Product & Technical Data Guide

Williams-Hayward Protective Coatings, Inc.

***Williams-Hayward International Coatings, Inc.**

Manufacturers Of Railroad And Industrial Finishes
7425 West 59th Street • Summit, Illinois 60501
(708) 458-0015 • Fax (708) 563-6266
www.williams-hayward.com

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Introduction: Chemical Nature of Waterborne Systems

An understanding of the chemical nature and behavior of water-borne finishes by the industrial user may help remove much of the mystique surrounding them. The premise of the following discussion is to emphasize the fact that chemically the water-borne paints are identical in most respects to solvent-based paints, i.e. In curing mechanism, (bake or air dry properties), and in basic polymer makeup. *The primary element of the paint system is the Resin portion, which is responsible for physical properties of the dry film and film integrity. The presence of water is purely for application and viscosity purposes as is the solvent, (VMP, Mineral Spirits, Toluol, MEK, Etc.) for solvent borne paints. For purposes of this discussion, how these polymers are dispersed or dissolved in water will relay significant information into their physical properties; i.e. gloss, viscosity (the fluidity of a material), impact, abrasion resistance, scrub ability, solvent resistance, corrosion resistance drying properties, etc. without requiring an in depth discussion or understanding of the polymers chemistry involved.

Water-Based Paint

A water-based paint is made up of the following components in varying ratios. There may be some exceptions, however for familiarization this should suffice:

Pigment: Several types, powders, whose purpose is to give color, opacity (coverage), restrict or alter flow, help improve corrosion resistance, or merely extend the coating reducing cost.

Resin: Polymer; the backbone of the coating, accounts for 90% of the paint's integrity (i.e. the batter in a cake or dough of a pie). Types: Alkyd, Acrylic, Epoxy, Rubber, Vinyl, Urethane, Silicone, Teflon, Polyvinyl Acetate and mixtures of these.

Co-Solvent: Special solvents, rarely exceeding 29% by volume of that total paint used to either thin the paint or coalesce (set or form) the polymer film. Types: Alcohols, Glycols, or Glycol Ethers. May also be present as low as 5%.

Additives: Unique additives and monomers, which may reduce foam, improve gloss and flow, change viscosity or catalyze dry. In air-dry solution resins, driers are used just as in solvent paints. In baking resins, catalysts are used to reduce bake cycles or lower baking temperatures, usually no more than 5% in the paint by weight.

Water: Used to eliminate flammability and to reduce the paint allowing easier application.

Amine: Used to neutralize the polymer to render it water soluble or compatible. Acts as a buffer similar or an antacid, neutralizing the acid portion of the resin to make it miscible with the water. Once the water, co-solvent, and amine evaporate from an applied paint these acid groups regain their acidity, allowing cure to proceed, rendering the dried paint water-resistant. Types: Ammonium Hydroxide, TEA, DMEA, etc.

Dispersion and Solution of Polymers in Water

Since the polymer is of major importance in the paint, (both solvent and water- based) the following is a description of the three basic ways of putting the polymer into water. For our industrial users, the polymers will be from the following categories: Alkyd, Acrylic, Epoxy, Vinyl, Urethane, Polyvinyl Acetate (PVA), Phenolic, and Polyesters. Excluding the last two resins, these materials are available in air dry, bake or forced baked forms. Phenolics and Polyesters are primarily baking systems.

An important concept that should be understood basic to the polymer itself, is a property known as Molecular Weight. The Molecular Weight of the polymer is a simple but crucial property of the resin. A polymer is a large molecule made up of repeating structural units or atoms. A large molecule is one with a Molecular Weight of at least 1000 or as one containing 100 structural units or more. A resin is composed of a number of these polymers or the polymers are the molecules of the resin. The Molecular Weight of the resin is simply a weight measure of the polymers present. As the strength and weight of a chain linked fence is dependent on the size and weight of each link and metal it is made of, so too is the resin's strength is determined by the nature of its polymer units and its Molecular Weight. It is generally known that the higher the molecular weight the stronger and more durable is the resin.

It is now possible to discuss the three basic types of water-borne paint resin systems available.

EMULSION OR LATEX SYSTEMS

SOLUTION OR WATER REDUCIBLE SYSTEMS

&

COLLOIDAL DISPERSION SYSTEMS

Emulsion Resins

A.) Discrete spherical particles (= .1 micron in diameter) of High Molecular weight dispersed in water.

B.) Since these polymer particles are only dispersed in the water, their presence does not affect the viscosity of the paint.

C.) Highest Molecular Weights can be reached to improve film properties and keep viscosity low.

D.) Allow highest application solids.

E.) Excellent toughness, chemical and water resistance and outdoor durability.

F.) Low co solvent demand.

1. The co-solvent is used to soften the polymer particles swelling them so they stick together as the water evaporates from the paint. This is known as coalescence. This is the crucial portion of the film formation process.

G.) The air dry resins are thermoplastic and generally hard enough to handle in 15-20 minutes - reach maximum hardness in 2-3 weeks.

H.) For improved hardness and solvent resistance, these emulsions are available in baked (cross-linked) form. Bakes of 250° F (121° C) – 275° F (135° C.) of 10-15 min.

I.) Average Molecular Weight = 1 million.

J.) No freeze thaw stability.

K.) A powder coating suspended in water.

L.) Resins available:

1. Acrylic
2. Alkyd
3. Vinyl
4. Urethane
5. PVA
6. Rubber
7. Epoxy

Solution or Water Reducible Resin

A.) Co Polymers (blend of polymers) formed by polymerization reaction in water/ water-soluble solvents. The acid groups of the resin are then treated with amine to allow reduction in water.

B.) Because the resin is soluble and part of the water phase, it reacts very closely to solvent reducible paints.

C.) Available in air dry, low bake or high bake (thermo set).

D.) Molecular Weight = 20,000 - 50,000.

E.) Being in solution, the higher the Molecular Weight, the higher the viscosity will be as in solvent systems, affecting solids at application. Thus the Molecular Weight is limited to the range indicated in (D.)

F.) Because of the lower Molecular Weight, these solution coatings are not as flexible as the emulsion or dispersion resins, as indicated in Tukon Hardness studies versus time under ambient conditions.

G.) Able to obtain high gloss.

H.) Very good durability.

I.) In most cases have freeze thaw stability.

J.) Solvent blend in paint is 80% water and 20% water miscible solvent, used for viscosity control.

K.) Can be supplied at high solids, high viscosity and with no amine or water present. The purpose of the latter is to allow reduction in organic solvents and have the option of water-based or solvent based use.

L.) Thermo set products have baking temperatures varying from 275° F (135° C) – 350° F (175° C) for 10-20 minutes or 600° F (315° C) for 20-40 sec.

M.) Available in:

1. Acrylic
2. Alkyd
3. Epoxy
4. Polyester
5. Phenolic

Colloidal Dispersion Resins

A.) Similar to the Emulsions, Colloidal systems are two-phase systems in water; however, the spherical particles are smaller, approximately .03 microns and they are swollen.

B.) Like the Solution resins they have chemical groups that are soluble in water.

C.) Molecular weights average between 20,000 - 300,000.

D.) Can sometimes be formulated with freeze thaw stability.

E.) Use low levels of co-solvent to obtain hard films.

F.) Will give a higher gloss than an emulsion resin.

G.) Also available in baking formulations.

H.) Temperature ranges of 225° F (107° C) – 275° F (135° C) 10-15 min.

I.) Viscosity is somewhat dependent on molecular weight.

J.) Essentially a blend - both emulsion and solution properties.

K.) Energy saving industrial quality coatings.

L.) Available in:

1. Acrylic
2. Alkyd
3. Epoxy
4. Vinyl
5. Phenolic
6. Polyester

Hopefully, the preceding discussion has helped develop some basic understanding of the types of water-borne systems available to you. Since 1956 WHPC has been able to demonstrate that the diversity of these systems allows for direct replacements of most if not all solvent-borne systems in use.

Wayne E. Kurcz
CEO
President International Operations

A

T H E R M A L B O N D / EUROTBOND SYSTEMS

THERMALBOND/EUROTBOND'S development was spurred by Williams-Hayward's interest in formulating economically and ecologically safe alternatives to solvent based epoxy systems however having improved gloss retention and flexibility. Generically, these coatings are derived from the melding of technologies of high molecular weight acrylic resins emulsified in water and emulsified rubber and vinyl latexes. The resulting polymers are extremely flexible, tough, and resistant to a variety of corrosive materials, while possessing superior gloss and color retention.

Since the THERMALBOND/EUROTBOND systems are single component and aqueous in nature, considerations such as pot-life, improper mixing procedures, flammability, pungent solvent odors, and hazardous waste disposal of spent coatings are virtually non-existent.

THERMALBOND/EUROTBOND coatings possess excellent humidity and salt spray resistances with gloss retentive properties equivalent to solvent-borne acrylic enamels and many low cost multi-component urethanes. Flexibilities are equivalent to conventional vinyl systems, while adhesive properties resemble closely that of epoxy materials.

The THERMALBON/EUROTBOND systems have been the result of an exhaustive research commitment beginning in the early 1950's for the specific purpose of introducing waterborne coatings to Williams-Hayward Protective Coatings, Inc.'s industrial and maintenance markets. This is a product line we personally believe will offer customers in chemically corrosive environments, ecologically safe, economically realistic options in the protection of their storage containers, machinery, and transportation equipment.

The ultimate resolution to air quality contamination and hazardous waste generation is in the conscious effort to reduce or eliminate their accumulation. THERMALBOND and NO VOC systems offer the potential user an opportunity to do so, while increasing overall durability, while protecting against the corrosive commodities they store.

Thermalbond/Eurotbond (Acrylic/Vinyl/Rubber) products are available in three basic forms:

1) High Acrylic Version for General Service where higher gloss and color retention are important. # I

2) Tri-Functional High Vinyl version, line for extremely high gloss /flexible finishes. This product may be:

    1) Used alone (self-cross linked).

    2) Cross-linked with WHPC's special water based epoxy hardener.

    3) Cross-linked with WHPC's special water base urethane hardener

3) High Rubber version for exposure to concentrated acids, alkalis, and corrosive salts.

Enclosed you will find complete technical data sheets and application recommendations for Williams-Hayward's unique THERMALBOND3 / EUROTBOND3 HIGH RUBBER corrosion resistant aqueous coating systems. Presently in service are covered hopper cars, tank cars, coal cars, center beam cars, gondolas, container cars, intermodal units and autorack cars. Following are a SOME of the users of Thermalbond/Eurotbond systems.

a) Potash and Phosphate - USLX
b) Liquid Caustic; Sodium Hydroxide Pellets; Chlorine; and Muriatic Acid
- Vulcan Materials, Occidental Chem., GE Capital
c) Sulfuric Acid - GATX, Kennecott, ASARCO
d) Alkali emulsion - Rohm & Haas
e) Anhydrous Ammonia - IMC, UTC
f) Organic Acids - Occidental & Virginia Chemical
g) Intermodal - Trailer Train Co., APL
h) Box, Gondola, Coal - Burlington Northern R.R., GE Capital
Hopper - Union Pacific Railroad, CN, CSX, NS, CP, BNSF
Conrail
i) Corn, Sugar Service - Crystal Carline (CPC)
j) Diesel Locomotives - Illinois Central Railroad, CN
Union Pacific
k) Coal DTM (Aluminum) - Detroit Edison, Alabama Power
- Lower Colorado River Authority
- Oklahoma Gas & Electric
- Wisconsin Power & Light
- Georgia Power & Light
- Norfolk Southern, Burlington Northern
l) Sodium Perchlorate - Pro Cor

m) New Car Construction Applicators of WHPC Waterbornes

ACF, ARI Industries - Thrall Car
Gunderson/Greenbrier - Trinity Industries, Inc.
Freight Car America - IRS Romania
Union Tank Car Co. - National Steal Car
n) Railroads - CSX, UP, Conrail, CP, CN, NS, BNSF,
Wisconsin Central. EWS, DB, Rail Polska
Repair Shops - Anheuser-Busch, Rescar, Berwind, Millennium Rail
GATX, DEC,
Applicators - UT Car, Transco, GE Capital, ELS
p) Multi-Purpose
Leasers - First Union, CIT, UTLX, GATX, Trinity Industries
- Helm, GE, Wascosa, AAE, KVG, HUPAC
- VTG,

* Over 500,000 units in the USA, Canada, Mexico and Europe & ASIA comprised of every imaginable car type and service since 1984.

PARAMETERS FOR APPLICATION AND STORAGE
OF
THERMALBOND /EUROTBOND LATEX RAIL AND TRANSPORTATION FINISHES

THERMALBOND/EUROTBOND systems dry to recoat and stencil times are affected by temperature and humidity. The higher the humidity, the slower the dry time, generally; the lower the humidity and the higher the temperature, the faster the dry time. To compensate for either situation, the choice of the proper tip and fan size is important. Wider fan sizes are suggested for humid conditions to assist I water evaporation. Narrower fan sizes are suggested in extremely hot temperatures to reduce over spray. The use of air assisted airless virtually eliminates overspray concerns.

If tack coating is the desirable method, insure that this coat is dry to touch prior to the application of the wet coat. Failure to do so will result in re-dissolving of the tack coat and subsequent sagging or sliding.

The preferred method of application with two painters is a tandem approach to insure an overlap-wet edge. Paint from the bottom up to insure any over-spray generated from the top painter will land on a wet surface of the painter below. Follow this from ”seam to seam”, “shell to shell”. Avoid snake patterns. The bottom painter should be ½ a seam or shell ahead of the top painter. If man lifts are employed one painter a side may be used painting in a similar manner “Bottom - Up”

A) Store coatings below 90° F / 32° C and above 40° F / 4° C.

B) Do not apply to surfaces below 40° F / 4° C or above 90° F / 32° C. Note: If surface temperatures are consistently above 90° F / 32° C, severe dry spray will result. Solvent modifications, painting technique adjustments or booth modifications will be necessary to insure proper aesthetics.

C) Apply under conditions such that surface temperatures are a minimum of 8° Higher than the dew point. THERMALBOND/EUROTBOND paints may be applied to slightly damp surfaces; however, the tendency to sag and flash rust is greatly increased, for the surface moisture mixes with the paint diluting it. Caution should be taken, and if it is absolutely necessary to paint a damp surface, a dust-coat, dry to touch, and second full coat approach should be performed.

D) Before exposing fresh paint to freezing temperatures, THERMALBOND/EUROTBOND should be completely dry to touch to ensure proper film formation.

E) Before exposing fresh paint to direct rainfall, THERMALBOND/EUROTBOND should be dry for at least 5 hrs at 60° F / 15° C to ensure proper film formation. In general, water spotting may occur; however, this will disappear on exposure to sunlight. The disappearance of the whitish or milky look is a good indicator of film drying. *Note

F) When re-coating THERMALBOND / EUROTBOND, the first coat must be dry to touch and free of visual signs of moisture, such as, angular blush or haze. If coated prior to this set up condition, a phenomenon known as “sliding” will occur; the second coat begins dissolving the partially dried first coat, creating a tear in the film to bare metal. Under extremely humid conditions, recoat times can be extended to three or four hours, from the normal 45 minutes to an hour.

G) A factor in drying water-based coatings is airflow. High velocity air helps remove moisture and increase set up times. This coupled with warm air can improve increase production rates.

1) Under adverse humidity and temperature conditions, hanging power at wet film thickness in excess of 10 mils / 250 micron may be severely limited. To assist the applicator a rheological modifier (thickeners) are available (T-6520A), EUROTHICKENER, or C-4030 for addition to Thermalbond / Eurotbond systems to aid in high build applications. A slow addition while mixing into the vortex of 20 oz. per 55-gallon drum or 2 oz. Per 5-gallon pail will permit wet film applications of 18-22 mils / 450-550 microns without sagging. Since these additives adjust the rheology and not the solution viscosity, normal pump pressures may be maintained to accomplish atomization. The use of T-6520A or Eurothickener in elevated temperatures and under low humidity is strongly discouraged for increased rheology increases dry spray tendencies under these conditions.C-4030 is suggested for use.

H) Flash rusting: THERMALBOND/EUROTBOND systems have been designed to inhibit the formation of flash rust on all flat metal surfaces and the majority of weld seams. However, severely corroded metal and certain types of unidentified welds may show these minute dots of red stain occasionally. This effect is purely aesthetic in nature and does not affect the coating durability and may be covered up with a second coat once the first coat is dry-to-touch. These dots are <u>not rust</u> (see Weld Staining Phenomenon in Technical Service Section).

I) Wet-on wet application is not possible.

J) THERMALBOND/EUROTBOND coatings may be refrigerated or heated to reduce dry sprat in extremely hot climates, or reduce dry time sin extremely humid climates. Under normal conditions, neither cooling nor heating is required.

K) Always rinse lines with THERMALBOND/EUROTBOND cleaning reducer, R-6958, and water prior to filling the system with THERMALBOND/EUROTBOND paints. Solvent paints are totally incompatible and will create jellation; craters or fish eyes, if mixed even at low levels.Where possible, separate lines and pumps should be dedicated for waterborne paints to eliminate possible contamination with solvents.

*NOTE: THERMALBOND/EUROTBOND Coatings may be modified to allow exposure to rain and freezing temperatures within 2.5-3.0 hours. This will increase the overall dry time of the material.

L) To insure the optimum in aesthetics (gloss, flow), airless pump pressures should not exceed 2,000 pounds per square inch. Pump pressures of 1200-1500 pounds per square inch yield highest transfer efficiencies and eliminate a dry sprayed surface.

M) All pump gaskets and “O” rings should be Teflon. Leather will be attacked by water, drying it out and creating cracking.

N) To reduce dry times in rainy environments, the use of wider fan tips is suggested, such as, 8-19’s or 9/19’s. (See F) (a)

O) Under most normal conditions, tip sizes of 6/17, 6/19,or 6/21 are effective, depending on the experience of the applicator. Larger orifices, such as 21 thousandths, permit higher film builds in one coat application but will be more difficult for an inexperienced painter to use.

P) Waterborne systems are to be applied manually in a cross-coat pattern where 50% of the wet film is applied vertically and 50% horizontally with a 20-30% overlap, e.g., (a right and left motion followed immediately by an up and down motion). This virtually eliminates bare spots caused by human error and makes it easier to fill deeper blast profiles. This is not necessary in automated spray systems for they have been designed to overlap paint strokes, filling all voids.

Q) THERMALBOND/EUROTBOND systems will not adhere to un-blasted metal, grease, oil, soot, or loose rust. Blasted units should be blown off properly prior to painting for any remaining shot, grit, or sand will interfere with the adhesion of the paint to the metal surface when not removed. Deep profiles made by steel shot or grit should be thoroughly covered. Uncovered peaks in a very short time begin corroding…showing rust. Once rust begins, like a cancer, it effects the integrity of the surrounding paint film. As with any coating, dry film thickness should be at least 25% above total profile depth.

R) THERMALBOND/EUROTBOND paints are emulsion copolymer blends of acrylic-vinyl and rubber, so in the initial stages of dry, they form continuous films more rapidly than they begin adhering to the surface. This is known as cohesive strength and is solely responsible for the rapid surface dry for stenciling and early water resistance. Cohesive properties also play an important role in the great flexibility and abrasion resistance of THERMALBOND/EUROTBOND paint systems. Unlike alkyd or alkyd acrylic paints which dry by oxidation, adhering first to the metal and becoming hard much later in their dry schedule. THERMALBOND/EUROTBOND latexes become tough first and build adhesion later in their dry schedule. This usually occurs under normal conditions without heat in 24-48 hours. Final cure will be accomplished in 30 days.

S) It is very important never to cut the THERMALBOND/EUROTBOND film with a knife or peel it in the early stages of dry; this would be similar to slicing and peeling your vinyl roof or the tire of your car. Both the roof and the tire are very durable products. Lasting many years in normal service for which they were designed, of which puncturing with a knife is not one. So, too, THERMALBOND coatings will, and have, out-serviced any railroad alkyd or alkyd copolymer or epoxy if not abused in an unconventional manner.

T) Industrial waterborne products have been applied successfully electro-statically for many years; however, paint isolation and grounding requirements are critical. One should consult with the equipment supplier prior to testing aqueous products.

NOTES:

1. THERMALBOND3/EUROTBOND3 Acid And alkali Resistant DTM's are available in a variety of tinted colors at 33% or 42% volumetric solids. Contact Williams-Hayward Protective Coatings, Inc.'s office for pricing and further information.

2. Do not use existing electrostatic equipment, since most non-industrial spray equipment has not been designed for water based paints; consult you equipment manufacturer for proper modifications.

3. While good dilute acid resistance is present at applications 4-5 mils / 100-125 microns dry, best results were obtained at applications of 9-11 mils / 225-275 microns dry which is the minimum recommendation for "direct spill" areas in concentrated services. Fifteen-year durability in corrosive service has been obtained at 13-17 dry mils / 325-425 microns.

4. For repaints of equipment in acid and chlorine service, where the "direct spill" areas show that severe acid fatigue has occurred and deep yellow staining is present after an (SSPC-SP6) blast, it is recommended that an SSPC-SP-10 blast be done to remove all such staining, followed by neutralization techniques that will insure the deactivation of the embedded acid. This staining is believed to be water-soluble sulfates and combined residual corrosion; if not removed will bleed to the surface or will expose new sites susceptible to early future fatigue.

5. THERMALBOND/EUROTBOND products possess high flash points deeming their wastes non-hazardous.

6. NACE splash spill tests indicated the following order for pigmentation at decreasing resistances to concentrated mineral acids. Graphite Blacks, Titanium Whites, Titanium White Tints, Carbon Blacks, Iron Blacks and Iron Reds.

APPLICATIONS PROCEDURES

COATING TYPE: Thermalbond1/Eurotbond1 (1K) Acrylic Terpolymer

Thermalbond1/Eurotbond1: Waterborne latex single component acrylic-vinyl-rubber Terpolymer with dehydrated V.O.C. of 0.9 - 2.4 for use as a primer, topcoat, or direct-to-metal paint. Has superior chemical resistance and abrasion resistance equal to any known single or multi-component urethane or epoxy. Possesses a medium gloss of 75-85% (60° head). Gloss retention is superior to conventional systems and comparable to many two-component urethanes. Forward and reverse impact is 100-180 pounds per square inch. Heat resistant, fly ash filled and non-skid formulations are also available.

