

# STRATEGIC VISIONARY SOLUTIONS® LLC

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*"Providing Solutions to Your Challenges"*

*Strategic Visionary*

**SVS**

*Solutions® LLC*

*—Established 2014—*

**NANO-CLEAR® NCI  
INDUSTRIAL COATING  
TECHNICAL GUIDE**

## TECHNICAL GUIDE

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**Strategic Visionary Solutions® LLC** is pleased to present you with the following information and Technical Guide for our industrial nano-structured coating products **called Nano-Clear® (NCI)**. **This Technical Guide** has been prepared in order to provide you with the proper understanding required for the preparation and application of Nano-Clear®, along with its long-term benefits and features.

We suggest that you take your time to carefully review this Technical Guide and make notes on any information that may not be clear, or that you feel requires further clarification. It would be our pleasure to assist you in answering any additional questions that you may have regarding **Nano-Clear® Industrial Coatings (NCI)** technology. We can be reached by email at: [info@strategicvisionsolutions.com](mailto:info@strategicvisionsolutions.com) or call us at 586.295.7825.

A thorough knowledge and understanding on how **Nano-Clear® (NCI)** works is important in being able to properly and accurately explain its properties to customers. Please keep in mind that intellectual property on formulation(s) are a trade-secret and are, therefore, proprietary in nature.

This corrosion and technical guidance is drawn from the Association of Materials Protection and Performance (AMPP) published instructions.

# TABLE OF CONTENTS

<b>TECHNICAL GUIDE</b>	.....	.....	.....	.....	.....	.....	.....	.....	<b>2</b>
<b>SECTION 1 - NANO COATINGS</b>									<b>5</b>
1.1	Nanotechnology								5
1.2	Multifunctional Concepts								5
1.3	Nano Coating Definition								5
1.4	Benefits of Nano Materials								6
1.5	Protective Polymer Coatings								6
<b>SECTION 2 - NANO-CLEAR® INDUSTRIAL COATINGS</b>									<b>7</b>
2.1	Crosslink Density Importance								7
2.2	Enhancement for Highly Oxidized Coatings								7
2.3	Nano-Clear® Restoration of Color								8
2.4	Recommended Applications for Nano-Clear® Coating Systems								9
<b>SECTION 3 - NANO-CLEAR® PROPERTIES</b>									<b>10</b>
3.1	Nano-Clear® Coating Systems Physical Properties								10
3.2	Nano-Clear® Shelf Life, Storage, and Package Stability								11
3.3	Nano-Clear® Limitations								11
3.4	Nano-Clear® Features & Asset Benefits								12
	3.4 a - Nano-Clear® Features								12
	3.4 b - Nano-Clear® Benefits								12
3.5	Nano-Clear® Test Results								13
<b>SECTION 4 - SAFETY DATA SHEETS</b>									<b>18</b>
4.1	Safety Data Sheets								18
<b>SECTION 5 - SURFACE PREPARATION</b>									<b>19</b>
5.1	Substrate Consideration								19
5.2	Surface Preparation								19
5.3	Surface Preparation Standards								20
<b>SECTION 6 - NANO-CLEAR® PROCESS</b>									<b>22</b>
6.1	Application Considerations and Recommendation								22
6.2	Personal Protection Equipment								22
	6.2 a - Respiratory Protection								22
6.3	Application Environment								22
6.4	Application Parameters								23
6.5	Environmental Conditions Consideration								23
6.6	Substrate Consideration								23
6.7	Recommended Film Build								24
	6.7 a - General Film Build								24
	6.7 b - Nano-Clear® Applied Over Oxidized/Chalked Paint								24
	6.7 c - Nano-Clear® Applied Over Fresh Paint								24

<b>SECTION 7 - APPLICATION EQUIPMENT</b>	.....	.....	.....	.....	.....	.....	<b>25</b>
7.1 Application Equipment	.....	.....	.....	.....	.....	.....	25
7.1 a - Air Spray Equipment	.....	.....	.....	.....	.....	.....	25
7.1 b - Airless Spray Equipment	.....	.....	.....	.....	.....	.....	25
7.1 c - Wipe-On Technique Equipment	.....	.....	.....	.....	.....	.....	25
7.2 Buffing & Polishing	.....	.....	.....	.....	.....	.....	26
7.3 Surface Maintenance & Cleaning	.....	.....	.....	.....	.....	.....	26
<b>SECTION 8 - WARRANTY &amp; LEGAL DISCLAIMER</b>	.....	.....	.....	.....	.....	.....	<b>27</b>
8.1 Warranty & Legal Disclaimer	.....	.....	.....	.....	.....	.....	27
<b>SECTION 9 - GLOSSARY, CONVERSIONS &amp; PROLOGUE</b>	.....	.....	.....	.....	.....	.....	<b>28</b>
9.1 Glossary of Terms & Definitions	.....	.....	.....	.....	.....	.....	28
9.2 Coating Thickness Conversion Table	.....	.....	.....	.....	.....	.....	35
<b>SECTION 10 - APPENDICES</b>	.....	.....	.....	.....	.....	.....	<b>36</b>
Appendix 1 Business Case Analysis	.....	.....	.....	.....	.....	.....	37
Appendix 2 Spray Technique on Flat Surfaces	.....	.....	.....	.....	.....	.....	39
Appendix 3 Prevention: HVLP, Viscosity and Hot Spraying.....	.....	.....	.....	.....	.....	.....	42
Appendix 4 Water & Solvent Based Coatings Technologies.....	.....	.....	.....	.....	.....	.....	44
Appendix 5 Volatile Organic Compounds (VOCs) Comparison	.....	.....	.....	.....	.....	.....	46
Appendix 6 Respiratory Personal Protection Equipment	.....	.....	.....	.....	.....	.....	48
Appendix 7 Portable Controlled Workshop Environment	.....	.....	.....	.....	.....	.....	49
Appendix 8 Nano-Clear® Dispensing Process	.....	.....	.....	.....	.....	.....	50
Appendix 9 Coating Failures & Defects	.....	.....	.....	.....	.....	.....	55
Appendix 10 Spray Equipment Information	.....	.....	.....	.....	.....	.....	65
<b>CONTACT INFO.</b>	.....	.....	.....	.....	.....	.....	<b>68</b>

# 1 – NANO COATINGS

## 1.1 - Nanotechnology

**Nanotechnology** provides us with the ability to develop and alter materials at the molecular level. Manufacturing at the atomic levels allows chemists, master chemists, chemical engineers, and scientists world-wide to alter physical characteristics of parent materials atom-by-atom to create entirely new substances.

All products are produced from raw materials. These raw materials are composed of particles which are usually invisible to the naked eye. Conventional materials have particles with sizes varying from 100's of a micron (a millionth or  $10^{-6}$  of a meter) to a millimetre (a thousandth or  $10^{-3}$  of a meter). A nano material has a particle size of 1 - 100 nano-meters/nm ( $10^{-9}$ ), which exhibits unusual physical and electronic properties.

Nanotechnology is very diverse, ranging from extensions of conventional device physics to completely new approaches based upon molecular self-assembly, from developing new materials with dimensions on the nano-scale, to investigating whether we can directly control matter on the atomic scale.

## 1.2 - Multifunctional Concepts

One nanometer (nm) is one billionth, or  $10^{-9}$ , of a meter. By comparison, typical "carbon-carbon" bond lengths, or the spacing between these atoms in a molecule, are in the range of 0.12 – 0.15 nm. DNA double-helix has a diameter around 2 nm. The smallest cellular life-forms of the bacteria genus Mycoplasma are around 200 nm in length.

The comparative size of a nanometer to a meter is the same as that of a marble to the size of the earth. Or another way of putting it: a nanometer is the amount a man's beard grows in the time it takes him to raise the razor to his face.

Two main approaches are used in nanotechnology. In the "bottom-up" approach, materials and devices are built from molecular components which assemble themselves chemically by principles of **molecular recognition**. In the "top-down" approach, nano-objects are constructed from larger entities without atomic-level control.

## 1.3 - Nano Coating Definition

It is best to begin by defining a conventional nano coating. By adding nano-particles to a coating or polymer system, there will be improvements to physical properties such as UV ray absorption, scratch resistance, its anti-bacterial function, odor absorption, and its hydrophobic or hydrophilic properties.

Nano-particles act as a filler or additive to a conventional coating system. These added nano-particles do not form the "building blocks" of a polymer structure or change the overall physical properties of the coating system. These physical properties are inherent within the polymer itself.

If the coating polymer is inferior, so is the coating system. Adding nano-particles to an inferior coating polymer will only incrementally improve the system.

## **1.4 - Benefits of Nano Materials**

With the addition of nano materials, some benefits can include exceptional lightness, strength, hardness, durability, high wear resistance, high chemical resistance activity, and even claimed self-cleaning characteristics. It can be noted that materials built from nano-sized particles can generate tremendous useful properties for further exploration.

## **1.5 - Protective Polymer Coatings**

Numerous different polymer-based coatings are used for protective coatings. The word polymer comes from Greek where “poly” means many, and the word “mer” means unit, hence "many units". Polymers refer to compounds of high molecular weight derived from the addition of many smaller molecules or by the condensation of many small molecules along with the elimination of water, alcohol, or the like.

Coatings are based on polymers such as epoxies, polyesters, vinyl esters, polyurethanes, polyureas, and others. A higher degree of chemical crosslinking or crosslink density produces coatings with much greater chemical and thermal resistance.

## 2 - NANO-CLEAR® INDUSTRIAL COATINGS

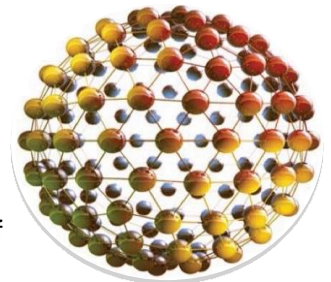
**Nano-Clear®** Industrial Coatings are a transparent, aliphatic, humidity cured, single component (1K), polyurethane/polyurea hybrid formulated coating. Nano-Clear® Industrial Coatings (NCI) solutions are manufactured using proprietary 3D nano-structured polymers. These 3D nano-scale networks form the polymer backbone of all Nano-Clear® Coating Systems.

### 2.1 - Crosslink Density Importance

Dynamic Mechanical Thermal Analysis (DMTA) has been utilized to effectively evaluate the “crosslink density” of coating polymer systems. Recorded DMTA measurements support an unprecedented high crosslink density of Nano-Clear® Coating Systems, a result that is 3X higher than conventional industrial, marine, aerospace, or fleet coating systems.

Coatings contain “building blocks” with functional groups. The chemical reaction of these groups during curing forms a network. In traditional coating polymer systems, its network is a linear chain of molecules with low crosslink density.

Conversely, Nano-Clear® uses a “nano-structure” to produce a *3D Molecular Architecture*. This 3D polymer network has an exponentially higher number of crosslinked sites. The result is a tight knit mesh with unprecedented DMA density.



**3D Molecular Architecture**

Extreme crosslink density provides a platform for the development of multi-functional surface properties, which include, but are not limited to, unmatched corrosion, UV, scratch, abrasion, chip, and chemical resistance with extended durability.

This also leads to low surface energy, repelling water (hydrophobic), and aiding in the ease of release for common surface contaminants such as ice, dirt, brake dust, concrete dust, and oil/grease, and bio-fouling.

Nano-Clear® coatings impart these dramatic functions **without** the addition **or need** of nano-particles as is common to many marketed Nano Coatings.

All Nano-Clear® Coating systems rely on high crosslink density, so they can easily meet and exceed OEM automotive, aerospace, marine, and industrial manufacturing technical specifications.

### 2.2 - Enhancement for Highly Oxidized Coatings

Over the last three decades, coating polymer chemistries have been a variation on the same (linear chain) polymer themes. As a result, industrial customers are on an endless cycle: paint the asset and then watch as the unavoidable sequence of oxidation, loss of gloss, corrosion, and paint failure takes place.

This is followed by the eventual and unavoidable costly, labor-intensive surface preparation and re-painting project in order to maintain an asset with the reapplication of the same conventional coating systems.

Nano-Clear® Industrial Coating systems can restore color and gloss and add a surface hardness that will extend the life of a conventional coating by 10 years.



No matter how badly the oxidized (chalked) condition of the existing coating, Nano-Clear® can restore its color and gloss with unmatched surface protection backed by a full 10-year warranty.

Nano-Clear® (NCI) can be applied to new or highly oxidized coatings: 2K epoxies, 2K polyurethanes, powder-coatings, polyesters, gel coats, e-coats, latexes, fiberglass, and anodized aluminum (to prevent filiform corrosion, etc.).

### 2.3 Nano-Clear® Restoration of Color

NCI has a very low viscosity (200 centipoise) which helps it to penetrate deeply into the smallest pores of fresh or oxidized (chalked) coatings, turning the chalked and powdered layers transparent and allowing the original underlying color to show through while fortifying and hardening the surface.

Humidity cured at ambient temperatures, NCI quickly hardens to fortify the painted surface, subsequently “locking-in” the restored color and stopping future damage from oxidization with its long-term UV absorbers (aliphatic properties).

#### IMPORTANT NOTE:

NCI must be applied over the existing coating before the coating has deteriorated into a powdered, peeling, and/or eroded state. NCI is not a rust converter. Rust or peeling coatings must be removed, and the surface should first be repainted with coatings such as a "high solids" 2K epoxy or 2K polyurethane before applying NCI.

## 2.4 - Recommended Applications for Nano-Clear® Coating System

NCI is the premium coating solution for applications such as, but not limited to, the following:

- **Above Ground Fuel and Chemical Storage Tanks**
- Agriculture, Construction and Earth Moving Equipment (ACE)
- **Anodized Aluminum**
- Chemical Transport Railcars
- **Commercial and Industrial HVAC Equipment**
- Commercial Cooling Towers
- **Concrete Building Facades**
- Concrete Floors
- **Epoxy Coated Floors**
- Fiber Glass - Gel Coated Vehicles and Equipment
- **Fleet Vehicles**
- Hydro, Electrical and Telecom Enclosures
- **Industrial pumps and Valves**
- Life Boats
- **Marine Vessels**
- Metal Roof Manufacturing
- **Oil Pipelines**
- Painted Metal Guard Rails
- **Painted Steel Bridges**
- Painted Utility Poles
- **Primary and Secondary Wood Protection Manufacturing**
- Shipping Containers
- **Small, Medium and Large Appliance Manufacturing**
- Stamped and Precast Concrete

# 3 - NANO-CLEAR® PROPERTIES

## 3.1 - Nano-Clear® Coating Systems Physical Properties

- Polymer Chemistry - Nano-structured Polyurethane/polyurea hybrid coating
- Mixing Ratio - No mixing required
- Recommended Dry Film Thickness (DFT) - 1.00 to 2.00 mils (25 – 50 µm)
- Tested
  - Pencil Hardness - 4H
  - Pendulum Hardness (Persoz) - 220
  - Abrasion Resistance - 8.4 mg loss
  - Impact Strength - >140
  - Water Immersion - Pass
  - QUV Resistance - 99%
  - MEK Resistance - >1500
  - Salt Spray - 4000 hours, No rust, No blisters
  - DMA Crosslink Density (x103 mol/m<sup>3</sup>) - 2.17
  - VOC (less exempts) - 1.05 lbs/gal or 126 g/L
  - Viscosity - 200 cps (23 Seconds #3 Zahn Cup)
- Weight per gallon - 8.0 lbs (3.63 kg)
- Packaging\*
  - 1 gallon (3.8 ltrs)
  - 5 gallon (19ltrs)
  - 55 gallon (208 ltrs)
- Shipping weight
  - 1-gallon container - 8 lbs (3.63kg)
  - 5-gallon pail - 40 lbs (18.14 kg)
  - 55-gallon drum - 440 lbs (200 kg)
- Surface Coverage per gallon
  - 1,122 ft<sup>2</sup> / gal @ 0.50 mil **DFT**
  - 93m<sup>2</sup> / 3.8 ltr @ 0.50 mil **DFT**

### IMPORTANT NOTE:

\* All Nano-Clear® products are packaged in plastic, UN compliant containers and drums for domestic and international shipping and storage.

## 3.2 - Nano-Clear® Shelf Life, Storage, and Package Stability

1. Shelf Life for Unopened Containers - 6 months from date of manufacturing
2. Storage Temperatures - Between 40°F / 4°C and 72°F / 22°C
3. Shelf Life for Opened Containers - 2 weeks
4. General Storage Information - Storage location must be dry with temperatures between 40°F / 4°C and 72°F / 22°C

**NOTE:** Higher storage temperatures will decrease shelf life.

Nano-Clear®, a humidity cured coating, is sensitive to moisture contamination. It is **VERY** important to quickly recap and tightly close the Nano-Clear® container once the product has been dispensed. **DO NOT** leave the container open for any short or extended periods of time. Doing so will allow the solvents to evaporate and crosslinking will begin.

