ORGANIC CHEMICALS DIVISION RESEARCH Report

REPORT NO.- P-1551 JOB NO.- 2-21-760.01-1113115

TENTATIVE PROCESS FOR

MCS 988 (PYDRAUL AC-A, WINTER GRADE 28)

DATE - December 30, 1969 WRITTEN BY - L. R. Stark

Monsanto

ST. LOUIS, MISSOURI

DSW 620172

STLCOPCB4094199

1) MCS 988 - a fire resistant air compressor lubricant (Pydraul AC-A Winter Grade 28)
2) Ardlar 5442 used for blending MCS 988
3) Cresyl diphenyl phosphate in place of tricresyl phosphate for blending MCS 988.

SAFETY REVIEW COMMITTEE
APPROVED BY [signature] 2/9/70
[signature] 2/9/70
[signature] 2/9/70

FILE) Hydraulic Fluid

Monsanto Company
Organic Chemicals Division
St. Louis Research Department

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St. Louis Research Report No. P-1551

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FOR

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December 30, 1969

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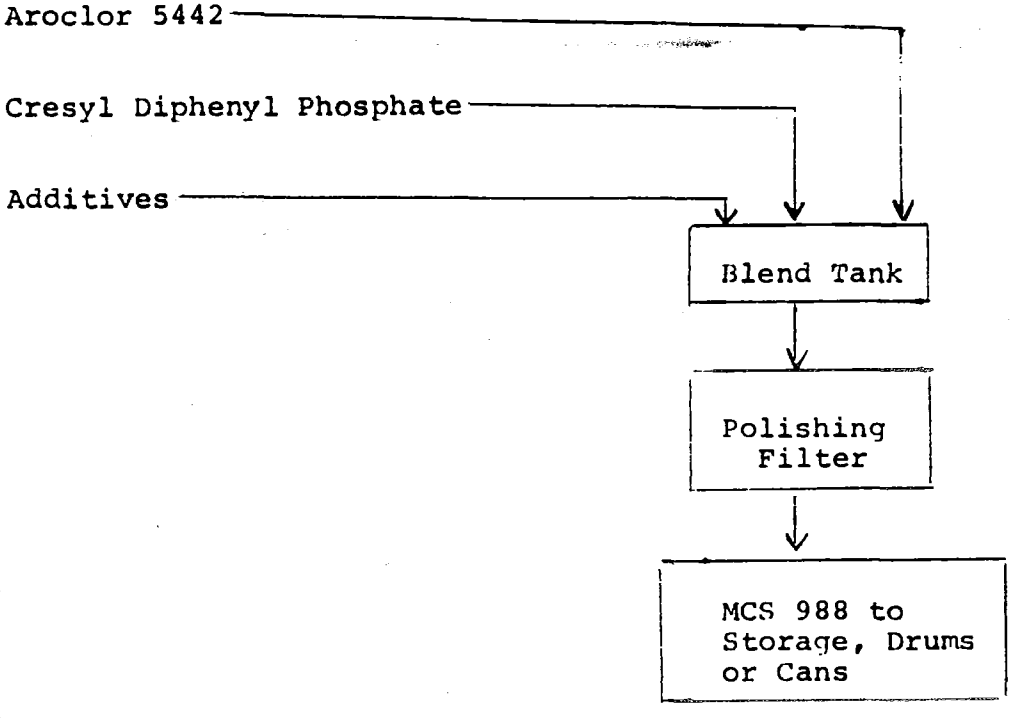
INTRODUCTION

MCS 988 (Pydraul AC-A, Winter Grade 28) is a fire resistant air compressor lubricant for operation at low ambient temperatures. This formulation was developed to eliminate Aroclor 1254 from the Pydraul AC, Winter Grade 28 blend and to use cresyl diphenyl phosphate to replace tricresyl phosphate.

SYNOPSIS OF PROCESS

MCS 988 is prepared by blending Aroclor 5442 with cresyl diphenyl phosphate and blue dye. The blended product is filtered through a simple filter to remove any stray debris from raw materials or blending and is transferred to containers or storage.

FLOW SHEET



BILL OF MATERIALS

Basis, 100 lb of product

Raw Material	Weight, lb
82621 - Aroclor 5442	14.0
80077 - Cresyl diphenyl phosphate	86.0
20640 - Dye, DuPont Oil Blue A	0.0007

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Note: This blend can also be made by combining 67.7% wt. Pydraul AC-A with 32.3% wt. Cresyl diphenyl phosphate.

