EXAM

Course 10888

SPS 322 Energy Conservation & Commentary

6 Hour Continuing Education Course

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We would like to thank you for ordering Course #10888 (SPS 322 Energy Conservation). This course has been approved for 6 hours of continuing education by the Wisconsin Department of Safety and Professional Services.

This course is intended to familiarize Contractors and Inspectors with information on the updated construction codes required for building a home, according to the Uniform Dwelling Code (UDC). SPS 322 Energy Conservation and the Commentary are used as reference materials.

Topics covered in this course include Scope, Application, Definitions, insulation materials and Installation, Dwelling Thermal Envelope, Systems and Simulated Performance Alternative are included in this course.

Materials included

1. REVIEW MATERIALS
2. EXAM
3. Answer Sheet

Once you complete the course

Return the bubble answer sheets to our company. Fax: (608) 571-0096
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We will grade your exam and notify you of the results and will notify the State of Wisconsin of your successful completion of the course.

The State of Wisconsin requires that you attain a passing score of 70%**.**

After you are notified that you passed the course

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Please feel free to contact us with any questions and/or suggestions on improving this course or future educational courses you would like to see us offer.

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Questions 1 to 24 (Refer to Review Materials–SPS 322.01 Scope to SPS 322.10 Definitions)

1. SCOPE. This chapter applies to all construction covered by this code that use any amount of renewable energy for heat generation.
   Note: Non−renewable energy sources used for heat distribution only will also require compliance with this chapter.
   Note: Although the actual source of heat delivered by a heat pump is renewable, a dwelling using a heat pump is not exempt from the requirements of this chapter due to the required input of electricity to run the pump and compressor.

   a. True
   b. False

2. APPLICATION. This chapter allows the designer the option of using various methods to demonstrate compliance with thermal performance requirements. The designer shall identify on the plan submittal form what method or subchapter is being used, and indicate the design criteria and how it is being applied. Unless specifically exempted, all requirements of this chapter apply regardless of the method used.

   a. True
   b. False

3. DEFINITIONS. “Mass wall” means a wall of concrete block, concrete, insulated concrete forms, masonry cavity, _____, earth and solid timber or logs.

   a. styrofoam composite
   b. brick or brick veneer
   c. brick other than brick veneer
   d. none of the above

4. DEFINITIONS. “_____” means a floor slab in which an uninsulated heating element, uninsulated hydronic tubing or uninsulated hot air distribution system is in contact with the slab or placed within the slab or the subgrade.

   a. Heated slab
   b. Cooled slab
   c. Sizzling slab
   d. none of the above

5. DEFINITIONS. “Conditioned space” means space within the dwelling thermal envelope which is provided with heated air or surfaces to provide a heated space capable of maintaining the temperature of the space to at least _____ at design conditions.

   a. 45°F
   b. 50°F
   c. 55°F
   d. 60°F

6. APPLICATION. This chapter is not intended to conflict with any safety or health requirements. Where a conflict occurs, the safety and health requirements _____ govern.

a. may
b. might
c. shall
d. should

7. DEFINITIONS. "Infiltration" means the controlled inward and outward air leakage through cracks and interstices in any dwelling element and around windows and doors of a dwelling caused by the pressure effects of wind, and the effect of differences in the indoor and outdoor air density.

a. True
b. False

8. DEFINITIONS. "Opaque areas" means all exposed areas of a dwelling envelope which enclose conditioned space except openings for _____ and dwelling service systems.

a. windows
b. skylights
c. doors
d. windows, skylights and doors

9. DEFINITIONS. "_____" means the sum of areas of all floors in conditioned space in the structure, including basements, cellars, and intermediate floored levels measured from the exterior faces of exterior walls or from the center line of interior walls, excluding covered walkways, open roofed−over areas, porches, exterior terraces or steps, chimneys, roof overhangs and similar features.

a. opaque areas
b. Conditioned space
c. Conditioned floor area
d. none the above

10. DEFINITIONS. "HVAC system" means the equipment, distribution network, and terminals that provide either collectively or individually the processes of heating, ventilating, or air conditioning to a building.

a. True
b. False

11. DEFINITIONS. "Dwelling thermal envelope" means the elements of a dwelling with enclosed conditioned space through which thermal energy may be transferred to or from unconditioned space or the exterior.

a. True
b. False

12. DEFINITIONS. “Exterior wall area” means the normal projection of the dwelling envelope wall area bounding interior space which is conditioned by an energy−using system including opaque wall, window and door area. Any skylight shaft walls that are _____ or more in depth, measured from the ceiling plane to the roof deck, are considered in the area of exterior walls and are not considered part of the roof assembly.

a. 6 inches
b. 8 inches
c. 10 inches
d. 12 inches

13. DEFINITIONS. “IC−rated” means an electrical fixture tested and listed by an independent testing laboratory as being _____ for installation in a cavity where the fixture may be in direct contact with thermal insulation or combustible materials.

a. unfitting
b. unacceptable
c. suitable
d. improper

14. DEFINITIONS. “Crawl space wall” means the opaque portion of a wall which encloses a crawl space and is partially or totally below grade.

a. True
b. False

15. DEFINITIONS. “Renewable energy sources” means sources of energy, including minerals and petroleum products, derived from incoming solar radiation, trees and other plants, wind, waves and tides, lake or pond thermal differences and from the external heat of the earth.

a. True
b. False

16. DEFINITIONS. “Sun room” means a one−story structure attached to a dwelling with a glazing area in excess of _____ of the gross area of the structure’s exterior walls and roof.

a. 30%
b. 35%
c. 40%
d. 50%

17. DEFINITIONS. "_____" means a space or group of spaces within a dwelling with heating requirements sufficiently similar so that comfort conditions can be maintained throughout by a single controlling device.

a. Segment
b. Section
c. Sphere
d. Zone

18. DEFINITIONS. "_____" means the process of supplying or removing air by natural or mechanical means to or from any space. The air may or may not have been conditioned.

a. Ventilation
b. Oxygenation
c. Purification
d. Aeration

19. DEFINITIONS. "Thermal transmittance" or "_____" means the time rate of heat flow through a body or assembly which is located between 2 different environments, expressed in Btu/h • ft.^{2} • °F. The _____ applies to combinations of different materials used in series along the heat flow path and also to single materials that comprise a dwelling section, including cavity air spaces and air films on both sides of a dwelling element.

a. R-factor/ U-factor
b. U-factor/U-factor
c. T-factor/ R-factor
d. S-factor/T-factor

20. DEFINITIONS. "Thermal resistance" or "_____" means a measure of the ability to retard the flow of heat. The _____ is the reciprocal of thermal transmittance or U−factor expressed as R = 1/U.

a. R-value/ R-value
b. U-factor/ R-value
c. T-factor/ R-value
d. S-factor/ T-factor

21. DEFINITIONS. "Roof assembly" means some components of the roof and ceiling envelope through which heat flows, thus creating a building transmission heat loss or gain, where such assembly is exposed to outdoor air and encloses a heated space. Any skylight shaft walls less than 12 inches in depth, as measured from the ceiling plane to the roof deck, are considered in the roof assembly and are considered in the area of exterior walls.

a. True
b. False

22. DEFINITIONS. “System” means a combination of central or terminal equipment and their _____ by which energy is transformed so as to perform a specific function, such as HVAC, water heating, or illumination.

a. components and controls
b. accessories
c. interconnecting means and terminal devices
d. accessories, components and controls, interconnecting means and terminal devices

23. DEFINITIONS. “Thermally isolated” means physically and thermally separated with separate zone or separate equipment controls for space heating.

