

Color-Coated Purlins Used for Pre-Engineered Buildings

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INTRODUCTION

The paper discusses continuous color coating line to coat Narrow width, thicknesses up to 3.2 mm, pre-painted GI/GL coils with state-of-the-art design features. Paper also discusses tangible and intangible benefits of using color coated strips for Pre-Engineered Building solutions over the conventional methods.

BACKGROUND

India is the second fastest growing economy in the world and a lot of it, is attributed to its construction industry. In its steadfast development, the construction industry has discovered, invented and developed a number of technologies, systems and products. The journey of construction industry has gone through various techniques and PEB is one of the latest and rapidly growing techniques. We can easily say that PEB is the future of developing nations.

To make this concept more beautiful, more durable and corrosion free, APL Apollo, India has introduced a completely new concept of making purlins with Color Coated steel. It is a revolutionary change in the history of PEB and first ever option of pre-painted GI and GL options for purlins.

APL Apollo has introduced first ever narrow and thicker color coated coil and sheets named as NAVRANG, with width between 300-750mm and thickness between 0.3 to 3.2 mm in plethora of beautiful colors produced on the color coating line designed, manufactured and installed by YOGIJI DIGI.

An architect's wild imagination would prefer a 3D print instead of steel structure so the PEB industry will soon face competition from 3D printing. So the technological innovations in the PEB systems will need to compete with art and fantasy. Commercial viability and business economics is a direct derivative of mass acceptability. With time being a major cost, pre-engineered structures have become the preferred norms for industrial buildings and warehouses. With the increasing use of PEB's in all types of buildings be it hospitals, offices, commercial establishments, the demand for pre painted and printed steel will continue to grow multi-fold in the coming years.

CASE STUDY

Some manufacturers have shied away from using pre-painted metal parts when there is an exposed cut-edge in the design, for fear of corrosion. The National Coil Coating Association (NCCA) set out to put this misconception to the test. The NCCA, along with the help of PPG Industries, Inc., and the North American Zinc-Aluminum Coaters Association (NamZAC), worked together to compare the corrosion resistance of pre-painted metal louvers on air conditioning units to those coated with three types of post-paint.

Pre-painted louvers with exposed cut edges were tested in the field alongside three sets of metal louvers, one with a post-painted electro coat, a second with a powder finish and a third with a spray finish. The parts in all instances were made of hot-dipped galvanized steel; louvers were exposed to the same environment over time in Daytona Beach, Florida.

Comparisons made after 16 months, 39 months, 44 months and 68 months of exposure to the elements showed pre-painted parts were repeatedly and significantly better than the post-painted parts in terms of the corrosion resistance, uniformity of treatment and film thickness.

The reason that the pre-painted parts outperformed each of those with a post-painted application is due to the fact that pre-painted metal sheet is uniformly cleaned, pre-treated and painted as a flat surface, so the edge-to-edge and side-to-side variability is virtually eliminated. In addition, the pre-painted part also has two coats of paint, tightly bonded to the metal as compared to a post-painted part, which generally has only one coat of paint. In most cases, the pre-painted part has paint (one or two coats) on the backside as compared to the post-painted part, which at best has a minimal amount of overspray. Uniform pre-treatment and paint on the backside of a part increases the corrosion resistance of the part, enhancing long-term durability.

COIL COATING BENEFITS

Sometimes people think zinc is waterproof as it is used to protect other metals. However, this is not the case. The Zinc coating is sacrificial and will wear away over time. Rather than the water simply washing over the zinc without having an effect as it would if it were waterproof, the zinc starts to slowly corrode. As it is sacrificial, this means that the zinc defers to the metal it is protecting, significantly reducing the development of corrosion of the other metal. The steel or iron will not corrode as the zinc will corrode first, but eventually it will catch white rust and then red rust as shown in Figure 1. The zinc coating through hot dip galvanizing process is also not uniform.



Figure 1. Types of rust on zinc-coated sheets.

