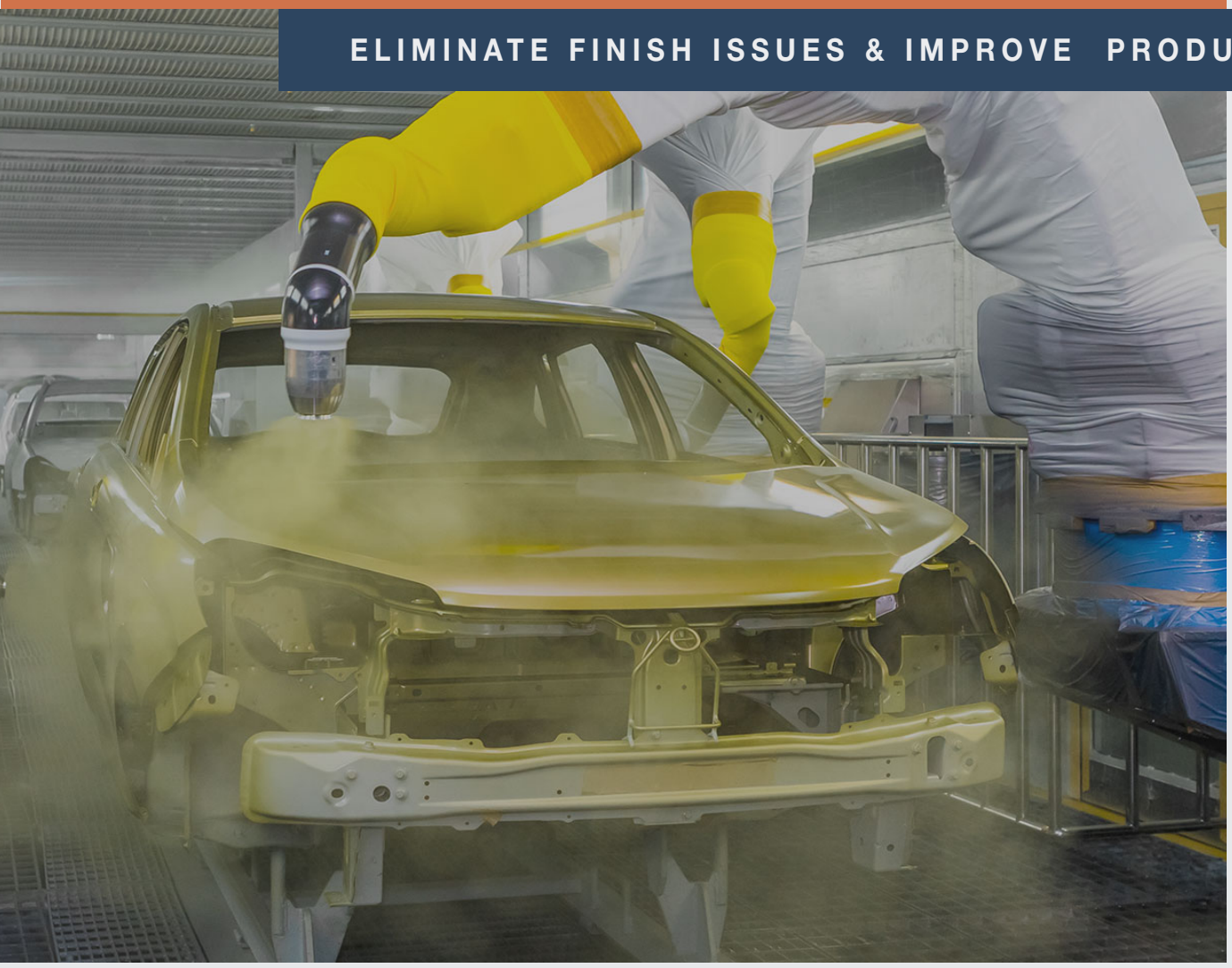
saint clair SYSTEMS
norcross Temperature & Viscosity Control

Paint Defects
Troubleshooting Guide

ELIMINATE FINISH ISSUES & IMPROVE PRODUCTIVITY



The painting industry has always been heavily reliant on technology and engineering to make the business both feasible and cost effective. If it weren't for advancements in mass production, the ability to produce such enormously complex systems as an automobile, in large volume and high quality simply wouldn't be possible.

