

# Test Your Building-Code IQ

Vague language allows flexibility for inspectors, but it can be confusing to the rest of us. How do you score?

BY PAUL FISETTE

Understanding and satisfying the building code can be confusing. To be fair, writing one set of regulations that addresses every building condition is difficult. But having a reasonable level of code consistency would be helpful.

Building codes are written as national models, but they are adopted and enforced locally, which leads to tremendous inconsistency. Until recently, three code councils have been writing building codes for different parts of North America. Not long ago, a director at the National Conference of States on Building Codes and Standards told me that there are more than 2,000 different code interpretations in our country. It's mind-boggling. To make matters worse, inspectors interpret the same code differently, even in states that have statewide codes.

There is hope, however. The International Code Council ([www.iccsafe.org](http://www.iccsafe.org)) is promoting its International Residential Code (IRC) and International Energy Conservation Code (IECC) as national standards for residential construction, and many communities are adopting this model. Even with more universal acceptance of these codes, though, there's still plenty of room for interpretation. The 10 questions in this test cover some common misconceptions of the 2003 IRC.

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## BUILDING-CODE IQ TEST

Mark these statements either true or false.

- |    |                                                                                                       |                               |                                |
|----|-------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------------|
| 1  | Small gaps around ductwork and plumbing holes are OK as long as they're not in an exterior wall.      | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 2  | Metal roof-framing connectors are required only in high-wind zones.                                   | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 3  | Manufacturers' span charts are suitable for designing engineered-floor frames.                        | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 4  | Vented rain-screen walls violate fire-blocking requirements.                                          | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 5  | Code allows no more than 15% of wall area to be windows.                                              | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 6  | Unvented roofs are illegal.                                                                           | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 7  | Vapor barriers are required.                                                                          | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 8  | Connecting gutter downspouts to foundation drains is OK.                                              | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 9  | Steel reinforcement (rebar) isn't required in continuous concrete footings and poured-concrete walls. | True<br><input type="radio"/> | False<br><input type="radio"/> |
| 10 | Crawlspaces must be vented.                                                                           | True<br><input type="radio"/> | False<br><input type="radio"/> |

Find the correct answers on the following pages.

# 1 Small gaps around ductwork and plumbing holes are OK as long as they're not in an exterior wall.

True  False

While few plumbers fill the holes they run pipes through, section R602.8 of the IRC outlines this fire-blocking requirement: "Fire-blocking shall be provided to cut off all concealed draft openings (both vertical and horizontal) and to form an effective fire barrier between stories, and between a top story and roof space." The IRC goes on to prescribe sealing six specific locations. No. 4 on the list: "At openings around vents, pipes, and ducts at ceiling and floor level, with an approved material to resist the free passage of flame and products of combustion." This issue also involves energy efficiency and indoor-air quality.



**Best-practice solution:** Seal the gaps around plumbing pipes or HVAC ducts with intumescent caulk or expanding foam that is fire-rated.



**Best-practice solution:** Make installing hurricane clips your standard procedure on both rafters and trusses. A pneumatic palm nailer helps.

# 2 Metal roof-framing connectors are required only in high-wind zones.

True  False  Both true and false.

Toenailing trusses to a wall's top plate won't satisfy basic code requirements. Section 802.10.5 states, "Trusses shall be connected to wall plates by the use of approved connectors having a resistance to uplift of not less than 175 lb. and shall be installed in accordance with the manufacturer's specifications." Section 802.11.1 imposes further requirements for roof assemblies subject to wind-uplift pressures of 20 psf or greater.

An interesting side note is that the code allows toenailing of roof rafters. This issue is complicated, however, because you must consider location, roof pitch, natural topography, building height, and constructed features of a building site to craft an adequate roof-fastening strategy. Jim Cheng, a senior research analyst with State Farm Insurance Co., explains that recent tests have shown that toenailed connections can fail at 90-mph wind loads. "Toenailed connections for the roof-to-wall system are not appropriate in wood-frame structures," says Cheng. "Stronger connection methods for the uplift-load resistance should be recommended."

