Wiring a Two-Pole GFCI

Q. *I have a 240-volt electric job-site heater, which is required by the* NEC *to be GFCI protected. Will a 120/240 two-pole GFCI breaker provide protection for a 240-volt load with no neutral? In what situations would a 120/240 two-pole GFCI breaker be recommended?*

A. *Master electrician Rex Cauldwell responds:* Some equipment, including some spas, are pure 240-volt, with no neutral. Most everything else is both 120- and 240-volt. It doesn't make any difference if the load is pure 240-volt (with two hots and no neutral) or 120/240-volt (with two hots and a neutral) — you use the same double-pole GFCI breaker. You even install it the same. Wire both hot conductors to the breaker and the breaker pigtail to the neutral bus. There will be no connection to the breaker neutral, so just ignore it.

The way the breaker works is via "vector addition." It sums the current of the load and uses that as a reference as the current leaves one leg of the breaker. In theory, the current coming back should be the same. If it is not, the breaker opens. The vector addition will not work if the pigtail is not connected.

Correcting Joist Deflection

Q. *A double 2x8 floor joist that runs beneath a nonbearing partition has deflected 5/8 inch in the middle. If I jack the joist up, returning the compressed and stretched wood fibers back to their original positions, will they stay that way?*

A. *Corresponding editor Paul Fisette replies:* The joists are curved downward either in response to a load that has been placed upon them or because bowed lumber was originally installed. If the joists are responding to load, and they have been deformed for a long period of time, a good portion of the deflection is permanent deformation known as "creep." The bowed joists will not return to the original straight shape, even if you remove all the load. If you jack it up, it will not automatically straighten. If you jack it up and then support the joist with a wall or post, you should be able to keep the joists relatively straight, providing the span from post-to-post matches the design potential of the double joist.

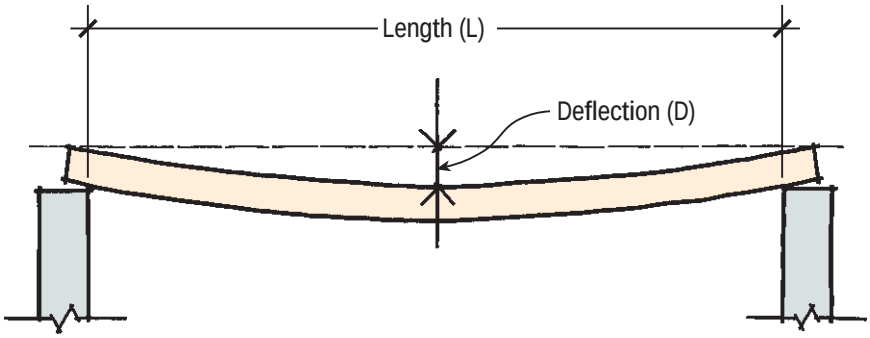
According to most codes, the maximum allowable deflection for floors is L/360, with L equal to the joist's span in inches (see illustration, below). This means the maximum deflection allowed under full load (usually 40 psf live load) is the joist's clear-span distance divided by 360. In your case, the clear span of the joist must be greater than 225 inches (18 feet 9 inches) for 5/8-inch deflection to be acceptable. The fact is, 2x8s simply cannot span 18 feet 9 inches safely. I am concerned that you may have overloaded your joists to have this much deflection, so check your spans and loading carefully.

Installing Cedar Siding Over Rigid Foam Sheathing

Q. *What are the risks of installing cedar siding directly over foil-faced rigid foam insulation? Should tar paper or housewrap be used as well?*

A. *Joe Lstiburek responds:* Wood siding, including cedar siding, should be installed over an air space, regardless of the type of sheathing used. With foam sheathing, an air space is essential, both to reduce the siding's water uptake and to provide a receptor space for the moisture in the siding. If the cedar siding is installed directly on foil-faced foam sheathing, it will be prone

