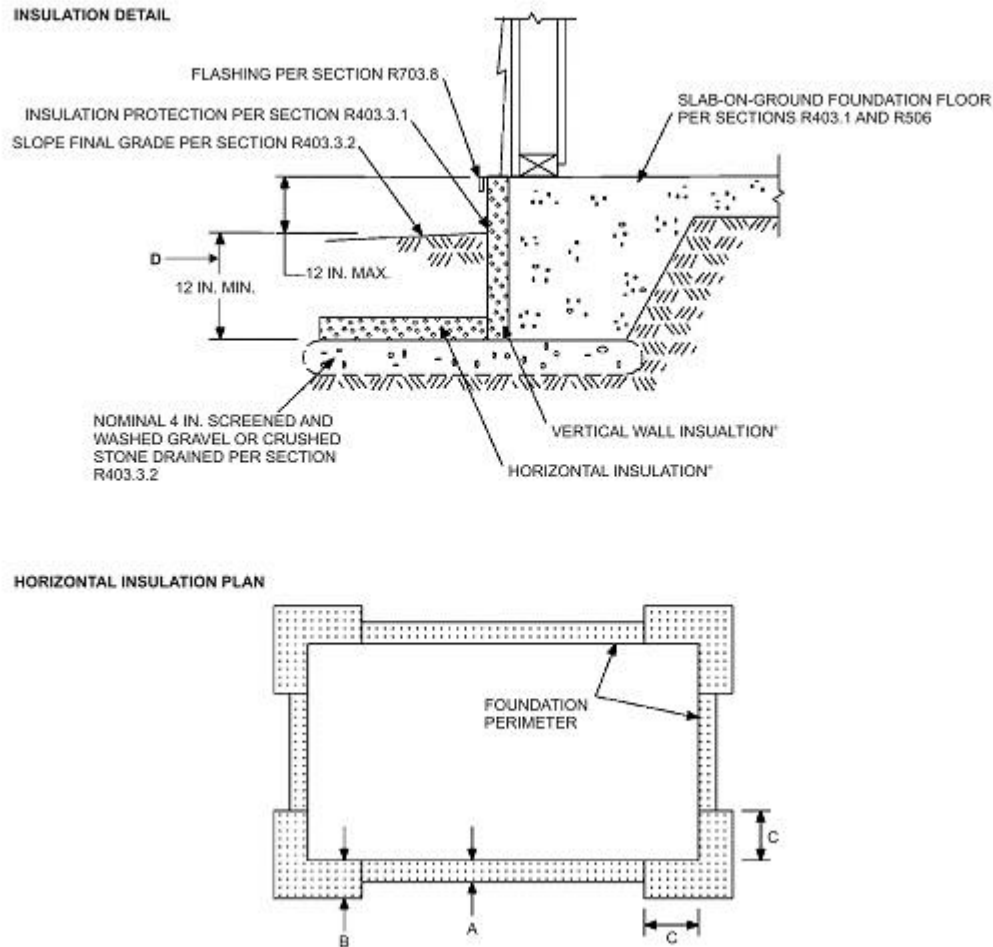
1309.R403.3 Frost Protected Shallow Foundations

R403.3 Frost-protected shallow foundations.

For buildings where the monthly mean temperature of the building is maintained at a minimum of 64°F

(18°C), footings are not required to extend below the frost line when protected from frost by insulation in accordance with Figure R403.3(1) and Table R403.3(1). Foundations protected from frost in accordance with Figure R403.3(1) and Table R403.3(1) shall not be used for unheated spaces such as porches, utility rooms, garages and carports, and shall not be attached to basements or crawl spaces that are not maintained at a minimum monthly mean temperature of 64°F (18°C).

Materials used below *grade* for the purpose of insulating footings against frost shall be *labeled* as complying with ASTM C 578.



For SI: 1 inch = 25.4 mm.

a. See Table R403.3(1) for required dimensions and R-values for vertical and horizontal insulation and minimum footing depth.

