

Metal Panel Thickness vs Gage

INTRODUCTION

Given: A metal roof is damaged by hail. The insurance company has determined that it is a covered loss. It needs to be replaced.



Task: Provide a replacement product. We need to match the look and the performance of the material. How do we select a panel today that will meet or exceed a panel at the site.

Answer: All we have to do is figure out what steel gage was used, copy the profile, find a matching color, and we are good. Right?

It's not that easy. It is more than just supplying the same thickness of steel. Here are a few factors to consider:

- A. As a minimum, the replacement material must meet or exceed the building code requirements for the load carried and the span provided.
- B. If the manufacturer is still producing the product, then it's very easy: just order the same thing.
- C. If the product is old or we don't know who made it, we should match the strength, the profile, the color and the durability. However, we don't really have to worry about durability. Today's coatings far exceed yesterday's technology.
- D. The strength of steel panel is a factor of the steel thickness and the steel chemistry. Not all steel has the same strength. There are softer steel such as Grade 33, and there are stronger steel such as Grade 80. Resistance to an applied load is a function of the material thickness and the material strength.
- E. A field measurement of the thickness includes the base steel thickness, the corrosion protection, and the paint. Each must be considered when evaluating a suitable replacement.

1. Gage (Gauge) Designation

Thickness refers to the actual measurement of the metal panel's physical dimension, usually expressed in inches.

The question "what is the gage thickness" is not a good question.

Gage or Gauge are used interchangeable. The words are identical and mean the same thing. Manufacturers have been moving away from the gauge system.

Gage is an older system that refers to the thickness of metal sheets prior to any coatings. The gage number is inversely related to the thickness: the lower the gage number, the thicker the metal. For example, a 26-gauge steel panel (0.0188 inches) is thinner than a 22-gauge steel panel (0.0313 inches).

In the U.S., the most common steel gage numbers for metal roofing are 22, 24, and 26; however, the gage system is not standardized. Gage numbers are different for different materials (e.g., aluminum and steel use different gage tables).

There is no "National Standard" that specifies what thickness must be met for a specific gage. Manufacturer's order steel by specifying a minimum thickness. Therefore, what a manufacturer orders from a steel supplier may not be the same as other manufacturers.

The closest standard there is for gage thickness is 15 USC 2006. This standard is used for determining duties and taxes levied by the United States, but it is not a material standard that steel manufacturers or suppliers must satisfy.

15 USC 206: Standard gauge for sheet and plate iron and steel shows the following common thickness. Taking a 5% reduction as a minimum variation in thickness, the last column in the table shows common thickness used by manufacturers in the US.

Gauge	inches	inches	-5%
18	1/20	0.0500	0.0475
20	3/80	0.0375	0.0356
22	1/32	0.0313	0.0297
24	1/40	0.0250	0.0238
26	3/160	0.0188	0.0178
29	9/640	0.0141	0.0134

2. Material Strength

When metal panels were introduced into the building industry, there was one strength of steel available. Through innovation stronger metals were created. A 80 ksi piece of steel is much stronger than 40 ksi. It outperforms the softer material against impact and carrying weight such as snow.

If we simply want to match thickness, then we must consider three things:

1. The base minimum thickness
2. The corrosion protection thickness
3. The paint thickness

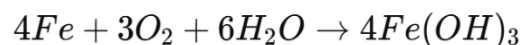
When evaluating metal panels, the question often comes up as to how thick the panels are or what was the panel gage number.

Thickness and gage are often used interchangeably, but they are not the same. Understanding the difference between thickness and gage, especially in the context of galvanized and painted metal roofing materials, is essential for making informed decisions when providing a replacement material.

Strength is not just related to thickness. There are other factors.

3. Corrosion of Steel

Steel will rust when left out in the elements. The basic chemical equation for the corrosion of exposed steel is a reaction of iron, water, and oxygen to form rust:



Because of this equation, metal panels are coated on both sides with zinc (galvanized) or a combination of zinc and aluminum (galvalume) to prevent corrosion.

4. Galvanized Steel (G40, G60, G90)

ASTM A653 is a standard specification that defines the requirements for steel sheet coated with zinc. G40, G60, G90 are the typical coating weights that are used.

G90 galvanizing refers to a specific coating thickness standard for galvanized steel. The "G" stands for galvanized, and the "90" refers to the weight of zinc applied to the steel, measured in grams per square meter (oz/ft²).

G90 means that there is 0.90 oz/ft² of zinc coating on both sides of the steel. This is a common coating standard for steel products that require moderate corrosion protection, such as for roofing, siding, or structural steel in outdoor or mildly corrosive environments.

The higher the "G" number, the thicker the zinc coating, which provides better protection against rust and corrosion.

The galvanizing process is a chemical reaction that takes place on the surface of the steel. The process adds thickness that cannot be removed.

