

About Coil Coating

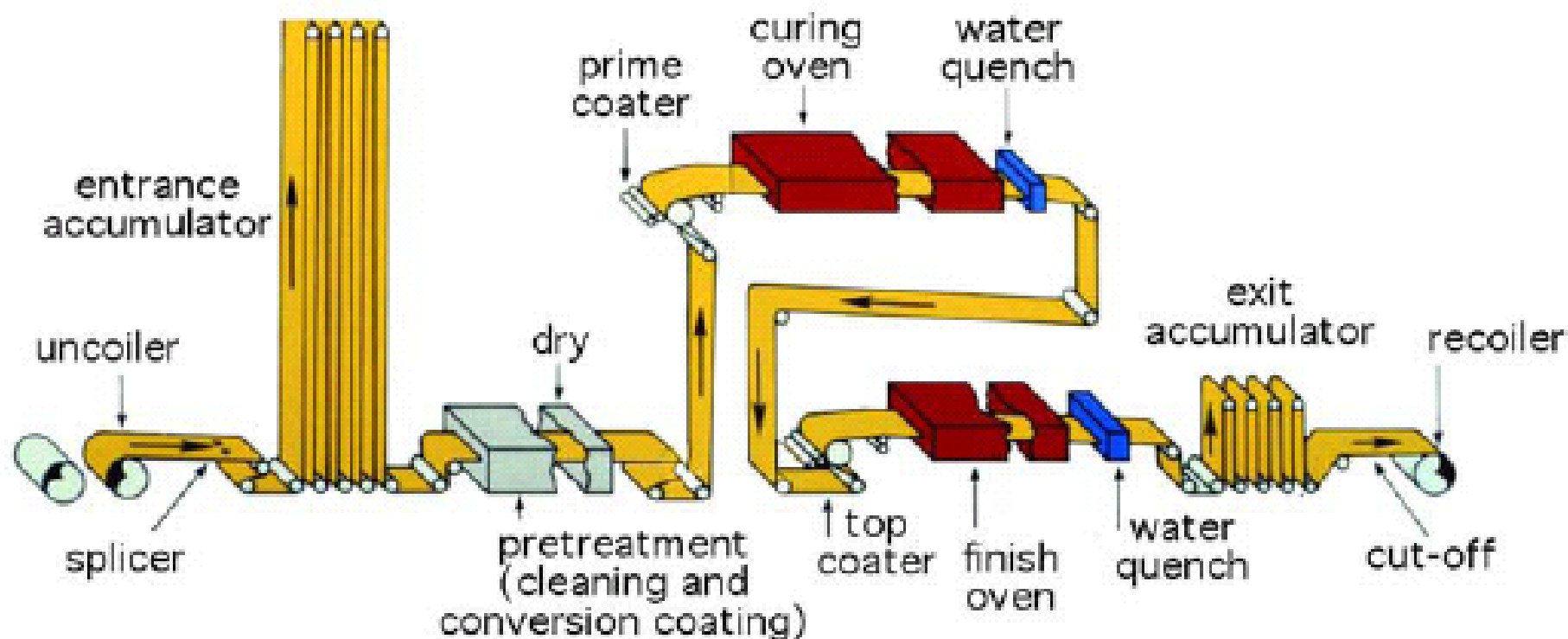


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Coil Coating Paint Line Process

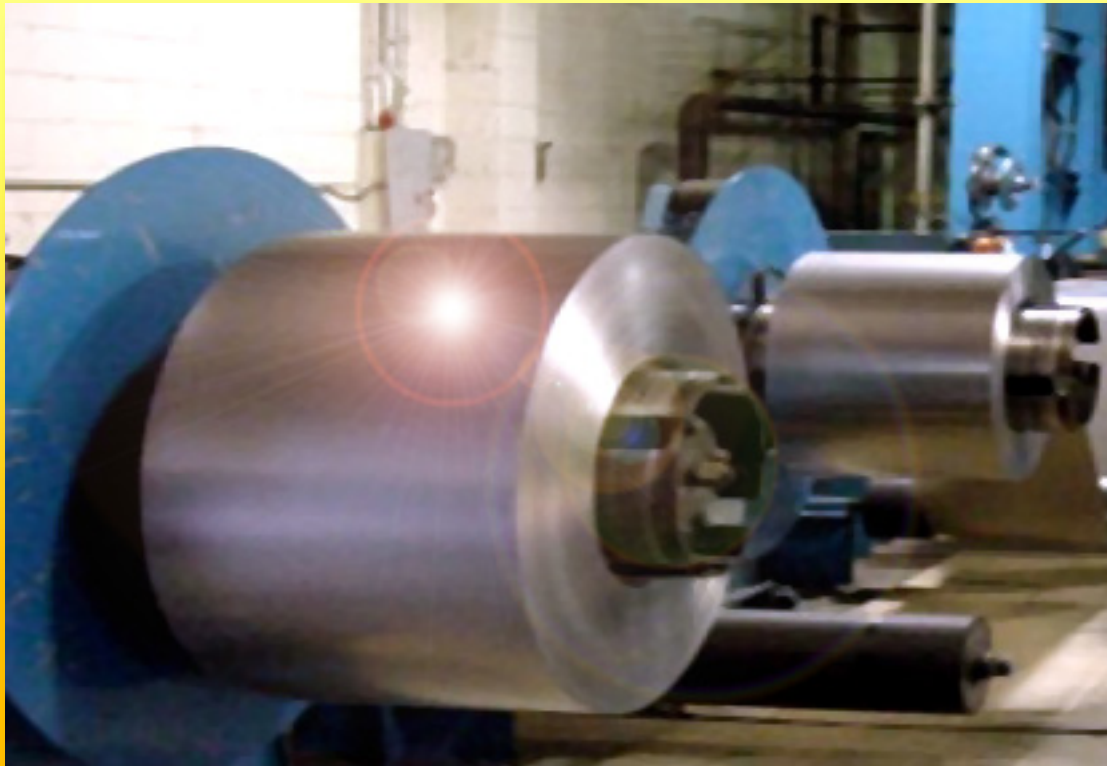
CONTINUOUS COIL COATING LINE



A modern coil coating line represents an investment of tens of millions of dollars and is capable of line speeds up to 800 feet per minute with 72-inch coil widths and material thickness up to .135 inch.