But for all the advances made in the paint process, things are not always perfect. Defects can–and do–happen in paint jobs, which means lost time, money and business for everyone. That's why it's important to find and eliminate paint problems on the line before they interfere with your bottom line.

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Orange Peel

A coat of paint that should be smooth and unblemished instead, forms with a texture across the entire surface of application which resembles the peel of an orange, hence the name.

CAUSES	SOLUTIONS
Substrate too warm	Adjust ambient or substrate temperature to control solvent evaporation rate
Substrate too cold	Adjust ambient or substrate temperature to control solvent evaporation rate
Excess reducing solvent	Restrict the amount of reducing solvent being added to adjust viscosity
Solvent evaporating too quickly	Add a small amount of solvent or change to a “slower” solvent
Incorrect spray gun pressure (see atomization below)	Adjust spray gun pressure
Incorrect nozzle in spray gun (see atomization below)	Change spray nozzle
Applying excess paint	Ensure paint applied is consistent in solid content and viscosity
Improper paint viscosity	Ensure correct paint viscosity is supplied to atomizer
Improper atomization (particle size)	Adjust gun or bell to obtain proper atomization rate (particle size)
Insufficient flash time	Adjust line speed or flash tunnel temperature to assure proper flash-off before entering curing oven

Color Inconsistency

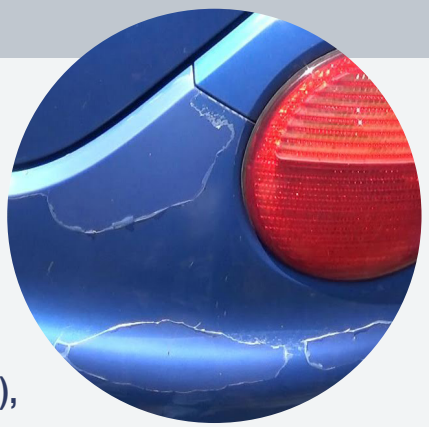
Variations in the application of the paint lead to differences in color instead of the desired uniform appearance.

CAUSES	SOLUTIONS
Variations in application parameters	Check for variables in spray application
Variations in paint (separation, settling, etc.)	Confirm that paint is properly mixed in tank and that it is circulating at an acceptable rate (≥1 FPS)
Variety of substrates (plastics, steel, aluminum, alloys, etc.)	Different substrates take paint in different ways. Confirm that the proper paint and process is being used for the substrate.
Improper flake lay (metallics & micas)	Check for proper mixing, agitation, and circulation rate (≥1 FPS). Confirm proper film build to promote consistent flake lay (excess film allows flake lay variation)
Inconsistent film build	Check gun/bell setup for proper atomization, and robot for proper pattern and overlap
Striping (inconsistent film application)	Check gun/bell setup for proper atomization, and robot for proper pattern and overlap
Contamination	Check lines and equipment for contamination from a previous color

Off Color

This differs from Color Inconsistency in that, though the color appears uniform, the shade, intensity or appearance simply does not match the requirement, often set by a sample panel or color meter reading.

