FM 5064J (HITCO) LOTS #1 (H) - #4 (H)

FINGERPRINT TEST DATA REPORT

NAS8-36298 COPY # 21

p.261

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NAS8-36298

U.S. Polymeric O.E. 71108

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U.S. Polymeric

FILLER TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

Filler Lot for NASA Lot# 1

		SAMPLE #1-1	#1-2	#1-3	
1. Carbon Content, % QAI-5560		99.17	99.10	99.12	
	NASA LOT# 1		AVERAGE	99.13	
2. Ash Content, % PTM-71B		.005	.000	.000	
		.009	.014	.005	
	AVG.	.007	.007	.003	
	NASA LOT# 1		AVERAGE	.006	
3. Atomic Absorption, ppm CTM-53B (Values are average of 2 determinations)		#1-1	#1-2	#1-3	LOT#1 AVG.
	Na	3.0	2.0	1.5	2.2
	K	1.5	0.0	0.0	0.5
	Ca	0.0	0.0	0.0	0.0
	Mg	0.5	0.0	0.0	0.2
	Li	0.0	0.0	0.0	0.0
	TOTAL	5.0	2.0	1.5	2.8
3a. Moisture Content, % CTM-53B		.005	.010	.005	
		.019	.005	.005	
	AVG.	.010	.008	.005	
	NASA LOT# 1		AVERAGE	.008	
3b. Ash Content, % CTM-53B		0.000	0.000	0.000	
		0.000	0.000	0.005	
	AVG.	0.000	0.000	0.003	
	NASA LOT# 1		AVERAGE	0.001	
4. pH, Units ASTM D1512		4.85	4.85	4.95	
		4.90	4.90	5.05	
	AVG.	4.88	4.88	5.00	
	NASA LOT# 1		AVERAGE	4.92	
5. Particle Size, microns S.E.M. procedure (Average values are of 10 determinations)	AVG.	.45	.36	.38	
	Maximum	.65	.62	.85	
	Minimum	.22	.17	.22	
	Std. Dev	.08	.08	.08	
	NASA LOT# 1		AVERAGE SIZE	.40	
6a. TGA, °C at 50% Loss CTM-51		750	751	749	
	NASA LOT# 1		AVERAGE	750	

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Filler Lot for NASA Lot# 1

6b. TGA
CTM-51 — See Charts 6A-6C

7. Particle Size Distribution
CTM-72 — See Charts 7A-7C

7a. Particle Size, microns
CTM-72

	#1-1	#1-2	#1-3
	.87	.88	.92
	.86	.95	.95
AVG.	.86	.92	.94

NASA LOT# 1 AVERAGE .91

U.S. Polymeric

Hamid M. Quraishi

Hamid M. Quraishi, Manager
Quality Assurance Department

Sample: 1-1
Size: 8.84 mg
Run No: MIR #12830 (I3)
Date: JAN/31/86 12:59

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #93
File No: D 35.DAT V2.1
Plotted: FEB/04/86 07:23

