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Marshall Laboratory
June 15, 1953

MEMORANDUM REPORT NO. M-601

Prepared by: William C. Johnson

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PRODUCTION UNIFORMITY AND ALIGNMENT OF 301-916

#40 OUTSIDE WHITE HOUSE PAINT

INTRODUCTION

Over 49,000 gallons of 301-916 have been made at Philadelphia during its field trial, trial sale and general release. Most Philadelphia batches have been high in solids (high in cost) while Fort Madison batches generally have been low in solids (low in cost). This report points out the known principle variables which control solids. We would like to see all production conform to the Fort Madison range of solids.

CONCLUSIONS

Laboratory and plant data establish that solids and cost may be reduced as follows:

1. Use zinc oxides equivalent to American zinc oxide
ZZZ-33.
2. Increase the acid number range of VO-5339 from 6-8
to 7-9.
3. Reject low oil absorption lots of FT Asbestine W-1001.

N3547

Other variables such as body and solids of the bodied oil, molecular composition of the bodied oils and bodied oil acids, and the oil absorption of the TiO_2 pigments may be minor factors.

Some high solids paints have a tendency to drop off in viscosity.

Follow-up: Projected work is being handled by the Production Department.

DISCUSSION

American zinc oxide ZZZ-33 has given lower solids than Eagle Picher ZnO in two laboratory tests and in several comparisons in the plant. The two laboratory tests are shown in Table I. The paints were made eight months apart with laboratory materials which were available at the time they were made. American zinc oxide ZZZ-33 shows an advantage of 3.6% and 2.3% more thinner than the identically prepared Eagle Picher paints. The difference in the solids level between the two tests can probably be explained by the use of FT Asbestine on 3/19/53 and Nylal 300 on 7/10/53 along with the other lesser variables.

Plant batches made with Azo ZZZ-33 are lower in solids. For example, batches of P-301-U- 59436 versus P-301-U-59437 of Table II show the respective Azo batches to be lower in solids than the Eagle Picher batches. Likewise batches of P-301-U-59435 are on the average lower in solids than P-301-U-59434 but the difference is not significant to 95% reliability. In comparing paints on Table II be sure the acid number and batches of extender correspond.

Note in Table IV the Fort Madison batch 45-3376 made with Eagle Picher is higher in solids than any of the five succeeding batches made with Azo ZZZ-33. These batches presumably used the same batch of bodied oil.

Acid Number of Bodied Oil Versus Solids

Acid number is shown to be a variable which affects solids but is probably not the only such variable connected with the bodied oil.

Data in Table I show what we find in the laboratory concerning the acid number of bodied oils. Higher acid numbers reduce the solids and we recommend that the acid number limits be raised one unit.

Data on plant production in Table II indicate that higher acid numbers give lower solids although there are a few inconsistencies in the data. Azo ZZZ-33 seems to be more sensitive to acid number variation than Eagle Picher #415 zinc oxide.

Lots of Extender

Lot 8388 of W-1001, FT Asbestine, resulted in high solids whenever it was used. A laboratory check of lots of extender is shown at the bottom of Table I.

Lot 8388 was first suspected when plant batches using 8388 were found high in solids. In Table III, an inspection of data on batches 464829 consecutively through 465134 with data of preceding and following batches show lot 8388 to affect high solids. Compare batches with bodied oil of equal acid numbers. A similar inspection of batches 455842 to 455844 and batches 436226 to 436229 will show the same.

Viscosity Stability

There is an indication that paints which drop off 5 KU or more in viscosity also give high solids. However, all paints high in solids do not necessarily drop off in viscosity.

Data in Table II show that paints containing bodied oil having an acid number of 8.7 or Azo ZZZ-333 do not fall off as far in viscosity. Then, too, in Table III all but one of the batches which first brought about the concern over the 5 KU drop off in viscosity on aging contained lot number 8388 of WT-1001 FT Asbestine, the lot of extender which gives high solids. These batches which dropped off 5 KU are 436229, 436227, 436226, 455843 and 455844.

Attachments and Acknowledgements

For the record, plant alignment data which have been collected from batch cards are listed in the attached tables.

