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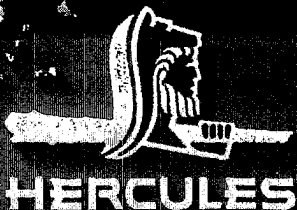
Government Regulations
LEAD REFORMULATION - PIGMENT
Trade Maintenance Solvent



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IMPERIAL*

TECHNICAL DATA BULLETIN

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LEAD-FREE PIGMENTATIONS

Pigment reformulating by paint manufacturers has been necessary as the result of Government restrictions on the use of lead in coatings. This bulletin is being issued in answer to many requests for assistance in replacing lead-containing standards. It provides pertinent information concerning Imperial® colors that will meet the lead-free requirements when approximating coatings pigmented with chrome yellow, molybdate orange, and chrome green.

This bulletin is intended to give general relationships and to help familiarize you with Imperial pigments for lead-free coatings. The actual formulations and final decisions must be based upon the formulators' own tests. The following recommendations were based on color comparisons prepared from alkyd enamels. Approximate cost relationships were obtained from masstone enamels at similar hiding and tint enamels at similar strength.

Experienced formulators are well aware of the problems involved in making these substitutions. In general, the organic pigment substitutes are higher in cost and lack the tint lightfastness, opacity, working properties, hue characteristics, and nonbleeding properties of the lead chromates. Deficiencies in organic pigment working properties are accentuated when working in the masstone ranges. These problems include high viscosity and puffiness. The masstone lightfastness of organic pigments will be as good as, or better than, lead chromate pigments in most cases, and chemical resistance will be improved in both masstone and tint applications.

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Lead-Free Pigmentations Versus Chrome Yellows and Molybdate Orange (Masstone and Tint)

The following pigment types were selected as the basic components of the lead-free pigmentations:

More Lightfast Types

Hansa-type yellows
Dinitroaniline orange

More Bleed- and Heat-Resistant Types

Diarylide yellows and orange
Manganese Red 2B

Reasons for specific pigment selections can be summarized as follows:

More Lightfast Types

1. X-3051 (10G Hansa) has the green hue required when working against primrose chrome yellow. It has good tint lightfastness, comparable to that of X-2846.
2. X-1351 and X-1956 were selected for masstone pigmentations because of their combined cleanliness, opacity, and low cost. They provide a high degree of masstone lightfastness at lowest cost. The more expensive types do not show as much advantage in masstone lightfastness as they show in tints.
Tint comparisons, based on X-1351 and X-1956, are furnished for the formulator who wants to keep the number of standards at a minimum and is working only with interior finishes.
3. X-3473, X-2846, and X-2910 were selected for tints because of their superior tint lightfastness. X-3473 is the most lightfast of the group. All three are among the most lightfast hansa types available, but they will fade on exterior exposure and must be checked carefully for this application. Lightfastness can be improved by combining with more durable pigments, such as iron oxides.
4. X-3410 provides an intermediate degree of tint lightfastness. It is less lightfast than X-2846 and more lightfast than X-1351. It is stronger and better in money value, at equal strength, than either X-2846 or X-1351. It is less red in hue, however, and loses this money-value advantage when it is necessary to redden it with higher priced products.
5. X-881 (dinitroaniline orange) provides an approximate match for yellow-shade molybdate orange. It is fairly opaque but does bleed. It has very good lightfastness in masstone, but it must be evaluated for tint lightfastness where prolonged exterior exposure is anticipated.

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More Bleed- and Heat-Resistant Types

1. X-2600 is among the greenest of the diarylide yellows and is required when working against primrose chrome yellows.
2. X-2864 is a fairly lightfast, opaque diarylide yellow that lies, in redness, between light and medium chrome yellow. Shading with X-2065 (diarylide orange) is recommended for redder hues. For greener masstones, X-2476 (opaque-type diarylide) can be used. For greener tints, X-2485 (high-strength diarylide) will provide the best money value. X-2864 is considerably better in tint light-fastness than X-2476 and X-2485.
3. X-2065 (diarylide orange) is considerably less red than yellow-shade molybdate orange. X-3297 (a manganese Red 2B with good opacity) was selected as the toning agent.