FIGURE R403.3(3) INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO UNHEATED SLAB-ON-GROUND STRUCTURE

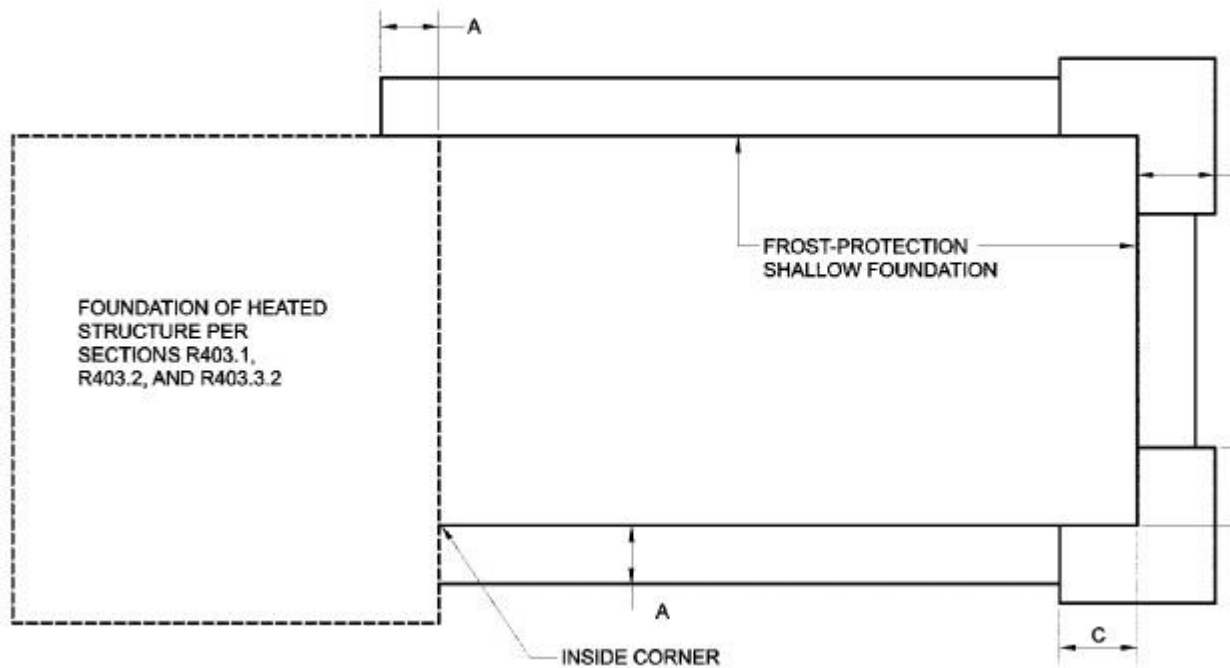


FIGURE R403.3(4) INSULATION PLACEMENT FOR FROST-PROTECTED FOOTINGS ADJACENT TO HEATED STRUCTURE

TABLE R403.3(1) MINIMUM FOOTING DEPTH AND INSULATION REQUIREMENTS FOR FROST-PROTECTED FOOTINGS IN HEATED BUILDINGS^a

AIR FREEZING INDEX (°F-days) ^b	MINIMUM FOOTING DEPTH, D (inches)	VERTICAL INSULATION R-VALUE ^{c, d}	HORIZONTAL INSULATION R-VALUE ^{c, e}		HORIZONTAL INSULATION DIMENSIONS PER FIGURE R403.3(1) (inches)		
			Along walls	At corners	A	B	C
1,500 or less	12	4.5	Not required	Not required	Not required	Not required	Not required
2,000	14	5.6	Not required	Not required	Not required	Not required	Not required
2,500	16	6.7	1.7	4.9	12	24	40
3,000	16	7.8	6.5	8.6	12	24	40
3,500	16	9.0	8.0	11.2	24	30	60
4,000	16	10.1	10.5	13.1	24	36	60

For SI: 1 inch = 25.4 mm, °C = [(°F) - 32]/1.8.

