MONSANTO COMPANY

ORGANIC CHEMICALS DIVISION

W. G. KRUMMRICH PLANT

MONSANTO, ILLINOIS

STANDARD MANUFACTURING PROCESS

FOR

PYDRAUL A-200

DEPARTMENT B-246

Supersedes: Process Description for the Manufacture of Pydraul A-200 in Department B-246, dated January 7, 1962.

Prepared by: L. G. Cole
L. G. Cole
PTS Engineer

Approved by: E E Martin
E. E. Martin
Prod. Supervisor

P. E. Heisler, Gen. Prod. Sup

D. B. Hosmer 7/20/64
D. B. Hosmer, General Offices

R. W. Bucknell 7/24
R. W. Bucknell, Research

Copy 9 Issued: 8-4-64

MONS 044678

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MONSANTO COMPANY
MONSANTO, ILLINOIS

SAFETY REVIEW COMMITTEE

10-14-64

10-14-64

10-14-64

Date: 9-28-64

Messrs:
P. E. Heisler
E. E. Martin
W. D. Robinson - JFQ
D. B. Hosmer - GO

Process Holders

Tentative Amendment No. A

Tentative Amendment No. A to the Process Description for the Manufacture of PYDRAUL A-200 (Issued 8-4-64)

OBJECTIVE

This amendment recommends a change in one of the components of the additive package to improve the odor and functionality of Pydraul A-200.

PRESENT PROCEDURE

Santolube 393 (0.5%) a zinc dialkyl dithiophosphate, is added to an Aroclor-tricresylphosphate mixture containing Santolube 70 (0.5%) as well as a small amount of Dow Corning 200 defoamer (50 ppm). Most of the finished product is dyed a distinctive blue color with blue and black dye.

PROPOSED PROCEDURE

Substitute 0.5% (cwt.) Lubrizol 1360, a competitor's zinc dialkyl dithiophosphate, for Santolube 393 in the formulation of the fluid. The proportions of the other components will remain the same. The following table lists the revised raw material requirements for Pydraul A-200.

Aroclor 1242	33% (vol.)
Aroclor 1248	67% (vol.)
Lubrizol 1360	0.5% (wt.
Santolube 70	0.5% (wt.)
Dow Corning Fluid 200	50 ppm

Tentative Amendment No. A (Cont'd.)

PROPOSED PROCEDURE (Cont'd.)

Most of the final product is dyed to a standard Pydraul color (blue) which does not change any other property.

JUSTIFICATION

Lubrizol 1360, having a toxicity rating equal to Santolube 393, will eliminate general customers' complaints of a sulfur odor in our current Pydraul A-200 and will increase the thermal stability of the fluid. Increased thermal stability in Lubrizol 1360 is accomplished by the use of primary alcohols in the preparation of the additive. The improved odor control associated with Lubrizol 1360 is well known throughout the industry.

P. E. Heisler

J. D. Sullivan

E. E. Martin

L. R. Stark

D. B. Hosmer
P. W. Edwards

Date: 9-28-64
emc

Copy 9

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Dept. B-246 - Process Description

PYDRAUL A-200

SECTION I

SYNOPSIS OF PROCESS

Pydraul A-200 is a tradename used to designate a mixture of Aroclor 1242, Aroclor 1248, Santolube 393, Santolube 70, and Dow Corning Fluid 200.

Pydraul A-200 is a fire resistant, industrial hydraulic fluid. The pydraul series of fire resistant fluids include a low viscosity and low temperature fluid, a high viscosity fluid, and a medium viscosity fluid, Pydraul A-200 is a non-viscosity index improved hydraulic fluid. Pydraul A-200 is the member of the Pydraul series manufactured in Department B-246 of the W. G. Krummrich Plant.

The proportion of ingredients used to manufacture Pydraul A-200 is listed below:

% Aroclor 1242	% Aroclor 1248	% Santolube 393	% Santolube 70	Dow Corning Fluid 200
33% (vol)	67% (vol)	0.5% (wt.)	0.5% (wt.)	50 ppm

Most of the final product is dyed to a standard Pydraul color (blue) which does not change any other property.

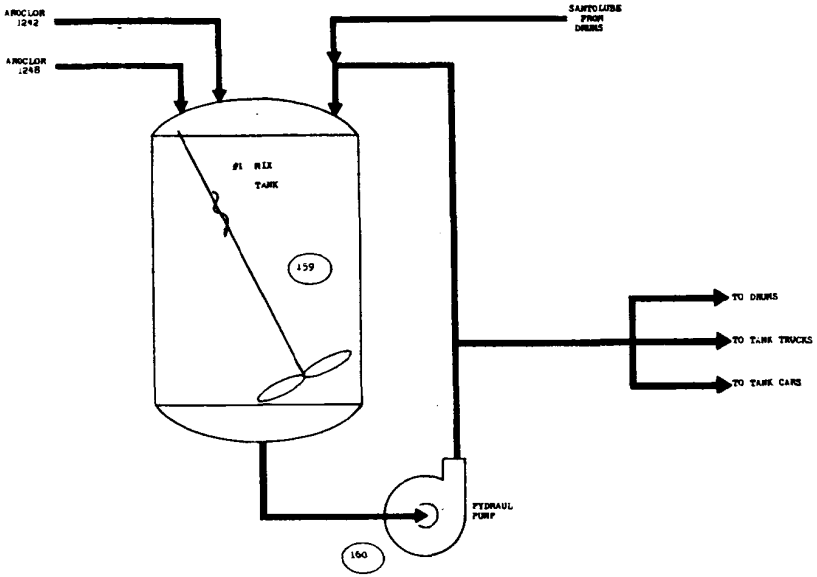
Dept. B-246 - Process Description

PYDRAUL A-200

SECTION II

FLOW SHEET

This section contains a Pydraul A-200 process flow sheet.



FLOW SHEET
810.9b

PYDRAUL A-200

DEPT. B-246

7-29-64

Dept. B-246 - Process Description

PYDRAUL A-200

SECTION III

PROCESS IN DETAIL

A. BACK GROUND AND BATCH DATA

Pydraul A-200 is a tradename used to designate a mixture of Aroclor 1242, Aroclor 1248, Santolube 393, Santolube 70, and Dow Corning fluid 200. The blend is colored with a mixture of Blue A and Azo Black dye.

Pydraul A-200 is Monsanto's high Aroclor hydraulic fluid designed as a low cost replacement for Pydraul F-9. Pydraul A-200 was formulated to meet viscosity and lubricating requirements and anti-rust characteristics as specified by the Sales Department.

The use of Santolube 70 in the Pydraul A-200 blend can cause undesirabl foaming. A concentration of 50 ppm of Dow Corning Fluid (DCF) 200 will inhibit foaming.

The raw materials necessary to blend Pydraul A-200 are listed below:

Item	12,000 gallon Batch	8,000 gallon Batch
Aroclor 1242	4,000 Gal.	2,670 Gal.
Aroclor 1248	8,000 Gal.	5,330 Gal.
Santolube 393	700 Lbs.	500 Lbs.
Santolube 70	700 Lbs.	500 Lbs.
Dow Corning Fluid - 200	7.5 Lbs.	5.0 Lbs.
Blue A Dye	326 Gm.	264 Gm.
Azo Black Dye	120 Gm.	80 Gm.