Mixing Ratio: N/A
Pot Life: N/A
Pump Pressure: 1200-1500 psi
Tip Sizes: 5/19, 6/19, 6/21
Filters: 60 Mesh
Min. Steel Temp: 40° F / 4° C
Min. Application Temp: 40° F / 4° C
Required Wet Mils: 8-10 / 200-250 micron
micron
Spray Technique: Cross coat - 50% overlap
Dry to Touch: 1-2 hrs.
Min. Recoat Time: Dry to touch
Equipment Requirements: Airless
V.O.C.: 0.0 - 1.8 Dehydrated
Substrate: CRS, HRS, Alum, Galv.
Surface Prep: Remove Oil & Grease, SSPC-SP-6
D.O.T.: Non-Flammable

Sweat in time: N/A
Thinning: N/A
Solvent Type: Water
Reduction: None
Viscosity: Thixotropic
Max. Steel Temp: 85° F / 30° C
Max Application Temp: 85° F / 30° C
Required Dry Mils: 3-3.5 / 75-87.5

Dry Through: 8 - 10 hrs.
Max. Recoat: Will Not Lift
Solids by Volume: 38-42%
Freeze/Thaw: None

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 40° F / 4° C.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true: the lesser the humidity or mils decreases the time for a coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tip sizes and pump pressures are used.

3) For brush and roll, add 2 liters of R-11533RA per 5-gallon buckets - add while mixing.

+ Reduction: Normally not required, however, when low humidity (less than 40%) and warm temperatures (in excess of 75° F / 24° C metal/air temperature) are encountered, additions of water, not to exceed 2% by volume, may be made.

AQUA-EPOXY (ERP) 2K
Emulsification of Reactive Polymer

The industrial trend has been to concentrate on the elimination of alkyd resin technologies in the coating of transportation equipment. The impetus for this change is rooted in ever tightening environmental regulations and the desire to increase overall durability of the paint systems used on the rolling stock. Several alternatives have been adapted, such as, Epoxy solvent borne and Epoxy solvent primers with urethane solvent borne topcoats. While these technologies are not in themselves new, they have become less cost prohibitive and viewed as excellent responses to EPA restriction.

The latter, Epoxy/Urethane, is still a significant upgrade for customers who have calculated economics of paint application on alkyd technologies. Therefore, a significant number of coatings specifiers have adopted Epoxy solvent products less the urethane topcoat as their replacement choice. The primary drawback of this decision is loss of gloss retention associated with the epoxy polymer system. While epoxies are superior to alkyds in corrosion resistance and alkali resistance, they are far inferior to even the most economical alkyd in gloss retentive properties; chalking within six to eight months of application. Color retention, because of the propensity of the epoxy resin to degrade under “UV” exposure, has been drastically sacrificed. So the problem that has arisen is, through the use of Epoxy, solvent Technologies has resolved many environmental issues, it has been at the expense of customers’ aesthetics as their fleet ages.

Williams-Hayward Protective Coatings, Inc., a leading developer of rational environmental alternative products for the transportation industry since 1928, realized these drawbacks many years ago and began investigations into products that would answer the application concerns on environmental issues while not penalizing their customers on the aesthetics of the coating products applied to their fleets. A new technology was needed sensitive to the transportation industry’s need, such that the customer could be proud of their finishes on their units, hauling their all-important commodities for their customers and still demonstrate ecological responsibility.

This technology is rooted in the chemistries common to all known systems offered, with but one unique variance. That variance, the change of carrier, has opened a “New Universe” of options and unique properties unknown before. The technology is the “**EMULSIFICATION OF REACTIVE POWDERS**”, or “**ERP**” and the carrier is **“Water”.** The true significance of this approach is to remove the handcuffs of “solubility” in an appropriate solvent to attain realistic application viscosities in a production shop environment. Historically, coatings have been limited in their base “glue”, an adhesive portion (resin), by its ability to be dissolved by an appropriate solvent. High molecular weight resins (more durable), such as, epoxies/acrylics or urethanes, require large amounts of solvent to be dissolved for use or, as is now common, the use of lesser amounts of stronger, more pungent solvents and “heat” to thin products of a higher solids nature for shop application.

Even with this latter approach, the most durable “Highest Molecular Weight” resins still cannot be used, for there are no known inexpensive solvents that are effective in reducing their viscosities enough to adequately create a viable product for application. This is not so for “ERP” technology where it is not necessary to dissolve the polymer, but merely suspend it in an aqueous state. Since the polymer needs not be dissolved or interact in any way with its solution, extremely “High Molecular Weight” polymers can be used and heretofore, incompatible polymers can exist in the same container without concerns for package stability. It is conceivable and not uncommon to have epoxy, urethane, acrylic polyester, vinyl, PVC, Teflon, and rubber present together in one polymer matrix. One of the systems resulting from this technology is the Aqua-Epoxy paint system. The coating itself is an acrylic-epoxy copolymer matrix that affords the end user or the person who specifies a gloss retentive automotive grade acrylic finish possessing acid and solvent resistance, coupled with the corrosion resistance and longevity of the epoxy cross-link polymer.

V.O.C. (volatile organic compounds) levels, as applied, below 1.0 lbs/gal are now possible and all wastes are classified non-hazardous. Water is used for equipment cleaning and no heat is necessary for reduction for application. The dried film is high in gloss and orange peel-free. “ERP” Acrylic-Epoxies insure the users or those who specify that requesting an epoxy finish on their rolling stock does not automatically dictate a chalked surface within six months to a year of application.

APPLICATION PROCEDURES

COATING TYPE: AQUA-EPOXY WATERBORNE (2K) DISPERSION

AQUA-EPOXY: Waterborne dispersion two-component epoxy-copolymer with dehydrated V.O.C. range of 1.4-2.3, for use as a primer-topcoat or direct-to-metal paint. Has an initial gloss of 85-90% (60 deg. head) with good depth of image. Possesses excellent gloss retention, far superior to standard solvent borne epoxies. Aqua-Epoxy also has good chemical and corrosion resistance.

MIXING RATIO: 4:1
POT LIFE: 8-10 HRS
PUMP PRESSURE: 1800-2100 psi
TIP SIZES: 6, 19; 6, 21'S
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
REQUIRED WET MILS: 10-12 / 250-300 micron micron
SPRAY TECHNIQUE: SINGLE CROSS COAT, 30% OVERLAP

SWEAT IN TIME: 15 MIN
THINNING: SEE **
SOLVENT TYPE: WATER
REDUCTION: SEE ***
VISCOSITY: THIXOTROPIC
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
REQUIRED DRY MILS: 3-3.5 / 75-87.5

DRY TO TOUCH: 6-8 HRS
MIN RECOAT TIME: 6-8 HRS
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 1.4-2.3 DEHYDRATED
SUBSTRATE PREP: SSPC-SP-6
D.O.T.: NON-FLAMMABLE

THROUGH DRY: 24 HRS.
MAX RECOAT TIME: WILL NOT LIFT
SOLIDS BY VOLUME: 38-42%
FREEZE THAW: NONE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 40° F / 5° C.

** Thinning is not required for this product unless you are using an oven to force cure. In this case you would thin with 2 gal. of R-121-3/50 gallons of mixed paint. The bake parameters are 160°-180° F / 70°-83° C for 1-2 hrs.

*** 2 gal of R-121-3 per 50 gallons of mixed paint. (Reducer is only used when forces curing the coating see **)

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity of mils decreases the time for the coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tips sizes and pump pressures are used.

3) Additives are available for applications in dessert conditions.

4) Follow Thermalbond/Eurotbond Application procedures.

PAINTING PROCEDURE
FOR
AQUA-LUST EPOXY ESTER (1K) DTMs

A Painters must make sure the unit is free of any type contamination before painting is to begin, i.e., loose blast media, oil, or grease, moisture, etc. Failure to follow this procedure can result in lack of adhesion. A commercial blast (SSPC-SP6) is the minimum accepted.

B Material is designed to be used through an in-line heater. Temperatures should be maintained at 110°-120° F / 43°-50° C. The use of heaters is necessary in order to provide optimum atomization, flow, and leveling, and to accelerate drying times in high humidity.

C Equipment necessary and working parameters that have demonstrated optimum spray ability are as follows:

1 45:1 King pump @ 2200 - 2500 PSI.
2 6/19 tips for both airless and/or air assisted airless (A 6/17 or 6/21 tip size may be required, depending on temperatures and humidity).
3 3/8" lines.
4 60 Mesh filters for pumps and guns.
5 Ovens - 40 minutes @ 125° F / 54° C (optional).

D. Painters should work together, across from each other, from one end of the tanker (B end) to the other end (A end).

1 Initially, the two painters should detail the tanker. All gratings, handrails, grips, ladders, appliances, and underbelly should be painted first. All areas should have 10-12 wet mils / 250-300 wet microns.

2 The second stage is for the two painters to start on the top at the B and/or A end, and spray the top of the head and work the top of the tanker to the platform. The painters then come down and apply paint to the bottom section, from the head to the platform, re-wetting in areas previously coated.

3 The next step is for the painters to go back up on top and sprat from the platform to the other end. Once this is completed, they once again come down and finish the bottom of the tanker to the opposite end. All painting should be done in a cross coat overlapping fashion, hanging 10-12 wet mils / 250-300 wet microns.

E. Once finished, each painter should check the unit, especially the hidden areas, so touch up could be accomplished while the tanker is still wet.

F. Clean all equipment with water before flushing with R-6958 Line Cleaner. Remove all filters and gun tips and rinse with water prior to flushing with R-6958 Line Cleaner.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: AQUA-LUST/AQUA-LUST EPOXY ESTER

AQUA-LUST: Waterborne solution acrylic-alkyd & ester copolymers with a dehydrated V.O.C. range of .60 -.5 for use as a topcoat or direct to metal paint. Possesses excellent initial gloss of 90-95% (60° head). Has clear depth of image with superior gloss retention. Has dilute acid and alkali resistance.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 1500-1800 psi
TIP SIZES: 6, 17; 6, 19's
FILTERS: 100 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 8-10 DTM / 200-250 micron
SWEAT IN TIME: N/A
THINNING: N/A
SOLVENT TYPE: WATER
REDUCTION: NONE
VISCOSITY: 10-11,000 cps
MAX STEEL TEMP: 90° F / 32° C
MAX APPLICATION TEMP: 85° F / 30° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3.5-4.0 DTM / 87.5-100 micron
SPRAY TECHNIQUE: SINGLE CROSS COAT 25% OVERLAP
DRY TO TOUCH: 3-5 HRS
MIN RECOAT TIME: 6-8 HRS
EQUIPMENT REQUIREMENTS: AIRLESS SPRAY
V.O.C.: 0.60-1.50 #s/GAL
SUBSTRATE: CRS, HRS
SURFACE PREP: REMOVE OIL & GREASE, SAFE-T-COAT PRIME, SSPC-SP-6
THROUGH DRY: 24 HRS. (SEE **)
MAX RECOAT TIME: 48 HRS.
SOLIDS BY VOLUME: 35-40%
FREEZE THAW: YES
D.O.T.: NON-FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** Alkyd polymers, because of their oxidative nature do not reach full hardness for 30-45 days from application.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity or mils decreases the time for the coating to dry.

2) Waterborne systems will yield transfer efficiencies as high as 86 to 90% when proper tip sizes and pump pressures are used.

3) Aqua-Lust Epoxy Ester Formulations require 110° F / 43° C in-line heats for proper flow & leveling.

For Brush and Roll Applications: (Touch Up) Thinning may be required. Recommended cut: 0.5-1.0% by volume tap water per gallon. **Do not over reduce**. Waterborne coatings cannot tolerate cuts that conventional solvent borne products can. Do no reduce coating with any type of solvent, other than water.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: WATERBORNE SOLUTION COPOLYMER SAFE-T-COAT

SAFE-T-COAT: Waterborne solution alkyd, epoxy ester and vinyl copolymers for use as a primer for two coat application. Dehydrated V.O.C. range of 1.4 -2.9, Non-skid formulations are also available.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 1500-1800 psi
TIP SIZES: 6,17; 6,19; 6,21's
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 4-6 / 100-150 micron
SWEAT IN TIME: N/A
THINNING: N/A
SOLVENT TYPE: WATER
REDUCTION: N/A
VISCOSITY: READ ON FORD #4 CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30 ° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 1.5-2.0 / 37.5-50 micron
SPRAY TECHNIQUE: SINGLE CROSS COAT 30% OVERLAP
DRY TO TOUCH: 30-50 MIN
MIN RECOAT TIME: 30-50 MIN
EQUIPMENT REQUIREMENTS: AIRLESS/AIR
V.O.C.: 1.4-2.9 DEHYDRATED
SUBSTRATE: CRS, HRS
SURFACE PREP: REMOVE OIL & GREASE, SSPC-SP-6
D.O.T.: NON-FLAMMABLE
THROUGH DRY: 24 HRS.
MAX RECOAT TIME: WILL NOT LIFT
SOLIDS BY VOLUME: 28-33%
FREEZE THAW: NONE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity or mils will decrease the time for the coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tip sizes and pump pressures are used.

3) KEEP FROM FREEZING.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: ACRYLEM (1K) WATERBORNE ACRYLIC LATEX COPOLYMER

ACRYLEM: Waterborne latex single component copolymer with dehydrated V.O.C. of 1.0 - 2.4 lbs. per gallon. For use as a primer-topcoat or direct-to-metal paint. Possesses gloss of 85-95% 60 deg head, with gloss retention comparable to many two-component urethanes. Forward and reverse impact of 100-130, with very good abrasion resistance. Chemical resistance is limited to dilute acids or alkali.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 1500-1800 PSI
TIP SIZES: 6/17, 6/19
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 8-10 / 200-250 micron
micron
SPRAY TECHNIQUE: CROSSCOAT 30% OVERLAP
DRY TO TOUCH: 30-60 MIN
MIN RECOAT TIME: 1-3 HRS
EQUIPMENT REQUIREMENTS: AIRLESS/AIR
V.O.C.: 1.0-2.4 DEHYDRATED
SUBSTRATE: CRS, HRS
D.O.T.: NON-FLAMMABLE

SWEAT IN TIME: N/A
THINNING: N/A
SOLVENT TYPE: WATER
REDUCTION: NONE
VISCOSITY: 40-50 J CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3.5-4.0 / 87.5-100

DRY THROUGH: 24 HRS.
MAX RECOAT TIME: WILL NOT LIFT
SOLIDS BY VOLUME: 38-43%
FREEZE THAW: NONE
SURFACE PREP: SSPC-SP-6/PRIME

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity or mils will decrease the time for the coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tip sizes and pump pressures are used.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: NO-VOC ACRYLIC COPOLYMER

NO-VOC: Waterborne latex single component acrylic-vinyl-rubber copolymer with no measurable EPA V.O.C. Possesses similar properties to Thermalbond systems and may be used in areas where zero (0) emission is required. Available for use as a primer, topcoat or direct-to-metal coating.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 1200-1500 PSI
TIP SIZES: 6/17,6/19,6/21
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: *
REQUIRED WET MILS: 10-12 / 250-300 micron
SWEAT IN TIME: N/A
THINNING: N/A
SOLVENT TYPE: WATER
REDUCTION: NONE
VISCOSITY: 40-60 J CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: *
REQUIRED DRY MILS: 5.5-6.6 / 137.5-165 micron
SPRAY TECHNIQUE: CROSSCOAT 30% OVERLAP
DRY TO TOUCH: 1-2 HRS
MIN RECOAT TIME: DRY TO TOUCH
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 0.00
SUBSTRATE: Ferros/Non-Ferros metals
SURFACE PREP: SSPC-SP-6/PRIME
DRY THROUGH: 8-10 HRS
MAX RECOAT TIME: WILL NOT LIFT
SOLIDS BY VOLUME: 50-55%
FREEZE THAW: NONE
D.O.T.: NON-FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 40° F / 5° C.
(A)
1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity or mils decreases the time for the coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tip sizes and pump pressures are used.

3) Keep from freezing.

(B)
High temperature resistant coatings are available in silicone modified graphite formulations for tank shells and inside of jackets and smoke stacks for temperatures as high as 1500° F / 816° C.

AQUA-SLIP
Thermalbond / Eurotbond or NO-VOC

"*ERP" technologies allow the construction of High Molecular Weight polymer blends of Acrylic, Vinyl's, and Rubber with Teflon or PE Filling in a single aqueous package. Characteristics developed in the dried film possess high impact resistance, both forward and reverse, (180-200 psi ASTM G14). Abrasion resistance (5-10 mg loss Taber Abrader CS17/1000 gm; 1000 cycles; ASTMD4060). The incorporation of PTFE or PE can create a surface with quick release properties for more efficient unloading. If a harder, yet still flexible, surface is desired, Aqua-Slip may be force cured as high as 275° F / 135° C without detriment to the polymer Matrix.

Aqua-Slip is a unique answer to solvent borne epoxy products with improved flexibility, abrasion resistance, lower V.O.C. and the elimination of hazards normally associated with the painting operation. Aqua-Slip, ERP products are also available in FDA approved formulae for indirect Food Service.

*Emulsification of Reactive Powders (see pg. 2 Aqua-Epoxy Section)

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: AQUA-SLIP WATERBORNE COPOLYMER/TERPOLYMERS

AQUA-SLIP: Waterborne dispersions, emulsions or solution coatings. For use as a quick release coating for interiors of plastic pellet hoppers, coal cars, fly ash hoppers, refuse containers and recycle trucks. Polyethylene and /or Teflon extenders are used. The emulsion versions exhibit excellent acid and alkali resistance, while the dispersions and solution have dilute acid and alkali resistance.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 1500-1800 psi
TIP SIZES: 6/19; 6/21's
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 6-8 / 150-200 micron micron
SWEAT IN TIME: N/A
THINNING: N/A
SOLVENT TYPE: WATER
REDUCTION: NONE
VISCOSITY: 40-50 J CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3.5-4.0 / 87.5-100
SPRAY TECHNIQUE: CROSSCOAT 50% OVERLAP
DRY TO TOUCH: 30-60 MIN
MIN RECOAT TIME: 30-60 MIN
EQUIPMENT REQUIREMENTS: AIR/AIRLESS
V.O.C.: 0.60-1.20 DEHYDRATED
DRY THROUGH: 10-12 HRS
MAX RECOAT TIME: SEE **
SOLIDS BY VOLUME: 50-54%
FREEZE THAW: SEE ***
SUBSTRATE: THERMALBOND VERSIONS: CRS, HRS,GALV,AL
AQUA-LUST VERSIONS: CRS,HRS
D.O.T.: NON-FLAMMABLE
SURFACE PREP: SSPC-SP-6/REMOVE OIL & GREASE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** Aqua-Slip coatings will not lift or wrinkle when recoated. However, if the surface is to be recoated after 24 hours, it should be scuffed or lightly sanded to ensure proper inter-coat adhesion.

*** Aqua-Slip coatings made in Thermalbond polymer blends cannot be frozen. Certain Aqua-lust versions will pass 3-5 freeze thaw cycles. However, as with all waterborne coatings, they should be kept from freezing at all times.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity or mils decreases the time for the coating to dry. The use of air movement great assists in speeding up dry.

2.) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tip sizes and pump pressures are used.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: AQUATHANE-WATERBORNE URETHANE
SINGLE & TWO-COMPONENT

AQUATHANE: Water dispersion single- or two-component urethane - copolymers with dehydrated V.O.C. range of 1.6-2.4; must be used with Aqua-Epoxy for optimum results.

**MIXING RATIO: 9:1	SWEAT IN TIME: N/A
POT LIFE: 8-10hrs	THINNING: 20-30%
PUMP PRESSURE: 1200-1500 PSI	SOLVENT TYPE: WATER
TIP SIZES: 6/15	REDUCTION: NONE
FILTERS: 60 MESH	VISCOSITY: 40-50 J CUP
MIN STEEL TEMP: 40° F / 5° C	MAX STEEL TEMP: 85° F / 30° C
MIN APPLICATION TEMP: 40° F / 5° C	MAX APPLICATION TEMP: 85° F / 30° C
MIN RELATIVE HUMIDITY: SEE *	MAX RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 4-6 / 100-150 micron micron	REQUIRED DRY MILS: 2.0-3.0 / 50-75
SPRAY TECHNIQUE: CROSSCOAT 50% OVERLAP	
DRY TO TOUCH: 30-60 MIN	DRY THROUGH: 8-10 HRS.
	MAX RECOAT TIME: WILL NOT LIFT
EQUIPMENT REQUIREMENTS: AIRLESS/AIR	SOLIDS BY VOLUME: 60-65%
V.O.C.: 1.6-2.4 DEHYDRATED	FREEZE THAW: NONE
SUBSTRATE PREP: CRS, HRS	SURFACE PREP: PRIMED WITH AQUA-EPOXY

D.O.T.: NON-FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true, the lesser the humidity of mils will decrease the time for the coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tips sizes and pump pressures are used.

** Single package urethane is isocyanate free and has no mixing ratio or pot life, Solids 28-33% by volume.

B

While Williams-Hayward Protective Coatings, Inc. prides it as being innovators in aqueous technologies, its presence as a supplier to the Rail, Industrial, and OEM Industries since 1920 has also established a full line of solvent based coating products. Williams-Hayward Protective Coatings, Inc. concentrates its efforts in this area with HAPS free, low VOC products under the registered trade names of:

SOLVENT BASED OXIDATIVE ALKYDS

High Kote	High Solids Alkyds
Acralust	High Solids Acrylic/Acrylic Alkyd
Super Stanzwear	High Solids Silicone Alkyds

CONVENTIONAL HIGH SOLIDS EPOXYIES

Power Grip	High Solids Epoxy
NO-VOC Power Grip	"O" V.O.C. Epoxy
Power-Flex	High Solids Abrasion Resistant Interior Linings (Epoxy)

GLOSS RETENTIVE EPOXY AND URETANE ADDUCTS

EPOL	High Solids Epoxy/Polyester
Super Epol	High Solids Acrylic/Epoxy
UR-OH-THANE	High Solids Urethanes
Acrathane	High Solids Acrylic Urethanes

Most products are available as interior or exterior finishes, complemented with a full line of appropriate reducers

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: HIGH-KOTE ALKYD COPOLYMERS

HIGH-KOTE: High-solids solvent borne alkyd and alkyd copolymers for use a primers, topcoats, and direct-to-metal coatings. Electrostatic formulations as well as 2.8 versions are also available. High-Kote has a good balance of durability properties.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 2000-3000 PSI
TIP SIZES: 6,17; 6,19's
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 6-8 / 150-200 micron
SWEAT IN TIME: N/A
THINNING: N/A (SEE ***)
SOLVENT TYPE: MINERAL SPIRITS
REDUCTION: N/A (SEE ***)
VISCOSITY: 50-60 ZHAN #3
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3.5-4.0 / 87.5-100 micron
SPRAY TECHNIQUE: SINGLE CROSS COAT 30% OVERLAP
DRY TO TOUCH: 4-6 HRS
MIN RECOAT TIME: 4-6 HRS
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 3.0-3.5 (2.8 AVAILABLE)
SUBSTRATE: CRS,HRS
D.O.T.: FLAMMABLE
DRY THROUGH: 24 HRS (SEE **)
MAX RECOAT TIME: N/A
SOLIDS BY VOLUME: 50-55%
FREEZE THAW: YES/STABLE
SURFACE PREP: SSPC-SP-6/PRIMER

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15 ° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** Alkyd polymers and copolymers, because of their oxidative nature, do not reach full hardness for 30-60 days from specified time of application.