a. True
b. False

24. DEFINITIONS. “Proposed design” means a description of the proposed dwelling used to estimate annual energy use for determining compliance based on total building performance.

a. True
b. False

Questions 25 to 34 (Refer to Review Materials – SPS 322.20 Basic requirements and SPS 322.21 Protection of insulation)

25. “LABORATORY OR FIELD TEST MEASUREMENTS. (a) *General dwelling thermal envelope materials.* When information specified under sub. (1) is not available, or when a different value is claimed, supporting data _____ be obtained using one of the following test methods:
1. ASTM C177, Standard test method for steady state heat flux measurements and thermal transmission properties by means of the guarded−hot−plate apparatus.
2. ASTM C335, Standard test method for steady state heat transfer properties of pipe insulation.
3. ASTM C518, Standard test method for steady state thermal transmission properties by means of the heat flow meter apparatus.
4. ASTM C1363, Standard test method for the thermal performance of building materials and envelope assemblies by means of a hot box apparatus.

a. may
b. might
c. shall
d. should

26. IDENTIFICATION. (b) 1. The thickness of blown−in roof and ceiling insulation shall be identified by thickness markings that are labeled in inches and installed at least one for every _____ through the attic space.

a. 200 square feet
b. 300 square feet
c. 350 square feet
d. 400 square feet

27. GENERAL. When available, information and values on thermal properties, performance of building envelope sections and components, and heat transfer shall be obtained from the ASHRAE Handbook of Fundamentals.

a. True
b. False

28. GENERAL INSTALLATION. (a) Materials, equipment and systems shall be identified in a manner that will allow a determination of their _____ with the applicable provisions of this code.

a. denial
b. defiance
c. nonconformity
d. compliance

29. IDENTIFICATION. The thickness of installed insulation shall meet or exceed the minimum initial installed thickness shown by the marker.

a. True
b. False

30. CERTIFICATE. (a) A permanent certificate shall be posted on or immediately adjacent to the electrical distribution panel.
(b) The certificate shall be completed by the _____.

a. owner or builder
b. builder or insulation installer
c. owner, builder or insulation installer
d. owner or insulation installer

31. COMPUTATION OF R-VALUES. Insulation material used in layers, such as framing cavity insulation and insulating sheathing, _____ be summed to compute the component R−value.
(b) The manufacturer's settled R−value shall be used for blown insulation.

a. may
b. can
c. shall
d. should

32. CONCRETE MASONRY UNITS. Systems using integrally−insulated concrete masonry units can be evaluated for thermal performance in accordance with both:

1. Default values as approved by the department with no extrapolations or interpolations.
2. Laboratory or field test measurements specified under par. (A)

a. True
b. False

33. FOAM PLASTIC INSULATION. (a) Exterior foam plastic insulation shall be protected from physical damage and damage from ultraviolet light with a permanent, opaque, weather−resistant covering or coating.
(b) The protective covering shall cover the exposed exterior insulation and extend a minimum of _____ below grade, except the covering is not required below a brick ledge.

a. 2 inches
b. 3 inches
c. 4 inches
d. 5 inches

34. WIND WASH PROTECTION. (a) Except as provided under s. SPS 322.39 (4) for cathedral ceilings, all air−permeable insulation materials installed in any position other than horizontal, _____ be covered on the cold−in−winter side with a permanently attached material of low air permeability to maintain the R−value of the insulation.

a. can
b. shall
c. could
d. should

Questions 35 to 49 (Refer to Review Materials – Subchapter IV Dwelling Thermal Envelope. SPS 322.30 General Design requirements to SPS 322.32 Specific insulation requirements)

35. BASEMENTS AND CRAWL SPACES. Where basement and crawl space walls are not part of the dwelling thermal envelope, their R−values and U−factors shall be based on the wall components. Adjacent soil may be considered in the determination.

a. True
b. False

36. MASONRY VENEER. When insulation is placed on the exterior of a foundation supporting a masonry veneer exterior, the horizontal foundation surface supporting the veneer is not required to be insulated to satisfy the foundation insulation requirement.

a. True
b. False

37. GARAGES. (a) Except as provided under par. (b), a garage may not be provided with any supplemental heat unless all of the following conditions are met:
Note: Because of the scope of this chapter, the requirements under this subsection apply only to heat generated from non−renewable sources.
1. The dwelling shall be thermally isolated from the garage.
2. The garage floor, ceiling and walls shall be provided with a vapor retarder in accordance with s. SPS 322.38.
3. All building elements shall meet the requirements of s. SPS 322.31.

(b) The thermal envelope requirements under par. (a) are not required if all of the following conditions are met:
1. The thermostat is permanently limited to a maximum of _____.
2. Heating equipment is either separate from the dwelling unit equipment or installed as a separate zone.
3. Separate heating equipment shall be sized to provide a maximum indoor temperature of ____.

a. 40°F
b. 45°F
c. 50°F
d. 60°F

38. INFILTRATION. (a) Infiltration for heating design loads shall be calculated based on a maximum of 0.5 air change per hour in the heated space.

a. True
b. False

39. APPLIANCE EFFICIENCY. (a) Except as allowed under par. (b) and s. SPS 322.46, oil−fired and gas−fired furnaces and boilers shall meet the minimum efficiency requirements in Table 322.31−3.

a. True
b. False

40. THERMAL ENVELOPE. (a) *General.* If the total dwelling thermal envelope UA is less than or equal to the total UA resulting from using the U−factors in Table 322.31−2 multiplied by the same assembly area as in the proposed building, the dwelling is in compliance with this chapter. The UA calculation _____ using a method consistent with the ASHRAE Handbook of Fundamentals and shall include the thermal bridging effects of framing materials.
Note: UA is equal to the product of the U−factor times the assembly area.
Note: REScheck is an acceptable software program for determining compliance with this section.

a. may be done
b. can be dome
c. shall be done
d. will be done

41. CEILINGS WITH ATTIC SPACES. _____ will satisfy the ceiling R−value requirement for a dwelling where the full height of uncompressed _____ insulation extends over the wall top plate at the eaves.

a. R-24
b. R-28
c. R-32
d. R-38

42. BOX SILL AND RIM JOIST SPACES. Box sills and joist spaces at _____ shall be insulated to the required wall R−value with air−impermeable insulation that is sealed on all sides to all framing members and the foundation, or with air−permeable insulation held in place as required under s. SPS 322.21 (1).

a. inside walls
b. outside walls
c. inside and outside walls
d. none of the above

43. FLOORS. Floor insulation shall be installed to maintain permanent contact with the underside of the subfloor decking.

a. True
b. False

44. BASEMENT WALLS. Where the total basement wall area is less than _____ below grade, the entire wall area, including the below−grade portion, is included as part of the area of exterior walls.

a. 50 percent
b. 60 percent
c. 70 percent
d. 75 percent

45. WALL INSULATION. Except for closed−cell sprayed foam, wall insulation shall _____ the wall cavity.

a. partially fill
b. completely fill
c. either partially or completely fill
d. none of the above

46. OVERHANG JOIST SPACES. (a) Joist spaces that extend beyond exterior walls shall be insulated with an R−value of _____or higher with insulation that completely fills the cavity including over the top of the exterior wall supporting the joists.

a. 24
b. 26
c. 28
d. 30

47. OVERHANG JOIST SPACES. If piping that is subject to freezing is located in the joist space, additional insulation does not need to be provided on the conditioned side of the space.

