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STABILITY REPORT

SIXTEEN 330-LINE DISPERSIONS

PERFORMANCE IN ALKYD AND NITROGEN-ALKYD PRODUCTS

Prepared by: M. H. Schaffer
Date Issued:
Project: P-63 DSC
Previous Reports: D.S.C. #66-2
Notebooks: 7682, 7857, 8091, 8189, 8196, 8385, 8500, 8653, 8661, 8662, 8885, 9029

ABSTRACT:

This report covers the stability performance of alkyd and nitrogen-alkyd products containing sixteen of the twenty-four dispersions in the 330-Line colorant gamut. Data demonstrate that products containing any one or a combination of the sixteen dispersions are satisfactory from a stability performance standpoint. Conclusions are based on the evaluation of over 3,500 laboratory pilots and on feedback from commercial experience. A report describing the performance of the eight 330-Line dispersions not covered herein will follow completion of a statistical evaluation program currently underway.

REASON FOR REPORT:

This report is issued to:

(1) Serve as a reference on the stability performance of products containing 330-Line dispersions in support of the full scale 330-Line commercialization proposal.

(2) Document a vast amount of experimental data regarding the stability performance of products containing 330-Line dispersions.

(3) Eliminate superfluous 330-Line stability evaluations by providing comprehensive recommendations based on experimental data.

(4) Appraise Management of the satisfactory completion of the finished product stability evaluation work phase of the P-63 Project.

(5) Supplement and consolidate earlier correspondence on 330-Line finished product stability performance.

OBJECTIVES:

(1) The overall immediate objective of the P-63 Project is to replace and subsequently obsolete 42, 732 and 743-Line conventional dispersions by satisfactorily commercializing 330-Line dispersions.

(2) The specific objective of the stability evaluation phase of the P-63 Project is to determine if products containing 330-Line dispersions are equivalent in stability performance to conventional based analog systems.

CONCLUSIONS:

(1) Sixteen (16) dispersions in the 330-Line formulating gamut (See Table I) can be used to replace their 42, 732 and 743-Line conventional dispersion counterparts in alkyd and nitrogen-alkyd systems without any significant effect on finished product stability characteristics.

(2) The settling performance of a finished product is directly related to the degree of flocculation of the dispersions which it contains. Due to their higher level of deflocculation (better dispersion), eight (8) 330-Line coarse pigment dispersions (See Table I-A) inconsistently display varying degrees of poorer settling resistance in finished products as compared to their conventional based, more highly flocculated, counterparts. A statistical evaluation program is currently underway to define the extent and determine commercial significance of the settling performance in this area. Early results are satisfactory and conclusions, which will be based on these and longer term stability data from this statistical program, will be presented in future correspondence and in the Release Letter proposing full-scale commercialization.

FUTURE ACTION:

(1) Work continues to commercialize 330-Line Dispersions. A Release Letter proposing full-scale commercialization of the 330-Line gamut (24 dispersions) will be written.

(2) The coarse pigment dispersion statistical analysis program will continue to completion with report on data to follow.

(3) No new stability evaluations are planned in alkyd and nitrogen-alkyd systems for thirteen (13) of the sixteen (16) 330-Line dispersions classified in this report as satisfactory. The other three (3) dispersions are satisfactory in straight-alkyd quality but have yet to be evaluated in nitrogen-alkyd quality. Plans have been made to evaluate these dispersions accordingly.

(4) Stability evaluations already in progress will continue according to standard schedules and testing procedures.

(5) Any new dispersions introduced into the 330-Line gamut will be evaluated in both alkyd and nitrogen-alkyd systems on a high spot basis only.

ACKNOWLEDGEMENTS:

The data presented in this report was planned and accomplished over the past several years. Many members of the Divisional Plants Chemical Groups contributed to the setting-up and conducting of the experimental program.

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DISCUSSION:

Introduction:

The immediate objective of the P-63 Project is to replace 42, 732, and 743-Line, conventional dispersions, with 330-Line DSC dispersions. To successfully achieve this objective it is necessary to establish that 330-Line dispersions perform equivalent to their conventional counterparts in alkyd and nitrogen-alkyd finished product systems. To determine performance, an experimental program was set up to not only evaluate initial film properties, but to also establish durability and stability characteristics of the 330-Line based systems as compared to conventional based controls. The data accumulated during this program demonstrates satisfactory durability performance of 330-Line dispersions, ref.: DSC Reports #66-4, and #67-2. This report summarizes the results of the stability evaluation phase of the experimental program.