PROCESS IN DETAIL

The blending operation may be carried out in any suitable metal or glass lined vessel. The materials are not corrosive and carbon steel equipment is suitable. An agitator should be provided.

To the clean, dry vessel charge the cresyl diphenyl phosphate (CDP). Addition of the Aroclor 5442 will depend on local preference for handling. The Aroclor can be added as a crushed solid or in the molten liquid state.

Aroclor 5442 is a resinous, glassy solid at room temperature. In this state it is friable and can be crushed to small chunks for addition to the heel of CDP. If addition is made in the molten state, Aroclor 5442 should be heated to 180 to 200F (82 to 93C). At 180F viscosity is 300 to 500 centistokes and at 200F, 80 to 120 cs.

The dye should be carefully measured on a suitable scale or balance and added as a solid to the batch. Note: relatively small changes in dye concentration or incomplete mixing can cause batch-to-batch color variations.

It is suggested the blend be warmed to 125 to 150F (50 to 65C) and agitation continued for sufficient time to insure complete component mixing. Thirty minutes to one hour should be sufficient. Lower blending temperatures may be used if experience indicates satisfactory mixing. Heat from molten Aroclor 5442 may be sufficient to raise batch temperature. The low viscosity of Aroclor 5442 at 200°F will aid dispersion in phosphate ester. The batch is then circulated through a polishing filter. Samples are taken as required for analytical purposes. The batch may be held for possible viscosity adjustment or be sent to storage. After blending is complete, it is recommended that the temperature be reduced to 80 to 129F (26 to 49C). Prolonged exposure at higher temperatures may cause some product quality deterioration.

DISCUSSION OF IMPORTANT VARIABLES

The most important specification property of MCS 988 is viscosity. Adjustments in the blend should be made to keep the 100F viscosity within the required specification range.

If the 100F viscosity is low, add Aroclor 5442. One lb of Aroclor 5442 per 100 lb of blend will increase the 100F viscosity about 0.8 centistokes.

If the 100F viscosity is high, add CDP. One lb of CDP per 100 lb of blend will decrease the 100F viscosity about 0.8 cs.

The quantity of dye added should be carefully measured on a suitable small balance or scale. This is important to insure uniform color from batch-to-batch.

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Another caution mentioned in the previous section concerned prolonged heating. It is suggested that maximum temperatures of 125 to 150F be limited to 2 or 3 hours. Also, manner of heating the batch should control film temperatures so there are no significant hot spots. Prolonged heating may cause gradual darkening of the product as well as gradual increase in acidity due to decomposition of the CDP.

MATERIAL SPECIFICATIONS

Raw Materials

Refer to raw material specification sheets included in the Appendix.

Finished MCS 988

Typical analyses and suggested specification limits follow:

Property	Tentative Specification	Typical Value	JFQ Method
Appearance	Clear blue liquid		16-B
Viscosity, cs			
At 100 F	26-30	28.1	126-A
At 210 F	3.8-4.2	3.96	
Acidity, mg KOH/gm	0.15	0.09	80-B
Specific Gravity, 25/25C	1.235-1.255	1.246	116-A
Moisture, KF	0.15	0.04	78-B
Pour point (each 10th lot)	-15°F	-25°F	100-A

ANALYTICAL METHODS

No new or special analytical procedures are required for this product. A cross reference table appears in the Appendix listing standard analytical procedures used at J. F. Queeny Plant, W. G. Krummrich Plant, and at the Anniston Plant. These procedures are currently used on similar products.

TOXICITY AND HAZARDS

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No unusual toxicity or hazards are expected with the raw materials or finished blend. The process is a simple blending procedure

and no hazardous reactions should occur between the various components.

Aroclor 5442 and CDP have been known materials produced by Monsanto for many years. CDP has been used in Pydraul fluid formulations. (Note: Current specific toxicity information is being obtained from the Medical Department on these materials and it is suggested these be included in the Appendix of this report.)

General Precautions include the following:

1. Goggles should be worn where splashing or spillage may occur.

2. Any material in contact with the skin should be removed by washing with soap and water.

3. Prolonged or repeated exposure to the skin may cause irritation due to removal of skin oils with resulting dryness and chapping.

4. Material may be irritating to sensitive skin areas and eyes. In case of contact with eye tissue, flush copiously with water and then get medical attention.