a. True
b. False

48. STEEL−FRAME CEILINGS, WALLS AND FLOORS. (a) Steel−frame ceilings, walls and floors _____l meet the insulation requirements of Table 322.32 or _____ meet the U−factor requirements in Table 322.31−2.

a. can/may
b. shall/shall
c. could/will
d. should/shall

49. CEILINGS WITHOUT ATTIC SPACES. Where the design of the roof or ceiling assembly does not allow sufficient space for the required ____ insulation, the minimum required insulation for the roof or ceiling assembly shall be R−30. This reduction of insulation shall be limited to 500 square feet of ceiling area.

a. R-28
b. R-38
c. R-49
d. R-55

Questions 50 to 58 (Refer to Review Materials – SPS 322.33 Slab floors to SPS 322.36 Fenestration)

50. HEATED OR UNHEATED SLABS. Any heated or unheated slab floor, the bottom of which is less than _____ below adjacent grade, shall be provided with perimeter insulation in accordance with Table 322.31−1 or Table 322.31−4, except as provided in par. (b).

a. 12 inches
b. 14 inches
c. 16 inches
d. 18 inches

51. THERMALLY ISOLATED SUNROOMS. (1) The minimum opaque ceiling insulation R−value shall be _____. The minimum opaque wall R−value shall be R−13.

a. R-24
b. R-28
c. R-32
d. R-38

52. GLAZED FENESTRATION EXEMPTION. Up to _____ feet of glazed fenestration per dwelling unit may be exempt from U−factor requirements of the chapter.

a. 10 square feet
b. 12 square feet
c. 15 square feet
d. 18 square feet

53. CRAWL SPACES. (a) Crawl space walls shall be insulated in accordance with Table 322.31−1. (b) Crawl space wall insulation shall be _____ to the wall and shall extend the entire height of the wall.

a. fixed
b. attached
c. temporarily fastened
d. permanently fastened

54. DETAILS. (b) Horizontal insulation extending outside of the foundation shall be covered by soil a minimum of _____ thick or by pavement.

a. 6 inches
b. 8 inches
c. 10 inches
d. 12 inches

55. THERMALLY ISOLATED SUNROOMS. New walls, windows and doors separating a sunroom from conditioned space do not need to meet the building thermal envelope requirements.

a. True
b. False

56. VAPOR RETARDER. The edges of the vapor retarder shall extend at least _____ up the foundation wall and shall be attached and sealed to the foundation wall or insulation.

a. 6 inches
b. 8 inches
c. 10 inches
d. 12 inches

57. MAXIMUM FENESTRATION U−FACTOR. The area weighted average maximum fenestration U−factor permitted using tradeoffs from s. SPS 322.31 (2) or subchapter VI shall be 0.40 for vertical fenestration, and 0.75 for skylights.

a. True
b. False

58. VAPOR RETARDER. All decayable organic material, including topsoil, _____be removed from crawl space floors prior to placing the vapor retarder.

a. can
b. shall
c. could
d. should

Questions 59 to 73 (Refer to Review Materials – SPS 322.37 Air leakage to SPS 322.39 Ventilation and moisture control)

59. VAPOR RETARDERS. *General.* (a) *Definition.* Under this section, a vapor retarder is a material with no intrinsic thermal or structural properties that has a rating of 1.0 perm or less when tested in accordance with ASTM standard E 96, Procedure A.

a. True
b. False

60. AIR LEAKAGE. *Window and Door Assemblies.* (a) *General.* Except as specified in par. (b), windows, skylights and sliding glass doors shall have an air infiltration rate of 3 cfm per square foot, and swinging doors 5 cfm per square foot, when tested according to NFRC 400 or AAMA/WDMA/CSA 101/I.S.2/A440 by an accredited, independent laboratory and listed and labeled by the manufacturer.

a. True
b. False

61. VAPOR RETARDERS. *Continuity*. The vapor retarder shall be continuous. All joints in a vapor retarder consisting of sheet material shall be overlapped _____ and taped or sealed, except as provided in subd. 2. Rips, punctures and voids in the vapor retarder shall be patched with vapor retarder materials and taped or sealed.

a. 2 inches
b. 4 inches
c. 6 inches
d. 8 inches

62. AIR LEAKAGE. *Fan Housings*. Gaps between a fan housing and a ceiling or wall that could result in air leaks shall be _____.

a. sealed
b. sealed or caulked
c. gasketed
d. gasketed, sealed or caulked

63. VAPOR RETARDERS. *Coverage.* The vapor retarder _____ cover the exposed insulation and the interior face of the framing.

a. shall
b. should
c. may
d. can

64. AIR LEAKAGE. *Joint and Penetration Sealing*. (a) Exterior joints, seams or penetrations in the dwelling envelope, which are sources of air leakage, shall be sealed with durable caulking materials, closed with gasketing systems, taped, or covered with water-vapor-permeable house wrap. Joints to be treated include all of the following:

1. Openings, cracks and joints between wall cavities and window or door frames.

2. Between separate wall assemblies or their sill−plates and foundations.

3. Between _____ and between separate wall panel assemblies, including between interior and exterior walls.

4. Penetrations of utility services through walls, floor and roof assemblies, and penetrations through top and bottom wall plates.

a. walls, roofs
b. ceilings or attic ceiling seals
c. walls, roofs, ceilings or attic ceiling seals
d. none of the above

65. AIR LEAKAGE. *Recessed Lighting*. When installed in the dwelling envelope, recessed lighting fixtures shall be sealed to limit air leakage between conditioned and unconditioned spaces by one of the following means:

(a) The fixture shall be IC−rated and labeled with enclosures that are sealed or gasketed to prevent air leakage to the ceiling cavity or unconditioned space.

(b) The fixture shall be IC−rated and labeled as meeting ASTM E 283 when tested at 1.57 psi pressure differential with no more than 2.0 cfm of air movement from the conditioned space to the ceiling cavity.

(c) 1. The fixture shall be located inside an airtight sealed box with clearances of at least 0.5 inch from combustible material and _____ from insulation.

a. 2 inches
b. 3 inches
c. 4 inches
d. 5 inches

66. VAPOR RETARDERS. *Concrete or masonry basement walls*. A non−rigid sheet vapor retarder with a perm rating of 0.1 or less is _____ in all of the following locations:

(a) On a concrete or masonry wall which is below grade to any extent.

(b) On an insulated frame wall constructed in front of a concrete or masonry wall which is below grade to any extent.

a. allowed
b. permitted
c. prohibited
d. none of the above

67. VAPOR RETARDERS. *Concrete floors*. (a) Except as allowed under par. (d), a vapor retarder shall be installed directly under the concrete floor slab or under the base course of concrete floor slabs.

(b) Vapor retarder material shall be at least _____ in thickness or shall be a reinforced material.

a. 4 mils
b. 6 mils
c. 8 miles
d. 9 mils

68. VENTILATION AND MOISTURE CONTROL. *Vented Attics*. (a) 1. Except as allowed under subd. 6., where air−permeable ceiling or attic insulation is installed in a horizontal position, ventilation shall be provided above the insulation in accordance with this paragraph.

2. _____ of the net free ventilating area shall be distributed at the high sides of the roof.

a. No more than 40%
b. At least 40%
c. No more than 50%
d. At least 50%

69. VENTILATION AND MOISTURE CONTROL. *Mechanical Ventilation*. Outdoor air intakes and exhausts shall have automatic or gravity dampers that close when the ventilation system is not operating.

a. True
b. False

70. VENTILATION AND MOISTURE CONTROL. *Vented Attics*. (a) 1. Except as allowed under subd. 6., where air−permeable ceiling or attic insulation is installed in a horizontal position, ventilation shall be provided above the insulation in accordance with this paragraph.