a. Insulation requirements are for protection against frost damage in heated buildings. Greater values may be required to meet energy conservation standards.

b. See Figure R403.3(2) or Table R403.3(2) for Air Freezing Index values.

c. Insulation materials shall provide the stated minimum R-values under long-term exposure to moist, below-ground conditions in freezing climates. The following R-values shall be used to determine insulation thicknesses required for this application: Type II expanded polystyrene-2.4R per inch; Type IV extruded polystyrene-4.5R per inch; Type VI extruded polystyrene-4.5R per inch; Type IX expanded polystyrene-3.2R per inch; Type X extruded polystyrene-4.5R per inch.

d. Vertical insulation shall be expanded polystyrene insulation or extruded polystyrene insulation.

e. Horizontal insulation shall be extruded polystyrene insulation.

R403.3.1 Foundations adjoining frost-protected shallow foundations.

Foundations that adjoin frost-protected shallow foundations shall be protected from frost in accordance with Section R403.1.4.

R403.3.1.1 Attachment to unheated slab-on-ground structure.

Vertical wall insulation and horizontal insulation of frost protected shallow foundations that adjoin a slab-on-ground foundation that does not have a monthly mean temperature maintained at a minimum of 64°F (18°C) shall be in accordance with Figure R403.3(3) and Table R403.3(1). Vertical wall insulation shall extend between the frost protected shallow foundation and the adjoining slab foundation. Required horizontal insulation shall be continuous under the adjoining slab foundation and through any foundation walls adjoining the frost protected shallow foundation. Where insulation passes through a foundation wall, it shall either be of a type complying with this section and having bearing capacity equal to or greater than the structural loads imposed by the building, or the building shall be designed and constructed using beams, lintels, cantilevers or other means of transferring building loads such that the structural loads of the building do not bear on the insulation.

R403.3.1.2 Attachment to heated structure.

Where a frost-protected shallow foundation abuts a structure that has a monthly mean temperature maintained at a minimum of 64°F (18°C), horizontal insulation and vertical wall insulation shall not be required between the frost-protected shallow foundation and the adjoining structure. Where the frost-protected shallow foundation abuts the heated structure, the horizontal insulation and vertical wall insulation shall extend along the adjoining foundation in accordance with Figure R403.3(4) a distance of not less than Dimension A in Table R403.3(1).

Exception: Where the frost-protected shallow foundation abuts the heated structure to form an inside corner, vertical insulation extending along the adjoining foundation is not required.

R403.3.2 Protection of horizontal insulation below ground.

Horizontal insulation placed less than 12 inches (305 mm) below the ground surface or that portion of horizontal insulation extending outward more than 24 inches (610 mm) from the foundation edge shall be protected against damage by use of a concrete slab or asphalt paving on the ground surface directly above the insulation or by cementitious board, plywood rated for below-ground use, or other *approved* materials placed below ground, directly above the top surface of the insulation.

R403.3.3 Drainage.

