

DEMONSTRATIONS OF IMPERFECTIONS

The vocabulary of the coil coating industry includes terminology taken from both the strip processing and paint industries. In some cases, coil coaters have developed their own terminology. This glossary contains definitions of terms in common use throughout the industry. Although not exhaustive, effort has been made to provide common descriptions and synonyms for specific terms.

This glossary *does not* include terminology related to the measurement of color and appearance.

Bare metal—This condition is caused by the lifting of the paint rolls away from the coil surface.

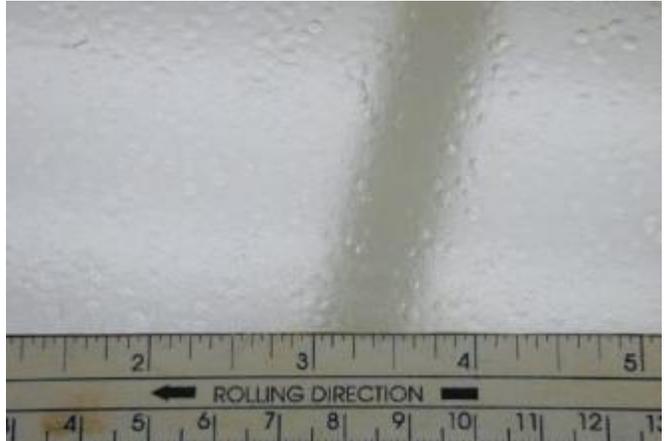


Black rust—residue from the corrosion of steel consisting of iron (ferrous) oxide(s). Black rust is often referred to as scale. It is usually formed during annealing. The thickness of the black oxide is a function of the cooling step. This form of rust adheres more tightly to the steel surface than the more familiar loose and flaky red rust. Black rust can be smooth enough to be mistaken for the steel surface itself. See also **red rust**.

Bleed over—see **sloping over**.

Blister—a raised spot in a paint film or other coating, caused by the expansion of gas in or under the coating.

This Tool Kit is part of a series of educational aids developed by the members of the National Coil Coating Association. NCCA is a trade association of coil coaters and suppliers of raw materials and equipment used in the coil coating process. The association concentrates its efforts on providing educational resources and assisting its members in providing superior products and services to their customers. NCCA Tool Kits are information tools and should not be used as substitutes for instructions from individual manufacturers. Always consult with individual manufacturers for specific instructions regarding their products and equipment.



Blocking—the sticking of a layer or wrap of a painted coil to an adjacent layer or wrap.

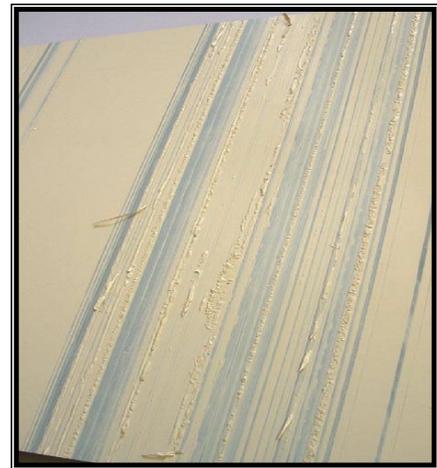


Block marks or Bruising—caused by handling damage, normally from sitting a coil on a hard object like a strapping seal. Can extend into the coil for many inches depending on the pressure applied.

Burr—a metal imperfection characterized as a thin ridge of roughness left by cutting operations such as shearing, slitting, trimming, blanking, etc. Any burr that is less than 10% of the gauge is considered acceptable.

Camber—the deviation of a side edge (of metal strip) from a straight line. Camber is measured on a concave side using a straight edge. Long lengths of unsupported strip having a large amount of camber tend to deviate from the horizontal or slope to one side. Also referred to as **lateral bow**.

Catenary or oven scratches—Streaks in the paint, always parallel to length, or small lines indicative of strip bouncing in the oven section and striking oven components.



Center (crown)—the difference in thickness between the middle and edges of a sheet.

Center stretch (center buckle, full center, snap buckle)—a phenomenon that occurs when the center of the metal strip is longer than the edges, so that the strip is not flat. See also **oil canning**.



Chatter—(paint) a series of transverse marks in the paint.



Chatter—(metal) a series of transverse marks in the metal.



Coil set—longitudinal curving or curling of the strip to the shape of the coil. Reverse coil set is a longitudinal curving or curling counter to the shape of the coil.



