CLEARCLAD HSR

Product code: 252B063

1. PRODUCT DESCRIPTION

CLEARCLAD HSR is a cathodic electropaint system which combines all the advantages of its application technology with outstanding chemical resistance, high build capability to confer wear resistance, and excellent weathering properties due to its high degree of UV resistance. These together with its excellent decorative properties make CLEARCLAD HSR an advanced coating system for a wide range of substrates and applications.

2. SUPPLY FORM

The base resin concentrate of CLEARCLAD HSR is a tan colored, free flowing liquid of moderate viscosity. Pigmented and matte variants will vary in appearance and viscosity accordingly.

Packaging is 20 Liter American pails. Other packing types and sizes may be available on request.

3. SUPPLY SPECIFICATION

This will vary according to product type. The base resin concentrate is supplied in ready-to-dilute form, solids content 45 - 50% by weight (determined gravimetrically at 120°C (248°F) for 1 hour).

4. METHOD OF DILUTION

CLEARCLAD HSR concentrates should always be pre-mixed with either high purity de-ionized water, bath material at coating solids, or bath permeate when making a new bath or replenishing an existing bath respectively.

Pre-mixing must take place in a suitable clean vessel equipped with a motorized stirrer. Diluting material is added gradually to the concentrate, under stir, until a solids content of less than 18% is achieved. At this stage, at least 10 minutes stirring is applied to achieve complete emulsification. Subsequently, this pre-mix may then be further diluted to the required solids or added to the bath as appropriate.

CLEARCLAD HSR concentrates must never be added directly into de-ionized water or into the bath without this pre-mixing procedure.

5. CONDITIONING OF NEW BATHS

A period of at least 24 hours, and preferably 48 hours, should elapse between initial bath make up and commencement of production. During this time, the bath should be kept circulating through adequate particle filtration at its normal operating temperature, and at least one bath volume of ultrafiltrate permeate should be eliminated. Solvent loss due to permeate elimination is not significant, but the MEQ (corrected) should be maintained at a minimum value of 30 by appropriate additions of CLEARCLAD Emulsion Stabilizer.

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6. BATH OPERATING PARAMETERS

Parameter	*Range*
Solids %w/w	8.0 - 10.0
pH	3.7 - 4.3
Conductivity microsiemens/cm	450 - 700
MEQ @ 10% solids	35 - 45
Solvent PM A264 %w/w	3 - 6
Operating temperature	23 – 29°C (73-84°F)
Coating voltage	30 - 120 dependent upon load type and required thickness. (up to 30µm available)
Coating time (seconds)	60 - 120 as above
Current density	(70v achieving 20µ) 1.5A/Ft^2 surge, 0.5A/Ft^2 average continuous.
Curing schedule	160 - 180 °C (320- 356°F) for minimum 20 minutes metal temperature.
Particle filtration	1 micron cartridge type for clear or tinted products. Higher micron ratings required for matted and pigmented systems.
Ultrafiltration	Preferably used in conjunction with TRAP UF/ion exchange system. Approx. 10% permeate production should be routinely eliminated on a continuous basis.
Bath temperature control	Heating, if applicable, should preferably be via indirect means. Direct heating should only be via low wattage quartz type immersion heaters. Always take advice on this. Cooling may be effected via immersed stainless steel coils using circulating cold water as the cooling medium. Any control system should be capable of maintaining the recommended operating temperature plus/minus 1^{o}C.

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Bath Operating Parameters - continued

Circulation	Continuous pumped circulation from a skim weir and return via submerged sparge pipe. Circulation turnover rate for clear and tinted systems is 3 - 5 bath volumes per hour. Matte and pigmented systems require 8 - 10 bath volumes per hour.
Anodes	316 grade stainless steel. Anode:cathode ratio 1:1
Bath turnover rate	In order to maintain the optimum properties, the feed replenishment rate should be consistent with one bath turnover within three months.

7. ASSESSMENT OF CURE

Due to CLEARCLAD HSR having extremely high resistance to chemicals and solvents, a quick unequivocal test for cure/polymerization such as the acetone rub test is difficult. Using cotton wool as the absorbent for acetone, it is normal for fully cured HSR to require 1000 double rubs. A lower number may be achieved if absorbent paper is used, but the mechanism of the test is laborious and therefore subject to operator variability.

In this case, in order that the adequacy of cure may be assessed for production quality control, we suggest that a correlation is established between resistance to acetone rubs and *immersion* of the test part in either acetone or ethanol. The immersion test will be assessed in terms of the length of time of immersion consistent with the coating passing a pencil hardness test.

The parameters of this test will be degree of polymerization and coating thickness. The action of the acetone/ethanol will be to permeate the coating and swell it. This has the effect of softening the coating and its apparent pencil hardness will reduce.

Example: A coated part is immersed in ethanol for 30 minutes and tested with 2B pencil. Resistance of the coating to removal to substrate would be deemed a pass.

It is not possible here to specify the performance of such a test. The user should establish the values of the parameters according to the particular degree of polymerization required by the application, as this factor can vary.

Alternatively, if the thermogram of the cured part is monitored using an oven temperature tracking device, and this indicates compliance with the cure schedule, then this may be accepted by the user as a predictor that adequate cure has been achieved.