B. BLENDING

Primary chemical reactions are absent in the production of Pydraul A-200. The only process step in Pydraul A-200 production is the unit operation of blending.

Aroclor 1242 and Aroclor 1248 are pumped from storage in department 246 to the #1 mix tank located in Department B-246. The mixture of Aroclors consists of one part Aroclor 1242 to two parts Aroclor 1248.

The mixture of Aroclors is agitated for four hours, and then sampled to measure specific gravity and viscosity. One 16 oz. sample is taken to measure these properties. Small additions of either Aroclor 1242 or Aroclor 1248 are added to alter specific gravity and viscosity to meet specifications if necessary. No steam is applied to the coils of the tank during agitation. Mixing is promoted by heating to 80°C., but must be allowed to cool to 65°C. or less to fill drums to the proper weight.

Dept. B-246 - Process Description

PYDRAUL A-200

SECTION III

PROCESS IN DETAIL

B. BLENDING (Cont'd.)

After the period of agitation, Santolube 393 and Santolube 70 are pumped into the #1 mix tank. One half pound each of Santolube 70 and 393 are added for 100 pounds of finished product. The batch is then circulated until the temperature has fallen below 70°C.

Santolube 393 imparts good anti-wear properties to the Aroclor mixture. Santolube 70 is a rust inhibitor.

Next, Dow Corning Fluid 200 (DCF) is added to the mix - one pound per 2,000 pounds of product. DCF inhibits foaming caused by Santolube 70.

Most of the finished product is dyed a distinctive blue with blue and black dye. The dye does not change any properties other than color.

After all ingredients have been added the batch is agitated an additional 4 hours.

Three 16 oz. samples are taken from the discharge side of the circulating pump and analyzed for moisture, specific gravity, viscosity and foam.

If the batch meets all specifications (See Appendix B), the finished Pydraul A-200 is packaged in 5 gallon cans, 55 gallon drums, or loaded in tank cars and tank trucks.

Three 16 oz. lot samples are taken from each tank car or tank truck.

Dept. B-246 - Process Description

PYDRAUL A-200

SECTION IV

COMMENTS ON PROCESS

A. RAW MATERIAL YIELDS

Raw material yields are about 99% for this blending operation. Small material losses are attributed to samples. The exact amount of raw material usage for a given batch of Pydraul A-200 is not known since slightly different proportions of Aroclors may be needed to meet specific gravity and refractive index specifications.

B. CAPACITY

The capacity of Department B-246 is about 5 million pounds per year. The supply of Aroclor 1242 and Aroclor 1248 for Pydraul production is limited and thus a controlling factor of Pydraul production. Also, storage facilities are a bottleneck in the production rate. The #1 mix tank has a dual purpose and serves as both a blend tank and storage tank for the final product.

C. QUALITY

The specifications of Pydraul A-200 are more readily obtained than some of the other Aroclor-base products. The finished product does not have as many properties with rigid specifications as do Pyranols and Inerteens.

Some of the critical factors in producing a good quality Pydraul A-200 are as follows:

1. The viscosity of the Aroclor mix must be in specification.

2. The temperature of the Aroclor mix must be reduced to 90°C. before adding the Santolubes to avoid decomposition of the Santolubes.

3. The temperature of the Aroclor-Santolube mix must be reduced to 80°C. before adding the Dow Corning Fluid.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX A

EQUIPMENT LIST - W. G. KRUMMRICH PLANT

Item No.	Equipment Name	Equipment No.	Description
*149	#3 Storage Pump	19-0585 66-0853	Taber Vert. Sub. Pump. Dwg. A-387. Type C-3, 2" x 2", C.I. Body, Length 11'6". Cap. 50 GPM, 60' Static Head, Sp. Gr. 1.18 at 170°F. Motor is 3 H.P., 1800 R.P.M.
*151	#4 Storage Pump	19-0584 66-1501	Taber Vert. Submerged Pump Type L-2, 2 1/2" x 2", Length 11'6". Cap. 50 GPM at 40' Static Head. Motor is 3 H.P., 1800 R.P.M.
*157	#7 Storage Pump	19-2077 66-1691	Blackmer Pump. Monel shaft. 2 1/2 x 2 1/2. Motor is 3 H.P., 1800 R.P.M.
159	#1 Mix Tank	21-0321 23-1288 66-2168	Tank (Nooter), Dwg. D-6455, 14' O.D. x 10' high. 3/8" shell, steel construction. Capacity is 15,000 gallons. Agitator motor is 7 1/2 H.P. 1750 R.P.M.
160	Pydraul Pump	19-1540 66-3133	Taber Horiz., Cent. Pump 304 Stainless Steel, 2" suction, 1 1/2 discharge. Motor is 10 H.P., 1750 R.P.M.
161	Full Flow Filter	15-0239	Sweetland Filter. Size #10 RH, 54 leaves, C.I. Body, lined with Nickel.

*Equipment assigned to Department 246 also.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX B

SPECIFICATIONS - W. G. KRUMMRICH PLANT

The following is a list of the raw materials used for the manufacture of Pydraul A-200. Specification Sheets are included for the materials.

Material Code	Raw Material
82113	Santolube 70
31100	Dow Corning Fluid 200
81176	Santolube 393
81101	Aroclor 1242
81102	Aroclor 1248
20640	Blue A Dye
20317	Azo Black Dye

The following is a list of the finished products manufactured in Department B-246. Specification Sheets are included for the materials.

Product Code	Product
81096	Pydraul A-200

W. G. KRUMMRICH PLANT
MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION

RAW MATERIAL SPECIFICATION

MATERIAL CODE: 82113

USING DEPTS.: B-246

SUPPLIER: Nitro Plant

Issued 4/13/62
W.G.Krummrich Plant
By C. O. Mark

MATERIAL: SANTOLUBE 70

CHEMICAL FORMULA: Mixture

MOL WT.---

SUPERSEDES SPECS OF: New

SAMPLE FOR ANALYSIS: 1 x 16 oz. W.M.Bottle

General Tests (Made on request only)

Property	Specification	Method Numbers	
		Nitro	WOX
Appearance	Dark-Oily Liquid	6-C-01	T-2134
Color, ASTM Dil.	5.0, max.	6-C-21	T-2141
Neutralization Number	50-60	6-A-24	T-2135
Specific Gravity @ 60/60°F	Ca. 0.92	---	T-2139
Emulsification Test	30, max.	6-S-28	---
Rust Test	Pass	6-R-04	---
Solubility	95%, min.	---	T-2140
Viscosity @ 210°F	Ca. 240 SUS	6-X-02	---
Flash Point	350°F, min.	6-O-01	T-2138

NOTE: This material is shipped upon invoice certification of compliance with specifications. Prior permission will be obtained to ship non-specification grade material.

W. G. KRUMMRICH PLANT
MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION

RAW MATERIAL SPECIFICATION

MATERIAL CODE: 31100

USING DEPT'S: B-246

SUPPLIER: Dow Corning Corporation

Issued 3/14/62
W.G.Krummrich Plant
By C. O. Martin

MATERIAL: Dow Corning 200 Fluid-350 cs.

