C-2

Cross Reference:

Exposure Series #9888
"Dulux" Pigmentation
W-622

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MEMORANDUM REPORT NO. M-253:

PIGMENTATION OF ORANGE AND RED "DULUX"

Introduction:

This study was undertaken to develop durability and cost information for the Orange and Red range of "Dulux" colors. The trade's greatly expanded use of Molybdate Orange and the introduction of more durable organic pigments seemed to indicate that we should make a complete review of our formulating practice in this range. Although this work was done in short oil "Dulux" formulations, it is believed that the information and results will be generally adaptable to other lines and products.

The six colors selected to represent the range were:

(a) Orange, Molybdate Orange, W-622
(b) Orange Red, Red Toner, W-880
(c) Light Red, BON Red, RT-565-D
(d) Medium Red, Cadmium Red, W-381
(e) Medium Maroon, Cadmium Maroon, W-843
(f) Dark Maroon, BON Maroon, RT-521-D

Summary & Conclusions

Table #1 is a complete summary of hiding, cost and durability results. The use of this table will make it possible to select a pigment combination for any of the above color ranges to develop either optimum durability, hiding, or cost.

Summarizing these results, we found that Molybdate Orange, W-622, represents a very satisfactory balance of properties. Its hiding, gloss and gloss retention are superior to

the chrome yellow and orange pigments and organic modifications of these pigments. Molybdate Orange darkens on exposure, and in this respect, is slightly inferior to the Chromes. However, all these facts were taken into consideration and as a result, it was decided to adopt Molybdate Orange generally for use in 93 Line and 94 Line Automotive "Dulux".

The cadmium formulations are the most expensive, and most lightfast.

The new BON pigments show good lightfastness but a poor level of hiding. They are also showing definite blistering tendencies. However, RT-521-D, Dark Maroon, shows much more superior durability, (color retention and film integrity), than W-873, Infrex, and W-875, Victoria. It is planned to replace these two pigments with RT-521-D.

Experimental Details

At the start of this test, it was recognized that a satisfactory reproducible hiding power test for this type of "Dulux" enamels was lacking. The Pfund cryptometer method gave results in terms of wet film only and results were hard to reproduce. Difficulties were experienced in getting accurate film thickness measurements with hiding power charts; and, here again, results were not reproducible. It was decided that the cryptometer principle of a wedge shaped film would be most desirable if the film were applied over a contrast background, then dried and measured with a micrometer.

For this purpose, 4 x 12 steel panels were prepared with two black stripes down the middle over a white background. This represented a nearly 100% contrast surface. Then, strips of ½" masking tape were applied lengthwise along each edge. This would make it possible to measure the panel thickness at the later selected point of complete hiding. The test enamel was applied by spraying a wedge shaped film of increasing thickness from top to bottom. In many cases with enamels of low hiding, it was found necessary to apply this film in two separate bakes to prevent sagging and wrinkling. After baking, the finished panel would show an area of incomplete hiding at the top and total hiding at the bottom. Examination was made under a constant source of illumination, (MacBeth Daylight) and the points where the two center black lines disappeared was selected as the area of complete hiding. The masking tapes were removed and micrometer measurements made of the panel and the panel plus the test enamel in the area of complete hiding. The result was film thickness for complete hiding over a 100% contrast background. We consider these results reliable and easily reproducible.

The basis for the exposure grading shown on Table I was 5-1/3 months exposure at 45°S. in Florida. This was the time when some of the low pigment/binder Molybdate Orange and Cadmium formulations were showing definite line checking. In general, color change was only slightly worse than the four months exposure panels.

The cost calculations were made using current pigment prices and assuming each gallon of finished enamel to contain 2.77 lbs. of binder. Numerous checks were made and it was found that there was little deviation from this factor with the average 94 Line "Dulux" enamel. By considering the pigment cost per gallon and the mills for complete hiding, the economic value of each product can be determined.