Results:

Experimental data demonstrates that the stability performance of products containing any one or a combination of sixteen (16) of the 330-Line dispersions scheduled for full-scale commercialization are equivalent to their conventional based counterparts. From these experimental results it is predicted that there will be no significant commercial differences in stability performance between 330-Line and conventional based finished products. This forecast is supported by satisfactory complaint-free experience with many products manufactured on a commercial scale at Toledo using 330-Line dispersions over the past three years. A summary of the results supporting conclusions are presented in Tables II through XVIII.

Tables II to XVII list individually, by Colorant, the performance of the sixteen (16) 330-Line dispersions in alkyd and nitrogen-alkyd qualities. All of the finished products systems in this series of Tables either contain (1) the individual dispersion under evaluation, alone, with no other Colorants in the system (masstone), (2) the dispersion under evaluation in combination with a prime white base (tint), or (3) the individual dispersion under evaluation in combination with other conventional dispersions. Systems in any one Table are listed in numerical order by product Line Number. Line Numbers 15 to 699 represent straight-alkyd systems and 700 through 799 nitrogen-alkyd systems.

Table XVIII shows the performance of combinations of the sixteen (16) 330-Line dispersions (gamut replacements) in alkyd and nitrogen-alkyd systems. Most of the systems used for evaluation here are active product formulas.

Results in all Tables are expressed in terms of experimental vs. control performance: a plus (+) designates experimental is better than control and a negative (-) designates experimental is poorer than control. Only those specific results showing a difference between experimental and control are recorded in the Tables. Where a specific result is shown, it should be understood that all other results of that evaluation are equal. Where there are no differences between experimental and control, results are designated as "equal to control."

The results reported in the Tables cover the performance of prototype as well as the currently scaled-up, scheduled for commercialization, dispersions. Many of the earlier dispersions were similar in design to the present systems and results on these early systems correlate with, and tend to support data obtained from the current dispersions.

Stability performance of products using any of the eight (8) coarse pigment dispersions in the 330-Line gamut will be presented in a separate report covering the statistical analysis program of these dispersions currently underway.

Criteria For Analysis of Results:

In most cases, finished products have numerically defined specification limits for controlling performance parameters and physical properties such as gloss, hardness, cure, gallon weight, viscosity, etc. In these cases, performance of an experimental system can be measured in two ways:

(1) Comparison to control and/or
(2) Comparison to specification limits.

Specification limits provide a basis for determining if an experimental system is commercially satisfactory even though results do not duplicate control performance, e.g., if a product has a viscosity specification of 50 to 60 seconds and the experimental is 52 and the control 58, the experimental, even though it is not equal to control, is still considered commercially satisfactory since it meets product specifications.

Where no specifications exist for a particular performance test, comparison of experimental to control is the only criterion for determining satisfactory performance. Tests such as viscosity, stability, seed and settling generally fall into this category of non-specification. To define performance of 330-Line versus conventional based systems results were related to product end use, duration of stability and importance of the specific tests in relation to what is required by the customer of the product.

The ratings given for a particular evaluation are a composite of the performance of the experimental versus control over the entire duration of testing rather than expressed as results at any single interval, e.g., seed resistance of an experimental system slightly poorer than control at one month; slightly better than control at two months; and equal to control at six months is considered equivalent to control. Rating stability in this manner eliminates slight variations in performance due to: (1) sampling inconsistencies; (2) batch-to-batch raw material variations; (3) testing reproducibility; and (4) use of several subjective type tests.