Cleaning and Pretreatments

- **Alkaline Cleaners, Mechanical Brushes and Fresh Water Rinses** are used to prepare metal strip surface for the **Pretreatment** process by removing surface contaminants and mill oils applied to prevent corrosion during transit and storage.



- Successful cleaning of the strip depends upon optimizing control of dwell time, bath temperature and chemical concentration.

Cleaning and Pretreatments

- **Pretreatments** or **Conversion Coatings** are chemical treatments applied to the metal strip after cleaning and prior to painting. They are designed to improve the surface reactivity of the metal substrate, promote paint adhesion and provide corrosion resistance.

Pretreatments

- 1. Improve Surface Reactivity**
- 2. Promote Paint Adhesion**
- 3. Provide Corrosion Resistance**

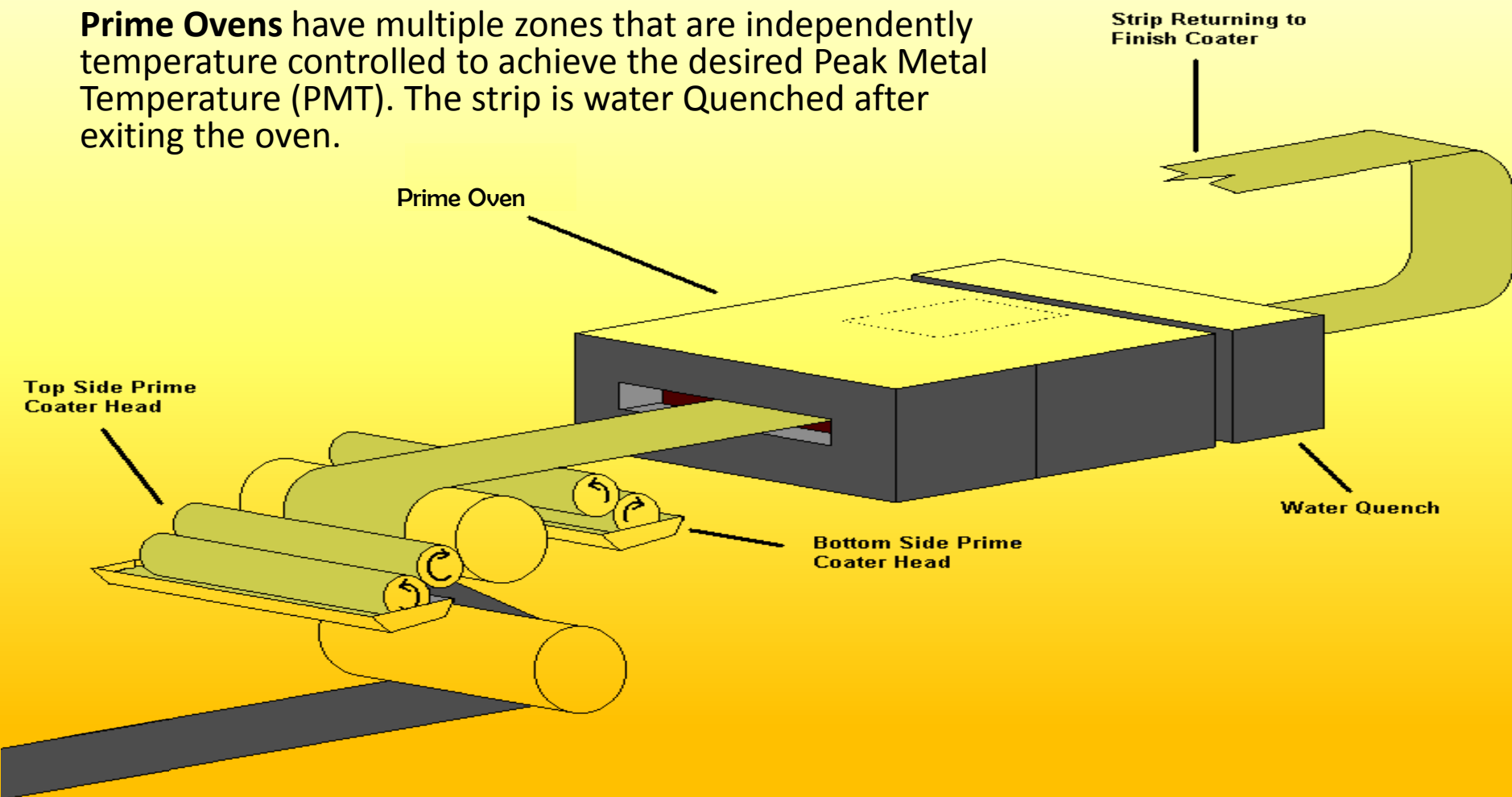
- **Primers** are applied before the finish coat to aid in the paint systems adhesion to the substrate, add additional corrosion resistance properties through the use of corrosion resistant pigmentation and to improve the paint system's flexibility.
- **Thick film primers** can further enhance abrasion resistance (i.e. falling sand) and corrosion resistance properties for high performance applications that may have previously required the thickness of a Plastisol.
- **Thick film paint systems** typically offer a lower pencil hardness and may also be prone to Edge Frilling on sheared edges and to Cracking/Crazing when cold formed.

Prime - Coater, Oven & Quench



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Prime Ovens have multiple zones that are independently temperature controlled to achieve the desired Peak Metal Temperature (PMT). The strip is water Quenched after exiting the oven.