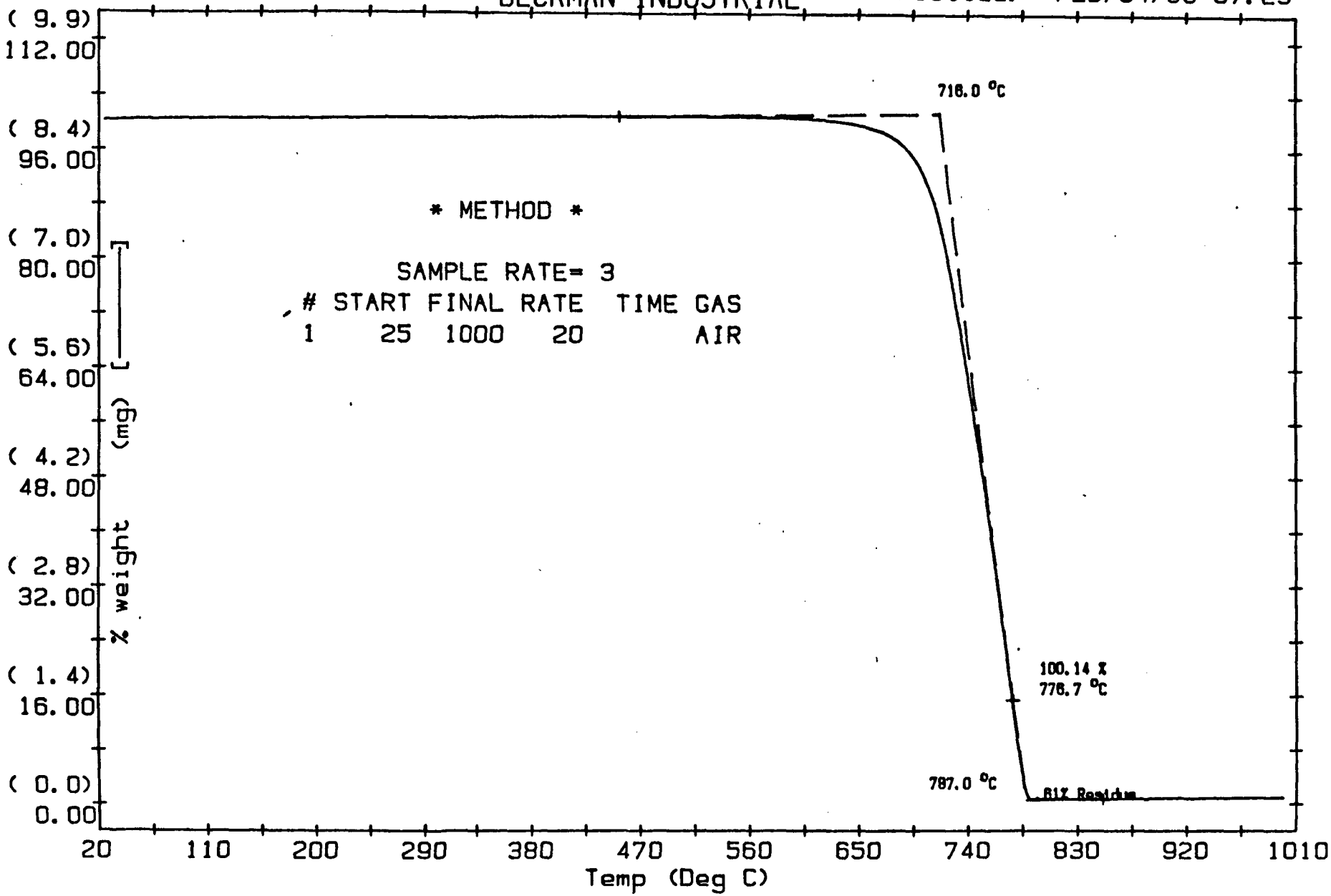

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CHART 6A

Sample: 1-2
Size: 14.192 mg
Run No: MIR #12830 (13)
Date: FEB/03/86 07:13

