Cross Reference:
700 Line General
Refrigerator Finishes
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Alkyd Resins
Urea Formaldehyde Resins
Epon Resins
Melamine Formaldehyde Resins
Competitive Resins

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MEMORANDUM REPORT NO. M-232:

COMPETITIVE RESINS IN 700 LINE ENAMELS

INTRODUCTION:

Synthetic resin manufacturers are offering newer type resins, with claims for outstanding properties, suitable for formulation in 700 Line enamels. To keep abreast with these new developments and to improve our present products, a group of 7 competitive alkyd type resins have been evaluated. The resins include non-modified alkyd resins, oil modified Epon resins and a U-F-modified Epon resin.

The recommendations of the resin suppliers have been used in formulating these competitive resins into our corresponding products.

This report is a supplement to Memorandum Report No. M-143, M-178, M-208 and Blue Cover Report No. 941.

SUMMARY AND CONCLUSIONS:

The attached chart shows the general type formula used and in a condensed manner, the significant results obtained.

Our evaluation indicates that of the 7 competitive resins tested, only 4 show outstanding performance in one or more properties, and a usable balance of properties suitable for use in our 700 Line products.

The following competitive resins have been found to be equal or superior to our standard resins:
(1) Epi-Tex 120 - an oil modified Epon resin, manufactured by Jones-Dabney Co., imparted a decided increase in gloss, adhesion, flexibility, moisture, grease and stain resistance and color

retention in overbaking as compared to our standard RC-305 and RC-306.
(2) Epi-Rez 201 - a U-F -modified Epon resin, manufactured by the Jones-Dabney Co., imparted films of superior properties and outstanding grease and soap resistance. The only deficiency noted with this resin was the poor color retention in heat resistance and the bad popping that appears prevalent all with U-F coupled Epon Resins when applied at 1.6 mils or higher film thickness.
(3) Plaskon 3115 - a 48% castor oil resin manufactured by the Libbey-Owens-Ford Glass Company, offered a definite improvement in gloss and moisture resistance when compared against RL-295. The Plaskon 3115 compared against RL-344, a 43% castor oil resin, imparted outstanding improvements in all properties when formulated in 706-7661, a high solids industrial white enamel.
(4) Plaskon 3120 - a 37% DCO resin manufactured by the Libbey-Owens-Ford Glass Company gave improved gloss, flexibility and color retention in overbake when compared with our standard RC-306. It was slightly deficient in alkali resistance in 727-6741.

PROPOSED PROGRAM:

It is recommended that the following competitive resins with outstanding properties should be further evaluated for use in our standard products:
(1) Epi-Tex-201 versus RC-306 and RC-305 for improvement in all properties.
(2) Epi-Rex 201 (Jones-Dabney) versus Shell Co.'s Epon resin #1007 for better baking potential.
(3) Plaskon 3115 versus RL-295 and RL-344 for gloss increase and moisture resistance improvement.
(4) Plaskon 3120 versus RC-306 for gloss increase and color retention improvement.

DISCUSSION:

The competitive alkyd resins were substituted on the equal oil basis for our corresponding resins in 700 Line enamels, thus varying the U-F/alkyd ratio. The Epon resin (Epi-Rex-201) has been used in formulations suggested by Jones-Dabney Co.

The tests and exposures used in this program are as follows:

(a) Long Time Tests
  (1) Florida 45° south - exposed for 12 months.
  (2) Yellowing in the Dark - exposed for 2 years.
  (3) Yellowing in the Light - exposed for 2 years.
(b) Short Time Tests
  (1) General Film Properties
  (2) Humidity Cabinet
  (3) Grease Test
  (4) Stain
  (5) Soap
  (6) Heat
  (7) Overbaking - 600 units at 325°F.