Finish Coats and Backers

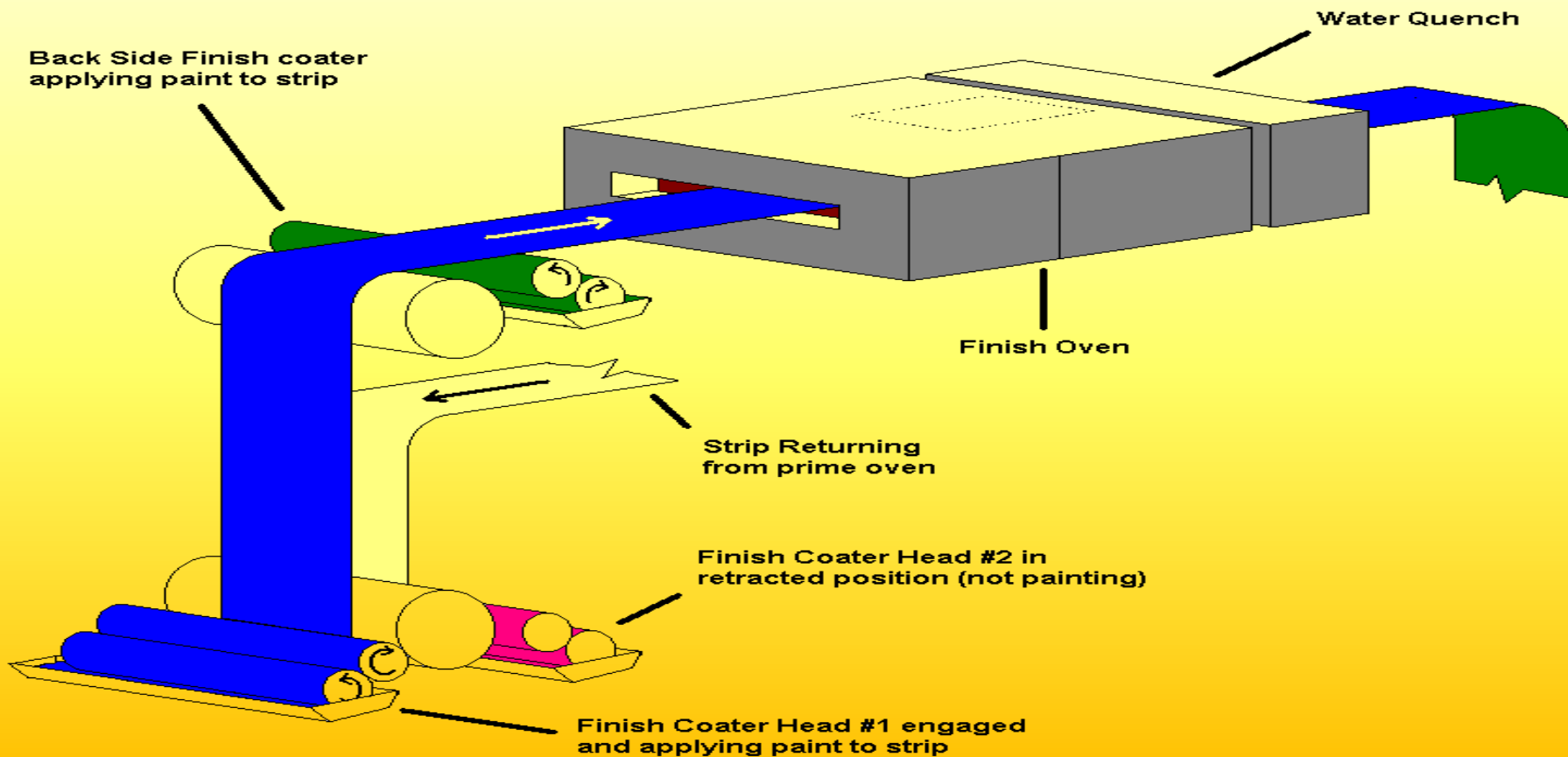
Finish Coats or Top Coats are applied after the prime coat to provide:

- The desired physical appearance or aesthetics
- Weathering Characteristics – Chalk, fade and gloss retention
- Physical Properties – hardness and flexibility

Backers are applied after the prime coat to provide:

- Additional corrosion protection
- Finish coat transit abrasion protection
- A consistent bottom side appearance

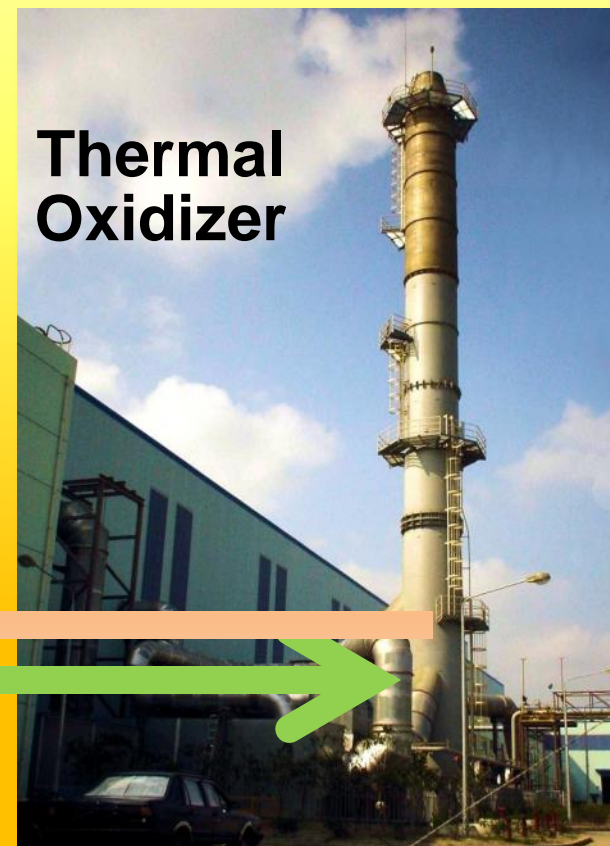
Finish - Coater, Oven & Quench



Finish Ovens have multiple zones that are independently temperature controlled to achieve the desired Peak Metal Temperature (PMT). The strip is water **Quenched** after exiting the oven.