*** Thinning and/or reduction are not needed for conventional 3.5 systems. However, for the 2.8 versions in-line heat between 120°-140° F / 48°-60° C is needed for proper application, atomization and flow out of the coating. If cold spray of the 2.8 systems are needed add up to 1½ pints of reducer per gallon of paint. Contact a Williams-Hayward representative for the recommended reducer.

1) To increase dry times, the coating can be force cured at 130°-140° F / 54°-60° C for 20-30 min.

2) For High-Kote Primer formulations specs are the same as above, except for the dry times, which are 1-2 hrs rather than the 4-6 for the topcoats.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: ACRALUST ACRYLIC-ALKYD

ACRALUST: High-Solids solvent borne acrylic modified alkyd for use as a topcoat or direct-to-metal. Has improved gloss and gloss retention than a conventional alkyd. Acralust is available in both 3.5 & 2.8 V.O.C. formulations.

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 2000-5000 PSI
TIP SIZES: 6,17; 6,19's
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 8-10 / 200-250 micron
SWEAT IN TIME: N/A
THINNING: N/A SEE ****
SOLVENT TYPE: MINERAL SPIRITS
REDUCTION: N/A SEE ***
VISCOSITY: 40-50 ZHAN #3
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3.5-4.0 / 87.5-100 micron
SPRAY TECHNIQUE: SINGLE CROSSCOAT 30% OVERLAP
DRY TO TOUCH: 4-6 HRS
MIN RECOAT TIME: N/A SEE ***
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 2.8-3.5
SUBSTRATE: CRS,HRS
D.O.T.: FLAMMABLE
DRY THROUGH: 24 HRS SEE **
MAX RECOAT TIME: N/A SEE ***
SOLIDS BY VOLUME: 47-50%
FREEZE THAW: YES STABLE
SURFACE PREP: SSPC-SP-6/PRIME

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** Alkyd polymers, because of their oxidative nature, do not reach full hardness for 30-60 days from specified application.

*** Acrylic alkyds go through a lifting stage beginning in 24 hrs, from application up to 7 days. This is based on dry film thickness of 3.5-4.3 mils / 87.5-107.5 microns.

**** Thinning is required for conventional 3.5 systems. However, for 2.8 versions in-line heat of 120°-140° F / 48°-60° C is needed for proper application, atomization and flow out of the coating.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: POWER GRIP 50%-80% SOLIDS

POWER-GRIP: High-Solids two-component solvent borne conventional epoxy-polyamide. Have superior flexibility, hardness and chemical resistance, with typical epoxy gloss retention properties. Use as a primer, topcoat or direct-to-metal.

MIXING RATIO: 1:1. 4:1, or 2:1
POT LIFE: 4-6 HRS
PUMP PRESSURE: 1600-2000 PSI
TIP SIZES: 6/17,6/19
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 6-7 / 150-175 micron micron
SPRAY TECHNIQUE: CROSSCOAT 30% OVERLAP
DRY TO TOUCH: 6-8 HRS
MIN RECOAT TIME: 8-12 HRS
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 2.6 - 3.50
SUBSTRATE: CRS,HRS
SURFACE PREP: SSPC-SP-6, EPOXY PRIMER

DWELL TIME: 15-30 MIN
THINNING: N/A
SOLVENT TYPE: EEP TYPE
REDUCTION: NONE
VISCOSITY: 40-50 ZHAN #3
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3-4 / 75-100

DRY THROUGH: 24 HRS
MAX RECOAT TIME: 24-36 HRS
SOLIDS BY VOLUME: 50-80%
FREEZE/THAW: STABLE
D.O.T.: FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

1) Do not use after mixture has set for 6 hours.

2) If thinning is preferred: Use 1 quart of #1 epoxy thinner (R-10480) to 5 gallons of mixed paint.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: POWER GRIP 80% SOLIDS

POWER GRIP: High-Solids two-component solvent borne epoxy. Available as a polyamide or amine. Have superior flexibility, hardness and chemical resistance, with typical epoxy gloss retention properties. Use as a primer, topcoat or direct-to-metal. Possesses an initial gloss of 90-95% (60 deg. head).

MIXING RATIO: 1:1
POT LIFE: SEE **
PUMP PRESSURE: 2500-3000 PSI
TIP SIZES: 6/19,6/21
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 6-8 / 150-200 microns
DWELL TIME: N/A
THINNING: N/A
SOLVENT TYPE: EEP TYPE
REDUCTION: NONE
VISCOSITY: 50-60 J CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 90° F / 32° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 4.8-6.4 / 120-160 micron
SPRAY TECHNIQUE: CROSSCOAT 50% OVERLAP
DRY TO TOUCH: 3-4 HRS
MIN RECOAT TIME: 3-4 HRS
DRY THROUGH: 12 HRS
MAX RECOAT TIME: 25-36 HRS
EQUIPMENT REQUIREMENTS: PLURAL COMPONENT AIRLESS SYSTEM
SOLIDS BY VOLUME: 80-82%
V.O.C.: 1.20-1.40
SUBSTRATE: CRS,HRS
SURFACE PREP: SSPC-SP-6
FREEZE/THAW: STABLE
D.O.T.: CORROSIVE LEVEL 3

NOTES:
* The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** The amine version does not have a useable pot life. A plural component system must be used in this case. The polyamide version has a pot life of 6-8 hrs. And can be used conventionally.

1) Heat is not needed for application or polyamide versions.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: EPOXY POLYESTER (EPOL)

EPOL: High-Solids two-component solvent borne epoxy-polyester. Has the optimum in gloss retention when compared to a conventional epoxy or silicone acrylic alkyd. Slightly less chemical resistance than conventional epoxies, but has equivalent hardness and flexibility, (e.g. non chalking epoxy) topcoat or direct-to-metal. Possesses an initial gloss of 85-90% (60 deg head).

MIXING RATIO: 1:1; 2:1; 4:1
POT LIFE: 4-6 HRS
PUMP PRESSURE: 1600-2000 PSI
TIP SIZES: 6,17; 6,19's
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 6-8 / 150-200 micron
DWELL TIME: 15-25 MIN
THINNING: N/A
SOLVENT TYPE: EEP TYPE
REDUCTION: N/A
VISCOSITY: 40-50 ZHAN #3
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 90° F / 32° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 3.0-4.0 / 75-100 micron
SPRAY TECHNIQUE: SINGLE CROSS COAT 30% OVERLAP
DRY TO TOUCH: 4-6 HRS
MIN RECOAT TIME: 12-14 HRS
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 3.00-3.5
SUBSTRATE: CRS,HRS
DRY THROUGH: 24 HRS
MAX RECOAT TIMES: 24 HR SEE**
SOLIDS BY VOLUME: 50-55%
FREEZE/THAW: YES/STABLE
SURFACE PREP: SSPC-SP-6/POWER GRIP EPOXY PRIMER

D.O.T.: FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** If recoating is needed after a 24 hr period, the coating must be sanded or scuffed before recoating to insure proper inter coat adhesion.

1) Do not use mixed coating after 6 hrs.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: ACRATHANE (ACRYLIC URETHANE)

ACRATHANE: High-Solids two-component solvent borne acrylic-urethane topcoat. Possesses the optimum in gloss retention and hardness, with dilute chemical resistance. Must be applied over Power Grip primer. Initial gloss 98-105% (60 deg head).

MIXING RATIO: 5:1, 4:1, 2:1
POT LIFE: 6-8 HRS
PUMP PRESSURE: 1800-2100 PSI
TIP SIZES: 6,15; 6,17's

DWELL TIME: 15-30 MIN
THINNING: IF REQUIRED
SOLVENT TYPE:
REDUCTION: 1 GAL OF R-10535/ 5 GAL MIXED PRODUCT

FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 5-6 / 125-150 micron

VISCOSITY: 60-70 ZHAN #3
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS: 2.5-3.5 / 62.5-87.5 micron

SPRAY TECHNIQUE: CROSSCOAT 30% OVERLAP
DRY TO TOUCH: 6-8 HRS
MIN RECOAT TIME: 16-24 HRS
EQUIPMENT REQUIREMENTS: AIRLESS
V.O.C.: 3.0-3.5
SUBSTRATE: CRS,HRS
D.O.T.: FLAMMABLE

DRY THROUGH: 24 HRS
MAX RECOAT TIME: 24 HR, SEE **
SOLIDS BY VOLUME: 55-60%
FREEZE/THAW: YES/STABLE
SURFACE PREP: POWER GRIP PRIME

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F /10° C.

** If the surface is to be recoated after 24 hrs, the area to be repaired should be sanded or scuffed to insure proper inter-coat adhesion.

1) Do not use the mixed product after the 6-8 hr pot life.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: NO-VOC POWER-GRIP 100% EPOXY

NO-VOC POWER-GRIP: 100% Epoxy has superior flexibility, hardness and chemical resistance. Initial gloss 90-95% (60 deg head). For use as a primer, topcoat or direct-to-metal.

MIXING RATIO: 1:1	SWEAT IN TIME: N/A
POT LIFE: SEE **	THINNING: N/A
PUMP PRESSURE: 2500-3000 PSI	SOLVENT TYPE: N/A
TIP SIZES: 6/19, 6/21	REDUCTION: N/A
FILTERS: 60 MESH	VISCOSITY: 55-65 J CUP
MIN STEEL TEMP: 50° F / 10° C	MAX STEEL TEMP: 85° F / 30° C
MIN APPLICATION TEMP: 50° F / 10° C	MAX APPLICATION TEMP: 90° F / 32° C
MIN RELATIVE HUMIDITY: SEE *	MAX RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 4-6 / 100-150 micron	REQUIRED DRY MILS: 4-6 / 100-150 micron
SPRAY TECHNIQUE: CROSSCOAT 30% OVERLAP	
DRY TO TOUCH: 3-5 HRS	DRY THROUGH: 12 HRS
MIN RECOAT TIME: 3-5 HRS	MAX RECOAT TIME: SEE ***
EQUIPMENT REQUIREMENTS: PLURAL COMPONENT	
PUMP 1:1 RATIO WITH 130-135 DEG HEAT	SOLIDS BY VOLUME: 100%
V.O.C.: 0.0	FREEZE/THAW: STABLE
SUBSTRATE: CRS,HRS	
SURFACE PREP: SSPC-SP-6	D.O.T.: CORROSIVE LEVEL 3

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** This material is designed to be applied with the use of plural component pumps at a 1:1 ratio. The use of in-line heaters will assist in viscosity control and improve flow and leveling, recommended temp of in-line heat is 130°-135° F / 55°-57° C.

*** If recoat is needed after 24 hrs, you should scuff the surface to insure inter-coat adhesion.

PAINTING PROCEDURE
FOR
100% EPOXY COATINGS

A. Painters must make sure the unit is free of any type of contamination before painting is to begin, i.e., loose blast media, oil, or grease, moisture, etc. Failure to follow this procedure can result in lack of adhesion. A commercial blast (SSPC-SP6) is the minimum accepted.

B. Material is designed to be used with plural component system and in-line heaters. Heated hoppers are optional, but can be employed as a first step reduction aid. Temperatures of the hoppers should be maintained at 90° – 100° F / 32°-38° C. The in-line heaters are essential to provide optimum atomization, flow and leveling.

C. Equipment necessary, and working parameters that have demonstrated optimum spray ability are as follows:

1. Plural component spraying system
   45:1 King pump @ 2200 - 2500 PSI.

2. 6/19 or 6/21 tips can be used with airless or air assisted an airless guns.

3. In-line heaters @ 130°-140° F / 55°-60° C.

4. 3/8” lines.

5. 30 Mesh filters for pumps and guns.

6. Ovens - 60 minutes @ 130° F / 55° C (optional).

7. Heated Hoppers - maintained at 90°-100° F / 32°-38° C (optional).

D. Two painters should work together, across from each other, from on end of the tanker (A or B) to the other end (A or B).

1. Initially, the two painters should detail the tanker. All gratings, hand rails, grips, ladders, appliances and underbelly should be painted first. All areas should have 7-8 wet mils / 175-200 wet microns.

2. After the detailing is completed, both painters should start at an end on top and paint from this head, across the top of the tanker to the opposite end. Once the top of the tanker is completed, the painters will then paint the bottom half, starting back at the first head coated and proceeding to the opposite end, re-wetting in areas that have been previously painted.

E. Once finished, each painter should check the unit, especially the hidden areas so touch-up can be accomplished while the unit is still wet.

F. After the unit is completed, the painters must instantly flush the lines, guns, and static mixer with solvent, in order to prevent solidification of mixed components.

Note: If there are moments when the painters, after charging the lines through the static mixer, are forced to stop painting for any reason, they must keep the guns triggered every 30 seconds. This will keep the paint flowing through the mixer preventing solidification that will ruin lines, guns and the static mixer.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: POWER-FLEX INTERIOR EPOXY LINING

POWER-FLEX: 75% Epoxy has excellent flexibility, hardness and chemical resistance. For use as a primer, topcoat or direct-to-metal.

MIXING RATIO: 1:1
POT LIFE: 2 hrs. @ 75° F / 24° C
PUMP PRESSURE: 2500-3000 PSI
TIP SIZES: 6/19; 6/21
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: See *
REQUIRED WET MILS: 6-8 / 150-200 Micron
SWEAT IN TIME: N/A
THINNING: **
SOLVENT TYPE: R-7383
REDUCTION: 2-5%
VISCOSITY: 55-65 J CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 90° F / 32° C
MAX RELATIVE HUMIDITY: See *
REQUIRED DRY MILS: 4-6 / 100-150 Micron
SPRAY TECHNIQUE: CROSSCOAT 30% OVERLAP
DRY TO TOUCH: 6-8 Hrs.
MIN RECOAT TIME: 12 Hrs.
DRY THROUGH: 24 Hrs.
MAX RECOAT TIME: 24 Hrs.
EQUIPMENT REQUIREMENTS: Plural Component***
PUMP 1:1 RATIO WITH 110°-120° F / 43°-50° C Heat
V.O.C.: 1.70
SUBSTRATE: CRS,HRS
SURFACE PREP: SSPC-SP-10
SOLIDS BY VOLUME: 75%
FREEZE/THAW: STABLE
D.O.T.: FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** This material is designed to be applied with the use of plural component pumps at a 1:1 ratio. The use of in-line heaters will assist in viscosity control and improve flow and leveling. Recommended temperature of in-line heat is 110°-120° F / 43°-50° C.

*** If a hot pot method is employed, a 2-5% reduction will aid in the flow and leveling of the coating. Pot life is 2 hrs. @ 75° F / 24° C.

INTERIOR COATING SPECIFICATION

WILLIAMS-HAYWARD PROTECTIVE COATINGS, INC.
POWER-FLEX
LOW BAKE SOLVENT BASED EPOXY
(for Hopper Cars)

GENERAL: Ventilate car five minutes before entering. Do not spray lining materials without adequate exhaust ventilation or when car is above 90° F / 32° C metal temperature. Periodic monitoring per shop safety procedures is required to prevent an explosive atmosphere. Inside hopper can wear soft shoes or foot protectors. Keep equipment clean (hoses, gun, etc.). Take care to minimize damage to exterior paint (if relevant).

CAR PREPARATION:

All bolted items to be removed and kept unique to the car. Stainless steel fittings may require protection from abrasive blast. All interior weld joints to be continuous and ground smooth to rounded contour per engineering instructions.

SYSTEM: Two-coat, light blue over white.

SURFACE PREPARATION:

Remove oil and grease safety solvents per SSPC-SP1. Near White metal blast per SSPC-SP-10 (use NACE visual standard TM-01-75 for comparison). Recommended surface profile is 2.0-3.0 mils. Compressed air to be clean and dry. Remove all dust, abrasive, other foreign material before coating. Sweep and vacuum surface (do not use cloth). Car, coating material and work to be minimum 60° F / 16° C. Maintain temperature of surface to be coated at a minimum of 5° F / -15° C above dew point. Apply first coat within 8 hours of blasting.

FIRST COAT:

WILLIAMS-HAYWARD PROTECTIVE COATINGS, INC. POWER-FLEX WHITE EPOXY, 2-COMPONENT #78-12775-80. Thoroughly mix 1 part of base with 1 part of activator. Pot life is 2 hours at 75° F / 24° C.

APPLICATION:

BRUSH STRIPING:

Use 15% thinned material to brush stripe welds, edges, corners, seams and previously corroded areas. Wet surface well and assure there are no runs or sags.

SPRAY: Apply a “mist” bonding pass; allow to flash off for several minutes, but long enough to allow film to completely dry. Then apply 6.0-8.0 wet mils / 150-200 wet microns, at 70% volume solids (after thinning) yielding 4.0-6.0 mils / 100-150 micron DFT, 4.0 mil / 100 micron minimums. Volume solids before thinning 74%.

THINNING: Up to 5% with R-7383, or reduce viscosity suitable for spray application using in-line heaters.

CLEANUP: Use standard cleanup solvent such as 4-8489.

DRYING: Approximate drying times to re-coat:

Surface Temperature	Minimum dry-to-re-coat time, hours, At 4 mils / 100 Micron DFT
70° F / 21° C	16
90° F / 32° C	8

NOTE: Variations in film thickness can alter drying times shown above, approximately proportional to the DFT difference.

SECOND COAT:

WILLIAMS-HAYWARD PROTECTIVE COATINGS, INC. POWER-FLEX BLUE EPOXY, 2-COMPONENT, WILLIAMS-HAYWARD #38-12774-80. Thoroughly mix 1 part of base with 1 part of activator. Pot life is 2 hours @ 75° F / 24° C.

SPRAY: Apply 6.0-8.0 wet mils / 150-200 wet microns at 70% volume solids (after 6% thinning) yielding 4.0-6.0 mils / 100-150 micron DFT. Volume solids before thinning 75%. Total DFT is 8.0-12.0 mils / 200-300 micron, 8.0 mils / 200 micron minimum.

THINNING & CLEANUP:

Use thinning or in-line heaters as above.

DRYING: Recommended final curing schedule for Food Grade Service:

Surface Temperature	Dry to touch, hours, @ 4 mils / 100 micron DFT	"Full" cure, days, @ 4 mils / 100 micron DFT
50° F / 10° C	12	6
70° F / 21° C	8	4
90° F / 32° C	4	3

LINING IDENTIFICATION STENCIL:

Per AAR C2.03 a.8 and Field Manual Rule 80.E.1. Stencil application shop.

Interior Power Flex Epoxy
Cure Cycle

Prime/Over Coating

Substrate Temperature (Deg. F.)	Dry to Re coat (Hrs.)
90° F / 32° C	9 hrs.
70° F / 21° C	16 hrs.
50° F / 10° C	56 hrs.

All values presented are applicable for a 4-mil / 100 micron DFT application. Additional time at temperature should be extended by a minimum of 50% for a 6 mil / 150 micron DFT single coat.

Top Coat

Substrate Temperature (Deg. F.)	Dry to Touch (Hrs.)	Full Cure (Days)
90° F / 32° C	4 hrs.	3 days
70° F / 21° C	8 hrs.	4 days
50° F / 10° C	12 hrs.	6 days

Cure data is based on consistent temperatures and adequate ventilation. All figures above are based on 4 mils / 100 micron DFT. As previously stated, an additional 50% increase in time at temperature is required for a 6-mil / 150 micron DFT single coat.

C

SPECIALITY COATINGS

1. Zinc Rich Coatings (AQUA-DUST)

2. Heat Resistant (see THERMALBOND)

3. Non-Skid (see THERMALBOND & SAFE-T-COAT)

4. Release Coatings (see AQUA-SLIP)

5. Reflective Coatings (REFLECT-IT) Available in solvent or water to be applied over a white base coat.

6. Stencils & Reducers: A full line of stencil paints and reducers are available in solvent borne and waterborne formulations.

7. Fly Ash Filled (see THERMALBOND)

8. Thermalbond roof & side screen Mastic for aged galvanized metal. Has over 12years in service durability applied to marginally cleaned, oxidized roofs and side screens.

For further technical information on these specialty coatings, contact your sales representative or Williams-Hayward directly.

TYPICAL TECHNICAL BULLITEN
FOR
COATING TYPE: AQUA-DUST

MIXING RATIO: N/A
POT LIFE: N/A
PUMP PRESSURE: 1500-1800 PSI
TIP SIZES: 6,17; 6,19
FILTERS: 60 MESH
MIN STEEL TEMP: 50° F / 10° C
MIN APPLICATION TEMP: 50° F / 10° C
MIN RELATIVE HUMIDITY: SEE *
REQUIRED WET MILS: 4-6 / 100-150 micron
DWELL TIME: N/A
THINNING: SEE **
SOLVENT TYPE: WATER
REDUCTION: SEE **
VISCOSITY: 120 J CUP
MAX STEEL TEMP: 85° F / 30° C
MAX APPLICATION TEMP: 85° F / 30° C
MAX RELATIVE HUMIDITY: SEE *
REQUIRED DRY MILS:1.0-2.0 / 25-50 micron
SPRAY TECHNIQUE: SINGLE CROSS COAT 50% OVERLAP
DRY TO TOUCH: 15-25 MIN.
MIN RECOAT TIME: DRY TO TOUCH
EQUIPMENT REQUIREMENTS: AIRLESS SPRAY
V.O.C.: 1.0-2.0
DRY THROUGH: 2-4 HRS
MAX RECOAT TIME: WILL NOT LIFT
SOLIDS BY VOLUME: 38-40%
FREEZE THAW: NONE
SUBSTRATE: CRS,HRS
SURFACE PREP: REMOVE OIL & GREASE
D.O.T.: NON-FLAMMABLE

NOTES:
* In coating application, the critical parameters are the relationship between surface temperature and dew point. The surface temperature must be a minimum of 5° F / -15° C above the dew point, with a minimum surface temperature of 50° F / 10° C.