Moisture contamination or high storage temperatures will cause Nano-Clear® to gel. Discard the contents if Nano-Clear® has turned WHITE or has entered a GEL state.

### WARNING:

It is also **NOT** recommended to repackage Nano-Clear® into smaller containers without first consulting [Strategic Visionary Solutions](#) for instructions on proper container types, as well as the procedures and usage of nitrogen gas blanketing.

## 3.3 - Nano-Clear® Limitations

**DO NOT** apply Nano-Clear® to:

- Bare untreated aluminium
- Bare untreated steel
- Bare untreated chrome
- Ceramic Tile
- Glass
- Nylon
- PMMA Plastic
- PPO Plastic
- HDPE Plastic
- Natural Stone

It is **CRITICAL** that a test panel/patch be coated prior to a large-scale application to confirm coverage rate and to ensure that the substrate to be coated with Nano-Clear® will accept it without negative aesthetic effects.

### **3.4 - Nano-Clear® Features and Asset Benefits**

NCI was designed from the beginning to provide not just an alternative to the status quo of products currently available on the market, but to exceed and far surpass the qualities of standard coatings.

Development of NCI's cutting edge, densely cross-linked, polymer technology provides the optimum in surface protection possible, which results in many additional valuable benefits including a highly reduced impact on the environment.

#### **3.4 a - Features**

NCI's protective coating provides the following in terms of premium protection:

- Low Viscosity
- Extreme Scratch, Abrasion, Chip, Impact, and Mar Resistance
- Extreme Chemical Resistance
- Extreme Corrosion Resistance
- Extreme UV and Weathering Resistance
- Extended Gloss Retention
- Highly Oxidized Coating Restoration
- Extended Service Life

#### **3.4 b - Benefits**

NCI's protective coating solutions have direct beneficial impacts on time and cost expenses, as well as the environment.

- Reduces Shipping & Handling
- 10 Year Recoat Cycle Lowers Maintenance Costs
- 2X - 4X Lower in Coating Volume Needs
- Increased Sustainability
- Higher Resale Value of Asset(s)
- Reduces Down-Time During Maintenance Periods
- Reduces Storage Needs, Less Product Required
- Higher and Sustained Visibility of Asset(s)
- Shorter Recoating Cycle (24-hour cure time)
- Low VOC Meets & Exceeds Global Environmental Responsibility Standards
- Low VOC Reduces Health Risks for Application Personnel
- Lower Recoating Inventory Needs, Reduces Costs
- Lowers Costs Due to Reduction and Elimination of Corrosion

### 3.5 - Nano-Clear® Test Results

PROPERTY/TEST	TEST METHOD	RESULTS	TESTING SOURCE
Crosslink Density	DMA (Dynamic Mechanical Analysis)	2.17 (X10 <sup>3</sup> mol/m <sup>3</sup> )	Nippon Paint
VOC	ASTM D3960	1.25 lb/gal (150 g/l)	Nanovere
Recommended Dry Film Thickness	ASTM D5796	1 mil to 2 mils	Nanovere
Coverage	Nanovere	1122 sq ft/gal (at 1 mil)	Nanovere
Gloss 20° / 60°	ASTM D523	86.0 / 92.2	Stonebridge Technical Services
ABUSE RESISTANCE			
Abrasion Resistance (CS-17, 1 kg, 1000 cycles)	ASTM D4060	8.4 mg loss	Nippon Paint
Pencil Hardness, Scratch	ASTM D3363	4H	Stonebridge
Scratch Hardness	SASO 2833	2500 gm	Saudi Standards, Metrology, & Quality Organization (SASO)
Pencil Hardness, Gouge	ASTM D3363	5H	Stonebridge
Pendulum Hardness (Persoz)	ASTM D4366	> 250 oscillations	Nippon Paint
Impact Resistance 18°C Direct in/lbs	ASTM D2794	50 Pass / 60 Fail	Stonebridge
Impact Resistance 18°C Reverse in/lbs	ASTM D2794	10 Pass / 20 Fail	Stonebridge
Impact Resistance	SASO ISO 3248	1 kg - 160 cm	SASO
Impact Strength	ASTM D2794	145 kg-cm	SASO
Chip Resistance 23°C (2 mils)	ASTM D3170	7A	Stonebridge
Chip Resistance -29°C (2 mils)	ASTM D3170	7B	Stonebridge
Falling Sand Abrasion 100 liters	ASTM D968	Pass	Stonebridge
Mar Resistance	ASTM D5178	5.0 kg	SASO
ENVIRONMENTAL RESISTANCE			
Xenon WOM Resistance 4000 hrs	SAE J1960 ASTM G155	100% Gloss Retention 99% Gloss Retention	Stonebridge Nippon Paint
QUV 313, >1500 hrs	ASTM D4587	100% Gloss Retention	Nippon Paint
Water Immersion Test 240 hrs @ 50°C	ISO 2812-2	Pass	Nippon Paint
Salt Spray, 4000 hrs	SASO ISO 11997	Excellent	SASO
Humidity, 100% RH, 100°F, 240 hrs	ASTM D 1735-02	No loss of adhesion. No change.	American Racing Custom Wheels
CASS 240 hrs @ 50°C	JIS H8502-7	Pass	Nippon Paint
Thermal Shock (100°F 3 hrs, Freeze 3 hrs, Steam Blast 30 sec)	GM9525P	No loss of adhesion. No Change.	American Racing Custom Wheels
CHEMICAL RESISTANCE			
10% Sulfuric Acid	ASTM D 1308	No effect	Stonebridge
10% Hydrochloric Acid	ASTM D 1308	No effect	Stonebridge
10% Sodium Hydroxide	ASTM D 1308	No effect	Stonebridge
10% Ammonium Hydroxide	ASTM D 1308	No effect	Stonebridge
Isopropyl Alcohol	ASTM D 1308	No effect	Stonebridge
Xylene	ASTM D 1308	No effect	Stonebridge
Skydrol® 500 Fluid	ASTM D6943-A	No effect	Stonebridge
MEK Resistance	ASTM 4752	1500 double rubs	Stonebridge
ADHESION, FLEXIBILITY & CLEANING			
Adhesion, Direct to Metal	ASTM D4541	3 Mpa	SASO
Adhesion, Cross Cut	SASO ISO 2409	Rating 10	SASO
Flexibility, 1mm Mandrel	SASO 2833	Passed (Very Good)	SASO
Flexibility, Cylindrical Mandrel	SASO ISO 1519	3 mm Passed (Excellent)	SASO
Flammability, Surface Flame Spread	ASTM E84 / BS476	Class 1 (Excellent)	SASO
De-Icing Aid	Coated equipment frozen in 20 ft freezer	It was possible to flake off ice bits and melting was faster.	Schlumberger
Self-Cleaning Properties		Oil & Dirt Release; Hydrophobic, Brake-Dust Release	Nippon Paint



## Nano-Clear NCI for Industrial - Ammon Painting Restoration & Abatement

### Summary of Bridge Testing, MoDOT Chemical Laboratory

Test Panels	Test Conditions	Test Method	Testing Time	Test Results Nano-Clear NCI	Test Results Conventional Topcoat
Coating applied over existing paint system	UV Exposure / Condensation	ASTM G154	2000 hr.	<b>PASS</b> No Weathering Observed	<b>Fail</b>
Coating applied over existing paint system	Salt Fog Exposure / Corrosion Resistance	ASTM B117	2000 hr.	<b>PASS</b> No Weathering or Corrosion Observed	<b>Fail</b>
Coating applied over existing paint system	UV Exposure on MoDOT Laboratory Roof	NONE	4000 hr.	<b>PASS</b> No Weathering Observed	<b>Fail</b>



Saudi Standards, Metrology and Quality Organization

SINo	Characteristics	Test Results		Method of Tests
		Polyurethane White without Nano-Clear NCI	Polyurethane White with Nano-Clear NCI	
1	Gloss at 60°	80 (Good)	92.0 (Excellent)	SASO 2833
2	Scratch Hardness	1500 gm. (Good)	2500 gm. (Excellent)	SASO 2833
3	Abrasion Resistance (Loss in weight)	20.6 mg (Good)	8.5mg (Excellent)	SASO 2833
4	Impact Strength	100 kg-cm (Good)	145 kg-cm (Excellent)	ASTM D4060
5	Mar Resistance	2.0 kg (Good)	5.0 kg (Excellent)	ASTM D5178
6	Alkali Resistance	Good	Excellent	SASO 2833
7	Acid Resistance	Good	Excellent	SASO 2833
8	MEK Resistance	200 cycles (Gloss decreased -Fair)	> 1000 cycles (No effect on gloss - Excellent)	ASTM D4752
9	Flexibility	Passed 3mm mandrel test (Good)	Passed 1mm mandrel test (V. Good)	SASO 2833
10	Adhesion (Metal Surface)	1.5 Mpa (Good)	3 Mpa (Very Good)	ASTM D4541
11	Pencil Hardness	3H (Good)	5H (Excellent)	SASO ISO 15184
12	Cross Cut Adhesion	Rating 7 (Good)	Rating 10 (Excellent)	SASO ISO 2409
13	Flexibility Cylindrical Mandrel	5 mm Passed (Good)	3 mm Passed (Excellent)	SASO ISO 1519
14	Impact Resistance	1kg – 120cm (Good)	1kg – 160cm (Excellent)	SASO ISO 3248
15	Flammability – Surface Flame Spread	Class 4 (Fair)	Class 1 (Very Good)	ASTM E84 / BS476
16	Salt Spray Resistance	500 hours (Passed)	4000 hours (Passed)	SASO ISO 11997
17	Accelerated Weathering (1000 hours)	Fair (Change in color and gloss >10%)	Excellent (Change in color and gloss <2%)	SASO ISO 16474-2

Testing performed by:  
Musarrat Husain Jafri, Consultant  
Saudi Standards, Metrology and Quality Organization

ICL employs some of the world’s most innovative scientists in the areas of agro, food, water and materials. We employ over 500 R&D specialists to serve our customers and to develop new, sustainable products and applications at our central R&D facility located in Israel (“IMI”) and at our business units worldwide. IMI has achieved ISO 9001, ISO 14001 and SI OHSAS 18001 certification from the Standards Institution of Israel.

## **EXECUTIVE SUMMARY**

Nano Clear NCI is a polyurethane topcoating that is a one-component in a hybrid structure with high cross-link bonding that should provide it with corrosion, UV and abrasion resistance (this in addition to its suitability to a wide range of coating systems).

In this study, samples of Nano Clear NCI from Strategic Visionary Solutions were tested in a salt spray chamber for up to 5000 hours and then tested in field test for 1 full year at ICL plants; Dead Sea Works and Rotem, in different locations with severe corrosion conditions.

The results show high corrosion resistance of the Nano-Clear NCI coating during 5000 hours in a salt chamber. In addition, an abrasion test, adhesion and thickness measurements were performed before and after the salt spray exposure. The results of the field tests are summarized below.

Summary	Overall Performance	V Cut	Change in thickness	Location
Good	✓	✓	✓	Rotem plant area #4
Good	✓	✓	✓	DSW area #1
Good	✓	✓	✓	DSW area #2

- Summary Legend: Bad, Medium or Good
- Adhesion results are between 7-10 MPa with adhesive failure.
- Abrasion results are: Average Wear Index 40 [mg/cycle] and Wear Cycles 1337 [cycle/mil].

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# Competitive Analysis

*CeramiClear® is considered the highest scratch resistant automotive clear coat*

## Nano-Clear vs. CeramiClear®

- **75%** better direct impact **60%** reverse
- **82%** better abrasion resistance
- **477%** better solvent resistance
- **6H** pencil break compared to **F**

## Vecdor vs. DuPont® OEM

*Acrylic Silane Melamine*

- **250%** better direct impact resistance
- **3,100%** better in-direct impact
- **163%** better abrasion resistance
- **6H** pencil break compared to **4H**

## Nano-Clear vs. Desothane HS®

*Military Aircraft – Boeing & Airbus*

- **75%** better direct impact resistance
- **6H** pencil break compared to **2H**
- Similar solvent resistance



**DLH Notes:** 1. During MEK double rubs, the Nano-Clear coat exhibited a lot of lubricity where the MEK seemed to have no impact on the clearcoat. In my experience with automotive clearcoats, there is a certain amount of "drag" felt at the beginning or within 100 double rubs of the test. This "drag" was felt with the CeramiClear product, but not with the Nano-Clear coat. The same phenomenon was noted when attempting to write on the clearcoat with a permanent marker. We were able to mark easily on the CeramiClear product with ink pen and permanent marker, but not on the Nano-Clear coat.

**STONEBRIDGE**  
TECHNICAL SERVICES  
Division of Stonebridge Technical Enterprises, LLC

## 4 - NANO-CLEAR® SAFETY DATA SHEETS

**Safety Data Sheets** include information about the properties of the substance or mixture, its hazards and instructions for handling, disposal and transport and first-aid, fire-fighting and exposure control measures. However, if the substance or mixture is also sold to the general public, an SDS does not need to be provided unless requested by a downstream user or distributor.

For mixtures which are not classified as hazardous, but which contain certain hazardous substances, an SDS should be provided if requested by downstream users or distributors. The safety data sheet should be updated without delay if new information becomes available on the hazards or the need for more stringent risk management measures.

When downstream users receive a safety data sheet, they need to identify and apply appropriate measures to adequately control the risks. Suppliers and recipients of SDSs are encouraged to check that the required information is provided. Downstream users are encouraged to inform their suppliers about inaccuracies or inconsistencies in the SDS received.

When safety data sheets are not required, the supplier must still provide sufficient information for safe use. If restriction or authorization applies to any substance, the necessary details should be provided. Suppliers of articles that contain more than 0.1% w/w of a substance on WHMIS must provide enough information to allow the safe use of the article to downstream users and distributors

### 4.1 - Safety Data Sheets

Safety Data Sheets can be downloaded and viewed on the <https://StrategicVisionarySolutions.com> website.

# 5 - SURFACE PREPARATION

**Surface preparation** is regarded and accepted by the corrosion control industry as the most important factor during any painting and coating operation. The amount of surface preparation carried out or the actual cleanliness of the substrate prior to coating application will ultimately determine and govern the lifespan of the protective coating system which is to be applied.

## 5.1 - Substrate Consideration

Nano-Clear® is designed to adhere directly to cleaned, highly oxidized (chalked) or newly painted metal surfaces for which industrial grades of either epoxy, polyester, polyurethane, latex and powder coatings have been applied. Nano-Clear® will also adhere directly to sanded fiberglass, sanded gel-coat, un-coated stone, raw concrete, and epoxy coated concrete.

Nano-Clear® will **“NOT”** adhere directly to bare aluminum, steel, rust, stainless steel or chrome unless their surfaces have been properly treated or primed. Nano-Clear® has been shown to successfully adhere to these substrates after a phosphoric acid surface treatment. Testing is required to ensure that proper adhesion has been achieved with any surface treatment.

## 5.2 - Surface Preparation

Prior to the application of Nano-Clear®, all surfaces must be clean, free of loose debris, oil, grease, silicone, wax, stains, rust, vegetative growth, organic fouling, chalking, moss, mildew or any other unsound or foreign materials that will inhibit the proper adhesion of Nano-Clear®.

The following recommended preparation methods for the removal of surface contaminants will greatly assist in the long-term service life and performance of Nano-Clear®. Here is a list of the cleaning agents and tools that can be used for preparation of the surfaces:

- An appropriate water based, multi-surface, multi-purpose degreaser
- An appropriate water based, multi-surface, bio-organic cleaner
- Cold-warm-hot, low pressure (~400 to 600 psi) washing and rinsing
- Combination of soft to medium bristled brush and/or sponge
- Clean compressed air or a leaf blower, to assist with drying
- Solvent based cleaners such as MEK, acetone, and paint thinner
- An orbital sander and 400 grit sand paper

All cleaning agents are to be applied according to the manufacturer's instructions. SuperClean has been noted to be an effective cleaner. Please contact Strategic Visionary Solutions for information regarding other appropriate multi-surface degreasers and bio-organic cleaning agents. It is also important that you follow the manufacturer's recommendation for personal protective gear before proceeding with the preparation stage.