Cratering—a coating effect characterized by small pock marks or depressions surrounded by a ring of coating material that projects above the general plane of the coating. In severe cases, the substrate may be visible in the center of the imperfection.



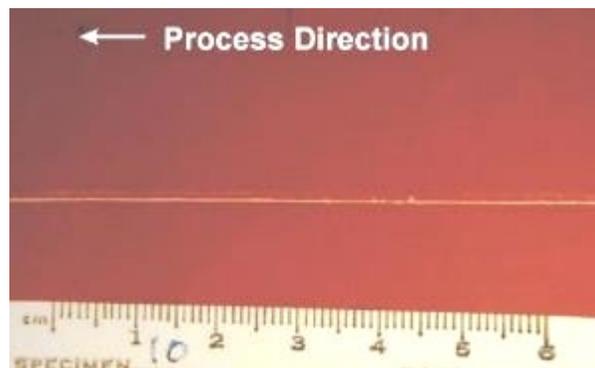
Crown—see center.

Dent—a mark transferred to a substrate surface from an imperfect process roll or something on a roll. The most common causes are tape, metal particles and dirt.

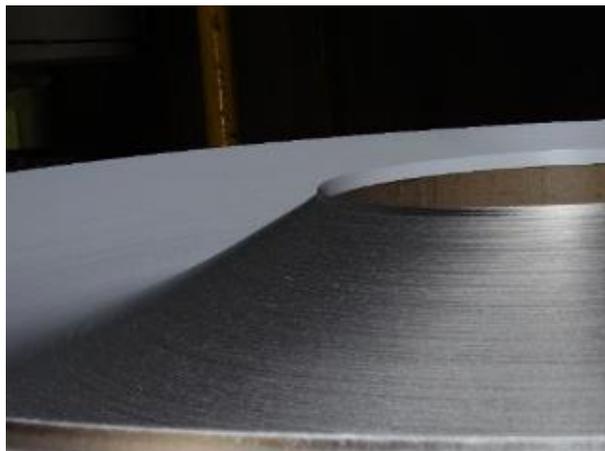
Dirt Streaks/Trash Marks (chip marks)—longitudinal or slightly angled continuous narrow lines where the paint flow has been disturbed by finite particles between the applicator roll and the substrate.



Dirt lines—a line in the painted surface caused by a particle trapped between the applicator roll and the moving strip. Typically the result of non-uniform edges of the substrate (garnished or saw-tooth edge) cutting the applicator roll and releasing coating roll particles into the liquid paint. Can also be caused by air bubbles trapped in the paint preventing proper flow.



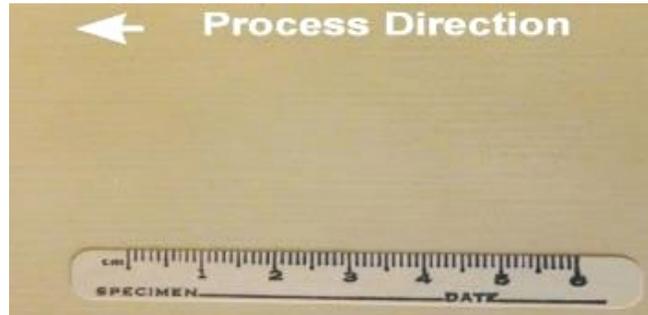
Dishing—a coil with a wall that tapers toward one side instead of being perpendicular to the coil ID. Normally this occurs toward the end of large coils.



Edge bead, edge build up—an excessive build up of paint on the edge of the strip.

Fish eye—a round or elongated crater-type coating imperfection that may have a particle in the center. May also be referred to as **craters** or **voids**. See also **cratering**.

Flow lines—lines on the surface of painted sheet, caused by either incomplete leveling of the paint or telegraphing of imperfections (flow lines) on the metal surface.



Friction scratches, cinching, friction digs—short, longitudinal scratches introduced during winding or unwinding either by different winding/unwinding tensions or movement of the painted surfaces relative to each other in adjacent wraps. Can be caused by coil collapsing during storage or in transportation. Sometimes referred to as **cat scratches**.

Full center—see **center stretch**.

Lateral bow—see **camber**.

Metal marking—black or gray marks left on a painted strip when bare metal is drawn across its surface. White and light-colored coatings are more susceptible to metal marking than dark coatings. Metal marking typically occurs during forming operations.

