METAL CONSTRUCTION ASSOCIATION

Metal Roof Installation Manual

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BUILD LEGACIES METAL

Chapter 3: Introduction to Metal Roofing Materials

Chapter Contents

3. INTRODUCTION

Metal roofing is manufactured from a variety of metals and alloys. These same materials are often coated in the factory with a high performance paint system. An installer must be familiar with some of the characteristics of these various materials and finishes, and how they affect working with each material.

Product selection is not the installer's job (although it may be in some cases), but it is important to understand that not every job requires the same material or coatings. Even when a job appears similar to another job, there may be other factors that will require different fasteners, materials, or methods. The installer must make sure that the correct products are being used for the job, and not accidently mix products with different gauges, materials, or coatings.

Understanding the material in this chapter is necessary; not only for new construction, but for any reroofing and repair work that involves only portions of a roof, or interfacing with another roof.

Using the wrong fasteners, materials, or method for the job will cause any roofing system to fall short of its expected performance.

Gauge indicates the thickness of the sheet material. It is often stated as a number. Common gauges for metal roof panels vary from 20 to 29 gauge. The lower the gauge number, the thicker the material. The exact thickness will depend on the type of material such as stainless steel, or aluminum. In most cases, the lower gauge, thicker material is a stronger, more durable product within the same type of material. A material with a lower gauge number will weigh more, and may also be more difficult for the installer to work with.

The gauge table below, Table 3-1, lists the gauge and sheet thickness in inches of the more common aluminum and steel roofing materials.

Sheet Thickness (Inches)								
	Uncoated Steel		Stainless Steel		Metallic Coated Steel		Aluminum	
Gauge No	Nominal	Tolerance Range	Nominal	Tolerance Range *	Nominal	Tolerance Range	Nominal	Tolerance Range *
10	0.1345	.1405 to .1285	0.1406	.1466 to .1346	0.1382	.1472 to .1292	0.1019	.1059 to .0979
11	0.1196	.1256 to .1136	0.1250	.1300 to .1200	0.1233	.1323 to 1143	0.0907	.0942 to .0872
12	0.1046	.1106 to .0986	0.1094	.1144 to .1044	0.1084	.1174 to .0994	0.0808	.0843 to .0783
13	0.0897	.0947 to .0847	0.0937	.0977 to .0897	0.0934	.1014 to .0854	0.0720	.075 to .0690
14	0.0747	.0797 to .0697	0.0781	.0821 to .0741	0.0785	.0865 to .0705	0.0641	.0671 to .0611
15	0.0673	.0723 to .0623	0.0703	.0733 to .0673	0.0710	.0770 to .0650	0.0571	.0601 to .0541
16	0.0598	.0648 to .0548	0.0625	.0655 to .0595	0.0635	.0695 to .0575	0.0508	.0538 to .0478
17	0.0538	.0578 to .0498	0.0562	.0592 to .0532	0.0575	.0625 to .0525	0.0453	.0478 to .0428
18	0.0478	.0518 to .0438	0.0500	.0530 to .0470	0.0516	.0566 to .0466	0.0403	.0428 to .0378
19	0.0418	.0458 to .0378	0.0437	.0467 to .0407	0.0456	.0506 to .0406	0.0359	.0379 to .0339
20	0.0359	.0389 to .0329	0.0375	.0395 to .0355	0.0396	.0436 to .0356	0.0320	.0340 to .0300
21	0.0329	.0359 to .0299	0.0344	.0364 to .0324	0.0366	.0406 to .0326	0.0285	.0305 to .0265
22	0.0299	.0329 to .0269	0.0312	.0332 to .0292	0.0336	.0376 to .0296	0.0253	.0273 to.0233
23	0.0269	.0299 to .0239	0.0281	.0296 to .0266	0.0306	.0346 to .0266	0.0226	.0246 to .0206
24	0.0239	.0269 to .0209	0.0250	.0265 to .0235	0.0276	.0316 to .0236	0.0201	.0221 to .0181
25	0.0209	.0239 to .0179	0.0219	.0234 to .0204	0.0247	.0287 to .0207	0.0179	.0199 to .0159
26	0.0179	.0199 to .0159	0.0187	.0202 to .0172	0.0217	.0247 to .0187	0.0159	.0179 to .0139
27	0.0164	.0184 to .0144	0.0172	.0187 to .0157	0.0202	.0232 to .0172	0.0142	.0162 to .0122
28	0.0149	.0169 to .0129	0.0156	.0171 to .0141	0.0187	.0217 to .0157	0.0126	.0146 to .0106
29	0.0135	.0155 to .0115	0.0141	.0156 to .0126	0.0172	.0202 to .0142	0.0113	.0133 to .0093
30	0.0120	.0140 to .0100	0.0125	.014 to .0110	0.0157	.0187 to .0127	0.0100	.0120 to .0080
* = tolerance is for 36 in. widths, 48 in. widths have slightly greater tolerance range								

