10 Confidence Inspiring Tests Your Metal Roof Undertakes

Learn the details of what guarantees a quality metal finish

Most people are aware of the longevity and strength offered by metal roofing and metal siding. Many homeowners select metal as their preferred material of choice due to its ability to outlast other material types by two or three times.

So what sets metal apart? A key difference that contributes to the longevity of a metal roof is the way its finish is applied and the stringent testing requirements it undertakes to ensure it will withstand the harshest conditions for years to come.

Quality at every corner

Reputable metal painters (called coil coaters) do not rely on the consistency of the process alone and employ a series of standardized tests to ensure the painted metal is fit for purpose. This article explores 10 of these tests and why each is important.

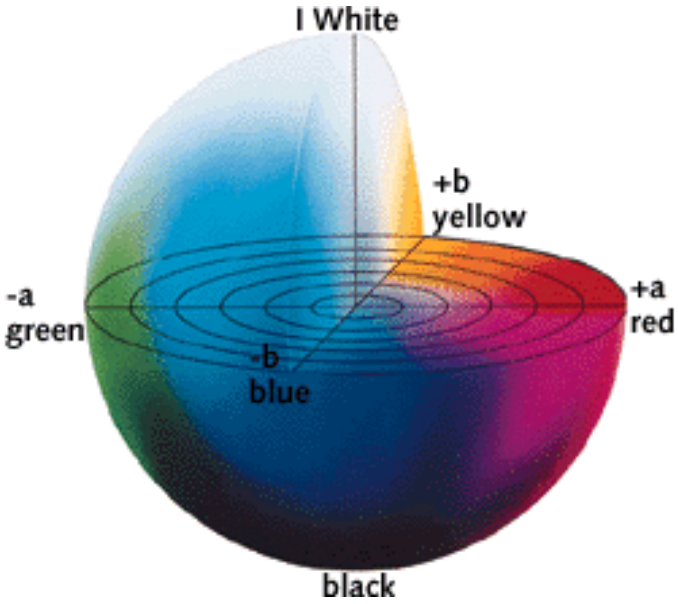
A disadvantage of metal is that low-quality and high-quality products will look the same when new. Performance only differs over time, after the product has already been installed. To avoid long-term disappointment, always check that the material used in your metal roof or siding project is sourced from a reputable organization that practices these test protocols. Organizations that belong to industry bodies, such as the National Coil Coating Association (NCCA), will follow these test protocols as part of their commitment to quality standards.

Quality Testing at Steelscape.

Coil coaters (metal painters) perform the first 7 tests for each production run:

1. *Is it the right color?*

Color is assessed on a standardized scale called the LAB scale, which plots the coordinate of color based on its lightness or darkness and magnitude of color. Instruments, such as a spectrophotometer, measure these coordinates. Testers sample multiple points and the color must be consistent across the width of the metal strip. The unit Delta E expresses color variance on a standard and the color must fall within a set range. Some color-shifting paints, such as micas, cannot be controlled instrumentally and must be inspected visually.



Lab Scale and light booth

2. *Is the paint the correct thickness?*

Dry Film Thickness is a key measurement and assesses the thickness of the coating, and if it aligns with specifications. Traditionally, this is done by cutting a V-shape in the painted coat to reveal the width of the different paint layers, including the topcoat and primer. Satisfactory width is assessed using a microscope calibrated to measure paint thickness based on the V-cut. Today most coaters use a stereoscope device that performs this function in a faster, automated manner. The paint thickness must fall within a designated range to pass this test.

Production Line Thickness Measurement

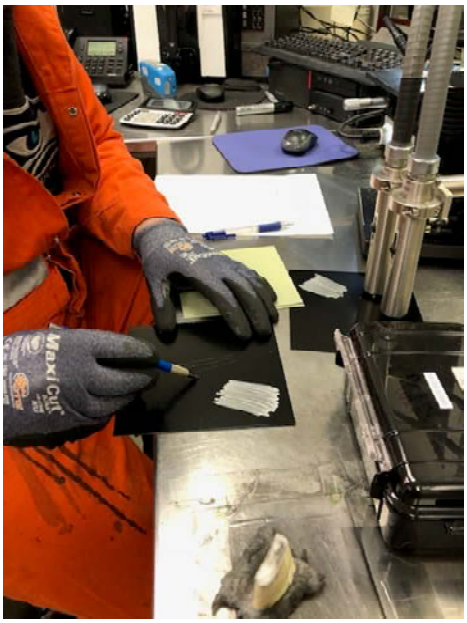
3. *Has the paint cured properly?*

In the metal coating process, paint is applied and cures in rapid a manner, often in seconds. This is far different from your regular household or automotive paints. The rub test evaluates if the paint has cured properly. In this test, the quality inspector, often with the aid of an automated machine, will rub the painted surface using a cloth soaked in Methyl Ethyl Ketone (MEK) solvent. The surface is rubbed in a back and forth motion for a prescribed number of rubs until it meets the minimum rub count criteria. The paint passes this test if there are no observable signs of paint loss or damage.