CHEMICAL FORMULA: Mixture

MOL WT.:

SUPERSEDES SPECS OF: New

SAMPLE FOR ANALYSIS: 1 x 8 oz. W.M.Bottle

General Tests (Made on request only)

Property	Specification	Method Number
Appearance	Syrupy Liquid	T-2134
Viscosity @ 25°C	330-370 cs.	T-2132
Color-Modified ASTM D-848-45T	1.5, max.	T-2142
Flash Point	600°F, min.	T-2138
Neutralization Number	0.05, max.	80-B (JFQ)
Stability (Viscosity Change after 16 hrs. @ 200°C)	10, max.	118-31100 (JFQ)

NOTE: This material is shipped upon invoice certification of compliance with specifications. Prior permission will be obtained to ship non-specification grade material.

MONS 044692

MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION
W. G. Krummrich Plant
FINISHED PRODUCT SPECIFICATION

PRODUCT CODE: 81176
DEPT. OR JOB: 266
USE: Sales and Internal
SALES CODE: 7536-393/800-07-03

Issued MAR 9 1964
W. G. Krummrich Plant
By M. D. Daly

PRODUCT (Trade Name): Santolube 393 and Santolube 393 SM
TYPE:
PRODUCT (Chemical Name):
TYPE:

CHEMICAL FORMULA

Mixture

MOL WT.

SUPERSEDES SPEC OF: 6-21-61
SAMPLE FOR ANALYSIS: 2 x 16 oz. W. M. Bottle

UNRESTRICTED INFORMATION

Routine Tests	Specification	Method No.
Appearance	Clear light yellow green to amber liquid	12,418
Haze (4% by wt. in P.E.)	95%, min.	12,421
Phosphorus	7.8 - 8.2%	12,428
Sp. Gr. @60/60°F	1.090 - 1.116	12,425
Sulfur	15.1 - 17.1%	12,349
Visc. @100°F	Report (Range 950-1150 SUS)	12,426
Zinc	8.4 - 9.2%	12,427

RESTRICTED INFORMATION

Routine Tests		
Color, ASTM	3, max.	12,419
Copper Corrosion 3 hrs. @100°C. (0.50% by wt. in STO 1)	ASTM Std., No. 1B, max.	12,420
Hydrogen Sulfide	None	12,422
Clarity:		10,975
Dark Insoluble Matter	DIM Std., max.	
White Insoluble Matter	WIM Std., max.	
Odor	Characteristic	12,423
pH (Stanisol-Butanol-water system)	5.0,min.	12,860

MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION
Krummrich and Anniston
FINISHED PRODUCT SPECIFICATION

PRODUCT CODE: 81101-82612 | DEPT. OR JOB: WGK-246-Ann.27
USE: Sales
SALES CODE: 1040-240-04/11/16-03/09

Issued JUL 15 1964
W. G. Krummrich Plant
By MDD

PRODUCT (Trade Name): Aroclor 1242 | TYPE: Non-Electrical Grade
PRODUCT (Chemical Name) | TYPE

CHEMICAL FORMULA

Mixture

MOL WT.

SUPERSEDES SPECS OF: 5-4-61
SAMPLE FOR ANALYSIS: 3 x 16 oz. W. M. Bottles

UNRESTRICTED INFORMATION

Routine Tests	Specification	WGK	Anniston Method No.
Condition	Clear	10084	G-1
Color, APHA	100 max.	10084	046
Sp. Gr. (25/15.5°C)	1.381 - 1.392	10114	052
Acidity (mg. KOH/g.)	0.010, max.	10087	050
Moisture (H_2O) (ppm.)	50, max.	10620	047
General Tests			
Distillation Range (ASTM D-20 Corrected)		10117	14-31-5
10% Distilled by wt.	325°C, min.		
90% " " "	360°C, max.		
Viscosity @100°F (SUS)	82-92	10086	049
Flash Point (°F)	338 - 392	10123	14-28-5
Fire Point	None	10123	14-28-5

MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION
Krummrich and Anniston
FINISHED PRODUCT SPECIFICATION

PRODUCT CODE: 81102 - 82641
DEPT. OR JOB: WGK 246-Ann.27
USE: Sales
SALES CODE: 1040-260-04/11/16-03/09

Issued JUL 15 1964
W. G. Krummrich Plant
By M D Daly

PRODUCT (Trade Name): Aroclor 1248
TYPE: Non-Electrical Grade
PRODUCT (Chemical Name):
TYPE:

CHEMICAL FORMULA: Mixture

MOL. WT.:

SUPERSEDES SPECS OF: 5-4-61
SAMPLE FOR ANALYSIS: 3 x 16 oz. W. M. Bottles

UNRESTRICTED INFORMATION

Routine Tests	Specification	WGK Method No.	Anniston No.
Appearance	Colorless to light yellow-green liquid	10084	G-1
Condition	Clear	10084	G-1
Color, APHA	100 max.	10084	046
Sp. Gr. @65/15.5°C	1.405 - 1.415	10114	052
Acidity (mg. KOH/g.)	0.010, max.	10087	050
Moisture (H_2O) (ppm.)	50, max.	10620	047
Viscosity @130°F (SUS)	73 - 80	10086	049
General Tests			
Flash Point (°F)	370, min.	10123	14-28-54

MONS 044695

FM 84 (REV. 12/58)

MONSANTO CHEMICAL COMPANY
ORGANIC CHEMICALS DIVISION
W. G. Krummrich Plant
FINISHED PRODUCT SPECIFICATION

PRODUCT CODE	DEPT. OR JOB
81096	B-246
USE: Sales	
SALES CODE: 4595-200-11-03	

Issued 7/12/63
W. G. Krummrich Plant
By M. D. Daly

PRODUCT (Trade Name): Pydraul A-200 — TYPE:
PRODUCT (Chemical Name): — TYPE:
CHEMICAL FORMULA:

MIXTURE

MOL WT.

SUPERSEDES SPECS OF: New
SAMPLE FOR ANALYSIS: 2 x 16 oz. W. M. Bottles

UNRESTRICTED INFORMATION

Routine Tests	Specification	Method Number
Appearance	Cloudy, Blue Liquid Free of Sediment	12,809
Flash Point	350°F, min.	12,803
Moisture, K.F.	0.05%, max.	12,810
Neutralization Number	0.80 - 1.10mg.KOH/g	12,794
Sp. Gr. @25/25°C	1.415 - 1.430	12,804
Viscosity,		12,837
@50°F	900 cs., max.	
@100°F	30.0 - 33.0 cs.	
@210°F	2.80 - 3.00cs	

RESTRICTED INFORMATION

Routine Test		
Foam Test	150ml, max.*	12,805

*Disposition of lots failing this limit will requre approval of the Sales Department.

Dept. B-246 - Process Description

PYDRAUL A-200

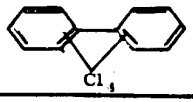
APPENDIX C

PHYSICAL CONSTANTS - W. G. KRUMMRICH PLANT

This section contains physical and functional properties of Pydraul A-200. Pydraul A-200 was formerly named OS-95.