Table 3-1
Gauge Table For Common Roofing Metals Measured In Inches
(Based on ASTM-AISI Thickness Tolerance Ranges)

3.1 Basics

Common to every roofing material are characteristics like grades, alloys, and tempers. These "basics" will help determine how a material cuts, bends, and reacts to an installer's handling.

3.1.1 Grades

Grades refer to the chemical make-up of the material, such as low or high carbon steel. Grade number may also affect other characteristics of the material such as yield strength, or workability. The installer may notice differences in cutting, bending, drilling, and fastening the material. Tool life may also be affected by the grade of the material being used.

3.1.2 Alloys

Often terms like aluminum, copper, and zinc are used to describe the make-up of a product. In reality, the product is not made of a pure form of the metal, but an alloy of that metal. Rarely is the pure form of a metal suitable for the purpose it may be used. Aluminum, for example, in its pure form, is very soft and lightweight, but tears easily. Using an aluminum alloy, a blend of aluminum and one or more other metals, the good qualities of aluminum can be maintained while improving its weaknesses.

An installer uses a variety of materials identified only as aluminum, steel, or copper. Remember that, in reality, these may be several different alloys. Each alloy will have different characteristics, and may present some of the same issues mentioned in the grading section above. Various alloys, especially copper alloys, will age and weather differently. They will show very different colors as they age.

3.1.3 Tempers

Temper refers to the state of metal in terms of hardness or strength. Metal is tempered by the application of heating and cooling cycles at the time of manufacture.

In manufacturing, metal is often tempered, or annealed, to make it easier to form and shape. Depending on the part and its intended use, this process may also be used to harden it where additional strength and support is needed.

Tempering, or annealing, may affect other characteristics of the material. Installers will notice the temper of a material when it is necessary to cut, drill, or bend the material.

3.2 Unpainted Metal

The most common unpainted metal roofs are aluminum, metallic-coated steel, copper, stainless steel, and zinc. As these metals age, they oxidize and provide a natural protection from weathering. The roof develops a beautiful natural finish called a patina. (Figure 3-1) This patina varies and can be uneven. Repairs on such older roofs can be challenging and impossible to visually match. There may be, however, methods available to "pre-weather" newer material in order to give it the appearance of an older, aged roof.

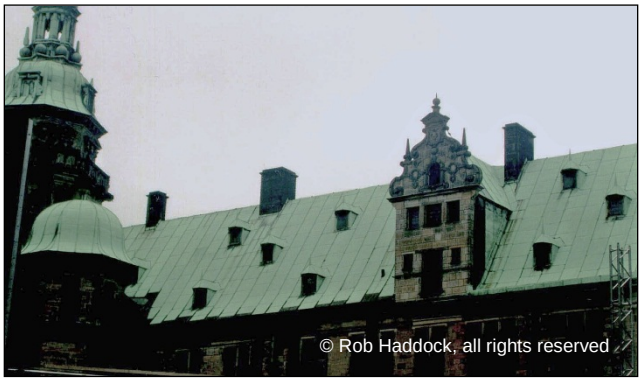

Figure 3-1
Aged Copper Roof Showing Blue-Green Patina

Steel, the most commonly used roofing material, requires some sort of covering to protect it from the weather and corrosion. Instead of paint, steel is often coated with another metal, usually zinc or a zinc-aluminum alloy.