Thermal Oxidation Process

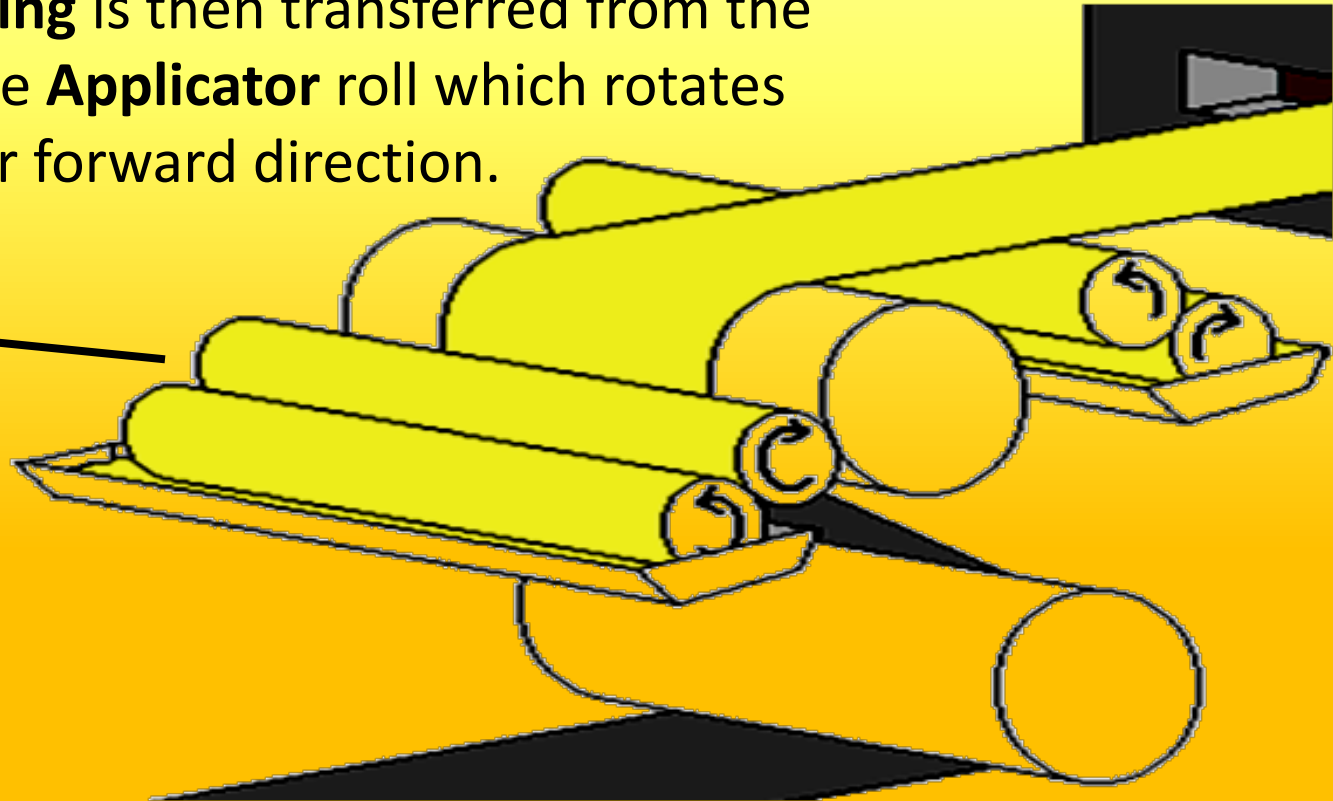
- **Coil line ovens** use a thermal oxidation process that destroys the Volatile Organic Compounds (VOCs) found in the coatings, making the coil coating process environmentally sound.



Application of Coatings

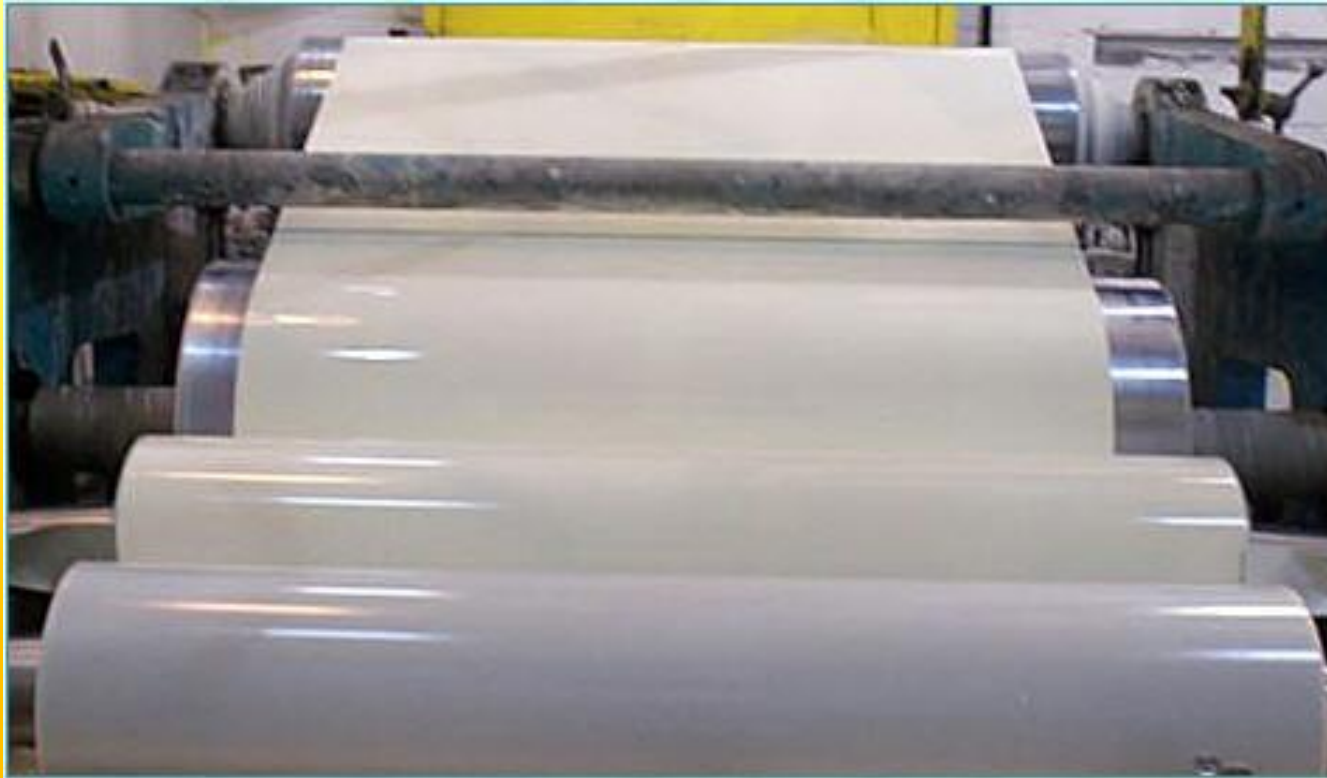
- The Liquid **Coating** is picked up from the pan with the pickup roll. This roll typically rotates in a counterclockwise or reverse direction.
- The Liquid **Coating** is then transferred from the pickup roll to the **Applicator** roll which rotates in a clockwise or forward direction.