** Thinning may be required. Contact your Williams-Hayward Rep for amount of water to be used.

1) Dry times depend on humidity and total mils. The greater of either or both together will increase the time for the coating to dry. The reverse is also true: the lesser the humidity or mils decreases the time for the coating to dry.

2) Waterborne coatings will yield transfer efficiencies as high as 86-90% when proper tip sizes and pump pressures are used.

D

WILLIAMS-HAYWARD PROTECTIVE COATINGS, INC.
QUALITY ASSURANCE

Williams-Hayward Protective Coatings, Inc. produces coatings for industry that have been formulated specifically to meet individual customers' requirements.

All Williams-Hayward Protective Coatings, Inc. employees are committed to customer satisfaction and a quality product.

Williams-Hayward Protective Coatings, Inc. quality program has been developed to comply with AAR M-1003 and ISO 9001-2000 requirements. The objective of the program is to prevent and detect any nonconformance in quality of our product from raw material to final inspection and shipment.

Williams-Hayward Protective Coatings, Inc. strives to be an innovator in its industry providing our customer with coatings systems of the highest quality.

AMERICAN ASSOCIATION OF RAILROADS M-1003 CERTIFICATION

PLANT 1	7425 W. 59TH ST. SUMMIT, IL	QA-WHI
PLANT 2	7400 W. ARCHER AVENUE SUMMIT, IL	QA-WHII
PLANT 3	5241 W. 70TH PLACE BEDFORD PARK, IL	QA-WHBP

ISO 9001-2000 CERTIFICATION

PLANT 1	7425 W. 59th ST. SUMMIT, IL	ANAB UKAS	CERT# 10520/1 CERT# 10771/2
PLANT 2	7400 W. ARCHER AVENUE SUMMIT, IL	ANAB UKAS	CERT# 10520 CERT# 10771
PLANT 3	5241 W. 70th PLACE BEDFORD PARK, IL	ANAB UKAS	CERT# 10520/2 CERT # 10771/4

Technical Service Information

Williams-Hayward Protective Coatings, Inc.
7425 W. 59th Street
Summit, IL 60501

Phone: (708) 458-0015

Corporate Contacts		Phone #'s
Joseph F. Kurcz	**Chairman of the Board & President**	(708) 458-0015
Wayne E. Kurcz	**CEO /President WHPC International Coatings** whpcwek@whpc.net	(708) 563-5179
Edward J. Kurcz	**CFO/ Director of Powder Coatings** eddiekurcz@whpc.net	(708) 563-5182
Mark J. Kristie	**Chemist / Director of Technical Services** markkristie@whpc.net	(708) 563-5178
Jacqueline Kurcz/Frett	**Vice President / Director of Quality Control** jkf@whpc.net	(708) 563-6264
Kevin P. Koran	**Director of Operations** kpk@whpc.net	(708) 563-3402

Technical Service/Sales Assistants

Carlos Contreras	**Servicio En Española: México /US** carloscontreras@whpc.net	(708) 267-7671
Jason Kristie	**USA / Canada** jasonkristie@whpc.net	(708) 218-6708
Edward A. Kurcz	**USA / Canada** eak@whpc.net	(708)218-8556

EUROPEAN OPERATIONS

Robert Zawalich	**DIRECTOR OF EUROPEAN OPERATIONS (WHPC)** **President of P.H.U "STEP" Distributor** **FABRYCZNA 4 ; 58-100 SWIDNICA POLAND** **whpc@onet.pl** **(rzawalich@whpc.net)**	(0048) 857 04 66 (708)557-5736

WILLIAMS-HAYWARD PROTECTIVE COATINGS, INC.

QUALITY CONTROL IN PLANT
ISO9001-2008, AAR M-1003
CERTIFIED

The following information is a basic guide that can be helpful not only in keeping track of the various paint systems that your shop is applying, but also a brief checklist as to what to look for when certain problems arise.

Initially, it is a good idea to copy the following information off of the paint container:

Material: Product Name:
Batch Number:
Date of Paint:
Expiration Date:

If you believe that the paint is suspect due to some problems that you have encountered, please have this information available. We keep a retain of every batch of paint we manufacture for any shop. The retain is a sample our production people take from the batch as it is being filled out.

When we visit any shop, some additional information we record is the shop environmental condition and equipment.

Shop Conditions: Paint Temperature
Viscosity
Air Temperature
Booth Temperature
Surface Temperature
Humidity
Dew Point

Equipment: Pumps: (Bulldogs 30:1)
(King 45:1)
(President 27:1)

Tips: 5/15 - 6/21 etc.
Line Sizes and Lengths: 1/4" x 1/2"/50-200 ft.
Pump Pressures: 1500-4500 psi
Booth: Down Draft/Side Vents/Up Draft, etc.
Scaffolding: Scissor Jacks, Ladders, etc.
Number of Painters
Ovens and Temperature

Blast Conditions: SSPC-SP 5/10/6/7 / Profile Depth / Blast Media (sand-grit-shot)

WHPC/WHIC technical reps. always record what car group or file the paint system is being applied to. We record steel numbers and stencil numbers along with dry film thickness readings. Also, if an interior lining is being done, any information on holiday testing that was conducted, and if there were any defects in the film, and where the defects were located.

Even though waterborne coatings need to be handled differently than conventional solvent paint, similar problems may still occur. Subsequently, when investigating some of the more common problems, certain things should be taken into consideration.

A. If sags and runs are a problem:
   1. Check the mil specs, painters may be trying to hang more mils than paint can hang.
   2. Check to see if wet mil gauges are being used, without this simple piece of equipment the painters are only guessing.
   3. Check the temperature and viscosity of the paint. If the paint is exceptionally warm, its viscosity will be less and it will flow more, which may cause sags. If the paint's viscosity is thin, it will obviously have a hard time hanging.
   4. Check to see if anyone has added, for any reason, H2O or a co-solvent to the paint. Too much, or in the case of most of our waterbase products, it does not take a lot of water to hurt the hanging power of the paint.
   *5. Check the dew point. If the car was sprayed when the surface temperature was not at least 5°-7° F / -15 to -14° C above the dew point, sags and runs most likely will occur.
   6. Check the size of the tip being used. Too large of an orifice or too small of a fan pattern can reduce atomization which will hurt hanging.
   7. Check to see if painters are too close to the unit, lack of fan pattern effects atomization and hanging power.

B. If any dry spray is present:
   1. Check pump pressure. Waterborne coatings do not like high pump pressures. These materials dry fall, subsequently; any particular matter that is thrown up into the air will be tack free when it hits the ground.
   2. Check the tip size. Smaller orifices can restrict proper atomization, which will not allow the paint to keep a wet edge.
   3. Check the car temperature. When the temperature of the car is extremely hot, it is very hard to keep a wet edge, thus creating dry spray.
   4. Check the way the painters are applying the coating. As outlined in our Thermalbond Kit, using two painters in tandem, along with proper overlapping and distance from the car, painting bottom-up, will eliminate dry spray.
   5. Check shop airflow. Excessive air movement when spraying the car can alter the fan pattern and actually start to dry the paint before it reaches the car.

C. If pinholes are detected:
   1. Check pump pressure. Holes may be blowholes.
   2. Check the distance from the car. The paint requires proper atomization. If the painters are too close, this can also produce holes in the wet film.
   3. Check the blast profile. If it is exceptionally deep, the holes may be caused due to the peaks protruding through the paint film.
   4. Check the blast media. If it has become contaminated, it may deposit some foreign material on the surface de-wetting the coating.
   5. Check the viscosity of the paint. If the body of the coating has increased, flow and leveling may be affected.

D. If the finished car looks blotchy or dull:
   1. Check the paint expiration date. All paints have a shelf life.
   2. Check the dry mils. If they are low, you may be seeing some profile.

3. Check the painter's technique. A waterborne coating need 30% overlapping and even passes. Water does not flow like solvent type coatings.
4. Check to see if any chalk or grease has been left on the car. Both are detrimental to a glossy finish.

E. If your paint has congealed or separated:

Water emulsion coatings fall apart if they have been frozen. Once this has happened, the paint cannot be salvaged. Water solution coatings will usually start to separate if they are one or more years old. If this occurs, in many cases a simple pH adjustment or solvent addition can be made to salvage the paint

F. If you encounter trash on the car:
1. Check to see if any skins have formed on the open paint and were not properly removed or filtered out when spraying
2. Check your intake tube. A screen should be used to reduce the chance of any trash being carried to the lines.
3. Check to see if the waterborne coating is not cleaning out the old material from your lines and pumps, if you are using the same equipment to spray both H_20 and solvent.
4. Check to see if the trash you are seeing is not really dry spray, especially if there was a primer applied first.

G. If you encounter the paint lifting/peeling:
1. Check for contamination on the substrate.
2. Check to make sure car has adequate blast profile.
3. Check to see if the car may have been frozen prior to painting. As it thaws, the paint will lose adhesion.
4. Check to see if a primer was used. The two systems may not be compatible.
5. Check to see if the car was pushed outside in the cold or rain too soon. If the paint was not allowed to flash off its water, it will freeze and lose adhesion.
6. Check to see if the car was put into the wrong service. Certain coatings are not recommended for various acids, caustics, etc.

H. If flash rusting or weld staining occur:
1. Check just where the defect is. If it is on the metal sheets, it may be due to low mils.
2. Check your profile. If it is very deep, you may not have covered the peaks from the blast.
3. Check to see if the red spots are only on the welds. Weld staining is not rust but a unique situation that occurs when our emulsion coatings come in contact with certain types of welds.

As described in the enclosed letter, weld-staining inhibitors are utilized in our paints, but every so often we run into exceptionally active welds that require a higher concentration of inhibitors.

TYPICAL DRY FILM PROPERTIES CHART

	Thermalbond/Eurotbond Aqueous Powders	2.8 V.O.C. High Solids Solvent	100% Solids Epoxy
Gloss	80-90	95-95	95+
Gloss Retention	Excellent	Very Good	Good-Fair
Abrasion Resistance	1000 Cycles (Weight Loss/ 1000 Cycles) 30mg loss	1000 Cycles (Weight Loss/ 1000 Cycles) 232mg loss	1000 Cycles (Weight Loss/ 1000 Cycles) 300mg loss
Impact Concave	180+	30 max.	30 max.
Impact Convex	180+	30 max.	30 max.
Single Component	yes	yes	no
Curing Mech	Water Evap.	Oxidative	Epoxy/Amine
Volume Solids	40-50%	60-70	100
V.O.C. (As shipped)	0.6-0.4	2.8	N/A
Dry Film/ Coat - 10 wet	4-5 100-125 micron	6-8 150-200 micron	10 250 micron
Drying Time		4-6 hrs.	2-3 hrs.
Touch	1 hr.		
Recoat	45 min	8 hrs.	4 hrs.
Stencil	1-1/2 hrs.	6 hrs.	6 hrs.
Accepts Rain	within 5hrs of dry		
Application Temp. Range	40°-110° F 4°-43° C	50°-110° F 10°-43° C	50°-110° F 10°-43° C
Special Shipping Precaution	do not freeze	DOT Red Label	Hardener- Corrosive
Transfer Eff. (%)	86	56	60

COATINGS SYSTEMS

Comparative Views Solvent Borne High Solids

Waterborne Solution and Latex Emulsion

Solvent Borne

	Alkyd	Epoxy	Urethane
VOC (#'s/GL)	3.5	2.6-3.5	3.0-3.5
Solids By Volume	50%	50-80%	50-60
Waste	H	H	H
Over spray	Tacky	Tacky	Tacky
Flammability	FL	FL	FL
Transfer Efficiency	56	56	56
Dry Times	4-6 hrs.	6-8 hrs.	6-8 hrs.
Gloss	80-90	70-80	95>
Gloss Retention	F	P	Ex.
Salt Spray	G	Ex.	N/A +
Acid Resistance	F	G	VG
Alkali Resistance	P	VG	VG-Ex.
Hot Sulfur	P	F	F
Impact Resistance	F	P	P-F
Abrasion Resistance	F	G	VG

NFL	Non-Flammable Liquid
FL	Flammable Liquid
H	Hazardous
NH	Non-Hazardous
P	Poor
F	Fair
G	Good
VG	Very Good
Ex.	Excellent

+ Urethanes are used in conjunction with epoxy primers and not available as direct-to-metal finishes.

Waterborne

	Aqua Lust	Thermalbond Eurotbond/ NO-VOC	Aqua-Epoxy	Aquathane urethane
VOC (#s/GL)	1.8-2.4	0-1.00	0.9-1.7	2.2-2.6
Solids by Volume	40%	40-55	40-55	30-40
Waste	NH	NH	NH	NH
Over spray	Tacky	*Dry	Dry	Tacky**
Flammability	NFL	NFL	NFL	NFL
Transfer Efficiency	82	86	82	82
Dry Times	4-6 hrs.	1 hr.	6-8 hrs.	4-6 hrs.
Gloss 60 deg Gardner	95	70-80	90-95	95 >
Gloss Retention	VG-Ex.	VG-Ex.	Ex.	Ex.
Salt Spray	VG	VG	Ex.	VG-Ex.
Acid Resistance	G	Ex.	VG.	G-VG.
Alkali Resistance	F	Ex.	VG.	G-VG.
Hot Sulfur	F	Ex.	VG	G
Impact Resistance	F	Ex.	P	G
Abrasion Resistance	F	Ex.	G	VG

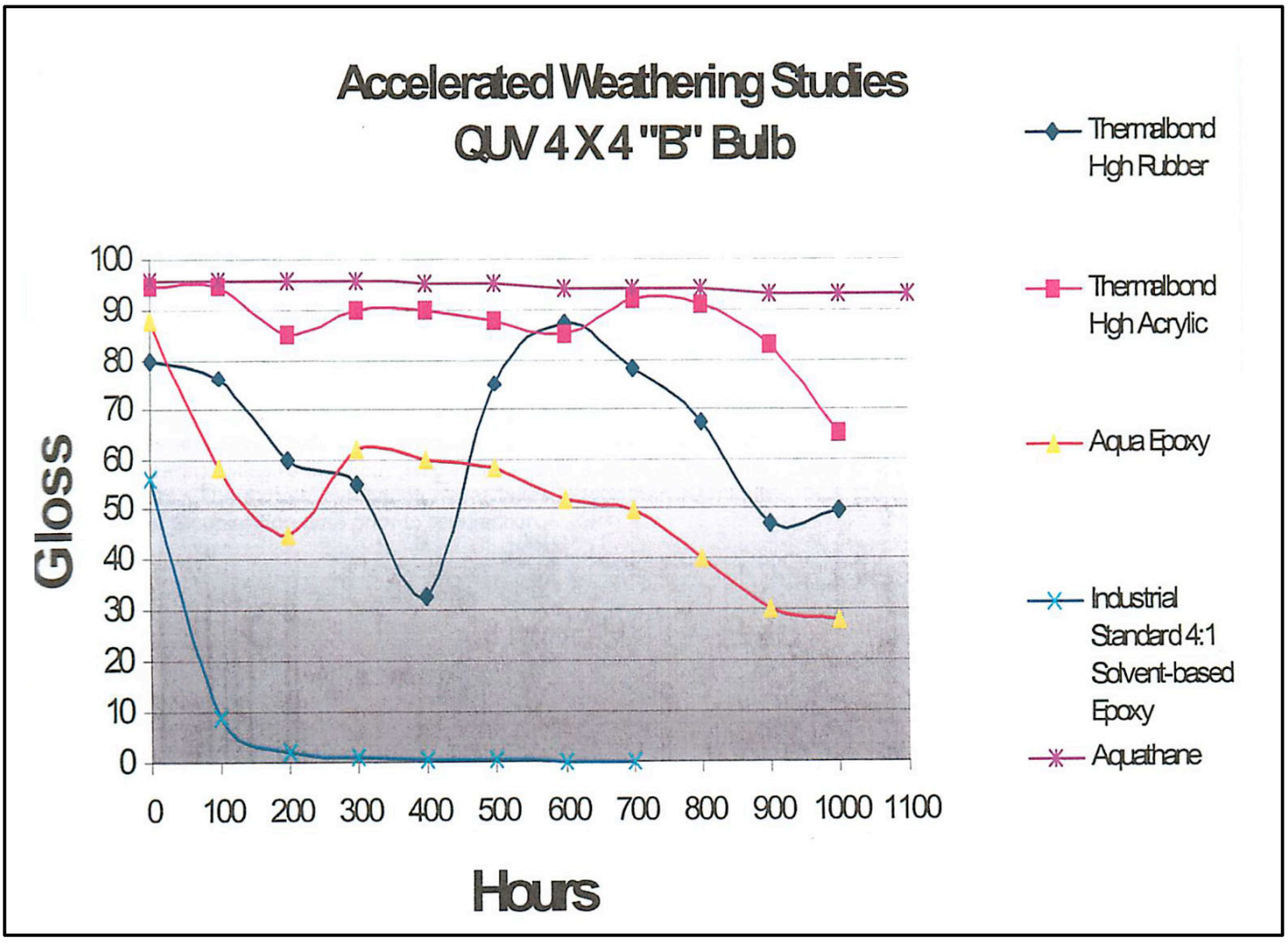
NFL	Non-Flammable Liquid
FL	Flammable Liquid
H	Hazardous
NH	Non-Hazardous
P	Poor
F	Fair
G	Good
VG	Very Good
Ex.	Excellent

NOTE:
* The unique advantage of latex paints is their “dry fall” over spray properties. The over spray can be swept up as a dry non-sticking powdered solid. This property improves paint shop hygiene and eliminates concerns for airborne damage of automobiles in shops where exposures occur.

** Aquathane is also available in latex form; however, in this form an aqua-epoxy primer is required.

NOTE:
AcryLem will have properties intermediate of Thermalbond and Aqua-Epoxy.

All tests performed according to ASTM standards at “STP” over properly blasted dry surfaces, film thickness at 3.5-4.5 dry mil / 87.5-112.5 microns.


Accelerated Weathering Studies
QUV 4 X 4 "B" Bulb
Gloss
100
90
80
70
60
50
40
30
20
10
0
0 100 200 300 400 500 600 700 800 900 1000 1100
Hours
Thermalbond Hgh Rubber
Thermalbond Hgh Acrylic
Aqua Epoxy
Industrial Standard 4:1 Solvent-based Epoxy
Aquathane

W H P C T E S T

THERMALBOND 3 / EUROTBOND 3
High Rubber

SPLASH SPILL EVALUATIONS & PROCEDURES
FOR
CORROSIVE COMMODITIES SERVICE
"Exterior Coating Systems"

Substrate Preparation:

Standard R36 3x6 Q panels are forwardly impacted at 120-130 in.-lbs. using a Gardner Variable Impact Tester (ASTM-D2794-69). A minimum of two to a maximum of six such impacts per panel is performed. The impacted specimens are then blasted via grit, shot or sand, to a minimum of SSPC-SP6 (NACE #3) at 1-1/2 - 2-1/2 mil profile: completely blow off all blast media. The blasted panels are wrapped in moisture retardant paper and stored in a moisture-free container until used.

Coating Application:

The corrosion barrier coating is applied to the aforementioned prepared panels in multiple coats being sure each coat is dry before recoating reaching the desired dry film thickness and according to the coatings specification using either airless or conventional air spray equipment. The sprayed panels are allowed to dry in a vertical position under standard laboratory conditions for two weeks or oven-dried one week at 78° F / 26° C.

Exposure:

The aged coated panels are then laid horizontally in a corrosion resistant plastic storage container possessing a seal able lid, coating side up. In each impacted indentation is placed .25 - .5 mil / 6.25-12.5 micron each of the corrosive chemical commodities under evaluations. Commodities are replenished daily and panels are removed for evaluation every 48 - 50 hrs. After each 48 - 50 hr. cycle, the panels are rinsed under tap water and dried, using low-pressure air, prior to exposure evaluation. Once evaluated, the panels are returned to the test container and the corrosive commodities re-injected. Repetitive cycles are performed until failure, or a maximum of 750 - 800 hrs. The panels' evaluation never takes longer than 10 minutes, thus the coating is virtually void of recuperation time prior to re-injection.

Evaluations:

A Failure - is constituted as blistering, dissolving of film, or severe rust-through.

B Passing - is the absence of failure conditions.

C Notes - Noted are film discolorations as slight, medium, or heavy and film swelling under the same parameters, where slight values are between 0 - 10% of the total film thickness, medium is 11 - 22% and heavy is 23% or over.

After exposure, panels are rinsed, cleaned and allowed to dry one week, swelling is again evaluated for film recovery considerations and so noted.

Recommendations:

Modifications of this test, such as covering chemical indentations with watch glasses or beakers can result in significantly different results as will improper blast or blow off. Williams-Hayward Protective Coatings, Inc. believes its test most closely simulates actual splash spill conditions. . Williams-Hayward Protective Coatings, Inc. does not intend or recommend these systems for lining service. Our evaluations of actual in-service units in the fleets of many major chemical producers since 1984 lend credibility to our laboratory test procedures.

Coating service recommendations are based solely upon comparative laboratory test data derived when using industry standard systems such as epoxy, coal tar epoxy, epoxy-urethanes as controls under the aforementioned test procedures and controlled conditions. Actual plan conditions may vary, therefore, production evaluations are suggested to determine true correlations.