4. _____ of the net free ventilating area is provided at the high sides of the roof, the total net free ventilating area shall be a minimum of 1/300 of the horizontal area of the ceiling.

a. If more than 60%, but less than 75%
b. If more than 50%, but less than 65%
c. If more than 50%, but less than 75%
d. If more than 60%, but less than 65%

71. VENTILATION AND MOISTURE CONTROL. *Cathedral Ceilings.* Air−permeable insulation in a cathedral ceiling assembly _____ fill the entire cavity space unless an air barrier separates the top of the insulation from the ventilation space.

a. should
b. shall
c. may
d. might

72. VENTILATION AND MOISTURE CONTROL. *Conditioned Attics*. Attic spaces are required to be vented where air−impermeable insulation is attached directly to the underside of the roof deck and one of the following conditions are met:

(a) Interior vapor retarders are installed between the living space and the conditioned attic.

(b) The temperature in the attic space is maintained low enough to prevent any moisture condensation on the insulation.

a. True
b. False

73. VENTILATION AND MOISTURE CONTROL. *Vented Attics*. If _____ of the net free ventilating area is provided at the upper sides of the roof, the total net free ventilating area shall be at least 1/150 of the horizontal area of the ceiling.

a. 55% or more
b. 65% or more
c. 75% or more
d. None of the above

Questions 74 to 78 (Refer to Review Materials – Subchapter V – Systems. SPS 322.40 Indoor temperatures and equipment sizing to SPS 322.43 Duct and plenum sealing)

74. TEMPERATURE CONTROL. *Mercury Thermostats*. The installation of thermostats containing mercury is _____.

Note: This section does not require the replacement of existing mercury−containing thermostats.

a. allowed
b. permitted
c. prohibited
d. none of the above

75. DUCT SYSTEMS. (1) Supply and return heating ducts, or portions thereof, that are not located completely within the thermal envelope, shall be provided with insulation with a thermal resistance of at least_____.

a. R-6
b. R-8
c. R-10
d. R-12

76. INDOOR TEMPERATURES AND EQUIPMENT SIZING. *Indoor design temperatures.* Unheated, non−habitable basement areas shall use a heating design temperature of less than _____. All other areas of a dwelling shall use a heating design temperature of 70°F.

a. 65°F
b. 60°F
c. 55°F
d. 50°F

77. DUCT AND PLENUM SEALING. (1) Duct systems with joints not located entirely within the conditioned space or with joints located on the unconditioned side of stud bays, joist cavities and similar spaces, shall be sealed in accordance with this section.

a. True
b. False

78. DUCT AND PLENUM SEALING. Tapes with rubber−based adhesives may not be used.
Note: Standard duct tape or "duck tape" has a rubber−based adhesive and does not comply with the requirements of this section.

a. True
b. False

Questions 79 to 83 (Refer to Review Materials – SPS 322.44 Pipe insulation to SPS 332.49 Lighting Equipment)

79. PIPE INSULATION. Heating pipes in unheated spaces shall be insulated with material providing a minimum thermal resistance of R−4 as measured on a flat surface in accordance with ASTM standard C 335 at a mean temperature of _____.

a. 65°F
b. 70°F
c. 75°F
d. 80°F

80. AIR CONDITIONER AND HEAT PUMP EFFICIENCIES. Heating and cooling equipment _____ meet the minimum efficiency requirements in Table 322.45 when tested and rated in accordance with the applicable test procedure.

a. shall
b. should
c. may
d. might

81. AIR CONDITIONER AND HEAT PUMP EFFICIENCIES. Where components, such as indoor or outdoor coils, from different manufacturers are used, _____ shall be furnished by the designer that demonstrate that the combined efficiency of the specified components meets the requirements under this section.

a. calculations
b. guesstimations
c. estimates
d. calculations and supporting data

82. REPLACEMENT FURNACE AND BOILER EFFICIENCIES. A replacement furnace in existing construction may meet only the prevailing federal efficiency standard provided the duct distribution system is sealed and tested at 0.02 inches water gage across the entire system, including the manufacturer's air handler enclosure, to have air leakage less than _____ of the furnace manufacturer's rated air flow across the blower at high speed.

a. 10 percent
b. 15 percent
c. 20 percent
d. 25 percent

83. LIGHTING EQUIPMENT. A minimum of 50 percent of the lamps in permanently installed lighting fixtures shall be high−efficacy lamps.

a. True
b. False

Questions 84 to 87 (Refer to Review Materials Subchapter VI Simulated Performance Alternative. SPS 322.50 General to SPS 322.53 Calculation procedures)

84. DOCUMENTATION. *Compliance report.* Compliance software tools shall generate a report that documents that the proposed design has _____ energy costs less than or equal to the annual energy costs of the standard reference design. The compliance documentation shall include all of the following information:

(a) Address of the dwelling.

(b) 1. An inspection checklist documenting the building component characteristics of the proposed design as listed in Table 322.53−1.

a. quarterly
b. semi-annual
c. annual
d. none of the above

85. PERFORMANCE-BASED COMPLIANCE. Compliance based on simulated energy performance requires that a proposed dwelling be shown to have an annual energy cost that is less than or equal to the annual energy cost of the standard reference design.

a. True
b. False

86. CALCULATION PROCEDURE. *General.* Except as specifically allowed under this section, the standard reference design and proposed design does not need to be configured and analyzed using identical methods and techniques.

a. True
b. False

87. CALCULATION PROCEDURE. *Calculation software tools.* Calculation procedures used to comply with this section shall be capable of calculating the annual energy consumption of all building elements that differ between the standard reference design and the proposed design and shall include the following capabilities:

(c) Calculations that account for the effects of _____ and part−load ratios on the performance of heating, ventilating and air conditioning equipment based on climate and equipment sizing.

a. indoor temperatures
b. indoor and outdoor temperatures
c. outdoor temperatures
d. none of the above

Questions 88 to 150 (Refer to Review Materials – UDC Commentary Chapter SPS 322 – "Introduction" and "Some Energy Basics")

88. INTRODUCTION. The standards attempt to satisfy the human comfort needs of _____ as well as economical and building-preserving construction and operation. To assist you in better understanding these standards, we've included the following energy basics section. Following that is the code section-by-section commentary.

a. proper temperature
b. air movement
c. humidity
d. all of the above

89. INTRODUCTION. Note that the effective date of the original energy conservation standards was December 1, 1978, differing from the June 1, 1980, effective date of the other chapters of the UDC.

a. True
b. False

90. SOME ENERGY BASICS. Chapter SPS 322 requirements can be put into the four categories of _____ with some overlap between the four.

a. heat loss control, radiation, ventilation design and moisture control
b. R-values, radiation, ventilation design and heating equipment requirements
c. heat loss control, moisture control, ventilation design and heating equipment requirements
d. heat loss control, moisture control, r-values and ventilation design

91. SOME ENERGY BASICS. The heat loss control requirements of Ch. SPS 322 are meant to limit heat transfer. Heat transfer is the tendency of heat or energy to move from a warmer space to a cooler space until both spaces are the same temperature. Obviously, the greater the difference in temperatures, the greater the heat flow.

a. True
b. False

92. SOME ENERGY BASICS. Conduction - transfer of heat through a material. An example is your warm hand held against the _____ surface of a cold exterior wall.

a. outside
b. exterior
c. inside
d. none of the above

93. SOME ENERGY BASICS. Radiation –transfer of heat through space. An example is your body heat radiating out a closed window on a winter night. The glass is cold so there is no radiation to you and it is a ____ reflector of your own heat back to you. Another example is sunshine coming in through a window.