3.2.1 Aluminum

Aluminum roof panels are often installed where resistance to severely corrosive environments is required. Coastal locations and heavy industrial manufacturing areas are two areas where aluminum panels are often used. The salt-filled coastal air and exposure to chemicals, pollutants, and even acid rain in manufacturing areas, make the excellent corrosion resistance of aluminum an attractive roofing choice. (Figure 3-2)

Figure 3-2

Roof Corrosion Due to Pollutants and Chemicals in Roof Exhaust System

Aluminum's excellent corrosion resistance is due to the formation of a thin invisible layer of aluminum oxide which protects the aluminum from any further corrosion. As mentioned earlier, while pure aluminum is excellent at resisting corrosion, it is too soft, and lacks the strength required for roofing material. Pure aluminum would display poor performance in hail storms or strong winds.

Aluminum alloys are used to provide the required structural strength for roofing panels. Tempering is often used to add strength to the initial alloy. When aluminum is specified, both the alloy **and** temper must be stated. For example, 3003 H14 is a 3003 aluminum alloy tempered to H14 hardness (heat or strained-hardened to the required strength). Caution must be taken to make sure additional material, or repair material, used by an installer is compatible with what was initially specified.

A common nominal thickness for aluminum roof panels is 0.032 inches. Where longer spans are required, 0.040 inch thick material may be used. Installation of aluminum panels will be different than panels of other materials. The thermal expansion characteristics of aluminum will cause the panels to expand and contract twice the amount of an equivalent sized piece of steel. Fasteners and attachment methods must accommodate this anticipated thermal movement.

3.2.2 Copper

Copper was one of the first metal roofing materials to be used by man. Copper has always been an attractive material for roofing due to its appearance, workability, low maintenance and longevity.

As copper ages its color changes from the formation of a low gloss dark patina. After several years, the copper develops a blue-green patina as shown in Figure 3-1. In cleaner, dryer environments, it may take up to 40 years to develop this blue-green color, depending on its orientation.

Describing Copper Thickness

Copper Thickness in Inches, Gauge, and Ounces

0.0100	30	
0.0162		12
0.0216		16
0.0270		20
0.0320	20	24
0.0431		32
0.0500	16	
0.0620	14	
0.0800	12	

Figure 3-3
Copper Thickness by Weight and Inches

Copper is specified by thickness and temper, but is measured differently than aluminum. Copper thickness is also denoted by weight, and is not normally measured by thickness or gauge. Sixteen or 20 ounce (by weight per sq. ft.) copper is usually used for roofing, wall cladding, flashing, and trim material. This equates to a measured thickness of 0.021

and 0.027 inches, respectively, as shown on the chart below. (Figure 3-3)

As mentioned earlier, copper is a very ductile material and has very low yield strength. Copper cannot be used as a structural or load-carrying panel. All copper panels will require a structural substrate under them, and can be susceptible to damage from hail.

Care should be used to avoid copper material and run-off from copper material coming in contact with other materials such as aluminum or zinc. This is discussed in more detail at the end of this chapter.

3.2.3 Stainless Steel

Stainless steel is not a pure metal, but a steel alloy containing high percentages of chromium. The addition of various other metals increases its resistance to corrosion. Types 302 and 304 stainless are common types for roof panels while Type 316 stainless is often used in highly corrosive environments. Stainless steels with soft tempers are used for roof panels.

Stainless steel sheet is available in a variety of finishes from a dull matte to a highly polished surface. When specifying or replacing stainless steel, the finish, alloy type, and temper are all important and must be specified.

Thickness of stainless steel sheet is typically specified in 26, 24, or 22 gauge thicknesses, but the trend in today's industry is to specify it in inches of the actual material design thickness.

3.2.4 Zinc

Zinc sheets are made from nearly pure zinc, but have trace amounts of copper and titanium. This material is sometimes referred to as "titanium-zinc." Nominal thickness of zinc sheets are 0.027 and 0.032 inches, and are normally shipped with what is called a mill finish, but may also be available as a "pre-weathered" variety, or other various colors and shades. Mill finish sheets will typically turn a dark gray color, with no gloss, as they weather.

Rapid draining and fast drying of zinc sheets minimizes any corrosion. Therefore, zinc roof panels are not used in low slope applications. However, manufacturers often apply finishes to both sides of the sheets to reduce corrosion.