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TABLE I

EXP. CODE	PIGMENTATION	P/B	Mils At Hiding	Pig. Cost/ gal.	DURABILITY: Color change (O = DARKEN, F = FADE, O = NO CHANGE)	DURABILITY: Gloss Retention (10 = PERFECT)	Clear	Remarks
		A. ORANGE						
P-94-R-11566	W-622	75	1.5	.89	3-D	10	OK	
P-94-R-11540	W-622	50	2.0	.61	3-D	10-	OK	
P-94-R-11554	W-677/W-880/W-43=75/21/4	56	3.0	.74	2-D	8	OK	Bleeds
P-94-R-11555	W-677/RT-565-D = 95/5	81	2.7	.92	3-D	8.5	OK	
P-94-R-11568	" " "	70	2.9	.78	3.5-D	8.5	OK	
P-94-R-11556	W-677/W-383 = 28/72	67	2.6	1.95	1	8.5	OK	
P-94-R-11567	" " "	54	3.0	1.56	2-D	8	OK	Sl.Checking
		B. ORANGE RED						
P-94-R-11543	W-880	25	3.3	.76	1	7.5	OK	Bleeds,Bronze
P-94-R-11557	W-622/RT-565-D = 53/47	34	2.1	1.16	1.5-D	8.5	OK	
P-94-R-1157CA	" " "	24	3.3	.81	3-D	9	OK	
P-94-R-11558	W-677/RT-565-D = 72/28	53	3.1	1.20	1.5-D	8.5	OK	
P-94-R-11584	W-384	67	3.0	2.48	0	8.5	OK	
P-94-R-11559	W-381/W-383 = 22/78	67	2.2	2.48	0	8.5	OK	
P-94-R-11571A	" " "	44	3.2	1.63	1.5	8.5	OK	SL. CHECKING
		C. LIGHT RED						
P-94-R-11536	RT-565-D	25	4.0	1.47	2-D	9	OK	
P-94-R-11594	"	35	2.9	2.02	2-D	8.5	OK	Sl.Bronze
P-94-R-11575	W-880/W-865 = 32/68	25	3.0	.86	1	7.5	OK	Bronze,BLEEDS
P-94-R-11577	W-382/W-384 = 50/50	67	2.3	2.48	1	8.5	OK	
P-94-R-11591	W-382/W-384 = 50/50	51	3.0	1.88	1	8.5	OK	
		D. MEDIUM RED						
P-94-R-11537	W-381	67	2.4	2.48	1	9	OK	
P-94-R-11595	"	32	3.4	1.16	0	9.5	OK	
P-94-R-11580	W-323/W-865 = 55/45	22	3.3	1.45	2-D	7.5	Spots	Bad Bronze,BLEEDS
P-94-R-11581	W-322/W-865 = 50/50	25	3.4	1.19	1	8	Blisters	Blisters,BLEEDS
P-94-R-11582	W-322/RT-525-D = 50/50	25	5.0	1.47	0	8	Blisters	Blisters
P-94-R-11590	" " " "	50	3.2	2.93	0	8	Blisters	Blisters
P-94-R-11593	" " " "	42	3.4	2.46	0	8	Blisters	Blisters

TABLE I (CONT'D)

EXP. CODE	PIGMENTATION	P/B	Mils At Hiding	Pig. Cost/ gal.	DURABILITY Color Chenco	Gloss Retention	Clear	Remarks
	E. MEDIUM MAROON							
P-94-R-11539	W-843	67	1.5	2.66	0	8	OK	
P-94-R-21101	W-322/W-303 = 45/55	25	1.1	1.08	3F	7	Blisters, Chalk	
P-94-R-21105	" " "	19	1.6	.81	3F	7	Blisters, Chalk	
P-94-R-21102	W-322/W-303 = 50/50	25	0.6	1.55	2F	7	Spots	
P-94-R-21106	" " "	15	1.7	.93	3F	7	Blisters	
	F. DARK MAROON							
P-94-R-18851	RT-521-D	25	3.0	1.16	1.5-D	8.5	OK	
P-94-R-21108	W-873/W-875 = 29/71	25	2.8	1.16	3-D	8	Blisters	

NOTE: RT-525-D, RT-565-D, & RT-521-D = Pigments Dept. BON Pigments