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #93
File No: D 36.DAT V2.1
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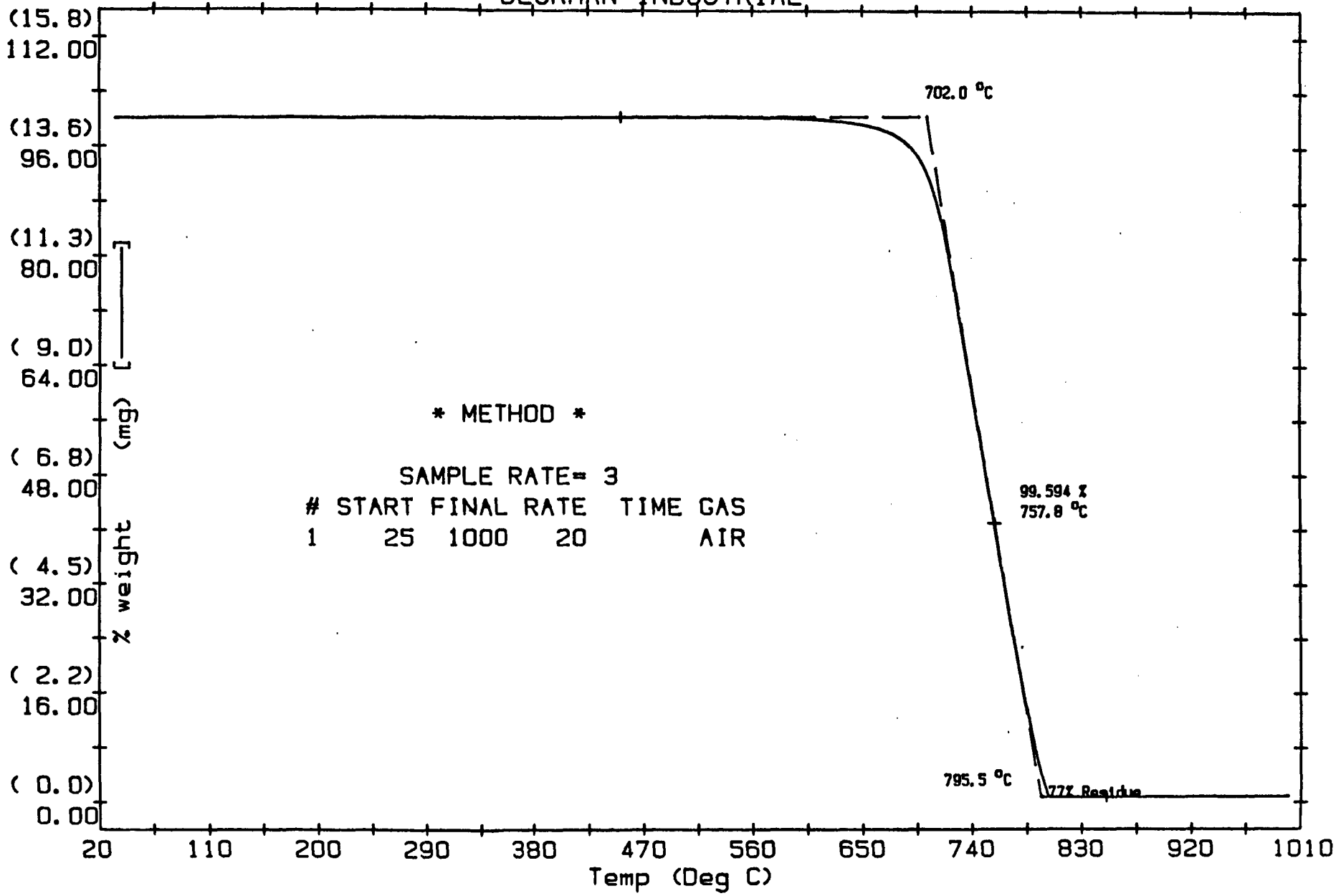