In all cases the surface cleaning agents must be thoroughly rinsed away using fresh, clean tap water and the surface allowed to dry for at least 24 hours, followed by a solvent cleaning/wipe down prior to the application of Nano-Clear®.

### IMPORTANT NOTE:

All disposal (waste and used) methods must follow Federal, State and local laws and regulations. These regulations may vary in different locations. Waste characterizations and compliance with applicable laws are the sole responsibility of the waste generator.

Repair all structural damage such as rust, chipped and/or peeling paint. This is to be proceeded by a touch up with a two-component (2K) epoxy primer and the appropriate industrial base coat.

Every effort made during this preparation stage is critical to the performance and longevity of the Nano-Clear® Coating system. It may require a combination of cleaning agents and tools for proper preparation of the surface for Nano-Clear® to achieve an optimum adhesion level.

### **5.3 - Surface Preparation Standards**

The basic standards for preparing metal substrates are a joint effort between the Association of Materials Protection and Performance (AMPP).

#### **1. SSPC-SP1 - Solvent Cleaning**

Removes all visible oil, grease, soil, drawing and cutting compounds, and other soluble contaminants from steel surfaces with solvent, vapor, cleaning compound, alkali, emulsifying agent, or steam.

#### **2. SSPC-SP2 - Hand Tool Cleaning**

Removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by hand chipping, scraping, sanding, and wire brushing.

#### **3. SSPC-SP3 - Power Tool Cleaning**

Removes all loose mill scale, loose rust, loose paint, and other loose detrimental foreign matter by power wire brushing, power sanding, power grinding, power tool chipping, and power tool descaling.

#### **4. SSPC-SP5 / AMPP 1 - White Metal Blast Cleaning**

When viewed without magnification, the surface shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter.

#### **5. SSPC-SP6 / AMPP 3 - Commercial Blast Cleaning**

When viewed without magnification, the surface shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter of at least 66-2/3% of unit area, which shall be a square 3 in. x 3 in. (9 sq. in.).

Light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating in less than 33-1/3% of the unit area is acceptable.

#### **6. SSPC-SP7 / AMPP 4 - Brush-Off Blast Cleaning**

When viewed without magnification, the surface shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust and loose coating. Tightly adherent mill scale, rust and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife.

#### **7. SSPC-SP10 / AMPP 2 - Near-White Blast Cleaning**

When viewed without magnification shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products and other foreign matter of at least 95% of each unit area.

Staining shall be limited to no more than 5 percent of each unit area, and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coatings. Unit area shall be approximately 3 in. x 3 in. (9 sq. in.).

#### **8. SSPC-SP11 - Power Tool Cleaning to Bare Metal**

When viewed without magnification, the surface shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter.

Slight residues of rust and paint may be left in the lower portion of pits if the original surface is pitted. The surface profile shall not be less than 1mil (25 microns).

### **9. SSPC-SP12 / AMPP 5 - Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultra High-Pressure Water Jetting Prior to Recoating**

This standard requires water jetting at high- or ultra-high-pressure to prepare a surface for recoating using pressure above 10,000 psi. Water jetting will not produce a profile; rather, it exposes the original abrasive-blasted surface profile.

Water jetting shall be performed to meet four conditions: WJ-1, WJ-2, WJ-3, and WJ-4, and a minimum acceptable surface shall have all loose rust, loose mill scale, and loose coatings uniformly removed.

### **10. SSPC-SP13 / AMPP 6 - Surface Preparation of Concrete**

Provides requirements for surface preparation of concrete by mechanical, chemical, or thermal methods prior to the application of bonded protective coating or lining systems.

### **11. SSPC-SP14 / AMPP 8 - Industrial Blast Cleaning**

Removal of all visible oil, grease, dust and dirt, when viewed without magnification. Traces of tightly adherent mill scale, rust, and coating residues are permitted to remain on 10% of each unit area of the surface if they are evenly distributed.

Shadows, streaks, and discoloration caused by stains of rust, stains of mill scale, and stains of previously applied coating may be present on the remainder of the surface.

#### **Aluminum Definition**

Remove water-soluble dirt and chemicals with water and detergent; and solvent-soluble contaminants with solvent. Rinse and allow to dry, then power or hand abrade to remove the thin film of aluminum oxide. Moderate exposures require only one or two topcoats. Avoid using lead pigmented primers and topcoats. Exposure to corrosive chemicals calls for an epoxy primer followed by an appropriate topcoat for the environment.

#### **Brass, Bronze, Copper, Lead Definition**

Remove contaminants with a combination of water, detergents and solvents (same as aluminum). Allow the metal to dry, and then power or hand abrade to remove oxides. Conventional oil and alkyd base primers or finishes may be used.

#### **Galvanized Metal Definition**

Clean same as aluminum and Brass etc. or allow to weather for six months. Caution: Be sure the manufacturer of the galvanized metal has used a paintable "white rust" preventative. Conventional coatings containing oil or alkyd resins must not be used. Specify only special primers made for use on galvanized metal. In severe "Type A" environments, or in areas of high humidity or continuous condensation, brush blasting is recommended to assure maximum system adhesion and performance.

#### **IMPORTANT NOTE:**

Laser Ablation can be used for cleaning and surface preparation.

When operated with appropriate process parameters, the laser photoablation (photon-induced ablation) process converts coating materials and corrosion products into a gaseous-phase and particulate waste that is readily captured and sequestered in a vacuum/filtration system.

The operating characteristics of the laser make it suitable for a wide range of maintenance applications, including coating removal, corrosion product removal, surface preparation for coatings application, and surface preparation for nondestructive inspection (NDI).

## 6 - NANO-CLEAR® APPLICATION PROCESS

Nano-Clear® / NCI, a high gloss, transparent, industrial top/finish coat, is the only coating in the global marketplace with the ability to enhance, restore, and extend the service life of “freshly” painted or “highly oxidized (chalked)” surfaces. A proper application of Nano-Clear® Industrial coating can dramatically improve the corrosion, scratch, abrasion, chip, UV, and chemical resistance of an asset.

Nano-Clear® is engineered to penetrate deep into the pores of painted surfaces to enhance and restore the original base coat color, improve gloss, and provide a superior level of asset protection from environmental and mechanical damage experienced in > 90% of the industrial, commercial, marine, and military outdoor or indoor working environments.

Nano-Clear® Industrial Coatings, a disruptive coating technology, is a transparent, aliphatic, humidity cured, one component (1K), nano-structured, polyurethane/polyurea hybrid coating supported by a 120-month (10-year) warranty.

### 6.1 - Application Considerations and Recommendation

The following application information for Nano-Clear® is very important in order to achieve the outlined physical properties and subsequent benefits it provides. The substrate type (material composition) and surface preparation are critical factors to be considered prior to the application of Nano-Clear® Coatings.



#### IMPORTANT NOTE:

Nano-Clear® + **Poor Adhesion** = **FAILURE**  
Nano-Clear® + **Excellent Adhesion** = **10 YEAR WARRANTY**

### 6.2 - Personal Protection Equipment

As with all hazardous chemicals, you must select and use the appropriate respiratory protection and personal protective equipment (PPE) and follow safe handling procedures to ensure your well being.

#### 6.2 a - Respiratory Protection

The general requirements for personal protective equipment can be found at OSHA under **29 CFR 1910.132** and the Respiratory Protection Standard is **29 CFR 1910.134 (OSHA - USA)**.

When choosing a respirator, keep in mind that most do not have an end-of-service life indicator (ESLI). Because cartridge respirators can't warn you to exposure, a positive pressure fresh air respirator with a full-face piece is recommended.

### 6.3 - Application Environment

Nano-Clear® is designed to cure (crosslink) in the presence of humidity. As a general rule, higher humidity will result in a fast cure cycle. Higher humidity may also reduce flow and levelling of Nano-Clear®. Lower humidity will result in a slower cure cycle.

A method for improving flow and levelling during higher humidity is to reduce the wet-on-wet recoat time to 2 or 3 minutes from the lower humidity time of 5 to 10 minutes.

It is very important that Nano-Clear® be sprayed in a dust-free environment in order to avoid surface contamination. Please use appropriate ventilation, approved personal respiratory equipment, and personal protective wear suitable for industrial spray painting.

Please review the SDS for detailed information on proper handling, clean up, disposal, and personal protective gear. Circulate enough air to maintain a safe working environment below the PEL and LEL recommendations. Nano-Clear® should be applied according to local, provincial, state, and federal OSHA regulations. -

## 6.4 - Application Parameters

Parameter	Minimum	Maximum
Ambient Temperature	40°F / 4°C	90°F / 32°C
Relative Humidity - R.H.	20%	80%
Metal Temperature	40°F / 4°C	90°F / 32°C
Metal Temperature Above the Dew Point	At least: 5°F / - 5°C	NA
Material Temperature	40°F / 4°C	90°F / 32°C

## 6.5 - Environmental Conditions Consideration

Unless otherwise specified, the coating application should not be carried out under the following conditions:

- The **Temperature** is below 40°F / 4°C,
- The **Surface Temperature** is less than 5.3°F / -15.4°C above the dew point,
- The **Surface Temperature** is above 90°F / 32°C.
- The **Relative Humidity** is above 80%,
- And the **Surface** to be coated is wet,

In addition to the above and depending on the geographical location of the repair yard, other ambient conditions may apply, e.g. - strong winds. This may require approval of the coating supervisor prior to initiating or continuing the coating process.

### KEY ADVICE

To mitigate and prevent the entrapment of solvent, the drying/curing and re-coating times provided are (unless otherwise stated) based on:

- ✓ Temperatures of 40°F / 4°C and 90°F / 32°C,
- ✓ Relative Humidity (RH) of 20 - 80%, and
- ✓ A well ventilated and controlled working environment.

## 6.6 - Substrate Consideration

Nano-Clear® is engineered to adhere directly to properly prepared, highly oxidized/chalked or newly painted steel surfaces including two-component (2K) epoxy, 2K polyester, 2K polyurethane, latex and powder coatings. Nano-Clear® will also adhere directly to sanded fibreglass, sanded gel-coat, un-coated and epoxy coated concrete, and anodized aluminium.

Nano-Clear® will **NOT** adhere directly to bare aluminium, steel, rust, or chrome unless these surfaces have been treated or have had a coat of primer applied. Nano-Clear® has been shown to adhere directly to these substrates with a phosphoric acid treatment. Testing will be required to ensure proper adhesion with any surface treatment.

## 6.7 - Recommended Film Build

### 6.7 a - General Film Build

The minimum number of sprayed wet coats is 2 - 3, with 5 - 10 minutes before the application of additional coats. This 5 to 10-minute waiting period is done to allow for the solvent to evaporate (Solvent Flash). Failing to follow this evaporation time frame can lead to “solvent entrapment”.

#### IMPORTANT NOTE:

Avoid the application of additional coats after 20 minutes have passed as flow and levelling will be negatively affected. Take and record the ambient and surface temperatures, along with the relative humidity (R.H.), which will greatly assist in film build timing.

Recommended **wet-film-thickness** (WFT) is 2.0 mil (50 µm) per wet coat.

Recommended **dry-film-thickness** (DFT) is 1.00 - 2.00 mil (25 – 50 µm) depending on the surface properties desired.

### 6.7 b - Nano-Clear® Applied Over Oxidized/Chalked Paint

The first wet coat of Nano-Clear® will “**Fill & Restore**” and enhance the underlying base coat’s color. One or two additional wet coats of Nano-Clear® will “**Fill & Fortify**” the oxidized/chalked base coat and will provide long term surface protection.

#### IMPORTANT NOTE:

“**Wax/Polish Free**” paint **MUST** be thoroughly cleaned as per **Section 5.2**.

“**Waxed and Polished**” paint **MUST** be sanded using "400 grit" paper with an orbital sander, solvent cleaned and then dried.

The number of wet coats required should be evident by the overall gloss level 5 minutes after the application process is completed:

**High Gloss** = Good film build

**Low Gloss** = Low film build (It is recommended to apply an additional wet coat.)

### 6.7 c - Nano-Clear® Applied Over Fresh Paint

The first coat of Nano-Clear® will “**Fill**” the primer or base coat pore layer. Two or three additional wet coats of Nano-Clear® will “**Fortify**” the primer or base coat layer and will provide long term protection.

The number of wet coats required should be evident by the overall gloss level 5 minutes after the application process is completed:

**High Gloss** = Good film build

**Low Gloss** = Low film build (It is recommended to apply an additional wet coat.)

# 7 - APPLICATION EQUIPMENT

For **Optimum results**, it is recommended to use the equipment noted on the next pages for each of the three different methods of applying NCI to properly prepared surfaces.

## 7.1 - Application Equipment

Nano-Clear® can be applied using the following methods:

- ✓ Air Spray System
- ✓ Airless Spray System
- ✓ Wipe-On Technique

### 7.1 a - Air Spray Equipment

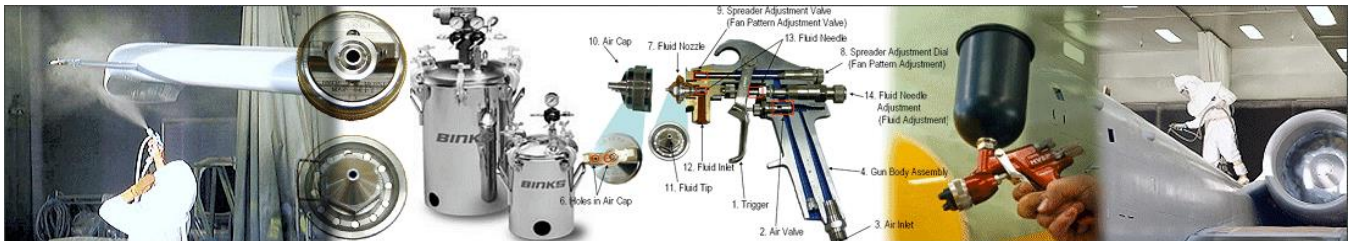
**Spray Gun:** HVLP or LVLP (Sata, Devilbiss, Krautzberger, Binks, or Iwata)  
**Fluid Tip:** 1.3, 1.4, or 1.5 mm  
**Fan Pattern:** Full  
**Fluid Control:** 2 ½ turns out  
**Spray Pattern:** 50% overlap  
**Pressure at Gun:** 29 - 30 psi (1.9 - 2.0 bar)

**Note:** a "Pressure Feed Tank" can add Portability.

#### IMPORTANT NOTE:

Appendix 10 provides valuable information related to:

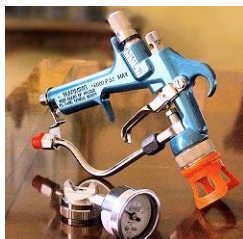
- ✚ **how to use the appropriate spray application equipment to provide a quality finish**
- ✚ **how to properly set up your spray equipment**



#### IMPORTANT REGULATORY NOTE:

Some regulatory agencies prohibit the operation of HVLP guns above 10 psi (0.7 bar) nozzle atomization pressure. Users subject to this type of regulation should not exceed 10 psi (50 psi inlet pressure). It is recommended that the nozzle test gauge be used to confirm actual nozzle operating pressure.

It may also be a requirement of some regulatory agencies that users have this test gauge nozzle available on site to verify that the gun is being operated within the limits of applicable rules.



## 7.1 b - Airless Spray Equipment

<b>Tip Size:</b>	Graco 519 or 619
<b>Pump:</b>	30:1 or 40:1
<b>Pump Pressure:</b>	800 psi (55.1 bar)

### IMPORTANT NOTE:

- Avoid recoating after 20 minutes as flow and levelling will be affected.
- Avoid contact with skin and hair as Nano-Clear® will adhere much like an industrial grade cyanoacrylate (Super Glue).
- Nano-Clear® is a moisture sensitive coating. It is **VERY** important to recap and tightly close containers immediately to avoid moisture contamination.
- Use dedicated clean and pressurized air supply lines and equipment for best results. Clean spray equipment immediately upon completion of job using paint thinner or acetone. Avoid contact with skin and hair.

## 7.1 c - Wipe-On Technique Equipment

<b>Paint Pad:</b>	9" (22.86 cm) Shur-Line or Blue Hawk
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### IMPORTANT NOTE:

Streaking or high spots may occur using a "wipe-on" technique. Limit and avoid high spots by smoothing the surface while wet.