Experimental Design

The target area for commercialization of 330-Line dispersions is alkyd and nitrogen-alkyd finished products. In carrying out this commercialization, 330-Line will replace 42, 732 and 743-Line dispersions in approximately 100 different product lines encompassing close to 8,000 formulas. To determine if these replacements could be made without affecting the present level of finished product stability performance, experiments were designed as follows:

(1) Quality of Products

a. Masstone and Tints - Each Colorant, where applicable, was evaluated in alkyd and nitrogen-alkyd quality, masstone and tint vs. conventional based controls. The 15, 93 and 181-Line Formulating Tables were used to develop data for straight alkyd quality and the 780 and 781-Line Tables were used to develop data for nitrogen-alkyd quality. These Lines were selected as representative of alkyd and nitrogen-alkyd quality, respectively, because of the high volume position they maintain in our production pattern and the fact that nearly all dispersions in the 330-Line gamut are included as Colorants for these Lines. In the few areas where a particular 330-Line dispersion was not used as a Colorant in any of the above Lines, masstones and tints were selected from other Formulating Tables, e.g., 195-Line, 794-Line, etc.

b. Active Product Formulas - All dispersions in the 330-Line gamut were evaluated in active product formulas, metallic and non-metallic, straight-alkyd and nitrogen-alkyd quality. These evaluations included single replacements and gamut replacements in many of the Lines which will ultimately be converted to a 330-Line formulating basis.

(2) Evaluation Intervals and Duration

Stability of each sample was routinely run up to six months. Where dictated by product end use, stability was either curtailed or extended. Testing intervals varied with the specific product, but usually included evaluation at one, three and six months. Oven stabilities (120°F), low temperature stabilities, and shelf stabilities were run as related to product end use.

(3) Evaluation Testing

Routine quality control tests such as gallon weight, viscosity, settling, seed, gloss, hardness, flexibility, adhesion, and color were used to define initial product performance. Settling evaluations, as well as all or a portion of the aforementioned tests were used to define performance at each stability testing period.

Non-routine tests specific to end product use were also run when and where required, e.g., appliance enamels were evaluated for humidity, salt spray, grease resistance and stain resistance in addition to the routine tests listed above.

Visual and microscopic analyses were made on wet samples and dry films to determine flocculation and pigment orientation characteristics.

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TABLE I

330-LINE DISPERSIONS

SCHEDULED FOR FULL-SCALE COMMERCIALIZATION
STABILITY PERFORMANCE COVERED IN THIS REPORT

330-LINE CODE	DESCRIPTION
330-3243	Carbon Black Dispersion
330-3300	Bon Red Dispersion
330-2312	Thio Red Dispersion
330-1362	Red Iron Oxide Dispersion
330-1393	"Monastral®" Maroon Dispersion
330-1505	"Monastral" Blue Dispersion
330-1550	"Monastral" Blue Dispersion
330-1559	Indo Violet Dispersion
330-2582	Milori Blue Dispersion
330-1588	Indo Blue Dispersion
330-1612	Green Gold Dispersion
330-1658	Ponsol Orange Dispersion
330-1785	"Monastral" Green Dispersion
330-1818	"Monastral" Violet Dispersion
330-1819	"Monastral" Red Dispersion
330-1830	"Monastral" Scarlet Dispersion

TABLE I-A

330-LINE DISPERSIONS
SCHEDULED FOR FULL-SCALE COMMERCIALIZATION
STABILITY PERFORMANCE TO BE COVERED IN FUTURE CORRESPONDENCE

330-LINE CODE	DESCRIPTION
330-1355	Red Iron Oxide Dispersion
330-1384	Medium Light Cadimum Red Dispersion
330-1622	Molybdate Orange Dispersion
330-2630	Ferrite Yellow Dispersion
330-1655	Red Toned Molybdate Orange Dispersion
330-1679	Light Chrome Yellow Dispersion
330-1686	Medium Chrome Yellow Dispersion
330-1687	Light Chrome Yellow Dispersion

TABLE II

STABILITY PERFORMANCE OF 330-3243 IN STRAIGHT ALKYD AND NITROGEN ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
15	M	3 mos.	+ slight initial gloss
15	T (10/90)	3 mos.	+ slight viscosity stability
15	M	2 mos.	+ slight viscosity stability
15	T (10/90)	2 mos.	+ slight viscosity stability
15	T (1/99)	2 mos.	+ slight viscosity stability
704	C	6 mos.	- slight gloss, + slight viscosity stability
717	C	12 mos.	= to control
752	C	6 mos.	= to control
780	M	6 mos.	= to control
780	T (90/10)	6 mos.	= to control
780	M	3 mos.	= to control
780	T (10/90)	3 mos.	= to control
780	C	1 mo.	= to control
780	C	3 mos.	= to control
799	C	6 mos.	= to control

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment);
C = Mixed Color Containing 330-3243 In Combination With Conventional Dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (Control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE III