Acid number of the bodied oil may not be the same as the batch number and batch card show but can be approximated from the storage tank number and pumping data. Bodied oil is held in a 1000-gallon tank in the 193 building. When some or all of the oil in this tank has been drained, more oil is pumped to it from 2500-gallon storage tanks. The acid number of the oil in the 2500-gallon storage tanks is known and a pumping log is kept.

By assuming the oil transferred to the 1000-gallon tank mixes with the oil already there, a acid number for the blend can be calculated. Figure 1 shows the calculated acid number of the blend of bodied oil in the tank in the 193 building for each day from December 1, 1952 to May 22, 1953.

Stability information in Table III was obtained by the Control Laboratory.

MARSHALL LABORATORY

William C. Johnson

WILLIAM C. JOHNSON

WCJ:alg
6/11/53
Attach.

TABLE I
LABORATORY EVIDENCE ON VARIABLES AFFECTING SOLIDS

ZINC OXIDE

<u>Code</u>	<u>Make of Zinc Oxide</u>	<u>Test on 3/19/53</u> <u>Excess Thinner</u> <u>% of Total</u> <u>Paint</u>	<u>Test on 7/10/52</u> <u>Excess Thinner</u> <u>% of Total</u> <u>Paint</u>
P-301-U-59424	Eagle Picher #415	-5.1	+ 2.5
P-301-U-59425	American Zinc Oxide ZZZ-33	-1.5	+ 4.8

ACID NUMBER OF BODIED OIL

<u>Code</u>	<u>Acid Number of</u> <u>Bodied Oil</u>	<u>Date of Test</u>	<u>Excess Thinner</u> <u>% of Total Paint</u>
P-301-U-59402	3.5	2/19/53	- 7.9
P-301-U-59401	8.0		- 6.3
P-301-U-59403	9.4		- 4.7
Test II			
P-301-U-32121	4.7	8/18/52	- 2.8
P-301-U-32120	7.0		- 2.6
P-301-U-32119	10.4		+ 1.4
P-301-U-32118	14.5		+ 1.5

VARIATIONS IN LOTS OF EXTENDERS

<u>Code</u>	<u>Lot Number</u> <u>of W-1001</u>	<u>Date of Test</u>	<u>Excess Thinner</u> <u>% of Total Paint</u>
P-301-U-59410	RS 8388 FT As-	2/24/53	- 7.3
P-301-U-59411	bestine		- 4.5
P-301-U-59412	RS 9459 FT		- 5.1
	Asbestine		
	W-98 Nytal		

Within each test all ingredients are constant except the one studied.

TABLE II

PLANT STUDY OF ZINC OXIDE AND EXTENDER

Code	Batch No.	Date	# Excess Thinner gals./ 100 gals.	Extender	Zinc Oxide	Average Thinner gals./ 100 gals.	Calculated Acid No. of Bodied Oil	Initial Stormer KU	Stormer KU Aging	Age of Sample Months
P-301-U-59434	4772	4/22/53	-2.8	Nytal W-98	Eagle	-2.2	6.0	87	84	1
	4773	4/23/53	-2.8	"	Picher #415	"	6.0	88	84	1
	4774	4/25/53	-1.9	"	"	"	8.7	87	87	1
	4775	4/25/53	-1.7	"	"	"	8.7	89	87	1
	4776	4/27/53	-2.1	"	"	"	7.2	88	81	2
P-301-U-59435	4777	5/6/53	-2.1	"	"	"	7.2	87	81	2
	4778	4/22/53	-2.8	Nytal	Azo ZZZ-33	-1.5	6.0	87	87	1
	4779	4/23/53	-2.6	W-98	"	"	6.0	89	87	1
	4780	4/27/53	-0.2	"	"	"	8.7	88	86	1
	4781	4/29/53	-1.1	"	"	"	6.7	89	87	1
P-301-U-59436	4782	4/30/53	-1.4	"	"	"	6.7	89	89	1
	4783	5/6/53	+0.1	"	"	"	7.2	88	-	-
	4784	4/22/53	-4.9	PT As-	Eagle Picher	-3.3	6.0	86	87	1
	4785	4/23/53	-3.6	bestine	#415	"	6.0	87	87	1
	4786	4/25/53	-2.5	"	"	"	8.7	88	87	1
P-301-U-59437	4787	4/29/53	-2.5	"	"	"	6.7	87	-	-
	4788	5/1/53	-2.6	"	"	"	6.7	89	-	-
	4789	5/6/53	-4.0	"	"	"	7.2	89	-	-
	4757	4/22/53	-2.8	PT	Azo ZZZ-33	-0.4	6.0	88	87	1
	4758	4/23/53	-2.2	Asbestine	"	"	6.0	89	87	1
P-301-U-59438	4759	4/24/53	+0.5	"	"	"	8.7	88	89	1
	4760	4/27/53	-0.2	"	"	"	8.7	87	-	-
	4761	5/6/53	-0.7	"	"	"	7.2	89	-	-
	4762	5/6/53	+0.4	"	"	"	7.2	89	89	1/2