a. good
b. poor
c. excellent
d. outstanding

94. SOME ENERGY BASICS. Convection - transfer of heat by moving masses of air. An example is _____ air leaking out through door and window openings.

a. heated
b. water laden
c. moist
d. none of the above

95. HEAT LOSS BY CONDUCTION. *C-Values and k-values*. A measure of a material's ability to Conduct heat is its _____ which is expressed in BTUs per (hour)(oF).

a. k-value
b. C-value
c. R-value
d. none of the above

96. HEAT LOSS BY CONDUCTION. *C-Values and k-values* Another term to be familiar with is a _____ which is merely the C-value for one inch of material.

a. k-value
b. C-value
c. R-value
d. none of the above

97. HEAT LOSS BY CONDUCTION. *R-values*. _____ is a measure of a material's Resistance to heat flow and is the inverse or reciprocal of the material's C-value (R=1/C).

a. k-value
b. C-value
c. R-value
d. none of the above

98. HEAT LOSS BY CONDUCTION. *C-Values and k-values*. A BTU is a _____ which is the heat required to raise one pound (about a pint) of water by one degree Fahrenheit and is roughly equal to the heat given off by the burning of one kitchen match.

a. British Thermal Union
b. British Thermal Unit
c. Burning Thermal Unit
d. none of the above

99. HEAT LOSS BY CONDUCTION. *R-values*. Usually materials are labeled or tables are written so that the material's _____ is given [see SPS 322.20(5)(a)], which relieves you of finding the inverse of the material's C-value.

a. k-value
b. C-value
c. R-value
d. none of the above

100. HEAT LOSS BY CONDUCTION. *C-Values and k-values*. You can add C-values to find the "series" value.

a. True
b. False

101. HEAT LOSS BY CONDUCTION. *U-Values*. For thermal heat loss calculations, we normally use "U"-values (U for _____ heat flow or transmittance) which is a material's C-value but also includes the insulating effect of the air films on either side of the material. So it is, therefore, a smaller number (less heat flow).

a. Unrestrained
b. Unresponsive
c. Underground
d. Unusual

102. HEAT LOSS BY CONDUCTION. *Heat Loss Calculations.* The purpose of these C-, k-, R- and U-values is to be able to calculate heat loss through a building component (_____). The basic equation is U x A x TD = Heat Loss or U x Area (ft2) x Temperature Difference (oF) = Conduction Heat Loss (BTU/hr).

a. wall
b. ceiling
c. floor
d. wall, ceiling, floor

103. HEAT LOSS BY CONDUCTION. *U-Values*. A U-value can also refer to thermal transmittance of a series of materials in layers. To obtain a U-value for such an assembly, you add the individual R-values of the layers and the air films on either side of the assembly. Then you take the reciprocal of the total R-value to get the total U-value of the assembly (U = 1/R).

a. True
b. False

104. HEAT LOSS BY CONDUCTION. *Heat Loss Calculations.* If you wanted to know the total envelope loss for a heating season, you do a degree-day calculation. A degree-day is the difference between _____ and the average temperature for a day if it was below _____. If this calculation is done for each day of the heating season, you can find the total heating degree-days for the year.

a. 55°F
b. 60°F
c. 65°F
d. 70°F

105. HEAT LOSS BY CONDUCTION. *Heat Loss Calculations.* To find the heat loss per hour through a building section of wall, you:
- determine its U-value by finding the inverse of the sum of individual R-values for each layer of material;
- decide on the inside and outside temperatures (in the case of the UDC, the winter design temperatures are mandated– see SPS 322.40(c) and the UDC Appendix A 323.02(1));
- measure the surface area of the building section;
- multiply these numbers together and get a result in BTUs per hour.

a. True
b. False

106. HEAT LOSS BY CONDUCTION. *U-Overall.* One more term to know is U-overall or U_o which refers to the overall U-value of a building component such as a wall or ceiling.

a. True
b. False

107. HEAT LOSS BY CONVECTION. The other mechanism of heat loss addressed by the UDC is convection, or heat loss by air movement. In homes, this is principally heat loss by _____.

a. infiltration
b. exfiltration
c. infiltration and exfiltration
d. none of the above

108. HEAT LOSS BY CONDUCTION. *U-Overall.* The U-overall value is calculated by taking the weighted average of the U-values and R-values of the different parallel paths through the different component (wall, ceiling or other) that you're dealing with.

a. True
b. False

109. HEAT LOSS BY CONVECTION. _____ is the loss of heated air through building cracks and other openings.

a. infiltration
b. Exfiltration
c. infiltration and exfiltration
d. none of the above

110. HEAT LOSS BY CONDUCTION. *System Design.* As an alternative, the system design method can be used so that more insulation is put in the ceiling to make up for the extra windows. However, it is not a one-for-one tradeoff because of the thermal transfer properties and mathematics of reciprocals involved. Let's say you have an R-10 (U = 0.1) wall and R-10 (U = 0.1) ceiling of equal area. If you transfer half of the wall insulation, to the ceiling, the wall becomes R-5 (U = 0.2) and the ceiling becomes R-15 (U = 0.07). However, you can see that the wall U-value increased by 0.1 and the ceiling U-value only decreased by 0.03. (Remember U-values are used to calculate heat losses.)

a. True
b. False

111. HEAT LOSS BY CONVECTION. _____ is the introduction of outside cold air into the building.

a. Infiltration
b. Exfiltration
c. infiltration and exfiltration
d. none of the above

112. HEAT LOSS BY CONVECTION. Air pressure differences are _____ caused by wind pressures and the "stack" effect of warm inside air that tends to rise. Mechanically induced air pressure differences can also occur due to such things as exhaust fans and furnace venting.

a. secondarily
b. principally
c. unexceptionally
d. none of the above

113. HEAT LOSS BY CONVECTION. The volume exchanged can be determined by measuring or judging how many air changes that a house goes through in an hour. To do this, you calculate the volume of the heated space and multiply by an air change rate. For a UDC home, you can assume a rate between 0.2 and 0.5 air changes per hour [see SPS 322.30(2)], usually with a lower rate for basements with little outside air exposure, and higher rates for living areas or exposed basements. If you have a 1500 square foot house on a crawl space with 8-foot ceilings, the calculation of the volume exchanged can be: 1500 sq. ft. x 8 ft. x 0.5 Air Changes/hr = 6,000 cu. ft./hr

a. True
b. False

114. HEAT LOSS BY CONVECTION. Another method of determining heat loss by convection is the _____ method.

a. crevice
b. cranny
c. crack
d. cut

115. TOTAL DWELLING HEAT LOSS. If you add the heat losses by conduction and convection, you arrive at the total dwelling heat loss for purposes of the UDC. Of course this figure is approximate and ignores other means of heat loss. However, it also ignores the major heat gain from secondary sources such as _____ etc. So the figure tends to overstate the heat loss but this ensures an adequately sized heating plant.

a. electric lights
b. human bodies
c. cooking
d. electric lights, human bodies, cooking

116. HEAT LOSS BY CONVECTION. For this method (crack) you obtain the air leakage rates in cubic feet per minute for the doors and windows from their manufacturers and multiply by the lineal feet of sash crack or square feet of door area. (A more exact analysis would multiply the door infiltration rates by 1 or 2 due to open/close cycles and add 0.07 cfm per lineal feet of foundation sill crack.) This gives an air change rate per minute. This has to be converted to an hourly rate by multiplying by _____. Then you substitute this figure for the air change rate in the infiltration heat loss equation above.

