



**RESTORE, ENHANCE,
EXTEND PROTECT**

NANO-CLEAR[®] FOR MARINE/NAVAL APPLICATIONS

- ❖ Industry Award Winning, Eco-Friendly Coatings Guaranteed to Extend the Service Life of Valuable Assets
- ❖ Unmatched Durability, Even in the Harshest Environments
(For Oxidized or Newly Painted Surfaces)



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Nano-Clear[®]

ASSERO Coating Technologies

PROTECTION WITHOUT COMPROMISE



INDUSTRIAL/MARINE MARKETS

Industrial asset owners commonly apply protective coatings over metal surfaces to mitigate the damaging effects from various environmental factors, to maintain optimal performance, and to extend asset service life thereby increasing profitability. However, conventional industrial coatings "alone" are still very susceptible to:

- Corrosion
- Rain Erosion
- UV Degradation
- Weathering
- Moisture / Water Intrusion
- Acid Rain / Chemical Damage
- Scratch / Abrasion / Chip Damage
- Normal Wear & Tear

What is needed?

- A combined basecoat - clearcoat system with a multifunctional clearcoat that protects surfaces more thoroughly than any existing technology.
- A permanent surface coating that enhances and extends the surface life of freshly painted or highly oxidized paint by 10+ years.

Nano-Clear[®] NCI

Nano-Clear[®] NCI dramatically improves surface protection and brand image while significantly reducing surface maintenance expenses.



- **Extreme Corrosion Resistance**
No Rust after 6,360 Hour Salt Spray Testing
- **Extreme Abrasion Resistance**
Only 8.4 mg Loss after 1000 Cycles, 1 kg
- **Low VOC**
1.25 lbs / Gal (150 g / L)
- **Weatherproof Gloss**
99% Gloss Retention after 4000 Hours; Xenon WOM
- **1K Coating, Ambient (Humidity) Cured**
Dry-To-Handle in 4 Hours; Return to Service in 24 Hours
- **Reduce Re-Paint Cycle by 2X - 3X**
As Documented in Production Case Studies
- **Improve Brand Appearance**
Achieve Deeper Colors & Dramatically Higher Gloss
- **Achieve Lower Operating Costs**
By Reducing Maintenance Time & Extending Recoat Cycle by 10+ Years



What Makes Nano-Clear[®] Unique?

Nano-Engineering (not nano-particles) Creates Exceptional Crosslink Density

Nano-Clear[®] NCI is manufactured using proprietary 3D nano-structured polymers (*not* nano-particles) which results in extreme crosslink density.

NCI dramatically improves corrosion, weathering, abrasion, scratching, chipping, marring, chemical & UV resistance and reduces surface maintenance. NCI penetrates deep into the pores of freshly painted or highly oxidized paints to enhance color, improve gloss, and significantly increase surface hardness.

Nano-Clear[®] is a one-component, humidity cured, highly cross-linked, polyurethane/polyurea, hybrid nanocoating.


With this exceptionally high crosslink density, we have the test data to prove that NCI is the world's best all-around clearcoat for resistance to scratches, chips, abrasion, chemicals, weathering, and more. Please see the back cover for test results or visit www.assero.co/tests.

AMAZING FLEXIBILITY!



Before / After

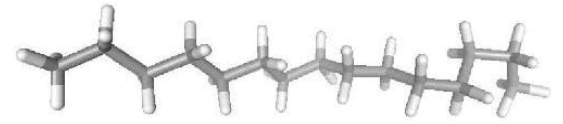
- ✓ Nano-Clear[®] has both remarkably high surface hardness and flexibility.
- ✓ Steel panel coated with Nano-Clear[®], bends in-half without cracking or any other failure to the coating.



Nano-Clear[®]

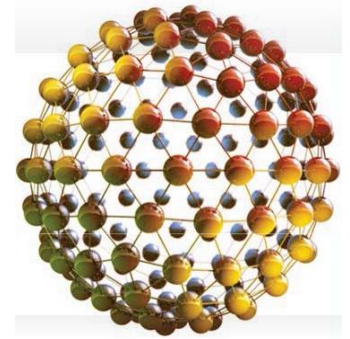
Why is Crosslink Density So Important?

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



Linear chain of molecules

Conversely, we “nano-structured” our clearcoat to have a 3D molecular architecture. The 3D polymer network has an exponentially higher number of crosslinked sites. The result is a tightly knit mesh with unprecedented DMA density.



3D molecular architecture

High crosslink density provides highly functional surface properties, including unmatched corrosion resistance, scratch resistance, chemical resistance and UV durability. It also means low surface energy, repelling water (hydrophobic) and aiding in the release of ice, dirt, brake dust, and even concrete dust.

BEFORE Application of Nano-Clear®



AFTER Application of Nano-Clear®



Note: Original colour and gloss was restored with NCI. Lifeboats were **not** repainted.