STABILITY PERFORMANCE OF 330-3300 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
15	M	6 mos.	= to control
15	T (90/10)	6 mos.	= to control
780	C	1 mo.	+ slight gloss, - slight color drift
780	M	6 mos.	= to control
780	T (90/10)	6 mos.	= to control

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment);
C = Mixed Color Containing 330-3300 In Combination With Conventional Dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE IV

STABILITY PERFORMANCE OF 330-2312 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE[1]	STABILITY DURATION	REMARKS[2]
15	M	6 mos.	+ viscosity stability
15	T (90/10)	6 mos.	+ viscosity stability
93	M	16 mos.	= to control
93	T (10/90)	16 mos.	= to control
752	C	6 mos.	= to control
780	M	6 mos.	+ slight gloss stability
780	T (10/90)	6 mos.	= to control
780	M	6 mos.	= to control
780	T (10/90)	6 mos.	= to control
794	M	16 mos.	= to control
794	T (90/10)	16 mos.	= to control

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-2312 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE V

STABILITY PERFORMANCE OF 330-1362 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
93	M	2 wks.	- slight settling
93	M	6 mos.	= to control
93	T (90/10)	6 mos.	= to control
780	M	6 mos.	= to control
780	T (90/10)	6 mos.	= to control
780	C	3 mos.	= to control

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment): C = Mixed Color containing 330-1362 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE VI

STABILITY PERFORMANCE OF 330-1393 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
93	M	6 mos.	+ slight seed resistance
93	T (10/90)	6 mos.	+ slight seed resistance
181	C	6 mos.	= to control
781	C	6 mos.	= to control
799	C	6 mos.	= to control

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1393 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE VII

STABILITY PERFORMANCE OF 330-1505 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
15	M	6 mos.	+ tinting strength
15	T (90/10)	6 mos.	= to control
93	T (10/90)	--	Initial properties = to control. No stability.
93	C	15 mos.	= to control.
181	C	15 mos.	= to control.
780	M	7 mos.	- slight gloss and haze, + color stability.
780	T (20/80)	7 mos.	= to control.
780	M	6 mos.	+ initial seed. (control re-made). - slight seed stability vs. new control.
780	T (80/20)	6 mos.	+ initial seed. (control re-made). - slight seed stability vs. new control.
780	M	15 mos.	= to control.
780	T (20/80)	15 mos.	= to control.
794	T (10/90)	--	Initial properties = to control. No stability.

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1505 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE VIII

STABILITY PERFORMANCE OF 330-1550 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
93	M	6 mos.	- color drift, + seed resistance.
93	T (80/20)	6 mos.	- color drift, + seed resistance.
181	C	6 mos.	= to control.

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1550 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE IX

STABILITY PERFORMANCE OF 330-1559 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE[1]	STABILITY DURATION	REMARKS[2]
93	M	6 mos.	+ initial color, + seed, + slight settling resistance.
93	T (10/90)	6 mos.	+ slight settling resistance.
93	T (90/10)	6 mos.	+ initial color, + seed.
93	C	13 mos.	= to control.
181	C	13 mos.	= to control.
780	C	2 mos.	= to control.

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1559 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE X

STABILITY PERFORMANCE OF 330-2582 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
93	M	6 mos.	= to control.
93	T (90/10)	6 mos.	= to control.
93	C	2 mos.	+ slight viscosity stability, + slight seed.
112	C	1 mo.	= to control.
181	C	2 mos.	+ slight viscosity stability, + slight seed.
751	C	3 mos.	= to control.
752	C	6 mos.	= to control.
762	C	3 weeks	= to control.
780	M	6 mos.	+ slight seed resistance, + slight gloss.
780	T (70/30)	6 mos.	+ slight seed resistance, + slight gloss.
780	C	14 mos.	= to control.
799	C	3 weeks	= to control.

(1) Pilot Type - M = Masstone: T = Tint, (followed by ratio of colored pigment/white pigment):
C = Mixed color containing 330-2582 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XI

STABILITY PERFORMANCE OF 330-1588 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
93	C	1 mo.	- slight hardness, + slight seed resistance.
181	C	1 mo.	= to control.