Din 819

PHYSICAL CONSTANTS DATA

SUBSTANCE	STRUCTURAL FORMULA
AROCLOR 1248	
COMPILED BY: A. M. Ellenburg	DATE: 4-25-57

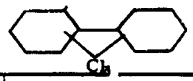
NAME		SOURCE & DATE
Formula	$C_{12}H_6Cl_4$	
Molecular Weight	292 (Avg.)	
Appearance	Yellow Tinted Mob. Oil	Monsanto Bull. OP-115(1956
Boiling Point at 760 mm Range	345-385°C.	"
Boiling Point at 3 mm "	165-210°C.	"
Boiling Point at mm		
Boiling Point at mm		
Crystallizing Point	Non-crystallizing	"
Melting Point		
Solution Point		
Specific Gravity @ 25/25 °C.	1.445	"
Specific Gravity @ 65/15.5°C.	1.405-1.415	Specifications 9/9/54
Pounds per Gal. @ 25 °C	12.04	M.B. OP-115
Coefficient of Expansion 25-65°C.	0.00070 cc/cc/°C.	"
Refractive Index @ 25°C n_D^{25}	1.6285-1.6305	Specification 9/9/54
Infra Red Spectrum *(Reference)*		
Ultra Violet Spectrum *(Reference)*		
Viscosity @ 130°F.	73-80 SUS	M.B. OP-115
Viscosity @		
Surface Tension Dynes/cm @20°C.	44.2	J. Coll. Sci. 7, 166, (1952)
Solubility in Water	Insoluble	M.B. OP-115
Solubility in 3A Alcohol @ 25°C.	15 g./100 cc	"
Solubility in Pyridine @ 29°C.	111.4g./100 cc	"
Flash Point °F.(Method) c.o.c.	196°C.	"
Fire Point °C c.o.c.	None	"
Heat of Combustion		
Heat of Formation		
Thermal Stability (cal./kg./min.)		
Latent Heat of Fusion		
Latent Heat of Vap. cal/gm.	54	Calculated
Specific Heat @ 25°C.	0.277	M.B. OP-115
Critical Temperature		
Critical Pressure		
Dissociation Constant		
Specific Heat @ 300°C.	0.356	"
Other Constants: Pour Point	0°C. or lower	"
Other Constants: Thermal Conductivity, cal/cm/°C/sec.	23.6 @ 28°C.	To be published
Other Constants: Dielectric Constant, 100°C., 60 cy.	4.5-4.7	M.B. OP-115
Toxicity *(Give Reference)*	Contact Medical Dept.	M.B. OP-115

MONS 044698

NOTE: *These data should not be relied ...*

TM 819

PHYSICAL CONSTANTS DATA

SUBSTANCE	STRUCTURAL FORMULA
AROCLOR 1242	
COMPILED BY: A. M. Ellenburg	DATE: 4-25-57

NAME		SOURCE & DATE
Formula	$C_{12} H_7 Cl_3$	
Molecular Weight	257 (avg.)	
Appearance	Colorless Mobile Oil	Monsanto Bull. OP-115 (1956
Boiling Point at 760 mm Range	325 - 360°C.	"
Boiling Point at 3 mm "	155-195°C.	"
Boiling Point at mm		
Boiling Point at mm		
Crystallizing Point	Non-crystallizing	"
Melting Point		
Solution Point		
Specific Gravity @ 25/25°C.	1.380	"
Specific Gravity @ 25/15.5°C.	1.381 - 1.392	Specification 2-14-55
Pounds per Gal. @ 25 °C	11.50	M. B. OP-115
Coefficient of Expansion 25-65°C.	0.00068 cc/cc/°C.	"
Refractive Index @ 25°C. n_D	1.6245 - 1.6265	Specification 2-14-55
Infra Red Spectrum (Reference)		
Ultra Violet Spectrum (Reference)		
Viscosity @ 210°F.	34-35 SUS	M. B. OP-115
Viscosity @ 100°F.	82-92 SUS	"
Surface Tension Dynes/cm @ 20°C.	45.3	J. Coll. Sci. 7, 166, (1952)
Solubility in Water	Insoluble	M. B. OP-115
Solubility in 3A Alcohol @ 29°C.	23.3 g./100 cc	"
Solubility in Pyridine @ 30°C.	132.5 g./100 cc	"
Flash Point °C (Method) c.o.c.	180°C.	"
Fire Point °C c.o.c.	None	"
Heat of Combustion		
Heat of Formation		
Thermal Stability (cal./kg/min.)		
Latent Heat of Fusion		
Latent Heat of Vap. cal/gm.	61	Calculated
Specific Heat @ 25°C.	0.293	M. B. OP-115
Critical Temperature		
Critical Pressure		
Dissociation Constant		
Specific Heat @ 300°C.	0.380	"
Other Constants: Pour Point	-14°C. or lower	"
Other Constants: Thermal Conductivity, cal/cm/°C/sec.	24.0 @ 28°C.	To be published
Other Constants: Dielectric Constant, 100°C., 60 cy.	4.7 - 4.9	M. B. OP-115
		MONS 044699
Toxicity (Give References)	Contact Medical Dept.	M. B. OP-115

NOTE: *These data should not be released outside of Monsanto Chemical Company. Use additional sheets if necessary.*

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX C

PHYSICAL CONSTANTS - W. G. KRUMMRICH PLANT

*PYDRAUL A-200 - PHYSICAL & FUNCTIONAL PROPERTIES

Appearance: Slightly cloudy, light yellow, oily liquid.

Viscosity:	Centistokes	Saybolt Universal Seconds
at 210°F.	2.86	35.8
at 100°F.	30.14	142.
at 40°F.	1920.	8500.

Density:

at 100°F.	1.4161 gm./ml.
at 60°F.	1.4305 gm./ml.

Flash Point (COC): 380°F.

Fire Point (COC): 680°F. (1)

Hot Manifold (MIL-F-7100), 1300°F. - Does not flash or burn on tube or after leaving tube.

Low Pressure Spray Flammability (AMS 3150-B) - Flame brightened, but did not increase.

High Pressure Spray Flammability (AMS 3150-B) - Will not ignite.

Molten Metal Ignition (molten aluminum alloy at 1150 to 1250°F.) - Does not spontaneously ignite. Flashes by spark.

Pour Point: +50°F.

Neutralization No.
mg KOH/gm. to pH 11: 0.83 (2)

Steam Turbine Oil
Rust (ASTM D-665) 10.0 at 48 hours (3)

Foam (ASTM D-892)

	Foam Vol. ml.	Collapse Time Seconds
at 75°F.	30	60
at 200°F.	8	60
at 75°F.	35	60

Shell Four-Ball Wear: Steel-on-steel 4 Kg. - 0.21 mm.
167°F., 630 RPM, 1 hr. 10 Kg. - 0.29
40 Kg. - 0.43

*Pydraul A-200 was formerly named OS-95.

MONS 044700

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX C

PHYSICAL CONSTANTS (Cont'd.) - W. G. KRUMMRICH PLANT

Shell Four-Ball Wear: 167°F., 630 RPM, 1 Hr.	Steel-on bronze	4 Kg. - 1.20 10 Kg. - 1.40 40 Kg. - 1.70
Almen E. P.	Passing load Passing torque	- 48 lb. 24,000 psi. - 41 lb.
Almen Wear (wt. loss mg.):	1.3 mg.	
Timken Load (passing):	50 lb., 16,340 psi film strength	

Steam Turbine Oil Oxidation (ASTM D-943): (1008 hours exposure)

Viscosity	
100°F. Initial	30.12 cs.
Final	30.03 cs.
210°F. Initial	2.87 cs.
Final	2.86 cs.
Acidity Initial, TAN	0.82
Final, TAN	0.21
Fluid Appearance:	Greenish brown with greenish white deposit in tube bottom.
Steel Appearance:	Soft black deposit on surface.
Copper Appearance:	Black rough (etched) surface.
Four-Ball Wear:	Initial 10 Kg. -0.29 mm., Final 10 Kg. -0.41 mm.