Zinc may be more brittle than most other metals, requiring special manufacturing and fabricating techniques. Zinc generally needs to be installed over a solid substrate and requires a working metal temperature above 48° F (9°C) during field fabrication to prevent fracturing. Inside corner cuts should be made with the use of punched holes in order to avoid tearing the material.

For instance, when notching zinc material, a radius should be used at the termination of the notch, or fracturing of the metal may occur. Zinc is malleable, meaning it can be hammered and shaped without breaking. It is also solderable and often used in the same types of applications as copper.

Although zinc has similar features to copper, any contact between copper and zinc should be avoided. This includes run-off from copper pipes or copper roofs. Compatibility of zinc, copper, and other metals will be discussed at the end of this chapter.

Zinc can be melted and used to cover thin steel. It is often hard to tell the difference between pure zinc sheets and zinc-coated steel. Here is a tip: zinc is nonmagnetic. All that is needed is a magnet. A magnet will not stick to a pure zinc sheet, similar to how a magnet reacts with aluminum.

3.2.5 Metallic Coated Steel

Steel is an ideal material for roof panels because of its strength and ability to be

formed. A characteristic of uncoated steel is that it rusts easily. This characteristic has been overcome by covering the steel with a thin coating of another metal. Zinc, aluminum, or aluminum-zinc alloys are the most common metallic coatings an installer will come across, but there are others.

The metallic coating is applied using a continuous hot-dip process, Figure 3-4. Steel sheet rolled into large coils are unwound at high speeds. The sheet is cleaned, heat-treated, and passes through a vat of molten coating material. The coated sheet is then cooled, dried, and the metal further treated. This coating forms a strong metallurgical bond which protects the steel from rust and corrosion.

Figure 3-4
Hot-Dip Material at a Production Plant

Although this metallic-coated steel is typically specified in various gauges, the actual thickness may be quite different due to the metallic coatings. To eliminate confusion, the current trend is to specify this material in terms of the thickness of the steel base material and metallic coating, in mils or inches, exclusive of paint. (1 mil = .001")

The two most frequently used metallic coatings are zinc and an aluminum-zinc alloy. Both coatings are applied using the same hot-dip process. Installers need to know the common terms and material characteristics of each when coated steel is being used on a job.

Installer Note on Welding

Steel **can** be welded; coated steel **cannot**. Welding destroys any metallic coating around the welded area, creating an ideal opportunity for rust and corrosion. This can be clearly seen in Figure 3-5 below. Any welds made must be protected from corrosion. However, brush applied, or spray-dried coatings, even those with zinc or aluminum particles, will not have the life or maintenance freedom of the original hot-dip coating. In addition, the surface of any metal roof should be covered and protected when welding is taking place due to splatter and heat.

Figure 3-5
Corrosion Due To Welding - Coated Material
Destroyed By Heat from Weld

3.2.5.1 Galvanized

Galvanized steel is one of the oldest, and may be the most common of the metallic coated materials. It is the standard hot-dip metallic-coated sheet material to which all other products are compared. The thin steel base is coated on both sides with molten zinc, providing an economical and corrosion resistant roofing material. (Figure 3-6)

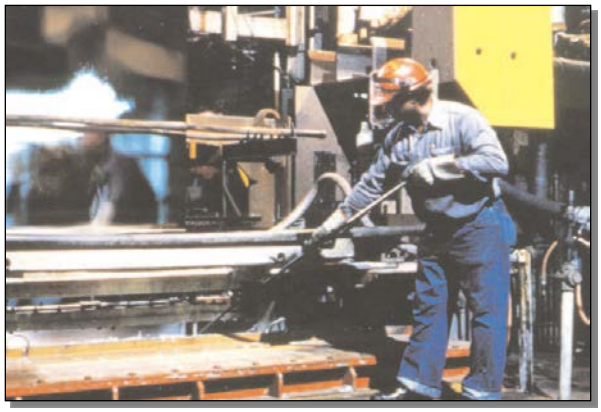

Figure 3-6
Zinc Coating of Steel

Zinc provides a strong bond to the steel. As zinc oxidizes, it has what is referred to as "self-healing" or sacrificial properties. For example, if the material is scratched or cut, exposing the steel base material, the zinc will sacrificially corrode, protecting the exposed steel from corrosive attack. This is illustrated in Figure 3-7.