Top Side
Prime Coater Head



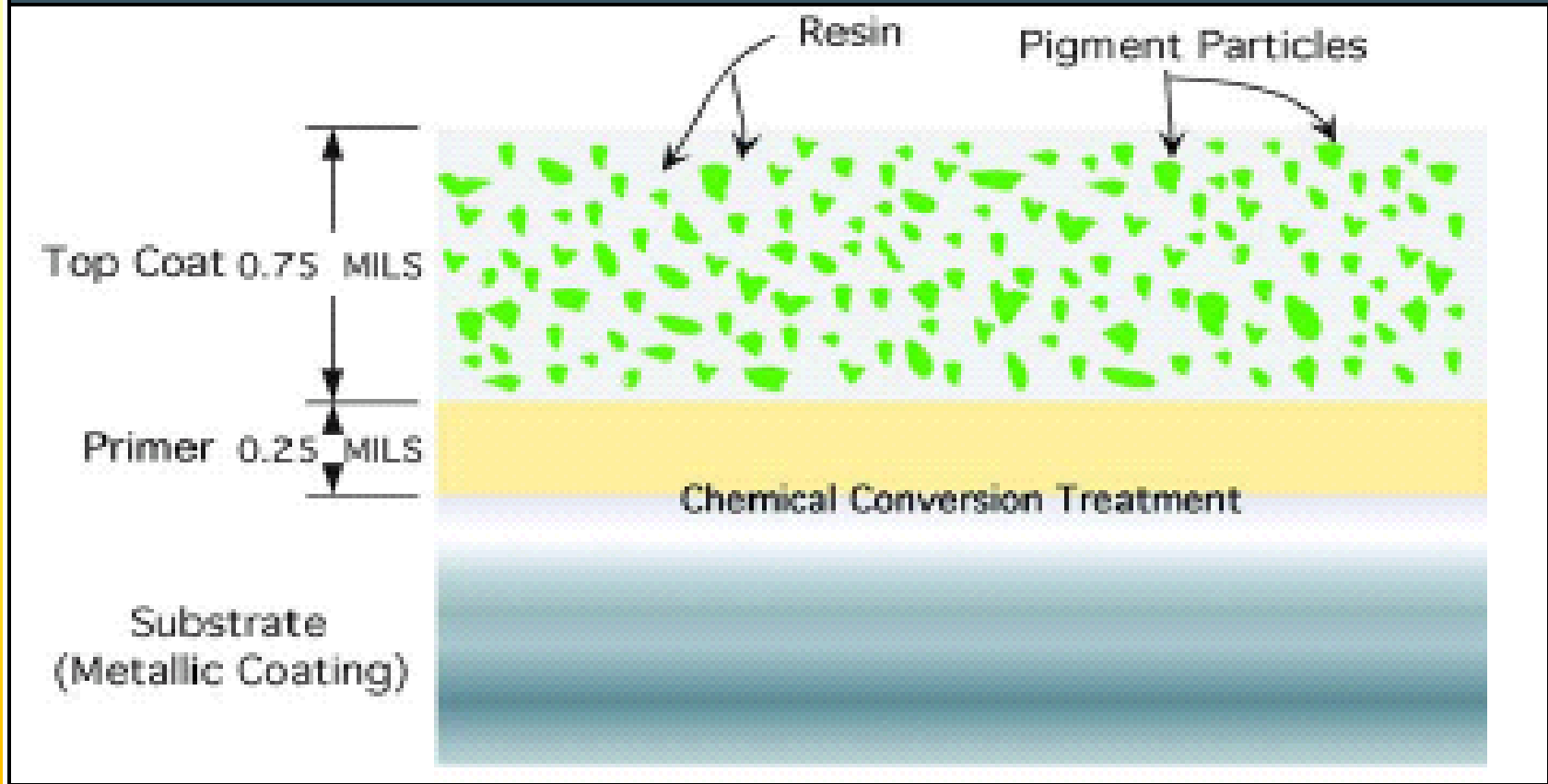
Application of Coatings

- The Liquid **Coating** is subsequently transferred from the **Applicator** roll to the metal strip.