Oxidation-Corrosion: (Fed. Spec. 791 Method 530.8, 168 hrs. at 250°F.)

Metal Attack (wt. change $mg/cm.^2$)

Copper	- 0.05 no etch, greenish to straw stain.
Aluminum	-+0.01 clear
Magnesium	- 0 very slight trace surface pitting
Steel	-+0.01 clear
Cadmium Plate	- 0.01 clear

Viscosity	
100°F. Initial	30.1 cs.
Final	31.8 cs.
210°F. Initial	2.86
Final	2.93
Acidity, TAN	
Initial	0.82
Final	0.68
Evaporation Loss, %:	0.6

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX C

PHYSICAL CONSTANTS (Cont'd.) - W. G. KRUMMRICH PLANT

Oxidation-Corrosion: (Fed. Spec. 791 Method 530.8, 168 hrs. at 250°F.)(Cont'd.

Fluid Appearance: Clear, light amber, no deposits.

(1) fluid boiled over onto heater.
(2) Apparent high acidity due to nature of additives present.
(3) Rust rating: REL M-400, 10.0 - no rusting.

PYDRAUL A-200 COMPATIBILITY LUBRICATING PROPERTIES

Fluid (% Vol.)	Almen Load		Four-Ball Wear (620 rpm, 167°F., 1 hr.)		
	Pounds Load	Pounds Torque	Steel-on-Steel 10 Kg.	40 Kg.	Steel-on-Bronze 10 Kg.
100% A-200	48	41	0.29 mm	0.43 mm.	1.40
90% A-200, 10% Pydraul F-9	47	41	0.23 mm	0.50 mm.	----
75% A-200, 25% Pydraul F-9	38	43	0.22 mm	0.55 mm.	----
25% A-200, 75% Pydraul F-9	50	45	0.22 mm	0.63 mm.	----
10% A-200, 90% Pydraul F-9	50	47	0.22 mm	0.68 mm.	----
100% Pydraul F-9	50	44	0.28 mm	0.67 mm.	1.18
100% A-200	48	41	0.29 mm	0.43 mm.	1.40
90% A-200, 10% Cellulube 220	43	53	0.25 mm	0.53 mm.	----
75% A-200, 25% Cellulube 220	37	54	0.23 mm	0.58 mm.	----
25% A-200, 75% Cellulube 220	50	55	0.28 mm	0.58 mm.	----
10% A-200, 90% Cellulube 220	50	52	0.30 mm	0.48 mm.	----
100% Cellulube 220	27	35	0.33 mm	0.54 mm.	0.81
100% A-200	48	41	0.29 mm	0.43 mm.	1.40
90% A-200, 10% Houghto-Safe 1120	40	44	0.24 mm	0.50 mm.	1.57
75% A-200, 25% Houghto-Safe 1120	36	56	0.22 mm	0.55 mm.	1.47
25% A-200, 75% Houghto-Safe 1120	49	57	0.31 mm	0.57 mm.	1.12
10% A-200, 90% Houghto-Safe 1120	50	47	0.37 mm	0.51 mm.	0.98
100% Houghto-Safe 1120	50	51	0.34 mm	0.56 mm.	0.90

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX D

UTILITIES - W. G. KRUMMRICH PLANT

The utility calculations are based on design calculations for a 5 million pounds per year production rate.

The breakdown of utility by individual equipment is only as estimate. The estimate of utility usages are average values in most instances as it is difficult to measure the operating time and load for a particular piece of equipment with great accuracy.

The total usage of each utility was taken from the cost sheets. Estimates of individual operating time and percentage of total load were made to calculate the distribution of utilities as given in the following pages of this section.

1. POWER CONSUMPTION

A. Electricity - 440 V., 3 phase, 60 cycle

Item No.	Equipment Motor	Motor H.P.	Peak Load KW	Monthly Usage KWH
160	Pydraul Pump	10.0	8.8	240
149	#3 Aroclor Storage Pump	3.0	2.6	20
151	#4 Aroclor Storage Pump	3.0	2.6	20
157	#7 Aroclor Storage Pump	3.0	2.6	20
159	#1 Mix Tank Agitator	7.5	6.6	600
		26.5	23.2	900

B. Electricity - 110 V., One-phase, 60 Cycle

Equipment	Peak Load KW	Monthly Usage
Miscellaneous	2	200

MONS 044704

2. COMPRESSED PLANT AIR

Item No.	Using Equipment	Normal use SCFM	Peak use SCFM	Monthly usage MSCF
159	#1 Mix Tank	15	30	1000

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX D

UTILITIES - W. G. KRUMMRICH PLANT (Cont'd.)

3. LOW PRESSURE STEAM

80 psig at 325°F.

Item No.	Using Equipment	Normal use Lb./Hr.	Peak use Lb./Hr.	Monthly Usage M Lb.
159	#1 Mix Tank	700	1000	400
	Miscellaneous	200	500	40
		900	1500	440

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX E

PERSONNEL

Departments 246, A-246, B-246 and C-246 are closely related. Operating personnel may work in all of the departments in a given day. For this reason, the description of operating classifications and assignments for departments 246, A-246, B-246 and C-246 is given as though all four of the departments are just one department.

Operating Classifications

Job	Number of Men	
	7 day/week Schedule	10 & 4 Schedule
Premium Operator	4	3
Standard Operator	4	3
Repairman	1	1
Packer	2	2
Porter	½	½
Swingman	1	0
Total	12½	9½

The swingman works two shifts per week (Saturday and Sunday) as a relief foreman, two shifts as a repairman, and one shift operating the premium job. There is an open shift on the standard operator job that is covered by overtime. The premium operator and standard operator cover three shifts each day. The repairman works the day shift, and with the swingman, there is 7 days per week repairman coverage. Packers work the day and middle shift 5 days per week. The porter works half time in department 246 and half time in department 243. The premium operator has lead responsibility for his shift.

The work force works all three departments Aroclor, Pyranol and Pydraul as one coordinated operation. The assignment of time is 70% to Aroclors, 15% to Pyranol and 15% to Pydraul.

Operating Assignments:

Premium Operator: Has overall responsibility and operates 5 chlorinators 2 stills and covers the necessary absences of the standard operator.

Standard Operator: Operates 2 blend tanks filter, 2 finished product tanks, storage tanks, makes Pyranol and Pydraul mixes, loads trailer, and tank cars, charges chlorinators and transfers receivers and also belongs to the Fire Brigade.

Repairman: Unloads cars and trailers of Biphenyl, Trichlorobenzene and Tetra-Trichlorobenzene and finished product, makes weekly safety inspections and department minor repair work.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX E PERSONNEL

Packer: Fills, stencils and labels 5 gallon, 30 and 55 gallon drums and clean-up assignments when not drumming.

Porter: Cleans office, control room, repair room, wash room and smoking shelter.

Swingman: Works one day per week as premium operator, two days as repairman and two days as relief foreman. As relief foreman takes overall supervision and day shift on weekends including arranging for maintenance, night sheets and line-up of work.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX F PACKAGING & SHIPPING

Aroclor, Pyranol & Pydraul are filled about half in drums and half in tank cars or tank trucks.

A substantial amount (about 40%) of Aroclor is used to make Pyranol and Pydraul.