Unfinished galvanized steel, by itself, does not provide adequate long-term corrosion protection. Galvanized roof panels are commonly factory-painted to provide additional protection and ensure the availability of zinc protection of the steel if needed.

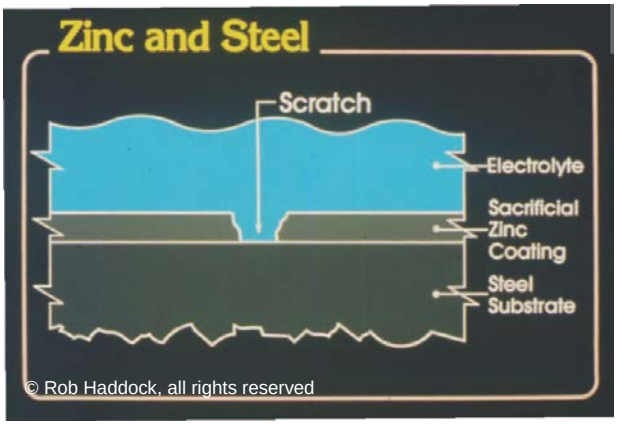

Figure 3-7
Self-Healing Property of Zinc Coating

There is a range of zinc coating thicknesses available for roofing panels, designated by terms such as G60 and G90. The numerals refer to the weight of the zinc coating. A G60 coating weight indicates 60 ounces per 100 square feet, or 0.60 ounces per square foot. A G90 coating weight indicates 90 ounces per 100 square feet, or 0.90 ounces per square foot. Keep in mind this weight refers to total weight of the coating on both sides. This translates to an average zinc coating thickness *on each side* of 0.5 mils for G60 and 0.8 mils for G90. For reference, a coating of 1 ounce per square foot would be a total of 1.7 mils, 0.85 mils per side.

3.2.5.2 Aluminum / Zinc Coatings (Galvalume®)

Galvalume® coated steel sheet was commercially introduced in 1972. Galvalume® is an internationally recognized trademark of BIEC International Inc. It is a 55/45%, by weight, alloy of aluminum and zinc. By volume, it represents 80% aluminum and 20% zinc. Galvalume® provides excellent corrosion resistance combining the galvanic protection of zinc with barrier protection of aluminum.

Standard Galvalume® coatings for steel panels are also designated by weight. AZ50 panels will have a coating weight of 50 ounces per 100 square feet, or 0.50 ounces per square foot. A rating of AZ55 will have 55 ounces per 100 square feet, or 0.55 ounces per square foot. These ratings, AZ50 and AZ55, translate to a coating thickness of 0.8 mils per side for AZ50 and 0.9 mils for AZ55. For reference, one ounce per square foot is 3.2 mills, or 1.6 mils per side

AZ50 is a common weight for painted Galvalume®-type panels. AZ55 is often used for unpainted or clear-coated Galvalume® type panels.

Around 1997, manufacturers began applying a very thin layer of clear acrylic, eliminating the need for lubricant. This

resulted in roof panels that were more uniform in appearance, resisted fingerprints and smudging, and slowed the effects of weathering. The clear acrylic coating is not intended to be a permanent finish, but weathers away after a period of time. Acrylic-coated Galvalume® is also sold under different trade names such as Galvalume Plus®[1], Zincalume Plus®[2] and Acrylume®[3].

Care should be used when bending Galvalume®. Warranties on Galvalume® will usually specify a minimum bend radius for the material. Normally this is not a problem for roll-formed shapes, but the bend limits may be exceeded when brake-formed. When the limits are exceeded, the material on the outside radius of the bend develops micro-fractures that may cause premature corrosion at the bend line. Typical minimum bend limits of Galvalume® are stated as "2T" meaning the bend radius must be at least twice the thickness of the material.