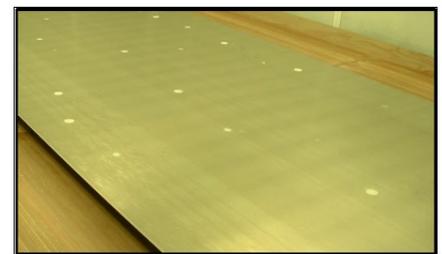
Night strip, starter strip, leader strip, stringer coil—used to thread a paint line and left in the line when it stops for maintenance, paint changes or any other reason. Reused so that prime material is not wasted or damaged.

Oil canning—a localized out-of-flat condition which is normally repetitive and often takes on the appearance of shallow buckles in areas that are flat or unformed. Can be caused by incorrect roll forming or press setups, but most commonly caused by incoming shape such as center buckle or quarter buckle. In roll formed building products, it is most easily eliminated by a rib in the pan.

Orange peel—a paint imperfection where the surface resembles the skin of an orange; also surface roughening on formed products resulting from the use of coarse-grained material.



Paint globs, splatter, splashing—paint dripping onto the strip or coating rolls flinging paint.



Paint picks—see friction scratches.



Pick-off—the tendency of paint to be picked up in very small pieces from one side of a painted strip and held by the coating on an adjacent wrap of the strip. It also refers to the transfer of coating material to tension and bridle rolls, and the transfer of loose paint or coating to tape in forming tests.

Pin holes (metal)—small randomly spaced holes in the substrate. These are imperfections in the metal and are more common in thinner material. Light can be seen through the metal.

Pin holes (paint)—(also sometimes referred to as **voids**) – most often caused by degassing in the metal coating and resulting in a small hole that penetrates through to the metal in the paint surface.



Severe Example of Pinholing Due to Rough Substrate

Pits—very small craters that extend into, or out from, the metallic substrate.

Polishing—an apparent increase in paint film gloss caused by the rubbing of the top and backing coats during the recoiling of a strip, or by contact with roll forming equipment or other smooth moving objects

Popping—a paint imperfection resembling fine blistering. Popping is usually caused by organic solvents trapped during the film cure. Under magnification they appear as tiny volcanoes usually caused by too much heat in zone 1 of an oven.

Pressure mottling (pressure marking)—an uneven or irregular gloss pattern on the face of a coil sheet. It is generally caused by disparity in the gloss between the top and bottom surfaces of a coil. These gloss differences are then transferred with time and pressure to either surface causing the irregular pattern. The distortion is typically temporary and will dissipate with time and exposure to heat or ambient conditions. In extreme cases where heat and pressure has been excessive, the distortion is permanent and will not dissipate under ambient conditions.

We have identified several factors that contribute to pressure mottling on a coil line and also apply to stacked sheets or parts. They are:

- Major gloss difference between the topcoat and the back coat
- Surface difference between the topcoat and the back coat as it relates to the glass transition temperature of the polymers used
- Differences in cross-linking densities between the topcoat and the back coat.
- High rewind tension
- Temperature (Coil wrapped too hot, wet, or subjected to conditions that allow condensation in the coil, etc. and can even cause “blocking”).

To eliminate pressure mottling that already exists, it is suggested that the strip be heated. This works because the appearance is normally a flattening or changing of the smoothness of the coating surface. A small amount of applied heat allows the coating to expand to a stable condition, thereby eliminating the characteristic appearance of pressure mottling. Typically the heat generated during the forming process is usually sufficient. In all but the most severe cases, the coating will "recover" (expand) within a few days after the "pressure" is removed.

Red rust—residue from the corrosion of steel consisting of iron (ferric) oxide. This is the ‘classic’ form of rust. The oxide is reddish in appearance (rust colored). Red rust may also manifest itself on galvanized steel. In this case, the protective zinc coating has been completely corroded exposing the underlying steel. Caused by the exposure of steel or iron to moisture. See also **black rust**.

Ribbing—caused by incorrect roll speed adjustment, improper nip pressure or incorrect paint viscosity. Normally occurs when painting using the forward roll direction. Results in paint of differing thickness in parallel lines. Appears to be narrowly spaced continuous lines in the rolling direction in the paint.

Roll nicks, roll mark—a repetitive mark that appears in the paint at a fixed interval.



Roping—caused by incorrect roll speeds adjustment, improper nip pressure or incorrect paint viscosity. Paint of differing thickness in near parallel lines in the rolling direction. It is differentiated from ribbing by being coarser and the paint not forming continuous lines. Normally it occurs at thicker paint films.

Scratches—streaks in the paint caused by an abrasion of the painted surface.