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CHART 6B

Sample: 1-3
Size: 18.045 mg
Run No: MIR #12830 (I3)
Date: FEB/03/86 08:45

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #93
File No: D 37.DAT V2.1
Plotted: FEB/04/86 07:36

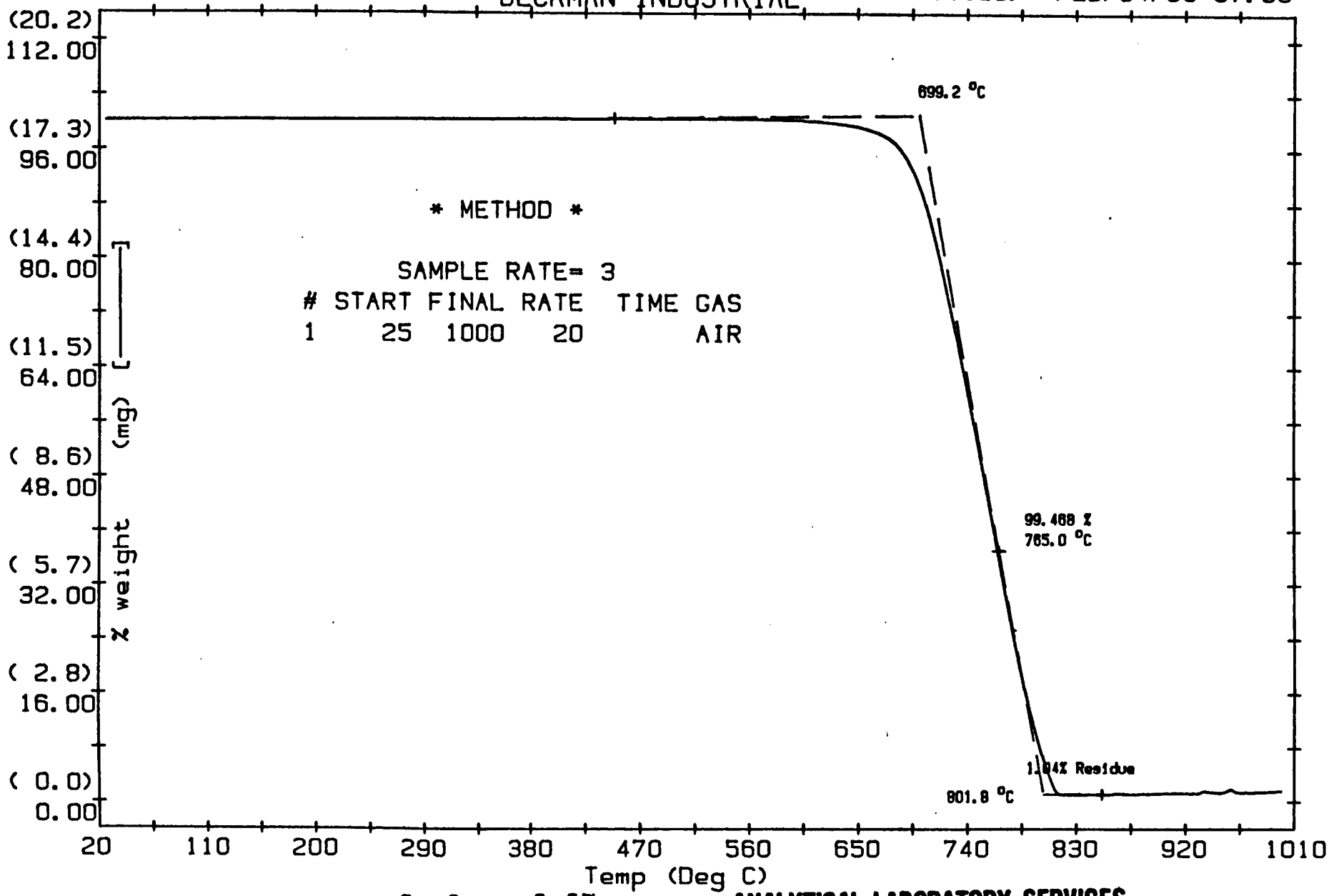

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CHART 6C

HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-22-86
#1 SAMPLE NASA LOT#1-1
SOLVENT ETHYL GLYCOL
C=0.013 mg/ml

* CONDITIONS

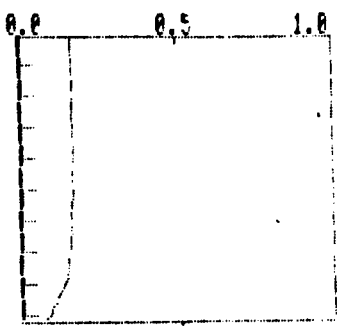
SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)

SPEED 5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

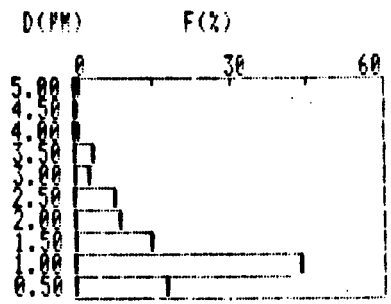


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.9	0.9
4.50-4.00	0.1	1.0
4.00-3.50	0.6	1.6
3.50-3.00	3.4	5.0
3.00-2.50	2.7	7.7
2.50-2.00	7.8	15.5
2.00-1.50	8.6	24.0
1.50-1.00	14.5	38.5
1.00-0.50	43.9	82.5
0.50-0.00	17.5	100.0

D(AVE) 0.87 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT #1-1
Sample #1

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HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-22-86
#2 SAMPLE NASA LOT#1-1
SOLVENT ETHYL GLYCOL
C=0.013 mg/ml

* CONDITIONS

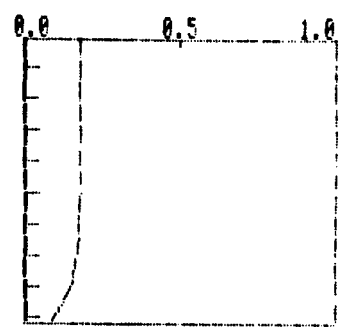
SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)

SPEED 5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

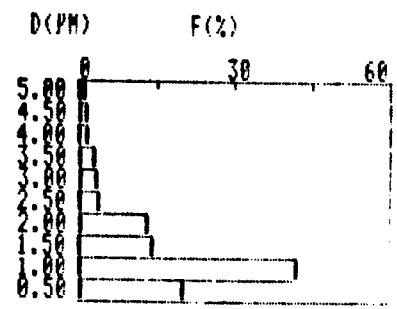


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.7	0.7
4.50-4.00	1.1	1.8
4.00-3.50	1.4	3.3
3.50-3.00	2.5	5.7
3.00-2.50	2.7	8.4
2.50-2.00	3.6	12.0
2.00-1.50	12.8	24.8
1.50-1.00	13.9	38.7
1.00-0.50	41.7	80.4
0.50-0.00	19.6	100.0

