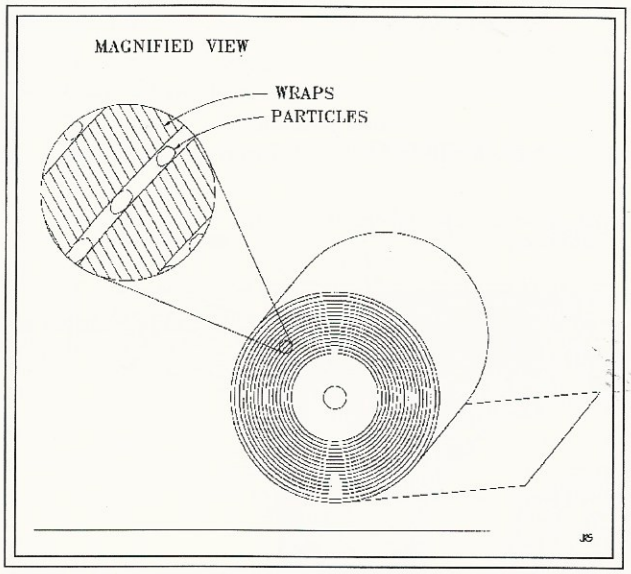
TDC'S ELECTROSTATIC POWDER DEPOSITION TECHNOLOGY: A Better Way to Prevent Stickers

How many steel coils do you have to scrap because of stickers that form in the annealing furnace?

The mechanical gallings ("stickers") and surface scratches that occur during annealing lead to high scrap rates, poor product quality, and reduced line efficiency. How can you solve this problem once and for all?

Low rewind tensions prior to annealing may reduce the occurrence of stickers, but this unreliable strategy requires a slow, unproductive pass through a mill or even a separate off-line rewind operation. This extra step is virtually the same as downtime on a mill, with little gauge reduction and poor shape control of the strip.



Particles soften contact between coil wraps (not to scale).

Powder release agents applied before annealing can prevent stickers. When properly applied, powder particles act as spacers to keep coil layers separated during of the annealing process. However,precise targeting and high efficiency are necessary to avoid powder overspray.

TDC's electrostatic powder technology is proven to give excellent post-annealing release by depositing a light, uniform layer of powder on strip steel at your highest rewind speeds and tensions. Layers of strip are separated throughout the coil during the annealing cycle to prevent the high-friction contact that causes stickers. Numerous benefits come from this:

PRESERVES PRODUCT QUALITY - High surface quality of metals is preserved during annealing by effectively separating coil layers.

REDUCES SCRAP RATES - Virtually eliminates stickers and the related scrap.

ALLOWS INCREASED COIL TENSION - Powder can be applied during the last pass of the cold-rolling operation at normal tensions, giving more reduction, better shape and gauge control, and improved coil handling.

ALLOWS FASTER PROCESSING - Allows higher rewind operating speeds.

INCREASES LINE EFFICIENCY - No need for a low-tension rewind operation.

NO AIRBORNE POWDER MAINTENANCE HEADACHES - All powder is either applied to the target or contained locally.

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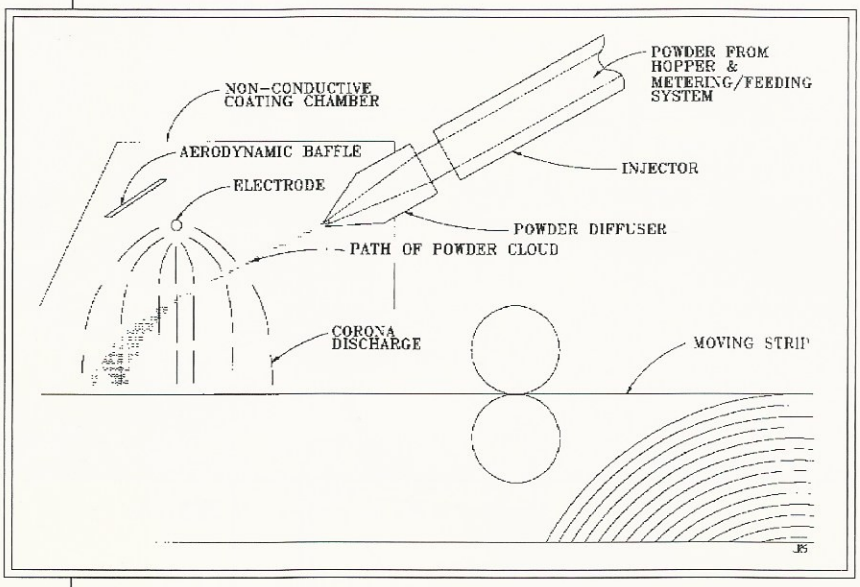
TDC Technical Development