5. In case of internal ingestion get immediate medical attention.

6. Avoid inhaling volation material or mists.

POLLUTION CONTROL

No waste by-products are generated by this process. Used filtering material, flushings from the system during cleaning, as well as any spoiled product should be disposed of as dictated by local regulations.

APPENDIX

L. R. Stark
L. R. STARK

W R Richard
File Copy Approved by
Manager of Research

Feb 2, 1970
Date of Approval

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APPENDIX

IN 619

PHYSICAL CONSTANTS DATA

SUBSTANCE	STRUCTURAL FORMULA
MCS 988 (Pydraul AC-A, Winter Grade 28)	Blend: 23.9% wt. Aroclor 544 76.1% Cresyl diphenyl phosphate
COMPILED BY / DATE	

NAME		SOURCE & DATE
Formula	Blend	
Molecular Weight		
Appearance	Clear, blue oily liquid	
Boiling Point at 760 mm	810°F	
Boiling Point at mm 2.3mm	200C	
Boiling Point at mm 2.2×10^{-2}mm	100C	
Boiling Point at mm		
Crystallizing Point	None	
Melting Point	None	
Solution Point		
Specific Gravity @ 25/25C	1.235-1.255	
Specific Gravity @		
Pounds per Gal. @ 25 °C	10.4	
Coefficient of Expansion	.00041	
Refractive Index @ n_D^{β}		
Infra Red Spectrum *(Reference)*		
Ultra Violet Spectrum *(Reference)*		
Viscosity @ 100F	26-30 cs	
Viscosity @ 210F	3.8-4.2 cs	
Surface Tension		
Solubility in Water	Nil	
Solubility in		
Solubility in		
Pour Point	-25F (-15F max)	
Moisture (Karl Fisher)	0.15 max	
Thermal Cond. BTU/hr/ft/°F	0.068 (est.)	
Flash Point °F *(Method)* ASTM D-92	475F	
Fire Point °C ASTM D-92		
Heat of Combustion		
Heat of Formation		
Thermal Stability (cal./kg. min.)		
Latent Heat of Fusion		
Latent Heat of Vap.		
Specific Heat	0.33 (est.)	
Critical Temperature		
Critical Pressure		
Dissociation Constant		
Acidity, mg. KOH/gm	0.06 typ., 0.15 max.	
Foam, ASTM D972, 75F	25ml, 0 sec.	

Other Constants

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Analytical Procedures

Property	WGK	JPC	Anniston	ASTM
Appearance	12809	16-B	G-1	-
Viscosity	12837	126-A	049	D-445
Flash & Fire Point	12803	50-A	114	D-92
Specific Gravity	12804	116-B	052	-
Pour Point	13005	100-A	053	D-97
Cloud Point	-	36-A	-	D-2500
Acidity	12794	80-B	050	D-664/D-974
Moisture	12810	78-B	047	D-1744
Foam	12805	54-A	-	D-892
Refractive Index	13123	104-A	048	D-1218
Distillation Range	10117	-	054	Modified D-20

* Approximate equivalent ASTM method.

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MONSANTO COMPANY
ORGANIC CHEMICALS DIVISION
J. F. QUEENY PLANT
FINISHED PRODUCT SPECIFICATION

PRODUCT CODE	DEPT. OR JOB
80077/80151	

USE: Sales - W.F.Waychoff, Manager and Internal for blends

SALES CODE: 7680-940-04-001

ISSUED JAN. 23,1967
STANDARDS COMMITTEE
J. F. Queeny Plant
Paul N. Briem

PRODUCT (Trade Name)	TYPE
SANTICIZER 140	A GRADE
PRODUCT (Chemical Name)	**TYPE**
CRESYL DIPHENYL PHOSPHATE	A GRADE

CHEMICAL FORMULA

MOL WT.

SUPERSEDES SPECS OF	SAMPLE FOR ANALYSIS
November 26, 1963	1 x 16-ounce NN Flint Bottle

TEST	UNRESTRICTED SALES LIMITS	CONTROL LIMITS	METHODS
On each lot			
Acidity	0.20 meq/100 g. max. (=0.01% max. as H_3PO_4)	0.15 meq/100 g. max.	4-A
Appearance	Clear, mobile liquid	Clear, mobile liquid	16-B
Color	APHA 40 max.	APHA 15 to 35	38-D
Moisture (By KF in methanol)	0.15% max.	0.12% max.	78-B
Odor	Essentially odorless	Essentially odorless	84-A
Specific gravity @ 25/25°C	1.203 to 1.213	1.205 to 1.208	116-B
Stability to $KMnO_4$	65% transmission, min.	65 to 90% transmission	118-D
Upon request			
Refractive index @ 25°C	1.550 to 1.570	1.558 to 1.563	104-A

Sampling procedure

1. Circulate storage tank the night before filling shipping containers.
2. While filling drums or tank car, take one 16-ounce bottle from the filling line and submit to the laboratory for analysis.