# 3 Manufacturers' span charts are suitable for designing engineered-floor frames.

True  False  This is a trick question; it's up to your local inspector.

I-joists and floor trusses are similar to roof trusses with regard to the code-approval process. Unlike solid lumber, the sizes, spans, and performance values of engineered-wood products are not found in the building code. Builders must submit a floor-framing detail drawing to the local building official along with the set of plans. IRC section R502.1.4 provides clear guidance about what is required when wood I-joists are used in a design. Floor trusses aren't so clear (R502.11). Some of the relevant code language states that "the truss-design drawings shall be prepared by a registered professional ..." and that "truss-design drawings ... shall be provided to the building official and approved prior to installation." The drawings must address many details, including span, spacing, bearing widths, design loads, connections, and deflection ratios for live and dead loads. Twelve issues are listed in all. Although these requirements might be satisfied by a faxed document, some inspectors may require the submission of plans that are wet-stamped by an engineer.



**Best-practice solution:** Double-check with your building inspector about what documentation is required.



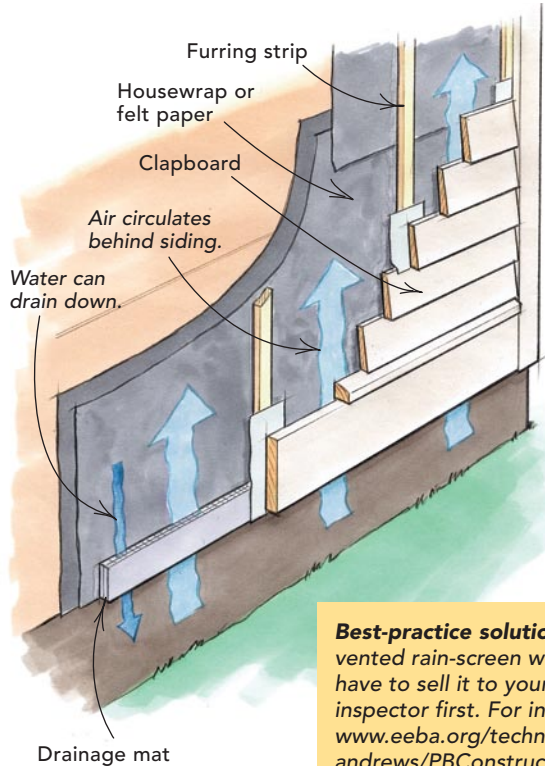
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## Vented rain-screen walls violate fire-blocking requirements.

True

False

In this case, the answer is not straightforward.



This exterior-siding strategy typically calls for furring strips to be applied vertically over the wall sheathing and left open at the top and bottom. Siding is nailed to the furring strips. This technique creates an airspace between the back of the siding and the face of the housewrapped sheathing that drains and dries readily. It is highly effective, but there is one code issue to consider. Section R602.8 requires fire blocking to cut off all concealed draft openings, "including furred spaces." Cross blocks must be placed at the bottom, between stories, every 10 ft., and at the top near the roof. Installing all this cross blocking reduces airflow, drainage, and drying. Many builders and building-code officials think the spirit and intent of

this code provision is not directed at vented rain screens but rather at furred interior spaces. However, some inspectors disagree and think the code section holds as written.

**Best-practice solution:** Build a vented rain-screen wall, but you'll have to sell it to your building inspector first. For information, [www.eeba.org/technology/andrews/PBConstruct0206-2.pdf](http://www.eeba.org/technology/andrews/PBConstruct0206-2.pdf).

## How to communicate with your building inspector

- **Learn the code**  
Buy a copy of the IRC, and read it (\$62; [www.iccsafe.org](http://www.iccsafe.org)). Ask your inspector questions, and understand what he or she tells you when discussing inspection-related issues.

- **Develop a professional friendship with your inspector**  
Be cordial, and respect the inspector's authority. The inspector can be a good ally if you get into trouble and is unlikely to develop animosity unless you present a reason.