c o r p o r a t i o n

The Electrostatic Powder Coating Process

Uniform particle deposition is the key to effective anneal release. In TDC's patented system, this is accomplished in a two-step process: a powder feeding and deagglomerating system followed by electrostatic deposition. The feeding system meters and deagglomerates the powder, supplying the patented injector with uniform, broken-up particles. The injector propels these particles as a flat, uniform cloud toward the electrostatic zones adjacent the moving strip. As the slow-moving cloud approaches the strip, it acquires an electrostatic charge from the corona discharge of a series of high-voltage, low-amperage electrode wires and is simultaneously steered toward the strip by aerodynamic elements.



Schematic of the electrostatic powder deposition process (not to scale).

The cloud of charged particles is drawn to the electrically grounded strip where it is uniformly deposited. Charged powder particles are guided by electrostatic attraction to the grounded, electrically neutral strip. Exposed areas on the strip that are not yet covered by particles attract new particles more strongly. Additionally, the like-charged particles avoid each other in flight such that they do not "cluster" on the strip. These balanced electrostatic driving forces create an inherently uniform coating and exceptional powder deposition efficiency even at high line speeds.

A thin space between steel strip layers is all that is necessary to prevent stickers from forming in a coil during annealing. If particles are uniformly distributed across the strip, only a minimal amount of powder is necessary to drastically reduce the incidence of sticking. Typically a monolayer of powder with about 5-15% surface coverage is used, which translates into less than an ounce (28 g) of powder applied to a typical 0.050" coil.

Typical Questions

Will I need to change the layout or operation of my cold-reduction mill?

Line space of 18-42" (45-117cm) either above or below the strip passline or adjacent to the rewinder will be necessary to install the coating chamber assembly. Operationally, rewind tensions not only can, but should be increased.

What happens to the powder during annealing?

It depends on choice of release agent. Most organic release agents reduce to a trace level of ash-like material which can be easily removed if necessary.

Will this system be reliable on my line?

By pioneering this application, TDC brings a wealth of design, engineering, and applications experience to develop a production-worthy system that meets your exact needs and requires little maintenance or operating attention.

Is this a good investment?

Expect a rapid project payback. Measurable savings are realized in improved processing efficiencies and reduced scrap rates and you also enjoy better surface quality and a clean operating environment.

Operating and Design Information

Subassemblies

POWDER RESERVOIR AND FEEDING SYSTEM — A patented feeding system, driven by a variable-speed DC motor, delivers powder to the injector.

INJECTOR SYSTEM— Deagglomerates and propels a powder cloud to the electrostatic zone and the strip. Injector can narrow or widen the cloud to accommodate a range of strip widths.

PATENTED COATING CHAMBER — Injectors are housed in an impact-resistant, non-conductive chamber with geometry optimized for introducing the powder cloud to the electrostatic field and for promoting its deposition on the strip.

ELECTRICAL CONTROL SYSTEM — An Allen-Bradley PLC (or otherwise, as specified) provides control of all systems. Control and instrumentation panel can be located remotely.

HIGH VOLTAGE POWER SUPPLY — A low-amperage unit is operated at 20-30KV.

PNEUMATICS CONTROL CONSOLE — Regulates and routes air to the powder injector and feeding systems.

POSITIONING SYSTEM — Retraction mechanism pulls the coater off-line during non-coating operations.

Release Agent Selection

Corn starch and a variety of other particulate release agents are used.

Line Speeds

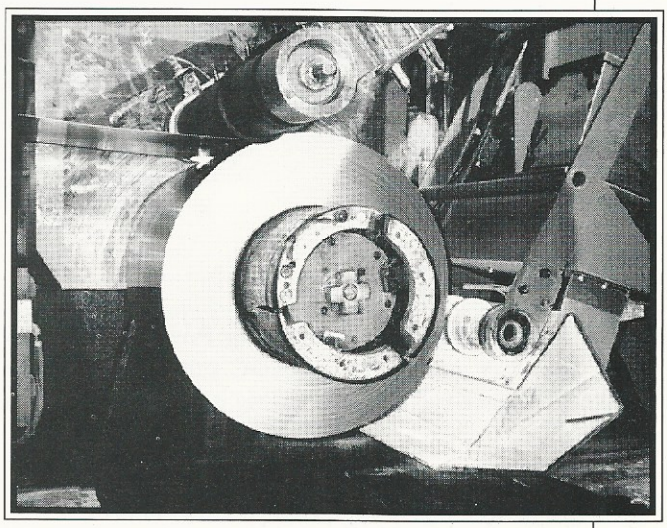
Up to 1500 fpm (450 m/min) in existing installations, higher speeds are possible.