a. 40
b. 50
c. 60
d. 70

117. MOISTURE CONTROL. There are _____ methods of reducing the possibility of condensation--vapor retarders and cold-side venting.

a. two
b. three
c. four
d. unlimited

118. MOISTURE CONTROL. *Vapor Retarders and Air Barriers*. A perm is at least two grains of water per (30 minutes) (square foot) (inch of mercury vapor). The higher the number, the more resistant is the material to moisture flowing through it.

a. True
b. False

119. MOISTURE CONTROL. The second area of concern addressed by the UDC is control of moisture. The occupancy of a dwelling produces a large amount of water vapor. As you may recall from weather forecasts, warmer air can hold more moisture than cold air. In the winter, the inside air is warmer than the outside, so if moisture moving outside by convection or dispersion (similar to conduction) reaches too cold of air, it will "condense out." This occurs at the dew point for that water vapor/air mixture. This condensation can be damaging to the building if it happens inside part of the wall or ceiling construction. It can promote structural member decay and lessening of the insulation's effective _____.

a. k-value
b. C-value
c. R-value
d. none of the above

120. MOISTURE CONTROL. *Vapor Retarders and Air Barriers*. The temperature _____ is generally cooler due to the fact that it is difficult to insulate at this location due to the method of construction. The insulation may be further reduced due to the roof system allowing less insulation to be placed above the corner.

a. in the curve
b. at the corners
c. none of the above

121. MOISTURE CONTROL. *Vapor Retarders and Air Barriers*. The required continuity of the vapor retarder over the warm-in-Winter surface provides the required barrier to bulk movement of moist air through the assembly. This means the retarder also needs to be continuous with seams and holes lapped or sealed.

a. True
b. False

122. MOISTURE CONTROL. *Vapor Retarders and Air Barriers*. A vapor retarder (sometimes called a vapor barrier) acts to slow down the movement of moisture through a section of the building envelope by water vapor diffusion and bulk movement of moist air. A vapor retarder's efficiency at improving moisture movement by water vaper diffusion is measured by its permeability in "berms."

a. True
b. False

123. MOISTURE CONTROL. *Vapor Retarders and Air Barriers*. Vapor condenses when it comes in contact with material that is at a temperature lower than its dew point. This temperature typically occurs within the wall cavity and thus would condense out water vapor before it can escape from the dwelling. This moisture can cause decay of building materials and a reduction in insulating value.

a. True
b. False

124. MOISTURE CONTROL. *Vapor Retarders and Air Barriers*. Additional areas where condensation occurs are generally at corners of rooms at the exterior walls. This area is subject to condensation for only one reason. Condensation never occurs in areas with poor air circulation such as closets.

a. True
b. False

125. MOISTURE CONTROL. *Cold-side venting*. The other means of controlling moisture is cold-side venting. This is usually employed in _____.

a. attics
b. unheated crawlspaces
c. heated crawlspaces
d. attics and unheated crawlspaces

126. MOISTURE CONTROL. *Moisture Control During Construction*. Unless proper construction techniques are utilized during construction, serious problems can occur as a result of water vapor that is trapped inside and then causes deterioration of gypsum wallboard.

a. True
b. False

127. MOISTURE CONTROL. *Cold -Side Venting.* The venting removes all moisture created in the ceiling or in the crawl space. This venting is usually done by mechanical means through the use of grills or louvers from the space to the outside.

a. True
b. False

128. MOISTURE CONTROL. *Impervious Insulation*. Use of closed-cell foam plastic insulation or similar non-absorbent insulating materials that are unaffected by moisture condensation is another effective method used for some designs of dwellings to deal with this issue.

a. True
b. False

129. MOISTURE CONTROL. *Cold-Side Venting*. Cold-side attic venting also keeps the roof cooler so that there is less melting of snow and contributes to less creation of ice dams at the eaves in the winter. It also helps dissipate summertime attic heat, which increases comfort and reduces cooling costs.

a. True
b. False

130. MOISTURE CONTROL. We offer the following suggestions to incorporate in construction procedures, especially during winter months:

4. Make sure _____ required attic ventilation is installed and operable to remove any water vapor trapped in the attic.

a. only one
b. some
c. all
d. none of the above

131. MOISTURE CONTROL. Most building codes are only a reflection of our latest achievements in _____. The vapor retarder requirements in the Uniform Dwelling Code are a reflection of state-of-the-art insulation techniques.

a. technology and architecture
b. technology and engineering
c. technology and manufacturing
d. engineering and manufacturing

132. MOISTURE CONTROL. We offer the following suggestions to incorporate in construction procedures, especially during winter months:

3. Make sure all heating appliances, i.e., _____ etc., are vented to the outside of the home. Builders who do not follow this warning are adding additional water vapor created by combustion of heating fuels.

a. furnaces
b. temporary heaters
c. salamanders
d. furnaces, temporary heaters, salamanders

133. MOISTURE CONTROL. *Post-Construction Moisture Control Problems*. Additional recommendations above and beyond the UDC minimums are included for homeowners who may experience more severe moisture problems.

a. True
b. False

134. MOISTURE CONTROL. We offer the following suggestions to incorporate in construction procedures, especially during winter months:

2. Make sure attics are insulated _____ to putting heat into the home for gypsum board taping and finishing. Many builders neglect to do this and create condensation problems when the water vapor condenses upon hitting the cold, attic air above the gypsum board. Gypsum board ceilings should be hung and insulated _____ to putting heat into the home.

a. after
b. later
c. prior
d. none of the above

135. MOISTURE CONTROL. *How can you determine if a home has a moisture problem?*

Extensive condensation on windows during the heating season. Some condensation is normal. Condensation that streams off the window and puddles on the frame and sill when outside temperatures are 10°F or above and inside temperatures are above _____ indicates humidity levels are probably too high.

a. 50°F
b. 55°F
c. 60°F
d. 65°F

136. MOISTURE CONTROL We offer the following suggestions to incorporate in construction procedures, especially during winter months:

5. Provide a means for the _____ in the home to escape; such as periodic opening of windows, doors, etc. Perhaps the installation of a humidistatically controlled exhaust fan is necessary, particularly where electric baseboard heat or heat pump systems are utilized.

a. water vapor
b. heat
c. cold air
d. none of the above

137. MOISTURE CONTROL. *What are typical causes of moisture problems in homes?* In most older homes there is enough movement of air into and out of the house that moisture does not build up and only small amounts of condensation occurs. However, when air leaks into and out of a house it _____. In order to make homes more energy efficient, builders have been trying to seal cracks and cut air leaks.

a. only takes moisture.
b not only takes moisture but heat as well
c. only takes heat
d. none of the above

138. MOISTURE CONTROL. *How can you determine if a home has a moisture problem?* Staining and mold on window frames.

a. True
b. False

139. MOISTURE CONTROL. *How can you determine if a home has a moisture problem?* Mold or water spots in numerous locations on the inside surface of outside walls. Common trouble spots include _____ or other areas where air circulation is limited.

a. closets on outside walls
b. corners between two outside walls or between an outside wall and ceiling
c. outside walls behind furniture
d. closets on outside walls, outside walls behind furniture, corners between two outside walls or between an outside wall and ceiling

140. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems?* Other ways you can reduce moisture generation:

- Vent clothes dryers outdoors;
- Don't line dry clothes indoors;
- Limit the number of houseplants;
- Cover kettles when cooking;
- Limit the length of showers; and
- Do not operate a humidifier in the wintertime unless your indoor relative humidity is below _____.
- Be sure any crawlspace floors have a vapor retarder covering.