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FINISHED PRODUCT SPECIFICATION

PRODUCT		DEPT.
Aroclor 5442		27-S
PLANT	PRODUCT CODE	USE
Anniston	826,21	Sales
DATE EFFECTIVE	SALES CODE	
3-15-66	1040-470-04-009	

APPROVALS

PRODUCTION	RESEARCH
R. G. Moody /s/ 12-29-65	L. R. Stark /s/ 3-11-66
SALES	QUALITY CONTROL (Chief Chemist)
W. E. Ault /s/ 3-2-66	O. E. Dolin /s/ 12-29-65

GENERAL DESCRIPTION

Mixture

CHEMICAL FORMULA

MOL WT.

SUPERSEDES SPECS. OF	SAMPLE FOR ANALYSIS	ISSUED BY
4-25-61	1 x 16 oz. Can or W.M. Bottle	J. A. Liddle 11-30-65

CHARACTERISTIC	LIMITS	METHOD
UNRESTRICTED INFORMATION		
(R) Appearance and Color	Clear, yellow sticky resin	G-1
(R) Color, NPA, Molten	2 Max.	G-4
(R) Softening Point, °C	46 - 52	115
Acid No., mg. KOH/g	0.05 Max.	116

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FROM (NAME & LOCATION) William H. Hunt - Medical Department

DATE January 23, 1970

CC W.R. Richard
L.R. Stark
J.F. Herber
J.D. Sullivan

SUBJECT Pydraul AC-A Winter Grade 28
Acute Toxicity Screen

REFERENCE

TO P.D. Fowlkes

The undiluted sample was classed as practically non-toxic when administered orally to mixed sex rats. The acute oral LD_{50} was 10,250 mg/kg. Time to death was 12 hours to 2 days. Toxic signs were reduced appetite and activity, increasing weakness, collapse, and death. During the study it appeared that the sample was slightly more toxic to females than to males. Macroscopic examination of those that succumbed revealed slight liver discoloration, hemorrhagic lungs, and acute gastrointestinal inflammation. Macroscopic examination of those that were sacrificed revealed slight liver discoloration and areas of lung congestion in those receiving the higher doses, while those receiving the lower doses exhibited a normal viscera.

The undiluted sample was classed as slightly toxic when applied to and retained for 24 hours on the clipped intact skin of mixed sex rabbits. The acute minimal lethal dose was greater than 2000 but less than 3160 mg/kg. Time to death was 4 to 6 days. Toxic signs were greatly reduced appetite, lethargy, mild diarrhea, increasing weakness, collapse, and death. Macroscopic examination of those that succumbed revealed an enlarged gall bladder, hemorrhagic lungs; slight liver discoloration and acute gastrointestinal inflammation. Macroscopic examination of those that were sacrificed revealed, in some cases, areas of lung congestion and a slightly enlarged gall bladder.

The undiluted sample was classed as a mild irritant when applied to and retained for 24 hours on the clipped intact skin of mixed sex rabbits. Maximum irritation (2/8) occurred 24 hours after the sample was removed from the skin. The skin was normal (0/8) 96 hours after removal of the sample. The reaction at maximum irritation was well-defined erythema but no edema.

The undiluted sample was classed as a slight irritant when instilled and retained for 24 hours in the conjunctival sac of the rabbit eye. Maximum irritation (2/110) occurred at 1 hour of contact and consisted of slight erythema with no edema. The eye was normal at 24 hours of contact, at which time it was irrigated.

When male rats were exposed to the saturated vapors of the sample, at ambient temperature for 6 hours no deaths occurred. It was concluded that the vapors of this sample were practically non-toxic. Macroscopic examination of the sacrificed animals revealed a normal viscera.

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No special handling of this product appears necessary.

In case of excessive skin contact wash off with soap and water.

In case of accidental eye contact, flush out with water.

William H. Hunt

William H. Hunt, Ph.D.

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