Coil Width and Control

Width control is possible across a wide range to allow processing of narrow and wide coils on the same line. Strips up to 50" or more can be accommodated. The operator selects the target width from multiple preprogrammed choices.

Typical Deposition

10-50 mg/ft^2 (100-500mg/m^2) on one side



Coating chamber located at the rewinder in a bottom side orientation.

Deposition Control

Deposition weight is controlled by the PLC, based on the strip width, preprogrammed or operator selected coating weight and an analog line speed signal (4-20mA or 0-10 volts DC).

Installation

Compact design can be retrofit into most lines without requiring modification of existing equipment. 18-42" (45-117 cm) of line space is necessary, above or below the strip passline or at the rewinder.

Start-up

Assisted by TDC engineers who remain on-site through successful start-up and steady-state operation.

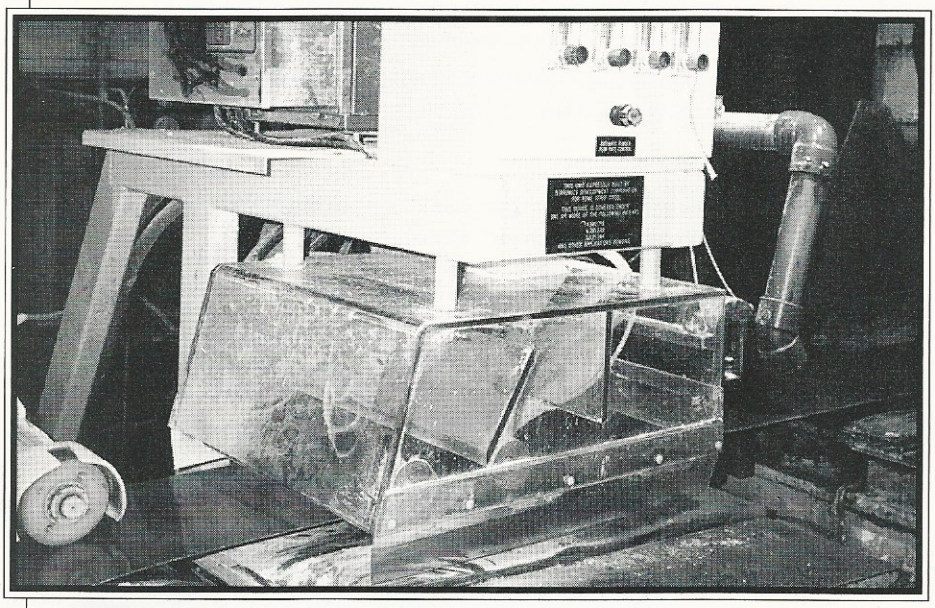
Maintenance

Routine quarterly/biannual cleaning and inspection is recommended. Maintenance requirements are generally minimal, stemming from system's low-energy design and industry testing.

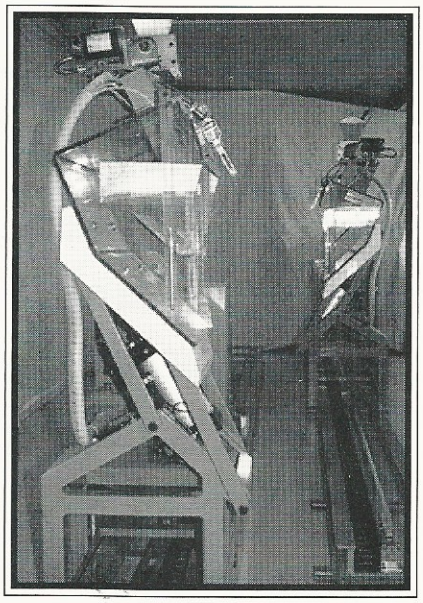
Utility Requirements

Power 120 or 220 VAC single-phase, 5 amps

Air 5 scfm @ 100psi, 40°F max dewpoint (2.5 l/s @ 700kPa, 5°C max dewpoint).



System with coating chamber in a top side orientation.



Retractable coaters guided by ultrasonic sensors allow non-contact powder application to the strip at the rewinder. Shown: mirror-image coaters to be installed on a reversing mill.

Related Products and Services

Combined Oiler/Annealing Powder Applicator
See our information on TDC's Steel Strip Oilers. Our powder applicator and oiler can be installed together in the same system, permitting precise oiling and annealing powder treatment on the same line.

Any Questions?

Please feel free to contact TDC to discuss how this method will work in your mill or to learn more about our varied electrostatic technologies, development capabilities, and steel industry experience.

Electronics Development
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