Sales are largely directly to the customer. The remainder is in bulk shipments to the J. F. Queeny Plant.

All electrical grade tank truck shipments are made in the customers trucks which are stainless steel. Non-electrical Aroclors are shipped in leased trucks and may be iron although other materials of construction are suitable Pydraul is shipped in steel tank trucks.

Electrical grade Aroclor and Pyranols are shipped in lined tank cars either 4,000 or 8,000 gallons in capacity. The lining is either tin, zinc or aluminum spray because iron contamination is detrimental to the electrical properties. Electrical grade cars are either owned by Monsanto or on a long term lease. Non-Electrical grade Aroclor is shipped in steel cars.

All electrical grade lots and bulk shipments of non-electrical material are sampled from the final container. That is all tank cars and tank trucks are sampled and analyzed after loading. All electrical grade drums are sampled from one of the drums.

Tank cars and tank trucks are inspected to be sure they are free of dirt and water or other foreign material before loading. Heels are drained before loading some materials. Car washing when necessary is done by the repair track. Tank cars are sealed with a numbered aluminum seal

Lacquer lined drums are used for Aroclor and Pyranol and plain steel drums are used for Pydrauls.

A summary of products, weights and containers current use is as follows:

Product	Weights and Containers 5 Gal.	30 Gal.	55 Gal.	TT	TC
1232	-	-	600#	-	-
1242	60	-	600#	Yes	Yes
1248	60	-	600#	Yes	Yes
1254	60	-	600#	Yes	Yes
1254 Xylene	-	-	600#	-	-
1260	60	-	600#	Yes	Yes
1262	60	-	600#	-	-
MCS295	-	-	645#	-	-
Pyranol 1488	-	-	675#	-	-
Pyranol 1481	-	-	675#	-	-

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX F

PACKAGING & SHIPPING

Product	Weights and Containers 5 Gal.	30 Gal.	55 Gal.	TT	TC
Pyranol A-13B3B	65	360#	675#	-	4000 Gal.
Inerteen PPO	65	360#	674#	-	4000 Gal. & 8000 Gal.
Pydraul A-200	59	-	645#	Yes	-
Pydraul 280	-	-	625#	-	-

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX G

MATERIAL BALANCE - W. G. KRUMMRICH PLANT

A detailed material balance on Department B-246 was not made because blending and material losses in the process are negligible. The greatest material losses are the samples which are less than 1 pound per hundred pounds of finished product.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX H

ATMOSPHERIC - STREAM DISCHARGE

Waste materials are absent in the production of Pydraul A-200; no materials are sewered.

The temperature of the blend is about 70°C. At this temperature evaporation losses of the finished product are very small. Thus, almost no product is discharged to the atmosphere.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX I

PROCESS CONTROL PROCEDURE - W. G. KRUMMRICH PLANT

The data sheet in this section is typical of those used by operating personnel to record the various stages of the blending process as they are completed.

The process control procedure is listed below:

Sampling Point	Frequency	Reason for Sample	Normal Range	Method Number
Discharge of circulation pump of #1 Mix tank	One 16 oz. Sample every batch	Sp. gravity Viscosity	0.011 10 SUS	10,114 10,086
Discharge of circulation pump of #1 Mix tank	Three 16 oz. Samples every batch	Sp. gravity Viscosity	0.015 $50^{\circ}F$ - 900 CS., Max. $100^{\circ}F$ - 3.0 CS $210^{\circ}F$ - 0.17 CS	12,804 12,837
		Moisture Flash Point Neutralization Number Foam Test	0.05%, Max. $350^{\circ}F$, Min. 0.30mg KOH/g 150 ml, Max.	12,810 12,803 12,794 12,805
Tank truck or Tank car	Three 16 oz. samples once every load	The samples are the same as those in Item 2 above.		

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX J

SAFETY AND TOXICITY DATA - W. G. KRUMMRICH PLANT

SAFETY EQUIPMENT*

The following is a list of safety equipment (personal and departmental) required in Department 246.

1. FIRE EXTINGUISHERS

   A. Dry Chemical (3) - Southwest corner Bldg. CR-Main Floor.

   - West wall at top of stairs of Second Floor.

   -

   B. Carbon Dioxide Snow- South-West corner of Bldg. CR, Ground Level.

2. CHLORINE GAS MASKS (4) - South-West corner, Second Floor

   - Control Room, Second Floor

   - East side, outside Control Room

   - Wall, South-West corner of Sprinkler House, Main Floor.

3. SCOTT AIR MASKS -

4. SAFETY SHOWERS (2) - South-East corner of Bldg. CR, Ground Level.

   - South-East corner of Bldg. CR, 2nd Floor.

5. DAVIS VAPOTESTER

6. EYE BATHS

7. SPRINKLER SYSTEM

*The safety equipment for Department B-246 is the same as that of Department 246.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX J

SAFETY AND TOXICITY DATA (Cont'd.)

SAFETY PRECAUTIONS

The following are safety precautions followed in the operation of Department 246.

1. SAFETY EQUIPMENT OF EMPLOYEE

Each employee has the following safety equipment: (1) hard hat (2) safety glasses (3) goggles (4) rubber or canvas gloves (5) rubber overshoes.

Special equipment may be issued as necessary for performing a particular job in a safe manner.

2. SAMPLING

Precaution must be taken to avoid skin contact of samples and inhalation of vapors.

3. FIRES

Pydraul A-200 is not a fire hazard. Automatic fire extinguishers and sprinklers have been installed in building CR to combat any fires that may come about.

4. TOXICITY

Toxicity does not present a serious problem. However, a complete change of clothes is supplied to each person, and time is allotted at the end of each shift to take a bath. Instructions are also issued to avoid actual skin contact with Pydraul A-200 as much as possible and to wash hands and face before eating.

5. MISCELLANEOUS

There are many accidents that can occur which may be classified as health and safety hazards. These accidents may result from such things as broken steam lines, acid leaks, bare steam lines, etc.

6. SAFETY RECORD

The last lost-time accident in Department 246, A-246, B-246 and C-246 was January 28, 1948. The frequency of minor injurie is low, around one per month for all departments combined.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX J

TOXICITY DATA

AROCLORS AND PYDRAULS

TOXICITY:

This material is a liquid under normal conditions and has a medium toxcity range for liquid injestion and a high toxicity for vapor inhalation. The maximum allowable concentration (M.A.P.) is 1 mg/cubic meter.

FIRE HAZARD:

There is no fire hazard under normal conditions.

OTHER HAZARDS:

This material can cuase dermititis, systemic poisoning from the fumes, and yellow atrophy of the liver. There are skin, mucous membrane and eye hazards encountered in handling this material.

TREATMENT AND ANTIDOTES:

Call a physician and remove patient from fumes.

STORAGE AND HANDLING:

Protect the skin, lungs, and eyes by wearing approved protective clothing, respirator and goggles. There are no special storage restrictions under normal conditions except to store in a ventilated area.

SHIPPING:

There are no special shipping restrictions.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX K

BACKGROUND - W. G. KRUMMRICH PLANT

Monsanto has been actively interested in functional fluids since 1948. Two lines of products, Skydrol fire resistant aircraft hydraulic fluids and Pydraul fire resistant industrial hydraulic fluid, have been introduced and several individual fluids have reached commercial status.

