MONSANTO CHEMICAL COMPANY
Organic Chemicals Division
St. Louis Research Department

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TRIP REPORT

General Electric Company
Capacitor Division
Hudson Falls, N.Y.
May 25-26, 1954

Present for General Electric Company:
Ralph Ruscetta, M. S. Scoville, J. D. Stacy,
M. S. Mead, E. P. Kozoriz, R. N. Dalton,
N. R. Clark, R. J. Hopkins, Joseph Petley

Transformer Division
Pittsfield, Massachusetts
May 27, 1954

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Present for General Electric Company:
E. L. Raab, K. W. MacFadyen, S. W. Kernaghan

Present for Monsanto at both meetings:
H. L. Hubbard, P. G. Benignus, J. W. Carlson,
R. Kuster, A. M. Ellenburg, W. M. Russell.
J. C. Hutchison and R. P. Sullivan (Hudson Falls only).
L. T. Johnson (Pittsfield only).

Purpose of Trip: To agree on specification changes with G.E. on Aroclors and Pyranols.

Abstract

This meeting with G.E. was a follow-up on a previous conference in January, 1954 on specifications. Agreement was reached on all Aroclor and Pyranol dielectric specifications and acceptance tests for materials now used by G.E. Handling procedures for advance samples on tank cars of Aroclor and Pyranol were revised in order to obtain better use of these samples.

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Conclusions

The specifications on Aroclors and Pyranols have been agreed upon in these meetings with G.E. personnel. The new specifications are realistic in view of the actual analytical data on our present products and will facilitate the operation of the Aroclor departments at both Anniston and Krummrich plants.

Recommendations

1. The new specifications should be put into effect immediately.

2. Proper acceptance of the specifications should be obtained by those responsible for specifications.

3. Anniston should analyze Aroclor 1232 to supply data to me for transfer to G.E. at Pittsfield.

4. WGK plant should supply data on Aroclor 1248 for G.E. to include in their specification sheet.

5. Mr. Benignus will inaugurate the revised handling of advance samples as desired by the G.E. people.

6. Mr. Carlson will send to Mr. Neil Dalton of G.E. at Hudson Falls the source of the high refractive index standards.

7. A drum of Aroclor 1242 from WGK will be sent to Hudson Falls for trial tests in capacitors after approval by both WGK and Anniston laboratories.

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REPORT

A Technical Sales Report of May 24-28, 1954 on General Electric Company by P. G. Benignus discusses in general the topics considered at both locations. This report will deal primarily with the specifications as agreed upon by G.E. and both Monsanto plants producing Aroclors.

The specifications as agreed upon are attached to this report. At Hudson Falls, specifications were set for Aroclor 1242, Aroclor 1254, Pyranol 1478 (trichlorobenzene) and Pyranol 1481 (75% Aroclor 1254 and 25% trichlorobenzene).

At Pittsfield, specifications were accepted for Aroclor 1260, Tri-tetrachlorobenzene Blend, Pyranol 1470 (45% Aroclor 1260 and 55% Tri-tetrachlorobenzene Blend) and Pyranol 1467.

These specifications represent an earnest effort to obtain limits that will fit our present product. Several analyses have been eliminated which will be a time saving factor in the analyses of Aroclor and Pyranol production.

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Capacitor Division, Hudson Falls, N.Y.

Specifications

General Electric Company had issued a new Pyranol Specification A13B1-S2 covering Chlorinated Diphenyl Liquid Insulation dated May 14, 1954. This specification was reviewed and modified for Aroclors 1242 and 1254 to meet the specifications agreed on at this meeting.

Products covered by this A13B1-S2 specification are as follows:

G.E. Designation	Monsanto
A13B1	Aroclor 1254
A13B1B	Aroclor 1248
A13B1C	Aroclor 1242
A13B1D	Aroclor 1232

Aroclors 1232 and 1248 are not used commercially yet by G.E. but they wish to set up a specification for future reference. Anniston will determine data on Aroclor 1232 and WGK will run Aroclor 1248 to obtain sufficient data to allow G.E. to include these products in their specification sheet. Our recommendations would be subject to revision after history is obtained on these products.