a. 25 percent
b. 30 percent
c. 35 percent
d. 40 percent

141. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems?* One way to substantially reduce the chances that condensation will occur either on _____ is to keep indoor moisture levels low. The first step is to reduce the amount of moisture produced in the home.

a. inside surfaces
b. within walls
c. inside surfaces or within walls
d. none of the above

142. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems?* Prevent moisture from entering through basements. Many basements feel damp in the summer due to condensation of moisture from the air on cool basement surfaces. However, in some cases damp basements may be due to _____ entering the home through basement walls. Cracks or stains on basement walls and floors are signs of dampness entering through these surfaces.

a. run-off
b. ground moisture
c. humidity
d. rain

143. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems?* Do not store large amounts of firewood in the basement. Even seasoned wood can contain large amounts of moisture. It also may be a source of fungus.

a. True
b. False

144. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems? Add Mechanical Ventilation*. A widely recommended ventilation rate for homes is one half air change per hour. In a 1,200-square-foot house with 8-foot high ceilings, there are about 9,600 cubic feet of air. To meet the ventilation standard, half of that amount or 4,800 cubic feet of air must be exchanged every hour. This roughly equals _____ of air exchange. Even in a tight house some of this air exchange occurs naturally.

a. 100 cubic feet per minute (cfm)
b. 200 cubic feet per minute (cfm)
c. 300 cubic feet per minute (cfm)
d. 400 cubic feet per minute (cfm)

145. RELATIVE HUMIDITY. In winter, the ideal relative humidity range for <u>comfort</u> is _____. A lower humidity may cause excessive skin evaporation which in turn will cause an undesired cooling effect. For the sake of protecting the structure from damage due to excessive moisture, an ideal relative humidity range of less than 45 percent is recommended. Therefore, to provide comfort and still protect the building, a relative humidity range between _____ is recommended.

a. 35 percent - 45 percent.
b. 30 percent - 45 percent.
c. 30 percent - 50 percent.
d. 35 percent - 50 percent.

146. RELATIVE HUMIDITY. In summer, the ideal comfort range is _____. Higher humidity won't allow adequate skin evaporation and the resulting desired cooling effect.

a. 35 percent - 45 percent.
b. 30 percent - 45 percent.
c. 30 percent - 50 percent.
d. 35 percent - 50 percent.

147. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems? Mechanical Ventilation*. As the code has mandated tighter home construction, the UDC has had to provide increase of mechanical ventilation as an alternative to infiltration to maintain indoor air quality so excessive humidity or other pollutant levels are checked. This has taken the form of required exhaust ventilation for rooms with a _____.

a. toilet
b. tub or shower
c. kitchen exhaust
d. all of the above

148. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems? Mechanical Ventilation*. A designer may decide to use an air-to-air heat exchanger to satisfy the exhaust requirement, while at the same time recovering heat from the exhausted air. This is done by moving the exhausted air past the intake air with a heat exchanging barrier between the two air streams.

a. True
b. False

149. MOISTURE CONTROL. *Besides the UDC requirements, what measures can help prevent moisture problems? Add Mechanical Ventilation*. Stop Moisture At The Inside Wall Surface (In Addition To The Required Moisture Vapor Retarder). In addition to reducing moisture levels of the interior air, carefully seal all openings in the inside surface of all exterior walls to prevent moist air penetration. This includes _____ and any other penetrations. Gaskets for electrical penetrations are now commonly available, be sure that they extend to the outside edge of the cover plate of electrical devices.

a. joints around window and door casings, baseboards
b. baseboards, electrical outlets and switches
c. joints around window and door casings, baseboards, electrical outlets and switches
d. none of the above

150. MOISTURE CONTROL. *Add Mechanical Ventilation*. Negative pressure could cause exhaust gases from your furnace or water heater, which should be going up your chimney or out a vent, to be sucked into the living space.

a. True
b. False

Questions 151 to 180 (Refer to Review Materials – UDC Commentary Chapter SPS 322 – Subchapter I – Scope and Application to Subchapter VI – Simulated Performance Alternative)

151. SCOPE AND APPLICATION. As there are _____ method, submitters of plans & calculations should clearly communicate which method of compliance is being provided for the dwelling.

a. just one
b. more than one
c. not more than one
d. none of the above

152. MATERIALS AND EQUIPMENT. *Material Installation.* This section requires all _____ to be installed per the manufacturer's installation instructions which are to be available at job sites during inspection.

a. insulation,
b. mechanical equipment and systems
c. venting
d. insulation, mechanical equipment and systems

153. SCOPE AND APPLICATION. Dwellings that use non-renewable sources of energy, such as wood or solar, for heat generation, including for what is used by any heat pumps, are not exempt from the building envelope insulation requirements.

a. True
b. False

154. DWELLING THERMAL ENVELOPE. *Ceilings with Attic Spaces*. This section permits the use of _____in the attic space in lieu of R-49 specified in Table 321.23-1 as long as the _____ insulation covers the entire attic area including over the exterior wall top plates. This could be accomplished with the use of "energy heel" trusses. The height of the heel would depend on the type of insulation used to attain the _____ insulation value.

a. R-28
b. R-30
c. R-38
d. R-45

155. MATERIALS AND EQUIPMENT. *Protection of Insulation*. This section now requires blanket insulation to be held in place by a covering or mechanical fastening. SPS 322.2 1(2) requires cold-in-Winter side windwash protection of air-permeable insulation, thus also keeping insulation in place and maintaining the _____ of that insulation. Normally the exterior sheathing would do this, but where that is not present, some other vapor- permeable material, such as house wrap would be required.

a. R-value
b. U-value
c. T-value
d. S-value

156. MATERIALS AND EQUIPMENT. *Building Certification*. This section requires that a permanent certificate of insulation R-values and fenestration _____ be provided on or immediately adjacent to the electrical distribution panel.

a. R-factors
b. U-factors
c. T-factors
d. S-factors

157. DWELLING THERMAL ENVELOPE. *Envelope Compliance*. Envelope compliance may be by prescriptive method of SPS 322.31(1) by either complying with Table 322.31-1 or Table 322.31-4 or alternatively, per SPS 322.3 1(2) by showing the overall envelope U-value multiplied by Area complies. The latter method may be done by hand calculation or more typically by the use of the free software program, Rescheck, available from the federal government at www.energycodes.gov .

a. True
b. False

158. DWELLING THERMAL ENVELOPE. *Sun Rooms vs. Screen Porch.* This option for increased insulation levels is available to heated sunrooms with opaque walls and glazing as well as heated screen rooms with only screens for a portion of the walls.

a. True
b. False

159. DWELLING THERMAL ENVELOPE. *Fenestration*. Different types of window operating hardware will produce different U-values for similar-sized windows. Therefore, a 3'-0" x 3'-0" double hung window would have a different U-value from a 3'-0" x 3'-0" fixed window sash. Similar size windows produced by two different manufacturers would most likely also have _____ U-values. Averaging of U-values is by area-weighting per SPS 322.36(1).

a. similar
b. the same
c. identical
d. different

160. DWELLING THERMAL ENVELOPE. *Crawl Spaces.* This section requires a vapor retarder on the floor of a crawl space. Per Table 332.37, it shall be a Class I vapor retarder, which is defined by the IBC as having a perm rating of 0.1 or less. Note that requirement to run the vapor retarder _____ wall is applicable when there is no floor present to maintain the vapor retarder in place.

a. 4” up the foundation
b. 5” up the foundation
c. 6" up the foundation
d. up to the