There is no prescribed standard for coating thickness for purlin. The standard purlins popular today is 275 gsm galvanized steel. Why 275 gsm, why not 200 or 300 or even higher. The high coating does not guarantee better corrosion resistance always, rather the thick layer sometimes solidify and get cracked.

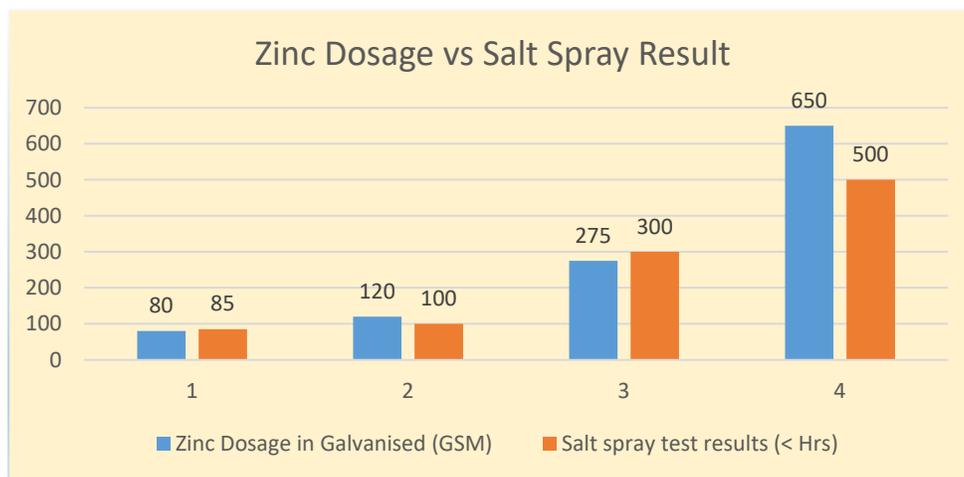


Figure 2. Zinc consumption on GI vs. corrosion results.

The Figure 2 clearly suggests that higher coating gives better corrosion resistance but the cost goes up on account of more zinc consumed per ton of steel. The aesthetics are also compromised with thick coating.

TECHNICAL SPECIFICATIONS OF THE THICK GAUGE COLOR COATING LINE

Type of Line	: Two Coat Two Bake Continuous Color Coating Line
Strip Width	: 250 – 710 mm
Strip Thickness	: 0.40 – 3.20 mm
Production rate	: 17.0 tons per hour
Chemical Coat	: 4 microns @ 80°C
Prime Coat	: 4 – 12 microns @ 250°C
Finish Coat	: 5 – 26 microns @ 250°C
Fuel	: LPG

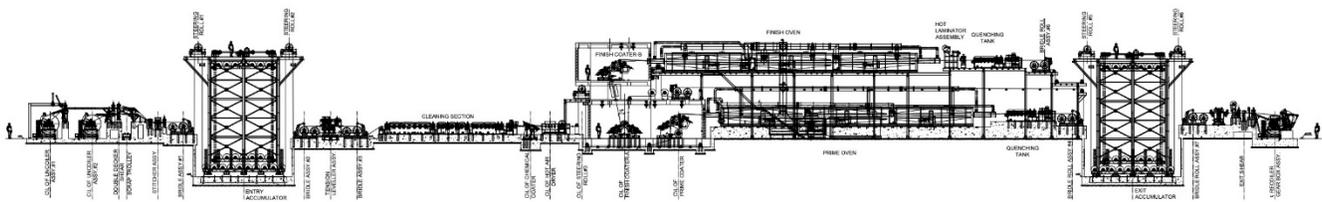


Figure 3. Line GA of the narrow thick gauge CCL.

The entry section of the line consists of two un-coilers and a coil stitcher to feed the incoming GI/GL coils into the entry accumulator.

The thick gauge GI/ GL are prone to shape issues, so an entry Tension Leveller is provided to take care of any shape issues in the incoming coils and also remove the coil set prior to coating.

The line is equipped with a pre-treatment section consisting of Alkali Degreasing Section 1, Brushing and Alkali Degreasing Section 2 and a Hot Air Dryer to prepare the coil surface.

