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NEWARK PLANT
PIGMENT COLOR RESEARCH REPORT

INITIAL & FINAL REPORT

IMPROVEMENT OF ZINC YELLOW STRUCTURAL PRIMERS

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NEWARK PLANT

PIGMENT COLOR RESEARCH REPORT

Initial & Final Report

Title: Improvement of Zinc Yellow Structural Primers

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DATE SUBMITTED: 10/3/46

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OBJECT:

To improve the following properties of the current P-244-Y* structural primer:

Drying time
Brushing
Leveling (Flow)
Spreading rate
Cost
Wetting of rusted steel
Distinctive primer color

*Y-539-D/Ferrite Yellow/Talc-40/40/30, in GE-2466/Raw L.O.-50/50.

INTRODUCTION:

This investigation was prompted by the conviction of the writer that research along the lines of improved durability alone has reached the point of diminishing returns and that a new approach might lead to a more rapid advance in zinc yellow primer technology. The plan of research was to formulate a primer possessing the optimum in the qualities listed above, and then to alter those properties somewhat if durability requirements made it necessary.

SUMMARY:

The primer (1124-15-35) resulting from such a study is Y-539-D/Whiting/Aluminum-38/57/5 in U.S.I. S-239 alkyd*/Acid Refined L.O.-50/50 at 35% PV. Comparison with red lead in oil (conservation formula) and orthodox P-244-Y is as follows:

	<u>1124-15-35</u>	<u>Red Lead</u>	<u>P-244-Y</u>
Drying time	sl.+	sl.+	std.
Consistency, 7 day	82	82	69
Brushing	sl.+	sl.+	std.
Leveling	equal	equal	std.
Spreading Rate at .002" dry film, (sq.ft./gal.)	670	600	525
Cost/Gal.	\$1.56	\$2.80	\$1.45
Cost/1000 sq.ft. dry film, .002"	\$2.33	\$4.67	\$2.46
Wetting of rusted steel	sl.	sl.	none
Distinctive Color	light green	red orange	mustard yellow
Durability	To be detd. (Series 7029)		
Can Stability	"	"	

CONCLUSIONS:

1. Primers containing U.S. Industrial Chemicals S-239 experimental resin or DuPont RC-141 give the greatest wetting of rusted steel.

2. U.S.I. S-239 and DuPont RC-141 primers require the least thinner for reduction to 75 KU, hence yield the highest theoretical spreading rates.

* It should be borne in mind that this is an experimental alkyd and is not in production at present.

3. Acid refined linseed oil wets rusted steel better than raw linseed oil.
4. Acid refined linseed oil in the primer imparts better brushing than raw linseed oil.
5. Celite 110 or York whiting replacing talc require the least thinner for reduction to 75 KU.
6. In none of the primers is reactivity or water-sensitivity excessive.
7. Formulation 1124-15-35, encompassing the changes indicated by the foregoing conclusions is outstanding in brushing, cost, and wetting of rusted steel. The only volatile in the primer is that contained in the alkyd solution, no extra thinner being required. Drying time is slightly better than red lead, and it possesses a pleasing light green color. In general, this primer compares very well with red lead in application properties.

DISCUSSION:

Research in structural primers has heretofore concentrated itself in improvements in durability. Changes in formulation dictated by improved durability often altered the application properties (brushing and leveling etc.) so much that a compromise in durability was necessary in order to obtain a practical paint product.

The optimum primer so far, and the one which we are currently promoting in the structural field, is P-224-BR or P-244-Y. P-224-BR is Y-539/brown iron oxide/talc-40/30/30 in alkyd/raw L.O.-50/50, while P-244-Y is the same as P-224-BR, but with ferrite yellow replacing the brown iron oxide.

Our most serious competition in the structural primer field is red lead. Red lead structural primers are of four types:

- a) Red lead in raw linseed oil.
- b) Red lead conservation formula. This contains about 50% bodied linseed oil in the vehicle and carries about 7% volatile matter by weight.
- c) Red lead in oil fortified with synthetic resin.
- d) Extended red lead in oil or in the conservation oil vehicle.