## 7.2 - Buffing and Polishing (If Required)

<b>Equipment:</b>	Pro orbital sander and Pro orbital polisher
<b>Sand Paper:</b>	Start with 800 grit, then 1,000 grit, 1,500 grit, and finish with 2,000 grit.
<b>Polishing</b>	
<b>Compound:</b>	Heavy cut compound applied with wool pad @ 1,200 - 1,400 RPM
<b>Polishing:</b>	3m SRC (scratch resistant clears), and a Polishing paste with wool pad @ 1,200 to 1,400 RPM
<b>Final Polish:</b>	Use light/medium cut polishing paste with wool pad @ 1,200 - 1,400 RPM

## 7.3 - Surface Maintenance and Cleaning

1. Use low pH soap and water for surface clean up.
2. Use lint-free microfiber cloths to clean and dry surfaces.
3. Use paint thinner to remove graffiti and/or an appropriate graffiti removal product.  
(Please contact [Strategic Visionary Solutions LLC](#) for information regarding effective graffiti removal products, if required.)

# 8 - WARRANTY & LEGAL DISCLAIMER

## 8.1 - Warranty & Legal Disclaimer

The recommendations made, and information herein is based on the manufacturer, our own, and independent laboratory experience, and is believed to be accurate under controlled conditions. We cannot, however, cover every possible application of Nano-Clear<sup>®</sup>, nor anticipate every possible variation encountered in weather condition, job-site condition, application methods used, and types of surfaces upon which the coating is being applied. It is strongly recommended that the applicator perform test patches to review suitability for their intended coating project.

The Manufacturer reserves the right to have the true cause of any difficulty determined by accepted test methods.

Nothing herein shall be construed as granting a license to, or recommendation for use of, any proprietary rights.

Product performance is affected by many factors, including storage, methods of application and use.

Pre-testing of the surface to be coated is essential in determining the suitability of Nano-Clear<sup>®</sup> based on its intended method of application use.

The Manufacturer's SOLE WARRANTY is that Nano-Clear<sup>®</sup> has been manufactured to designed specifications. Nano-Clear<sup>®</sup>, when properly stored and applied, shall provide exceptional protection as designed for a minimum period of 10 years.

No oral or written information or advice shall increase the warranty or create new warranties.

The Manufacturer's SOLE WARRANTY is to replace product proven defective. The Manufacturer is not responsible for reimbursing costs of application or removal. In no event shall the Manufacturer or **Strategic Visionary Solutions<sup>®</sup> LLC** be liable for any consequential, indirect, or other damages whether arising from negligence or otherwise.

**THIS WARRANTY AND LIABILITY MAY NOT BE MODIFIED OR EXTENDED.**



# 9 – GLOSSARY AND CONVERSIONS

## 9.1 - Glossary of Terms & Definitions

### Adhesion Promoter

This refers to a coating which improves the adhesion between different coats and/or prevents certain problems in connection with over-coating. (EN ISO 12944- 5)

### Airless Spray

Airless spray is a method where paint under high pressure is sprayed through a nozzle onto the substrate.

### Anti-Corrosive Paint (Anti-Corrosion Paint)

A paint containing active pigments, e.g. zinc phosphate, which prevent corrosion.

### Application Viscosity

This is the viscosity the paint should have when applied, after any necessary thinner has been added. Generally, the viscosity is stated as the time (in seconds) that it takes for the paint to pour through a viscometer (ISO 2431).

### Artificial Aging Test

This is a method developed to accelerate the ageing of a paint system, e.g. to degrade the corrosion protective properties faster than in the natural environment (EN ISO 12944-2).

### Atmospheric Corrosion

Corrosion caused by the atmosphere. (ISO 8044)

### Certification

To prove, by the presentation of official signed documents, that stated demands have been observed.

This also refers to the qualification system which ensures that a manufacturer's quality control is confirmed by a certificate.

### Chalking

This refers to a fine, powdery layer on the paint surface caused by UV attack of the coating surface and which will have a pale, whitish appearance.

### Classification

Standard concerning environmental conditions in the standard EN ISO 12944-2 the atmospheric environment is classified into six corrosion categories:

<b>C1</b>	- very mild
<b>C2</b>	- mild
<b>C3</b>	- moderate
<b>C4</b>	- severe
<b>C5-I</b>	- very severe (industrial)
<b>C5-M</b>	- very severe (maritime)

Objects in immersion are divided in three categories:

<b>Im1</b>	- fresh water
<b>Im2</b>	- sea and brackish water
<b>Im3</b>	- soil

### Climate

The weather in a certain place or region, statistically specified based on meteorological factors over a long period. (EN ISO 12944-2)

### Coat

This refers to a uniform layer of paint which is achieved by one application. (EN ISO 12944- 1)

### Coating

A layer of resin-based material applied to a surface for protection or decoration.

### Color

A sense observation caused by light reflected from a surface. The color can be described by three properties; hue, chromaticness and brightness.

### Compatibility

1. Products in paint systems: the possibility to use two or more products in a paint system that no problems occur;
2. The product and the substrate: The properties of the product should be such that it can be applied on the substrate without causing any harm.

## **Corrosion**

Corrosion is a physical/ chemical reaction between a metal and the environment which changes the properties of the metal and often causes damage to the metal, its environment or the technical system (ISO 8044).

## **Corrosion Damage**

That effect of corrosion which is functionally harmful to metals, environment or technical systems. (ISO 8044)

## **Corrosion Prevention**

To change the corrosion system, e.g. by painting, in order to reduce the damage caused by corrosion. (SFS 8044)

## **Corrosion System**

A system which consists of one or several metals and all the environmental factors which have a corroding influence.

## **Corrosion Strain (Stress)**

This refers to environmental factors which cause corrosion. (EN ISO 12944-1)

## **Coverage**

1. The practical coverage: The practical coverage depends on the application method and application conditions, the shape of the construction and the surface quality and the skill of the painter.

2. Theoretical coverage: The theoretical coverage (TC) is stated as m<sup>2</sup>/litre and it can be calculated based on volume solids (VS-%) and specified dry film thickness (DFT- µm).  $TC = 10 \times VS\%/DFT$

## **Degreasing**

Grease, oil and contamination, which make rust removal and painting difficult, are removed by degreasing.

## **Density**

The density is the weight of one litre of paint at 23°C (kg/l). ISO 2811-2

## **Dew Point**

This is the temperature at which the humidity in the air condenses onto the surface (ISO 8502-4).

## **Dry Film Thickness DFT**

This refers to the thickness of the remaining coat on the substrate when the paint/coating has dried (EN ISO 12944-5).

## **Drying Time**

The drying times are stated, if not otherwise mentioned, at a temperature of 23°C, relative humidity 50% and sufficient ventilation.

A lower temperature, too thick coats, bad ventilation and high relative humidity extend the drying time.

By raising the temperature, the drying and over-coating times can often be reduced. In most paint data sheets, the following drying times are stated; dust dry, touch dry, over-coatable and fully cured (ISO 1517).

## **Durability**

This refers to the expected life of a protective paint system to the first major maintenance painting.

Important additional information: see the standard EN ISO 12944-1.

## **Dust**

A fine powder, caused by blast cleaning, other pre-treatment work or from the neighbourhood, which lays on the surfaces which shall be painted (ISO 8502-3).

## **Emulsion Wash**

A cleaning method with a solution containing organic solvents, water and detergents which binds grease and oil particles and removes them together with the rinsing water.

## **Evaporating Time**

See: flash-off time

## **Film**

This refers to a uniform layer of metal or a homogeneous coat of paint which has been received by one application. (EN ISO 12944-1)

## **Finishing Paint (Finish, Topcoat)**

This is the last coat in a paint system. For this the color and gloss grade are usually specified in accordance with the demands for the object.

**Flash-off Time**

Flash-off time is the time after application during which most of the solvents evaporate, before more thorough drying occurs.

The flash-off time depends on the type of paint, the solvent composition, the film thickness, the temperature and the ventilation.

**Flash Rust**

This refers to the thin rust layer which is formed very quickly on a prepared surface (EN ISO 12944-2).

**Gloss (Gloss Level, Limit, Value, Group, Grade)**

The gloss grade is the relative gloss of the paint surface or the capacity to reflect light.

The relative gloss is usually specified at an angle of 60° (EN ISO 2813). According to their capacity to reflect light, paints are divided in gloss groups.

The definition below is used in the RAL EFFECT color collection by RAL Institute.

Nominal marking	Gloss level
Full gloss	$x \geq 90$
High gloss	$80 \leq x < 90$
Gloss 60	$\leq x < 80$
Gloss 60	$\leq x < 80$
Semi-gloss	$35 \leq x < 60$
Semi matt	$10 \leq x < 35$
Matt 5	$\leq x < 10$
Full matt	$x < 5$

**Grade of Pre-treatment**

See: preparation grades.

**Hardener**

This is the part of a two-component paint which, when added to the base, causes the curing process. By choosing the type of hardener, it is possible to adjust the properties of the paint.

**High-build Coat**

A property of the coating which allows for a thicker coat than would generally be the case for that kind of paint to be applied.

In the standard EN ISO 12944, this means dry film thicknesses over 80µm.

**High-solid Paints**

High solid paints are paints with a high content of volume solids. Generally, the volume of solids exceeds 70% by volume.

**Hot Spraying**

This refers to an airless spraying method in which the temperature of the paint is risen, in a way or another, to a higher temperature than usual.

Generally, a temperature range of 30-60°C is used, depending on type of paint and kind of equipment.

**Industrial Environment (Atmosphere, Climate)**

An atmosphere which contains pollution, mainly Sulphur dioxide, from local and regional industries (EN ISO 12944-2).

**Influence of Corrosion (Corrosive)**

The corrosion caused by the surrounding atmosphere in a certain corrosion system (ISO 8044).

**Inhibitor**

An inhibitor is a material which slows down the rate of metal corrosion. There are several types of inhibitors.

**Intermediate Paint**

This is the paint between the primer and the topcoat used to increase the film thickness. Generally, a primer or a topcoat is used as an intermediate paint.

**ISO 9000**

This refers to a standard concerning quality management and verification. Instructions for how to choose and how to use are found in ISO 9000, 9001 and 9004.

**Maintenance**

This is the entirety of all factors in standard EN ISO 12944 which ensure that the corrosion prevention of the steel construction can be maintained.

**Maritime Environment**

This refers to the atmosphere at sea and in coastal areas. The maritime environment reaches a certain distance inland, depending on the shape of the landscape and current winds.

The salinity, mainly chlorides, in this environment is high (EN ISO 12944-2).

### **Maximum Dry Film Thickness**

This is the thickest dry film which can be approved. If it is exceeded, it is possible that the properties of the paint or the paint system may deteriorate (EN ISO 12944-5).

### **Micro Environment**

Environmental conditions close into the surfaces of the construction. The micro environment is an important factor when the corrosion strains are estimated. (EN ISO 12944-2)

### **Mixing Ratio**

Information about the mixing ratio is found in the data sheets and the labels. The mixing ratio is the relation between base and hardener.

Generally, the mixing ratio is stated as "parts by volume", or in exceptional cases in "parts by weight".

### **Nominal Dry Film Thickness (NDFT)**

This is the dry film thickness which is specified for each layer or the whole paint system.

The dry film thickness ensures that the paint system achieves the durability which is required (EN ISO 12944-5).

### **One-component Paint (1K)**

This is a paint which does not need any additive to start the drying and curing process. One component paint includes e.g. alkyds, chlorinated rubber paints and vinyl.

### **Paint**

A pigmented liquid paste or powder like coating material, which applied on the substrate forms a hiding, opaque coat, which has protective, cosmetic or other special properties (ISO 4618).

### **Paint System**

A paint system consists of the pre-treatment and the paint film that is formed by the protective paints used.

The paint system can consist of only one paint, applied one or several times.

Usually the paint system consists of several paints which each have complimentary properties.

### **Painting**

Painting is a surface treatment where one of the treatment components is paint.

### **Pickling**

This is a chemical method to remove mill scale and rust from the substrate by immersion of the metal in a suitable pickling agent.

At pickling, a white metal surface should be achieved.

### **Pigment**

Pigments are pulverized dyestuff which gives the paint hiding power and color. Furthermore, the pigments protect the paint and the substrate from ultraviolet radiation.

Anti-corrosive pigments can prevent or retard the corrosion process.

### **Pot-life**

The pot-life is the time within which it is possible to use a "two component" paint after mixing.

### **Preparation Grades**

Per standard ISO 8501-1 several pre-treatment grades are specified. Rust removing methods and preparation grades are described.

The preparation grades are specified by a photographic description of the appearance of the surface after the treatment has been completed.

Every preparation grade is marked with a sign for the pre-treatment method. "Sa", "St", or "Fl".

The number after the sign describes the preparation grade (removal of mill scale, rust or earlier coating).

### **Pre-treatment**

The cleaning of the surface and other steps taken in order to protect the surface to be painted or to promote the adhesion and durability of the coat is called pre-treatment.

### **Primer**

The first layer in a paint system and this determines the quality demands on the preliminary cleaning and the preparation grade.

### **Project**

A project is a complete program of work for which the specification is made. A project can include one or several constructions (EN ISO 12944-8).

### **Project Specification**

The specification describes the project and the special demands which are included.

The writer of the specification may be the owner or the main contractor (EN ISO 12944-8).

### **Protective Coating System**

This is the total coating, formed by metallic material and/or paints or similar products which are applied on the substrate in order to protect it from corrosion (EN ISO 12944-1).

### **Protective Paint System**

This is the total coat, formed by paints or similar products which are applied on the substrate in order to protect it from corrosion (EN ISO 12944-1).

### **Protective Paint System Specification**

In the specification is described how the construction should be pre-treated and which protective paint systems should be applied in accordance with the project specification.

The writer of the specification can, for instance, be the paint manufacturer.

### **Quality**

The quality includes all the properties of a product or service which are necessary so that they fulfil stated or presumed demands (ISO 9000).

### **Quality Control (QC)**

Quality control of corrosion prevention is supervision and inspections of methods, material, equipment and application conditions.

The contractor is responsible for the quality of the painting work and executes the quality control.

The customer may, in addition to the quality control done by the contractor, make his own inspection if he finds it necessary (EN ISO 12944-7).

### **Relative Humidity**

The relative humidity is the amount of water held by the air as a percentage of the greatest amount it can hold at that temperature.

### **Resin**

The resin forms a coat which sticks to the substrate. Into this coat the pigments are bound.

The resin characterizes the properties of the coat, such as the adhesion to the substrate, the internal strength (cohesion) and chemical properties.

### **Rust**

This is a visible corrosion product (iron, steel) which mainly consists of iron oxides.

### **Solids by Weight**

The solids are specified in percentage of the weight of the paint (ISO 3251).

### **Solids by Volume (Volume Solids)**

The solids are specified in percentage of the volume of the paint. The determination of volume solids is usually calculated according to ISO 3233.

### **Solvent**

This is a component in solvent-borne paints which shall dissolve the firm resins and polymers and reduce their viscosity.

### **Solvent-free Paints**

Paints which do not contain solvents, e.g. powder coatings and solvent free epoxy and polyurethane coatings.

### **Solvent-free Paints (High solids)**

Paints with a "Solids by Volume" of 70-98% are called solvent-less paints. E.g. epoxy and polyurethane paints can be solvent-free paints.

### **Specific Gravity**

See: Density.

### **Specification**

This refers to a document where the demands on the work or the service are described. This document should specify the methods and criteria to ensure that the demands have been fulfilled (ISO 9000).

It can also be a detailed working specification, including details of the working methods and materials to be used.

By following this, the work or the service can be carried out so that it fulfils the demands in the specification or in the agreement.

**Spreading Rate**

See: Coverage.

**Storage Time**

This is the time during which the paint preserves its properties and usefulness.

This assumes that the paint is stored in its original packaging in normal, dry, dust free warehouse conditions, and at a temperature between +3°C and +30°C (EN ISO 12944-5).

**Substrate**

The surface on which the coating is or has been applied (EN 971-1).

**Supervision (Control, Inspection)**

This refers to the measuring, inspection, testing, estimation of one or several properties of the work or service and to compare how well these fulfil the demands in the specification and other corresponding actions.

**Supervisor**

This is a person who is responsible for ensuring that the actions are compatible with the demands in one or several documents concerning the project (EN ISO 12944-8).

**Surface Treatment**

This is a general term that refers to alteration of the surface, e.g. pre-treatments and painting.

The term is also used in a limited sense excluding metallic coatings.

**Surface Pre-treatment**

This refers to any method which is used to prepare the surface before coating.

**Surrounding Atmosphere**

This is a mixture of gases and generally also aerosols and particles which is the environment for a certain object (EN ISO 12944-2).