A top and bottom chemical coater with chemical oven is provided to apply chromate based coating prior to the primer. The S-wrap Prime Coater with top and bottom coating facility and a catenary baking oven to ensure multiple layers of protection. The line has two Finish Coaters with quick color change and pattern coating options followed by the catenary baking oven.

The exit section consists of an accumulator, guard film applicator and a recoiler to coil the color coated strip.

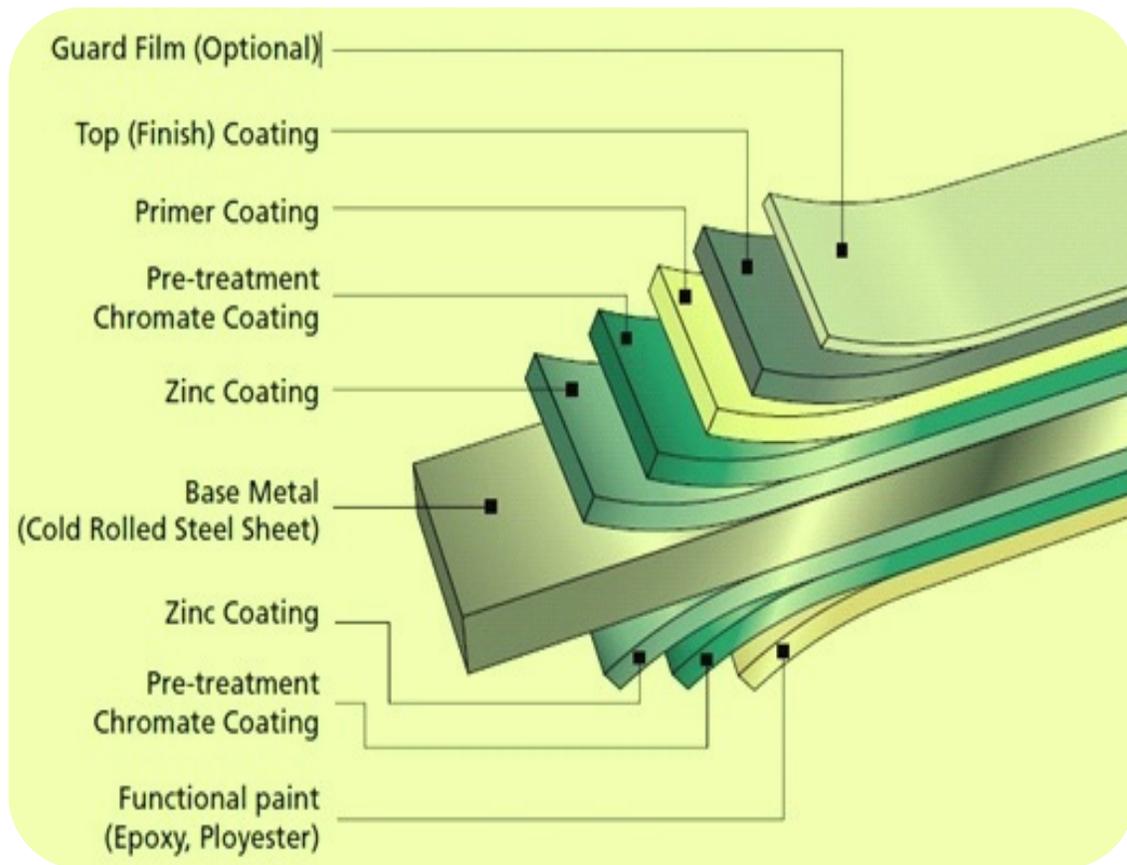


Figure 4. Multi layers of protection in the pre-painted coil.

The enhanced corrosion resistance observed when using pre-painted sheet as compared to other post-painted methods of application is so significant, that it is possible to reduce the metallic coating weights. The salt spray test result on PPGI sheet with 120 gsm coating were quite remarkable as shown in Figure 5.