If the data to fit the properties listed in the G.E. A13B1-S2 specification are forwarded to me, I will refer them to G.E. for their use. Data on two or three lots are desired. The distillation range should be uniform with values only at the 10, 50 and 90% distilled points.

Mr. Ruscetta suggested that Refractive Index be read by the sodium line for better reproducibility. It is therefore included in the specification as the D-line for refractive index.

The sampling procedure at both Monsanto plants was described. Anniston samples the tank car in three 5-pint bottles. One is sent to G.E., one is analyzed and one is held in reserve for a year or longer.

At WGK plant, the storage tank is sampled in three 5-pint bottles. One is tested by Monsanto, one sent to G.E. after testing chlorides and water, and the other is retained. After car is loaded, a sample is taken from the tank car and tested for water and chlorides, then held in reserve. G.E. requested that the advance sample on shipments to them be taken from the tank car. Cars are now shipped on our analyses without G.E. approval to Hudson Falls and Fort Edward.

General Electric also requested that Monsanto inspect the tank cars and clean when necessary. Concern was expressed over the possibility of contaminating capacitor Pyranol with tin-tetraphenyl from transformer Pyranol. In any interchange of a car from transformer to

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capacitor Pyranol service, a thorough cleaning of the car is necessary to insure against contamination.

Monsanto suggested that G.E. seal all tank cars with railroad seals for return to Anniston or Monsanto, Illinois. This will prevent contamination of the car and insure closure of the dome.

Anniston will send duplicate copies of the certificates on two or three tank cars lots of Pyranol by air mail and first class mail to check on the faster service.

Mr. Carlson promised to send Neil Dalton the source of the Refractive Index standard used at Anniston to check the Abbe Refractometer in the upper range.

Two samples of Aroclor 1254 were requested by Hudson Falls to check against their results and to compare with Anniston Aroclor 1254. These have been sent by Mr. Kuster.

Aroclor 1242 as manufactured by WGK plant will be tested for dielectric fluid, then sent to Anniston for further checking by the Anniston laboratory. If the product is considered satisfactory, a 55 gallon drum will be sent to Hudson Falls for G.E. to test. If the WGK Aroclor is acceptable, then G.E. will have two sources of supply for Aroclor 1242.

Representatives of the Engineering Department at Hudson Falls led a round table discussion on the requirements of a dielectric in various fields of capacitor application. Low pour point for use at -55°C. and low power factor with good stability are some of the important things desired. Something better than Aroclor 1242 in these properties are being sought. A table in Mr. Benignus' Sales Report summarizes the requirements for both AC and DC work.

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Transformer Division, Pittsfield, Mass.

Specification's

As a result of work by both laboratories, agreement on various distillation ranges was reached. All temperatures on fluids now used by G.E. are reported as corrected temperatures for both stem and barometric pressure.

On the tri-tetra blend distillation range it was suggested that WGK use electric heat and a shield. This should improve the first drop reading. G.E. is using electric heat on all their distillations.

G.E. requests that we supply a certificate of chemical composition on each car of tri-tetrachlorobenzene used in making Pyranol 1470 for them. It is suggested that we contact Hooker for their analysis and use that in fulfilling the G.E. requirement.

Pyranol 1470, Pyranol 1478 and tri-tetra chlorobenzene have their distillation ranges measured by volume instead of by weight according to G.E.

Since Pyranol 1467 is a partially obsolete transformer fluid, no changes were made in these specifications. However, Monsanto can ship to customers on Monsanto specifications. Therefore, the distillation range on Pyranol 1467 has been corrected on the 90% value and now all Pyranol distillation ranges are on a corrected basis in Monsanto specifications.