**Thinner**

Thinner is an evaporating liquid, solvent or water, which is added to the paint in order to reduce the viscosity. The thinner is often the same as the solvent in the paint.

**Tinting System**

This refers to an economical, accurate and quick method to produce colored paints. It is suitable for most types of paints.

The tinting system generally includes tinting pastes, base paints, tinting formulas, a tinting machine and a mixer (shaker).

**Topcoat**

See: Finishing Paint

**Treatment System**

The treatment system means the treatment which concern a certain object, including pre-treatment and painting work with material included.

The term is usually used for painting of buildings.

**Two-component Paint (2K)**

This is a paint to which another component is added in order to start the curing process. The components react with each other and form the coat.

Two component paints can be solvent or water-borne or solvent-free. E.g. epoxy, polyurethane and oxirane ester paints are two component paints.

**Type of Paint**

The paints can be divided in different groups depending on the way they dry or their resin. E.g. alkyd, epoxy and polyurethane paints.

**Type of Surrounding Atmosphere**

A classification of the atmosphere based on the quantity and type of corrosive agents present.

The compounds of most importance are gases (particularly sulphur oxide) and salts (mainly chlorides and sulphates) (EN ISO 12944-2).

**VOC**

This refers to Volatile Organic Compounds (i.e. solvent).

**Viscosity**

Viscosity describes a fluid's internal resistance to flow and may be thought of as a measure of fluid friction.

The greater is the viscosity, the worse the consistency of the paint. Consistency of the liquid is measured with a flow cup.

The measured viscosity is generally expressed in seconds of flow time.

**Volume Solids**

See: Solids by Volume

**Water-borne Paints**

In water-borne anticorrosive paints the polymer is dispersed, emulsified or dissolved in water.

Typical resins are alkyd, polyester, acrylic, polyurethane and epoxy resins and modifications of them.

**Wet Time**

This is the period during which the metal surface is covered by electrolyte which can cause corrosion.

The wet time can be calculated as that period when the relative humidity exceeds 80% and the temperature exceeds 0°C (EN ISO 12944-2).

**Working Manual (See also Specification)**

This refers to a specification which describes the working process, the paint system, inspection and estimation specifications (EN ISO 12944-8).

Includes the writer of specification; the person who is responsible for the specification.

## 9.2 - Coating Thickness Conversion Table

Micrometers (um)	Millimeters (mm)	Inches	Mils (Thousandths)	"Tenths" (Ten-Thousandths)	Millionths (Micro-inch)	Comments
0.1	0.0001	0.000004	0.004	0.04	3.94	
0.5	0.0005	0.000020	0.020	0.20	19.69	
1.0	0.0010	0.000039	0.039	0.39	39.37	
1.5	0.0015	0.000059	0.059	0.59	59.06	
2.0	0.0020	0.000079	0.079	0.79	78.74	
2.5	0.0025	0.000098	0.098	0.98	98.43	
3.0	0.0030	0.000118	0.118	1.18	118.11	
3.5	0.0035	0.000138	0.138	1.38	137.80	
4.0	0.0040	0.000157	0.157	1.57	157.48	
4.5	0.0045	0.000177	0.177	1.77	177.17	
5.0	0.0050	0.000197	0.197	1.97	196.85	
5.5	0.0055	0.000217	0.217	2.17	216.54	
6.0	0.0060	0.000236	0.236	2.36	236.22	
7.0	0.007	0.000276	0.276	2.76	275.59	
8.0	0.008	0.000315	0.315	3.15	314.96	
9.0	0.009	0.000354	0.354	3.54	354.33	
10.0	0.01	0.000394	0.394	3.94	393.70	
12.0	0.012	0.000472	0.472	4.72	472.44	
15.0	0.015	0.000591	0.591	5.91	590.55	
20.0	0.02	0.000787	0.787	7.87	787.40	
25.0	0.025	0.000984	0.984	9.84	984.25	
<b>25.4</b>	<b>0.025</b>	<b>0.001</b>	<b>1</b>	<b>10</b>	<b>1,000</b>	<b>Minimum Nano-Clear® DFT</b>
<b>50.8</b>	<b>0.051</b>	<b>0.002</b>	<b>2</b>	<b>20</b>	<b>2,000</b>	<b>Average Nano-Clear® DFT</b>
<b>76.2</b>	<b>0.076</b>	<b>0.003</b>	<b>3</b>	<b>30</b>	<b>3,000</b>	<b>Maximum Nano-Clear® DFT</b>
101.6	0.102	0.004	4	40	4,000	
127.0	0.127	0.005	5	50	5,000	
152.4	0.152	0.006	6	60	6,000	
177.8	0.178	0.007	7	70	7,000	
203.2	0.203	0.008	8	80	8,000	
228.6	0.229	0.009	9	90	9,000	
254.0	0.254	0.010	10	100	10,000	10 point business card stock
304.8	0.305	0.012	12	120	12,000	12 point business card stock
381.0	0.381	0.015	15	150	15,000	
508.0	0.508	0.020	20	200	20,000	
635.0	0.635	0.025	25	250	25,000	
Inches = mm / 25.4 mm = Inches * 25.4						
Mils = microns / 25.4 microns = mils * 25.4						
0.001 inch = 1 mils = 10 "tenths" = 1,000 micro-inches						
0.001 mm = 1 microns = 1 micrometers = 1,000 nanometers = 10,000 Angstroms						

# APPENDICES

The information on the following pages provides further details regarding the history of development of Nano-Clear®, its introduction into industrial markets, and the dedication involved in its continuing advancement as the premier industrial coating solution.

Additional Appendix information is provided on the following topics:

✚ <b>Appendix 1</b> – Business Case Analysis	.....	.....	.....	.....	37
✚ <b>Appendix 2</b> - Spray Technique on Flat Surfaces	.....	.....	.....	.....	39
✚ <b>Appendix 3</b> - Prevention: HVLP, Viscosity and Hot Spraying	.....	.....	.....	.....	42
✚ <b>Appendix 4</b> - Water & Solvent Based Coatings Technologies	.....	.....	.....	.....	44
✚ <b>Appendix 5</b> - Volatile Organic Compounds (VOCs) Comparison	.....	.....	.....	.....	46
✚ <b>Appendix 6</b> - Respiratory Personal Protection Equipment	.....	.....	.....	.....	48
✚ <b>Appendix 7</b> - Portable Controlled Workshop Environment	.....	.....	.....	.....	49
✚ <b>Appendix 8</b> - Nano-Clear® Dispensing Process	.....	.....	.....	.....	50
✚ <b>Appendix 9</b> - Coating Failures & Defects	.....	.....	.....	.....	55
✚ <b>Appendix 10</b> – Spray Equipment Information	.....	.....	.....	.....	65

## APPENDIX 1

### Business Case Analysis

High-performance industrial coatings are more expensive (on average) than architectural coatings, there's far more to the cost of a coating than the "price on the can". A more accurate way to analyze cost is to consider the expense incurred over the life cycle (LC) of the coating.

For example, some pertinent questions can include:

- How durable is the coating?
- Can it withstand frequent cleaning with harsh chemicals?
- Will it retain its glossy sheen and fresh color despite intense UV exposure?
- Is the coating hard enough to resist abrasion and tough enough to protect the substrate from corrosive environments?
- Does moisture threaten to cause poor adhesion or blistering?

How well a coating stands up to these types of challenging conditions has a direct bearing on the long-term cost of keeping substrates protected and looking clean and attractive.

Of equal consideration is the labor factor. While every project is different, depending on the scope of the work, the contract price for a commercial paint project is typically comprised of 15% for the coating material and 85% for the applicator's labor. The labor cost usually remains the same whether the painter is applying standard architectural paint or a high-performance industrial coating. Therefore, if the paint material cost is increased by 50 percent to upgrade the paint to a high-performance industrial coating, this only increases the total paint project cost by ~7.5%.

The right high-performance coating is designed to take a lot of abuse and still look great, year after year. That reduces the need for frequent retouching or repaints, minimizes labor expenses, decreases the burden on local landfills, and helps to limit costly downtime. This has an obvious appeal on projects where long-term value outweighs initial cost considerations.

A client wants to know, "What am I getting, and what is it going to cost me?". If they can see a return value, they'll consider the higher cost product if they think it's going to pay off in the long run. Everything comes back to cost.

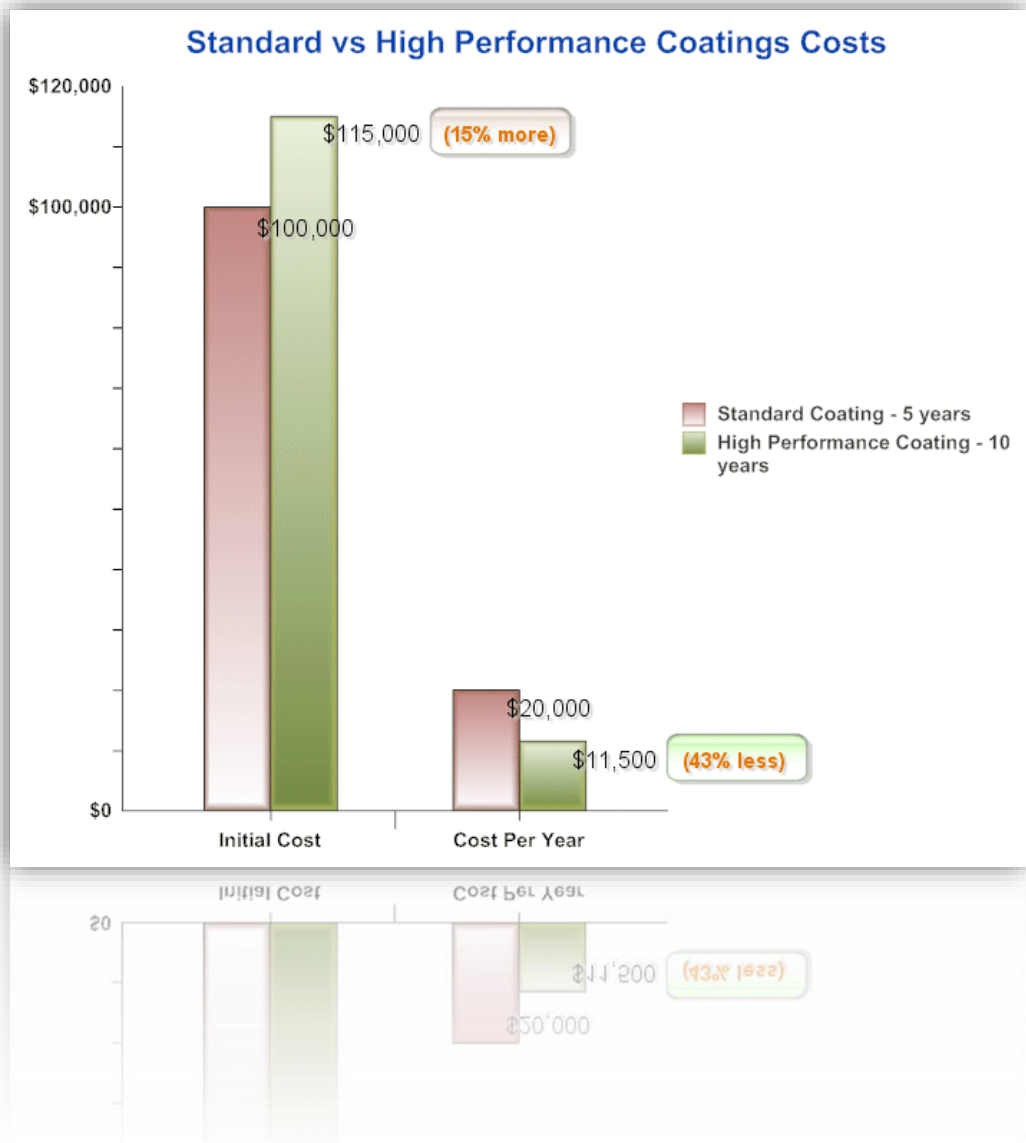
To gain a better understanding of the likely cost of a coating over its life cycle, add the cost of the labor to the initial cost of the paint and materials, and divide that number by the expected service life of the coating.

To illustrate this point, we can compare the cost of painting a commercial interior space with a standard coating versus a high-performance coating. Assume that the initial cost of the standard coating plus the applicator's labor is \$100,000. The expected service life of the standard coating is five years, resulting in a cost of \$20,000 per year over the life cycle of the paint job.

By comparison, a high-performance coating has a higher cost initially of \$115,000. However, the expected service life of the high-performance coating is more than twice that of the standard coating at 10 years. This reduces the per-year cost of the high-performance coating to just \$11,500. Based on this example, that's nearly 43% less than the cost of a standard coating based on life cycle!

Nano-Clear® adds an additional value proposition with its ability to provide the same life cycle of 10 years for highly oxidized (aka - chalked) coatings, first by eliminating the need for a basecoat re-coating, and second by reducing subsequent re-coating cycles. As a high-performance multifunctional coating, Nano-Clear® meets and

exceeds “challenging conditions” and will have “a direct bearing on the long-term cost of keeping substrates protected and looking clean and attractive”.



## APPENDIX 2

### Spray Technique on Flat Surfaces

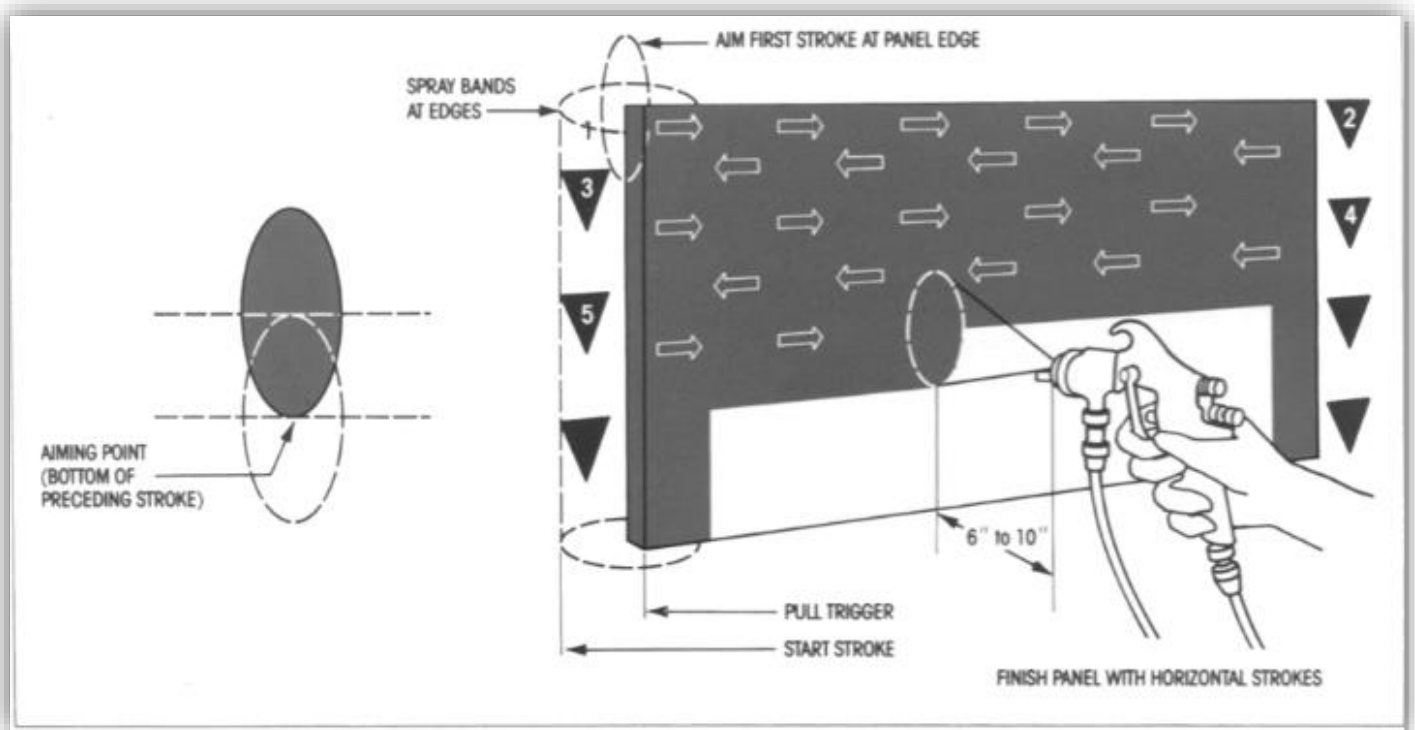
The technique of spraying a flat surface is shown in the diagram below. Every stroke is "triggered". The stroke is started off the work area surface, and the trigger is pulled when the gun is just opposite the edge of the surface being coated. The trigger is released at the other edge of the panel, but the stroke is continued for a few more inches before reversing to begin the next stroke.