D(AVE) 0.86 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT# 1-1
Sample #2

CHART 7A

HORIBA CAPA-500
PARTICLE ANALYZER

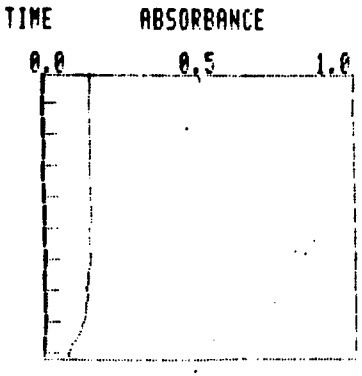
DATE 5-24-86
#1 SAMPLE NASA LOT#1-2
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

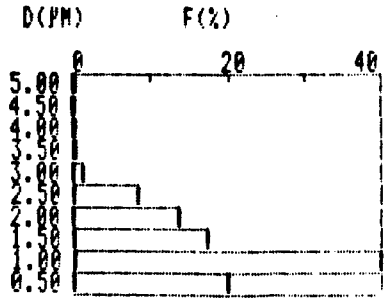


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.0	0.0
3.50-3.00	0.0	0.0
3.00-2.50	1.1	1.1
2.50-2.00	8.2	9.3
2.00-1.50	13.7	23.0
1.50-1.00	17.2	40.2
1.00-0.50	39.9	80.1
0.50-0.00	19.9	100.0

D(AVE) 0.88 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#1-2
Sample#1

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HORIBA CAPA-500
PARTICLE ANALYZER

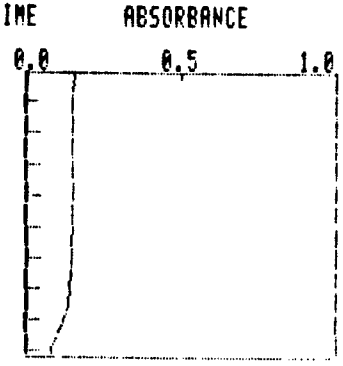
DATE 5-24-86
#2 SAMPLE NASA LOT#1-2
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

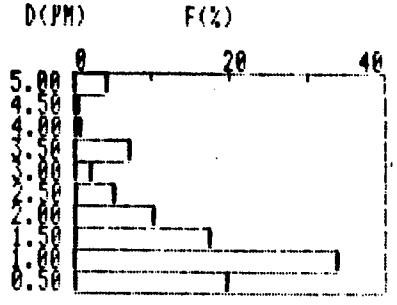


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	4.1	4.1
4.50-4.00	0.2	4.3
4.00-3.50	0.4	4.8
3.50-3.00	7.1	11.9
3.00-2.50	1.9	13.8
2.50-2.00	4.8	18.7
2.00-1.50	10.3	29.0
1.50-1.00	17.5	46.5
1.00-0.50	33.8	80.3
0.50-0.00	19.7	100.0

D(AVE) 0.95 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot# 1-2
Sample#2

CHART 7B

HORIBA CAPA-500
PARTICLE ANALYZER

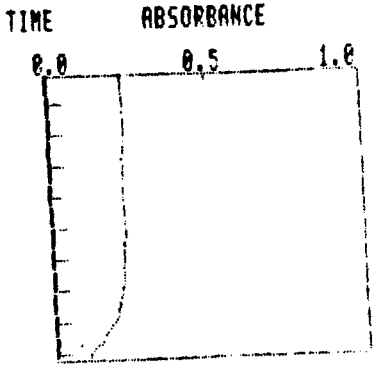
DATE 5-24-86
#1 SAMPLE NASA LOT#1-3
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (μM)
D(MIN)	0.01(μM)
D(DIV)	0.50(μM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

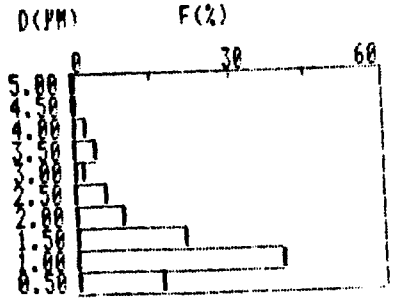


* DISTRIBUTION TABLE (BY VOL.)