A new system of handling advance samples has been put into effect at Pittsfield. Mr. Benignus will put this system into effect. An advance sample from storage tank or car of Aroclor 1260 or Pyranol 1470 must be approved by G.E. before shipment is released to Pittsfield or Rome. Heretofore the advance sample has been arriving the same day as the tank car and, therefore, failed to serve any purpose.

All specifications have three sections:

A. - Acceptance Tests - reported by certificate to G.E.
B. - Specification which must be met but not reported.
C. - Properties which are listed as being helpful in characterizing the product.

The trip was very profitable and resulted in the agreement desired on the specifications for Aroclors and Pyranols.

A. M. Ellenburg

dm

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Aroclor 1242
Pyranol 1499
G.E. Specification No. A13B1C

A. Acceptance tests and certificate on G.E. shipment.

Specific Gravity at 25/15.5°C.	1.381-1.392
Color, APHA	100 maximum
Condition	Clear
Acidity, mg KOH/gm	0.010 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.6245-1.6265
Pour Point, °C.	-14 or lower
Water Content, ppm	35 maximum
Dielectric Constant, 1000 cycles, 100°C.	4.7-4.9
Resistivity, 500 VDC, 100°C. at 0.1" Gap	500 x 10^9 ohm-cm minimum
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in weight of Al	0.0%
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.010 maximum
Free Chlorides, ppm	0.10 maximum

B. Specification to be met, but not reported on acceptance tests. Properties to be determined by special request only.

Dielectric Strength, 25°C.	35 KV minimum
Sulfates	None
Fire Point, °C.	None
Viscosity, SUS, 37.8°C.	82-92
Distillation Range, °C. - Corrected for stem and barometric pressure.	
10% by weight	325 minimum
90%	366 maximum

C. Typical properties which characterize the product.

Specific Heat at 25°C.	0.30
Coefficient of Expansion, cc/cc/°C.	0.00068 (25-65°C.)
Fixed Chlorine, %	42.0 ± 0.5

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Aroclor 1254
Pyranol 1476
G.E. Specification No. A13B1

A. Acceptance tests and certificate on G.E. shipment.

Specific Gravity at 65/15.5°C.	1.495-1.505
Color, APHA	100 maximum
Condition	Clear
Acidity, mg KOH/gm	0.010 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.6370-1.6390
Pour Point, °C.	7-12
Water Content, ppm	35 maximum
Dielectric Constant, 1000 cycles, 100°C.	4.15-4.35
Resistivity, 500 VDC, 100°C. at 0.1" Gap	500 x 10^9 ohm-cm minimum
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in weight of Al	0.0%
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.010 maximum
Free Chlorides, ppm	0.10 maximum

B. Specifications to be met but not reported on acceptance tests. Properties to be determined by special request only.

Dielectric Strength, 25°C.	35 KV minimum
Sulfates	None
Fire Point, °C.	None
Viscosity, SUS, 98.9°C.	44-48
Distillation Range, °C. - Corrected for stem and barometric pressure.	
10% by weight	366-378
50%	372-~~285~~ 383
90%	383-396

C. Typical properties which characterize the product.

Specific Heat at 25°C.	0.27
Coefficient of Expansion, cc/cc/°C.	0.00066 (25-65°C.)
Fixed Chlorine, %	55.0 ± 0.5

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Trichlorobenzene
Pyranol 1478

A. Acceptance tests and certificate on G.E. shipment.

Specific Gravity at 15.5/15.5°C.	1.460-1.477
Color, APHA	15 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.5680-1.5715
Crystallizing Point, °C.	10 maximum
Water Content, ppm	75
Dielectric Strength at 25°C.	30 KV minimum
Distillation Range (ASTM 850 Modified) - Corrected for stem and barometric pressure.	
First Drop	205 minimum
5% by volume	210 minimum
50% by volume	213 minimum
90% by volume	215 minimum
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in weight of Al	0.0%
Color, APHA	200 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum

B. Specification to be met but not reported on acceptance tests. Property to be determined by special request only.

Fire Point, °C.	None to boiling point
Fixed Chlorine	58.5% minimum

C. Typical properties which characterize the product.

Dielectric Constant, 1000 cycles, 100°C.	3.8-4.3
Viscosity, SUS, 37.8°C.	30 ± 2

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HARTOLDMON0005017

Pyranol 1481

A. Acceptance tests and certificate on G.E. shipment.

Viscosity, SUS, 37.8°C.	70-82
Specific Gravity at 15.5/15.5°C.	1.525-1.535
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.010 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.6205-1.6215
Pour Point, °C.	-15 or lower
Water Content, ppm	35 maximum
Dielectric Constant, 1000 cycles, 100°C.	4.1-4.6
Resistivity, 500 VDC, 100°C. at 0.1" Gap	100 x 10^9 ohm-cm minimum
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in weight of Al	0.0%
Color, APHA	200 maximum
Condition	Clear
Acidity, mg KOH/gm	0.010 maximum
Free Chlorides, ppm	0.10 maximum

B. Specification to be met, but not reported on acceptance tests. Properties to be determined by special request only.

Fire Point, °C.	None to boiling point
Distillation Range, °C. - Corrected for stem and barometric pressure.	
First Drop	205 minimum
Below 270°C.	25% maximum
90%, by weight	380-395°C.

C. Typical property which characterizes the product.

Fixed Chlorine	55.4% minimum

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Aroclor 1260
Pyranol 1482

A. Acceptance tests and certificate on G.E. shipment.

Viscosity, SUS, 98.9°C.	72-78
Specific Gravity at 90/15.5°C.	1.555-1.566
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.6455-1.6470
Pour Point, °C.	25-34
Water Content, ppm	35 maximum
Distillation Range (ASTM D-20) - Corrected for stem and barometric pressure.	
10% by weight	385-398
50%	390-404
90%	400-420
Corrosion Test, 6 hours at 210°C. with Aluminum	
Charge in weight of Al	0.0%
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum

B. Specifications to be met but not reported on acceptance tests. Properties to be determined by special request only.

Dielectric Strength, 50°C.	30 KV minimum
Resistivity at 100°C., 500 volts at 0.1" Gap	500 x 10^9 ohm-cm minimum
Fire Point, °C.	350 minimum
Fixed Chlorine	60 ± 0.5%

C. Typical properties which characterize the product.

Dielectric Constant, 1000 cycles, 100°C.	3.6-3.8
Evaporation Loss, 6 hours at 100°C.	0.2% maximum
Stability Test, 100°C., in glass sealed in air, 30 days	No liberation of chlorine or chlorides

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HARTOLDMON0005019

Tri-Tetrachlorobenzene Blend
G.E. Designation D5B69

A. Acceptance tests and certificate on each G.E. shipment.

Specific Gravity at 15.5/15.5°C.	1.510-1.520
Color, APHA	15 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.5775-1.5790
Last Crystal Point, °C.	0 maximum
Crystallizing Point, °C.	-15 maximum
Water Content, ppm	75 maximum
Dielectric Strength at 25°C.	30 KV minimum
Distillation Range (ASTM 850 Modified) - Corrected for stem and barometric pressure	
First Drop	210 minimum
5% by volume	215 minimum
65% by volume	228 minimum
90 by volume	255 maximum
95 by volume	265 maximum
Dry Point	278 maximum
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in Weight	0.0%
Color, APHA	100 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum
Chemical Composition	
Trichlorobenzene	58.5% minimum
1,2,3,4-Tetrachlorobenzene	26.0-29.0%
1,2,4,5-Tetrachlorobenzene	3.0% maximum
Pentachlorobenzene	5.5% maximum