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8. COVERING POWER

One kilo of the base resin concentrate of CLEARCLAD HSR will apply a coating of 1 micron over approximately 4800 square feet assuming 100% efficiency.

Near to 100% efficiency can be achieved using closed-loop ultrafiltration reclaim. Without a reclaim system, efficiency and consequently covering power will reduce.

"Tinted" systems, using relatively low concentrations of colorants, will have covering power very similar to the base resin concentrate. Other types of pigmented systems, incorporating significant concentrations of dense colorants or matting agents will have lower covering power. This will depend entirely on the particular product and such information will form part of the appropriate data sheet.

9. RESISTANCE OF CLEARCLAD HSR COATINGS TO ULTRAVIOLET LIGHT

In addition to CLEARCLAD HSR's outstanding resistance to a great variety of chemicals, it has been formulated to have high resistance to UV light in order to render it suitable for exterior applications where resistance to the effects of weather is essential. As a transparent coating, its UV resistance is comparable to the best available exterior-quality acrylics or polyesters. However, its principal advantage is in being able to provide the well established "tinted" simulation of colored metals onto reflective "white" metal substrates, but with at least ten times the color change/fade resistance achieved with previous similar systems. (assessment using ΔE measurements according to the CIELAB system after exposure to minimum 500 hours QUV UVB).

CCI have developed a colorant system which will achieve yellow metal effects from "brass" through "gold" to "bronze", the actual color being determined by a combination of the mixed colorants and the color of the base metal.

Other colored "tints" in addition to hard colors including white and black in a range of gloss values may be formulated on request.

10. RESISTANCE OF CLEARCLAD HSR TO ARTIFICIAL PERSPIRATION

As a principal target market for CLEARCLAD HSR is door and window hardware, the resistance to handling in terms of sensitivity to human perspiration is of great importance. Accordingly, one of the prime criteria in the development of CLEARCLAD HSR has been the compliance with the perspiration test detailed in the ANSI/BHMA "American National Standard For Bored And Pre-assembled Locks And Latches". At full cure and 20 microns thickness, CLEARCLAD HSR will readily comply with this demanding test.

This also makes CLEARCLAD HSR suitable for other applications where, especially, contact with and resistance to human perspiration may be a requirement.

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11. CORROSION PROTECTION AFFORDED BY CLEARCLAD HSR COATINGS

The resistance to corrosion of any coated metal is always determined by the particular "system" - which means a combination of the base metal, its pretreatment, the type of coating applied, and the thickness and type of pigmentation of the coating.

CLEARCLAD HSR is effectively a one-coat paint system. Accordingly, its corrosion-protective properties will be principally influenced by its thickness and quality of adhesion to the base metal. In this way, HSR will provide a barrier (optimized by its thickness) to corrosive agents, and a resist against spread of corrosion (optimized by its adhesive strength). Further than this, the intrinsic corrosion resistance of the base metal should be optimized, for example by the chromating of brass and zinc. Proper preparation of the base metal will both increase the intrinsic corrosion resistance and enhance the adhesion of HSR, both factors combining to optimize the corrosion resistance of the whole system.

12. WEAR AND ABRASION RESISTANCE

CLEARCLAD HSR has good intrinsic abrasion resistance (as determined by ASTM D968 Falling Sand test - 18 liters/25 micron thickness). This in combination with it being a high-build product (30 micron thickness readily available) affords a high degree of wear and abrasion protection. As the absolute wear property of organic coatings is principally a function of thickness, applications demanding wear resistance should utilize the higher thicknesses available with HSR.

For Health and safety data see separate MSDS

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Comparison of CLEARCLAD HSR with some competitive products with respect to chemical and physical tests.

Test	Competitive products A (Cathodic)	B(Cathodic)	C(Anodic)	**HSR**
Solvent resistance Double rubs acetone(1)	20	60	100	**1000+**
Sweat resistance(2) cycles	Fail 1	Fail 1	Fail 3	**Pass 4**
Pencil Hardness(3)	3 - 4H	3H	3 - 4H	**4H**
Corrosion resistance(4) (Polished brass) hours	250	250	unsuitable	**500+**
Corrosion resistance(4) (Zinc diecast) hours	Fail 72	Fail 72	unsuitable	**240+**
Abrasion resistance(5) liters sand	<5	<5	<5	**18+**
UV Light resistance(6) Dyed "brass" color ΔE change (CIELAB)	complete fade at 120 hours	complete fade at 120 hours	complete fade at 120 hours	**less than ΔE 2.0 at 500 hours**
Relative cost based on area covered per kilo of supplied product.	2.78(7)	2.5/4.2(7)	1.3(7)	**1.0**

(1). Using acetone soaked tissue paper. Rating is when the coating is removed to the substrate.

(2). ANSI/BHMA test (USA specification).

(3). Gouge method. Load on pencil approx. 2000 gm.

(4). ASTM B117 neutral salt spray. Criterion is no more than 2mm creep of corrosion from a scribe cut to substrate.

(5). ASTM D968 using Ottowa sand.

(6). QUV using UVB 313 tubes. 2 hours UV at 60°C/1 hour condensation at 50°C. ΔE of 2.0 . is a just perceptible change in color. "Complete fade" is equivalent to approx. ΔE 20.

(7). Ultrafiltrate reclaim not used.

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