Calculating Deflection

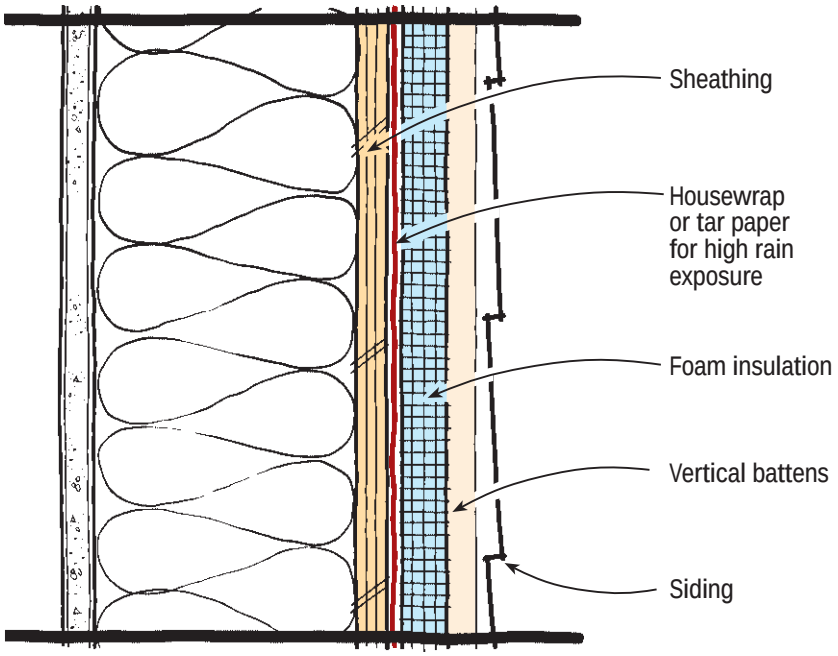


Maximum allowable deflection (D) for joists is equal to L/360

For example, if L = 20'-0":

$$\text{Deflection (D)} = \frac{L}{360} = \frac{20' \times 12''}{360} = \frac{240''}{360} = .666'' \cong 5/8''$$

Siding Over Rigid Foam



to cupping, splitting, and premature paint peeling.

Since sidings are not watertight, no matter what we do, moisture will get into any wood siding. Rain water penetrates the siding at joints, nail holes, penetrations, and overlaps, and runs down the back surface of the siding. Additionally, capillary action can pull water upward at siding overlaps.

When the sun beats down on wet siding, it drives the moisture inward. If the sheathing is plywood or boards, the moisture is redistributed into the sheathing, relieving the moisture stress on wood siding that happens when the front is really dry and the back is really wet. This redistribution of the moisture can't happen with wood sidings over foam sheathing, so we need an air space. Even a shallow air space — 1/4 to 3/8 inch — will do. To provide an air space, most installers find it easiest to install the siding on vertical battens.

Housewrap or asphalt felt is useful to control rainwater that penetrates the siding. In locations with high exposure to wind-driven rain, it may be necessary to install tar paper or housewrap behind foam sheathing to help control any rainwater that penetrates the siding.

To sum up, If you want to install tar paper or a housewrap with foam sheathing, install it under the foam sheathing — but keep the air space between the siding and foam.

Joe Lstiburek is an engineer and principal with Building Science Corp. in Westford, Mass.

Using Pressure-Treated Wood for Trim

Q. *We are planning to use pressure-treated wood as exterior trim on a house with fiber-cement siding. The siding will be finished with acrylic paint. Is pressure-treated wood appropriate for use as exterior trim? What precautions, if any, are necessary when painting pressure-treated wood? Can we use the same acrylic paint we will be using on the siding, or should we be using an oil-based paint?*

A. *Wood finishes expert Bill Feist responds:* Most pressure-treated wood sold in lumberyards is treated with CCA (chromated copper arsenate). Although this type of pressure-treated wood is paintable, be aware that painting is possible only when the wood has been cleaned (using soapy water and a stiff bristle brush, followed by a clear water rinse), and allowed to dry thoroughly. Getting the wood dry can sometimes be a problem, because treated wood is often sold very wet from the treating process. Depending on the climate and drying conditions, it may be necessary to dry the wood for several weeks before painting.

An exterior all-acrylic latex house paint would be the best choice for painting pressure-treated wood. Exterior acrylic latex house paints can normally be used on many different substrates — aluminum, galvanized steel, masonry, concrete, brick — as well as pressure-treated wood and fiber-cement siding. However, always check the label on the paint can to be sure it is recommended for use on wood products.

If possible, find a manufacturer who also has an acrylic latex primer. The combination of latex primer and topcoat has been shown to give the best overall paint performance on treated wood. I would not use oil-based paint, which does not perform well on pressure-treated wood.

Pressure-treated wood may not be the best choice for exterior trim, since most pressure-treated wood is southern yellow pine, a species that is not particularly good at holding paint. Southern yellow pine, whether or not it is pressure-treated, does not hold paint as well as western red cedar. Since most pressure-treated wood has knots and other defects, any lumber used for exterior trim would need to be carefully selected to find boards that are as clear as possible. Although some lumberyards do sell premium grades of pressure-treated wood for exterior trim, this grade may be difficult to find.

Finally, since pressure-treated wood has a tendency to warp and crack rather easily, the trim would need to be carefully and securely nailed or screwed.

GOT A QUESTION? Send it to On the House, *JLC*, 186 Allen Brook Ln., Williston, VT 05495; or e-mail to *jlc@bginet.com*.