* Corrected to 88 Stormer by assuming that 20# in a 1000-gallon batch will reduce the Stormer 1 KU.

Confidence limits for these averages are ± 0.8 .WCJ:sig
6/15/53

TABLE III
PRODUCTION UNIFORMITY - PHILADELPHIA

Batch No.	Date of Mfg.	*Excess Thinner gals./100 gals.	Lot of W-1001	Lot of W-65	Source of W-65	Calculated Acid No. of Bodied Oil	Initial Stormer K.U.	Stormer on Aging K.U.	Age of Sample Months
506919	8/26/52	-4.4	7105	7113	St. Joe	-	86	85	7
506969	9/12/52	-2.3	7077	7113	St. Joe	-	90	95	6-1/2
494240	9/23/52	-1.5	7072	7548	St. Joe	-	86	86	6
484314	10/1/52	-0.5	7072	7671	E. P.	-	86	86	6
474820	10/29/52	+0.7	8197	7912	Unknown	-	89	84	5
474821	10/30/52	+1.0	8197	7912	"	-	89	86	5
474822	10/30/52	+1.3	8197	7912	"	-	90	87	5
474823	10/31/52	-1.0	8197	7912	"	-	86	86	5
474824	11/6/52	-0.1	8197	7912	"	-	89	86	5
474825	11/6/52	+0.6	8197	7912	"	-	90	84	5
474826	11/7/52	+0.5	8197	3071	E. P.	-	86	86	5
474827	11/7/52	+1.5	8197	3071	E. P.	9.7	87	87	4
474828	12/1/52	-3.2	8388	8386	"	9.7	87	84	4
464829	12/1/52	-3.6	8388	8386	"	9.7	87	87	4
465130	12/4/52	-3.2	8388	8386	"	7.0	87	87	3-1/2
465131	12/8/52	-3.9	8388	3071	E. P.	6.7	89	87	3
465132	12/9/52	-4.5	8388	1246	St. Joe	6.7	87	87	3
465133	12/29/52	-1.6	8388	1246	"	6.7	86	82	3
465134	12/30/52	+0.1	8197	1246	"	6.7	87	84	3
455135	1/3/53	-2.7	8197	1246	"	6.7	90	87	3
455136	1/6/53	-2.5	8197	1246	"	6.7 or 7.7	87	84	3
455137	1/6/53	-3.6	8197	1246	"	6.7 or 7.7	87	87	3
455138	1/7/53	-0.6	8197	8386	E. P.	6.7 or 7.7	90	83	3
455139	1/7/53	-1.2	8197	8386	"	7.7 or 8.1	86	80	2-1/2
455839	1/8/53	-2.2	8197	8386	"	8.5	87	83	2
455840	1/12/53	-4.5	8197	8386	"	8.5	90	85	2
455841	1/16/53	-3.6	8388	1246	St. Joe	8.5	87	82	2
455842	1/29/53	-3.9	8388	1246	St. Joe	8.5	90	85	2
455843	1/26/53	-0.6	8388	7909	Unknown	8.4	89	84	2
455844	1/26/53	-0.6	9459	7912	Unknown	8.4	89	84	2

TABLE III (Continued)