"The results are stunning. I have a meticulous bosun who rolled and back brushed the product onto the boat, and despite having far from ideal circumstances (outdoors, wind, dust) the improvement to my lifeboats is remarkable."

Master/Chief Mate - MarAd Fleet



Unrivalled Performance Enhancement for Newly Painted or Highly Oxidized Coatings

For decades, conventional coating systems have relied on numerous variations of the same linear chain polymers as noted above. As a result, in order to properly protect equipment, it's necessary for industrial customers to perform frequent, costly, labour intensive maintenance cycles every 6 months to 5 years which includes surface preparation & repair, and then repaint & recoat using the same *conventional* technology.

Nano-Clear® Coatings on the other hand, are designed from the bottom up with nano-structuring properties and no matter how badly oxidized your existing coating is, **Nano-Clear® NCI for Marine Naval Applications** will restore its color and provide unmatched surface protection.

Put Simply: NCI restores the color, gloss, surface hardness and extends the surface life of conventional coatings by 10+ years.

Nano-Clear® NCI is also designed to be applied directly over freshly coated surfaces including 2K epoxies, 2K polyurethanes and powder coatings.



Nano-Clear® Coatings are also eco-responsible and engineered with protective qualities that are non-leaching and will not harm the environment.

NCI is a high performance, low VOC, green chemistry, sustainable solution.

Nano-Clear®

How Does Nano-Clear[®] Enhance Color & Physical Properties?

NCI has a low (200 cps) viscosity, so it penetrates deep into the smallest pores of newly painted or oxidized coatings, **turning the white, chalked layers transparent**, allowing the original underlying color to show through while fortifying/hardening the surface.

Humidity-cured at ambient temperatures, NCI quickly hardens and fortifies the painted surface, "locking-in" color and preventing future chalking with its long-term UV absorbers.

Please note: NCI must be applied over the existing coating system before the coating has deteriorated into a powdered, peeled and/or eroding state. NCI *is not a rust converter*. Rust or peeling paints must be removed and repainted first (prior to applying NCI) with a coating such as a high-solids, two-component epoxy.

For additional details, please review the Nano-Clear[®] NCI Technical Data Sheet at: www.asserco.com/resources.

Industrial Users of Nano-Clear[®]



STERLING CRANE



Celebrity **X** Cruises[®]

CASE
CONSTRUCTION

 **Carnival**

ODEBRECHT
Oil & Gas

Where Can Nano-Clear[®] Be Used?

On New or Highly Oxidized Coatings:

Nano-Clear[®] (NCI) has been engineered to be applied over 2K epoxies, 2K polyurethanes, powder coatings, polyesters, gel coats, e-coats, latexes, fibreglass, and anodized aluminum (to prevent filiform corrosion, etc.).

For Marine Applications:

NCI is the premiere solution for a diverse range of applications:

- Lifeboats
- Cargo Ships / Ocean Going Vessels
- Chemical, Oil and Gas Storage Tanks
- Pumps & Valves
- Locomotives, Tank & Chemical Railcars
- Oil & Gas Pipelines
- Oil Field Platforms, Pipes and Tubes
- Drinking Water Pipelines
- Epoxy Coated Floors
- Shipping Containers
- Generators
- High & Low Voltage Utility Boxes
- Bridge Structures
- Mass Transit Vehicles & Equipment
- Emergency Response Vehicles & Equipment
- Concrete Warehouse Floors
- Painted & Concrete Building Structures
- Interior and Exterior Concrete / Wood Architectural Structures
- Agriculture, Construction, & Earth Moving Equipment
- Aircraft and Equipment
- Naval and Military Air, Ground & Marine Equipment
- And much more.

Problem: The US Army amphibious forces required a solution for the decks of their Landing Craft Utility ship to reduce surface corrosion, and to extend the service life of painted surfaces. Using conventional epoxy topcoats, the deck also suffered chipping & abrasion from tracked vehicle/tank traffic.

Solution - NCI: After cleaning & drying the surface, NCI was then applied with a conventional sprayer. NCI was selected in order to protect the surface against 10+ years of UV degradation, to dramatically improve corrosion, chipping, chalking, abrasion & chemical resistance, and to reduce surface maintenance. The LCU ship was back to service within 24 hours post-application. See other Nano-Clear[®] case studies:

www.assero.co/resources



Nano-Clear[®]

Industry Recognition

Nano-Clear® has been recognized for its innovative engineering by:

- ❖ **NACE MP 2019 / 2020 Corrosion Innovation of the Year Award**
NACE (the National Association of Corrosion Engineers) sets the standards for surface preparation, coating selection, coating application, painting contractor certification, and testing.
- ❖ **Frost & Sullivan Technology Leadership Award 2020**
Frost & Sullivan is the premiere business consulting firm to the Paints and Coatings Industry.
- ❖ **PaintSquare Prestige Award 2020 (Top Product: Coatings for Steel)**
PaintSquare is the premier industry publication to the Paints & Coatings Industry.