161. DWELLING THERMAL ENVELOPE. *Slab Floors.* _____ less than 12" below grade must meet Table 322.31-1 or 322.31-4 for Unheated Slab R-value with perimeter insulation. Heated slabs of any depth with embedded, uninsulated heating ducts or pipes require slab insulation throughout, with additional insulation at the perimeter.

a. Unheated slabs
b. Shallow slabs
c. Horizontal slabs
d. Heated slabs

162. DWELLING THERMAL ENVELOPE. *Air Leakage*. Air leakage at fenestration and at other penetrations in the envelope are to be sealed properly per SPS 322.37(3), (4) & (6)(b) requirements or pass a blower door test per (6)(a). SPS 322.37(4) provides specific guidance on recessed lighting installed at envelope areas, without leading to overheating fires.

a. True
b. False

163. DWELLING THERMAL ENVELOPE. *Slab Floors.* _____ insulation that projects away from the building shall be protected by either pavement or a minimum of 10 inches of soil. See UDC Appendix drawings showing acceptable and unacceptable perimeter insulation in terms of ensuring the edge of the slab is properly insulated.

a. Unheated slab
b. Shallow slab
c. Horizontal slab
d. Heated slab

164. DWELLING THERMAL ENVELOPE. *Air Infiltration Barrier.* The UDC does not define materials to be used as an infiltration barrier. It does require them to:

1. Be installed on the interior face, typically as part of the vapor retarder, or on the exterior face of the wall, typically as a house wrap or caulked building panels.
2. Form a continuous barrier over the walls of the building from the bearing points of the roof to the top of the foundation.
3. Have all _____ sealed.

a. joints and tears
b. seams and punctures
c. joints, seams and tears
d. seams, joints, tears and punctures

165. DWELLING THERMAL ENVELOPE. *Fenestration*. Fenestration is an architectural term for _____.

a. windows and doors
b. doors and patios
c. windows and patios
d. none of the above

166. DWELLING THERMAL ENVELOPE. *Paint as a Vapor Retarder*. The following is the recommended procedure to be followed by building inspection agencies to assure compliance with the vapor retarder requirement:
3. At the time the insulation/rough energy inspection is made, the inspector will be able to determine where the standard vapor retarder was applied in the dwelling.

a. True
b. False

167. DWELLING THERMAL ENVELOPE. *Paint as a Vapor Retarder*. Certain paints have been tested per ASTM E-96 to provide a vapor retarder with a _____ or labeled as Class II (Class I would also be acceptable) when applied at specified rates and coats for certain surfaces.

a. perm of 1 or lower
b. perm of 2 or lower
c. perm of 3 or lower
d. perm of 4 or lower

168. DWELLING THERMAL ENVELOPE. *Paint as a Vapor Retarder*. In order to assure building officials and owners that vapor retarder paint has in fact been installed and the intent of SPS 322.38 met, a certificate of compliance may be filled out and submitted to the Building official with a copy to the owner.

a. True
b. False

169. DWELLING THERMAL ENVELOPE. *Vapor Retarder Continuity*. Vapor retarder continuity is important for purposes of preventing bulk movement of warm, moist air into building assemblies, which is a more significant source of moisture than diffusion through the vapor retarder.

a. True
b. False

170. DWELLING THERMAL ENVELOPE. *Vapor Retarders Not on In-Winter Warm Side*. Occasionally it occurs that a wall will have two materials or layers that may act as vapor retarders. It is important in this situation that the better vapor retarder (lower perm rating) be placed closer to the warm side. Also, extreme care _____to make the interior vapor retarder continuous with good joint and penetration sealing. This will help avoid condensation of moisture in the wall.

a. shall be taken
b. may be taken
c. can be taken
d. should be taken

171. DWELLING THERMAL ENVELOPE. *Vapor Retarders Prohibited on Concrete or Masonry Walls*. The code prohibits installing a non-rigid vapor retarder of a _____, such as roll polyethylene sheeting ("Visqueen"), on or in front of masonry or concrete below grade foundation walls. This is avoiding the potential for moisture from adjoining earth being trapped between an interior vapor retarder and the wall and possibly causing degradation and mold.

a. perm rating appropriate for the wall
b. 0.1 perm or more rating
c. 0.1 perm or less rating
d. none of the above

172. DWELLING THERMAL ENVELOPE. *Exceptions to Vapor Retarder.* If the exceptions in this section to a continuous vapor retarder at boxsills or over spray-applied foam are used, you are also required to stop air leakage at those locations that would have been otherwise provided by a continuous vapor retarder.

a. True
b. False

173. SYSTEMS. *Ducts in Unconditioned Spaces.* Ducts located outside conditioned space, including those in _____ shall be insulated to at least R-8. Per SPS 322.10(3), conditioned is defined as being heated to 50 degrees or more at design conditions.

a. attics and unheated garages
b. vented crawl spaces and under slabs
c. attics, unheated garages, and vented crawl spaces and under slabs,
d. none of the above

174. SYSTEMS. *Duct Sealing and Testing.* Any part of the supply and return duct system that is outside the conditioned space, including those in unconditioned attics, unheated garages, insulated floors, exterior stud spaces and vented crawl spaces and under slabs, _____ per this section. Additionally, the whole duct system, including the air handler and both supply and return ducts, shall be tested for air tightness at either the rough-in or post-construction testing.

a. can be tested
b. shall be tested
c. shall be sealed
d. can be sealed

175. SYSTEMS. *Pipe Insulation.* Subsection (1) requires hydronic heating pipes in all areas to have at least _____ and subsection (3) requires hydronic spaces in unheated spaces to have at least _____. Generally basements are not considered unheated spaces, even without radiators installed.

a. R-3 insulation/ R-3 insulation
b. R-4 insulation/ R-4 insulation
c. R-4 insulation/ R-5 insulation
d. R-3 insulation / R-4 insulation

176. SYSTEMS. *Duct Sealing and Testing*. Duct tightness, especially relative to the outdoors, is important in that any air lost to the outdoors causes negative dwelling pressure as the result of the air handler drawing in outside air to replace the leaked duct air. Negative dwelling pressure potentially causes backdrafting of any open combustion appliances and infiltration of unconditioned air into the dwelling

a. True
b. False

177. SYSTEMS. *Replacement Furnace & Boiler Efficiencies*. Alternatively, the replacement equipment is required to comply with the less stringent Wisconsin heating equipment efficiency requirements of Table 322.31-3 (as for new construction that is permitted reduced thermal envelope insulation levels) without duct sealing or circulating motor limits.

a. True
b. False

178. SYSTEMS. *Pipe Insulation*. The requirement for insulating circulating service hot water piping is applicable to systems mechanically circulated with pumps, not to thermosiphon systems that use convection to circulate the water.

a. True
b. False

179. SYSTEMS. *Replacement Furnace & Boiler Efficiencies*. Normally replacement equipment may meet the code at the time of their original installation per s. SPS 320.07(61) definition of repair, as opposed to alterations that need to meet the current code. (Note that the federal government has evolving minimum heating appliance efficiencies that apply to all residential installations, new or replacement.) However, this section requires that replacement furnaces also comply with specified duct sealing criteria and that replacement boilers comply with circulating motor limits.

a. True
b. False

180. SIMULATED PERFORMANCE ALTERNATIVE. *Documentation of Simulated Performance Alternative.* Acceptance of SPS 322.52 is typically required by REMrate software that models the whole house energy usage. REM/Rate software is proprietary to certain providers. The version 12.6.2.1 or earlier is required to show compliance with the current code.

a. True
b. False