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment);
C = Mixed color containing 330-1588 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XII

STABILITY PERFORMANCE OF 330-1612 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
15	M	3 mos.	= to control
15	T (40/60)	3 mos.	= to control
15	M	6 mos.	= to control
15	T (50/50)	6 mos.	= to control
15	T (10/90)	6 mos.	= to control
15	M	6 mos.	= to control
15	T (50/50)	6 mos.	= to control
93	M	12 mos.	= to control
93	T (50/50)	12 mos.	= to control
704	M	12 mos.	= to control
704	C	12 mos.	= to control
707	C	12 mos.	= to control
780	M	6 mos.	= to control
780	T (10/90)	6 mos.	= to control
794	M	12 mos.	= to control
794	T (50/50)	12 mos.	= to control
794	M	3 mos.	= to control
794	T (40/60)	3 mos.	= to control

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment):
C = Mixed color containing 330-1612 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XIII

STABILITY PERFORMANCE OF 330-1658 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE[1]	STABILITY DURATION	REMARKS[2]
15	M	6 mos.	+ slight seed resistance
15	T (90/10)	6 mos.	+ slight seed resistance
15	T (10/90)	6 mos.	= to control
15	T (50/50)	6 mos.	= to control
780	M	6 mos.	= to control
780	T (10/90)	6 mos.	= to control

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1658 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XIV

STABILITY PERFORMANCE OF 330-1785 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE[1]	STABILITY DURATION	REMARKS
15	M	---	Initial properties = to control. No stability.
15	M	17 mos.	= to control
15	T (10/90)	17 mos.	= to control
15	M	--	Initial properties = to control. No stability.
15	T (80/20)	--	Initial properties - slight gloss. No stability.
15	T (60/40)	--	Initial properties = to control. No stability.
15	T (40/60)	1 mo.	= to control.
15	M	2 mos.	+ slight hardness.
15	T (60/40)	2 mos.	+ slight hardness.
93	T (10/90)	--	Initial properties = to control. No stability.
181	C	2 mos.	- slight hardness.
193	C	17 mos.	= to control.
195	M	12 mos.	+ slight flexibility.
701	C	7 mos.	= to control.
780	M	6 mos.	+ slight clarity.
780	T (60/40)	6 mos.	+ slight clarity.
780	T (20/80)	6 mos.	+ slight clarity.
780	C	6 mos.	= to control.
780	C	6 mos.	= to control.
793	M	6 mos.	= to control.
793	T (50/50)	6 mos.	= to control.
793	C	6 mos.	= to control.
794	C	7 mos.	= to control.

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1785 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XV

STABILITY PERFORMANCE OF 330-1818 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
93	M	6 mos.	= to control
93	T (90/10)	1 mo.	= to control
93	M	6 mos.	= to control
93	T (90/10)	6 mos.	= to control
93	C	6 mos.	= to control
181	C	6 mos.	= to control
181	C	13 mos.	= to control
780	M	6 mos.	= to control
780	T (10/90)	6 mos.	= to control

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment):
C = Mixed Color containing 330-1818 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XVI

STABILITY PERFORMANCE OF 330-1819 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
15	T (90/10)	1 mo.	+ slight seed resistance
93	T (10/90)	16 mos.	= to control
93	M	6 mos.	= to control
93	T (90/10)	6 mos.	= to control
93	M	6 mos.	= to control
93	T (90/10)	6 mos.	= to control
93	C	6 mos.	= to control
181	C	6 mos.	= to control
780	M	6 mos.	- Slight seed resistance, + color stability, + gloss and clarity.
780	T (90/10)	6 mos.	- Slight seed resistance, + color stability, + gloss and clarity.
794	T (10/90)	16 mos.	= to control
799	C	6 mos.	= to control

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment); C = Mixed Color containing 330-1819 in combination with conventional dispersions.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XVII

STABILITY PERFORMANCE OF 330-1830 IN STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMELS

MASSTONES, TINTS AND IN COMBINATION WITH CONVENTIONAL DISPERSIONS

PRODUCT LINE NO.	PILOT TYPE(1)	STABILITY DURATION	REMARKS(2)
15	C	9 mos.	= to control
181	C	9 mos.	+ slight seed resistance, + slight flexibility

(1) Pilot Type - M = Masstone; T = Tint; (followed by ratio of colored pigment/white pigment);
C = Mixed Color containing 330-1830 in combination with conventional dispersions.