THERMALBOND3 / EUROTBOND3 SPLASH SPILL DATA

Gloss Gray or Gloss Black 32% Solids: 10-12 mils dry / 250-300 microns dry

Exposure Hrs.	10% HCL	10% H2S04	Con H2S04 66	Con HCL 20	50% KOH	50% Na0H
48	P	P	P	p	P	P
96	P	P	P	P	P	P
144	P	P	P	P	P	P
192	P	P	P	P	P	P
240	P	P	P	P	P	P
288	P	P	P	P	P	P
336	P	P	P	P	P	P
384	P	P	P	P	P	P
432	P	P	P	P	P	P
480	P	P	S1 swell S1 fade			
528	P	P	P”	P	P	P
576	P	P	P”	P	P	P
624	P	P	P”	P	P	P
672	P	P	P”	P	P	P
720	P	P	P”	P	P	P
768	P	P	Med fade P”	P	P	P

Semi-Gloss White: 32% Solids ,10-12 mils dry / 250-300 microns dry

Exposure Hrs.	10% HCL	10% H2S04	Con H2S04 66	Con HCL 20	50% KOH	50% Na0H
48	P	P	P	P	P	P
96	P	P	P	P	P	P
144	P	P	P	P	P	P
192	P	P	P	P	P	P
240	P	P	P	P	P	P
288	P	P	P	P	P	P
336	P	P	P	P	P	P
384	P	P	P	P	P	P
432	P	P	P	P	P	P
480	P	P	S1 fade P”	P	P	P
528	P	P	P”	P	P	P
576	P	P	S1 swell P”	P	P	P
624	P	P	P”	P	P	P
672	P	P	P”	P	P	P
720	P	P	P”	P	P	P
768	P	P	P”	P	P	P

THERMALBOND SPLASH SPILL DATA

Graphite Black - Low Gloss:10-12 mils dry 250-300 microns dry

Exposure Hrs.	10% HCL	10% H2S04	Con H2S04 66	Con HCL 20	50% KOH	50% Na0H
48	P	P	P	P	P	P
96	P	P	P	P	P	P
144	P	P	P	P	P	P
192	P	P	P	P	P	P
240	P	P	P	P	P	P
288	P	P	P	P	P	P
336	P	P	P	P	P	P
384	P	P	P	P	P	P
432	P	P	P	P	P	P
480	P	P	P	P	P Stain	P
528	P	P	P	P	P Stain	P
576	P	P	P	P	P Stain	P
624	P	P	P	P	P Stain	P
672	P	P	P	P	P Stain	P
720	P	P	P	P	P Stain	P
768	P	P	P	P	P Stain	P

NO-VOC Graphite Black - Low Gloss Zero V.O.C. 10-12 mils dry / 250-300 microns dry

Exposure Hrs.	10% HCL	10% H2S04	Con H2S04 66	Con HCL 20	50% KOH	50% Na0H
48	P	P	P	P	P	P
96	P	P	P	P	P	P
144	P	P	P	P	P	P
192	P	P	P	P	P	P
240	P	P	P	P	P	P
288	P	P	P	P	P	P
336	P	P	P	P	P	P
384	P	P	P	P	P	P
432	P	P	P	P	P Stain	P
480	P	P	P	P	P Stain	P
528	P	P	P	P	P Stain	P
576	P	P	P	P	P Stain	P
624	P	P	P	P	P Stain	P
672	P	P	P	P	P Stain	P
720	P	P	P	P	P Stain	P
768	P	P	P	P	P Stain	P

*Similar results have been observed on stainless steel and untreated aluminum.

THERMALBOND SPLASH SPILL DATA

NO-VOC White- Low Gloss Zero V.O.C., 10-12 mils dry/250-300 microns dry

Exposure Hrs.	10% HCL	10% H2S04	Con H2S04 66	Con HCL 20	50% KOH	50% Na0H
48	P	P	P	P	P	P
96	P	P	P	P	P	P
144	P	P	P	P	P	P
192	P	P	P	P	P	P
240	P	P	P	P	P	P
288	P	P	P	P	P	P
336	P	P	P	P	P	P
384	P	P	P	P	P	P
432	P	P	P	P	P	P
480	P	P	P	P	P	P
528	P	P	P	P	P	P
576	P	P	P	P	P	P
624	P	P	P	P	P	P
672	P	P	P	P	P	P
720	P	P	P Med fade S1 swell	P	P	P
768	P	P	P	P	P	P
868	P	P	P	P	P	P

42% Solids White or Gray Semi- Gloss,10-12 mils dry mils / 250-300 microns dry

Exposure Hrs.	10% HCL	10% H2S04	Con H2S04 66	Con HCL 20	50% KOH	50% Na0H
48	P	P	P	P	P	P
96	P	P	P	P	P	P
144	P	P	P	P	P	P
192	P	P	P	P	P	P
240	P	P	P	P	P	P
288	P	P	P	P	P	P
336	P	P	P	P	P	P
384	P	P	P	P	P	P
432	P	P	P S1 Fade	P	P	P
480	P	P	P “	P	P	P
528	P	P	P “ S1 Fade	P	P	P
576	P	P	P “	P	P	P
624	P	P	P “	P	P	P
672	P	P	P “	P	P	P
720	P	P	P “	P	P	P
768	P	P	P “	P	P	P
868	P	P	P “	P	P	P
968	P	P	P “	P	P	P

"WELD STAINING PHENOMENON"

This communiqué is concerning the phenomenon we term as "Weld Staining". As described earlier in our Thermalbond Kit, "Weld Staining" is most closely associated with the application of waterborne latex emulsions over a particular type of weld believed to be of the gas flux type. This was first seen in 1981 as Williams Hayward began the first production applications of Latex products in repair facilities. The effect is not observed initially on applications but appears as brown dots randomly scattered, usually over 5- 10% of the welded bead after latex has set to touch. On close observation prior to painting, these dots, though not brownish in color, can be observed as darker discolorations on the welded surface. We believe these to be impurities that are soluble in water. Many times merely rubbing firmly with your finger on the dried painted surface will remove them. In all other cases, recoating eliminates their appearance.

Our earlier belief that these stains were rust related could not be substantiated, for they did not occur on all types of welds and are also absent from the Un-welded blasted parts of the surface, (blasted metal which itself is prone to rapid rust bloom in the presence of moisture). Add to this the fact the conventional waterborne rust inhibitors did not seem to reduce the weld stain effect.

To date, our research efforts have enabled us to offer an inhibitor, however, the exact concentration to be used is not at all certain. Established (concentrations) currently packaged in our products work extremely well at many locations and are less effective in others. Increasing the levels on the job virtually eliminates the Stain effect noted in the latter cases. If on the site additions are not desirable minor touch up with a small paintbrush will suffice.

We have successfully been able to reproduce the effect in the laboratory. All our accelerated tests and in service field data since 1984 conclusively demonstrates that this effect is purely aesthetic and has in no way affected the overall durability of our products. Our confidence and assurances of durability of our latex products, and for that matter all our waterborne systems, for the surfaces we have recommend, is solid and backed by eighty years of honorable service in the transportation industry and over 45 years in the development of aqueous coatings.

The most important factors to the overall durability of the latex systems are no different than those for any coating system and still reside with: A.) Adherence to the specifications on dry film thickness, B.) Surface cleanliness proper blast and C.) Final surface preparation, in new car construction, (A) and (C) are of greatest concern. In repair and repaint programs, all three factors are key, however, the removal of commodity and commodity corrosion by products (B) plays a very important role. Much attention in the past has been directed in this area for interior coating systems only, however, it is only a logical conclusion that exposure to spillage of corrosive commodities shows no bias as to whether the substrate is on the exterior or interior. The design for ultimate longevity of a coating system must include the need for a properly clean commodity free surface prior to blast. This has been a point of least interest and unwanted extra expense in the exterior coating applications at repair and refurbishment facilities, blasting alone being considered sufficient as the means of preparation. New concerns require new approaches; for it has become apparent industry wide, there is a trend in requests for extended warranties from customers on exterior coatings. Analogously, your home is only as solid as its foundation.

We at Williams-Hayward Protective Coatings, Inc. offer what we are confident to be superior coating alternatives for the longevity of transportation fleets. These systems have proven themselves to outperform even the most sophisticated solvent-based systems available in our industry. Besides their superior durability, they answer all the environmental concerns facing the world we inhabit, specifically in the areas of waste, emissions, and employee safety.

- TRANSFER EFFICIENCY -

Transfer efficiency was determined by calculating the ratio of the amount of paint solids applied to the car divided by the paint solids sprayed according to the equation:

$$T.E\ (\%) = 100 \times \frac{\text{Volume of Paint Solids Applied to the car}}{\text{Volume of Paint Solids Sprayed}}$$

The amount of paint solids sprayed is determined by measuring the change in height in the drum of paint after the paint hoses are filled but before painting is started and again after the completion of painting and multiplying the difference by the volume fraction solids and the appropriate conversion factor to convert the answer to gallons. The equation is:

$$A = 1.72 \times (Hs - Hf) \times S$$

Where

A = Gallons of paint solids sprayed.

1.72 = Conversion factor to convert inches to gallons.

Hs = Distance from the top of the drum to the level of the paint at the start of spraying, measured in inches.

Hf = Distance from the top of the drum to the level of the paint after completion of painting, measured in inches.

S = The volume fraction of solids in the paint as determined and reported by the paint manufacturer. This is the same as volume percent solids divided by 100.

We know that each height measurement is accurate to +/- 1/8 inch and the reported volume percent solids for a particular batch of paint is accurate to 5 percent. Thus, the overall precision for measuring the solids sprayed is approximately +/- 7% (+/- 5 percent for volume solids and +/- about 2 percent for height measurements).

The amount of paint solids deposited on the car is calculated by taking numerous dry film thickness readings and calculating an overall average film thickness readings and calculating an overall surface area of the car to yield a volume of paint which is converted into gallons.

For such tests the dry film thickness is measured the day after painting by using a PosiTector 2000 magnetic dry film thickness gauge. This gauge reads within 0.1 mil / 2.5 micron or 0.0001 inches. Before each car is measured, the gauge is standardized against a set of "certified Coating Thickness Calibration Standards" from the U.S. Department of Commerce, National Bureau of Standards.

In order to obtain a meaningful number for the average dry film thickness, approximately one hundred measurements should be taken on each car.

The other information required is the surface area that is painted. This is determined by actually measuring the car's tank shell and attachments such as number of ladder rungs, length and size of pipes, bolsters, brake equipment, gratings, grab irons and brackets. Measurements are verified by comparing to dimensions shown on the drawings used on each car's building order.

The gallons of paint solids applied to the car are calculated by the equation.

$$B = \frac{(X) \times (T) \times 7.48 \text{ gal./ft.}^3}{12 \text{ in./ft.} \times 1000 \text{ mils/in.} / 25{,}000 \text{ micron}}$$

Where

B = Paint solids on car, gallons

X = Area of car including attachments, ft^2

T = Average paint thickness, mils

The precision of the measurement of the surface area, B is probably within 2 percent. The precision of the average dry paint film thickness is probably within 5 percent. Thus, the overall precision of the volume precision of the volume of paint solids on the car is 7 percent. By combining the precision of the determination of the solids sprayed with the determination of the solids applied one can state that the transfer efficiency can be determined to +/- 14 percent. It would be difficult to determine this value more precisely than this.

SURFACE PREPARATION

Introduction:

The life of a protective coating depends largely upon the degree of surface cleanliness prior to application. There are no coatings available today which will provide long term protection in aggressive environments when applied over mill scale, active red rust, greases, oils, moisture, unsound coatings or other forms of surface contamination. Generally accepted views produced by the coatings industry suppliers and their regulatory organizations NACE and SSPC, give insight as to the problems and proper methods to insure durability. These are presented here for review.

Adhesion:

Protective coatings adhere by means of two mechanisms. The first is adhesion which can be defined as molecular attraction of the interfacial forces of both the coating and the substrate. The second is bonding which is a mechanical attachment or anchoring of the coating to the substrate. To insure integrity of the coating/substrate, interface, both adhesion and bonding must occur. This means that the surface cleanliness, and therefore, surface preparation is essential, i.e. the removal of interference products (named above) and development of a surface profile.

Cost of Surface Preparation:

The cost of surface preparation materials and labor is worthy of consideration as is the cost of application. Both are significantly more expensive than coatings materials. Therefore, it is essential that these three facets, surface preparation, application, and coatings materials be considered together as a total coatings system. One aspect cannot be neglected or limited without the entire system being jeopardized.

How Much Surface Preparation:

The degree of surface preparation or surface cleanliness necessary is dependent upon several factors.

+ Environment to which the substrate is exposed - If the environment is chemically aggressive, continuously immersed or extremely hot, then a high degree of surface cleanliness is essential. If, however, the environment is not aggressive, the surface preparation requirements may be minimal.

+ Expected service life - The life of a protective coatings system depends largely upon the degree of surface cleanliness. The best protective coating will perform poorly in an aggressive environment if applied over a poorly prepared surface.

Surface Preparation Standards

- National Association of Corrosion Engineers (NACE)
- Steel Structures Painting Council (SSPC)
- Swedish Standards (Sa, St)

National Association of Corrosion Engineers (NACE)

- NACE 1 White Metal Blast Cleaning
- NACE 2 Near-White Blast Cleaning
- NACE 3 Commercial Blast Cleaning
- NACE 4 Brush-Off Blast Cleaning

Steel Structures Painting Council (SSPC)

- SP-1 Solvent Cleaning
- SP-2 Hand Tool Cleaning
- SP-3 Power Tool Cleaning
- SP-5 White Metal Blast Cleaning
- SP-6 Commercial Blast Cleaning
- SP-7 Brush-Off Blast Cleaning
- SP-10 Near-White Blast Cleaning

Swedish Standards (Sa, St)

- St 2 Hand Tool Cleaning
- St 3 Power Tool Cleaning
- Sa 1 Brush-Off Blast Cleaning
- Sa 2 Commercial Blast Cleaning
- Sa 2 ½ Near-White Blast Cleaning
- Sa 3 White Metal Blast Cleaning

Surface Preparation Methods:

Surface preparation methods have been well defined by organizations such as the National Association of Corrosion Engineers (NACE), the Steel Structures Painting Council (SSPC), the American Society of Testing and Materials (ASTM), and the American Water Works Association (AWWA). NACE and ASTM have pictorial standards. Recently the SSPC, ASTM, Swedish Standards Institution and five other organizations jointly approved a pictorial reference book which shows the abrasive blast standards on new mill scale bearing steel, rusted steel with flaking mill scale, heavily rusted steel and steel which has visible pitting corrosion.

The surface preparation standards listed below are condensed from the SSPC and NACE texts. For complete definitions, please refer to either of the above references. The following is a brief explanation of surface preparation methods.

+ Solvent Cleaning (SSPC-SP 1): Prior to abrasive cleaning of steel substrates, it is imperative to solvent clean for removal of grease and oil. A misconception exists that abrasive cleaning removes grease and oil. In reality, it may remove a fraction of the contaminant, however, the remainder is impinged upon the substrate. To be effective a solvent cleaning operation must be implemented. Solvent must be rejuvenated periodically as it becomes saturated with grease and oil.

+ Steam Cleaning: This method effectively removes heavy deposits of dirt and grime due to a combination of high velocity, high temperature steam. The addition of caustic detergents or cleansers into the water will readily remove greases and oils by emulsification, suspension of an oil in water, or saponification, conversion of an oil to a water soluble material.

+ Hand Tool Cleaning (SSPC-SP 2, St 2): Procedure for removal of loose mill scale, loose rust, and loose paint by hand brushing, hand sanding, hand scraping, hand chipping, or other hand impact tools, or by a combination of the above methods.

+ Power Tool Cleaning (SSPC-SP 3, St 3): Procedure for removal of loose mill scale, loose rust, and loose paint with power wire brushes, power impact tools, power grinders, power sanders, or by a combination of the above methods. It is not intended that all mill scale, rust, and paint be removed by this process; however, loose mill scale, loose rust, loose paint and other detrimental foreign matter will be removed.

+ Commercial Blast Cleaning (SSPC-SP6, NACE No. 3, Sa 2): Procedure for removal of mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels. All oil, grease, dirt, rust scale, and foreign matter shall be completely removed from the surface according the SSPC-SP1. All rust, mill scale and old paint shall be completely removed except for slight shadows, streaks, or discolorations caused by rust stain, mill scale oxides or slight, tight residues of paint or coating that may remain. If the surface is pitted, slight residues of rust or paint may be found in the bottom of pits; at least two-thirds of each square inch of surface shall be free of all visible residues and the remainder shall be limited to the light discoloration, slight staining or tight residues mentioned above.

+ Brush-Off Blast Cleaning (SSPC-SP 7, NACE No. 4, Sa 1): Procedure for removal of loose mill scale, loose rust, and loose paint by the impact of abrasives propelled through nozzles or by centrifugal wheels. All oil, grease, dirt, rust scale, loose mill scale, loose rust and loose paint or coatings shall be removed completely. Tight mill scale and tightly0-adhering rust, paint and coatings are permitted to remain provided that the entire substrate is exposed to the abrasive blast patter sufficiently to expose numerous flecks of the underlying metal uniformly distributed over the entire surface.

+ Near-White Blast Cleaning (SSPC-SP 10, NACE No. 2, Sa 2 1/2): Procedure for removal of mill scale, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels. All oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter shall be completely removed from the surface except for very light shadows, very slight streaks, or slight discolorations caused by rust stain, mill scale oxides, or slight tight residues of paint or coating that may remain. At least 95 percent of each square inch of surface area shall be free of all visible residues, and the remainder shall be limited to the light discoloration mentioned above.

+ White Metal Blast Cleaning (SSPC-SP5, NACE No. 1, Sa 3): Procedure for removal of all mill scale, rust, rust scale, paint, or foreign matter by the use of abrasives propelled through nozzles or by centrifugal wheels. Defined as a surface with a gray-white, uniform metallic color, slightly roughened to form a suitable anchor patter for coatings. The surface, when viewed without magnification, shall be free of all oil, grease, dirt, visible mill scale, rust, corrosion products, oxides, paint, or any other foreign matter. The color of the clean surface may be affected by the particular abrasive medium used.

SURFACE PREPARATION COMPARISON CHART

Description Of Cleanliness	NACE	SSPC	Swedish Standard (St,Sa)
White Metal Blast	1	SSPC-SP 5	Sa 3
Near White	2	SSPC-SP 10	Sa $2^{1}/_{2}$
Commercial	3	SSPC-SP 6	Sa 2
Brush Blast	4	SSPC-SP 7	Sa 1
Solvent Cleaning	N/A	SSPC-SP 1	N/A
Hand Tool Cleaning	N/A	SSPC-SP 2	St 2
Power Tool Cleaning	N/A	SSPC-SP 3	St 3

Keys to successful surface preparation:

All forms of surface contamination, especially oil and moisture, must be eliminated.

Spent abrasive must be removed by sweeping or blowing down surfaces.

Remove weld spatter and slivers.

Keep abrasive clean.

Apply coatings prior to flash rusting of steel (usually 8 hours or less) after blasting.

Select abrasive of the proper size and hardness in relation to the type steel being used and surface profile desired.

Follow all applicable safety standards.

Inspection:

Surface preparation should be inspected at the time it is being performed. Pictorial standards (NACE, ASTM, SSPC, SA) or visual standards (NACE) may be used.

Surface Profile Depth:

The surface profile can be defined as the average measurement of the peaks and valleys present on the substrate.

Surface profile depth is determined by the velocity, size and hardness of the abrasive media in relation to the hardness of the substrate. Substrate condition, angle, and how the media is recycled are also factors in profile depth.

There are several ways to determine or measure this depth. Perhaps the best way, but the least practical, is by microscopic examination. Methods used in the field include the following:

+ Keane-Tator Surface Profile Comparator
+ PRESS-O-FILM: permanent record of the profile
+ Roughness Gauge
+ Surface Profile Gauge

Non-Ferrous Metals

These metals react or corrode when exposed to normal weathering conditions and form a surface oxide layer. This layer poses a potential adhesion problem for coatings and must therefore, be removed. Procedures are as follows:

+ Aluminum - Solvent clean in accordance with Steel Structures Painting Council Specification No. 1. "Solvent Cleaning." Brush blast or acid etches with Alum prep 33 to provide an etched surface.

+ Copper - Solvent clean and sand to remove oxides.

+ Galvanized Metal - Remove all oil, grease, dirt and foreign matter by solvent or detergent cleaning. Treat surface with Galvaprep 5 in accordance with manufacturer's printed instructions.

Concrete and Masonry

The masonry contractor should resurface air and water pits, splatter, protrusions, or other surface irregularities while the concrete is still "green."

Surfaces must be clean, dry and free from curing compounds, laitance, oil, grease, dirt, chalk, or previously applied coatings.

Poured and pre-cast concrete almost always have a surface layer of unreacted Portland cement and other particles known as "laitance." This Laitance represents a potential adhesion problem for coatings for two reasons. As many coatings cure, they generate stress, which may break the bond of the laitance to the concrete. The unreacted lines and Portland cement may interfere with the curing and bonding mechanism of the liquid coating. Acid etching, sweep blasting or other means prior to coatings application must therefore, remove Laitance.

To insure that the concrete is sufficiently dry to receive coatings, securely tape down approximately one square foot of 3 to 8 mil / 75 to 200 micron polyethylene plastic to several areas of the substrate.

This is especially important for corners and areas below grade. Areas should be inspected after a period of 12-24 hrs. Coatings should not be applied if any moisture is found on the backside of the polyethylene film or if the concrete beneath the plastic appears dark in color or moist when compared to the surrounding concrete or if the moisture content exceeds 8 percent. At such time as the concrete is judged to be sufficiently dry, then all surfaces (except those to receive acrylic, latex, or bituminous sealers) shall be brush blasted to remove all loose concrete, laitance, and provide a tooth for bonding.

Floors can also be acid etched with Muriatic Acid solution (1 part acid to 2 parts water). Apply solution by brush or spray until surface is wetted. When bubbling ceases (5 to 10 minutes), wash down surface with fresh water and scrub with a stiff brush. Rinse with plenty of water. If surface is acidic (pH below7), neutralize surface by washing with 1-2% ammonia solution. Allow surface to dry (less than 8% moisture) before coating.

Concrete Block

Remove all oil, grease, dirt and foreign matter. Rub surface with a masonry block or scrape with a 6" to 8" floor scraper to remove any mortar fins or protrusions. Remove loose foreign matter from block and sweep dust with bristle broom.