To arrange a Nano-Clear® application demonstration, contact **Assero** at:

info@assero.co



ASSERO COATING TECHNOLOGIES

Assero Coating Technologies delivers **Exceptional Surface Protection™** which extends the useful service life of valuable assets that operate in harsh environments. Assero is built around an ethos of delivering eco-innovative / eco-responsible, sustainable, green chemistry solutions with a line of **Protective Clearcoats™** that reduce damage to the environment.

Recommended Uses: For Oxidized or Freshly Painted Surfaces
Chemistry: 3D Nano-Structured Polyurethane / Polyurea Hybrid

| TABLE 1 | | NANO-CLEAR® WITHOUT PERFORMANCE UPGRADES | |
|---------------------------------|---|--|--|
| TEST PROPERTIES | | TEST METHOD | RESULTS |
| 1 | Crosslink Density | DMA (Dynamic Mechanical Analysis) | 2.17 (x 10 ³ mol/m ³) |
| 2 | VOC | ASTM D3960 | 1.25 lb/gal (150 g/l) |
| 3 | Recommended Dry Film Thickness | ASTM D5796 | 1.0 mil to 2.0 mils (25.4µm to 50.8µm) |
| 4 | Coverage | Nanovere Inhouse | 1,122 ft ² /gal @ 1.0mil |
| 5 | Gloss 20° / 60° | ASTM D523 | 86.0 / 92.2 |
| ABUSE RESISTANCE | | | |
| 6 | Abrasion Resistance (CS-17, 1 kg, 1000 cycles) | ASTM D4060 | 8.4 mg loss |
| 7 | Pencil Hardness, Scratch | ASTM D3363 | 4H |
| 8 | Scratch Hardness | SASO 2833 | 2500 gm |
| 9 | Pencil Hardness, Gouge | ASTM D3363 | 5H |
| 10 | Pendulum Hardness (Persoz) | ASTM D4366 | > 250 oscillations |
| 11 | Impact Resistance 18°C Direct in/lbs | ASTM D2794 | 50 Pass / 60 Fail |
| 12 | Impact Resistance 18°C Reverse in/lbs | ASTM D2794 | 10 Pass / 20 Fail |
| 13 | Impact Resistance | SASO ISO 3248 | 1 kg - 160cm |
| 14 | Impact Strength | ASTM D2794 | 145 kg - cm |
| 15 | Chip Resistance 23°C / 73.4°F (2.0 mils) | ASTM D3170 | 7A |
| 16 | Chip Resistance -29°C / -9.4°F (2.0 mils) | ASTM D3170 | 7B |
| 17 | Falling Sand Abrasion 100 liters | ASTM D968 | Pass |
| 18 | Mar Resistance | ASTM D5178 | 5.0 kg |
| ENVIRONMENTAL RESISTANCE | | | |
| 19 | Xenon WOM Resistance 4,000 hrs | SAE J1960 / ASTM G155 | 100% Gloss Retention 99% Gloss Retention |
| 20 | QUV 313, >1,500 hrs | ASTM D4587 | 100% Gloss Retention |
| 21 | Water Immersion Test 240 hrs @ 50°C/122°F | ISO 2812-2 | Pass |
| 22 | Salt Spray, 6,360 hrs | ASTM B117 / 2018 | No corrosion points - Approved |
| 23 | Humidity, 100% RH, 100°F / 37.8°C - 240 hrs | ASTM D1735-02 | No loss of adhesion - No change |
| 24 | CASS 240 hrs @ 50°C / 122°F | JIS H8502 | Pass |
| 25 | Thermal Shock (Heat: 100°F / 37.8°C: 3 hrs, Freeze: 3 hrs, Steam) | GM9525P | No loss of adhesion - No Change |
| CHEMICAL RESISTANCE | | | |
| 26 | 10% Sulfuric Acid | ASTM D 1308 | No effect |
| 27 | 10% Hydrochloric Acid | ASTM D 1308 | No effect |
| 28 | 10% Sodium Hydroxide | ASTM D 1308 | No effect |
| 29 | 10% Ammonium Hydroxide | ASTM D 1308 | No effect |
| 30 | Isopropyl Alcohol | ASTM D 1308 | No effect |
| 31 | Xylene | ASTM D 1308 | No effect |
| 32 | Skvdrol® 500 Fluid | ASTM D6943-A | No effect |
| 33 | MEK Resistance - 1,500 Double Rubs | ASTM D4752 | No effect |
| FLAMMABILITY | | | |
| 34 | Flammability: Fire Retardant & Flame Spread | ASTM E84 / BS476 | Class 1 (Excellent) |

