Screw the Deck and the Welds

By Richard P. Canon, FRCI, RRC, PE

Steel roof deck can be secured to structural bar joists using "puddle" welds, powder-actuated pins, pneumatically driven pins, or self-drilling screws. It is not unusual to find that the consistency of deck-to-joist welding is poor. Some welds, by some welders, are good. Some would argue, however, that most welds are inferior. Although many welders can join plate, beams, angles, etc., satisfactorily, they just cannot weld steel deck correctly. The basic problem is that it is difficult to weld relatively thin steel decking (e.g., 22 gauge is 0.0295 inches thick) to the top chord angle of a steel joist (which may be ±0.25 inches thick). This applies to certified welders as well as non-certified welders. The quality of the weld is a function of the condition of rods, the type of rods being used, and most importantly – the delivery amperage.

At the intersection and lap of four pieces of deck (which occurs at each corner at each end of each piece of deck), weld fusion is seldom optimum. To get a good weld, the welder must compress all four pieces of the deck at the same time snugly to the joist or beam. This is to eliminate any gap between individual pieces of deck or between the bottommost piece of deck and the joist or beam. Failure to do this *every time* results in a gap and, thus, a deficient weld.

On almost every project, the inspector observes some welds that "appear" sound one day but that will have sheared off a week later. One can actually hear welds failing on a deck in the early morning as the sun heats the deck up and it expands, shearing a deficient weld. If this can happen within only a few days of installation, it can happen over the life of the deck as well. This affects the integrity of the roof deck, the bracing system, and the roofing system above the deck.

"Blow-through" or "burn-through" of welds has always been a problem with arc welding on a steel deck. Blow-through occurs when the electrode burns through the deck to air, not to a structural member. When this happens, the conscientious welder moves over a few inches and tries again. If the weld hits steel that time, the job is done. If not, the electrode is moved over a few more inches and tried again. This leaves one or more burn holes in the deck that must be coated.

All welds should be wire-brush-cleaned and painted before the roof is installed. All burn-throughs should also be painted and then, in some fashion, sealed or covered. Some designers/specifiers call for pieces of duct tape to be placed over the holes. That is not a very effective repair, as the tape will soon lose adhesion and peel off. Few techniques are better, other than maybe self-adhering foil tape.

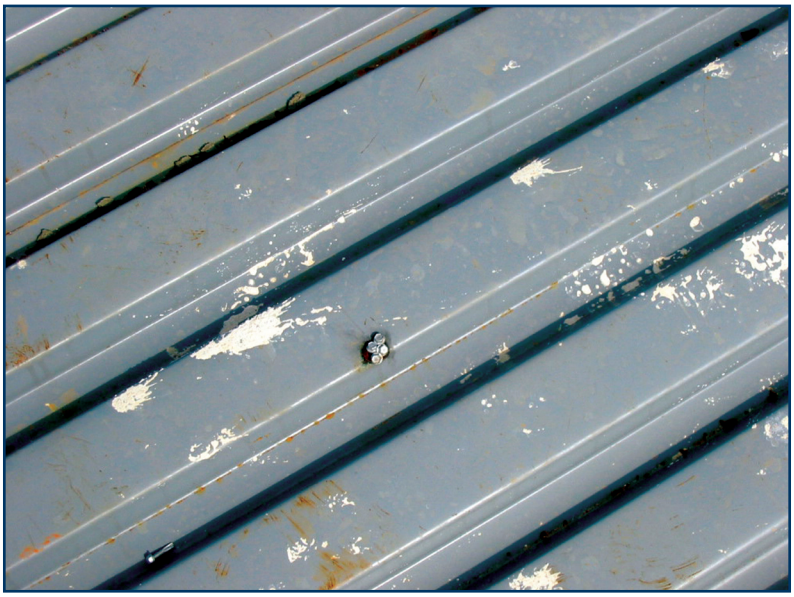

Photo 1 – Burn-through in the top flange of the deck that was not repaired.

Generally, the burn-holes are left. Now we all know that roofs never leak, but God forbid, if they do, that the water runs the flutes of the deck and then drips into the building at every blow-through down slope of the leak point. The same can occur with a screw if it is extracted; however, the hole is smaller, and there seems to be a tendency for screw applicators to strike a line to stay on steel. Many inspectors or observers just haven't seen too many "iron workers" do that.