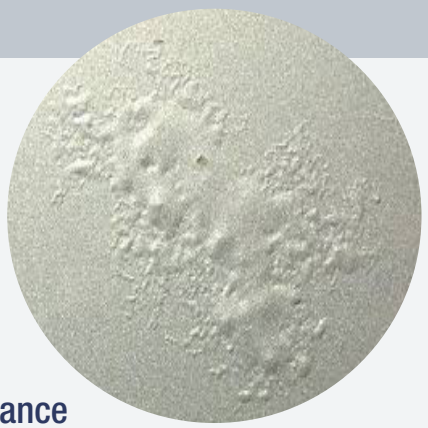
CAUSES	SOLUTIONS
Bad paint	Check paint status with manufacturer to assure that it meets specification
Excess reducing solvent added	Adding solvent can shift color. Assure that the minimum amount of solvent is being added during color setup (preferably 0%)
Low film build	Confirm that the film build is sufficient to prevent lower layers or the substrate to bleed through
Improper flake lay (metallics & micas)	Check for proper mixing, agitation, and circulation rate (≥1 FPS). Confirm proper film build to promote consistent flake lay (excess film allows flake lay variation)
Contamination	Check lines and equipment for contamination from a previous color
Bad color meter	Assure that the proper color meter (make/model) is being used for the application and that the meter is properly calibrated



Poor Adhesion

Paint is flaking, peeling or cannot pass a cross-hatch tape-pull test. This may be interlayer adhesion either (between clearcoat and topcoat, or top coat and primer), or substrate adhesion (between the substrate and the first coating layer).

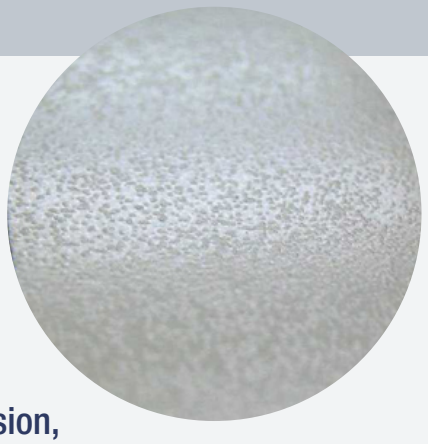
CAUSES	SOLUTIONS
Substrate not clean	Check pretreat processes to assure that the surface is properly prepared for paint application
Primer applied too dry or too thin	Review primer process for appropriate application (no dry spray, etc.)
Base coat applied too dry or too thin	Review base coat process for appropriate application (no dry spray, etc.)
Excess solvent in coating	Assure proper solvent load in layer that is failing adhesion test as excess solvent can cause improper curing and poor adhesion (see Blistering and Solvent Pop below)
Excessive flash time between coats	Especially for wet-on-wet applications, assure that the lower layers are properly prepared for application of the next coating layer
Drying conditions inappropriate	Review oven settings and confirm recommended profile to assure suitable peak substrate temperature and timing for proper curing



Substrate Inconsistency

Inconsistencies like mold or grinding marks, dents, scratches, etc. in the surface of the part causes appearance issues when painted, particularly when viewed from different angles.

CAUSES	SOLUTIONS
Poor surface preparation	Assure that smooth continuous surface is presented to the painting operation
Poor primer coverage	If primer layer is too thin it may not be able to properly fill minor surface imperfections
Poor basecoat coverage	If the basecoat layer is too thin it may not be able to hide variations in the substrate

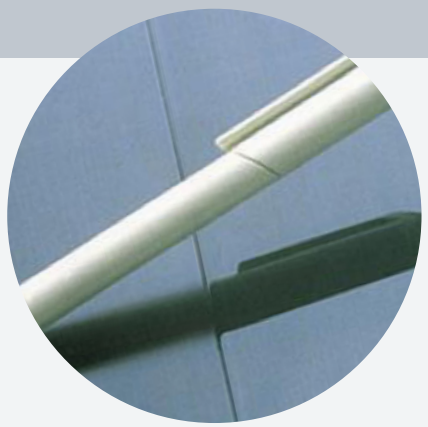


Dry Spray

The term “Dry spray” refers to a phenomenon where the paint does not flow out and the atomized particles appear more like sand or microbeads on the surface of the coating. This will usually be accompanied by adhesion, color and gloss issues.