Formulation work was done by Monsanto on an Aroclor base fluids in an effort to develop a satisfactory fluid of lower price than the Pydrauls available on the market. Viscosity index improved versions were abandoned due to unfavorable costs and performance characteristics. This project resulted in a non-viscosity index improved, fire resistant, Aroclor base industrial type hydraulic fluid designated OS-95.

In May 1958, six batches of OS-95 (later to be named Pydraul A-200) were prepared for the first time in the research pilot plant. Since 1958, the production of Pydraul A-200 has increased to nearly 400,000 pounds per month.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX L

TIME CYCLES - W. G. KRUMMRICH PLANT

The design capacity of Department B-246 is 500,000 pounds per month, or 6 million pounds per year. The normal production of the department is around 4 million pounds per year. The limiting factor of the process is the amount of Aroclor available to form Pydraul A-200 and the available storage facilities of the finished product. The following table shows the time cycle to blend a 12,000 gallon batch of Pydraul A-200.

TIME CYCLE

ITEM	TIME
Charge Aroclor 1242	2.5 Hrs.
and Aroclor 1248	5.0 Hrs.
Agitate Aroclor 1242	4 Hrs.
and Aroclor 1248 Mixture	
Sample Aroclor Mixture	½ Hrs.
Charge Santolube 393	1½ Hr.
and Santolube 70 and	1½ Hr.
Charge DCF-200	½ Hr.
Charge Dye to Batch	½ Hr.
Circulate Blend (Agitate, Air)	5 Hrs.
Transfer to Storage	16-48 Hrs.
	41.5-73.5 Hrs.

The time cycle for the preparation of a Pydraul A-200 batch illustrates the storage bottleneck. It takes approximately 16 hrs. to pump a finished batch into a tank truck, and approximately 48 hours to drum a finished batch.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX M

QUALITY CONSIDERATIONS - W. G. KRUMMRICH PLANT

Pydraul A-200 is an Aroclor base, fire resistant, industrial type hydraulic fluid which was formulated to meet viscosity and lubricating requirements, and anti-rust characteristics specified by the sales department. The physical and functional properties of Pydraul A-200 are discussed in the following sections.

1. VISCOSITY

The required viscosity range of Pydraul A-200 is 200 to 300 absolute SUS. The results of formulation work as given in table 1 indicate that a mixture of one part Aroclor 1242 to two parts of Aroclor 1248 by weight exhibits the lower limit viscosity of 200 SUS absolute at 100°F.

2. LUBRICATING PROPERTIES

Results of four-ball wear tests on the Aroclor base stocks as given in table 2 indicates the necessity of an anti-wear additive. Santolube 393 imparts good anti-wear properties to Aroclor based fluids.

3. RUST INHIBITION

Previous work with rust inhibitors for Pydrauls has indicated that Santolube 70 is relatively effective as an inhibitor as measured by the ASTM D-665 rust test.

4. MISCELLANEOUS

A. APPEARANCE

Pydraul A-200 is a blue liquid with a hazy appearance. The haze is due to very small quantities of antifoamant, DCF-200.

B. FOAM

The use of Santolube 70 in the Pydraul blend causes undersirable foaming. A concentration of 50 ppm Dow Corning Fluid 200 inhibits foaming.

C. NEUTRALIZATION NUMBER

Unused Pydraul A-200 has a total acid number of about 0.8. This apparent high acid number is due to the nature of the Santolube 393 and Santolube 70 present.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX M

QUALITY CONSIDERATIONS - W. G. KRUMMRICH PLANT

4. MISCELLANEOUS (Cont'd.)

It is important that any contemplated process changes be carefully evaluated before the actual change is made, since the quality of Pydraul A-200 can only be determined by full scale performance tests. Tests such as those given in table 3 are necessary to evaluate the product.

TABLE 1

HIGH AROCLOR FLUID FORMULATION

Formulation Number	Formulation (% wt.)	Kinematic Viscosity Centistokes		Saybolt Seconds	
		100°F.	210°F.	Kin 100°F.	Abs 100°F.
1	55% Aroclor 1248, 45% Aroclor 1242	27.6	----	130	183
2	18% Aroclor 1254, 82% Aroclor 1242	24.7	----	117	166
3	78% Aroclor 1248, 22% Aroclor 1232	22.6	----	108	150
4	61% Aroclor 1248, 39% Aroclor 1242	29.0	----	---	193
5	20% Aroclor 1254, 80% Aroclor 1242	25.7	----	---	---
6	81% Aroclor 1248, 19% Aroclor 1232	24.30	----	---	---
7	65% Aroclor 1248, 35% Aroclor 1242	30.17	----	142	200
8	27% Aroclor 1254, 73% Aroclor 1242	29.6	----	---	---
9	88% Aroclor 1248, 12% Aroclor 1232	31.3	----	---	---
10	66% Aroclor 1248, 33% Aroclor 1242, 0.5% Santolube 393, 0.5% Santolube 70, 100 ppm. DCF-200	30.22	2.87	142	200

TABLE 2

PYDRAUL A-200 ADDITIVE STUDY

Aroclor 1242		Aroclor 1248		Sant. 393	Sant. 70	Other Additive	4-Ball Wear (1)	Almen EP	
Lot	%	Lot	%	%	%	%		Load Pounds	Torque psi
Pydraul F-9							0.63	50	43
Cellulube 220							0.56	27	35
T-410	100	--	0	0	0	0	0.81	--	--
---	0	T-512	100	0	0	0	0.83	50	38
T-410	33	T-512	66	0.5	0	0	--	44(2)	39
T-410	33	T-512	65.95	1.0	0.05	0	--	40(2)	34
T-410	3315	T-512	66.3	0.5	0.05	0	0.55	38(2)	46
T-412	3315	T-523	66.3	0.5	0.05	0	0.53	34(2)	38
T-410	33	T-512	66	0.5	0.5	0	0.46	48	41
T-412	33	T-523	66	0.5	0.5	0	0.45	50	40
T-412	33.1	T-523	66.1	0.5	0.05	0.25(3)	--	38(2)	40
T-412	33.1	T-523	66.25	0.5	0.05	0.10(4)	--	--	--
T-412	33.0	T-523	66.15	0.5	0.05	0.20(4)	--	--	--
---	33.0	---	66	0.1	0	0	0.53	--	--

(1) 1 hr., 40 kg., 630 rpm, steel-on-steel.
(2) Squealing during most of run.
(3) No. 5 process oil (Santolube 70 inert).
(4) Dioctylmaleate.

TABLE 3

EVALUATION OF USED PYDRAUL A-200

Chevrolet - Bay City Division - 260 Hrs. (14 hrs. at 190°F.)

	Pydraul A-200 New	Pydraul A-200 Chev.-Bay City Div., 260 Hr.
Viscosity		
100°F., cs.	30.63	31.8
210°F., cs.	2.89	3.05
4-Ball Wear (630 RPM, 1 Hr., 167°F.)		
Steel-on-Steel		
4 kg.	.21	.20
10 kg.	.29	.26
40 kg.	.43	.59
Steel-on-Bronze		
4 kg.	1.20	.95
10 kg.	1.40	1.48
40 kg.	1.70	1.69
Neutralization Number	0.82 TAN	0.82 TAN
Rust Test (REL, P-101, 10.0=Perfect)	10.0	10.0
Appearance	Yellow, slight cloudy	Reddish-brown-nearly opaque

MONS 044722

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX N

MISCELLANEOUS - W. G. KRUMMRICH PLANT

This section contains the following information:

1. Additional Raw Material Information
2. References
3. Production Cost Standard

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX N

RAW MATERIALS

1. AROCLOR 1242

Aroclor 1242 is received from department 246 by pipeline. Aroclor 1242 batches are composited in a storage tank and a lot analysis is run on the composite sample. The Aroclor 1242 must pass all non-electrical specifications before it is transferred to department B-246.