Automated MEK Rub Test (Image Source: National Coil Coating Association)

4. *Is the paint surface too brittle or too soft?*

The hardness test evaluates the initial durability of the surface. This validates if the paint can be formed into a finished product without cracking or scratching. In this test, a beryl pencil is run against the surface at a 45-degree angle for a prescribed length. The material will pass this test if this pencil mark does not cut or scratch the painted surface.



Hardness assessment in the lab

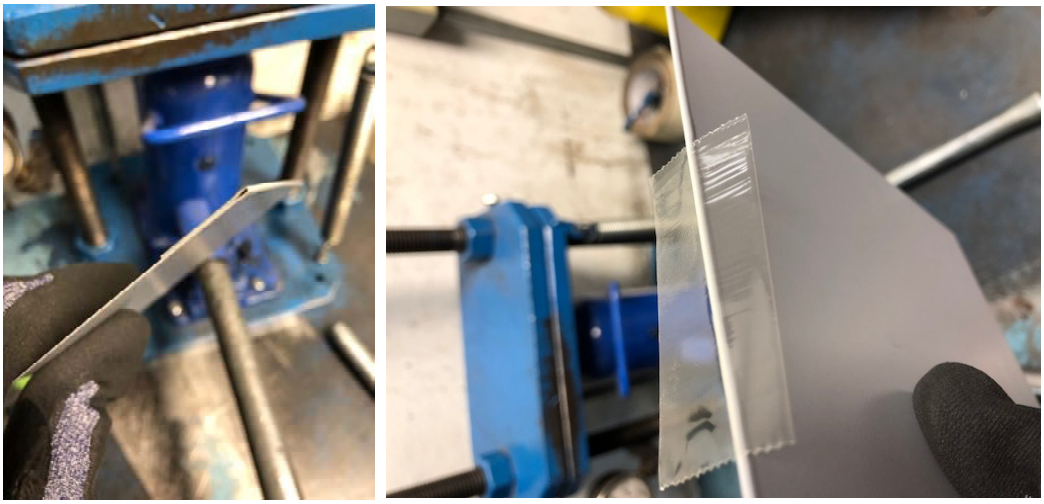
5. *Is the painted finish as vibrant as promised?*

The way paint interacts with light can drastically alter its visual appearance. Gloss and sheen are two measurements that record how the surface reflects light and provide a comparable scale for visual appearance. Gloss measures the reflection of the surface coating at a 60-degree viewing angle, and sheen is measured at an 85-degree angle. To undertake this test, a gloss meter is used (pictured below). Testers observe multiple points of the painted surface to confirm that the gloss reading is within a prescribed range.

Spectrometer in use

6. *Can it be formed into tight shapes without issues?*

Many metal products employ tight bends to create strong interlock designs such as panel seams. Some of these are formed further in the field by roofing contractors to create weathertight seals. The painted surface must be both durable and flexible so that it can be formed into these tight shapes without cracking or deforming. The 'T bend' test simulates extreme radius turns in which a sample piece of metal is bent per test protocols, and the painted surface inspected for cracks. Any apparent cracks to the surface represent a failure. In addition to the bend test, clear tape is applied to the bend and rapidly removed to confirm paint adhesion on the formed area. Removing the tape cleanly without any paint damage passes this test.



T bend test

7. *Is the paint adhering to the base metal properly?*

The paint adhesion test (or drop impact test) is the final test performed with the production sample. This test confirms that the bond between the paint and the metal is secure. The tester drops a round-ended weight onto the metal from a predetermined height. The deformed surface is examined for cracks or breaks in the coating. Similar to the 'T bend' test, the tester applies and quickly removes clear tape from the deformed area. The sample fails the test if any paint remains on the tape.

Impact Test and Pass/Fail Criteria (Image Source: National Coil Coating Association)

Paint systems must also meet more extensive testing requirements that demonstrate their aged performance. The following tests are undertaken in a laboratory and test paint performance using accelerated tests harsher than the real world. While this helps assess long term performance, there is not a direct correlation to real world time. For decades, manufacturers and paint companies test product samples in harsh outdoor climates such as Florida, to monitor the performance of paint systems over time.