D(μM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	2.1	2.1
3.50-3.00	4.0	6.0
3.00-2.50	1.5	7.5
2.50-2.00	5.8	13.3
2.00-1.50	9.2	22.5
1.50-1.00	20.8	43.3
1.00-0.50	40.4	83.7
0.50-0.00	16.3	100.0

D(AVE) 0.92 (μM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#1-3
Sample#1

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HORIBA CAPA-500
PARTICLE ANALYZER

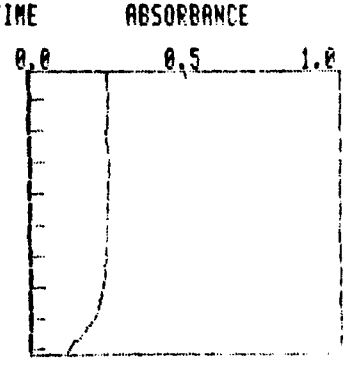
DATE 5-24-86
#2 SAMPLE NASA LOT#1-3
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (μM)
D(MIN)	0.01(μM)
D(DIV)	0.50(μM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

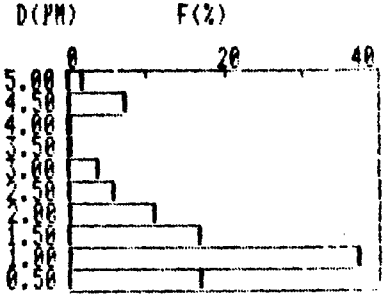


* DISTRIBUTION TABLE (BY VOL.)

D(μM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	1.6	1.6
4.50-4.00	7.3	9.0
4.00-3.50	0.0	9.0
3.50-3.00	0.0	9.0
3.00-2.50	3.6	12.6
2.50-2.00	5.7	18.3
2.00-1.50	11.0	29.3
1.50-1.00	16.6	45.9
1.00-0.50	37.2	83.1
0.50-0.00	16.9	100.0

D(AVE) 0.95 (μM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#1-3
Sample#2

CHART 7C

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RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 1

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1.	Resin Solids	1
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3.	Brookfield Viscosity	1
4.	Gel Time	1
5.	Atomic Absorption	1
6.	Gas Chromatography	1
7.	TGA	1
8.	DSC	1
9.	HPLC	1
10.	GPC	1
11.	pH	2
12.	Phenol Content	2
13.	Chang's Index	2
14.	RDS	2
15.	NMR	2

CHARTS

Gas Chromatography	6A - 6B
TGA	7A - 7B
DSC	8A - 8B
HPLC	9A - 9B
GPC	10A - 10B
RDS	14A - 14B
NMR	15A - 15B

U.S. Polymeric

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 1

			#1-1	#1-2	
1. Resin Solids, % PTM-7C			79.4	80.2	
			80.2	80.5	
			81.2	81.7	
		AVG.	80.3	80.8	
		LOT# 1	AVERAGE	80.6	
2. Specific Gravity @ 25°C PTM-29C			1.186	1.193	
		LOT# 1	AVERAGE	1.190	
3. Viscosity, Brookfield, cps. @ 22.8°C PTM-14C			16,750	18,750	
		LOT# 1	AVERAGE	17,750	
4. Gel Time, min:sec PTM-47B			3:30	3:47	
		LOT# 1	AVERAGE	3:39	
5. Atomic Absorption, ppm CTM-53B (Values are averages of four determinations)			#1-1	#1-2	LOT1 AVG
		Na	22.5	31.3	26.9
		K	0.3	0.5	0.4
		Ca	5.3	5.8	5.5
		Mg	2.0	2.0	2.0
		Li	0.0	0.0	0.0
		AVG.	30.0	39.5	34.8
6. Volatiles, Gas Chromatography CTM-55			See Charts 6A-6B		
7. TGA, % Weight Loss at 500°C CTM-51 (AIR)			39.1	37.9	
		LOT# 1	AVERAGE	38.5	
			See Chart 7A-7B		
8. DSC, temperature °C CTM-50A			187	187	
		LOT# 1	AVERAGE	187	
			See Chart 8A-8B		
9. HPLC CTM-49A			See Chart 9A-9B		
10. GPC, Average molecular wt. CTM-49A			1231	1291	
		LOT# 1	AVERAGE	1261	
			See Chart 10A-10B		

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2407

USP-39A Resin Lot for NASA Lot# 1

11. pH, units
    CTM-1B

	#1-1	#1-2
	8.3	8.4
LOT# 1 AVERAGE		8.4

12. Phenol Content, %
    CTM-55 Appendix 1

	13.89	13.96
	13.77	14.03
AVG.	13.83	14.00
LOT# 1 AVERAGE		13.91

13. Chang's Index, ml.
    CTM-5B

	23.4	23.8
LOT# 1 AVERAGE		23.6

14. RDS, Minimum Viscosity, cps.
    CTM-57A

	Min. Visc.	°C
#1-1	229	115
#1-2	290	119
AVG.	259	117

See Charts 14A-14B

15. NMR
    Vendor procedure

See Charts 15A-15B

U. S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

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TYPICAL GAS CHROMATOGRAPH SET-UP