2. AROCLOR 1248

Aroclor 1248 is received from department 246 by pipeline. Aroclor 1248 is composited and sampled in the same manner as Aroclor 1242.

3. SANTOLUBE 393

Santolube 393 is received from Department 266 in 55 gallon drums.

4. SANTOLUBE 70

Santolube 70 is received from the Nitro plant in 55 gallon drums.

5. BLUE A DYE

Blue A dye is purchased from the Dupont Company. The material is received in 25 lb. boxes.

6. AZO BLACK DYE

Azo black dye is from the Allied Chemical Company. The material is received in 25 pound boxes.

7. DOW CORNING FLUID 200

Dow Corning Fluid 200 is purchased from the Dow Corning Corporation. The material is received in 5 gallon cans.

Dept. B-246 - Process Description

PYDRAUL A-200

APPENDIX N

REFERENCES

1. St. Louis Research Report No. 2472, Job No. 2-02-760.01-3505 (II), February 16, 1960.

Title: Functional Fluids Application Research

Summary: This Report includes application studies of Aroclor base fluids. Discussion includes formulation, physical and functional properties of Pydraul A-200.

2. St. Louis Research Report No. 2842, Job No. 2-02-750.01-3550, November 7, 1961.

Title: Application Research - Fire Resistant Fluids

Summary: Report includes investigation of problem areas arising in Pydraul fluids. Reference job numbers are 3505, 3766 and 4009.

3. St. Louis Research Report No. 1562, Job No. 2-02-750.01-2815, July 6, 1956.

Title: Functional Fluids - Application Research for 1954-55.

Summary: Report includes formulation studies, property determinations, and sample preparations of Pydrauls.

PRODUCTION COST STANDARD

PLANT W. G. Krummrich | PAGE 1 OF 1

Product Pydraul A-200 | Dept. No. B-246 | Prod. Code 810.96

Yield on 111.01 | Std. 111.03 | Theory 303.03 | % Theory/Std 101.00 | Capacity 575000 | Effective Jan 1, 1964

Yield on 111.02 | Std. 147.99 | Theory 151.51 | % Theory/Std 101.01 | Cost Unit 100 lbs | Inv. Unit Cost 8053

	F OR V	ZERO PROD. BRACKET 1	INVENTORY VALUE & CAP. BRACKET 2		BRACKET 3		BRACKET 4	
PRODUCTION-QUANTITY		NONE	575000		280000		140000	
EXPENSE-AMOUNT		AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT	UNIT COST	AMOUNT
MATERIAL COST	V	—	7574	43551	7574	21209	7574	10604
STEAM	F	19	031	176	046	128	068	96
ELECTRICITY	F	2	005	29	005	15	006	9
COMPRESSED AIR								
WATER-PURCHASED								
WATER-PLANT								
FUEL-GAS								
FUEL-OIL								
REFRIGERATION								
ICE								
LABOR-MANUFACTURING	F		186	1069	261	731	522	731
SALARIES	F	161	029	161	057	161	115	161
PAYROLL-OVERHEAD	F	21	025	145	038	106	076	106
FACTORY SUPPLIES	F		005	30	007	20	007	10
LABORATORY	V		070	400	089	250	107	150
CLOTHING & LAUNDRY	F		010	60	014	40	021	30
PROD. DEPT. CONT. EXP.								
TECHNICAL SERVICE	F	25	004	25	009	25	018	25
MECH. EXP.	F	135	023	135	049	135	096	135
Total Direct Conversion		363	387	2227	576	1611	1037	1452
DEPRECIATION	F	120	021	120	043	120	086	120
FACTORY INDIRECT EXPENSE	F	405	071	405	145	405	289	405
Total Indirect Conversion		525	092	525	188	525	375	525
Total Product Cost		888	8053	46303	8337	23343	8186	12581
Cost $ D			4120					

EXPENSE-QUANTITY	UNIT	UNIT PR.	QUANTITY	QUANTITY	QUANTITY	QUANTITY
LABOR	HOURS	XXX		302	210	210
LABOR RATE	XXX	XXX		3.53	3.49	3.49
LABOR	MEN	XXX		30	20	20
STEAM	M LBS.	643	38	275	290	150
ELECTRICITY	C KWH	978	2	34	18	10
COMPRESSED AIR	M CF					
WATER-PURCHASED	M GAL.					
WATER-PLANT	M GAL.					
FUEL-GAS	M CF					
FUEL-OIL	GAL.					
REFRIGERATION	TON					
ICE	BLKS.					
LAB.	MAN/HRS					
LABOR STANDBY BASE	XXX			XXXX	XXXX	XXXX
NUMBER OF UNITS						
EQUIPMENT USED:						
DEPT. NO. 8109 (A,V,M)			50 %	50. %	50 %	50 %
DEPT. NO.			%	%	%	%
DEPT. NO.			%	%	%	%
OPERATING PERIOD:						
DAYS			XXX	30	15	11
SHIFTS			XXX	3	3	3

D13M 10/4/63

MONS 044726

A 178 REV. 12/60

PRODUCTION COST STANDARD

PLANT: Krummrich | PAGE 1 OF 1

PRODUCT: Pydraul A-200 | DEPT. NO. B-246 | PROD. CODE 810.96

% THEORY TO STD. ON 811.01 99.81 % | CAPACITY 516000 # | EFFECTIVE Jan 1, 1964

% THEORY TO STD. ON 811.02 98.99 % | COST UNIT 100 lbs | INV. UNIT COST 4083

RAW MATERIALS

MATERIAL CODE	NAME	QUANTITY PER UNIT THEORY	QUANTITY PER UNIT STANDARD	PRICE PER LB.	UNIT COST
81101	Aroclor 2142	38.000	33.330	.0591	2.497
81102	Aroclor 1248	66.000	64.670	.0731	4.896
81176	Santolube 393	.500	.505	.1136	.057
81787	Santolube 70	.500	.505	.2880	.142
	RAW MATERIAL WAREHOUSING & HANDLING				.002
	GROSS TOTAL MATERIALS				7.594
	BY-PRODUCTS None				
	TOTAL BY-PRODUCTS				
	NET TOTAL MATERIALS				7.594

PRODUCTION CONTROL DATA

CLASSIFICATION	AMOUNT	CLASSIFICATION (Contd.)	AMOUNT
COST OF SHUT-DOWN		COST OF STAND-BY	
COST OF START-UP		COST TO MOVE A MAN	
COST OF CHANGEOVER		STAND-BY LABOR - NO. OF MEN	

OTHER PRODUCTS PRODUCED IN THIS PLANT

PRODUCTION CODE	CAPACITY

OTHER PRODUCTS PRODUCED IN CONJUNCTION

OTHER DATA

Inventory Down Time =
Repair " " = 1%
Project " " = 1
Other " " = 2
On Stream = 96

$530 #/Hr. on Stream Production Rate
x720 x 96%
518696

MONS 044727