| TABLE 2 | | COMPARISON TEST FOR COMPOSITE MATERIALS (FIBREGLASS WITH GEL-COAT) BASF VS NANO-CLEAR® WITHOUT PERFORMANCE UPGRADES | | | | |
|-----------------|--|--|--------------------------|-------------------|---------|-------------|
| TEST PROPERTIES | TEST METHOD | CLEAR TOP COAT (1K or 2K) | DRY FILM THICKNESS (DFT) | ACETONE PRE-CLEAN | RESULTS | |
| 35 | Mechanical Scratch Ambient Temperature | ASTM D7027 | BASF DC92 (2K) | 2.0 - 3.0 mil | NA | 43.853 Mean |
| 36 | Mechanical Scratch Ambient Temperature | ASTM D7027 | Nano-Clear® (1K) | 2.0 mil | NA | 38.129 Mean |
| 37 | Mechanical Scratch After 7 Day 8 hr Heat Cycling @ 50°C/122°F, Ambient Cool down Temperature | ASTM D7027 | BASF DC92 (2K) | 2.0 - 3.0 mil | Yes | 1.532 Mean |
| 38 | Mechanical Scratch After 7 Day 8 hr Heat Cycling @ 50°C/122°F, Ambient Cool down Temperature | ASTM D7027 | Nano-Clear® (1K) | 2.0 mil | Yes | 35.99 Mean |

| TABLE 3 | | TESTING OF CHEMICAL AGENT RESISTANT COATINGS - CARC NANO-CLEAR [®] WITH MATTING ADDITIVE (NCI+MA) | | |
|----------------------------|---|---|------------------------------|------------------------|
| TEST PROPERTIES | | TEST METHOD | CONVENTIONAL COATING RESULTS | NCI +MA RESULTS |
| OPTICAL PROPERTIES | | | | |
| 39 | Gloss 20° 60° 85° | ASTM D234 ASTM D234 ASTM D234 | 0.7 3.6 7.4 | 0.6 1.3 7.8 |
| 40 | Color L a b | ASTM D2244 ASTM D2244 ASTM D2244 | 66.66 6.02 20.71 | 66.66 6.02 20.71 |
| 41 | Infrared Reflectance | ASTM E-903 | PASS | PASS |
| PHYSICAL PROPERTIES | | | | |
| 42 | Adhesion | ASTM D3359 | 5B | 5B |
| 43 | Pencil Hardness | ASTM D3363 | 2B | >6H |
| RESISTANCE | | | | |
| 44 | Acid Spot Resistance | MIL-DTL-53039E Sec 4.6.24 | No Effect | No Effect |
| 45 | MEK Resistance: Double Rubs to Substrate Double Rubs to Start of Coating Dissolution | ASTM D4752 ASTM D4752 | >200 20 | >1,500 >1,500 |
| 46 | Water Immersion Test: Visual Observation Pencil Harness Adhesion | MIL-DTL-53039 Sec 4.6.22 | No Effect 4B 5B | No Effect >6H 5B |

| TABLE 4 | | CONTACT ANGLE AND ICE DE-BONDING (SHEDDING) TEST | |
|--|----------------------|--|--|
| COATING INFORMATION | | CONTACT ANGLE RESULTS (%) | |
| CONTACT ANGLE RESULTS OF FROZEN DI WATER ICE DROPLETS (%) | | | |
| 47 | Control | 43.12 | |
| 48 | NCI +EC @5% | 102.41 | |
| 49 | NCI +MA @30% +EC @5% | 101.07 | |
| SHEDDING TIME RESULTS OF FROZEN DI WATER ICE DROPLETS (Seconds) | | | |
| 50 | Control | 58.0 | |
| 51 | NCI +EC @5% | 32.0 | |
| 52 | NCI +MA @30% +EC @5% | 40.05 | |



Sample of Ice De-bonding Test on Aluminum Substrate (NCI +MA +EC: 40 seconds)

| TABLE 5 | | ANTI-MICROBIAL (LOG ₁₀ REDUCTION) TEST NANO-CLEAR [®] WITH ANTI-MICROBIAL ADDITIVE (NCI+AM) | | |
|-----------------|-------------|--|--|------------------|
| TEST PROPERTIES | TEST METHOD | AVERAGE CFU/CARRIER | RESULTS (Log ₁₀ Reduction / % Efficacy) | |
| 53 | Control | JIS Z 2801 | 3.97E+05 | NA |
| 54 | NCI +AM | JIS Z 2801 | 1.53E+01 | 6.87 / 99.99998% |



Sample Log Reduction Test (Comparing CFU (Colony Forming Units), Before & After)

Available Locally Through:

PROGUARD CANADA
Toronto, ON; Montreal, QC; Halifax, NS

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