3.3 Painted Metal – Primary Performance Types

Additional protection and aesthetic improvements are added by painting the metal roof material. Paint is composed of three parts: **pigment**, **resin**, and **solvent**. Installers are not normally involved in the painting of metal roofs, but they may be involved in touch-up, maintenance, or repairs which often require the application and knowledge of paint used for metal roofs.

Before going any further and discussing various types of paint, a key point needs to be emphasized:

NO FIELD-APPLIED PAINT OR TOUCH-UP WILL BE AS GOOD, OR LAST AS LONG, AS ORIGINAL, FACTORY-APPLIED PAINT.

This point will be understood as the three parts of paint are discussed separately, and the installer understands how paint deteriorates.

Solvent is the liquid used to carry the pigment and resin to the surface of the panel. The solvent evaporates during the oven curing process, leaving a solid coating of just pigment and resin.

Pigment is the color particles that are seen. Its purpose is not only to provide the color, but to hide the primer and substrate.

Resin is the clear substance that surrounds the color particles and binds the coating to the substrate. It also provides the weather resistance and durability that are so important to architectural products. The pigment and resin are blended in an approximate 50-50 ratio.

Weathering of paint is the gradual degrading of either the pigment, resin, or both. The breakdown of resin is known as "chalking" due to the appearance of a chalky substance on the paint surface. Breakdown of the pigment is called "fade." Fading is the gradual changing of the color towards white. Breakdown of the resin and pigment is primarily caused by exposure to the ultraviolet rays of the sun. It is important to know that there is no paint that does not fade or chalk. However, with the ingredients and application methods used in the formulation of today's premium metal roofing paints, most allow for long time appearance protection.

Paints are generally referred to by their resin types, such as acrylic, polyester, fluoropolymer, and many others. Some paints will blend and mix several types of resins. The two most common paint types used in metal roofing are silicon-modified

[1] Galvalume Plus® is a registered trademark of BIEC International, Inc.

[2] Zincalume Plus® is a registered trademark of BHP Steel (JLA) Pty Ltd.

[3] Acrylume is a registered trademark of US Steel Corp.

polyesters (SMP) and fluoropolymer based paints.

3.3.1 Silicone-Modified Polyester (SMP)

Siliconized polyester is composed of silicon additives in a base resin of polyester. The addition of silicon supplements the paint's performance by improving gloss retention and weather resistance. As a general rule, "the higher the percentage of silicon, the better the paint performance." Some manufacturers also add ceramic pigments to reduce color fading. It is economical and long-lasting.

3.3.2 Fluoropolymer Paints

Fluoropolymer paints are better known in the industry by their trade names of Kynar 500® and Hylar 5000®. These paints use a resin of 70% fluoropolymer/30% Acrylic, and are considered the most durable paint in the industry. The formulation provides the ultimate protection for metal roofs and other architectural materials. This type of resin is also referred to as PVDF (Polyvinylidene fluoride).

When specifying or selecting this 70% fluoropolymer paint, it should be specified as "Kynar 500" or "Hylar 5000." Merely stating Kynar/Hylar paint will **NOT** guarantee a 70% resin, and quality issues may arise.

3.3.3 Other Paint Finishes

There are many additional paint and resin types being marketed. Within each type, there are many classes and grades that will vary in performance. Care must be taken to ensure all the pieces of the roof system will match, not only in color, but in performance, over the years.

Some roof systems have a metallic finish which was directionally applied. This type of material is stamped indicating a direction for reference. The installer must make certain that each piece of this material is installed in the proper orientation. Any panel, or trim piece, installed in the wrong direction will be very distracting visually.

3.4 Stone-Coated / Granular

Very few products show the versatility and variety that are shown by today's metal roofs.