Jones-Dabney's Epi-Rez-201, a UF modified Epon resin (85/15 = Epon/UF), was formulated into a W-28 enamel at a pigment/binder of 90/10 and at a UF/alkyd ratio of 90/10, as recommended by the resin supplier. Enamels were also prepared using the Epi-Rez-201 as the sole vehicle. General film property tests indicated that although a slight decrease in gloss was noted upon adding the additional UF, the enamel could be baked at slightly lower temperatures. Enamels based solely on the Epi-Rez-201 imparted poor flexibility characteristics when baked at temperatures lower than 15 min. at 400°F.; on the other hand, enamels based on the 90/10 = alkyd/UF ratio produced satisfactory properties at temperatures of 30 min. at 375°F. to 30 min. at 350°F. and superior alkali and grease resistance at temperatures of 30 min. at 325°F. Short time tests indicate that the only deficiency noted with the use of this UF modified Epon resin was severe popping at film thickness of 1.5 mils and higher, which is characteristic of the UF coupled Epon resins. The inert properties obtained with Epi-Rez-201 make it particularly interesting for further evaluation as a one-coat alkali resistant enamel.

Jones-Dabney Company has also introduced an oil modified Epon resin, Epi-Tex-120, with claims for outstanding initial color, adhesion, gloss and fast curing. This oil modified Epon resin was substituted for RC-305/RC-306 in 727-6741 and baked 1/2 hour at 300°F. We found this resin to have many interesting properties and general improvements as compared to standard resins. Improvements were noted in initial gloss, adhesion, humidity cabinet performance, grease and soap resistance as compared to RC-305 and RC-306, however, it was very slightly inferior in color retention on overbaking. Since this Epi-Tex-120 has many interesting properties, it should further be evaluated for possible use as a one-coat enamel with improved alkali and grease resistance.

The Plaskon resins manufactured by the Libbey-Owens-Ford Glass Co., imparted a definite gloss increase in all cases. Of particular interest is Plaskon 3115, a 48% castor oil resin, which offered improvements in all properties as compared to RL-344. The only deficiency noted upon using this 48% castor oil resin, was a very slight decrease in color retention in overbaking as compared to RL-295. The Libbey-Owens-Ford Glass Company's 37% DCO resin, Plaskon 3120, offered improvements in initial gloss and flexibility versus RC-306, with a very slight decrease in alkali resistance. The only Plaskon resin which did not show any advantages over our standard products, was Plaskon 3105, a 34% coconut oil resin. When substituted in 722-23743 and compared against RL-413, Plaskon 3105 was very deficient in moisture resistance, hardness, grease resistance and stain resistance.

The other resins evaluated (Aroplaz 1084 and Aroplaz 1081) were generally deficient in gloss and color retention and

did not show as uniform a balance of properties as did the control resins.

Exposure series #10508 and 10540 have been prepared to obtain durability and long time tests on the competitive resins evaluated.

REFERENCES:

Formulations and detailed gradings may be found in Notebooks 3405 and 5085.

PHILADELPHIA LABORATORY

H. L. COSTENBADER

HLC:ms

DS-Number	Designation	%Oil	Type Oil	%Solids	Solvent	Visc.	Acid No.
U.S. INDUSTRIAL CHEMICALS							
DS-18839	Aroplaz-1081	50		50	H-287	Z_4-Z_6	6-10
DS-18716	Aroplaz-1084	50		50	H-287	X-Z	4-8
JONES-DABNEY CO.							
DS-19000	Epi-Tex-120	--	Oil modified Epon resin	50	H-202/H-583= 20/80	W-Y	1.0
DS-19015	Epi-Rez-201		Epon Resin containing 15%UF	45	H-79/H-583/ H-12=45/48.4/ 6.6	T-U	1-4
LIBBEY,OWENS FORD GLASS CO.							
DS-19094	Plaskon 3105	34	CNO	60	H-583		5
DS-19093	Plaskon 3115	48	CO	60	H-583	X-Z	4
DS-19095	Plaskon 3120	37	DCO	48.5	H-583/H-12= 95/5	Y-Z	3