CAUSES	SOLUTIONS
Insufficient solvent in coating	Add a small amount of solvent to the coating blend
Solvents in coating are “too fast”	Change to a “slower” solvent
Paint is too warm when applied	Reduce temperature of paint being supplied to atomizer
Atomized particles are too small	Adjust gun or bell to obtain proper atomization rate (particle size)
Ambient air temperature is too warm	Control ambient air at a lower temperature
Shaping air is too warm	Reduce temperature of shaping air to slow solvent evaporation rate

Gloss Variation



A glossy finish is inconsistent, with some areas across the surface having a lower gloss than others.

CAUSES	SOLUTIONS
Uneven curing of the base coat	Inspect and ensure proper flash off and oven settings and confirm recommended profile to assure suitable peak substrate temperature and timing for proper curing prior to clearcoat application
Uneven curing of the clear coat	Confirm oven settings and recommended profile to assure suitable peak substrate temperature and timing for thorough, uniform curing
Insufficient film build	Confirm that the clearcoat film build is sufficient and uniform across the part
Improper resin/catalyst mix	Review resin to catalyst ratio and confirm that there is sufficient mixing taking place, and extend static mixer length if required
Uneven clearcoat application	Adjust gun or bell to obtain proper atomization rate (particle size) to assure that the particles are not caught in the booth draft during certain parts of the coating process

Improper Gloss

This differs from Gloss Variations in that the entire surface is consistent, but the gloss is either lower or higher than required. This may be based on sample panels or a gloss meter reading.

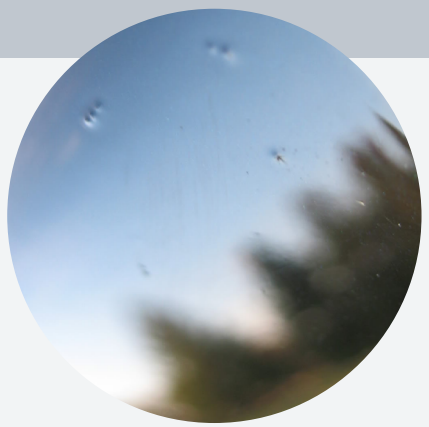
CAUSES	SOLUTIONS
Bad clearcoat	Check clearcoat status with manufacturer to assure that it meets specification
Insufficient film build	Confirm that the clearcoat film build is sufficient and uniform across the part
Improper resin/catalyst mix	Review resin to catalyst ratio and confirm that there is sufficient mixing taking place, and extend static mixer length if required
Improper atomization (particle size)	Adjust gun or bell to obtain proper atomization rate (particle size)
Improper clearcoat viscosity	Ensure correct clearcoat viscosity is supplied to atomizer
Improper clearcoat temperature	Ensure correct clearcoat temperature is supplied to atomizer
Insufficient flash time	Adjust line speed or flash tunnel temperature to assure proper flash-off before entering curing oven
Incorrect curing conditions	Review oven settings and confirm recommended profile to assure suitable peak substrate temperature and timing for proper curing

Mottle

For metallic paints, the color pigments separate from the metallic flakes, creating an uneven appearance of color.

CAUSES	SOLUTIONS
High film build	Decrease the paint flow rate or increase robot speed to reduce film build
Insufficient agitation of paint	Check for proper mixing, agitation, and circulation rate (≥1 FPS)
Inconsistent film build	Check gun/bell setup for proper atomization, and robot for proper pattern and overlap
Incorrect nozzle size	Change to correct spray nozzle
Improper atomization (particle size)	Adjust gun or bell to obtain proper atomization rate (particle size)
Insufficient air volume	Increase air flow to gun
Incorrect fan pattern / overlap	Test and correct fan pattern for smooth laydown and proper overlap to produce even film across all surfaces of part
Paint layers too heavy	Apply thinner layers to control flake lay
Insufficient time between layers	Extend time between layers by slowing line or repeating passes
Solvent too “fast”	Switch to a slower solvent to allow more time for flake laydown and orientation
Poor spray pattern	Review robot program and adjust accordingly

Dirt



Specks of dirt and other impurities are visible in the paint job.

