

FROM: F. G. Hidalgo

FOR: Mr. S. T. Howell,
D.P.J.

CITY: Strongsville

SUBJECT: REPLACEMENT OF LEAD CONTAINING PIGMENTS AND DRIERS

The following information is being sent to assist you in the replacement of lead containing pigments and lead driers in those formulas which you will need to reformulate to a lead-free basis.

Replacement of Lead Driers

Considerable work has been done by the Trade Sales Laboratory at the Research Center in arriving at the best drier combinations to replace lead in the various qualities that we manufacture. Primarily, the replacement is based on addition of zirconium with a slight increase in the cobalt drier that was previously present in the formula.

Where both lead and manganese were used, they have both been replaced by zirconium, since the lab found better results that way than if the manganese was left in.

Where E-396 Lead Feeder Drier has been used to prevent loss of dry in the package, the addition of calcium drier in the grind has been found useful since calcium appears to be absorbed preferentially over the remaining drier metals.

I am sure you have seen recommendations from various drier manufacturers in which different percentages of zirconium, cobalt and calcium are quoted as suggested replacements for lead. Since a great deal depends on the particular vehicle system employed, I have summarized in Table I the old and new drier combination of different types of trade products so that, by referring to this table, you may arrive at better starting points for your own air-drying regional formulations which largely will be based on these same vehicles.

Now that practically all of your formulations that contain driers will need to be re-written to eliminate lead, this will be the best time to also replace the old fashioned tallate and naphthenate driers, as well as the high cost octates, with the new high concentration driers. E-303 (12% cobalt), E-325 (9% manganese), E-371 (16% zinc), E-382 (6% calcium), E-390 (12% zirconium) should be used in place of all the other naphthenates, octates and tallates that you may have in your formulas at present. By so doing, you will gain a head start on our new raw material simplification program and will also benefit from cost savings.

One interesting item of information which came up in a recent discussion with some of our drier suppliers, was regarding the order of addition of

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driers. Calcium, when used, is best added in the grind since it has good wetting properties and it also will prevent absorption of cobalt by the pigments. The remaining driers can be added in any sequence desired, but anti-skinning agents should always be added last, after the driers have been stirred in. Oximes will preferentially complex cobalt and other metals, if the driers have not been absorbed first by the vehicle, and loss of dry could result if the anti-skinning agent is added first or if it is blended with the driers for addition to a batch. Please keep this in mind when re-writing your formulas.

Replacement of Lead Containing Pigments

Several suppliers have published bulletins on this subject. A particularly good one is Bulletin ICC-8 dated September, 1971, issued by Imperial Color and Chemical Department, Hercules Incorporated. This is an eight page bulletin that contains many specific combinations to illustrate replacement of lead containing pigments, both for masstone and tint, and which also includes cost information. If you did not receive this bulletin, please request a copy from your local Imperial representative.

Chrome Greens

Chrome green shades can be matched with a combination of L-304 Hansa Yellow, L-209 Ferrite Yellow, titanium dioxide and either A-200 Iron Blue or A-116 Phthalocyanine Blue depending on the cost and durability requirements. A typical combination which is used in X-965 Sprad Gloss Shamrock Green is 18 pounds W-830, 10 pounds L-209, 20 pounds L-304 and 4.5 pounds A-116. Lighter or darker shades of green will be obtained by increasing the Hansa Yellow or the Phthalo Blue, respectively.

Chemetron have announced new blended pigments that will match specific light, medium and dark chrome green shades, but we believe this can best be done by arriving at our own blend from pigments that we now have in stock instead of adding to our inventory.

Chrome Yellows

Primrose Chrome Yellows such as J-115 are best matched with the greener (10G) shade of Hansa Yellow which we have not been using. If you need this shade, try X3051 Popress Yellow 10G from Imperial. Some titanium dioxide and a slight addition of L-209 Ferrite Yellow is required for a close match.

The light chrome yellow shade such as L-110 can be matched with either L-301 or L-304 Hansa Yellows plus titanium dioxide at a ratio of about 3:2.

Medium chrome yellow shades such as L-133 can be matched with Hansa Yellows by blending approximately 40% L-301, 30% L-305 and 30% titanium dioxide.

All the above replacements for chrome yellows will be higher cost and will also entail sacrifices in bleeding and heat resistance, as well as in lightfastness.

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Where bleed and heat resistance are of greater importance and light fastness is a secondary consideration, a diarylide yellow such as Imperial's X-2476 could be used in place of Hansa.

Where better quality is required, regardless of cost, a more permanent yellow such as 11-1400 from American Hoechst (code L-356) could be used.

Molybdate Orange

Molybdate orange is used primarily in combination with lithol or BON reds to produce low cost, bright red shades.

For air drying products, toluidine red (R-710) could be used as a replacement for the combination of molybdate orange plus lithol or BON red. However, for baking finishes, a dinitroaniline orange replacement such as R-735 should be used. R-735 has fairly good opacity and good light fastness when used for masstone, but it is a bleeding pigment.

Again, for additional permanency, a higher cost organic orange pigment such as American Hoechst 12-1010 (code L-357) or 12-5000 (code R-752) would have to be used. These are over three times the cost of R-735.

For a lead-free, bright red shade, R-640 and R-641 could be used. R-640 at \$3.00 per pound is a light-shade red, while R-641 at \$4.00 per pound is a medium-shade red. Both will be practically non-bleeding and will have good permanency and baking resistance.

It is practically impossible to supply a specific recommendation for replacement of each lead containing pigment in the many formulations in which they are used. The above recommendations are, of necessity, general in nature but we believe they will be useful as starting points.

Keep in mind that we should endeavor to make all the replacements of lead containing pigments by using presently coded raw materials. If you have a color matching problem, the use of the COMIC which is available at most plants will allow you to get a good approximation.

Some specific customer color standards may need to be modified in order for lead-free versions to be economically feasible and of reasonable durability.

Please be sure to include in your future Product Development Reports and Monthly Letters of Comments, the progress you have made in replacing lead containing pigments and driers so that this information may be published for general reference.

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Table I

<u>Product</u>	<u>* Lead Drier</u>	<u>* No Lead Drier</u>
Y-49 Glid-Tone Hi-Gloss Varnish	E-344 - 0.07% Pb E-324 - 0.03% Mn E-304 - 0.05% Co E-380 - 0.024% Ca	E-303 - 0.05% Co E-390 - 0.10% Zr
Y-900 Spred Gloss Enamel White	E-396 - 0.51% Pb E-382 - 0.034% Ca E-390 - 0.14% Zr E-303 - 0.075% Co	E-382 - 0.04% Ca E-390 - 0.14% Zr E-303 - 0.07% Co
Y-4550 Glid-Guard Alkyd Industrial Enamel White	E-396 - 0.78% Pb E-304 - 0.085% Co E-392 - 0.076% Zr	E-382 - 0.066% Ca E-390 - 0.14% Zr E-303 - 0.07% Co
Y-4600 Spred Lustre Semi-Gloss Enamel White	E-396 - 0.80% Pb) E-344 - 0.42% Pb) 1.22% E-380 - 0.045% Ca E-304 - 0.044% Co	E-382 - 0.051% Ca E-390 - 0.145% Zr E-303 - 0.057% Co
Y-5900 Ultra Hide Gel-Flo Alkyd Semi-Gloss White	E-396 - 0.58% Pb) E-347 - 0.47% Pb) 1.05% E-382 - 0.023% Ca E-303 - 0.051% Co	E-390 - 0.13% Zr E-382 - 0.045% Ca E-303 - 0.051% Co

* Percentages shown correspond to metal content based on vehicle solids
(by weight).

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