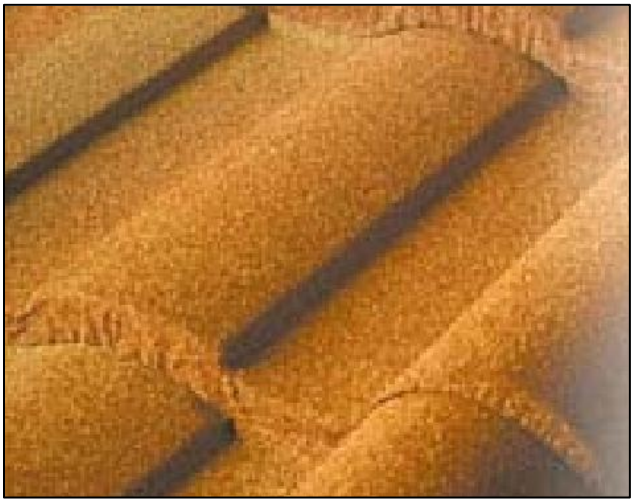

Figure 3-8
Granulated Covered Metal Panels Formed to Simulated Tiles

Stone or granular coated panels, like those shown in Figure 3-8, are treated metal panels which have been formed and shaped, painted a base color, then covered with crushed, granular pieces of stone using a special epoxy to bond the particles to the metal. An additional clear coating is normally applied over the top for extra protection.

For the installer, while the material may *look* like a traditional asphalt or tile roof, the proper application of a metal roof of this type will require different methods and considerations. Stone-covered panels may be more difficult to trim and cut without special tools and equipment, often including reshaping of the panel after it is cut.

Installation and fastening methods will vary, and fastener types may be different than those often used with other metal roofs. Extra care needs to be taken installing this

type of panel as they are easily dented and damaged if improperly walked on, or by the weight of the installer, stacked materials, or tools. The stone particles are also harder on any cutting and shaping tools used. Loose particles from cutting and bending of the panel can cause problems and should be removed from the roof.

3.5 Common Attributes

When properly installed as roofs, natural metal, metal alloy, coated metals, painted and stone-coated metal panels all share the same common attributes.

- **Longevity** – As shown in Figure 3-9, a metal roof can easily be expected to last 40-50+ years, depending on the environment and geography.

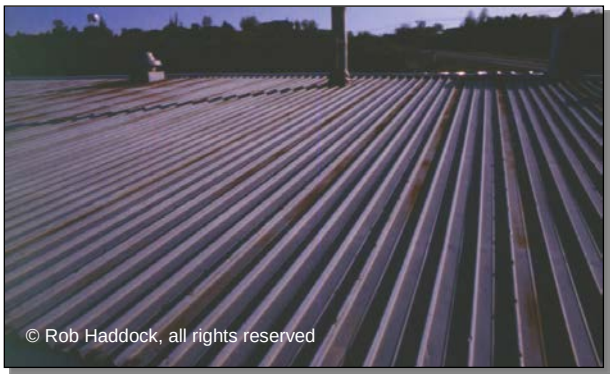

Figure 3-9
This Properly Installed 40 Year Old Roof Has Many More Years of Service Remaining

- **Durability** – resistance to fire, wind, ice, hail, and mold make metal roofs a positive option in most any environment or location.

- **Environmentally Responsible** – metal roofs are virtually 100% recyclable, and are made with a minimum of 25% recycled material, depending on the specific metal. Landfill issues are eliminated with metal roofing materials, and scrap value of used material is a positive attribute.

- **Lightweight** - Metal weighs about 40 to 120 pounds per square compared to wood, asphalt, or fiberglass shingles at 200-350 pounds per square. Slate and clay tiles weigh even more. Most metal roof materials are easier to lift and handle for the installer, and any structural support does not have to be as substantial as for other types of roofing material.

3.6 Compatibility

Metal roofing materials share many common attributes, but some materials do not work well together. The installer needs to be aware of certain compatibility issues and situations which may affect the performance of the installed roof.

Common enemies for metal roofs of any material are **corrosion**, **excess water**, **trapped moisture**, and **galvanic reaction** due to dissimilar metals. Specific installation details addressing these issues will be given in later chapters, but some key points on these matters need to be introduced at this time.

Corrosion is the process in which a solid, especially a metal, degrades and changes by a chemical action. For example, oxidation of iron in the presence of water by an electrolytic process is a form of corrosion. It forms iron oxide or rust. Oxidation requires both moisture and air in order to occur. Some metals, like aluminum and copper, actually form a hard protective coating when they oxidize, but when a zinc coating on steel is sacrificed, it becomes thinner, eventually exposing the steel it was covering.