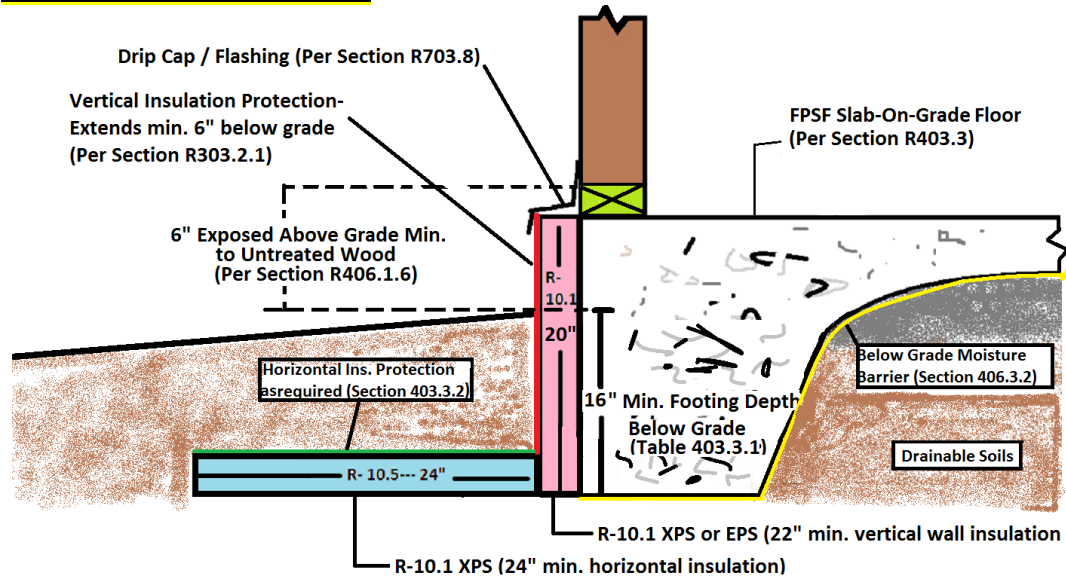
Final *grade* shall be sloped in accordance with Section R401.3. In other than Group I Soils, as detailed in Table R405.1, gravel or crushed stone beneath horizontal insulation below ground shall drain to daylight or into an *approved* sewer system.

R403.3.4 Termite damage.

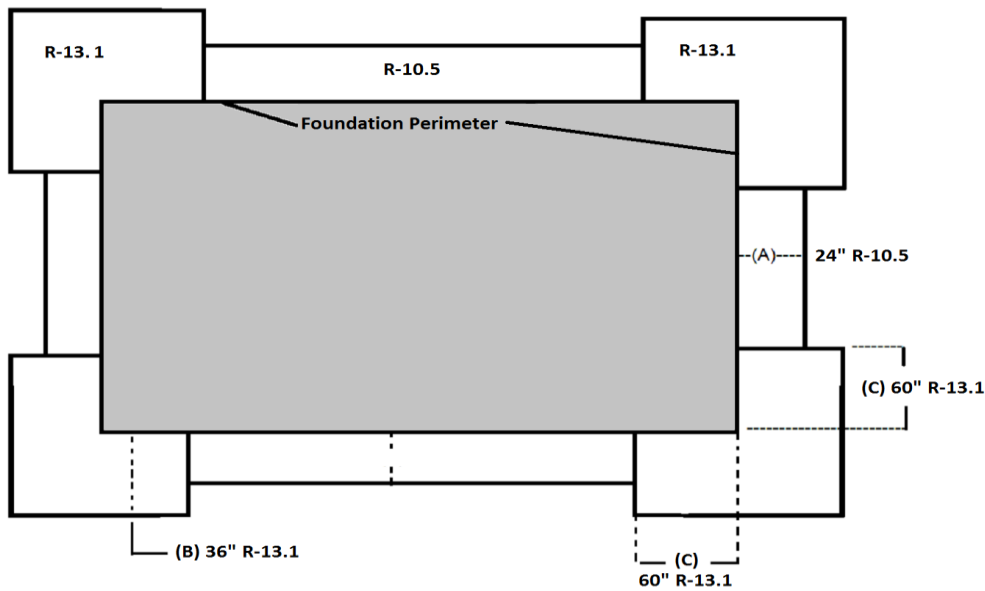
The use of foam plastic in areas of “very heavy” termite infestation probability shall be in accordance with Section R318.4.

The following diagrams are intended to provide helpful direction for the proper installation of passive or active sub-slab soil-gas mitigation systems. While they may be helpful, they are not the actual code and may not include all code requirements. Refer to 2015 MSBC Chapter 1303.2400-2403 for all code requirements.

