

Oil Canning

By Jim Austin
Associate editor

Oil canning. You can deny it, avoid it, ignore it, and totally disassociate yourself from it, but it's out there.

Anyone schooled in marketing knows the dangers in discussing possible negative perceptions, no matter how insignificant. So how significant is oil canning in the selling, installation, maintenance, and public perception of metal roofing? It depends on who you ask.

By accepted definition, oil canning is "a perceived waviness in the flat area of roofing panels." In its technical bulletin on oil canning, the closest thing to a standard as the industry has at this point, the Metal Construction Association says oil canning "is an inherent part of light gauge cold formed metal products, particularly those with broad flat areas." Because oil canning is an "inherent" property of light gauge metals, most metal roofing manufacturers spell it out in the black and white of their contracts — oil canning is not cause for rejection.

Most in the industry recognize oil canning as an aesthetic issue and nothing else. In fact, some metal roofing customers actually prefer the look of panels with a certain degree of oil canning. So its significance, as they say, is in the eye of the beholder.

"I think the customer has to be made aware of the possibility, but sometimes that can be worse than not telling them," says Dean Laraway, president of Laraway Roofing in New Ulm, Minn. "The average person might not see it until someone else gives them the idea."

Anecdotal evidence suggests that average people are not complaining about oil canning en masse. "I talk to a lot of companies who deal with the

problem of oil canning on a day-to-day basis," says MCA technical director Scott Kriner. "We don't get a lot of calls from customers about the issue, so that tells me that our members are doing a good job of dealing with it."

Kriner says there are many variables that can lead to the possibility of oil canning. The MCA devotes more than half of its technical bulletin to the sources of oil canning, which can be caused by "many uncontrollable factors" and occur during coil production, fabrication, and/or installation. Oil canning that occurs during production and/or fabrication can be compounded during installation.

The exact cause of oil canning in a metal roofing panel on a particular project can be difficult to pin down. Then, when oil canning occurs, it can occur in an infinite degree of measures, making it difficult (some say impossible) to set a standard of acceptability.

An oil canning standard?

Oil canning is a reality, and so are the fears that come with establishing an industry standard for what degree of oil canning is acceptable and what is not. Some don't believe it is necessary to establish a standard. Others believe a standard would benefit the industry. Many acknowledge it would be at least difficult to establish such a standard, while others believe it would be impossible.

One key concern comes from the possibility of someone outside the metal roofing industry establishing a standard that may be difficult, or almost impossible, to meet. The American Society for Testing and Materials has established the A924/A924M-04 Standard Specification for General Requirements for Steel Sheet, Metallic-

Industry weighs in on a possible standard

Coated by the Hot-Dip Process. According to Tom Shingler, P.E., president of Design Dynamics, Inc., the standard allows for a flatness tolerance of 1/4-inch maximum deviation from a horizontal flat surface of the raw steel sheet (at the steel mill) used to fabricate a light gauge steel wall or roof panel. "This maximum allowable deviation represents a very high level of flatness imperfection," Shingler says.

Metal roofing panels endure many more opportunities to become oil canned before the homeowner or building owner views their new metal roof for the first time — or the second time, or third time, if oil canning occurs because of thermal expansion and contraction after installation. So, in essence, the industry is currently being guided by the conscience, integrity, and skill level of individuals in the industry, and the consumer demand for quality.

If the metal roofing industry can address its own weaknesses (perceived or not), it answers to challenges from the competition. Those challenges will surely increase as the popularity of metal roofing grows and earns market share.

Standard thoughts

No one denies oil canning exists and all agree there are plenty of causes. Many think at least to some degree, it's unavoidable and that's the way it should be addressed.

"Quantifying an acceptable, measurable amount of oil canning would be very difficult to do," says Bill Croucher, director of product at Fabral. "Also, even if you could quantify an acceptable level you'd still have the problem of who pays to correct the problem, since the causes can be from several sources.

"Even if the panels are perfect when they arrive at the jobsite, which would

be difficult to accomplish in the first place, the way the installer handles the sheets, installs the sheets and the condition of the substrate they are being installed on can all cause oil canning. We need to educate the architects that this is something that can be a part of a metal panel and many of the causes are out of the manufacturer's control. You always see oil canning, for example, in a copper roof, but it is accepted as a part of the appearance of that product. Oil canning is, normally, an aesthetic problem only. It does not impact the performance of the metal roof."