- **Use reason when arguing a point**  
Do not rely on emotion to win arguments with inspectors. They have no emotional tie to your project and won't be influenced by your emotions. In fact, your emotions probably will work against you. Get hard data, and present it courteously.

- **Accept setbacks imposed by your inspector**  
Alter your paradigm to reflect reality when it faces you. Your inspector has a responsibility to verify code compliance. An alternative approach that you propose may be acceptable but must be approved by the building official, the inspector's boss. Don't get mad at inspectors if they deny requests. Instead, enlist their help in winning approval of the building official.

—Lynn Underwood is the chief building official in Arlington County, Va.

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## Code allows no more than 15% of wall area to be windows.

True

False

The code is flexible in this case. Section N1101.2.1 provides you with options. It prescribes code compliance by stating that buildings are limited to a glazing area that does not exceed 15% of the gross area of the exterior walls. However, this section also provides you with the opportunity to use performance-based solutions through the IECC for detached one- and two-family dwellings. The IECC performance-based approach is more complicated but far more powerful about design choices. It allows you to consider total building performance, and energy trade-offs are permitted. For example, you can use more insulation or other energy-saving design strategies to compensate for the energy lost by additional glazing.



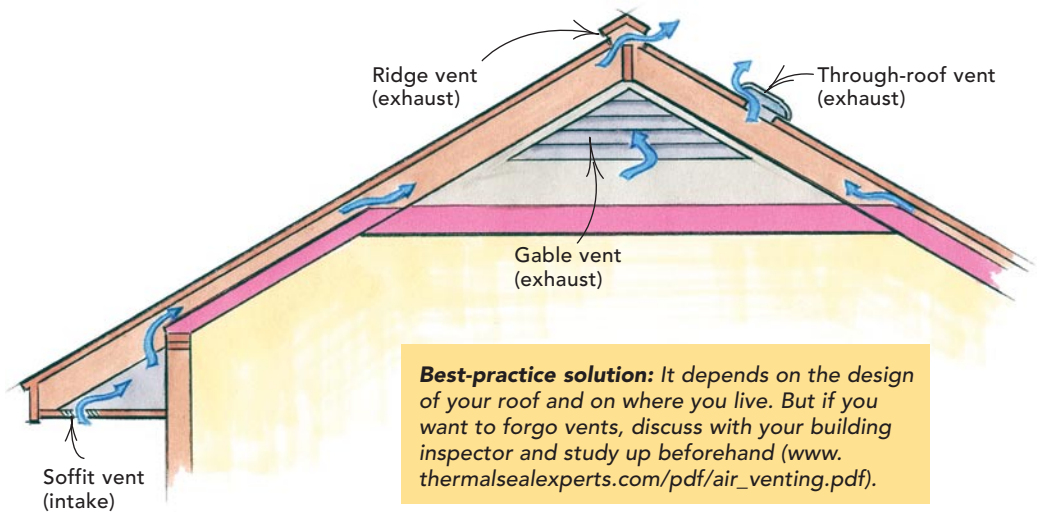
**Best-practice solution:** Get an Energy Star home-energy rater ([www.energystar.gov](http://www.energystar.gov)) involved at the beginning of your building project.

## 6 Unvented roofs are illegal.

True  False

The code is clear. You need to ventilate roofs. This goes for both attic and cathedral-roof frames. Section R806.1 states that "... enclosed rafter spaces formed where ceilings are applied directly to the underside of the roof rafters shall have cross ventilation for each separate space ..." Subsections under R806 provide specific guidance about the minimum vent area and clearance required. This section of the code has no exceptions, but the case may not be closed.

