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330-LINE DISPERSIONS
FINAL DURABILITY REPORT
PERFORMANCE IN ALKYD AND NITROGEN-ALKYD SYSTEMS

PREPARED BY: M. H. SCHAFFER
DATE ISSUED: MAY 3, 1966
PROJECT: P-63, DISPERSION
STABILIZATION CONCEPT

ABSTRACT:

Exterior durability performance of alkyd and nitrogen-alkyd products containing 330-Line dispersions is equivalent to their conventional base analogs, i.e., 330-Line dispersions can be substituted for their conventional dispersion counterparts without affecting durability performance. This conclusion is based on results from over 100 exposure series covering the evaluation of approximately 6,000 panels. The results further demonstrate that the durability of a product system will vary with the particular pigment in the dispersion regardless of whether it is dispersed by conventional means or based on the Dispersion Stabilization Concept (DSC).

INTRODUCTION:

Commercial application of Universal Colorants involves replacement of multiple lines of conventional mill-base dispersions with a single line of dispersions. At inception of the Dispersion Stabilization Concept (DSC) program it was recognized that demonstration of satisfactory durability performance would be a prime requisite for acceptance of 330-Line Dispersions. The objective was to demonstrate that the DSC method of dispersion does not adversely affect product durability.

Earlier reports on the durability performance of Universal Colorants issued by G. C. Fox and the writer indicated favorable results based on mostly short and intermediate term exposures. Data obtained since our last report are now of sufficient duration and scope to enable issuance of this final report on durability. This report culminates the efforts initiated in 1962 and carried to the present to demonstrate the commercial application of 330-Line Dispersions from a durability standpoint.

All results have been summarized into final report form to (1) inform management that a major program objective has been completed, (2) provide a reference on durability performance of 330-Line Dispersions to support expanded commercial proposals and (3) present additional correlations between Accelerated Weathering and Florida exposure stations (a side benefit from the vast number of evaluations made in this study).

CONCLUSIONS:

From the efforts expended and the results obtained on durability evaluations of Universal Colorants, both a general and specific conclusion have been drawn.

The general conclusion is that application of DSC technology in formulating 330-Line Dispersions produces dispersions which are equivalent in durability performance to dispersions formulated by conventional technology. Since demonstration of durability equivalency is on the critical path of the program to commercialize 330-Line Dispersions, completion of this objective represents a major step towards expanded commercialization.

The specific conclusion is that 22 out of the 24 Universal Colorants evaluated, are considered acceptable replacements for their conventional base counterparts in alkyd and nitrogen-alkyd systems. The other two Colorants have poorer gloss retention in nitrogen-alkyd systems but perform satisfactorily in straight alkyd systems.

FUTURE ACTION:

Based on the above conclusions we plan to (1) eliminate durability evaluations of Colorants which have been shown to be equal to their conventional base analogs and (2) minimize the durability evaluations formerly required to establish performance of a DSC dispersion for new pigments.

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RESULTS AND DISCUSSION:

The 24 dispersions in the Universal Colorant gamut were exposed in masstones, tints and mixed color active product formulas, both metallic and non-metallic, at the Accelerated Weathering, Florida and Delaware exposure stations to define durability. Film systems were evaluated for all film failure parameters - water spotting, exudation, mildew, chalking, checking, cracking, blistering, flaking, bronzing, rusting and color change - at each inspection interval. Gloss readings were also taken each time the panels were evaluated.

No significant differences between the conventional and universal (control and experimental) based film systems were noted for the film failures listed above. Differences in gloss readings, where they existed, were the sole criteria for rating performance.

Table I lists the results obtained at the Florida exposure station for presently active scaled-up 300-Line Dispersions in alkyd and nitrogen-alkyd systems. Unless otherwise noted, each of the results represent exposure in a masstone and at least one level of tint. The 15 and 93-Line formulating tables were used for formulating straight alkyds and the 780-Line formulating tables for nitrogen-alkyds. The levels of tint exposed were based on the levels recommended in the formulating practices which correlate to the levels of commercial usage. All ratings in Table I refer to the performance of the Universal compared to the conventional systems. The ratings are given in terms of; better than control (+), marginally better than control (E+), equal to control (E), marginally poorer than control (E-) and poorer than control (-). The definition of these ratings in terms of variations in gloss are indicated at the bottom of Table I.

As shown in Table I, across-the-board performance of 22 of the 24 scaled up Colorants in the Universal gamut are considered equivalent to controls, i.e., ratings of E- or better for both alkyd and nitrogen-alkyd systems. Although 330-1608 and 330-1687 perform satisfactorily in straight alkyds, these dispersions are classified as poorer than control for across-the board performance since they are poorer than control in nitrogen-alkyd quality. Work to upgrade performance is indicated with 330-1608 since the initial clarity of films containing this dispersion was not equal to control. On the other hand, no further work is planned to upgrade performance of 330-1687 since this dispersion performed satisfactorily at 12 months in the particular exposure series cited and additional evaluations of 330-1687 indicate that the poorer gloss retention of the experimental system at 16 months may be an inconsistent result.

It should be understood that instances do arise where results might reverse themselves at adjacent inspection intervals e.g., the experimental could be -5 gloss units at 4 months exposure and +5 gloss units at 8 months vs. control. When inconsistent results of this type are encountered, performance of a system is rated on the overall picture rather than on singular results at a specific inspection interval. In the example cited above, the control and experimental systems are considered equivalent.