Triggering is the key to good spray technique. The goal is to time your triggering to hit the exact edge of the work. This maintains full coverage while minimizing over-spray. A cross hatch pattern should be maintained during film build for good flow and leveling of Nano-Clear®.

Proper handling of the spray gun is critical for results that will produce a professional finish.

**The gun should be held perpendicular** to the surface being coated and moved parallel across the surface. It's very important to begin the stroke before the gun is triggered so as not to build up coating at the beginning of the stroke. Also, releasing of the trigger should happen before the stroke has ended so one keeps an even film build.

**The distance between the gun and the surface** must be held even throughout the entire stroke, somewhere between 6 - 12 inches, depending on the material and atomization pressure. High-Volume-Low-Pressure (HVLP) spraying is usually sprayed closer. By overlapping each stroke by approximately 50%, one can achieve an even film build.



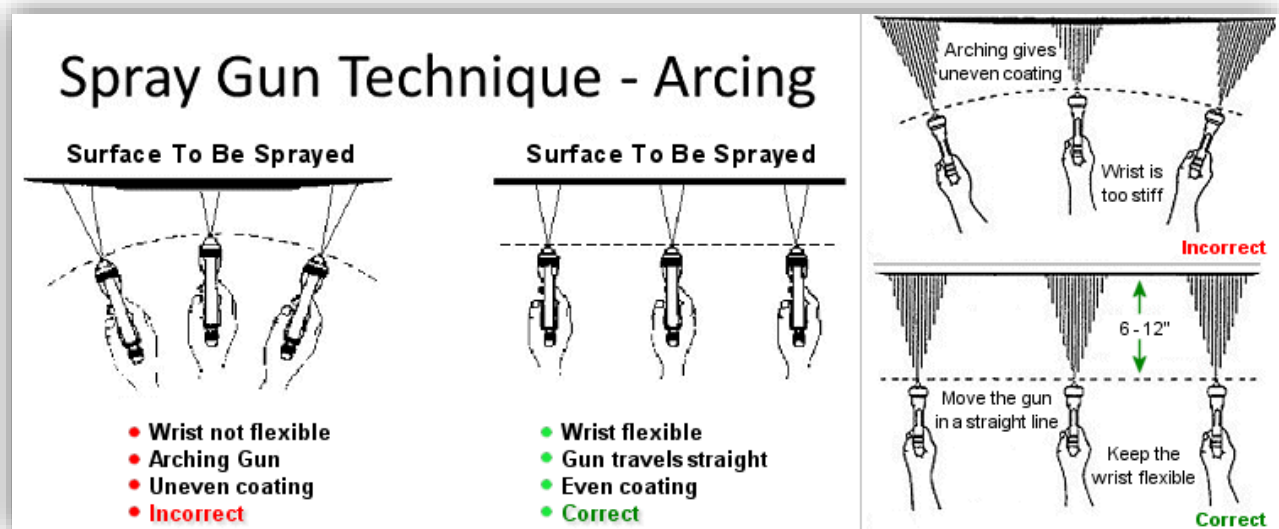
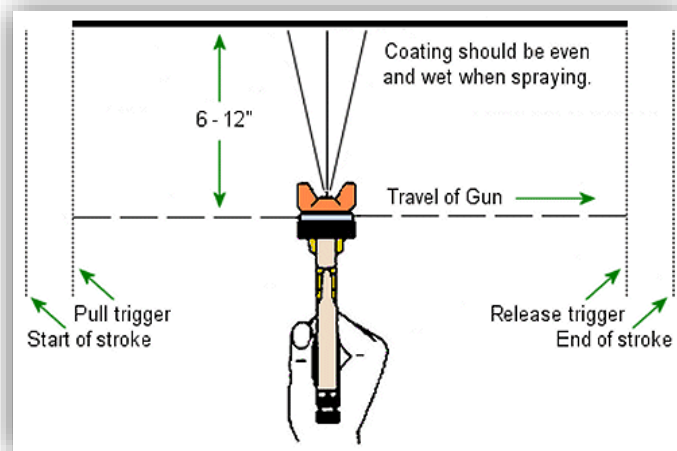
## Using the HVLP Gun

**Movement with an HVLP gun should be about half as fast** as compared to moving with a normal spray gun. Applicators accustomed to standard guns usually move at a speed about two (2) feet per second; however, with an HVLP gun, the recommended speed should be one (1) foot per second. Newer HVLP guns use less air pressure at the cap (maximum 10 psi) for compliant areas. These guns can be moved at approximately the same rate of speed as conventional guns at two (2) feet per second.

Because coatings can result in "drying rough" when applied with an HVLP gun, "tack" coats are not always recommended. The reason for the roughness has to do with the volume of air required to atomize the coating and the resulting droplet size – droplets tend to land further apart when applied dry, and larger droplets with a lower air pressure behind them will not flatten out as much when they contact the surface.

Rather than a "tack" coat, it's recommended that HVLP gun users start the coating application with a medium wet coat and follow the product manufacturer's recommendation for film build to achieve the proper flow, leveling, and final finish quality.

Holding the spray gun at a proper distance will help to ensure a uniform coating across the surface and avoid issues such as running (held too close) or uneven results (held too far away). Holding the spray gun at a constant perpendicular angle is also important in preventing uneven results.



## APPENDIX 3

### Prevention: HVLP, Viscosity and Hot Spraying

One of the limitations of conventional air spray coating is its poor transfer efficiency. This happens because of severe bouncing of the atomized coating particles from the substrate after impact. If, however, the speed of the atomized coating particles is reduced, the bouncing effect can be reduced considerably, leading to an improvement in coating transfer. This reduction has been accomplished with the development of a High-Volume Low Pressure (HVLP) spray gun.

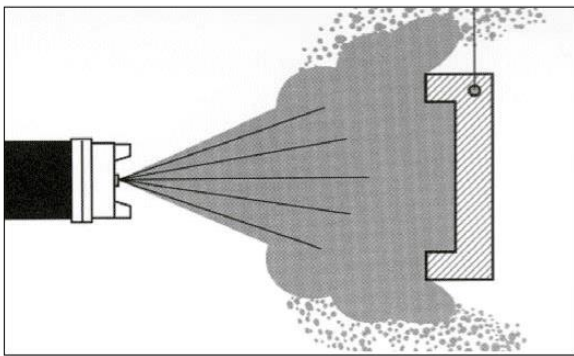
The development of the HVLP spray gun allows for a reduction of the supplied compressed gas (air), while using the same volume of coating. The speed of the atomized coating particles is reduced, severe bouncing is reduced, and spray transfer efficiency reaches a healthy 65% - 90%. When setting up a spray gun, the choice of air caps and fluid tips is highly dependent on the flow rate and viscosity of the coating being sprayed. The choice of fluid and air pressures is also based on flow rate and viscosity. The lower the viscosity, the lower the air and fluid pressure required. The lower the air and fluid pressures, the more efficient the spray gun. More efficiency translates to lower costs.

Many industrial coatings are high in solids (low in solvent). The temperature effects on a high-solids coating are the same as that of syrup. The thicker the syrup, the more of an effect heat will have on its viscosity. If viscosity varies due to temperature fluctuations, the atomization of the coating will also vary.

In spray painting operations, temperature-related variations can result in significant quality problems with film build, color matting, surface finish, adhesion, and more. While a common method of lowering viscosity is thinning or reducing, warming a coating up is more environmentally friendly and lower in cost. Many environmental laws limit the amount of solvent that may be added to the coating.

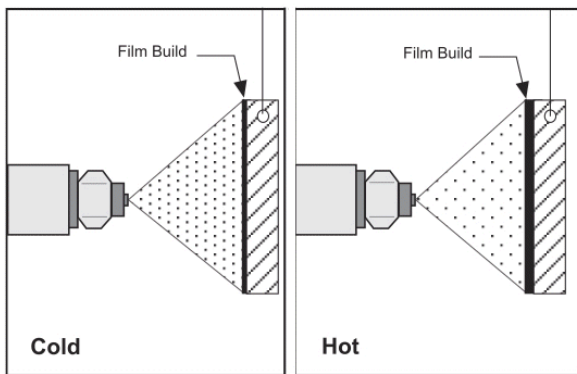
The heating of a coating addresses and brings with it the following features and benefits:

1. Consistent material “thinning” and temperature control of the coating being sprayed, regardless of fluctuating ambient temperatures. This lowers VOC, increases coverage, lowers material requirements, and lowers coating costs.
2. Heating also produces a “softer spray”, allowing for reductions in overspray, material waste, and results in cost savings.
3. A softer spray produces less “fog” and “rebound” because the coating is atomized at a lower pressure, amounting to savings in material, equipment wear and tear, and lowers compressed air and power consumption, dramatically reducing over-spray.
4. Faster “solvent flash” between coats saves time and helps to reduce finishing defects.
5. A higher rate of film build is possible per pass because the heated coating contains solids and much less solvent. This will result in savings in operator and project time with fewer passes needed to achieve the recommended film build.
6. “A conservative higher first-pass yield of 5% results in an ROI for hot spraying systems of months as opposed to years.”



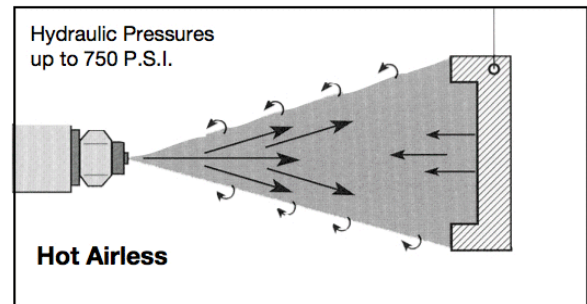
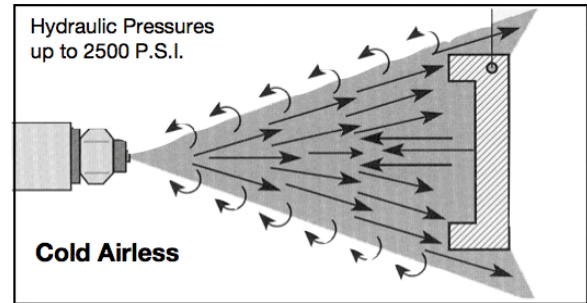
Conventional air spray creates a "cloud" as high-pressure air jets atomize coatings. As coating particles are blown at high speed toward the part, many are dispersed into the air.

### Higher Film Build



Heating coatings reduces viscosity and improves sprayability. A higher film build can be applied without sags or runs, and often equals two air-sprayed coats.

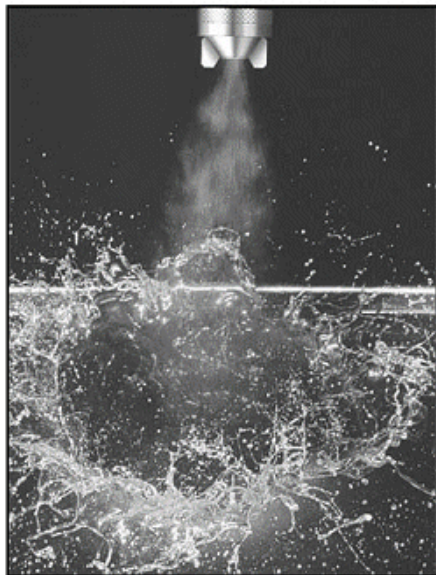
### Improved Material Usage



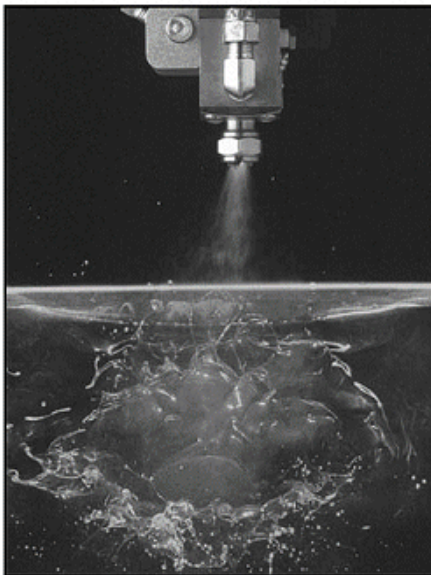
As heat is applied, solvent vapor pressure increases so atomizing pressure can be reduced. Lower pressure results in lower particle velocity and a softer spray. Better coating coverage and less solvents improve material savings.

## Characteristics of Spraying Velocity

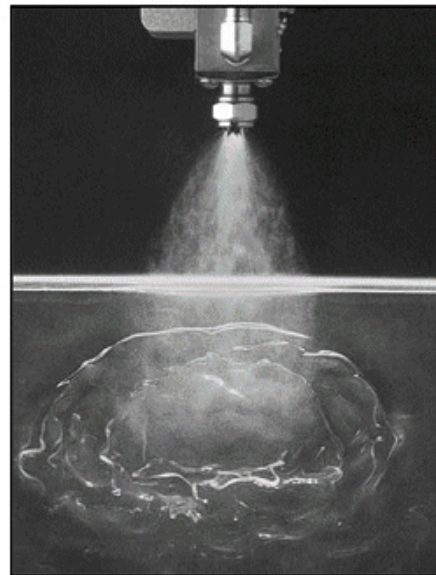
Photographs taken at 1/10,000 of a second reveal the differences between a turbulent spray and a "soft" spray.



**Air Spray.** At test pressures of 60 psi, an average of 600 parts of air were used to atomize one part of paint. The large volume of air means excessive turbulence, paint bounce, and overspray.



**Airless.** Hydraulic pressure during test was 1500 psi, but there is no air discharge to carry paint particles long distances from the gun.



**Heated Airless.** Spraying at 600 psi without air produces a soft, direct spray with minimum bounce and overspray.

## APPENDIX 4

### Water & Solvent Based Coatings Technologies

#### Water-Based Coatings

About 80% of waterborne coatings are used in architectural coatings. However, they also are used in selected industrial applications. Perhaps the most significant advantage of waterborne systems is that they emit relatively small amounts of VOCs and HAPs. With some exceptions, waterborne-coating systems also have low odor and are usually nonflammable. Water has a relatively slow evaporation rate, and more significantly, its evaporation rate varies dramatically with the ambient humidity and temperature. This poses an especially difficult challenge in climates with variable humidity.

The heat capacity and heat of vaporization of water also are high, resulting in significant energy requirements for evaporation. In addition, the surface tension of water is much higher than that of organic solvents, requiring surfactants to wet pigments and substrates adequately. These surfactants can have an adverse effect on gloss and water resistance.

Water also tends to increase corrosion of storage tanks, paint lines, ovens, and other equipment, and thus waterborne coatings require the use of specialized, corrosion resistant equipment. Similarly, flash rusting of mild steel substrates may be a concern with waterborne coatings. In addition, waterborne coatings are more susceptible to freezing under adverse storage and application conditions.

While durability of many waterborne coatings has improved in recent years, it still lags that of solvent-based coatings. This can mean that a water-borne coating will not last as long and will need to be applied more frequently, which can increase the actual amount of VOCs being emitted. Finally, although water is used in waterborne formulations, it is not the only ingredient, and therefore, the use of water-borne coatings in industrial applications often generates relatively large amounts of liquid and solid waste that must be treated before disposal.

#### Solvent-Based Coatings

Solvent-based coatings continue to offer significant performance advantages in most industrial applications. In many ways, solvent-borne coatings have set the standard for flexibility of application and superior finish qualities. Solvent-based technology is also sometimes the only way to formulate high-quality architectural coatings where superior flow and leveling are required.

Solvent-based paints often have favorable qualities that are essential in many applications. Some qualities are: flexibility and versatility of coating application and dry time; ease of achieving high gloss for good distinctness of image (DOI) for demanding applications; and they tend to be durable, which can mean fewer applications are needed.

In addition to the quality of the final finish, formulators must balance a number of other factors in order to develop high performance coatings for specific applications. When it comes to striking the proper balance, solvent-based coatings generally provide broad flexibility to both formulators and coating applicators. For most coating systems, evaporation rate is a key performance factor. With solvent-based systems, practically any evaporation rate can be achieved simply by adjusting the solvent mixture.

Although formulators of water-based coatings have overcome some of the initial evaporation shortcomings associated with this technology, temperature and humidity still have a much greater impact on water-based systems than they do on solvent-based systems.