Rarely does oil canning lead to system failure, what would be known more commonly as a leak. But it could be argued that if a customer purchases a metal roofing system because of its architectural appearance, a roof that ends up oil canning is indeed impacting the performance the customer paid for.

Dick Bus of ATAS, first vice president of the MCA, says the association is working on establishing a standard that would measure oil canning as it leaves the manufacturing facility. "What that does is put the onus on the contractor or the subcontractor to stop and correct any problems before installing the roofing system," he says. The MCA is an association of manufacturers, so for its purposes, a standard that tests panels for flatness on the way out of the manufacturing facility is a way of holding manufacturers accountable. Bus said he expects the MCA committee dealing with oil canning will be able to reveal some progress at association's semiannual meeting in Cincinnati in early August.

Some in the industry believe a standard should go a step further, arming the homeowner or building owner with a standard of acceptability.

Rob Haddock is the president of Metal Roof Advisory Group, and a consultant in the metal roofing industry. In a discussion on oil canning, Haddock was asked two questions: Is there a need for an industry standard? And, if so, how difficult would it be to establish?

"My answer to the first question is a very resounding, 'Yes,' and my answer to the second question is, 'Very difficult, very challenging,'" he says. "I deal with it all the time. I get calls from both owners and contractors. The owners are saying, 'I got this metal roof job installed and it looks horrible — all oil canned.' The contractors are saying, 'I installed this job and there is a little oil canning, so they won't pay me. They are threatening to make me replace it. My supplier tells me that oil canning is not a cause for rejection. What do I do?'"

Haddock says they are both right — to a degree — because there is no industry standard. Currently most manufacturers stand behind the phrase, "Oil canning is not cause for rejection." Haddock says that is not reasonable because it allows for even extreme examples of oil canning. "It gives a license to sleazebags to peddle secondary coil, run it through a \$20 machine and put it on a roof and say, 'That's acceptable. Live with it — oil canning is not cause for rejection.'"

Haddock says more savvy roof buyers are fed up to the point of writing their own standard, demanding the finished product show no signs of oil canning. "That's just as ridiculous," Haddock says. "I think a standard would have a positive effect on the industry," he says. "If the industry could adapt a position that's reasonable, then building owners and specifiers won't be making up their own, and irresponsible selling and installation practices would be reined in.

"I think it is prudent to come up with a means to measure oil canning so that an owner can reject a job if it is excessive after installation, just as the manufacturer can reject coil on flatness grounds before roll forming. There has to be a way to quantify acceptable or unacceptable levels of deformation on installed panels. I'm not pretending to have all the answers, it's going to be very, very difficult to do, and maybe it's not even doable, I don't know."

Therein lies the current problem —

no one has a solution for measuring or quantifying oil canning every time the metal endures another step in the process toward being an installed roof panel.

How is it measured?

"I can't imagine how on earth you would measure it," says Peyton Collie, project manager in the Sheet Metal and Air Conditioning Contractors' Association Technical Resources Department. "If you did, how would you go about deciding who's at fault? The reason you set a standard is to hold someone accountable, and there are so many people in the chain that could be held accountable."

SMACNA addresses the issue in its paper, "Oil Canning — It Bends Architects Out of Shape," which is included in *Architectural Sheet Metal Manual*, Sixth edition (page 29). It addresses methods of minimizing the effects of oil canning, because "it is unrealistic to expect any architectural roof or similar wide-metal element to be totally free of some degree of oil canning."

Collie says most of the problems that cause oil canning are design issues, and that even the most skilled installers can't overcome bad design.

"A high percentage of design questions we received were from architects," says Collie. "In some cases, up close, you can't see it. But very often, at a distance it shows up on large flat areas. And if you get up on the roof to see it, you can make it worse."

Haddock believes most in the industry care about making the building owner or specifier happy. He also says the easiest way to keep the owner happy is to come up with some kind of benchmark as to what is an acceptable finished product regarding flatness. "Right now we measure flatness only on coil, but the building owner is not buying coil, he's buying installed panels," Haddock says. "My approach has been from the owner's perspective — he is buying a finished roof. He

deserves a reasonable frame of reference of what's acceptable. Part of the resistance to this is that supply side participants of the process are worried about having the finger pointed at them, getting blamed. I think there are very few cases where the supply side is culpable, but the point is everyone in the chain needs to be accountable — and maybe some folks who aren't in the chain, too. What about the guy who installed the deck that is all mismatched and screwed up?"

Avoiding finger pointing

It's easy to get caught up in the finger pointing game, especially when there are so many places to point. No one likes to be accused of doing less than acceptable work. And certainly, no one wants to have to pay for replacing panels or a part of the substrate.