Batch No.	Date of Mfg.	*Excess Thinner gals./100 gals.	Lot of W-1001	Lot of W-65	Source of W-65	Calculated Acid No. of Bodied Oil	Initial Stormer K.U.	Stormer on Aging K.U.	Age of Sample Months
445846	2/6/53	-2.0	9459	9712	E. P.	8.4	86	-	-
445848	2/9/53	-1.4	9459	8386	E. P.	8.3	-	-	-
446223	2/23/53	-3.6	9459	10072	E. P.	7.2	90	-	-
446224	2/24/53	-1.9	9459	10072	E. P.	7.2	87	-	-
436225	3/3/53	-6.2	8388	10072	E. P.	7.2	84	-	-
436226	3/4/53	-5.6	8388	9740	E. P.	7.2	87	82	1/2
436227	3/10/53	-6.2	8388	9740	"	7.2	85	80	1/2
436228	3/10/53	-6.2	8388	9740	"	7.2	84	-	-
436229	3/9/53	-3.2	8388	9740	"	7.2	85	80	1/2
436230	3/17/53	-3.2	9459	9724	"	7.5 or 6.3	84	83	1/2
436231	3/20/53	-1.6	9459	9829	"	7.0	91	-	-
436528	3/21/53	-0.5	9459	9724	"	7.4	87	-	-
436529	3/25/53	-2.5	8388	9829	"	7.6	90	-	-
436530	3/26/53	-0.5	9459	9829	"	7.0	90	-	-
436531	3/31/53	-1.6	W-98 9799	9829	"	7.0	90	-	-
436532	3/31/53	-3.3	W-98 9799	9724	"	7.3	90	-	-
414711	5/2/53	-1.4	-	-	-	7.3	87	-	-
414712	5/4/53	-1.7	-	-	-	6.4	86	-	-
415073	5/9/53	-0.9	-	-	-	6.4	89	-	-
415076	5/11/53	-1.1	-	-	-	6.2	88	-	-
415078	5/13/53	-	-	-	-	6.0	88	-	-
415299	5/22/53	-2.3	-	-	-	6.0	89	-	-
415300	5/22/53	-0.9	-	-	-	6.0	86	-	-
415301	5/22/53	-1.4	-	-	-	6.0	88	-	-
415303	5/22/53	-0.8	-	-	-	6.0	88	-	-
		-1.2	-	-	-	6.0	88	-	-

* This quantity of thinner has been corrected to 88 Stormer by assuming that 20# in a 1000-gallon batch will reduce the Stormer 1 K.U.

E. P. - Eagle Picher

WJ:alg
6/16/53

TABLE IV

FORT MADISON PRODUCTION

Batch No.	Date	*Excess Thinner gals./100 gals.	Gal. Wt.	Source of Zinc Oxide	Reported Acid No. Of Bottled Oil	Initial Stormer	Stormer on Aging	Age of Sample Months
M-47791	11/12/52	-1.2	13.46	E. P.	6.1	86	84	4-1/2
M-471710	11/18/52	+0.4	13.41	E. P.	6.1	88	87	4
M-462943	12/11/52	-0.6	13.44	E. P.	6.1	86	84	3-1/2
M-453376	1/5/53	-4.0	13.62	E. P.	6.4	84	88	2-1/2
M-454499	1/19/53	+1.4	13.31	Azo	6.4	88	86	2
M-444072	2/5/53	+1.4	13.34	"	6.4	88	87	1-1/2
M-444073	2/7/53	+0.1	13.45	"	6.4	88	91	1-1/2
M-445626	2/12/53	+2.5	13.27	"	6.4	87	86	1-1/2
M-445686	2/14/53	+4.7	13.21	"	6.4	89	87	1-1/2
M-446485	2/25/53	+2.9	13.00	"	7.6	87	86	1
M-437198	3/11/53	+3.7	13.25	"	6.7	91	90	1/2
M-437286	3/12/53	+1.6	13.33	"	6.4	90	87	1/2
M-437355	3/13/53	+1.4	13.40	"	6.2	90	89	1/2
M-437711	3/23/53	+1.4	13.38	"	6.2	88	86	0

* Adjusted to 88 Stormer by assuming that 20% of thinner in a 1000-gallon batch will reduce the Stormer 1 K.U.