Previously Painted Surfaces

Remove all rust, rust scale, other corrosion products, loose or heavy chalk and loose or scaling paint by hand or power tool cleaning. Sand or brush blast glossy areas until dull and dust surfaces clean. Spot prime bare areas as recommended.

Before applying coating over large areas, underlying paint must be properly cured and compatible. Check compatibility by applying coating to as large an area as possible and allow curing. Then make crosshatch cuts through the coating and check adhesion by firmly applying masking tape to crosshatched area and removing with a fast pull. If the coating remains intact and there is no wrinkling, lifting, blistering or any sign of incompatibility present, coating work may then proceed. Always consult with Williams-Hayward Protective Coatings, Inc.'s Representative for specific coating recommendations over previously painted surfaces.

GALVANIC CORROSION

From a discussion on the gradual loss of one assets

The protection against loss of ones material assets or the subsequent premature devaluation past the point of their usefulness is and/or has been an essential factor in any sound economic strategy. We might say losses can occur as a result of two types of effects: those, which are internal in nature, and those, which are external in nature.

The internal effects are assumed to be generally controllable through proper design and engineering and are functions of well developed standards common to the industries furnishing the assets, e.g., grades of wood, brick, wiring, concrete, or metal, etc. Aside from uncharted new technologies, consumers have the option to accept or reject various grades in the construction of their assets.

Because any numbers of alternatives are available, the consumer does then indeed exert some form of "control", taking or not taking risks, which fix the means of internal loss.

Those effects that create "loss" beyond the "control" of the consumer are what we may refer to as external. External effects to loss may be a result of natural disasters: accidents or theft. While beyond the control of the consumer, these effects may be diminished significantly by using some form of alternate protection. This is the single greatest reason for the development of one of the most profitable entities in the history of economic growth in our country, that being: "The Insurance Industry". Therefore, one might assume that by mere growth of this industry the greatest loss to assets should be incurred by these external effects. This is not so, however, if you assets happened to be metallic in composition and steel by design. It is estimated that losses due to the very internal nature of steel to lend itself to corrosion amounts to billions of dollars annually and may be at the magnitude of 2-3% of the gross national product. Insurance, in conventional terms against this tendency to self-devaluate is for the most part unavailable and economically unaffordable for the devaluation processing may span as long as 30 years. Composition of steel may indeed reduce its self-destructive nature, but only moderately. So what then is the solution to the protection of these billions of dollars of assets? The answer being the primary function of this committee "Protective Coatings".

Historically, the use of coatings to protect steel had followed a band-aid type approach with little understanding of the process or the extent of the loss. This policy of covering up at minimal cost had persisted until the late 60's and early 70's, when book values of these assets drastically increased and the shipments of highly corrosive materials became more commonplace. Whether eroded by chemical attach, or nature itself, the protective barrier engulfing the metallic assets is at the mercy of a process, which will determine its longevity. This process is known as "Galvanic Corrosion". The understanding of Galvanic Corrosion is essential to the solution of Galvanic Protection.

Galvanic corrosion is an electrochemical process where dissimilar metals conductively connected immersed in an electrolytic solution such as salt water, creating the flow of an electric current resulting in chemical reaction. This circuit like any common electrical cell will be comprised of a positive (anodic) pole and a negative (cathodic) pole. The chemical reaction, which occurs, involves the dissolution of the anodic portion and is commonly known as corrosion. In this reaction, the cathodic portion will remain unchanged. What determines the anodic or corrosive portion of any metal-to-metal pair in the cell is its specific position on a pre-established table in what is known as the "electromotive series". A metal higher on this list will be the anode to that lower on the list (or cathode).

Steel is available in a wide variety of compositions as an alloy chemical (mixture) of iron carbon and various metals. Again, the choice of metal and its relationship to iron on the electromotive series will be the deciding factor whether the iron becomes the anode portion and corrodes at the surface. If, however, the alloy composition were truly uniform, surface corrosion could not occur for non-uniformity is necessary to create an electrical circuit.

The non-uniformity in steel is not only caused by chemical composition…it can be a result of physical stress, both through the forming and rolling process, and subsequent abrasion in handling and shipping. Since many of the common metals blended with iron in steel fall below it in the electromotive series, the non-uniformity needed is an electrolytic solution, such as, salt water and oxygen to initiate corrosion of the iron at the anode. Many factors are involved in the rate of surface corrosion, not the least of which is pH, temperature, type and concentration of electrolytic salt and the concentration of dissolved oxygen in the corrosive solution. Though complex a process as it is, the presence of galvanic corrosion in steel is more the rule than the exception.

Williams Hayward Protective Coatings believes the prevention and slowing down of the galvanic corrosion process will most assuredly involve an attempt to short-circuit or dope the galvanic cell. The most effective means is to insulate the conductors. We believe our "THERMALBOND" coating systems to be the best available insulators. Applied in multiple passes as barrier coats, these chemically resistant finishes retard attack of commodities at either side of the pH scale.

DEW POINT CALCULATION: Temperature (FAHRENHEIT)

AMBIENT AIR TEMPERATURE °F

% Relative Humidity	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°
90	18	28	37	47	57	67	77	88	97	107	117
85	17	26	36	45	55	65	75	84	95	104	113
80	16	25	34	44	54	63	73	82	93	102	110
75	15	24	33	42	52	62	71	80	91	100	108
7	13	22	31	40	50	60	68	78	88	96	105
65	12	20	29	38	47	57	66	76	85	93	103
60	11	19	27	36	45	55	64	73	83	92	101
55	9	17	25	34	43	53	61	70	80	89	98
50	6	15	23	31	40	50	59	67	77	86	94
45	4	13	21	29	37	47	56	64	73	83	91
40	1	11	18	26	35	43	52	61	69	78	87
35	-2	8	16	23	31	40	48	57	65	74	83
30	-6	4	13	20	28	36	44	52	61	69	77

Dew Point: Temperature at which moisture will condense on surface. No coatings should be applied unless surface temperature is a minimum of 5° F above this point. Temperature must be maintained during curing.

Example: If air temperature is 70° F and relative humidity is 65%, the dew point is 57° F. No coating should be applied unless surface temperature is 62° F minimum.

DEW POINT CALCULATION: Temperature (Celsius)

AMBIENT AIR TEMPERATURE °C

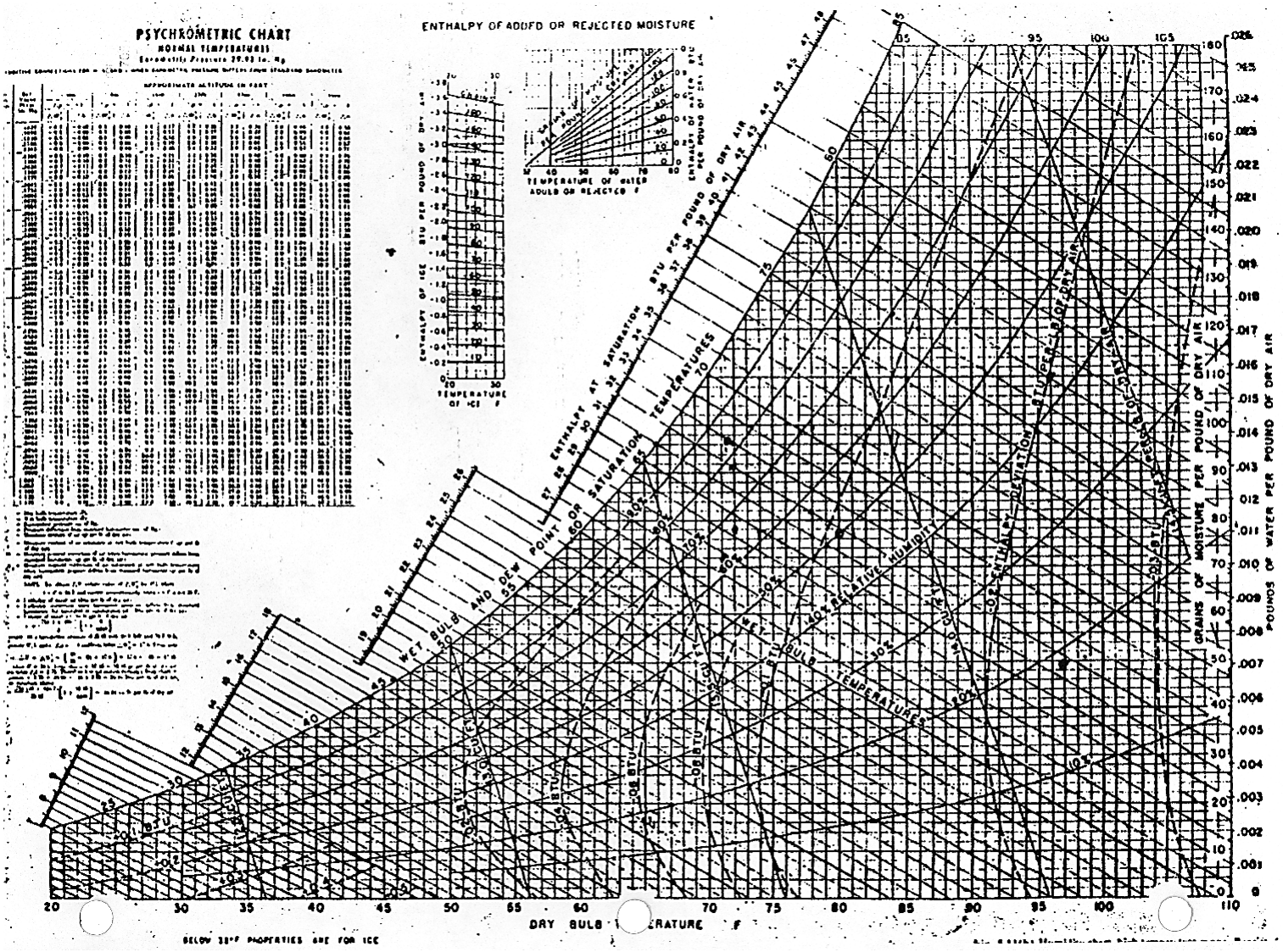
% Relative Humidity	-7°	-1°	4°	10°	16°	21°	27°	32°	38°	43°	49°
90	-8	-7	3	8	14	19	25	31	36	42	47
85	-8	-3	4	7	13	18	24	29	35	40	45
80	-9	-4	1	7	12	17	23	28	34	39	43
75	-9	-4	1	6	11	17	22	27	33	38	42
7	-11	-6	-1	4	10	16	20	26	31	36	41
65	-11	-7	-2	3	8	14	19	24	29	34	39
60	-12	-7	-3	2	7	13	18	23	28	33	38
55	-13	-8	-4	1	6	12	16	21	27	32	37
50	-14	-9	-5	-1	4	10	15	19	25	30	34
45	-16	-11	-6	-2	3	8	13	18	23	28	32
40	-17	-12	-8	-3	2	6	11	16	21	26	31
35	-19	-13	-9	-5	-1	4	9	14	18	23	28
30	-21	-16	-11	-7	-7	2	7	11	16	21	25

Dew Point: Temperature at which moisture will condense on surface. No coatings should be applied unless surface temperature is a minimum of -15° C above this point. Temperature must be maintained during curing.

Example: If air temperature is 21° C and relative humidity is 65%, the dew point is 14° C. No coating should be applied unless surface temperature is 17° C minimum.

INSTRUCTIONS: Intersect wet bulb temperature with dry bulb temperature. The intersection is the relative humidity. The horizontal line points to the dew point temperature on the left hand side of the chart.

EXAMPLE: 80° / 27° dry bulb if 60° / 16° wet bulb = 30% R.H. which also equals 46° F / 8° C Dew point.


PSYCHROMETRIC CHART
NORMAL TEMPERATURES
ENTHALPY OF ADDED OR REJECTED MOISTURE
DRY BULB TEMPERATURE F
BELOW 32°F PROPERTIES ARE FOR ICE
GRAINS OF MOISTURE PER POUND OF DRY AIR
POUNDS OF WATER PER POUND OF DRY AIR

TEMPERATURE CONVERSIONS

°C ←	°F	°C →	°C ←	°F	°C →	°C ←	°F	°C →	°C ←	°F	°C →
-17.8	0	32.0	10.6	51	123.8	38.9	102	215.6	73.8	165	329.0
-17.2	1	33.8	11.1	52	125.6	39.4	103	217.4	76.6	170	338.0
-16.7	2	35.6	11.7	53	127.4	40.0	104	219.2	79.3	175	347.0
-16.1	3	37.4	12.2	54	129.2	40.6	105	221.0	82.1	180	356.0
-15.6	4	39.2	12.8	55	131.0	41.1	106	222.8	85.0	185	365.0
-15.0	5	41.0	13.3	56	132.8	41.7	107	224.6	87.8	190	374.0
-14.4	6	42.8	13.9	57	134.6	42.2	108	226.4	90.5	195	383.0
-13.9	7	44.6	14.4	58	136.4	42.8	109	228.8	93.3	200	392.0
-13.3	8	46.4	15.0	59	138.2	43.3	110	230.6	96.1	205	401.0
-12.8	9	48.2	15.6	60	140.0	43.9	111	231.2	98.9	210	410.0
-12.2	10	50.0	16.1	61	141.8	44.4	112	233.0	101.6	215	419.0
-11.7	11	51.8	16.7	62	143.6	45.0	113	235.4	104.4	220	428.0
-11.1	12	53.6	17.2	63	145.4	45.6	114	237.2	107.2	225	437.0
-10.6	13	55.4	17.8	64	147.2	46.1	115	239.0	110.0	230	446.0
-10.0	14	57.2	18.3	65	149.0	46.7	116	240.8	112.7	235	455.0
-9.5	15	59.0	18.9	66	150.8	47.2	117	242.6	115.5	240	464.0
-8.9	16	60.8	19.4	67	152.6	47.8	118	244.4	118.2	245	473.0
-8.3	17	62.6	20.0	68	154.4	48.3	119	246.2	121.0	250	482.0
-7.8	18	64.4	20.6	69	156.2	48.9	120	248.0	123.8	255	491.0
-7.2	19	66.2	21.1	70	158.0	49.4	121	249.8	126.6	260	500.0
-6.7	20	68.0	21.6	71	159.8	50.0	122	251.6	129.4	265	509.0
-6.1	21	69.8	22.2	72	161.6	50.6	123	253.4	132.2	270	518.0
-5.6	22	71.6	22.7	73	163.4	51.1	124	255.2	135.0	275	527.0
-5.0	23	73.4	23.3	74	165.2	51.7	125	257.0	138.7	280	536.0
-4.5	24	75.2	23.9	75	167.0	52.2	126	258.8	140.5	285	545.0
-3.9	25	77.0	24.4	76	168.8	52.8	127	260.6	143.3	290	554.0
-3.4	26	78.8	25.0	77	170.6	53.3	128	262.4	146.1	295	563.0
-2.8	27	80.6	25.6	78	172.4	53.9	129	264.2	149.9	300	572.0
-2.3	28	82.4	26.1	79	174.2	54.4	130	266.0	151.7	305	581.0
-1.7	29	84.2	26.7	80	176.0	55.0	131	267.8	154.5	310	590.0
-1.1	30	86.0	27.2	81	177.8	55.5	132	269.6	157.2	315	599.0
-0.6	31	87.8	27.8	82	179.6	56.1	133	271.4	160.0	320	608.0
0.0	32	89.6	28.3	83	181.4	56.6	134	273.2	162.8	325	617.0
0.6	33	91.4	28.9	84	183.2	57.2	135	275.0	165.6	330	626.0
1.1	34	93.2	29.4	85	185.0	57.7	136	276.8	168.4	335	635.0
1.7	35	95.0	30.0	86	186.8	58.3	137	278.6	171.1	340	644.0
2.3	36	96.8	30.6	87	188.6	58.8	138	280.4	173.9	345	653.0
2.8	37	98.6	31.1	88	190.4	59.4	139	282.2	176.7	350	662.0
3.4	38	100.4	31.7	89	192.2	60.0	140	284.0	179.5	355	671.0
3.9	39	102.2	32.2	90	194.0	60.5	141	285.8	182.2	360	680.0
4.5	40	104.0	32.8	91	195.8	61.1	142	287.6	185.0	365	689.0
5.0	41	105.8	33.3	92	197.6	61.6	143	289.4	187.8	370	698.0
5.6	42	107.6	33.9	93	199.4	62.2	144	291.2	190.6	375	707.0
6.1	43	109.4	34.4	94	201.2	62.7	145	293.0	193.4	380	716.0
6.7	44	111.2	35.0	95	203.0	63.3	146	294.8	196.1	385	725.0
7.2	45	113.0	35.6	96	204.8	63.8	147	296.6	198.9	390	734.0
7.8	46	114.8	36.1	97	206.6	64.4	148	298.4	201.7	395	743.0
8.3	47	116.6	36.7	98	208.4	65.0	149	300.2	204.4	400	752.0
8.9	48	118.4	37.2	99	210.2	65.5	150	302.0	207.2	405	761.0
9.5	49	120.2	37.8	100	212.0	68.3	151	311.0	210.0	410	770.0
10.0	50	122.0	38.3	101	213.8	71.0	152	320.0	212.8	415	779.0

UNIT CONVERSIONS

LINEAR

	Inch	Mil	Cm	Mm	Micron
Inch	1	1,000	2.54	25.4	25,400
Mil	.001	1	.00254	.0254	25.4
Cm	.3937	393.7	1	10	10,000
Mm	.03937	39.37	.10	1	1,000
Micron	.00003937	.03937	.0001	.001	1

AREA

	Sq. In.	Sq. Ft.	Sq. Yd.	m^2
Sq. In.	1	.006944	.0007716	.0006452
Sq. Ft.	144	1	.1111	.0929
Sq. Yd.	1,296	9	1	.8361
m^2	1,550	10.7638	1.196	1

VOLUME

	US Gal.	Imp. Gal.	Liter	Cu. In.	Cu. Ft.
US Gal.	1	.8327	3.785	231	.1337
Imp. Gal.	1.201	1	4.546	277.4	.1606
Liter	.2642	.22	1	61	.0353
Cu. In.	.00433	.00361	.0164	1	.00058
Cu. Ft.	7.481	6.229	28.316	1,728	1

SPREADING RATE

	US Gallon		Imp. Gallon		Liter	
Mils	Sq. Ft.	m^2	Sq. Ft.	m^2	Sq. Ft.	m^2
.25	6,416.0	596.0	7,706.0	715.8	1,695.0	157.5
.50	3,208.0	298.0	3,853.0	357.9	847.6	78.7
.75	2,138.0	198.6	2,568.0	238.5	564.9	52.5
1.00	1,604.0	149.0	1,926.0	178.9	423.8	39.4
1.50	1,069.0	99.3	1,284.0	119.3	282.4	26.2
2.00	802.0	74.5	963.2	89.5	211.9	19.7
2.50	641.6	59.6	770.6	71.6	169.5	15.7
3.00	534.7	49.7	642.2	59.7	141.3	13.1
3.50	458.3	42.6	550.4	51.2	121.1	11.3
4.00	401.4	37.3	481.6	44.8	105.9	9.9
4.50	356.4	33.1	428.0	39.8	94.2	8.7
5.00	320.8	29.8	385.3	35.8	84.8	7.9
6.00	267.3	24.8	321.0	29.8	70.6	6.6
7.00	229.1	21.3	275.1	25.6	60.5	5.6
8.00	200.5	18.6	240.8	22.3	53.0	4.9
9.00	178.2	16.6	214.0	19.9	47.1	4.4
10.00	160.4	14.9	192.6	17.9	42.4	3.9

8.0 PRICE CONVERTER

This table aids in converting prices from US dollars per unit, to another currency per unit, or another unit.

Equation: $$C_2U_2 = \frac{C_1(E)}{U_1(F)}$$

where
C_1 = Amount in US dollars
C_2 = Amount in desired currency
U_1 = Units quoted
U_2 = Units desired
E = Exchange rate (US dollar = 1)
F = Unit conversion factor (Unit quoted = 1)
D = Density

UNIT CONVERSION TABLE

Units Desired / Units Quoted	Lb.	Kg	Ton	Metric T	US Gal.	Imp. Gal.	Liter
Lb.	1	.454	.0005	.000454	$\frac{.1201}{D}$	$\frac{.1}{D}$	$\frac{.454}{D}$
Kg	2.2	1	.0011	.001	$\frac{.2642}{D}$	$\frac{.22}{D}$	$\frac{.1}{D}$
Ton	2,000	907.2	1	.9702	$\frac{240.2}{D}$	$\frac{200}{D}$	$\frac{907.2}{D}$
Metric Ton	2,204	1,000	1.102	1	$\frac{264.2}{D}$	$\frac{220}{D}$	$\frac{1,000}{D}$
US Gal.	D(8.327)	D(3.785)	D(.004164)	D(.003785)	1	.8327	3.785
Imp. Gal.	D(10)	D(4.54)	D(.005)	D(.00454)	1.201	1	4.54
Liter	D(2.2)	D(1)	D(.0011)	D(.001)	.2642	.22	1

PARTICLE SIZE TABLE
SIEVE INFORMATION

SIEVE SIZE	OPENING		
U.S. Mesh	Inches	Microns	Millimeters
4	.187	4760	4.76
5	.157	4000	4.00
6	.132	3360	3.36
7	.111	2830	2.83
8	.0937	2380	2.38
10	.0787	2000	2.00
12	.0661	1680	1.68
14	.0555	1410	1.41
16	.0469	1190	1.19
18	.0394	1000	1.00
20	.0331	840	.84
25	.0280	710	.71
30	.0232	590	.59
35	.0197	500	.50
40	.0165	420	.42
45	.0138	350	.35
50	.0117	297	.297
60	.0098	250	.250
70	.0083	210	.210
80	.0070	177	.177
100	.0059	149	.149
120	.0049	125	.125
140	.0041	105	.105
170	.0035	88	.088
200	.0029	74	.074
230	.0024	62	.062
270	.0021	53	.053
325	.0017	44	.044
400	.0015	37	.037

E

APPLICATION TECHNICQUES FOR TRANSPORTATION INDUSTRIES

Thermalbond/Eurotbond and NO-VOC systems are best understood when you consider them as a powder coating dispersed in aqueous media. Doing so explains their superior durability over other candidates and gives insight into the type of chemistry used. It would be chemically impossible to formulate a solvent solution coating with acrylic, vinyl, and rubber, and have a spray able product; however, in powder, all this is possible for solubility is not a factor. To this point we now have aqueous urethane systems, known as Aquathane, that are acrylic/epoxy/and urethane polymers in a single package coating. We believe there is no limit to the possibilities and this is what excites us.