Top-Coat Cross-Sectional View

TYPICAL TWO-COAT PAINT SYSTEM



Most popular architectural paint finishes are 2-coat systems, resulting in a dry film thickness of about 1.0 mil. *Courtesy of: Metal Roof Advisory Group, Ltd.*

Paint Attributes & Test Methods

Attribute	Test Method
Color	L,a,b Color Value Measurement
Dry Film Thickness	Tooke – DJH - Electronic Gauges
Solvent Resistance/Cure	M.E.K. Rub Test
Film Hardness	Pencil Hardness Test
Gloss	Gloss Meter
Flexibility	T-Bend Test
Adhesion	Impact Test
Corrosion Resistance	Salt Spray Test
Water Resistance	Cleveland Humidity Cabinet
Light Degradation Resistance	QUV Test

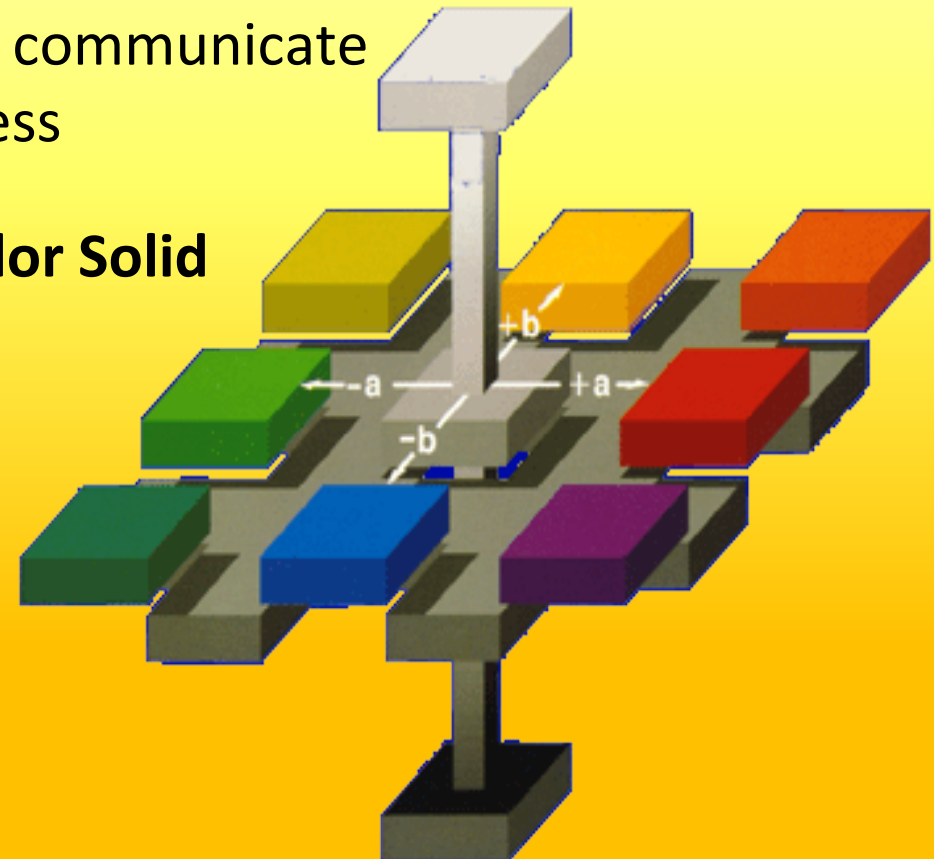
Color Control

Instrumental or Computed Color Difference:

Numerical L,a,b color-scale values are used to standardize the perception of color and set the criteria for color control.

These numbers provide a way to communicate color and form the basis to express color differences.

L,a,b Color Solid



Visual or Perceived Color Difference:

The magnitude and character of color differences are described by such terms as *redder*, *bluer*, *lighter*, *darker*, *grayer* or *cleaner*. These visual differences are used to control color.

Color Differences

Simple Color Difference:

Simple color difference is calculated by subtracting the “L, a, b” color-scale values of the standard from the sample.

Sample Value - Standard Value = Simple Color Difference (Δ Delta)

If ΔL^* is \oplus the sample is light

If ΔL^* is \ominus the sample is dark

If Δa^* is \oplus the sample is redder (less green)

If Δa^* is \ominus the sample is greener (less red)

If Δb^* is \oplus the sample is yellow (less blue)

If Δb^* is \ominus the sample is bluer (less yellow)

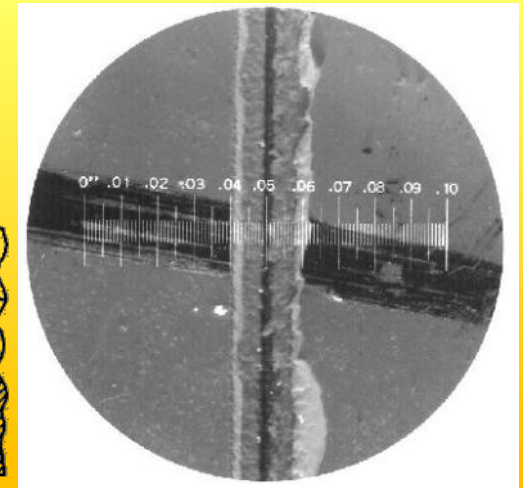
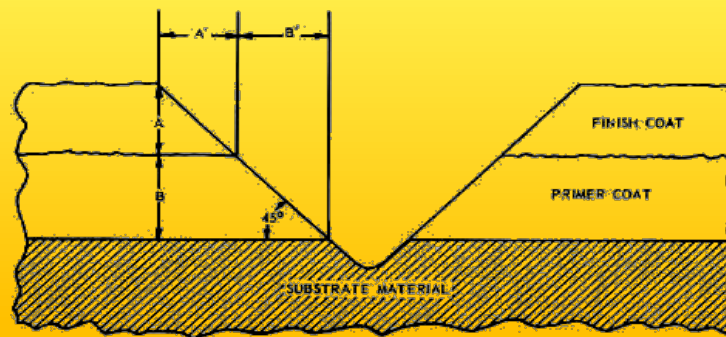
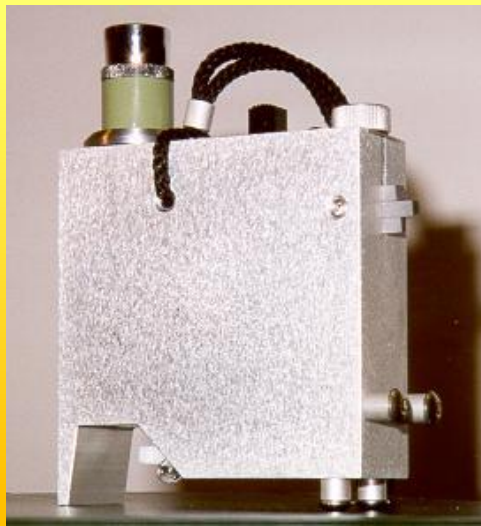
Total Color Difference:

Total color difference or Delta E (ΔE) is calculated with the formula:

$$\Delta E = \sqrt{(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2}$$

Dry Film Thickness

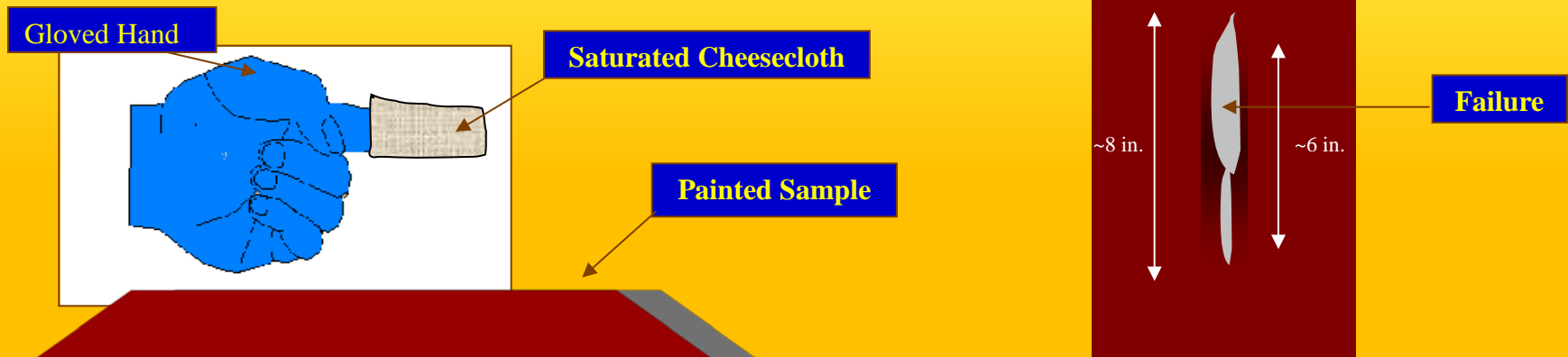
A Tooke Gauge can be used to measure the **Dry Film Thickness** (DFT) of a coating system. A precision V-groove is cut into the dry film to allow for the thickness of each coating layer to be read using a 50X illuminated microscope.



Solvent Resistance/Cure

Solvent Resistance is an indicator of how well the paint is **Cured**. Liquid coatings undergo a chemical change during the curing process and become more **Solvent Resistant**. An M.E.K. Rub Test using a saturated cheesecloth is the most common way to determine if the coating has been properly cured.

A sample is rubbed at a 45° angle under moderate pressure. One forward + back motion = one double rub. Rubbing continues until the total double rubs specified by the paint manufacturer's technical data sheet is met or a failure occurs.



Film Hardness

Film Hardness is measured using a Beryl pencil.

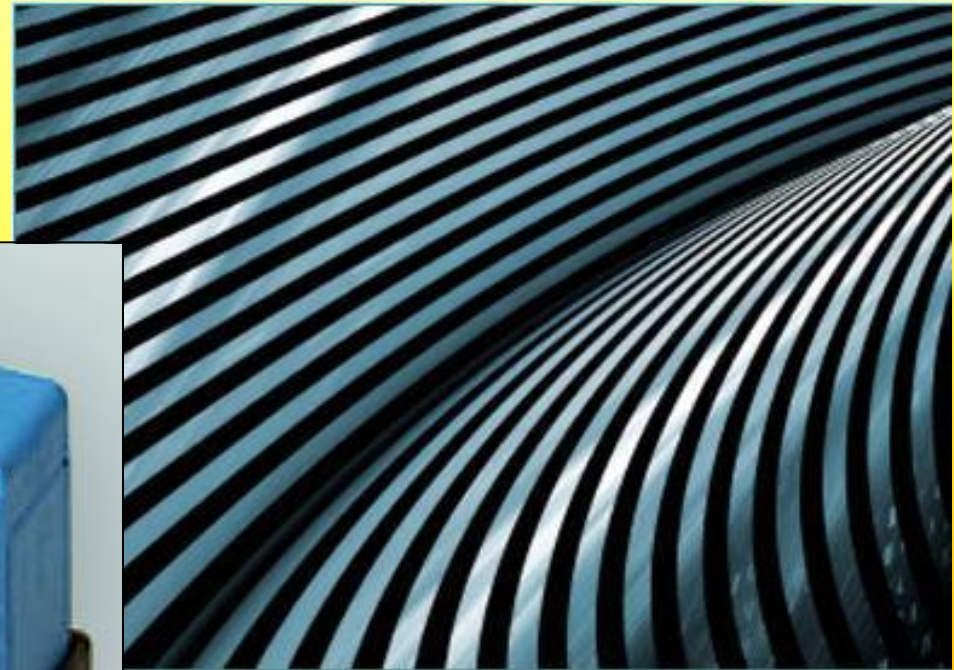
The pencil hardness is measured by pressing the pencil against the surface at a 45° angle and pushing the tip away from the operator with uniform downward and forward pressure to cut or scratch the film. The process is repeated down the hardness scale until a pencil is found that will not cut through the surface of the film. The hardness of the first pencil that is unable to cut the film indicates the hardness of the coating.