"It's more of an application problem than anything else," says Gary Battistella, director of sales and marketing for New Tech Machinery. "The education system in our industry is so bad. Most of the oil canning is caused through the actual application. We need more application schooling on metal

All decked up

David Mills, who handles international sales for Sunex International, Inc. of Pompano Beach, Fla., recalls a roof installation in the Bahamas that showed signs of oil canning and drew some complaints. The contractor did not use plywood clips and the deck was bowing up in places. "Once the general contractor's carpenter put some 2x4 braces in between the trusses so the plywood deck could be properly secured, the roof 'mysteriously' stopped oil canning," he says.

"I think a standard would help the industry greatly," Mills says. "I also think that roofing contractors should string line the decks and either refuse to put the roof on, or have a waiver signed, if they find the deck is not true."



roofing. Shoddy workmanship is the problem in our industry."

Jim Bush, director of marketing and sales at ATAS, says his company recommends to its installers that if they notice any imperfection in the substrate, they should contact the customer to let them know the situation could produce an oil canning effect. Before proceeding, the installer must have, in writing, the customer's acceptance of the substrate. "When I get called out to jobs on complaints of oil canning, I would say about 80 percent of them are not product related," Bush says. "They're due to inadequate substrates."

The last few comments should be a wake up call to the installer — a high priority should be to make sure the metal roofing system is being applied to an acceptable substrate, and that

What do you think?

Have an opinion on a standard for oil canning? Share it with the editors. Write to Metal Roofing Magazine at 700 East State St. Iola, WI 54990-0001, send a fax to (715) 445-4087, or e-mail jim.austin@krause.com

everything under that substrate is put together correctly, right down to and including the foundation.

"I tell the customer up front about the possibility of oil canning," says Darius Hart of H&H Sheet Metal in St. Louis. "We try to put it on right, which entails putting the clips on right so it can slide.

"I've only had a couple problems with oil canning. One was on siding and the other was on a curved roof barrel. The architect wanted it put on over metal decking and I told him it would oil can, and that we needed to use some smooth plywood. He insisted we use metal decking, so we put it on metal decking and he came back to tell us we were right. It oil canned."

Experience goes a long way toward minimizing the effects of oil canning created during the installation process. The SMACNA paper advises specifiers to use metal gauges and panel widths

MCA on oil canning

To view the MCA Oil Canning Position paper, visit, www.mca1.org/pubs/pdf/95-1060%20MCAoilcanning.pdf.

Cold shower

Tom Shingler, P.E., president of Design Dynamics, Inc., said he was called back to a job by an architect who insisted there was something wrong with the metal roof installed on his project. Shingler told the architect it was an installation problem, relating to how the panels were fastened — the fasteners did not allow for the proper thermal movement. When the roof heated up from being exposed to the sun, it appeared wavy, it had oil canned. Shingler dumped some cold water on the panel and it flattened out to its installed state.

they know have demonstrated an ability to minimize oil canning.

“We try to use lengths and gauges that won’t permit it to happen,” says Laraway. “Or we try to use other types of corrugation between the standing legs.”

Laraway says in most cases, his company is laying metal panels over plywood, a flat surface that supports the entire panel better than a panel attached to purlins. Laraway Roofing installs metal roofing systems on its own substrates or substrates constructed by a general contractor.

“You can go by jobs and not see oil canning,” says Ken Gieseke, vice president of marketing at McElroy Metals. “Is there luck involved? Sure, sometimes. There are so many factors that affect the metal — the sun, the substrate. That’s one of the biggest keys, the substrate has to be straight, plumb, square, however you want to say it. An uneven surface will cause oil canning.”

“It would be desirable to have an industry standard, but it would be very tough to do.”

Maybe, but the MCA is considering establishing some sort of standard. That would narrow the field of who can be blamed for oil canning. Then, those held accountable, will have to deal with oil canning issues and they won’t be able to deny it, avoid it, or ignore it — if they want to get paid. ■

SMACNA on oil canning

Oil canning is a perceived waviness across the flat areas of sheet metal panels. It is a naturally occurring phenomenon that is inherent in all light-gauge sheet metal. SMACNA’s new “Architectural Sheet Metal Manual,” Sixth edition, provides methods from design to installation to mitigate its occurrence.

Oil canning is more apparent under shallow cross lighting so its presence is more discernible during certain seasons or times of day. Also, differing thermal forces can create waviness—either temporary or sustained—as the sun moves across the sky.