B. Specifications to be met but not reported on acceptance tests. Properties to be determined by special request only.

Fire Point, °C.	None to boiling point

C. Typical property which characterizes the product.

Dielectric Constant, 1000 cycles, 100°C.	4.8-5.1
Viscosity, SUS, 37.8°C.	30 ± 2

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Pyranol 1470
(45% Aroclor 1260 and 55% Tri-tetrachlorobenzene Blend)

A. Acceptance tests and certificate on each G.E. shipment.

Viscosity, SUS, 37.8°C.	41-45
Specific Gravity at 15.5/15.5°C.	1.563-1.571
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.6075-1.6085
Pour Point, °C.	-44 maximum
Water Content, ppm	30
Dielectric Strength at 25°C.	35 KV minimum
Resistivity, 500 VDC, 100°C. at 0.1" Gap	100 x 10^9 ohm-cm minimum
Distillation Range, % by volume - Corrected for stem and barometric pressure.	
First Drop	210°C. minimum
35%	240-256
55%	290-330
65%	385-400
90%	395-415
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in weight of Al	0.0%
Color, APHA	200 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	5.0 maximum
Tin-Tetraphenyl, % by weight	0.115-0.135

B. Specifications to be met but not reported on acceptance tests. Properties to be determined by special request only.

Dielectric Constant, 1000 cycles, 100°C.	3.8-4.2
Fixed Chlorine, %	60.5 + 0.5
Fire Point, °C.	None to boiling point
Arced Formed Combustible Gases	1.0% maximum
Electrical Stability (Aged 96 hours at 100°C., covered jar, 15% air)	
Decrease in resistivity	10% maximum

C. Typical property which characterizes the product.

Dielectric Constant, 1000 cycles, 25°C.	4.5-4.9

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Pyranol 1467
(60% Aroclor 1260 and 40% Trichlorobenzene)

A. Acceptance tests and certificate on each G.E. shipment.

Viscosity, SUS, 37.8°C.	52-56
Specific Gravity at 15.5/15.5°C.	1.560-1.568
Color, APHA	150 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	0.10 maximum
Refractive Index at 25°C. (n_D)	1.6137-1.6147
Pour Point, °C.	-32 maximum
Water Content, ppm	30 maximum
Dielectric Strength at 25°C.	35 KV minimum
Resistivity, 500 VDC, 100°C. at 0.1" Gap	100 x 10^9 ohm-cm minimum
Distillation Range (ASTM D-20) - Corrected for stem and barometric pressure.	
First Drop	200°C. minimum
Below 270°C.	40% maximum
90% by weight	395-415°C.
Corrosion Test, 6 hours at 210°C. with Aluminum	
Change in weight of Al	0.0%
Color, APHA	200 maximum
Condition	Clear
Acidity, mg KOH/gm	0.014 maximum
Free Chlorides, ppm	5.0 maximum
Tin-Tetraphenyl, % by weight	0.115-0.135

B. Specifications to be met but not reported in acceptance tests. Properties to be determined by special request only.

Dielectric Constant, 1000 cycles, 100°C.	3.7-40
Fixed Chlorine, %	59.1 minimum
Fire Point, °C.	None to boiling point
Arced Formed Combustible Gases	1.0% maximum
Analysis of Products of fractional distillation:	
Each 10 cc fraction - minimum of one chlorine atom per hydrogen atom	
Arced formed combustible gases from each 10 cc fraction	1.5% maximum
Electrical Stability (Aged 96 hours at 100°C., covered jar, 15% air)-	
Decrease in resistivity	10% maximum

C. Typical property which characterizes the product.

Dielectric Constant, 1000 cycles, 25°C.	4.0-4.3

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Note: Since this material is practically obsolete, no change in Distillation Range was made. However, Monsanto can ship to its customers on their own specification which is shown herein as corrected.

Pyranol 1488 will have the same specification without the tin-tetraphenyl.

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