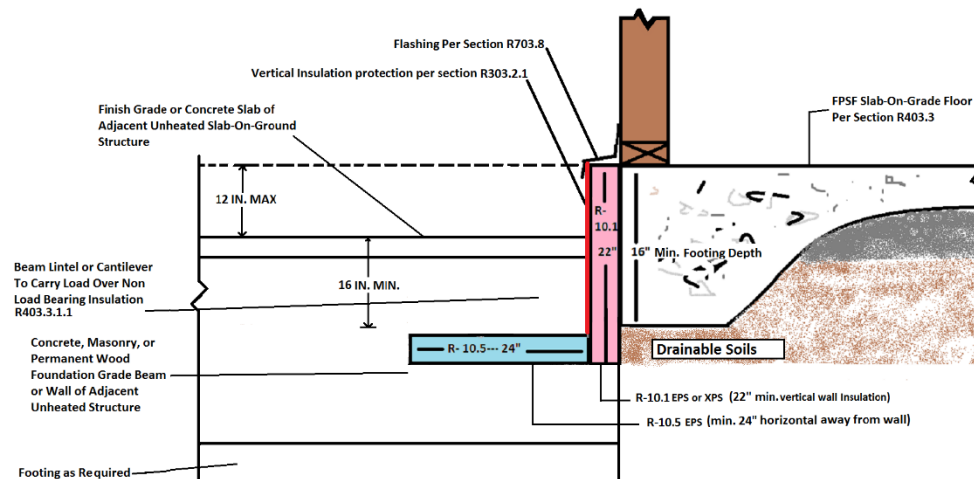
FPSF--- ADJACENT TO OUTSIDE



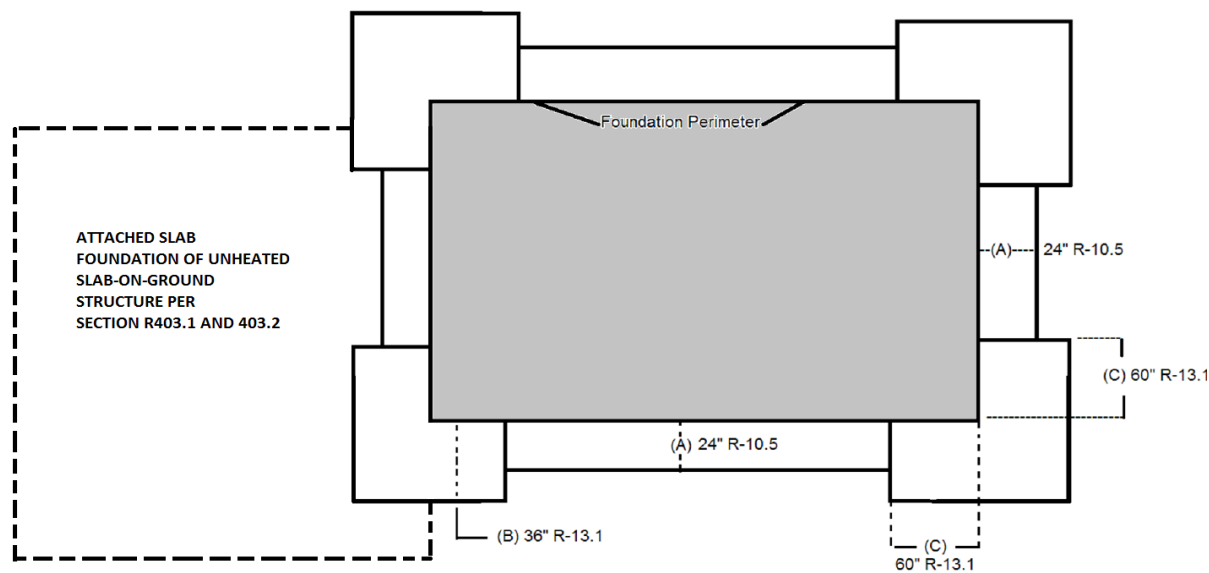
FPSF--- ADJACENT TO OUTSIDE, OVERHEAD VIEW



FPSF--- ADJACENT TO UNHEATED STRUCTURE



FPSF--- ADJACENT TO UNHEATED STRUCTURE, OVERHEAD VIEW



FPSF--- ADJACENT TO EXISTING HEATED STRUCTURE, OVERHEAD VIEW