Oxidation can occur very rapidly when **excess water** remains on a metal surface, or **moisture becomes trapped** against a metal surface. This is why metal roofing materials must be stored properly and provided proper air flow before being installed, and why certain materials, like

zinc, should not be used where there will be standing water and drainage problems. The resulting damage can be clearly seen on the new panels in Figure 3-10.

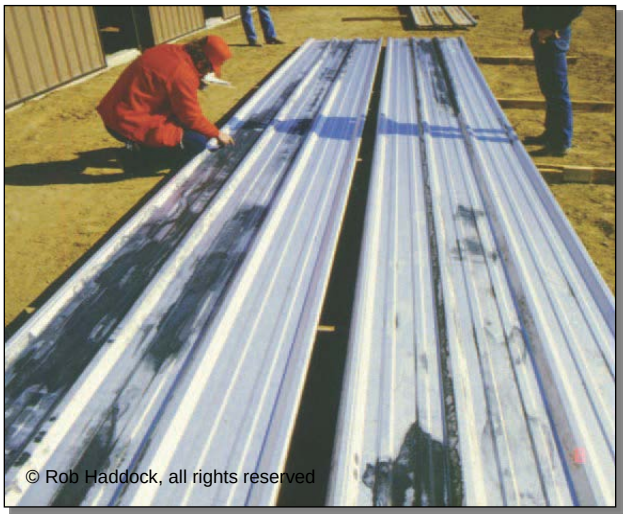

Figure 3-10
Stains on New Panels Due to Standing Water from Improper Storage of Material

Metal roofing panels can develop a form of corrosion when improperly stored, commonly called "storage stain." Zinc can also develop "white rust" when it is kept wet and unexposed to air. This white powder fails to give protection to the underlying metal. Other metals may experience similar conditions.

When different metals, and certain chemicals, are in contact with each other, an electrochemical reaction takes place which adds to the corrosion and breakdown of the metals. This reaction is known as a **galvanic reaction** due to the chemical make-ups of the dissimilar metals. This type of reaction can happen on most roofing jobs. When copper or copper run-off comes in contact with zinc or zinc alloys, corrosion quickly occurs. Be especially cautious of any copper plumbing (Figure 3-11), HVAC (Figure 3-12), or electrical materials (Figure 3-13) that may come in contact with, or have run-off on, the metal roof system. Realize that this additional work may take place *after* the roof has been installed, and the roof team leaves the work site.

Figure 3-11
Roof Corrosion Caused by Copper Pipes

Figure 3-12
Water Run-off from Copper Caused This Roof Corrosion

Figure 3-13
New Roof Corrosion from Direct Contact with Electrical Conductor

Aluminum is very susceptible to galvanic activity when it comes in contact with dissimilar metals. Care should be taken to avoid contact between uncoated aluminum and steel, especially where moisture is present. The worst corrosion of aluminum is the result of its interaction with copper, copper run-off, or drainage from copper pipes. Fasteners used on aluminum roof panels should be either stainless steel or aluminum.

The same is true of aluminum or aluminum-alloy roofing material around uncured mortar. Strong alkalis are detrimental to aluminum, and uncured cement products will stain and corrode certain metal roof materials. This can clearly be seen in Figure 3-14 below. Once the cement, or mortar, has cured, the problem is diminished.

Figure 3-14
Roof Staining and Corrosion Caused By Wet Mortar

Galvanic activity can also occur when no metals appear to be involved. For example, the use of fire retardant or preservative treated lumber should be avoided with all metal roofing material, except copper. The chemicals used in treated wood often have high concentrations of copper, salts, and other corrosive elements. When the materials get wet, these corrosives dissolve and attack the metal roofing material. (Figure 3-15)

Figure 3-15
Roof Corrosion from Treated Wood

Figure 3-16 shows this same corrosive reaction when graphite pencils are used to mark metal roofing material. The graphite quickly corrodes the metal, and within a short period of time, rust appears. It is recommended that a felt marker be used when marking metal roof panels.

Figure 3 - 16
Roof Corrosion from the Use Of a Graphite Pencil

Proper planning and coordination between the trades, and attention to details while storing, preparing, and installing the metal

roof will help prevent many of the compatibility issues discussed here and provide a quality, long lasting installation.

Notes:

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