As noted earlier, the drawbacks of solvent-based coatings are not related to their performance attributes, but to environmental and other concerns. Since many solvents are VOCs, they are regulated by federal and state governments and special considerations go into their formulation and use in industrial facilities.

## APPENDIX 5

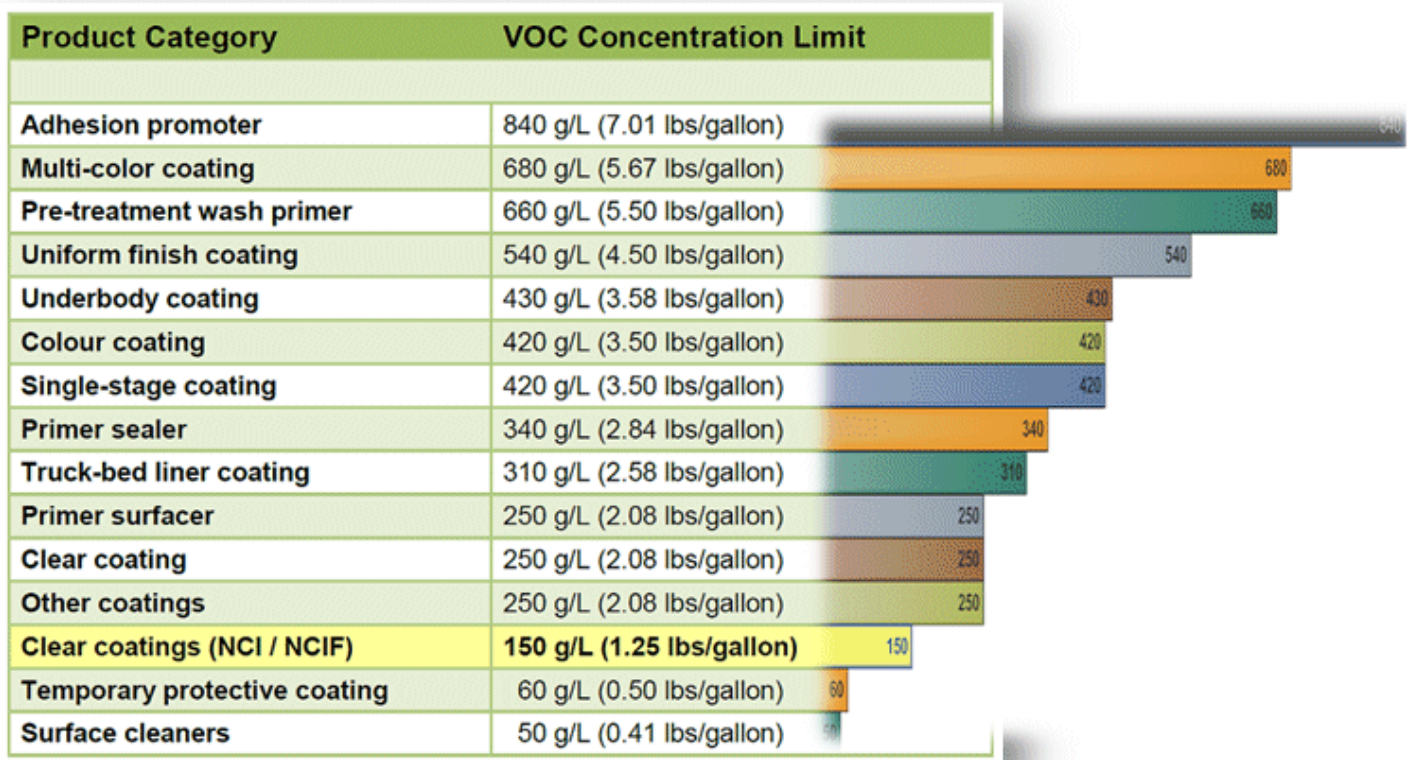
### Volatile Organic Compounds (VOCs) Comparison

Volatile organic compounds (VOCs) are organic chemicals that have a high vapor pressure at ordinary room temperature. Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublime from the liquid or solid form of the compound and enter the surrounding air, a trait known as volatility.

**Strategic Visionary Solutions LLC** is committed to Environmental Awareness & Stewardship and providing solutions that meet or exceed industry standards and responsibilities. We believe that such innovations should replace older products in markets and industries where it can be demonstrated that the newer products and practices inflict less or no harm upon the environment and/or to workers that handle these products. Superior alternatives = a healthier world for everyone.

VOCs are primary precursors to the formation of ground level ozone and particulate matter which are the main ingredients of smog. Smog is known to have adverse effects on human health and the environment. Air pollution has been shown to have a significant adverse impact on human health, including premature deaths, hospital admissions and emergency room visits. Studies indicate that air pollution is associated with an increased risk of lung cancer and heart disease.

The following chart provides a clear comparison of how NCI/NCIF ranks with respect to other common industrial coating products. At only 150 g/L (1.25 lbs/gal), the only other coatings with lower VOC values are temporary protective products and surface cleaners. (As noted in section 3.5, VOC results were obtained utilizing standardized testing procedures: ASTM D3960.)



The benefits of such a low VOC count include:

- ✓ Increased applicator safety and reduced health risks,
- ✓ Increased efficiency during product application,
- ✓ Reduced emissions which results in improved sustainability practices, and
- ✓ Ease of meeting and/or exceeding environmental standards/regulations and responsibilities

## APPENDIX 6

### Respiratory Personal Protection Equipment

The service life of a respiratory cartridge is the period for which the cartridge provides adequate protection to the user. After a cartridge has absorbed a contaminant to its capacity, the contaminant will begin to pass through the cartridge and enter the face piece of the respirator, a condition commonly referred to as breakthrough.

A cartridge change-out schedule allows the respirator wearer to replace the chemical cartridge or canister before breakthrough occurs, instead of relying on the contaminant's warning properties. An appropriate cartridge change schedule is one that is both convenient and assures that the concentration of the chemical downstream does not exceed the exposure limit.

User senses (odor, taste, irritation, etc.) are not an acceptable means for determining cartridge service life because warning properties rely upon human senses that are not foolproof. The 1987 NIOSH Respirator Decision Logic described the typical wide variation of odor threshold in the general population (greater than two orders of magnitude). Other problems exist: shift in odor threshold due to extended low exposures, shifts due to simple colds and other illnesses, and failure to recognize odor due to distraction in the workplace competing for worker attention. Given the variability among people with respect to detection of odors and differences in measuring odor thresholds, a better practice is to establish cartridge change-out schedules even for chemicals with adequate warning properties.

#### Rules of Thumb

As part of the overall assessment for determining a change-out schedule, one might look to various "rules of thumb" that have appeared in published literature. Please note that these "rules of thumb" do not work for every chemical in every situation. These statements do not generally apply to inorganic gases such as sulfur dioxide and hydrogen sulfide.

- a. If a chemical's boiling point is greater than 70°C and the concentration is less than 200 ppm you can expect a service life of eight hours at a normal work rate;
- b. Service life is inversely proportional to work rate;
- c. Reducing concentration by a factor of ten (10) will increase service life by a factor of five (5);
- d. Humidity above 85% will reduce service life by 50%;
- e. Breakthrough times are diminished from 1 - 10% with each 10°C rise in temperature; and
- f. Service life is directly proportional to the amount of carbon in the cartridge.



## APPENDIX 7

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### **Portable Controlled Workshop Environment**

This is a workshop specifically designed to conform to and comply with existing and changing environmental regulations that will protect the environment from damaging emissions. The workstations feature a patented airflow technology which allows it to match and exceed global Occupational Safety and Health Administration (OSHA) ventilation and combustible material requirements. This allows applicators to establish portable coating and spraying booths at geographically worksites.

## APPENDIX 8

### Nano-Clear® Dispensing Process

As noted, Nano-Clear® (NCI) is a humidity cured coating and is sensitive to moisture contamination. It is VERY important to quickly recap and tightly close the Nano-Clear® container once the product has been dispensed. DO NOT leave the container open for any short or extended periods of time. Doing so will allow the solvents to evaporate and crosslinking will begin. Moisture contamination or high storage temperatures will cause Nano-Clear® to gel. Discard the contents if Nano-Clear® has turned WHITE or has entered into a GEL state.

The following steps can be used to properly dispense and repackage Nano-Clear® from 55-gallon drums into smaller containers such as 5-gallon pails or 1-gallon containers which are specifically designed to withstand the solvents contained within NCI.



1. A DIY dispensing unit can be assembled using a polyurethane tube (which withstands solvents), a ½" valve with fittings (purchased from hardware stores), a 1 ¼" stainless steel valve (ordered online) and a 2" fitting which fits into the opening of a 55-gallon drum (also available from hardware stores).
2. Attach the unit with both valves closed to ensure no leakage occurs, and then tighten it properly with a large wrench to prevent leakage between the fitting and the drum.
3. Use a 55-gallon drum dolly to safely tilt and transport the drum during the dispensing process.

Ensure the valves are closed before tilting the drum and moving it onto a Hi-Lo apparatus.



4. Use a Hi-Lo to lay the drum in a horizontal position and raise it to a height appropriate for easy dispensing into 5-gallon and 1-gallon containers using a gravity feed method.



5. Move the drum into a booth with proper ventilation.



6. Place an absorbent material, as well as a basin, below the dispensing area to protect the surrounding areas and to soak up any potential leaks that may occur during the dispensing process.



7. Ensure the use of proper protective gear such as rubber gloves and a full-face mask with filters to ensure that no vapour enters the mask (see notes).



8. Place the pail under the spout, then open the large valve, then the second smaller valve to begin pouring.



9. Dispense the NCI liquid using a bottom-up approach with the tube at the bottom of the pail initially, raising it to the top of the pail as it fills in order to avoid the introduction of any bubbles into the 5-gallon pail during the filling process. Try to keep the polyurethane tube along the side of the pail, moving the pail down as it fills.



10. As the fluid reaches the top, close the top valve, then the bottom valve and allow any excess remaining liquid to drain out.

11. Wipe off any excess spilled liquid from the rim or side of the pail and surrounding area using acetone and a paper towel.



12. Next, use nitrogen gas to displace the humid air within the top of the container to ensure long term package stability.

Using a tank with inert gas such as nitrogen or argon, turn on the gas with a setting of about less than 5 lbs of pressure (as displayed on the gauge).



13. Then place the 5-gallon lid on the top edge of the container, moving the nitrogen hose around just inside the top of the container for about 30 seconds and blowing nitrogen gas inside to displace the air as you hold the lid in place on top. Since nitrogen gas weighs more than air, it will naturally gravitate towards the liquid and displace the oxygen within the pail.



14. Close the container, turn off the nitrogen gas, and use a rubber mallet to properly seal the pail.



**Automated Equipment Available**

15. Tilt and tip the container several times to ensure there are no leaks.



16. Apply the Nano-Clear® labels.



Use a similar process for the 1-gallon containers.



#### IMPORTANT NOTES:

**Do not use the red spouts/caps on the 1-gallon containers for shipping or storage.** They are designed for easier pouring and not for long term packaging or storage as air can seep into the cap. **Use the white or black caps with seals** for long term storage and package stability.



NCI has a package stability of 6-months in its unopened state, and period of approximately 2 weeks once it has been opened. NCI is a multi-polymer system that, when opened and the solvents evaporate out of the system, the polymers start to crosslink and react with the humidity in the air.

When opening an NCI container, pour out the desired amount, and then immediately close the container before the solvents begin to evaporate. If you leave the container opened and uncapped for any period, the solvents will evaporate out and the polymers within will begin to react.

For longer term stability, use inert gas such as nitrogen or argon blanketing for 5 - 10 seconds just before replacing the cap every time you open and use the product.

## Cleaning the Dispensing Equipment

Once dispensing is complete, it's very important to properly clean the equipment afterwards.

17. Remove the spout/dispensing unit from the 55-gallon drum and rinse the valves with acetone or MEK to dissolve NCI from the system.



18. Pour it into both ends of the unit, closing one end and opening the other allowing it to flush through the system.

Shake or rock the unit back and forth to ensure thorough cleaning of the solution within all areas of the spout dispensing unit.



19. Repeat this a few times. If NCI residue is not removed from the valve system, it will harden and will not be able to be removed.



20. Finally, add acetone into the valve system again and then blow out the excess with forced air.



21. Prior to storage, close both ends.

Please contact Strategic Visionary Solutions if you have further questions or concerns.

## APPENDIX 9

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### Coating Failures & Defects






Coatings are a complex combination of raw materials that must be mixed, applied to a prepared substrate, and dried and cured correctly to perform to their maximum capability. They must be able to be applied in diverse environmental conditions and then be expected to protect the substrate from the damaging effects of rain, sunlight, wind, heat, cold, humidity, and oxygen in various combinations and cycles, and still retain their integrity and often their aesthetic qualities.

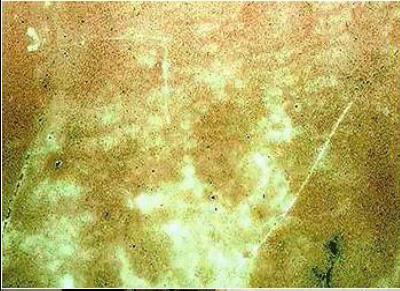

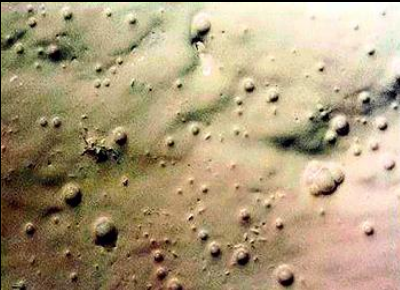

Some coatings, such as those applied to ships, must also be resistant to abrasion, in the case of cargo hold coatings, and cyclic changes of chemicals and tank cleaning, in the case of tank linings. Therefore, it's not surprising that those coatings can suffer from premature failure and/or exhibit defects that may or may not result in failure. Usually, it's not a straight-forward process to establish the reason for the failure of a coating due to the many potential factors that may be involved. Such factors can include: formulation issues, surface preparation errors, faulty application, inaccurate drying and curing times and conditions, and accidental environmental exposure. Also, often, more than one contributing factor can be involved.



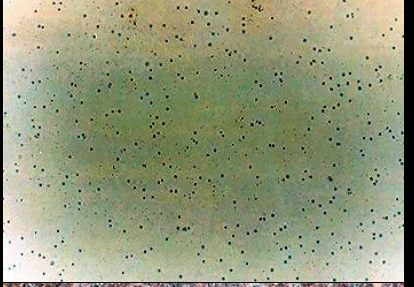


Failures and defects can manifest themselves at various times in the life cycle of a coating. Prior to application, they can take the form of settlement and skinning. During application, it can manifest as runs and sags. Shortly after application, failures & defects can appear as solvent popping and orange peel. And during the coating's service life, issues such as blistering and rust spotting can appear.

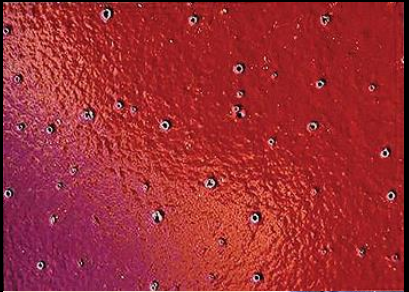



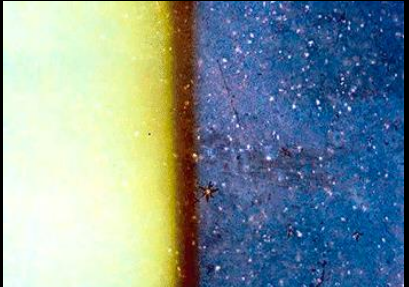
To determine the cause and mechanism of coating failures, all possible contributory factors must be evaluated, together with a detailed history from the time of application to the time the failure was first noted. Many coating failures require further evaluation and analysis to be carried out by a qualified chemist or coating specialist, often using specialized laboratory equipment.






The following pages present a table of common coating failures and defects. They are provided as a valuable resource reference for your convenience. If you aren't aware of (or have forgotten about) some of the common causes and preventive measures that can be taken to avoid such coating defects, please review and familiarize yourself with the details and samples that are listed below.