8. *Will the paint system deliver long-term corrosion resistance?*

The salt spray test evaluates the long-term corrosion performance of the paint system. The test exposes the product to constant spray from a saline solution in a temperature-controlled chamber. The standard calls for the application of a 5% salt spray solution to be applied for 1000 hours at 95 degrees Fahrenheit. This test replicates the extreme, extended exposure to salt spray a roof may undertake throughout its lifetime. To pass the test, the system must withstand a predetermined number of hours of exposure without signs of delamination or blistering. Signs of damage are observed either at the surface, edge, or cut lines in the test material.

Salt Spray Test Chamber (Image Source: Weisstechnik Testing Services)

9. *Will the finish perform in a humid environment?*

Water is a highly destructive force and can degrade coatings over time, such as the consistent exposure to condensation. To evaluate paint performance, this test exposes samples to consistent water condensation. A chamber encloses test samples, which has a heated mixture of air and water vapor. The tester maintains the temperature of the test chamber at 100 degrees Fahrenheit and 100% humidity. This causes prolonged condensation to form on the test metal samples. The paint finish passes this test if it can withstand extended exposure without any impact on the paint system such as blistering.

Humidity Testing Cabinet (Image Source: Assured Testing Service)

10. *Will sunlight impact the performance of the finish?*

This test exposes the painted metal sample to fluorescent light sources that simulate UVA and UVB light. Invisible to the naked eye, UVA and UVB rays can induce chemical reactions that create surface damage. UVA and UVB are two different wavelengths on the spectrum of solar radiation. UVA are the most prolific rays. While the ozone layer absorbs the majority of UVB rays, their higher energy makes them more destructive and must not be ignored. This accelerated test evaluates if long term exposure to direct sun will impact the performance of the coating. This test simulates if the finish will blister, chip, or crack due to extended exposure to the sun. As part of this process the tester may record gloss retention, paint adhesion and color fade performance data points.

UV Testing (Image Source: Assured Testing Service)

Some paint vendors have advanced testing practices to include new methods that test multiple variables at once. These tests utilize a combination of water and light exposure in a single test to better replicate real-world conditions. Tests such as ASTM D5894 provide alternating rain and dry conditions in combination with temperature fluctuations and outdoor UV light to provide a more realistic assessment. Other new tests replicate enhanced weathering using the combination of an open flame carbon-arc light and water apparatus to create varied light, heat, and rain conditions.

What this all means

Test	Attribute	Test Method	ASTM Standard	Standard Overview
1	Color	L,a,b Color Value Measurement	ASTM D2244	Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
2	Dry Film Thickness	Tooke – DJH - Electronic Gauges	ASTM D5796	Standard Test Method for Measurement of Dry Film Thickness of Thin-Film Coil-Coated Systems by Destructive Means Using a Boring Device.
3	Solvent Resistance/Cure	M.E.K. Rub Test	ASTM D5402	Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs.
4	Film Hardness	Pencil Hardness Test	ASTM D3363	Standard Test Method for Film Hardness by Pencil Test.
5	Gloss	Gloss Meter	ASTM D523	Standard Test Method for Specular Gloss.
6	Flexibility	T-Bend Test	ASTM D4145	Standard Test Method for Coating Flexibility of Prepainted Sheet.
7	Adhesion	Impact Test	ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
		Corss Hatch Adhesion Tape Test	ASTM D3359	Standard Test Methods for Measuring Adhesion by Tape Test.
8	Corrosion Resistance	Salt Spray Test	ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus.
		(Evaluating Blistering)	ASTM D714	Standard Test Method for Evaluating Degree of Blistering of Paints.
9	Water Resistance	Humidity Cabinet	ASTM D2247	Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity.
10	Light Degradation Resistance	QUV Test	ASTM G154	Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials.
			ASTM D4587	Standard Practice for Fluorescent UV-Condensation Exposures of Paint and Related Coatings
Other	Weathering Tests	Multi-Element Testing	ASTM D5894	Standard Practice for Cyclic Salt Fog/UV Exposure of Painted Metal
			ASTM D822	Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings
			ASTM G152	Standard Practice for Operating Open Flame Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials

A summary of the tests reviewed in this article

In summary, we can see that a series of rigorous processes help achieve a high-quality finish for painted metal products. Detailed testing and a controlled production process both guarantee that the painted metal finish is durable and will stand the test of time. End users should always source material from reputable manufacturers that employ these testing methods.

A high-quality painted finish forms only part of the total performance of the metal roof or wall solution. The paint-system, the type of roof or wall product, the quality of the installation, and the installed environment all influence the longevity of a metal roof or wall. To learn more about the different metal roof and wall product considerations, download one of our design guides available at Steelscape.com.