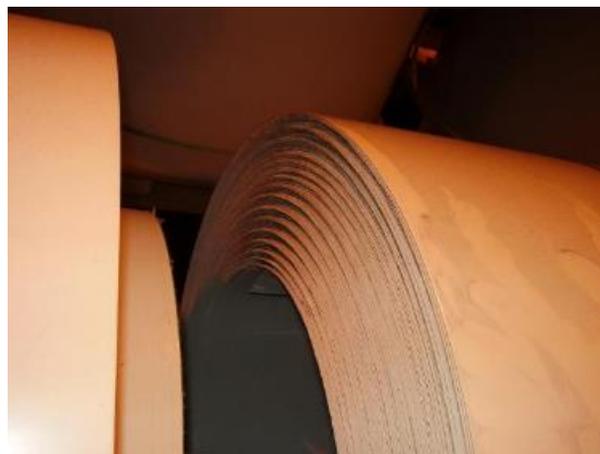
Skipping—an irregular paint application, usually occurring when improper contact is made between the applicator roll and the strip. See also **starving out**.



Slopping over (bleed over, wicking)—a term used when coating used on the top side of a continuous strip finds its way to the bottom side.

Snap buckle—see **center stretch**.

Stagger Wind—a process wherein the laps are intentionally oscillated



Excessive Stagger Wind

Stains—a show through or a staining is a discoloration of the surface of the paint.



Starving out, ghosting—an irregular film thickness caused by insufficient liquid in the coating pan, adverse reaction of the coating to shear, improper speed ratio between strip and roll coater rolls, or improper wetting of the rolls by the coating.



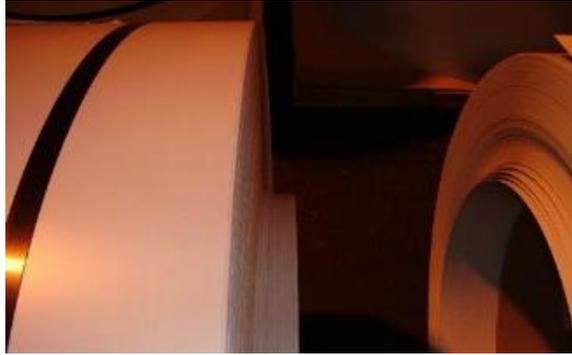
Streaking—any line, elongated mark, or stripe causing non-uniform surface appearance. See dirt lines.

Streaking (pigment)—typically lines in the rolling direction of the strip that are of a different color than the base paint.



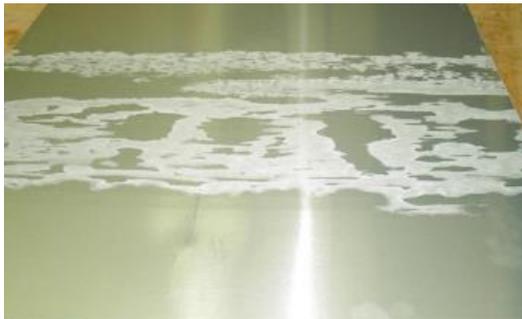
Stretcher strain— (also known as Lüders Lines) a deformation of the metal substrate beyond its yield point and resulting in elongated markings or lines which lie approximately parallel to the maximum shear stress in the material. They are seen in the substrate and may be highlighted by the paint layer.

Telescoping—transverse slipping of successive layers or wraps of a coil, so that the ends are conical rather than flat.



Transverse bow, up, down, canoe—curvature across the width of sheet. (May curve up called canoe or up bow or curve down and be called down bow.)

Water staining—type of white rust that is formed on aluminium surfaces consisting of aluminium oxide/hydrated oxide/carbonate. Caused by exposure of aluminium surfaces to moisture. See also **white rust**.



Wavy edge—edges of the strip are longer than the center.

Wet film gauge mark—two continuous parallel lines ½” apart with a continuous line in between that usually will be 2-3 feet long. More prevalent on the first coil of a particular run.

White rust—residue from the corrosion of galvanized steel consisting of zinc oxide/hydroxide/carbonate. Sometimes referred to as water staining when the zinc oxide layer is thin. Caused by exposure of zinc surfaces to moisture. See also **water staining**.

Zinc failure—seen as metal, behind the paint, on tape used to check either a bend or impact test. Normally caused by oxidation or incomplete cleaning of the steel prior to galvanizing. In severe cases zinc can be peeled from the steel with the paint on it.