Azo - American Zinc Sales

WCJ:alg
6/16/53

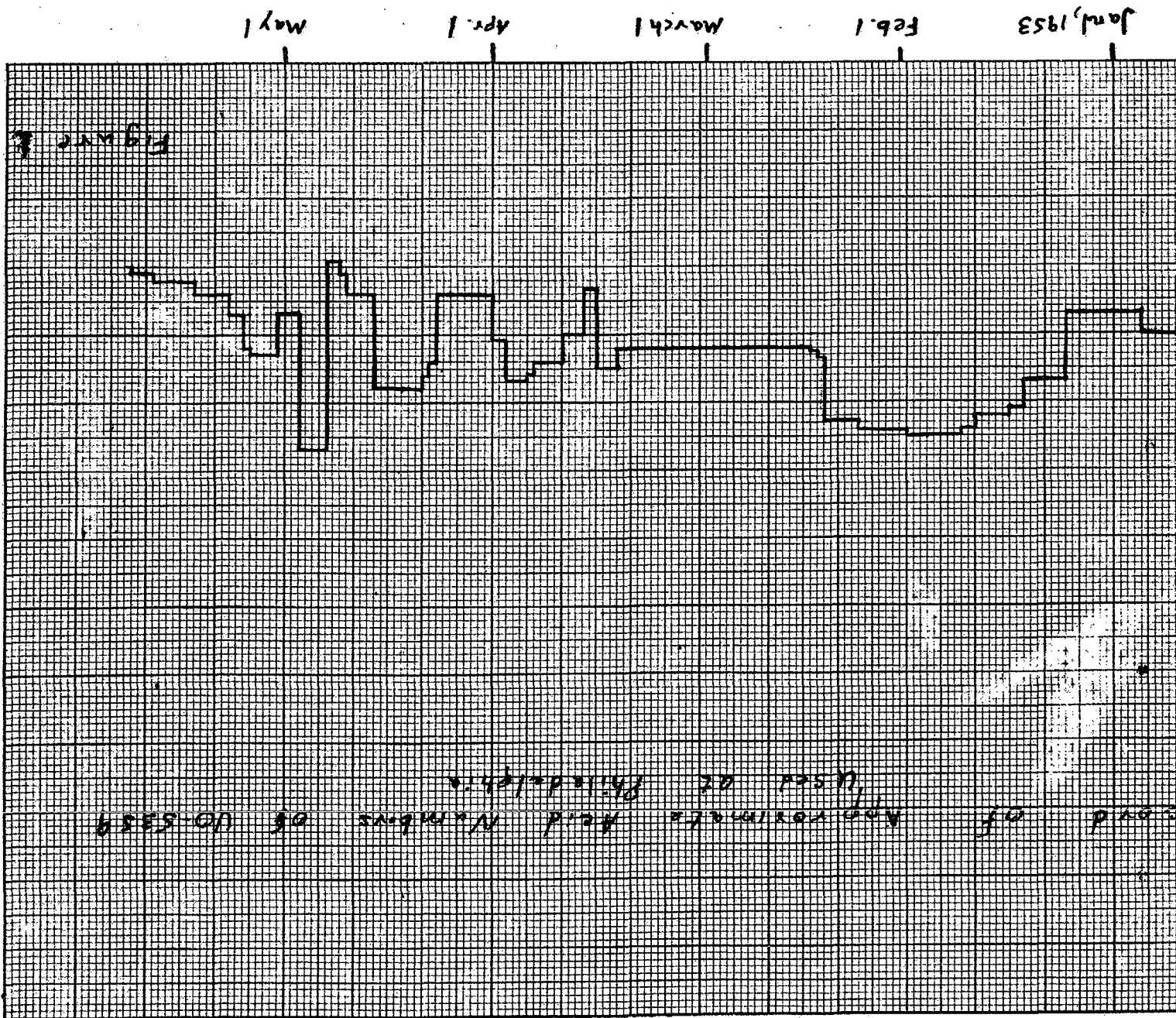


Figure 2