(2) Remarks = All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

TABLE XVIII

STABILITY PERFORMANCE OF STRAIGHT-ALKYD AND NITROGEN-ALKYD ENAMEL PILOTS CONTAINING COMBINATIONS OF 330-LINE DISPERSIONS AS REPLACEMENTS FOR CONVENTIONAL DISPERSIONS

PRODUCTION NUMBER	330-LINE COLORANTS(1)	STABILITY DURATION	REMARKS(2)
94	U-243, U-785, U-612	3 mos.	+ viscosity stability
94	U-243, U-362, U-630	3 mos.	= to control
94	U-300, U-655	3 mos.	- Initial seed resistance
181	U-362, U-658, U-819, U-243	6 mos.	= to control
181	U-505, U-243, U-312, U-785	6 mos.	= to control
181	U-312, U-785, U-505	6 mos.	+ viscosity stability
181	U-243, U-505, U-785	6 mos.	= to control
181	U-658, U-362, U-819	6 mos.	= to control
181	U-312, U-830, U-355	9 mos.	= to control
181	U-393, U-819, U-818	13 mos.	= to control
193	U-243, U-679	6 mos.	- settling resistance
193	U-243, U-622, U-686	6 mos.	= to control
193	U-243, U-630, U-785	1 mo.	+ color drift
193	U-243, U-630, U-785	6 mos.	= to control
193	U-243, U-630, U-785	12 mos.	- slight viscosity stability
704	U-612, U-630, U-785	12 mos.	= to control
704	U-243, U-630	12 mos.	+ slight viscosity stability, - slight color drift.
707	U-785, U-612	12 mos.	+ slight settling resistance
707	U-785, U-679, U-630	12 mos.	= to control
707	U-243, U-630	12 mos.	+ slight viscosity stability, - slight color drift.
717	U-243, U-785	12 mos.	= to control
717	U-243, U-785, U-630	12 mos.	= to control
717	U-312, U-819	6 mos.	= to control
717	U-312, U-658, U-819	6 mos.	= to control
752	U-243, U-630	12 mos.	= to control
752	U-243, U-630, U-785	6 mos.	= to control
752	U-785, U-612, U-630	12 mos.	= to control
752	U-785, U-679, U-630	12 mos.	= to control
752	U-300, U-384	6 mos.	- slight viscosity stability, + slight gloss
752	U-362, U-630, U-582	6 mos.	+ slight viscosity stability
H-772	U-818, U-655, U-243	6 mos.	= to control
G-780	U-612, U-630	7 mos.	= to control

TABLE XVIII (CONT'D)

PRODUCTION NUMBER	330-LINE COLORANTS(1)	STABILITY DURATION	REMARKS(2)
N-780	U-505, U-550	6 mos.	+ package stability, control gelled
O-780	U-559, U-505	1 mos.	= to control
O-780	U-312, U-505, U-243	6 mos.	= to control
O-780	U-505, U-582, U-785	13 mos.	= to control
O-780	U-362, U-630, U-243	6 mos.	= to control
780	U-243, U-630, U-362	3 mos.	= to control
781	U-505, U-785	6 mos.	= to control
G-781	U-819, U-312, U-658	6 mos.	= to control
G-781	U-658, U-819	6 mos.	= to control
G-781	U-505, U-785	6 mos.	= to control
G-781	U-505, U-785	3 mos.	- slight gloss
G-781	U-785, U-505	6 mos.	- slight gloss
793	U-300, U-655	6 mos.	= to control
O-793	U-312, U-658, U-362	6 mos.	= to control
F-799	U-312, U-505, U-243	6 mos.	= to control
F-799	U-612, U-658	6 mos.	= to control
G-799	U-505, U-582, U-785, U-312	6 mos.	= to control
G-799	U-312, U-505, U-582, U-785, U-559	6 mos.	- slight viscosity stability
G-799	U-582, U-362, U-630, U-785, U-559	6 mos.	= to control

(1) 330-Line Colorants - Expressed as U -, followed by the code of the pigment which the dispersion contains.

(2) Remarks - All remarks refer to the performance of the 330-Line system (experimental) as compared to the conventional dispersion system (control), i.e., a plus sign designates better performance of the 330-Line system; a negative sign designates poorer performance of the 330-Line system.

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