	Coating Failures & Defects	Probable Causes	Prevention	Examples
1	Abrasion	Removal of a portion of the surface of the coating or, in severe cases, removal to expose the substrate by contact with another object, such as the use of metal chains for lifting, cargo, fenders, or the grounding of a ship.	Use of abrasion-resistant coatings formulated with particular regard to resins and extender pigments. With severe cases of abrasion, the effects will be reduced or limited only by an abrasion-resistant coating.	
2	Adhesion Failure	Surface contamination or condensation, incompatibility between coating systems, or exceeding the over coating time.	Ensure that the surface is clean, dry, and free from any contamination and the surface has been suitably prepared. Use the correct coating specification and follow the advised regarding coating times.	
3	Alligatoring (Crocodiling)	Internal stresses in the coating where the surface shrinks faster than the body of the paint film. Excessive film thickness and limited paint flexibility. Application of the hard topcoat over a more flexible softer undercoat. Application of the topcoat before the undercoat has dried.	Use the correct coating specification and compatible materials.  Avoid excessive film thickness. Avoid application at high ambient temperatures.	
4	Bleeding	Bleed through is generally a full or partial re-dissolving of the previous coat or an ingredient of a previous coat and can occur when strong solvents are used in the topcoats.	Use the correct coating specification and materials.  Use compatible materials. Use appropriate sealer coating if possible.	
5	Blistering	Many mechanisms can be involved, including osmotic gradients associated with soluble salts, soluble pigments, corrosion products, retained solvents, and solvent from cargoes. Non-osmotic blistering is associated with cathodic disbonding, thermal gradients related to cold-wall effects, and compressive stress.	Ensure correct surface preparation and application. Apply suitable coating system after testing for soluble salts.  Consider the possibility of the different blister mechanisms in the particular environment.	





	Coating Failures & Defects	Probable Causes	Prevention	Examples
6	<b>Bloom (Blush)</b>	<p>Paint film exposed to condensation or moisture during curing, especially at low temperature (common phenomenon with amine-cured epoxies).</p> <p>Incorrect blend can also contribute to blooming.</p>	<p>Apply and cure coating systems under the correct environmental conditions and follow the manufacturer's recommendations.</p>	
7	<b>Bridging</b>	<p>Poor application. High viscosity paint system. Failure to brush paint into corners and over welds.</p>	<p>With a brush, apply a stripe coat into corners and welds and fill all cracks or weld them prior to application of the full coating system.</p>	
8	<b>Bubbles or Bubbling</b>	<p>Trapped air/solvent within the coating that is not released before the surface dries. Air entrapment during mixing. High ambient temperature during application. Also seen when over coating antifouling without removal of the leached layer and zinc silicates. Can be found with factory-applied coatings where application is by dipping, electro-deposition, or roller coating.</p>	<p>In spray application, adjust viscosity with thinners and follow the data sheet requirements for maximum application temperature.</p> <p>Use the correct mixing equipment to ensure that air is not stirred in during the mixing process.</p> <p>Apply a mist coat. Add de-foaming agent to emulsion paints.</p>	
9	<b>Cathodic Disbonding</b>	<p>High overvoltage mainly from impressed current systems, but also to a lesser extent with sacrificial anodes when the number of anodes is excessive. Factors are incorrect installation, poor monitoring, &amp; incompatible coating systems.</p>	<p>Use a well-designed cathodic protection system, regularly monitored with well-placed reference electrodes, and application of an alkali resistant coating system.</p>	






	Coating Failures & Defects	Probable Causes	Prevention	Examples
10	Chalking	Disintegration of the paint binder on exposure to weathering and/or ultraviolet light.	Apply a suitable topcoat with high resistance to chalking and with ultraviolet resistance.	
11	Checking	Typically, a formulation and/or a specification problem. As with cracking, stresses are developed that cause the surface of the paint film to become brittle and crack. Limited paint flexibility.	Use a correctly formulated coating system.	
12	Cissing	Surface contamination by either moisture or foreign matter such as oil, grease, or silicone.  Also known to happen when incorrect solvent blends have been used.	Ensure surface is clean and free from grease, oil, and other contaminants prior to application of coating.	
13	Cobwebbing	Too high a viscosity with some types of polymer solutions. Will occur with chlorinated rubber at almost any viscosity.	Reduce the spraying viscosity. Select a more suitable solvent blend. Change the spraying conditions.	
14	Cracking	Cracking is generally a stress-related failure and can be attributed to surface movement, aging, absorption and desorption of moisture, and general lack of flexibility of the coating. The thicker the paint film, the greater the possibility it will crack.	Use correct coating systems, application techniques, and dry-film thicknesses.  Alternatively, use a more flexible coating system.	





	Coating Failures & Defects	Probable Causes	Prevention	Examples
15	Cratering	<p>Trapped air or solvent bubbles that have burst, leaving small craters as the coating dries.</p> <p>The coating has insufficient time to flow into a uniform film.</p>	<p>Improve spray technique, apply a mist coat, and avoid air entrainment during mixing.</p> <p>Add thinners as recommended by the paint supplier.</p>	
16	Crazing	<p>Application temperature too low, incompatibility with previous coating, aging, or high film thickness.</p>	<p>Apply a thinner coat of paint, add slower drying solvent, check that application and drying conditions are correct for the paint system used, and check compatibility.</p>	
17	Crowsfooting	<p>Usually due to the surface drying rapidly to form a skin, which then wrinkles as solvent slowly evaporates from the soft underlying paint.</p>	<p>Apply a thinner coat of paint, add slower drying thinners, and check that application and drying conditions are correct for the paint system used.</p>	
18	Delamination	<p>Provided that compatible paint materials have been used, delamination defects are generally related to poor surface preparation and application defects, such as contamination between coats, exceeding overcoat times, or application to a glossy surface.</p>	<p>Ensure that no contamination occurs between paint coats.</p> <p>Follow the recommended over coating intervals. Lightly abrade and clean glossy surfaces between coats.</p>	
19	Fading	<p>Incorrect pigmentation, use of non-light- stable organic pigments, atmospheric contamination, porous substrate.</p>	<p>Use correct coating systems that resist ultraviolet light and fading. Use a coating with light stable pigments.</p>	

	Coating Failures & Defects	Probable Causes	Prevention	Examples
20	Flaking	Incorrect paint system used. Either no or an incorrect pre-treatment used for certain substrates, for example, nonferrous or galvanized. Poor application techniques. May also be attributed to differential expansion and contraction of paint and substrate, for example, wood. Can be the result of aging of the paint system.	Use correct coating system and pre-treatment.	
21	Grinning	Low film thickness of topcoat. Poor opacity and covering power of topcoat. Strong color of primer/undercoats.	Apply adequate dry-film thickness between individual coats. Use opaque coatings with good opacity.	
22	Heat Damage	Effect of high temperature often applied to the reverse side of a steel plate from burning, welding, or fire.	Ensure that all welding/burning is completed prior to painting.	
23	Impact Damage	Impact damage to a relatively brittle coating. Often seen on glass-fibre-reinforced plastics. Also occurs when steel is deformed by impact.	Prevent impact damage.	
24	Intercoat Contamination	The contamination could be present due to inadequate washing down, salts from weathering of shop primer, or deposits from nearby operations.	Carefully inspect and test the surface before paint application and wash down with fresh water if required.	

	Coating Failures & Defects	Probable Causes	Prevention	Examples
25	Mud Cracking	Generally, over application of heavily pigmented primers such as inorganic zinc silicates or water-based coatings, although can occur with other over thick systems.	Apply only the recommended coating thickness. Use recommended application techniques with suitably formulated products.	
26	Orange Peeling	Failure of the paint film to flow out. Usually caused by poor application techniques, incorrect solvent blend, or too-high thixotropy.	Use correct application techniques with suitably formulated products.	
27	Peeling	Peeling is the reduction in bond strength of the paint film due to contamination or incompatibility of coats.	Use correct coating system and specification applied to clean and uncontaminated surfaces.	
28	Pinholes	Solvent or air entrapment within a paint film. A common problem when coating porous substrate such as zinc-filled primers, zinc silicates, and metal-sprayed coatings. Pinholes can also be caused by incorrect spray application or incorrect solvent blend.	Use correct application techniques with suitably formulated products. Correct solvent blends and environmental conditions. Check the spray equipment and distance of spray gun from the surface. Apply a mist coat.	
29	Rippled Coating	Strong wind blowing across the surface of wet paint causes it to ripple. Where this occurs on the underside, the ripples can hang down in the form of small stalactites. Can also be caused by poor application techniques.	Do not apply paint under unfavourable conditions. Use correct application equipment and workmanship.	

	Coating Failures & Defects	Probable Causes	Prevention	Examples
30	Runs	Over application of paint, excessive use of thinners, incorrect (or lack of) curing agent, or poor workmanship.	Use correct application techniques and apply at the recommended dry-film thickness.	
31	Rust Rashing	Low film thickness, often in combination with a high surface profile.	Ensure that an adequate thickness of a primer coat is applied to cover the surface profile, and check that the surface profile is not too large.	
32	Rust Spotting	<p>Low film thickness (more likely creating rust rashing), voids and holidays (more likely creating rust rashing), but also defects in the steel, such as laminations and inclusions.</p> <p>Too high a surface profile may cause penetration of peaks through a paint film and cause rust spotting. May also occur from metallic contamination of a coated surface by grinding dust and so on.</p>	<p>Ensure that an adequate thickness of a primer coat is applied to cover the surface profile.</p> <p>Use a thicker coating system or a lower blast profile. Protect coating from contamination with grinding dust and so on.</p>	
33	Rust Staining	<p>Water runoff from a rusty surface above a soundly coated surface. Rust staining occurs when the rust is wetted-out and contaminated water runs over and discolors other items or locations.</p> <p>Usually more of an eyesore than a defect. The coating itself may not be defective, only stained.</p>	Ensure adequate design and suitable maintenance.	

	Coating Failures & Defects	Probable Causes	Prevention	Examples
34	Sags	<p>Over application of paint, excessive use of thinners, incorrect (or lack of) curing agent, or poor workmanship.</p> <p>In extreme circumstances, it could also be a formulation problem.</p>	Use correct application techniques with suitably formulated products.	
35	Settlement	Old stock, heavily pigmented paint, and incorrect formulation of product. Can be a problem with zinc-rich primers.	Use products within shelf life. Use adequate mixing procedures. Keep paint mixed or re-circulated during spray application.	
36	Skinning	Absence of anti-skinning agent, use of non-airtight container, hot storage conditions. Often occurs in partly-used cans.	Use airtight container, and store according to data sheet.	
37	Solvent Lifting	Incompatible paint systems used. Topcoats with a strong solvent blend can react with previous and weaker solvent-blended coatings. Over coating before the previous coat has adequately hardened.	Use correct coating specification, over coating times, and materials. Conduct compatibility trials with undercoats/topcoats.	
38	Solvent Popping	Incorrect solvent blends, porous surfaces, incorrect environmental conditions, or high surface temperature.	Use correct coating specifications and materials and ensure correct application techniques and environmental conditions.	

	Coating Failures & Defects	Probable Causes	Prevention	Examples
39	Staining	Contact with a solid or liquid that imparts a dis-coloration or stain to the coating.	Avoid contact with solids and liquids that are prone to cause staining or use dark-colored coatings where any staining would not be so apparent.	
40	Stress Cracking	Stress cracking can be attributed to surface movement, aging, absorption and desorption of moisture, thermal cycling, and general lack of flexibility of the coating. The thicker the paint film, the greater the possibility that cracking may occur. Often occurs around welds and changes in section.	Use correct coating systems, application techniques, and dry-film thicknesses, or use a more flexible coating system.	
41	Under Cutting	Application of paint to corroded substrate. Rust creep from areas of mechanical damage and missing primer coat. Can be found in areas of poor design or access, where inadequate preparation and coating thickness was applied. Could also be due to lack of maintenance.	Use adequate coating specifications and maintenance procedures. Apply a suitably formulated primer.	
42	Wrinkling	Usually due to the initial formation of a surface skin with solvent-based paints. Can arise from over coating before the previous coat has adequately hardened. Over thickness, particularly with alkyd coatings.	Use correct coating specification and materials, and ensure adequate mixing, application, and curing by following the paint supplier's recommendations.	

### Spray Equipment Information

#### HVLP Spray Gun Basics

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If you have a shop that has purchased an HVLP paint spray gun, you can use it to apply your product. HVLP guns use a high volume of air coursing through them to atomize the product rather than relying on high pressure. By using low pressure, more product will be applied on the target that you are spraying, which will help you to save both money and product. It is important that you understand how to set up your gun correctly.

#### How to get ready to set up

Setting up an HVLP spray gun correctly involves three steps, including choosing the air supply, selecting the correct tip and then setting it up. In order to operate correctly, HVLP guns need a high volume of air. Your gun's directions will tell you the minimum cubic feet per minute that it requires in order to operate. Your air compressor must be able to produce the required volume constantly, so make certain that it has the appropriate capabilities. You'll want to set it to where it's releasing about 90 pounds per square inch. In addition, you will need an HVLP regulator to set the pressure where it enters your gun. Finally, you will need an air dryer that mounts to the wall in order to keep your air lines free of any oil or water.

The tip that you choose is also important. You likely will have received a few with your gun. You'll want to choose the smallest fluid tip that will work for your project. Small jobs require about a 1.0 tip. In order to complete a large project, choose a tip that is sized at 1.3 or 1.4. If you will use your gun to build primers, a tip size of 1.8 to 2.3 should be chosen depending on the thickness that you desire.

#### Setting up your gun

Each time you are getting ready to use your gun, you will need to set it up. Start by taping a piece of masking paper on your wall for your spray test. Then, set the pressure at your gun's inlet. You will use the air regulator that you attached to your gun to do this. You will set it with the trigger pulled at about 50 psi to start. Close the air volume control knob and with the trigger still pulled, open it up to the point at which the air volume starts to remain the same and stop.

Next, you will need to open the fan control knob. You are wanting a fan that will be about 6 inches tall when you are holding the gun about 6 inches away from the surface. Then, turn the material knob until it seats and then unscrew it about two and one-half turns.

In order to complete your spray test, hold the gun aimed at the masking paper as if you are going to paint about 6 inches away. Pull the gun's trigger all the way in for a fraction of a second and then close it. You should see a cigar-shaped pattern on the masking paper. Turn the fan control knob until you are able to get it to 6 inches tall when the gun is 6 inches away from the paper. After your fan control is set, leave it alone.

Next, hold the gun about 8 to 9 inches away from the paper. The pattern should be around 8 to 10 inches long. The coverage should be full in the center with fading coverage going away. If your pattern does not look like this, it is likely because of some common problems. For example, if your pattern shows too much of your product at either end and not enough in the middle, you have too much air flow. If the reverse is true, you have too little. If there are runs in the center, you are either holding the trigger for too long or are holding the gun too close.

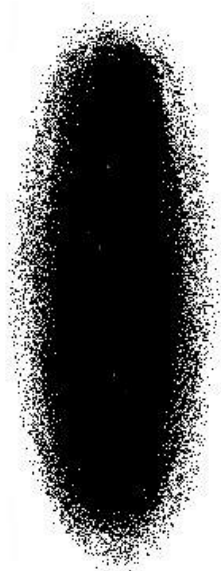
If your gun is spraying too much material, screw in the material knob slightly. If that doesn't help, put it back to where it was and turn down the air pressure on your regulator.

### Tune your HVLP gun

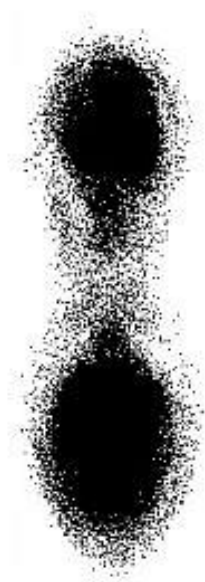
In order to tune your gun to where it gives the smallest possible paint droplets without losing full coverage, you will need to tune your gun. To do this, turn the material control knob a little at a time. You can also do the same thing by raising the air pressure. When you get it to where you want it, you're finished and ready to spray your project.



**EXAMPLE OF HVLP SPRAY GUN**



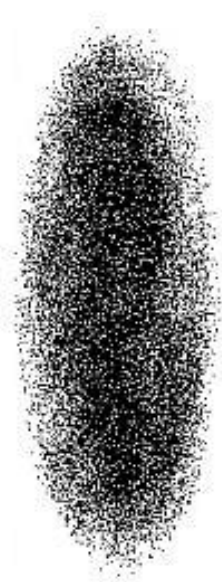
**EXAMPLE OF CORRECT SPRAY PATTERN**



**TOO MUCH  
AIR FLOW**



**NOT ENOUGH  
AIR FLOW**



**NOT ENOUGH  
MATERIAL**



**TOO MUCH  
MATERIAL**

TRENT ©



**GOOD!**



## Strategic Visionary Solutions® LLC

*"Providing Solutions to Your Challenges"*

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