The orthodox red lead primer is the one usually thought of by the average user. It appears, however, that the conservation formula became well established during the war, returns practically the same results, and is here to stay. Especially is this true when viewed in the light of continued oil shortages.

The resin fortified red lead primers are not too well accepted by most users because of the decreased wetting and adhesion on rusted surfaces. It would appear, too, that the lead industry is not emphasizing such primers for structural work. On the other hand, the short lead supply and the lower cost of competitive zinc yellow primers has caused increased promotion of extended red lead primers by that industry.

In trade contacts, the writer has met surprisingly few users who contend that red lead durability is superior to zinc yellow. The subject of durability has been an open question in most calls. Invariably, the application properties of zinc yellow primers are attacked. Poor wetting of rusted steel, low spreading rate, slower drying, poorer brushing, hence a tendency to over-thin on the job, etc. are the points of criticism.

From the above evidence, the importance of improving our recommended structural primer in application properties cannot be over-emphasized.

It is felt that the candidate, 1124-15-35, has extremely promising characteristics. The matter of a distinctive color is felt to be highly important from a psychological and promotional point of view, and color chips are attached for inspection. The matter of high solids content is also a factor, which, coupled with good brushing, should insure against excessive thinning by the painter on the job. The amount of aluminum paste added is only sufficient to give complete hiding at .0015 dry film thickness, thus insuring against thin spots in application. This paste is not a separately added component, but constitutes an ingredient of the ready-mixed primer. This aluminum content produces the green color, and was chosen because of the higher probability of good durability.

Little is known about the comparative durability of raw and acid refined linseed oil. Whiting as an extender has received hardly any attention in previous exposure series at Newark, but work at Newport using this extender in tinted house paints has shown it to have promising durability.

1124-15-36 is a more conservative pigmentation of 1124-15-35. It is Y-539-D/Ferrite Yellow/Talc-40/30/30 in U.S.I. S-239/Acid Refined L.O.-50/50, and requires additional thinner to bring it to 75 KU. Heavy mineral spirits was used to avoid the too rapid set-up of the film observed in most of the primers. Notwithstanding, it does not brush as well as the 1124-15-35.

Formula:

	<u>1124-15-35</u>	
	<u>Lb.</u>	<u>Gal.</u>
Y-539-D	265	9.06
Whiting	397	17.60
U.S.I. S-239	308	39.00
Acid Refined L.O.	216	27.80
Aluminum Paste*	50	4.10
24% Pb Naphthenate	17.3	1.83
6% Co. "	2.9	.38
6% Mn "	2.2	.29
	<u>1258.4</u>	<u>100.06</u>

* Added in the reduction of the mill base.

U.S.I. S-239: 70% solids, 7.9#/gal.

Gallon Weight: 12.6#

% Solids in Total Paint: 83.6% by vol.

PV: 35%

Consistency, immediate: 75 KU

EXPERIMENTAL DETAILS:

The primers investigated in this study are modifications of P-244-Y and comprise Series 7029, the series number under which they will be exposed.

For detailed information of the modifications studied, reference is made to the data sheets. The following, however, summarizes the variables explored:

- a) Paints No. 1 to 9 compare resins substituted for GE-2466.
- b) 10 to 13 compare straight linseed oil vehicles.
- c) 14 to 24 cover various extender types and ratios.
- d) 25, 26 contain ZnO partially replacing Y-539-D.
- e) 27 to 30 comprise the controls.
- f) 35 to 36 represent the improved primers, or the final candidates in good application properties.

The test of the ability of a primer to wet rusted steel is outlined in "The Protection of Structural Steel with Paint", Geo. Diehlman: Paint, Oil & Chem. Rev. July 11, 1946. This test is to allow a small drop of the paint to fall on a rusted panel, permit it to dry and observe the width of the dark ring around the dried paint spot.