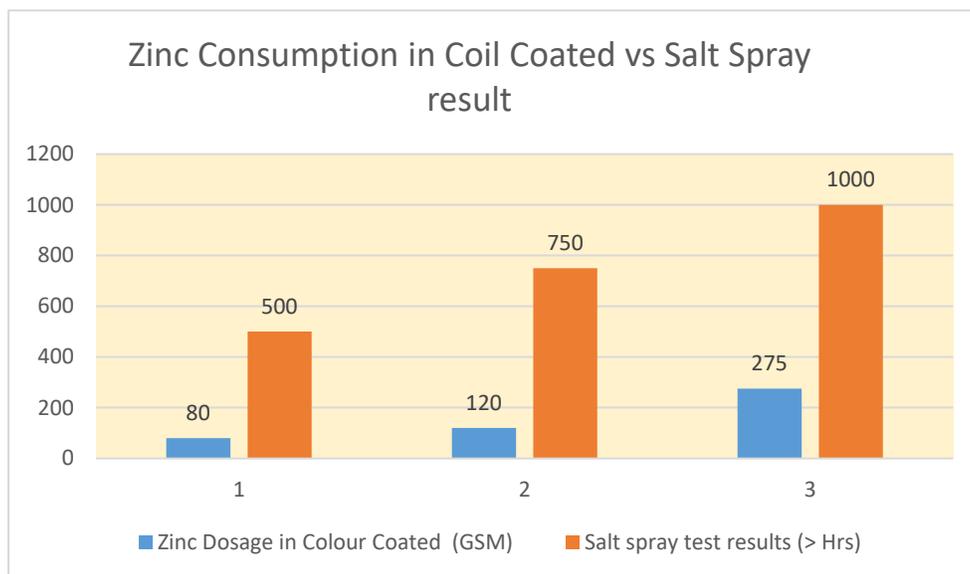


Figure 5. Zinc consumption on PPGI vs. corrosion results.

With thick gauge pre-painted steel available for purlins has ensured freedom from costly, labor intensive and inefficient post-paint systems. Long-term durability is a key property of any painted metal product. In particular, protection of a cut or exposed edge is critical, no matter what type of paint application method. It is more functional and durable and can be combined with

high-performance paint systems with an unlimited spectrum of colors and an array of properties. It is eye appealing without affecting long-term durability, corrosion and mar resistance, or functionality.

Table 1 gives the advantages of the pre-painted for pre-engineered buildings and it we should not forget that annual loss of steel due to corrosion accounts for about 1/10 of the entire steel production.

Table 1.

Basic Parameters required for PEB	Conventional Method of using Galvanized sheets	What does PPGI Purlins offer for PEB	Benefits of using PPGI in PEB
Salt Spray	≤ 120 Hrs	Between 750 to 1000 Hrs	Much better weatherability, Corrosion resistance and Humid resistance
Zinc Coating	275 GSM	120 GSM and 25 μ further paint coatings	100% Prevention from White Rust & Red Rust
Aesthetics	Only single color	Eye appealing with vast range of RAL shades	Innovative aesthetics
Durability	Short term shelf life	Almost 4x service life as compared to conventional	Products can be available with Long duration warranty periods
Processing time	In house paint processing	Readymade product available	No paint shop required at all and its much easier to work with.



Figure 6. Pre-painted Purlins in use for PEB.

The use of pre-painted purlins is quickly picking up with all the PEB companies in India. The next in line for the market is to produce pre painted reflective road crash barriers which will not only help reduce accidents but also give beautiful aesthetics to the country roadside.

Today, over 600,000 tons of zinc is consumed annually for galvanizing in North America alone and Zinc is not renewable resource. So it also plays a role towards conserving natural resources by reducing the zinc dosage wherever possible and converting those applications with pre-painted steel.

CONCLUSION

The advantages of narrow thick pre-painted coated sheets is as below:

1. Flexibility to the architects to play with pre-engineered building designs for better aesthetics
2. Do away with cumbersome manual painting activity at site
3. Longer life even with exposed cut edges
4. Better corrosion resistance even with less zinc coating
5. Opening of new market segments with superior features without cost impact
6. Availability in customized narrow widths for critical applications

ACKNOWLEDGMENTS

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