ENAMEL CODE	FINISH	VEHICLE	PRIMER	PRIMER ALKYD	ADVANTAGES	DISADVANTAGES
P-704-R-31117	704-23105	RC-305/RC-718=73/27	764-042	RC-114		Control
P-704-R-31117	"	" " "	--	--		Control
P-704-R-31116	"	Aroplaz-1081/RC-718=63/37	764-042	RC-114	Color Ret.in O.B.	Gloss
P-704-R-31116	"	" " "	--		" "	Gloss
P-704-R-31114	704-6735	RC-306/RC-718-50/50	64-923	RC-114		Control
P-704-R-31114	"	" " "	P-64-P-98595	Aroplaz-1084		Flexibility
P-704-R-31115	"	Aroplaz 1081/RC-718=43/57	64-923	RC-114	Stain	Grease
P-704-R-31115	"	" " "	P-64-P-98595	Aroplaz-1084	Stain	Flex. Grease
P-727-R-31113	727-6741	RC-306/RC-305/RC-718/G-78= 52.5/17.4/22.6/7.5	--	--		Control
P-727-P-98588	"	EPI-Tex120/RC-718/G-78= 70/22.5/7.5	--	--	Gloss,Adhesion,Color in O.B.,Flex.HC,Grease Soap	--
P-727-P-31100	"	EPI-REZ-201/RC-718/G-78= 70/22.5/7.5	--	--	Adhesion,Hardness,HC. Grease,Soap	Gloss, Flex.
P-100-P-98579	--	EPI-Tex 120/RC-718=90/10	--	--	Gloss,HC,Stain	Grease,Heat
P-100-P-98580	--	" /G-78= 90/10	--	--	HC,Stain	Gloss,Grease,Heat
P-100-P-98598		EPI-REZ-201/RC-718=90/10	--	--	Gloss,Scratch,Hardness,HC	
P-100-P-98599		" /G-78=90/10	--	--	Grease,Stain, Soap.	Heat
P-704-R-31125	704-6731	RL-295/RC-718=57/43	764-042	RC-114	Hardness,HC,Grease,Stain.Sp.	Gloss,Heat
P-704-R-31122	"	Plaskon 3115/RC-718=69.5/34.5	"	"		Control
P-706-R-31127	706-7661	RL-344/RC-718=65/35	--	--	Gloss, HC	Color Ret.
P-706-R-31123	"	Plaskon 3115/RC-718=58/42	--	--		Control
P-707-R-31131	707-6741	RC-306/RC-718=73/27	--	--	Gloss,Adhesion,Flex,Color in OB, HC, Stain	
P-707-R-31138	"	Plaskon 3120/RC-718=85/15	--	--		Control
P-727-R-31132	727-6741	RC-306/RC-305/RC-718/G-78= 52.5/17.4/22.6/7.5	--	--	Gloss	
P-727-R-31141	"	Plaskon 3120/RC-305/RC-718/G-78= 59/19.4/16.1/5.4	--	--		Control
P-725-R-31133	725-6740	RC-306/RC-305/RC-718/G-78= 27.5/17.5/42.5/12.5	475-761	VC-956/VC-957	Gloss,Flex.,Color Ret. in O.B.	Stain, Soap
P-725-R-31140	"	Plaskon 3120/RC-305/RC-718/G-78= 30.2/19.3/39/11.5	"	"		Control
P-704-R-31134	704-6735	RC-306/RC-718=50/50	64-923	RC-114	Stain, Soap	
P-704-R-31139	"	Plaskon 3120/RC-718=58/42	"	"		Control
P-722-R-31129	722-23743	RL-413/G-78=65/35	"	"	Gloss,Color in O.B.	
P-722-R-31136	"	Plaskon 3105/G-78=67/33	"	"		Control
					Gloss	--Hdns.HC,Grease,Stain

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