

## Quality Inspection of Pre-Painted Product

The final evaluation of pre-painted product to assure quality consists of two major types of assessment. They are:

1. Physical Tests
2. Visual Inspection

Physical tests are important to check that the paint has been applied and cured properly so that it will perform well in its end use. Visual inspection is important to confirm that there are no unacceptable visual defects, since coil coated metal must often satisfy an aesthetic requirement as well as one associated with performance. Following is a description of various tests and their importance for assuring the quality of pre-painted metal.

### Physical Tests:

**Film Thickness:** Having the right film thickness is critical for the long term performance of the paint film. For the primer, low film could result in premature corrosion or poor adhesion. For the topcoat, low film could result in premature failure due to weathering. High film is also a problem, as it is an added cost, which affects the profitability of the product.

**Color:** One of the main reasons for buying pre-painted product is to provide a specific colored appearance. Often the customer is matching the pre-painted product to other components of a building or product, so matching the color standard where specified is critical for good appearance of the final assembled product. For repeat colors, matching the standard on each run ensures that there will be consistency of color over time. Color must be consistent across the width of the strip, as well as between coils of an order. Many factors can affect color: paint formulation and quality, film thickness, substrate color, cure temperature (PMT) and dwell time in curing ovens or even contamination with other paints.

**Gloss:** Consistency in gloss is important to provide a uniform appearance to the customer. Their product may be made up of several components made from different coils. If the gloss is not consistent, the product appearance will be poor.

**Adhesion:** There are several tests conducted to check the various aspects of adhesion. They may include T-bends, Impact, and various Scratch tests. Pre-painted aluminum and steel coil may undergo several types of forming to convert it to the final product. Consider the types of bends in construction of siding or roofing, embossed garage doors, residential doors, ceiling grid, office furniture, embossed refrigerators, swimming pool parts, etc. One of the key advantages of pre-painted coil is that it can be formed after painting, so these tests are important to make sure that the paint will not be damaged or removed during later processing. Factors that can affect adhesion include paint formulation, film thickness, cure temperature (PMT), line speed, treatment quality, aluminum and steel quality, and cleanliness.

**Cure:** Cure is a term that refers to the degree to which a material is converted from its initial state to that of its final – or cured – state. All coil coatings are baked, and two things happen during this baking cycle:

1. The solvent in the paint evaporates and is burned in the afterburner
2. A chemical reaction in the paint film causes the resin molecules to join together (polymerize, or cross-link) to form a strong, cross-linked, solid paint film

There is no direct measure of the degree of cross-linking. A combination of tests are run, such as MEK rubs, Pencil Hardness and Adhesion, that indicate whether paint is under cured or over cured. Under cured paint will tend to be soft, and will not withstand forming or weathering in its end use. Over cured paint will tend to be brittle, and may be damaged during forming or weathering.

### **Visual Inspection:**

One of the most important aspects of pre-painted aluminum and steel from the end customer's perspective is its appearance. The customer expects a uniform, consistent appearance, with no unacceptable defects. Visual defects can be caused by the aluminum or steel substrate, the paint, or the method of application and curing.

Because of the wide variety of customers and products involved, there is also a fairly wide range of specifications for visual appearance. For example, the appearance standards for a smooth refrigerator, which is seen up close every day in a consumer's home, are much stricter than the appearance standards for a roofing product, which is only viewed from a distance. Ideally, we would like to have perfect appearance on all products, but that is not always cost effective, so some level of variation may be acceptable to the customer.

Defects that are identified during visual inspection may also affect the performance and life of the paint during its use. For example, craters are not only an appearance problem, but may result in premature peeling or corrosion at the location of the defect. Differences in texture across the strip or between coils may be an indication of film thickness inconsistencies, which could affect product life. Dirt lines are visual defects, and result in a strip of low film thickness – premature corrosion or peeling could occur at that spot.

Visual defects may start and stop suddenly during the painting process, so thorough visual inspection is important in order to minimize defective material produced. The sooner a defect is seen, the sooner it can be corrected, minimizing scrap and customer returns.