Building scientists have demonstrated that combining high levels of insulation with airtight detailing can provide superior, dry, durable cathedral-roof



**Best-practice solution:** It depends on the design of your roof and on where you live. But if you want to forgo vents, discuss with your building inspector and study up beforehand ([www.thermalsealexperts.com/pdf/air\\_venting.pdf](http://www.thermalsealexperts.com/pdf/air_venting.pdf)).

construction without roof venting. Roof cavities filled with expanding foams or dense-packed cellulose have a winning track record for keeping roof cavities dry and functional. Call section R104.11 to the rescue. This section states, "An alternative material, design, or methods of construction shall be approved where the building official finds the proposed design is satisfactory and complies with the

intent and provisions of the code." So the challenge is to convince the building inspector that your unvented roof will work. Submit thoughtful details and copies of research reports that demonstrate hot-roof designs satisfying the intent of the code. This approach is a case-by-case and inspector-by-inspector decision. Have a cooperative attitude, and be prepared to answer questions about performance.

## 7 Vapor barriers are required.

True  False

Moisture control is required in all framed walls, floors, and roof/ceilings of the building's thermal envelope. IRC section R318.1 states that "... a vapor retarder shall be installed on the warm-in-winter side of the insulation." However, the following exceptions are noted:

1. In construction where moisture or freezing will not damage the materials.
2. Where the framed cavity or space is ventilated to allow moisture to escape.
3. In counties identified with a footnote in table N1101.2. Language in section 502.1.1 of the

**Best-practice solution:** Use plastic in above-grade walls only in very cold climates. Don't ever use plastic in basement walls. For more information, go to [www.buildingscience.com](http://www.buildingscience.com) and search for "vapor barriers."

International Energy Conservation Code (IECC) also talks about "... other approved means to avoid condensation in unventilated walls ..." The intent of these codes is abundantly clear: to control moisture and to prevent damage to materials. But they also imply that we need to put plastic inside a framed basement wall. Obviously, trapping moisture between the foundation wall and a plastic wall membrane is not a good building strategy.

### Vapor barrier or vapor retarder?

Some materials stop moisture better than others. This characteristic, vapor permeability, is measured in units called perms and rated with a perm rating.

**Vapor barriers** don't allow moisture to pass through them. **Vapor retarders** slow moisture passage and are classified as either semi-impermeable or semipermeable.

Some materials commonly mistaken for vapor barriers and retarders are unpainted drywall and plaster, unfaced fiberglass insulation, cellulose insulation, synthetic stucco, some latex-based paints, #15 felt paper, asphalt-impregnated fiberboard sheathings, and housewraps.

#### VAPOR BARRIERS ( $\leq 0.1$ perm):

- Rubber membranes (EPDM, Bituthene)
- Plastic sheeting
- Glass
- Foil-faced sheathings (on foam insulation and plywood)

#### VAPOR RETARDERS:

##### Semi-impermeable (0.1 perm-1.0 perm)

- Oil-based paints
- Most vinyl wall coverings
- Unfaced extruded polystyrene (XPS) greater than 1 in. thick
- Traditional hard-coat stucco applied over building paper and OSB sheathing

##### Semipermeable (1.0 perm-10 perm):

- Plywood and OSB
- Kraft-faced fiberglass insulation
- Unfaced expanded polystyrene (EPS) or extruded polystyrene (XPS), 1 in. thick or less
- Fiber-faced isocyanurate
- #30 felt paper
- Most latex-based paints



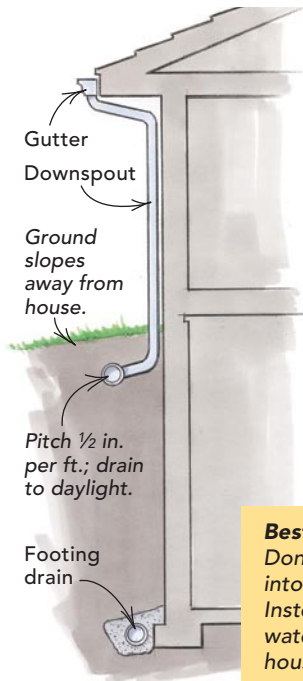
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## Connecting gutter downspouts to foundation drains is OK.