CAUSES	SOLUTIONS
Dirty air filters	Replace with clean filter media
Poor air flow	Identify and correct booth airflow issues
Contaminated substrate	Assure clean parts supplied to paint process from blow-off and/or tack operations
Agglomerated paint	Assure paint is properly filtered, agitated and circulated (≥1 FPS)
Contaminated circulation/supply system	Assure that system is clean prior to color change and that paint is transported at a sufficient velocity (≥1 FPS)

Craters

Also known as “Fisheyes” or “Cissing”, these are defects on the paint surface reminiscent of volcanic or lunar “craters” appear instead of the intended smooth finish. These are generally caused by low surface tension areas on the surface of the substrate but can also be caused by contamination of the wet surface after coating but prior to curing.

CAUSES	SOLUTIONS
Surface contamination with oil, grease, wax, silicone or other residue	Ensure proper cleaning of substrate prior to introduction into the paint process
Surface contamination with residue from clothing, gloves, lotions and antiperspirants	Enact and strictly enforce rules regulating the use of products containing silicone
Lubricants from moving parts	Assure proper lubrication of conveyors and other systems without over-lubricating
Release agents from plastic parts	Test equipment for silicone contamination
Dirty ceiling and floor filters	Perform regular maintenance on all filters and fans
Transportation or storage materials that became contaminated	Ensure that all materials entering the paint area are free of contamination
Inlet of impure air from another work area	Regulate and purify all air entering the paint and substrate areas

Poor Coverage

Substrate is visible through the topcoat, creating uneven coloration on the surface.

CAUSES	SOLUTIONS
Excess reducing solvent	Restrict the amount of reducing solvent being added to adjust viscosity
Inconsistent film build	Check gun/bell setup for proper atomization, and robot for proper pattern and overlap
Variations in paint (separation, settling, etc.)	Confirm that paint is properly mixed in tank and that it is circulating at an acceptable rate (≥1 FPS)
Atomized particles are too small	Adjust gun or bell to obtain proper atomization rate (particle size)
Electrostatic level set incorrectly	Check electrostatic system and adjust as required
Part not properly grounded	Assure that part/mule/conveyor is properly grounded
Excessive booth draft	Check booth airflow and adjust if required

Pinholes (Outgassing)

Caused by gasses that originate from the substrate or lower layers in the coating structure, these appear similar to solvent pops but are generally “less violent” as they occur before the uppermost coating layer has had a chance to “skin over” (see Solvent Pop” below). These are common in wet-on-wet applications.

CAUSES	SOLUTIONS
Air entrapment during coating	Assure that coating is applied with sufficient flow out time to allow entrapped air to escape prior to curing
Improper paint viscosity	Ensure correct paint viscosity is supplied to atomizer
Insufficient curing of lower paint layers	Assure proper curing is performed on each layer as it is applied
Improper surface cleaning	Assure all moisture is removed from the surface prior to coating at each stage of the process
Improper mixing of coating	Check for proper mixing, agitation, and circulation rate (≥1 FPS).
Solvent too “slow”	Switch to a “faster” solvent blend

Blisters

Usually solvent related, these are bubbles, ranging from micro-small to very large, that appear in the surface of the paint. These often are accompanied by adhesion related defects.

CAUSES	SOLUTIONS
High film build	Decrease the paint flow rate or increase robot speed to reduce film build
Flash off time between coats is too short	Extend flash off times or increase temperature to speed flash off
IR lamps used for flash off/drying/baking are placed too close to surface, prematurely curing the surface of the uppermost layer	Ensure proper distance between lamps and surface and that the appropriate exposure times are used with IR lamps
Poor surface preparation	Assure that part surfaces are clean and dry before sending to the paint operation
Compressed air contamination	Assure that all compressed air supplied to the painting operation is dry and free of all lubricants and contaminants
Excess reducing solvent added	Restrict the amount of reducing solvent being added to adjust viscosity