Lead-Free Pigmentations Versus Chrome Greens (Masstone)

1. Combinations of hansa yellow, titanium dioxide, and iron blue can be used for chrome green masstone shades. X-1351 was selected as a general-purpose hansa yellow, and combinations containing X-3473 are included for improved lightfastness at higher cost.

Substituting phthalocyanine blue for the iron blue will give a more lightfast, more chemically resistant, but a more expensive pigmentation.

2. Chromium oxide shaded with phthalocyanine green or blue offers a narrow range of depths, but provides excellent performance in both masstone and tint. Costs are higher at similar hiding. The phthalocyanine green combination provides the better color match at higher cost.
3. Zinc chromate plus iron blue will provide a very pale, clean green with moderately good lightfastness. Yellow oxide can be used for shading, but good color matches are difficult. Hiding is poor and costs slightly higher at similar hiding. Staining on white areas below the trim may occur because of the leaching of soluble chromate. Although this pigmentation is lead free, zinc chromate does not rate as well as lead chromate in Acute Oral Toxicity tests (AOT-LD₅₀).

Specific recommendations for approximating primrose, light, and medium chrome yellows; molybdate oranges; and chrome greens are listed on the following pages. Cost ratios are included, and suggestions limited strictly to interior

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applications are indicated. Since titanium dioxide is an integral part of the masstone pigmentations, cost ratios are based on total pigment. Cost ratios of the tint pigmentations are based only on color pigment to give a truer cost relationship in a wide range of tints.

In summary, the information contained in this bulletin is intended to give the formulator a base for his study of lead-free coatings.

IMPERIAL PIGMENTS USED IN LEAD-FREE RECOMMENDATIONS

Color Number	Color Name	Type	Colour Index	
			Name	Number
X-3051	Empress™ Yellow 10G	Hansa	Pigment Yellow 3	11710
X-1351	Horicon Yellow	Hansa	Pigment Yellow 6	11670
X-2846	Empress Yellow GX	Hansa	Pigment Yellow 73	11738
X-3410	Empress Yellow GS	Hansa	Pigment Yellow 74	11741
X-3473	Empress Yellow GSX	Hansa	Pigment Yellow 74	11741
X-1956	Yellow Toner R	Hansa	Pigment Yellow 6	11670
X-2910	Empress Yellow RX	Hansa	Pigment Yellow 75	11770
X-2600	Majestic Yellow	Diarylde (AAOA)	Pigment Yellow 17	21105
X-2485	Amazon Yellow	Diarylde (AAA)	Pigment Yellow 12	21090
X-2476	Sacandaga Yellow	Diarylde (AAOT)	Pigment Yellow 14	21095
X-2864	Sahara Yellow	Diarylde (AAPT)	Pigment Yellow 55	21096
X-2065	Oswego Orange	Diarylde	Pigment Orange 13	21110
X-881	Nippon Orange Toner	Dinitroaniline	Pigment Orange 5	12075
X-3297	Red Toner	Manganese Red 2B	Pigment Red 48	15865
X-3163	C.P. Blue	Iron blue	Pigment Blue 27	77510
A-4433	Monarch™ Green	Phthalocyanine	Pigment Green 7	74260
X-3367	Monarch Blue CFR	Phthalocyanine	Pigment Blue 15	74160
X-1134	C.P. Chromium Oxide	Chromium oxide	Pigment Green 17	77288
X-883	C.P. Zinc Yellow	Zinc chromate	Pigment Yellow 36	77955
610	Yellow Oxide L	Iron oxide	Pigment Yellow 42	77492
630	Yellow Oxide DO	Iron oxide	Pigment Yellow 42	77492

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