6B – 5B – 4B – 3B – 2B – B – HB – F – H – 2H – 3H – 4H – 5H – 6H
(Softer) (Harder)



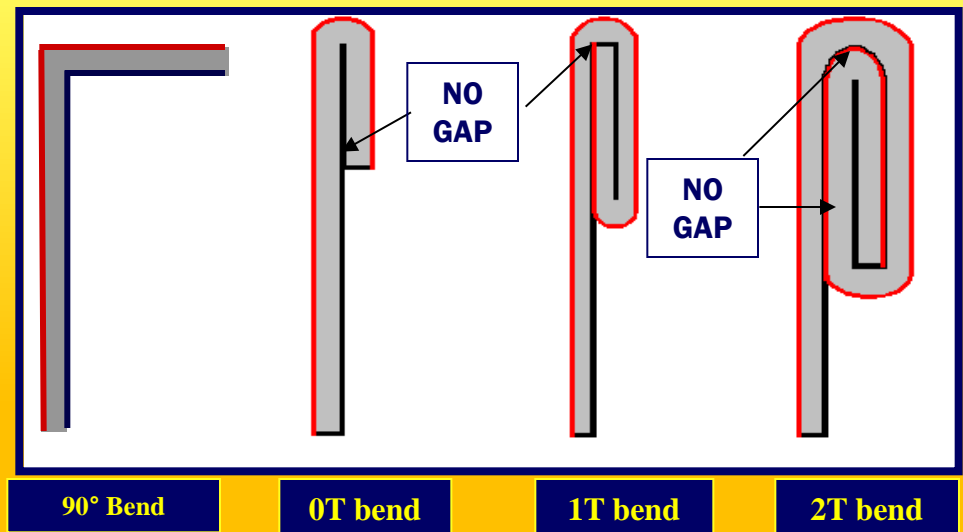
Gloss

- Gloss is measured with a gloss meter.
- The gloss meter illuminates the surface of the coating to confirm that the coating gloss is within a set range.



Flexibility

- **Flexibility** is measured by forming a **T-Bend**.
- 3" wide samples are bent in the direction of the metal's grain with the coating on the outside of the panel until the apex of the bend is as flat (i.e., no gap).
- The bend radius is inspected for cracks at the specified T-bend radius using a jeweler's loop. If no cracks exist, it is said to pass the No Crack (NC) test.



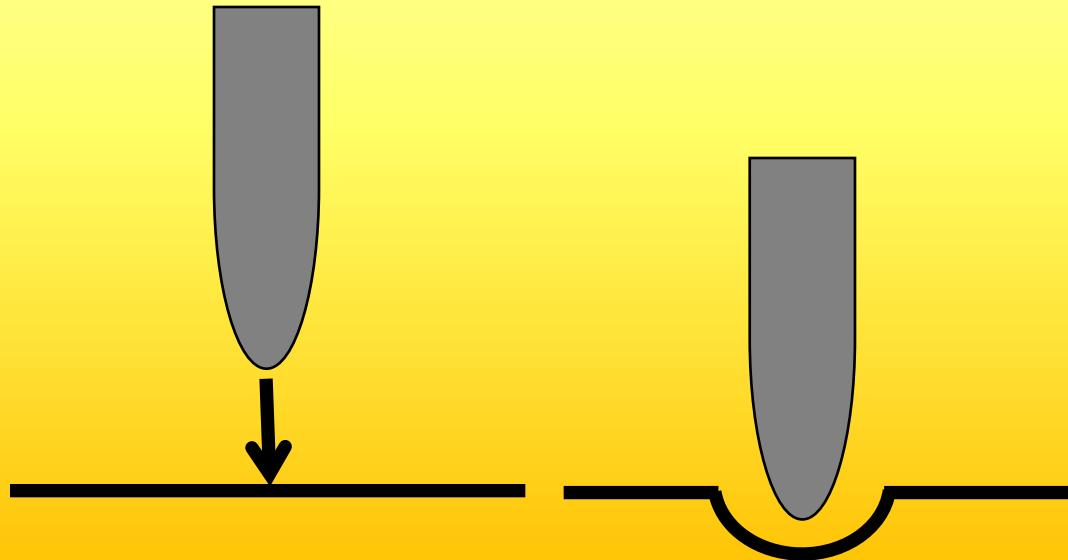
Flexibility

- **Pressure sensitive tape** is applied to the bend radius, rubbed flat and removed with a rapid movement at an angle of 180° to the bend surface.
- The tape is examined for any coating removal from the surface of the sample.
- If no coating is removed, this satisfies a no-tape-off (NTO) requirement.



Reverse Impact Testing

- A round-ended weight is dropped onto the strip from a height that is 3 times the metal thickness.



- The deformed surface is examined for cracks or breaks in the coating.

Reverse Impact Testing

- Tape is applied to the deformed area, then removed. If any coating is removed from the surface of the strip, the sample has failed the test.



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Industries That Benefit



Metal Doors



Appliances



Roofing



Beverage Cans



HVAC



Automotive



Agricultural Equipment



Office Furniture

The Benefits of Prepaint

■ Energy & Environmental Benefits

- Substantial Energy Savings vs. Post Painting
- Trouble-Free Environmental Compliance
- Minimizes Waste and Emissions
- 100% Transfer Efficiency
- Closed loop process allows for the efficient capturing of solvents and incineration heat recovery



The Benefits of Prepaint

- Precision roll coating method that applies extremely controlled and uniform thicknesses of pretreatment, primer and top coat on the flat metal sheet, from edge to edge.
- Corrosion Resistance.

Prepainted Metal

**Post Painted
Metal**



The Benefits of Prepaint

- Specialized coatings can differentiate your products from competitors.

Antimicrobial

Non-Skid

Fingerprint Resistant

Reflective



Precoat Metals



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