Solvent Pop

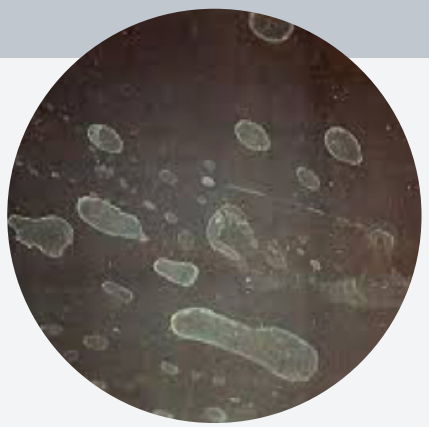
This is an extreme form of blistering where the pressure from the “bubbles” formed by the solvent trapped under the surface is sufficient to actually rupture the surface of the coating. These are generally of a more “violent” nature than pinholes, where the gas escapes through wet, uncured coating.

CAUSES	SOLUTIONS
Excess reducing solvent added	Restrict the amount of reducing solvent being added to adjust viscosity
High film build	Decrease the paint flow rate or increase robot speed to reduce film build
IR lamps used for flash off/drying/baking are placed too close to surface, prematurely curing the surface of the uppermost layer	Ensure proper distance between lamps and surface and that the appropriate exposure times are used with IR lamps
Zone 1 of oven too hot causing premature skinning of the coating before the substrate temperature is elevated	Check oven profile and assure that Zone 1 is not set too high
Flash off time is too short	Extend flash off time or increase temperature to speed flash off
Solvent too “slow”	Switch to a “faster” solvent blend

Runs & Sags

Generally associated with heavy coating areas, the paint does not adhere uniformly to the surface, forming layers which slip against one another causing beads, drips, runs and sags. These are worse in vertical surfaces where gravity exerts a downward force on the film but can also appear on horizontal surfaces as the excess paint attempts to flow out from the point of application.

CAUSES	SOLUTIONS
High film build	Decrease the paint flow rate or increase robot speed to reduce film build
Improper paint viscosity	Ensure correct paint viscosity is supplied to atomizer
Excess reducing solvent added	Restrict the amount of reducing solvent being added to adjust viscosity
Solvent too “slow”	Switch to a “faster” solvent blend
Flash off time between coats is too short	Extend flash off times or increase temperature to speed flash off
Improper atomization (particle size)	Adjust gun or bell to obtain proper atomization rate (particle size)
Incorrect spray gun pressure (see atomization below)	Adjust spray gun pressure
Incorrect nozzle in spray gun (see atomization below)	Change spray nozzle
Substrate surface is too cold when paint is applied	Increase substrate temperature before applying paint
Surface contamination with oil, grease, wax, silicone or other residue	Ensure proper cleaning of substrate prior to introduction into the paint process



Spitters

Spitters are the result of condensation which forms when the compressed air used for turbine drive and shaping air decompresses, falling below the dew point temperature of the booth, which is generally high due to the elevated humidity.

CAUSES	SOLUTIONS
Turbine drive air cools cup surfaces forming condensation which is atomized along with the paint	Heat turbine drive air so it is above dew point temperature when released
Shaping air falls below dew point temperature causing water droplets to form in the shaping air stream	Heat shaping air so it is above dew point temperature when released

The successful application of paint in the manufacturing process requires many variables to be both controlled and in alignment with one another. Identifying and resolving paint problems before they have the opportunity to impact a production run are key factors in an efficient business process to maximize revenue and minimize waste.

At Saint Clair Systems, we design temperature and viscosity control systems as a means of improving fluid delivery applications. When the correct fluid parameter control process is in place for your particular application, the incidence of paint defects will be reduced, providing a range of benefits. Contact Us today if you've been experiencing paint defects and need a reliable solution.

OUR COMPANY

Since 1990, Saint Clair Systems has focused on providing cost-effective paint temperature and viscosity control solutions for the automotive and industrial finishing industries. Our team can provide an analysis of your painting process and offer suggestions based on the hundreds of installations we've seen.

Need Assistance with your Viscosity Issues?

Contact us for a free consultation

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Discover the 3 biggest factors working against your finish.

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