Operator	Q.M.Z.	Date	12/11/86
Column		Detector	FID
Length	6 ft.	Voltage	
Dia.	1/4 in.	Sensit.	
Liquid Phase	AT-1000	Flow Rates, ml/min	
Wt. %	0.1	Hydrogen	60 Air 96
Support	GRAPHPAC	Scavenge	
Mesh	80/100	Split	
Carrier Gas	He	Temperature, °C	
Rotameter		Det.	220 Inj. 200
Inlet Press	60 psig	Column Initial	60
Rate	30 ml/min	Final	210
CHART SPEED		Rate	5°C/MIN
SAMPLE	USP39A, FI	Solvent	THF
Size	0.1 µl	Concn.	0.10227 g/ml

GAS CHROMATOGRAPHY STANDARD SOLVENT

TEST METHOD CTM-55

STANDARD SOLVENT/MONOMER	RETENTION TIME (MINS.)
MEOH	.6
ETHANOL	1.18
MECL2	1.28
ACETONE	1.45
IPA	1.83
THF	3.08
ACETONITRILE	3.2
CRESOL	4.03
MEK	4.08
FURFURAL	15.03
TOLUENE	17.98
CHLOROBENZENE	19.6
PHENOL	22.08

NOTE: THF WAS USED TO DILUTE THE RESIN SAMPLES.

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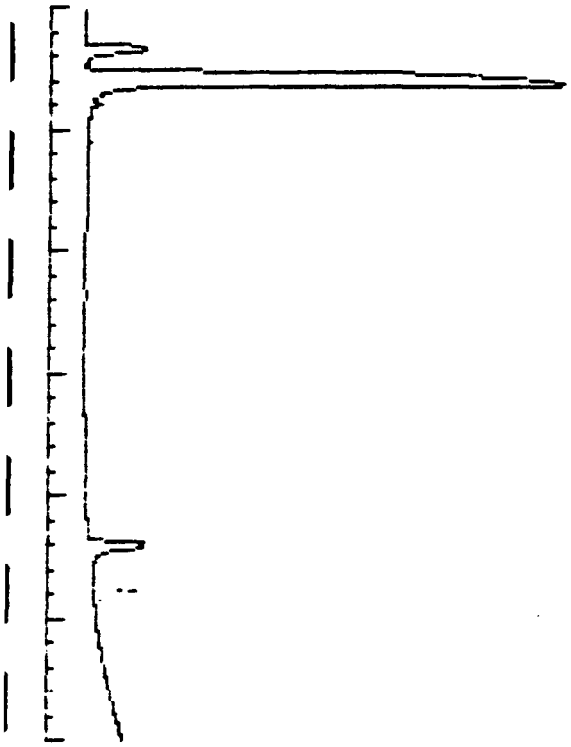
*** REAL TIME CHROMATOGRAM ***



FINAL FULL SCALE MV.=1000.00

SAMPLE: USP39A 1-1
MISC.: C=0 10227 GMS/ML

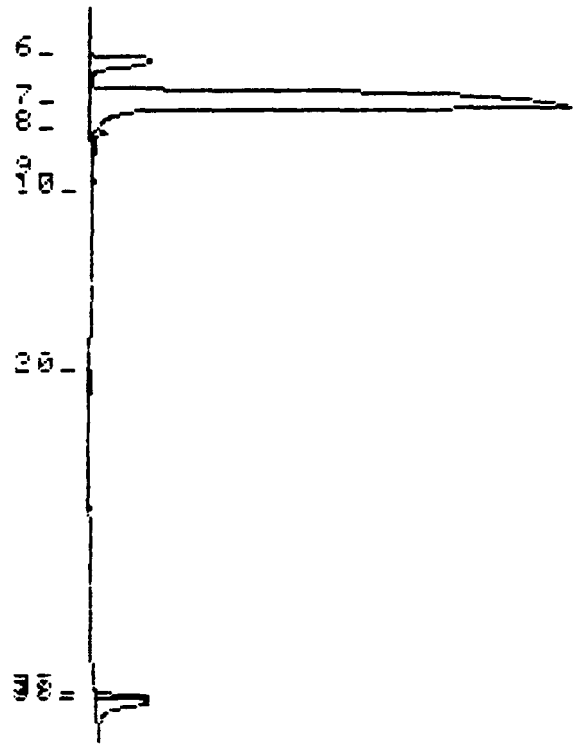
TIME: 11:15
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30 00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
3	65	2553	.068	3	262
6	1.70	255870	6.813	2	11563
7	3.25	3126900	83.261	3	90865
8	4.03	55251	1.471	4	2537
9	5 55	6042	.161	4	481
10	6.05	7408	.197	4	163
20	11.75	7490	.199	3	355
37	21.95	107040	2.850	2	10311
38	22.13	186990	4.979	2	10194