Water sensitivity of a few selected primers (paints 1 to 13 and those containing whiting) was measured by adding 1% by volume of soap solution and following the consistency trend.

The extenders and miscellaneous pigments used were the following:

Talc--Stanley Doggett #162

Magnesium Silicate--Asbestine 3X

Cellite 110

York Whiting

ZZZ-11 Zinc Oxide

Yellow Iron Oxide--Mapico Lemon Yellow

Red Iron Oxide--Reichard-Coulston #671

Aluminum Paste--Albron 205

REFERENCES:

Exposure Program: S-7029.

"The Protection of Structural Steel with Paint" - Geo. Diehlman: Paint, Oil & Chem. Rev. July 11, 1946.

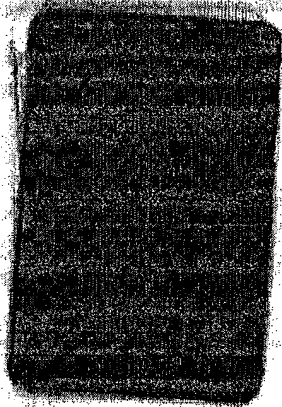
IMPROVEMENT OF ZINC YELLOW STRUCTURAL PRIMERS

Paint No.	1124-15-1	2	3	4	5	6	7	8	9	10	11	12	13
Pigmentation	40/30/30 - Y-539-9/Verdite Yellow/Talc												
Type Resin	Long Alkyd	Short Alkyd	Long Alkyd	Med. Phenol	Long Alkyd	Long Alkyd	Long Alkyd	Long Alkyd	Long Alkyd	Long Alkyd	Long Alkyd	Long Alkyd	Long Alkyd
Vehicles; Resin	CB-2466	CB-2385	CB-2466	Verdite	Verdite	Verdite	Verdite	Verdite	Verdite	Verdite	Verdite	Verdite	Verdite
" : Oil													
Resin/Oil (solids)	50/50												
Cons'y Imm.	72	71	74	74	74	74	74	74	74	74	74	74	74
7 day	68	68	80	73	82	82	81	84	83	82	82	82	82
30 day	71		82	78	82	84	84	85	84	78	78	78	78
*Con'y-Water Imm.	68	68	83	79	82	85	83	86	89	76	80	79	74
3 day	72	66	87	80	89	89	85	88	95	79	82	82	76
14 day	73	68	88	82	92	92	86	90	92	79	82	81	74
Breaching	std.	"	cons-	cons-	cons-	cons-	al-	cons-	al-	al+	"	cons+	cons+
Leveling	std.	v al+	al-	al-	al-	al-	al+	v al-	v al-	al-	al-	al-	al-
**Wetting of Rusted													
steel (no water)	0	0	2	0	0.5	3	1	1	0.5	12	8	18	10
Wetting (water added)	0	0	3	0	1	4	1	1	0.5	12	8	18	10
% Solids by Volume	65.1	50.0	74.6	64.6	66.3	74.5	66.7	74.2	71.5	75.9	75.2	69.5	67.2

* Water added to 7 day old paints.
 ** Millimeters width of annular ring.

Paint No. Pigmentation Y-539-B/Pel/Int. Extender	1124-15-14		15	16	17	18	19	20	21	22	23	24	25	26
	40/40/20 Talc	40/20/40 Talc	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Ng Sil	40/20/40 Whiting	40/20/40 Whiting	40/20/40 Talc + 250
Cons'y Imm. 7 day 30 day	74 80 84	74 78 84	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82	74 78 82
Cons'y+Water Imm. 3 day 14 day														
Brushing Leveling Wetting of Rusted Steel Wetting (water added) \$ Solids by Volume	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0	sl- vsl- 0
	70.2	70.2	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1	70.1

FILM COLORS OF PRIMERS



P-224-BR



P-244-Y



1124-15-35