Results of shorter term exposure of the basic formulating gamut of Universal Colorants, as reviewed in our report of August 1965, indicated a Gaussian type distribution where most of the systems were equal to control with approximately an equal number being better and poorer than control. Comparison of these earlier results with current data shows that the overall performance of the Universal systems have now taken a favorable rather than an equivalent position as compared to conventional systems. Our earlier results indicated that 19% of the 330-Line dispersions performed better or marginally better than control in alkyd and nitrogen-alkyd systems. Current results show 30% in this same rating category. Although the total percentage of 330-Line dispersions performing marginally poorer or poorer than control has remained at 15%, only 4% are in the poorer category now, as compared to 7% earlier. These results are pictorialized in Chart I.

In addition to the results included in Table I, exterior performance results from multiple evaluations of each Colorant are available for back-up data. These results which cover the evaluation of approximately 6,000 panels include performance evaluations of the scaled-up Colorants as well as earlier slightly modified dispersions.

Although not included in this report, durability evaluations of many of the Colorants have been made in thermosetting acrylic enamel quality. Results which include up to 15 months exposure indicate satisfactory durability performance. Favorable results on the exposure of a limited number of Colorants in vinyl and acrylic quality systems have also been obtained.

Performance correlation between Accelerated Weathering (X-1 Cycle) and Florida exposure stations continues to be good overall with nitrogen alkyds correlating slightly better than straight alkyds. This follows since straight alkyds being air dried do not attain their ultimate hardness until long after initial exposure and the severe treatment they are submitted to during the initial stages of A.W. exposure when the films are still soft could in some cases cause premature failure and lead to erratic results. This problem is greatly minimized or negated with nitrogen-alkyds since being baked products, they are much closer to ultimate hardness when exposed than are straight alkyds. It is significant, however, that when a systems performance has been equivalent to control on A.W. exposure, it has been, in all our results equivalent to control in Florida. Thusly, when A.W. exposure results are positive, it can be anticipated that Florida exposure results will also be positive.

MHS:jp

TABLE I*

DURABILITY PERFORMANCE OF SCALED-UP 330-LINE DISPERSIONS
IN ALKYD AND NITROGEN ALKYD MASSTONES AND TINTS

ACROSS THE BOARD PERFORMANCE	COLORANT CODE	ALKYD				NITROGEN-ALKYD			
		RATING	SERIES NO.	LENGTH OF EXP.	12 MOS. DUE	RATING	SERIES NO.	LENGTH OF EXP.	18 MOS. DUE
Equivalent	330-3243	E+	20764	6	8-1-66	E	20777	4	6-14-67
	330-2300 ^a	+	19829	18	---	E+	19997	12	5-30-66
	330-1312 ^a	E	19823	18	---	+	20645	8	9-4-66
	330-1327	E+	19829	18	---	E	19997	12	5-30-66
	330-1355	E+	20530	12	---	E	20647	8	9-4-66
	330-1362	E	19904	15	---	E	19932	20	---
	330-1384	E	19829	18	---	E-	19921	16	5-29-66
	330-1393	E+	19812	18	---	E-	20831	16	4-8-67
	330-1505	E	19823	18	---	E-	19881	16	5-29-66
	330-1559 ^a	E	20844	12	11-10-66	E	20844	3	5-10-67
To	330-1582 ^a	E	20530	12	---	E	20516	16	5-29-66
	330-1612	E	19845	15	---	E	19921	16	5-29-66
	330-1622	E	20222	12	---	E	19927	16	5-29-66
	330-2630	E+	20704	6	5-3-66	E+	20647	12	5-29-66
	330-1655	E	19692	21	---	E	19692	21	---
	330-1658	E	19845	15	---	E+	19932	20	---
	330-1679	E	19869	18	---	E+	19921	16	5-29-66
	330-1686	E	19823	18	---	E	19881	16	5-29-66
	330-1785	E	19803	18	---	E-	19833	15	5-19-66
	330-1818	E+	20508	12	---	E+	19974	16	5-25-66
Control	330-1819	E ^a	19812	18	---	E-	19974	16	5-25-66
	330-1830	E ^a	20883	3	11-15-66	Not Exposed	To Date		
	330-1608	E	19904	15	---	-	20786	4	3-24-67
	330-1687	E	19845	15	---	-	19921	16	5-29-66

^a Represents results from an active product formula.

^s Represents results from a tint only.

KEY: + Better than control - Either masstone or tint is 10 or more gloss units better than control and the other is at least equal to control.

E+ Marginally better than control - Either masstone or tint is 6 to 10 gloss units better than control and the other is at least equal to control.

E Equal to control - Both masstone and tint are within 5 gloss units of control.

E- Marginally poorer than control - Either masstone or tint is 6 to 10 gloss units poorer than control and the other is within 5 gloss units of control.

- Poorer than control - Both masstone and tint are 6 or more units deficient in gloss, or either one is 10 or more units deficient in gloss.

*The results listed in this Table are supported by results from shorter term evaluations of the scaled-up Colorants as well as multiple longer term evaluations of earlier slightly modified formulations of these Colorants.

**DURABILITY PERFORMANCE OF SCALED-UP 330-LINE DISPERSIONS
IN ALKYD AND NITROGEN-ALKYD QUALITIES**

**CHART I
COMPARISON OF CURRENT AND EARLIER RESULTS**