The added thickness (in inches) is approximately the values shown below:

	Single side	Both sides
G40	0.0007	0.0014
G60	0.0010	0.0020
G90	0.0015	0.0030

This means the minimum thickness of a 24-gauge metal roof panel with G90 galvanizing would measure to be approximately 0.0238 + 0.003 = 0.0241 inches.

5. Galvalume (AZ50, AZ55, or AZ60)

ASTM A792 is a standard specification that defines the requirements for steel sheet coated with aluminum and zinc. AZ50, AZ55, AZ60 are the typical coating weights that are used.

AZ50 means that there is 0.50 oz/ft² of aluminum-zinc coating on both sides of the steel.

The added thickness (inches) is approximately the values shown below:

	Single Side	Both Sides
AZ50	0.0016	0.0032
AZ55	0.0017	0.0034
AZ60	0.0019	0.0038

Galvalume adds more thickness to the steel than Galvanizing. In either case, all metal roof panels measure thicker than the ordered material because of the added coatings.

This means the total thickness of a 24-gauge metal roof panel with AZ60 galvalume would measure to be approximately 0.0238 + 0.0038 = 0.0276 inches.

6. Painting

After the panels are formed, they may be painted to enhance their durability and appearance. There are numerous types of paint. The exposed surface may be different than the unexposed surface.

Paints have become high tech. Even the paints are chemically bonded to the steel and are very difficult to remove, if not impossible. Different types of paint provide different levels of protection depending on exposure, climate, and potential impact.

In general, the coatings that are produced today far exceed the coatings of the past. However, there are better coating available for a price. Not all paints are the same.

Paint thicknesses must be added to the thickness that was ordered when measuring a roof panel.

Primer layers vary from 0.0003 to 0.001 per side. Thick film paint layers vary from 0.004 to 0.012 per side. The table below shows a typical coating profile:

top coat paint	0.00070
top coat primer	0.00030
bottom coat backer	0.00035
bottom coat primer	0.00035
	0.00170

This means the total thickness of a 24-gauge metal roof panel with a G90 galvanizing and the above paint system would measure to be approximately $0.0238 + 0.003 + 0.0017 = 0.0285$ inches.

7. Metal Panel Formation

Large coils of metal are unrolled and fed into a machine where they're flattened into large, thin sheets or strips. These sheets are then cut into desired lengths.

The metal sheets are fed into a roll-forming machine, which shapes them into the desired panel profile (e.g., ribbed, standing seam, or corrugated). This process involves passing the sheets through a series of rollers that gradually bend and form the metal into the desired shape.

There can be differences in the measured thickness of formed panels because of rolling.

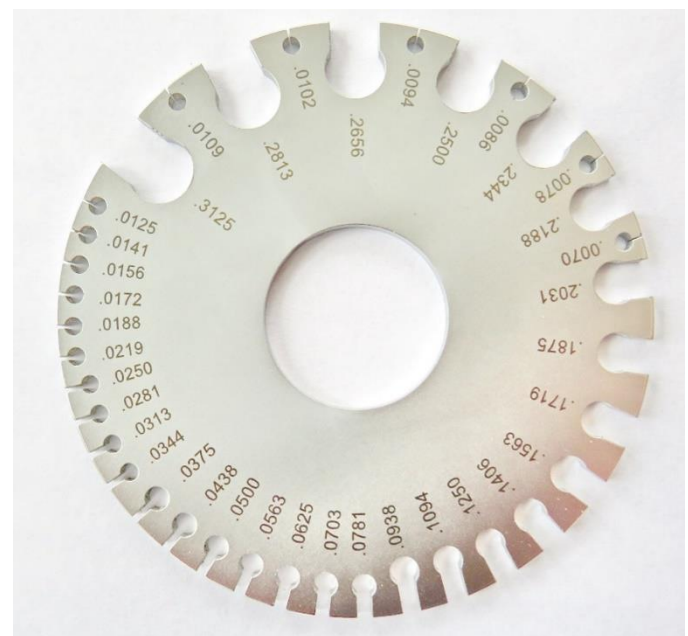
For this reason, steel coils will be ordered with a minimum thickness.

8. Gage Measurements Tools

Handheld tools are good, if we know what they are measuring. Different handheld gage tools are used for measuring sheet metal.

Some of these have adjustments for coatings. Some do not. When using a true measuring device, the coating must be considered.

The following gage tool reads uncoated bare steel without galvanizing or paint.



9. Thickness Measuring Tools

A micrometer measures the true thickness of the material. The instrument might have a digital screen or the thickness may need to be read directly on the sleeve of the instrument. Both types of micrometers are shown below.



10. Summary

Thickness refers to the actual measurement of the total material.

When determining a replacement panel for a building we must consider the coatings when measuring the thickness and trying to relate that to a specific minimum thickness.

The gage metal designation is an old unstandardized system that express the thickness of the steel prior to any coating. It is somewhat obsolete.

We cannot do away with the distinction that describes the base thickness of the steel prior to the addition of coatings or protecting layers of paint.

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