To use these products successfully, not much is required other than sound painting principles:

Metal Preparation

A The substrate should be free of grease or oil.

B SSPC-SP-6 or NACE commercial blast is required.

C The substrate should not be below 40° F / 4° C when applying paint.

D When all possible avoid applying within 5° F / -15° C of the dew point.

E If applying in dew point, in-line heaters are required to evaporate moisture from the paint to compensate for the dew on the substrate.

Equipment

A Standard airless or air assisted airless equipment may be used.

B Electrostatics may also be used by isolating the paint; consult your equipment manufacturer. Waterborne coatings have been applied electro statically successfully over the past 15 years in industrial and automotive industries.

C Air movement is more important to drying of Thermalbond products than is heat. The use of large box fans placed strategically around the unit to be dried can yield dry to stencil times of one hour, even at 97% humidity.

D In-line heaters with temperature of 100°-110° F / 38°-43° C are of great assistance when painting in extremely humid conditions near dew point.

E For painting in environments that are 100° F / 38° C or higher with little humidity and the substrate is ambient; solvent modifications must be made to retard dry. V.O.C. increases usually of 0.5 - 0.9 may be required.

F Every facility should have a means of recording relative humidity and temperature and substrate temperature to determine dew points.

G Airless pumps of 30:1 and 45:1 type are recommended.

H Pumps should have leather packing removed and replaced with Teflon because continuous use of water will dry and crack the leather, causing pump failures.

I A variety of tips should be available. For most conditions 6/17's and 6/19's reversatips are adequate. If, however, in-line heaters are not available for dew point application, tips such as 8/19's and 9/21's will aid in evaporating water.

J All painters should have wet film gauges and be trained in their use. (Williams-Hayward Protective Coatings, Inc. provides training sessions prior to conversion).

K A water line should be present in the paint area to keep equipment clean.

L Keep in mind fast drying paints will dry fast on the equipment; also, placing guns in a bucket of water after use will go a long way to reduce mechanical problems.

M If ovens exist, low temperatures with high CFMS (air movement) are desirable.

The Coating

Thermalbond & Eurotbond products are moisture resistant once they are thoroughly dry to touch, usually in 1-2 hours, under standard temperatures and conditions.

B Being powders, their fusion occurs gradually, developing cohesion before adhesion. The film is in the vinyl or plastic state for 72 hours, and is tough and durable to the elements, is pliable and may be torn with a knife. As with most coatings 90% of the dry film properties occur within 7 days with final cure occurring within 30-45 days.

C The viscosity of Thermalbond/Eurotbond products is variable and may be adjusted to hang 20-60 wet mils / 500-1,500 microns if so desired. Normally, viscosities are set to hang 10-12 mils / 250-300 microns wet, 4-5 mils / 100-125 microns dry.

D If aluminum or stainless are to be sprayed, the substrate should be degreased with citric acid or oxalic acid cleaner.

E Thermalbond/Eurotbond reflective coatings are available for auto rack use.

F Thermalbond/Eurotbond non-skid is also available. This product is as tough and abrasion resistant as the DTM's, eliminating the heat-softening problems associated with cheap non-skids.

G Certain Thermalbond/Eurotbond coatings have been USDA approved for use on abrasion resistant interior liners for plastic pellets and grains and interior boxcar liners.

Cost

The true cost of any coating system is based upon six factors:

A Price Per Gallon

B Volume Solids

C Transfer Efficiency

D Waste Disposal Costs

E Equipment Costs

G Production Throughput

H Solvent purchases

To evaluate a product cost without using all factors may be misleading.

"THERMALBOND3 /EUROTBOND3 COPOLYMER ACRYLICS"

SPECIAL EXTERIOR PAINT RECOMMENDATIONS FOR CONCENTRATED & DILUTE ALKALI, SULPHUR AND WEAK ORGANIC ACIDS FOR STORAGE VESSELS AND TRANSPORTAITON EQUIPMENT

A. **Surface Preparation** -

All surfaces to be painted shall be blasted to a commercial blast cleaning specification (SSPC-SP6-63), with a 2 - 2 1/2 mil / 50-62.5 micron profile on new cars. Center band or hatch cover areas of repainted units with signs of severe metal fatigue, due to commodity exposure will require an SSPC-SP10 blast to remove all visible signs of residual commodity staining. All dust and abrasive shall be removed either by blowing with compressed air or vacuum. The trucks, center plates, air hose and AB vents shall be protected during blasting. Couplers, trucks and AB valve shall not be blasted. Paint car same day it is blasted.

B. Priming -3 dry mils / 75 micron minimum center band or hatch cover areas. 3 dry mils / 75 micron minimum are to be applied to the remainder of the unit.

Primer: #62-10332CHS THERMALBOND BLACK or #62-10550 THERMALBOND NO-VOC.

1. Surface to be primed shall be at 50° F / 10° C.
2. Agitate paint before application. Use conventional airless equipment. CAUTION: Do not use existing electrostatic equipment -- Consult equipment manufacturer for proper grounding techniques.
3. All lines should be rinsed with WHPC, Inc.'s Solvent R-6958, and then water before pumping Thermalbond DTM paint. The use of 6-17's or 6-19's tips are recommended for the most uniform application. 21 thousand orifices are not recommended. Clear coats require 6-15s or 6-11s.
4. To center band area or hatch cover areas, apply an initial cross coat of 3 dry mils / 75 microns of primer. While these areas are setting up, begin painting the main body ends and underbody, applying 2-3 mils / 50-75 micron dry. The center band and hatch cover areas must be set to touch by the time it has been reached to apply 3 mils dry / 75 micron again.
5. Note: Side sheet weld seams generally protrude on hoppers and tend to repel wet pain, to insure proper dry millage tack coating may be needed in these areas.
6. Allow prime coat to dry 4-6 hours prior to top coating.
7. See - Application Notes - on page 3.

Top Coating: 3 dry mils / 75 micron of topcoat are to be applied to the entire unit.

Top Coats: #72-6134 THERMALBOND WHITE
#72-6427 THERMALBOND WHITE
#12-5850 THERMALBOND GRAY
#12-5850 HG THERMALBOND HIGH GLOSS GRAY
#62-7521 HG THERMALBOND HIGH GLOSS BLACK

The final dry film thickness should be 6 mils / 150 microns minimum on the bulk of the unit with 9 mils / 225 microns minimum in the center band and hatch cover areas.

Stenciling: #62-10332CHS THERMALBOND BLACK and
#72-6134 THERMALBOND WHITE for all stencils

Theoretical Thickness Chart: Pump 50 on 30:1 Bulldog using 6-19 tips

Products	*Wet Mills/ Microns*	*DFT Mils/Microns*	*Vol.Sol.*	*V.O.C.*
#72-6134 White #12-5850 Gray	6.25/156.25 9.4/235	2/50 3/75	32	1.60
#72-6427 White #12-5850HG Hi Gloss Gray #62-7521HG Hi Gloss Black	4.8/120 7.3/182.5	2/50 3/75	41	0.73
#62-10332CHS Graphite	4.76/119 7.14/178.5	2/50 3/75	42	0.50
#62-10550 Graphite	3.64/91 5.45/136.25	2/50 3/75	55	N/A
#C-10397WM Clear	1.8/45 2.1/52.5	6/150 7/175	30	0.54

NOTE: Critical to the final durability and resistance of the coating to these severely corrosive commodities is close adherence to the specified dry film thickness charts and correlating car numbers for our computer records. If charts are not accessible, blank charts are available free-of-charge from our laboratories.

Alternative: Stencil Paints for Roller Applications

#72-6134R THERMALBOND WHITE - Roller
#72-6022R THERMALBOND BLACK - Roller

"THERMALBOND3/EUROTNOD3 COPOLYMER ACRYLICS"

SPECIAL EXTERIOR PAINT RECOMMENDATIONS FOR CONCENTRATED SULFURIC ACID, CHLORINE AND STRONG MINERAL ACIDS OR EXTREMELY AGGRESSIVE ORGANIC COMPOUNDS FOR STORAGE VESSELS AND TRANSPORTATION EQUIPMENT:

A. **Surface Preparation** -

All surfaces to be painted shall be blasted to a commercial blast cleaning specification (SSPC-SP6-63). All dust and abrasive shall be removed either by blowing with compressed air or vacuum. The trucks, center plates, air hose and AB vents shall be protected during blasting. Couplers, trucks and AB valve shall not be blasted. Paint car same day it is blasted.

B. Priming - 8 dry mils / 200 microns minimum center band or hatch cover areas. 4 dry mils / 100 microns minimum are to be applied to the remainder of the unit.

Primer: #62-10332CHS THERMALBOND BLACK or #62-10550 THERMALBOND NO-VOC.

1 Surface to be primed shall be at 50° F / 10° C.
2 Agitate paint before application. Use conventional airless equipment. CAUTION: Do not use electrostatic equipment.
3 All lines should be rinsed with WHPC, Inc.'s cleaning solvent R-6958, and then water before pumping Thermalbond/Eurotbond DTM paint.
4 The use of 6-17s or 6-19s tips is recommended for the most uniform application. 21 thousand orifices are not recommended.
*5 To center band area; apply an initial cross coat of 4 dry mils / 100 microns or primer. While the center area is setting up, begin painting the main body ends and underbody, applying 4 mils dry / 100 micron. The center band area must be set to touch by the time it has been reached to apply 4 mils / 100 micron dry again. Allow prime coat to dry 4-6 hrs. prior to top coating.
6 Note: Side sheet weld seams generally protrude on hoppers and tend to repel wet paint; to insure proper dry millage, tack coating may be required to top coating.
7 Allow prime coat to dry 4-6 hours prior to top coating.
8 See - Application Notes - on page 3.

* The use of T-6520A will permit single coat applications under various conditions.
(See page 5.)

Top Coating: Apply 4 dry mils minimum to the entire unit.

Top Coats: #72-6134 THERMALBOND WHITE
#72-6427 THERMALBOND WHITE
#12-5850 THERMALBOND GRAY
#12-5850 HG THERMALBOND HIGH GLOSS GRAY
#62-7521 HG THERMALBOND HIGH GLOSS BLACK
#62-10332CHS THERMALNOND GRAPHITE BLACK

The final dry film thickness range should be 8 mils / 200 micron minimum on the bulk of the unit with 12 mils / 300 micron minimum in the center band and hatch cover areas.

Stenciling: #62-10332CHS THERMALBOND BLACK and
#72-6134 THERMALBOND WHITE for all stencils

Theoretical Thickness Chart: Pump 50 on 30:1 Bulldog using 6-19 tips

Products	*Wet Mills/ Microns*	*DFT Mils/Microns*	*Vol.Sol.*	*V.O.C.*
#72-6134 White	6.25/156.25	2/50	32	1.60
#12-5850 Gray	9.4/235	3/75		
#72-6427 White	4.8/120	2/50	41	0.73
#12-5850HG Hi Gloss Gray	7.3/182.5	3/75		
#62-7521HG Hi Gloss Black				
#62-10332CHS Graphite	4.76/119	2/50	42	0.50
	7.14/178.5	3/75		
#62-10550 Graphite	3.64/91	2/50	55	N/A
	5.45/136.25	3/75		
#C-10397WM Clear	1.8/45	6/150	30	0.54
	2.1/52.5	7/175		

NOTE: Critical to the final durability and resistance of the coating to these severely corrosive commodities is close adherence to the specified dry film thickness. Please supply Williams-Hayward with the final film thickness charts and correlating car numbers for our computer records. If charts are not accessible, blank charts are available free-of-charge from our laboratories.

Alternative: Stencil Paints for Roller Applications

#72-6134R THERMALBOND WHITE - Roller
#72-6022R THERMALBOND BLACK - Roller

THERMALBOND/EUROTBOND CLEAR SEAL-COAT RECOMMENDATIONS

Function:

To seal THERMALBOND/ EUROTBOND DTM'S and stencil paints yielding a high-gloss chemical and UV resistant finish.

60 deg. Gardner Gloss Ratings -

70-80 DTM No Clear Coat
92-96 DTM Plus 2 dry mils / 50 microns of Clear Coat

Application:

A Be sure DTM has dried 6-8 hours prior to seal coating.

B Apply a range of 2-4 dry mils / 50-100 microns of Seal Coat, using a cross-coat method at appropriate wet mils determined by the volume solids; apply 50% horizontally and 50% vertically. The amount of Clear Seal depends on the depth of gloss and abrasion resistance desired. Wait a minimum of 3 hours between subsequent clear coatings. A normal turbid appearance results on application; this will dry to a clear glossy finish.

C Clear Coat will dry in 2-3 hours.

D Airless tips: 6-11s, 6-15s, or 6-17s.

E Airless pump pressures of 1,200-1500 psi maximum are required. The use of higher pressures will create situations of sagging and dry spray generation and are not recommended.

PAINTING PROCEDURE FOR INTERMODAL SPINE / WELL CARS

A. Painters must make sure the unit is free of any type of contamination before painting is to begin, i.e., loose blast media, oil or grease, moisture, etc. Failure to follow this procedure can result in lack of adhesion of the coating and separation of paint form the substrate. A commercial blast is the minimum accepted. No blast is unacceptable.

B. Once unit is ready to paint, stripe in all welds, hard-to-reach areas, such as, channels between pipes, diagonal pedestal support brace, grooves under walk area, edges of unit top and bottom, and pedestal boxes. Stripping these areas first will eliminate the missed area problems on the units, thus avoiding excessive touch-up.

C. Once unit is striped completely, paint the underneath of the unit with 10-12 wet mils / 250-300 wet microns. Paint under the corrugated wheel wells.

D. Lower unit.

E. Begin painting main body of unit with 10-12 wet mils / 250-300 wet microns in a cross-coat overlapping pattern, making sure to cover striped-in areas and all other areas discussed in Step 1. Pay close attention to areas above pipes.

F. When the main body area is finished, begin painting the top of the unit, cutting in the boxed area first. Paint the center area from the hitch towards the corrugated wheel wells. Each painter then paints his corrugated wheel wells and half of center next, making sure to overlap each other's passes on top of unit.

(NOTE: The painter "must" walk the top sill, applying 12-14 wet mils / 300-350 wet microns of paint to wet out any dry spray that has landed there. To avoid airborne dust or paint dust, brush off the sill prior to painting.)

H. While painting the top, spray down above the pipes and underneath the lip. This procedure will guarantee that all falling paint will land on wet paint and blend in.

I. Once finished, each painter should walk around the unit and double check hidden areas before moving the unit to the drying area.

J. Once in the drying area, re-check usual areas of concern and touch them up before moving to the stencil bay.

Williams-Hayward Protective Coatings, Inc.

Boxcar Exterior Specification 62-223-5-7

This specification describes the cleaning, surface preparation, and general application parameter of generic exterior boxcar coatings. Specific instruction may supersede these instructions based on the nature of commodity or service.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during storage, handling, application, cure, and disposal. All work must be performed in strict accordance, but not limited to applicator's corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Skilled workmen shall perform work in a safe and workmanlike manner.

C.) **Car Exterior Cleaning**:

1 Remove all commodity spillage prior to blast. Remove oil and grease by solvent washing per SSPC-SP1.

D.) **Exterior Box Car Surfaces**:

1 All welds are to be continuous with no skip welds, weld splatter, slivers, or slag.

E.) **Surface Preparation**:

1 Blast interior to NACE 3 or SSPC-SP-6 commercial blast condition.
- a Plant air is to be free from moisture and oil.
- b Grit is to be clean and free of contaminates.
- c Blast nozzle pressure is to be a minimum of 90 psi.

2 Blast profile is to be continuous and equal to 1.5 mils or better / 37.5 microns.

F.) **Exterior Application**:

1 Car to be coated within eight hours of blast. Shop, metal temperature, and material temperature to be minimum 70° F / 21° C.

2 Remove all dust, abrasives and foreign material before painting.

3 Record Dew Point readings within paint room/spray booth. Retain readings as part of the car's permanent record. Do not coat car unless there is an 8° read between surface temperature and dew point. Record of conditions must be retained as part of the car's permanent record.

4 Record material number, and batch number. Retain as part of the car's permanent record.

5 Coating is to be mixed and thinned per manufacturer's current technical bulletin. Manufacturer's recommended thinner must be used unless otherwise advised by WHPC. Record thinning as part of the car's permanent record.

6 In the event that the specified systems require two coats, follow applicable Williams-Hayward technical bulletin for instructions on minimum and maximum intervals prior to recoat.

7 Apply material by airless spray in accordance with coating manufacturer's current recommendation unless otherwise specified by WHPC.

8 Material must be applied to a thickness specified by WHPC. Coverage is to be monitored during all applications. Sprayers **must** use wet mil gages to periodically check film build.

9 Repair any runs, sags, or coating discontinuities prior to recoat.

10 Coated surfaces must be free from all dust and foreign materials before recoating.

G.) **Intermediate Inspection**:

1 Required in the event of multiple coat applications. DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils. DFT mil gauges should be periodically calibrated. A total of 60 mil readings must be taken per vessel, pre coat. DFT readings must be retained as part of the car's permanent record. Film thickness will be specified as to acceptable minimum and maximum.

H.) **Final Inspection**:

1 Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray and trash.

2 Final cure cycle must be performed in accordance with WHPC current technical bulletin.

3 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils. DFT gauge is to be calibrated before use. A total of 60 mil readings must be taken per coat. Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin. DFT readings must be retained as part of the car's permanent record.

Williams-Hayward Protective Coatings, Inc.

Hopper Car Exterior Specification 83-222-5-7

This specification describes the cleaning, surface preparation, and general application parameter of generic exterior tank car coatings. Specific instruction may supersede these instructions based on the nature of commodity or service.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during: storage, handling, application, curing and disposal. All work is to be performed in strict accordance, but not limited to applicators' corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Skilled workmen shall perform work in a safe and workmanlike manner.

C.) **Car Exterior Cleaning**:

1 Remove all commodity spillage prior to blast. Remove oil and grease by solvent washing per SSPC-SP1.

D.) **Exterior Tank Car Surfaces**:

1 All welds are to be continuous with no skip welds, weld splatter, slivers, or slag.

E.) **Surface Preparation**:

1 Blast interior to NACE 3 or SSPC-SP-6 commercial blast condition.
- a Plant air is to be free from moisture and oil.
- b Grit is to be clean and free of contaminates.
- c Blast nozzle pressure is to be a minimum of 90 psi.

2 Blast profile is to be continuous and equal to 1.5 mils or better / 37.5 microns.

3 Sample a minimum of four areas for blast profile using the appropriate TESTEX tape. These tapes are to be maintained as part of the car's permanent record.

4 SCAT Test steel substrate at areas where previous surface corrosion has occurred. Retain test strips as part of the permanent car record.

5 If car shows signs of contaminates per SCAT test high-pressure wash areas and then reblast. Retest and retain strips as a part of the car's permanent record. Note: Failure to remove existing surface contaminates will result in premature coating failure.

F.) **Exterior Application**:

1 Car to be coated within eight hours of blast. Shop, metal temperature, and material temperature to be minimum 70° F 21° C.

2 Remove all dust, abrasives and foreign material before painting.

3 For best results, all weld seams should be striped with properly thinned material.

4 Record Dew Point readings within paint room/spray booth. Retain readings as part of the car's permanent record. Do not coat car unless there is an 8° read between surface temperature and dew point. Record of conditions must be retained as part of the car's permanent record.

5 Record material number, and batch number. Retain as part of the car's permanent record.

6 Coating is to be mixed and thinned per manufacturer's current technical bulletin. Manufacturer's recommended thinner must be used unless otherwise advised by WHPC. Record thinning as part of the car's permanent record.

7 In the event that the specified system requires two coats, follow applicable Williams-Hayward technical bulletin for instructions on required minimum and maximum intervals before recoat.

8 Apply material by airless spray unless otherwise specified by WHPC.

9 Material must be applied to a thickness specified by WHPC. Coverage is to be monitored during all applications. Sprayers **must** use wet mil gages to periodically check film build.

10 Repair any runs, sags, or coating discontinuities remove dust and foreign materials prior to recoat

G.) **Intermediate Inspection**:

1 Required in the event of multiple coat applications.

2 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge.

3 Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils.

4 Make sure gauges are properly calibrated before use.

5 A total of 60 mil readings must be taken per coat unless otherwise specified.

6 DFT readings must be retained as part of the car's permanent record.

7 Recommended film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

H.) **Intermediate Cure**:

1 Curing of coating between coats must be performed in accordance with current WHPC technical bulletin. Documentation of cure cycle must be retained as part of the car's permanent record.

I.) **Final Inspection**:

1 Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray and trash.

2 Final cure cycle must be performed in accordance with WHPC current technical bulletin. Documentation of cure cycle must be retained as part of the car's permanent record.

3 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils. Make sure gauge is properly calibrated before use. A total of 60 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record. Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

Williams-Hayward Protective Coatings, Inc.

Tank Car Exterior Specification 20-222-5-7

This specification describes the cleaning, surface preparation, and general application parameter of generic exterior boxcar coatings. Specific instruction may supersede these instructions based on the nature of commodity or service.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during storage, handling, application, curing and disposal. All work must be performed in strict accordance, but not limited to applicators' corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Skilled workmen shall perform work in a safe and workmanlike manner.

C.) **Car Exterior Cleaning**:

1 Remove all commodity spillage prior to blast. Remove oil and grease by solvent washing per SSPC-SP1.

D.) **Exterior Box Car Surfaces**:

1 All welds are to be continuous with no skip welds, weld splatter, slivers, or slag.

E.) **Surface Preparation**:

1 Blast interior to NACE 3 or SSPC-SP-6 commercial blast condition.
- a Plant air is to be free from moisture and oil.
- b Grit is to be clean and free of contaminates.
- c Blast nozzle pressure is to be a minimum of 90 psi.

2 Blast profile is to be continuous and equal to 1.5 mils or better / 37.5 microns.

3 Sample a minimum of four areas for blast profile using the appropriate TESTEX tape. These tapes are to be maintained as part of the car's permanent record.

4 SCAT Test steel substrate at areas where previous surface corrosion has occurred. Retain test strips as part of the permanent car record.