Welding galvanized deck breaches the galvanizing at

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Photo 2 – Missing weld at critical juncture of four pieces of deck that was repaired with screws. The leftmost weld has sheared or failed.

Photo 3 – Really poor-quality weld with blow-through on right side; second attempt was successful, though it is not painted yet.

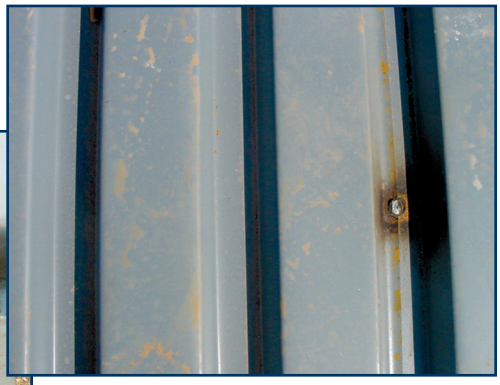

Photo 4 – Broken weld at toe of upper piece of deck (piece on left).

the most crucial point, the point of attachment. The spot painting is seldom as good as the galvanizing. This is probably the most important concern one can have. If the welder goes back and wire brushes the slag from the weld and applies a proper coating, the labor cost of the deck installation can nearly double.

Screwing the deck may be a better option for securement for several reasons, including the following.

With minimal training, a laborer can properly and consistently install screws using relatively inexpensive equipment. Welders seem to think installing screws is a little beneath them and want to do "what they've always done," which is to weld.

Screws are either a "go" or a "no-go" installation. There is little chance of a deficiently installed screw being overlooked. The most likely deficiency that may get overlooked is where the screw is in place and flush with the top of the deck but where it never penetrated the upper chord of the joist. For that reason, the inspector should test some screws at random. A socket on a long speed-handle, ratchet, or pull-bar makes this an easier task.

The same screw gun may be used to install the side lap fasteners and the joist-

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to-deck screws, so there is no need for extra equipment. The torque settings do have to be adjusted between installing the two types of screws, but that requires only a click on the screw gun.

It is important for the installer to use a quality screw to fasten the deck. Some manufacturers are better than others and produce consistently high-quality screws, while some do not.

Most specifications call for deck-to-joist screws to be self-drilling No. 12 - 24 x 1-1/4-inch long.

That consistency is often lacking in specs regarding the side-lap fasteners. Some say the side laps should be made with No. 10 screws, and others, No. 12 screws. A No. 10 screw is more easily over-driven and, as a result, requires a lot of drop-back and correction work. This may or may not take place. The pitch of the screw thread is critical for proper engagement of side-lap screws. If the pitch is too fine, the screw can be more easily overdriven, galling or stripping the threads. Most experienced specifiers require No. 12 - 24 x 3/4-inch long screws for side laps (or for that matter, whenever sheet metal is attached to sheet metal and strength is important).

Another benefit of securement using screws is that work can progress in less-than-ideal weather, as long as the screw guns are properly grounded and provided with a ground-fault interrupter. An option in inclement weather is to use battery-powered screw guns, but many installers have found these guns discharge rather quickly under such loading.

For these reasons, many experienced consultants and engineers advocate the use of screws for both deck-to-joist and sidelaps and recommend that the specs not be changed to allow welding.

Check the deck installation closely and bring deficiencies observed immediately to the attention of the construction team. Screw the deck, don't weld it!

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Richard ("Dick") Canon is a registered professional engineer in seven states and was one of the inaugural recipients of the Registered Roof Consultant classification in 1988. Dick became a Fellow of the Institute in 1987 and received the second Herbert Busching Award from RCI in 1996. Dick and his wife Connie celebrated their 40th anniversary recently. The couple started Canon Consulting & Engineering Co., Inc. in 1983 and have their office in Moore, SC. Dick has been a speaker/presenter at many of RCI's conventions and symposia. He has a driven interest in wind- and drainage-related issues and is a manufacturer of a negative pressure (uplift) chamber that is quickly becoming a standard in the industry for high-pressure tests. Dick says among his most rewarding and fulfilling experiences have been serving as first vice president of RCI in 1983 and 1984 and president of RCI in 1985 and 1986.

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