Oil canning is an aesthetic issue, not a structural problem or a defect. It is unrealistic to expect any architectural roof or similar wide-metal element to be totally free of some degree of oil canning.

While oil canning cannot be totally eliminated, adherence to industry accepted and recognized methods of design, metal specification, handling, fabrication, and installation can minimize its occurrence. Careful attention to the causes of oil canning within all the phases of design and construction is the most effective way to reduce its occurrence.

Design

Panel gauges and widths scheduled must be selected to minimize oil canning with proper installation. SMACNA’s “Architectural Sheet Metal Manual” provides metal gauge recommendations based on several factors and those recommendations should be considered minimum gauges and maximum widths.

Specifiers should use metal gauges and limit panel widths that based on experience, either their own or that of experienced local sheet metal contractors, has shown as appropriate for a particular application and metal. The most current American Society for Testing and Materials (ASTM) standards should also be reviewed to gain

Architectural Sheet Metal Manual, Sixth edition

■ **Product type:** Technical Manual; Size: 496 pages; File Size: 5.3MB Published: 2003

■ **Description:** Contains the most comprehensive set of recommended practices available for proper design and installation of custom-fabricated architectural sheet metal including roof drainage system design for scuppers, gutters, and downspouts. It features new historical restoration sections on skylights, cornices and spires; new moisture and maintenance guide; new mechanical fasteners and soldering chapter, and enhanced metals selection data. Offers new construction techniques and alternative methods of design and installation reflecting climatic conditions and rainfall rates.

■ **Hard copy or PDF:** Listed at \$262 (Discount price: \$184)

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insight into the standard tolerances to which various metals are manufactured.

Color and surface finishes also play a role in how oil canning is perceived. Wide, shiny, dark-colored, light-gauge sheet metal panels will exhibit a degree of oil canning that is directly proportional to the width and inversely proportional to the thickness. Darker colors simply accentuate any oil canning that is present; the presence of oil canning can be made less obvious by the use of lighter, more neutral colors. Also, reflective surfaces will be more unforgiving in revealing oil canning while the use of non-reflective or textured finishes aids in masking waviness.

Movement of the primary support system or the structure itself can cause waviness that may become permanent or temporary during certain weather conditions. The fastener system should

be designed so that the panels can “float” in response to thermal changes. In addition, the perimeter design is especially important. Ultimately, the magnitude of thermal stresses transferred from the structure to metal panels is carried through the fastener system. Stiffening ribs can be specified within wide panels to break up the panel and to reduce and make oil canning less apparent.

Metal Specifications

Generally, the heavier the gauge the less oil canning will be visible. Oil canning can also be reduced by ordering tension-leveled coils and re-squared sheet stock. Tension leveling involves stretching the metal on coils past its yield strength, which provides a flatter surface less subject to oil canning. Re-squared metal simply assures that the metal’s shape will be more amenable to roll or brake forming without generating unwanted sur-



face tensions due to warped raw material or metal edges that are not truly parallel.

Handling

Proper handling needs to be addressed in every step of the process from production to final installation. For example, panels should not be carried “flat” or lifted by a single corner to remove one panel from a bundle. In some cases, especially with custom finishes, it may be beneficial to use clean gloves to handle and position metal panels. Appropriate shoes should be worn to

avoid scuffing the finish.

Fabrication

Slitting panels from a coil releases and creates residual stress within the metal. Typically, slitting from wider coil stock is unavoidable due to the economic benefits of using wider coil stock. Residual stresses are also created by any forming operations required to develop flat metal into the desired shape. Metal forming equipment should be well adjusted, operated within its design limits, and operated by experienced sheet metal crafters to minimize stresses caused by fabrication.

Installation

The sheet metal’s foundation — the substrate — is a very important element of any architectural metal system. For non-structural panels the substrate must be flat with any required felt/membrane or slip-sheet, closely conforming to the supporting system. For structural panels, the resulting bearing surfaces must be properly aligned with the underlying roofing and one another, or the metal will “telegraph” the location of each support. Otherwise, stresses induced when the metal conforms to any contouring of the bearing system can create oil canning.

Placing panels too closely to one another at the “long” joints will not allow sufficient room for expansion and can generate waviness as daily and seasonally thermal stresses vary. Fasteners that are over-driven or are of incorrect height can severely restrict movement — especially for long or wide panels. This rigidity can transfer stress to the panels through the daily and seasonal thermal variations and can create visible deformations. ■