5 If car shows signs of contaminates per SCAT test high-pressure wash areas and then reblast. Retest and retain strips as a part of the car's permanent record. Note: Failure to remove existing surface contaminates will result in premature coating failure.

F.) **Exterior Application**:

1 Car to be coated within eight hours of blast. Shop, metal temperature, and material temperature to be minimum 70° F / 21° C.

2 Remove all dust, abrasives and foreign material before painting.

3 For best results, all weld seams should be striped with properly thinned material.

4 Record Dew Point readings within paint room/spray booth. Retain readings as part of the car's permanent record. Do not coat car unless there is an 8-degree read between surface temperature and dew point. Record of conditions must be retained as part of the car's permanent record.

5 Record material number, and batch number. Retain as part of the car's permanent record.

6 Coating is to be mixed and thinned per manufacturer's current technical bulletin. Manufacturer's recommended thinner must be used unless otherwise advised by WHPC. Record thinning as part of the car's permanent record.

7 In the event that the specified system requires two coats, follow applicable Williams-Hayward technical bulletin for instructions on required minimum and maximum intervals before recoat.

8 Apply material by airless spray unless otherwise specified by WHPC.

9 Material must be applied to a thickness specified by WHPC. Coverage is to be monitored during all applications. Sprayers **must** use wet mil gages to periodically check film build.

10 Repair any runs, sags, or coating discontinuities prior to recoat.

11 Coated surfaces must be free from all dust and foreign materials before recoating.

G.) **Intermediate Inspection**:

1 Required in the event of multiple coat applications. DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitably cured materials and recorded in mils. Make sure gauge is properly calibrated before each use. A total of 60 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record. Recommended film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

H.) **Intermediate Cure**:

1 Curing of coating between coats must be performed in accordance with current WHPC technical bulletin. Documentation of cure cycle must be retained as part of the car's permanent record.

I.) **Final Inspection**:

1 Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray and trash.

2 Final cure cycle must be performed in accordance with WHPC current technical bulletin. Documentation of cure cycle must be retained as part of the car's permanent record.

3 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils. Make sure gauge is properly calibrated before use. A total of 60 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record. Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

F

Williams-Hayward Protective Coatings, Inc.

Box Car Interior Specification 62-223-9-7

This specification describes the cleaning, surface preparation, and general application parameter of generic interior boxcar coatings. Specific instruction may supersede these instructions based on the nature of commodity or service.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during storage, handling, application, curing and disposal. All work must be performed in strict accordance, but not limited to applicators' corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Skilled workmen shall perform work in a safe and workmanlike manner.

C.) **Car Cleaning**:

1 Car interior is to be suitable cleaned to remove any residual commodity and provide a safe environment for workmen.

D.) **Interior Hopper Surfaces**:

1 All welds are to be continuous with no undercutting skip welds, delimitation, scabs, slivers, and slag must be repaired and removed.

2 Inspect and remove oil, or grease that might remain by SSPC-SPI-82 Solvent Cleaning just prior to interior blasting.

E.) **Surface Preparation**:

1 Blast interior to NACE 3 or SSPC-SP-6 commercial blast condition.
- a Plant air is to be free from moisture and oil.
- b Grit is to be clean and free of contaminates.
- c Blast nozzle pressure is to be a minimum of 90 psi.

2 Anchor patter is to be continuous and equal to 25% of final DFT.

3 Inspect substrate to assure that it is cleaned as specified.

a Sample a minimum of four areas for blast profile using the appropriate TESTEX tape. These tapes are to be maintained as part of the car's permanent record.

F.) **Interior Application**:

1 Car to be coated within eight hours of blast. Shop, metal temperature, and material temperature to be minimum 70° F / 21° C.

2 Vacuum interior to remove all dust and abrasives.

3 Stripe weld seams with material thinned per WHPC technical bulletin.

4 Take and record Dew Point readings within vessel. Retain readings as part of the car's permanent record. Do not coat car unless there is an 8-degree read between surface temperature and dew point. Record of conditions must be retained as part of the car's permanent record.

5 Record material number, and batch number. Retain as part of the car's permanent record.

6 Coating is to be mixed and thinned per manufacturer's current technical bulletin. Manufacturer's recommended thinner must be used unless otherwise advised by WHPC. Record amount of thinning as part of the car's permanent record.

8 Apply by airless spray in accordance with the coatings manufacturer's current recommendation unless otherwise specified by WHPC.

9 Material must be applied to a thickness specified by WHPC. Monitor coverage during all applications. Sprayers **must** use wet mil gages to periodically check film build.

10 Subsequent coats, as required, are to be applied within a time frame specified by manufacturer's current technical bulletin.

11 Repair any runs, sags, or coating discontinuities prior to recoat.

12 Remove all dust and foreign materials prior to re-coating.

G.) **Intermediate Inspection**:

1 In the event the specified system requires two or more coats, DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking.

All DFT readings are to be taken from suitably cured materials and recorded in mils. DFT mil gauges should be calibrated before use. A total of 100 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record. Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

H.) **Intermediate Cure**:

1 If required due to multiple coat system, curing of coating must be performed in accordance with current WHPC technical bulletin. Record of cure cycle must be retained as part of the car's permanent record.

I.) **Final Inspection**:

1 Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray and trash.

2 Final cure cycle must be performed in accordance with WHPC current technical bulletin.

3 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils. DFT mil gauges should be calibrated before use. A total of 100 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record. Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

Williams-Hayward Protective Coatings, Inc.

Hopper Car Interior Specification 8-223-9

This specification describes the cleaning, surface preparation, and general application parameter of generic interior boxcar coatings. Specific instruction may supersede these instructions based on the nature of commodity or service.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during storage, handling, application, curing and disposal. All work must be performed in strict accordance, but not limited to applicators' corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Work shall be performed by skilled workmen in a safe and workmanlike manner.

C.) **Car Cleaning**:

1 Car interior is to be suitably cleaned to remove any residual commodity and provide a safe environment for workmen.

D.) **Interior Hopper Surfaces**:

1 All welds are to be continuous with no undercutting skip welds, delimitation, scabs, slivers, and slag must be repaired and removed. Skip welds are to be welded solids. All pinholes and/or pits in the substrate must be welded and ground to contour. All weld flux and splatter is to be removed by power tool cleaning. All sharp edges are to be ground to a smooth one-eighth inch radius.

2 Inspect and remove oil, or grease that might remain by SSPC-SPI-82 Solvent Cleaning just prior to interior blasting.

E.) **Surface Preparation**:

1 Blast interior to NACE 2 or SSPC-SP-10 near white metal condition.
- a Plant air is to be free from moisture and oil.
- b Grit is to be clean and free of contaminates.
- c Blast nozzle pressure is to be a minimum of 90 psi.

2 Anchor patter is to be continuous and equal to 25% of final DFT.

3 Inspect substrate to assure that it is cleaned as specified.

a Sample a minimum of four areas for blast profile using the appropriate TESTEX tape. These tapes are to be maintained as part of the car's permanent record.

4 SCAT Test steel substrate at six locations giving priority to areas where previous surface corrosion has occurred. Retain test strips as part of the permanent car record.

5 If car shows signs of contaminates per SCAT test high-pressure wash areas and then reblast. Retest and clean substrate as necessary to remove contaminates. Retain strips as a part of the car's permanent record.

F.) **Interior Application**:

1 Car to be coated within eight hours of blast. Shop, metal temperature, and material temperature to be minimum 70° F / 21° C.

2 Vacuum interior to remove all dust and abrasives.

3 Stripe weld seams with material thinned per WHPC technical bulletin.

4 Take and record Dew Point readings within vessel. Retain readings as part of the car's permanent record. Do not coat car unless there is an 8-degree read between surface temperature and dew point. Record of conditions must be retained as part of the car's permanent record.

5 Record material number, and batch number. Retain as part of the car's permanent record.

6 Coating is to be mixed and thinned per manufacturer's current technical bulletin. Manufacturer's recommended thinner must be used unless otherwise advised by WHPC. Record amount of thinning as part of the car's permanent record.

7 Coating is to be applied in a minimum of two coats unless advised otherwise by WHPC current technical bulletin.

8 Apply by airless spray in accordance with the coatings manufacturer's current recommendation unless otherwise specified by WHPC.

9 Material must be applied to a thickness specified by WHPC. Monitor coverage during all applications. Sprayers **must** use wet mil gages to periodically check film build.

10 Subsequent coats, as required, are to be applied within a time frame specified by manufacturer's current technical bulletin.

11 Repair any runs, sags, or coating discontinuities prior to recoat.

12 Remove all dust and foreign materials prior to re-coating.

G.) **Intermediate Inspection**:

1 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitably cured materials and recorded in mils. DFT mil gauges should be calibrated before use. A total of 100 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record. Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

H.) **Intermediate Cure**:

1 Curing of coating must be performed in accordance with current WHPC technical bulletin. Record of cure cycle must be retained as part of the car's permanent record.

I.) **Final Inspection**:

1 Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray and trash.

2 Final cure cycle must be performed in accordance with WHPC current technical bulletin.

3 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge. Gauge used must be adequate for the film thickness it is checking. All DFT readings are to be taken from suitable cured materials and recorded in mils. DFT mil gauges should be calibrated before use. A total of 100 mil readings must be taken per vessel, per coat unless otherwise specified. DFT readings must be retained as part of the car's permanent record.

Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

4 Finished coating shall meet NACE 1, pinhole free condition after final cure.

5 Use a low voltage wet sponge type detector, such as a Tinker-Razor Model M-1 tester on coatings films of 20 mils / 500 micron or less. Use a high-voltage detector on films that exceed 20 mils / 500 microns. **Note**: High-voltage testers can be destructive to coating film if proper voltage is not selected.

a Finished coating shall meet NACE 1, pinhole free condition after final cure.

6 A record of pinhole test form must be signed by inspecting party and maintained as part of the car's permanent record.

Williams-Hayward Protective Coatings, Inc.

Tank Car Interior Specification 20-222-14-7

This specification describes the cleaning, surface preparation, and general application parameter of generic interior boxcar coatings. Specific instruction may supersede these instructions based on the nature of commodity or service.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during storage, handling, application, curing and disposal. All work must be performed in strict accordance, but not limited to applicators' corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Work shall be performed by skilled workmen in a safe and workmanlike manner.

C.) **Car Cleaning**:

1 Car interior is to be steam cleaned to remove any residual commodity and provide a safe environment for workmen.

D.) **Interior Tank Surfaces**:

1 All welds are to be continuous with no undercutting skip welds, delimitation, scabs, slivers, and slag must be repaired and removed. Skip welds are to be welded solids. All pinholes and/or pits in the substrate must be welded and ground to contour. All weld flux and splatter is to be removed by power tool cleaning. All sharp edges are to be ground to a smooth one-eighth inch radius.

E.) **Pre-Bake**

1 Pre-bake tank car interior to 450° F / 232° C for two hours.

2 Inspect and remove any oil, or grease, that might remain per SSPC SP1 Solvent Cleaning prior to blasting interior.

F.) **Surface Preparation**:

1 Blast interior to NACE 1 or SSPC-SP-5-82 white metal condition.
- a Plant air is to be free from moisture and oil.
- b Grit is to be clean and free of contaminates.
- c Blast nozzle pressure is to be a minimum of 90 psi.

2 Anchor patter is to be continuous and equal to 25% of final DFT.

3 Inspect substrate to assure that it is cleaned as specified.

a Sample a minimum of four areas for blast profile using the appropriate TESTEX tape. These tapes are to be maintained as part of the car's permanent record.

4 SCAT Test steel substrate at six locations giving priority to areas where previous surface corrosion has occurred. Retain test strips as part of the permanent car record.

5 If car shows signs of contaminate per SCAT test high-pressure wash areas, steam clean and then reblast. Retest and retain strips as a part of the car's permanent record. Note: permitting surface contaminates to remain on substrate will result in premature failure of the coating.

G.) **Interior Application**:

1 Car to be coated within eight hours of blast. Shop, metal temperature, and material temperature to be minimum 70° F / 21° C.

2 Vacuum interior to remove all dust and abrasives.

3 Stripe weld seams with material thinned per WHPC technical bulletin.

4 Take and record Dew Point readings within vessel. Retain readings as part of the car's permanent record. Do not coat car unless there is an 8-degree read between surface temperature and dew point. Record of conditions must be retained as part of the car's permanent record.

5 Record material number, and batch number. Retain as part of the car's permanent record.

6 Coating is to be mixed and thinned per manufacturer's current technical bulletin. Manufacturer's recommended thinner must be used unless otherwise advised by WHPC. Record amount of thinning as part of the car's permanent record.

7 Coating is to be applied in a minimum of two coats unless advised otherwise by WHPC current technical bulletin.

8 Apply by airless spray in accordance with coatings manufacturer's current recommendation unless otherwise specified by WHPC.

9 Material must be applied to a thickness specified by WHPC. Monitor coverage during all applications. Sprayers **must** use wet mil gages to periodically check film build.

10 Subsequent coats are to be applied within a time frame specified by manufacturer's current technical bulletin.

11 Repair any runs, sags, or coating discontinuities prior to recoat.

12 Coated surfaces must be free from all dust and foreign materials before recoating.

13 Refer to WHPC technical bulletin for instructions on required minimum and maximum intervals before recoat.

H.) **Intermediate Inspection**:

1 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge.

2 Gauge used must be adequate for the film thickness it is checking.

3 All DFT readings are to be taken from suitably cured materials and recorded in mils.

4 DFT mil gauges should be calibrated before use. A total of 100 mil readings must be taken per vessel, per coat.

5 DFT readings must be retained as part of the car's permanent record.

6 Recommended dry film thickness will be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

I.) **Intermediate Cure**:

1 Curing of coating must be performed in accordance with current WHPC technical bulletin. Record of cure cycle must be retained as part of the car's permanent record.

J.) **Final Inspection**:

1 Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray and trash.

2 Final cure cycle must be performed in accordance with WHPC current technical bulletin.

3 DFT readings must be taken with a mutually agreed upon type II DFT mil gauge.

4 Gauge used must be adequate for the film thickness it is checking.

5 All DFT readings are to be taken from suitably cured materials and recorded in mils. DFT gauge is to be calibrated before use.

6 A total of 100 mil readings must be taken per vessel, per coat.

a Recommended dry film thickness would be specified as to acceptable minimum and maximum by WHPC material technical bulletin.

7 DFT readings must be retained as part of the car's permanent record.

8 Finished coating shall meet NACE 1, pinhole free condition after final cure.

9 Use a low voltage wet sponge type detector, such as a Tinker-Razor Model M-1 tester on coatings films of 20 mils / 500 microns or less. Use a high-voltage detector on films that exceed 20 mils / 500 microns. **Note**: High-voltage testers can be destructive to coating film if proper voltage is not selected.

10 A record of pinhole test form must be signed by inspecting party and maintained as part of the car's permanent record.

Williams-Hayward Protective Coatings, Inc.

NO-VOC/THERMALBOND/EUROTBOND
Open Top Gondola Interior Specification
For Quick Release

This specification describes the cleaning, surface preparation, and general application parameter of multi-coat Thermalbond interior coating material.

A.) **General Safety**:

Williams-Hayward Protective Coatings, Inc. offers its products for sale and use to professionally trained industrial personnel. Workmen must observe all health and safety precautions shown on the Material Safety Data Sheet, current product technical bulletin, and packaging label during storage, handling, application, curing and disposal. All work must be performed in strict accordance, but not limited to applicators' corporate safety policies and applicable OSHA regulations.

B.) **Workmanship**:

All work shall be performed in strict accordance with these specifications and the current manufacturer's printed instructions. Work shall be performed by skilled workmen in a safe and workmanlike manner.

C.) **Interior Surface Preparation**:

All interior welds are to be continuous with no undercutting, skip welds, de-laminations, scabs, slivers, weld splatter, or slag. All pinholes or deep narrow throat pits in the substrate must be welded and ground to contour. All sharp edges are to be ground to a smooth one-eighth inch radius.

1. Remove all oil and grease by solvent washing per SSPC-SP1.
2. Plant air is to be free from moisture and oil.
3. Blast medium is to be free of contaminates.
4. Blast nozzle pressure is to be a minimum of 90-PSI minimum.
5. Grit blast to NACE 1 or SSPC-SP-5-82 white metal condition.
6. Car interior should be visually inspected for cleanliness.
7. Vacuum interior to remove all dust and abrasives.

D.) **Interior Application:**

Car is to be coated within eight hours of blast. Shop, metal, and material temperature to be a minimum of 50° F / 10° C.

Stripe weld seams, edges, corners and all areas where steel shows signs of corrosion with WHPC #22-8708NVT "0" V.O.C. -Primer. No thinning required. Wet surfaces well, however, avoid runs, sags, or excessive film build.

Allow striping material to dry to touch before proceeding.

E.) **First Coat:**

Single Component, Williams-Hayward Thermalbond/Eurotbond Red Oxide Interior Lining Primer

Take and record dew point, relative humidity, and substrate temperature readings. Retain as part of the car's permanent record. Do not coat car unless there is an 8° F / -13° C spread between surface temperature and dew point.

Description: Single component material. Agitate to uniform consistency.

Thinning: No thinning required.

Spray: Apply 10-12 wet-mils / 250-300 wet microns, using cross coat method, yielding 4-5 dry mils / 100-125 microns at 40% Volume solids.

*Cure: Ventilate car for 30 minutes before introducing heat. Set oven at 200° F / 93° C and run for one hour. Raise the temperature 25° F / -4 ° C every 30 minutes until 212° F / 100° C.

NOTE*: All water must be out of coating material before proceeding*.

*If heat is not available, ventilating with dry air for 4-6 hrs. will suffice.

F.) **Second Coat:**

Single Component, Williams-Hayward Thermalbond/Eurotbond Graphite Interior Lining

Take and record dew point, relative humidity, and substrate temperature readings. Retain as part of the car's permanent record. Do not coat car unless there is an 8° F / -13° C spread between surface temperature and dew point.

Description: Single component material. Agitate to uniform consistency.

Thinning: No thinning required.

Spray: Apply 10-12 wet-mils / 250-300 wet microns, using cross coat method, yielding 4-5 dry mils / 100-125 microns at 40% volume solids. Total DFT readings after this coat must be within the 8-10-mil / 200-250 micron range.

Cure: As shown above.

NOTE*: All water must be out of coating material before exposing to the elements.*

G.) **Third Coat:**

Grey Thermalbond / Eurotbond Graphite Interior Lining

Take and record dew point, relative humidity, and substrate temperature readings. Retain as part of the car's permanent record. Do not coat car unless there is an 8° F / -13° C spread between surface temperature and dew point.

Description: Single component material. Agitate to uniform consistency.

Thinning: No thinning required.

Spray: Apply 10-12 wet-mils / 250-300 wet microns, using cross coat method, yielding 4-5 dry mils / 100-125 microns at 40% volume solids. Total DFT readings after this coat must be within the 12-15 mil / 300-375 micron range.

Cure: As shown above.

NOTE*: All water must be out of coating material before exposing to the elements*

H.) **Fourth Coat:**

Single Component, Williams-Hayward Black Thermalbond/Eurotbond Teflon-Filled Interior Lining

Take and record dew point, relative humidity, and substrate temperature readings. Retain as part of the car's permanent record. Do not coat car unless there is an 8° F / -13° C spread between surface temperature and dew point.

Description: Single component material. Agitate to uniform consistency.

Thinning: No thinning required.

Spray: Apply 10-12 wet-mils / 250-300 wet microns, using cross coat method, yielding 4-5 dry mils / 100-125 microns at 40% volume solids. Total DFT readings after this coat must be within the 16-20 mil / 400-500 micron total, 16 mil / 400 micron minimum.

Cure: As shown above.

NOTE*: All water must be out of coating material before exposing to the elements.*

I.) **Inspection:**

After drying car interior, take and record 100 DFT readings with a mutually agreed upon type II DFT mils gauge. Areas that fall below specified mil thickness must be repaired.

J.) ***Final Cure:**

Set input air temperature at 200° F / 93° C and run for one hour. Then raise metal temperature 25° F / -4 ° C every 30 minutes until 200° F / 93° C is achieved. Next, raise temperature 15° F /-9° C every 30 minutes until 350° F / 177° C metal temperature is reached. Hold temperature for two hours.

*If heat is not available, ventilating with dry air for 4-6 hrs, will suffice.

K.) **Final Inspection:**

Use a low voltage wet sponge detector, such as Tinker-Razor Model M-1 tester on coatings films of 20 mils / 500 microns or less. Finish coat to meet NACE 1, pinhole free condition after final coat.

A record of pinhole test must be signed by inspecting party and maintained as part of car's permanent record.

Final coat is to be free of runs, sags, pinholes, fisheyes, solvent popping, over-spray or trash.

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The Powder Coating division
Of
Williams Hayward Protective Coatings
Manufactures
Epoxy, Polyester Urethane, and Hybrid and Polyester TGIC systems

Typical Properties of Thermosetting Powder Coatings

Properties	**Epoxy Polyester**	**Hybrid Polyester**	**TGIC**	**Urethane**
Application Thickness	1-20 mils[1] 25-500 Micron[1]	1-10 mils 25-250 Micron	1-10 mils 25-250Micron	1-3.5 mils 25-87.5 Micron
Cure Cycle[2] (Metal Temperatures)	450° F-3' 232° C-3' 250° F-30' 121° C-30'	450° F-3' 232° C-3' 240° F-20' 116° C-20'	400° F-7' 204° C-7' 310° F-20' 154° C-20'	400° F-7' 204° C-7' 350° F-17' 177° C-17'
Outdoor Weatherability	Poor	Poor	Excellent	Very Good
Pencil Hardness	HB-5H	HB-2H	HB-2H	HB-3H
Direct Impact Resistance (In./Lbs.)[3]	80-160	80-160	80-160	80-160
Adhesion	Excellent	Excellent	Excellent	Excellent
Chemical Resistance	Excellent	Very Good	Good	Good

[1] Thickness of up to 150 mils / 3750 micron can be applied via multiple coats in a fluidized bed.

[2] Time and temperature can be reduced, by utilizing by accelerated curing mechanisms, while maintaining the same general properties.

[3] Tested at a coating thickness of 2.0 mils / 50 microns.

Source: Powder Coating Institute