True  False

Section R903.4 prescribes drainage requirements only for those roofs that do not "... drain over roof edges." Traditional pitched roofs do not need gutters and downspouts to satisfy code. On the other hand, section R405.1 does require foundation drainage and provides fairly elaborate directions because it's important to keep basements dry. Surprisingly, nothing in the code prevents you from connecting downspouts to a foundation's perimeter-

drainage system. The logical question stands: Why introduce all that roof water into such a sensitive location? As a side note, you can't discharge this drain water into either a septic system or municipal waste system. Downspouts and foundation perimeter drains must be connected to a separate storm-sewer system.



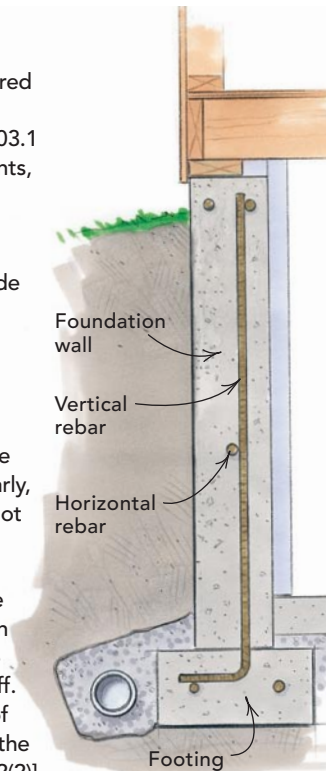
**Best-practice solution:** Don't drain downspouts into the footing drain. Instead, direct roof water away from the house.

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## Steel reinforcement (rebar) isn't required in continuous concrete footings and poured-concrete walls.

True  False

In general, steel reinforcement is not required in residential foundations. IRC subsections under R403.1 outline footing requirements, and those under R404.1 deal with foundation walls. Tables R404.1.1(1) through R404.1.1(4) provide design guidelines that list a wide range of options for designing concrete foundation-wall systems. Although not all designs are exempt from rebar, the guidelines are written clearly, and chances are you will not need to use rebar. There are notable exceptions to this free pass, so you have to review this code section carefully. If you live on the West Coast, all bets are off. You need rebar because of seismic exposure. In fact, the seismic map [figure R301.2(2)] reveals that most areas in the western United States and a significant region in the southeastern United States require the seismic reinforcement described in section R403.1.3.



**Best-practice solution:** Consult the seismic map in the IRC to determine whether you need rebar in foundation walls. But remember, rebar is cheap insurance.

## How did you score?

Give yourself 1 point for each correct answer. Because there were three trick questions, give yourself a point just for reading the article. If you skimmed the answers without reading the explanations, deduct a point.

### 0-2 points: Rookie

Considering that you earned a point just for reading the article, at most you got only one question right. Stay away from job sites, unless supervised.

### 3-5 points: Apprentice

You fell for the trick questions. Repeat after me: "Fool me once, shame on you. Fool me twice, red tag, stop-work order."

### 6-8 points: Journeyman

You nailed the straightforward questions and guessed well on the trick questions. Give yourself a raise, and take the rest of the day off with pay.

### 9-10 points: Master builder

Great job! You understand the codes better than the *FHB* editors. It's time either to buy a lottery ticket or to start moonlighting for *Fine Homebuilding* as a proofreader.

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## Crawlspaces must be vented.

True  False

Section R408.1 of the IRC regulates the ventilation of underfloor space. According to the IRC, "The underfloor space between the bottom of the floor joists and the earth under any building (except space occupied by a basement or cellar) shall be provided with ventilation openings through foundation walls or exterior walls." However, section R408.2 lists five exceptions. In general, building a code-accepted unvented crawlspace is straightforward. For example, crawlspace vents are not required when continuously operated mechanical ventilation is provided in the crawlspace; nor are they required when you install a vapor-retarding ground cover, supply conditioned air to the crawlspace, and insulate crawlspace walls according to the prescribed levels listed in section N1102.1.7.

**Best-practice solution:** Use unvented, insulated, and conditioned crawlspaces. For more information, go to [www.advancedenergy.org/buildings/knowledge\\_library/index.html](http://www.advancedenergy.org/buildings/knowledge_library/index.html).