TOTAL AREA= 3755543
THRESHOLD= 1
MIN PK.WIDTH= 15
AREA REJECT= 1000

VERTICAL SCALE FACTOR: 1X



SAMPLE: USP39A 1-1
MISC.: C=0.10227 GMS/ML

TIME: 11:15
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
6	1 70	255870	6.856	2	11563
7	3.25	3126900	83.785	3	90865
8	4.03	55251	1.480	4	2537
37	21.95	107040	2.868	2	10311
38	22.13	186990	5.010	2	10194

TOTAL AREA= 3732051
THRESHOLD= 1
MIN PK.WIDTH= 15
AREA REJECT= 10000

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CHART 6B

REAL TIME CHROMATOGRAM ***

NAL FULL SCALE MV.=1000.00

AMPLE: USP39A 1-2
SC.: C=0.10006 GMS/ML

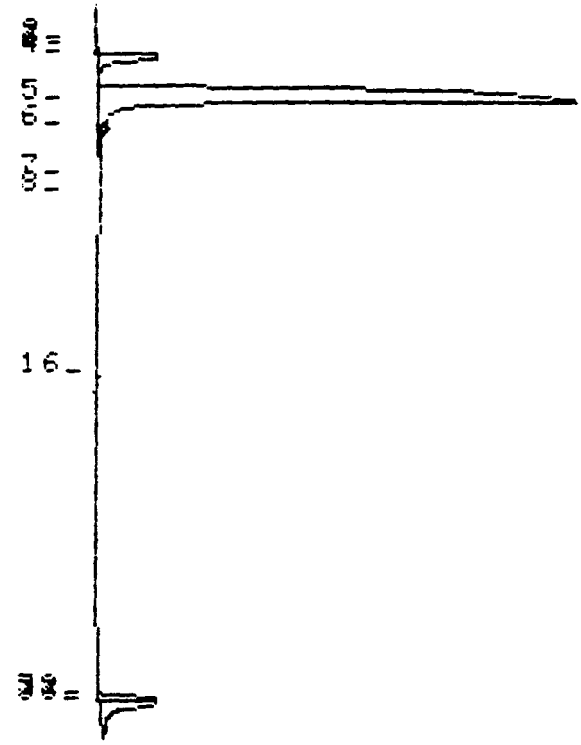
IME: 11:56
ATE: 12/11/86
PERATOR: JGZ

UN TIME: 30.00 MINUTES
ELAY TIME: 0.00
HAN: 0

K O	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
1	.65	1623	.056	2	202
2	1.25	1128	.039	2	53
3	1.45	1143	.040	2	122
4	1.73	195650	6.780	2	11047
5	3.15	2357000	81.673	3	87114
6	4.00	33273	1.153	4	1558
7	5.58	3232	.112	4	314
8	6.08	1817	.063	4	67
5	11.75	7514	.260	1	419
2	21.98	104640	3.626	2	10260
3	22.10	178880	6.198	2	10209

OTAL AREA= 2885899
HRESHOLD= 1
IN.PK.WIDTH= 15
REA REJECT= 1000

VERTICAL SCALE FACTOR: 1X



SAMPLE: USP39A 1-2
MISC.: C=0.10006 GMS/ML

TIME: 11:56
DATE 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
4	1.73	195650	6.818	2	11047
5	3.15	2357000	82.141	3	87114
6	4.00	33273	1.160	4	1558
32	21.98	104640	3.647	2	10260
33	22.10	178880	6.234	2	10209

TOTAL AREA= 2869443
THRESHOLD= 1
MIN.PK.WIDTH= 15
AREA REJECT= 10000

Sample: USP39A71108 1-1
Size: 12.898 mg
Run No: MIR #13079 (I2)
Date: MAY/21/86 07:14

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 32.DAT V2.1
Plotted: MAY/22/86 07:35

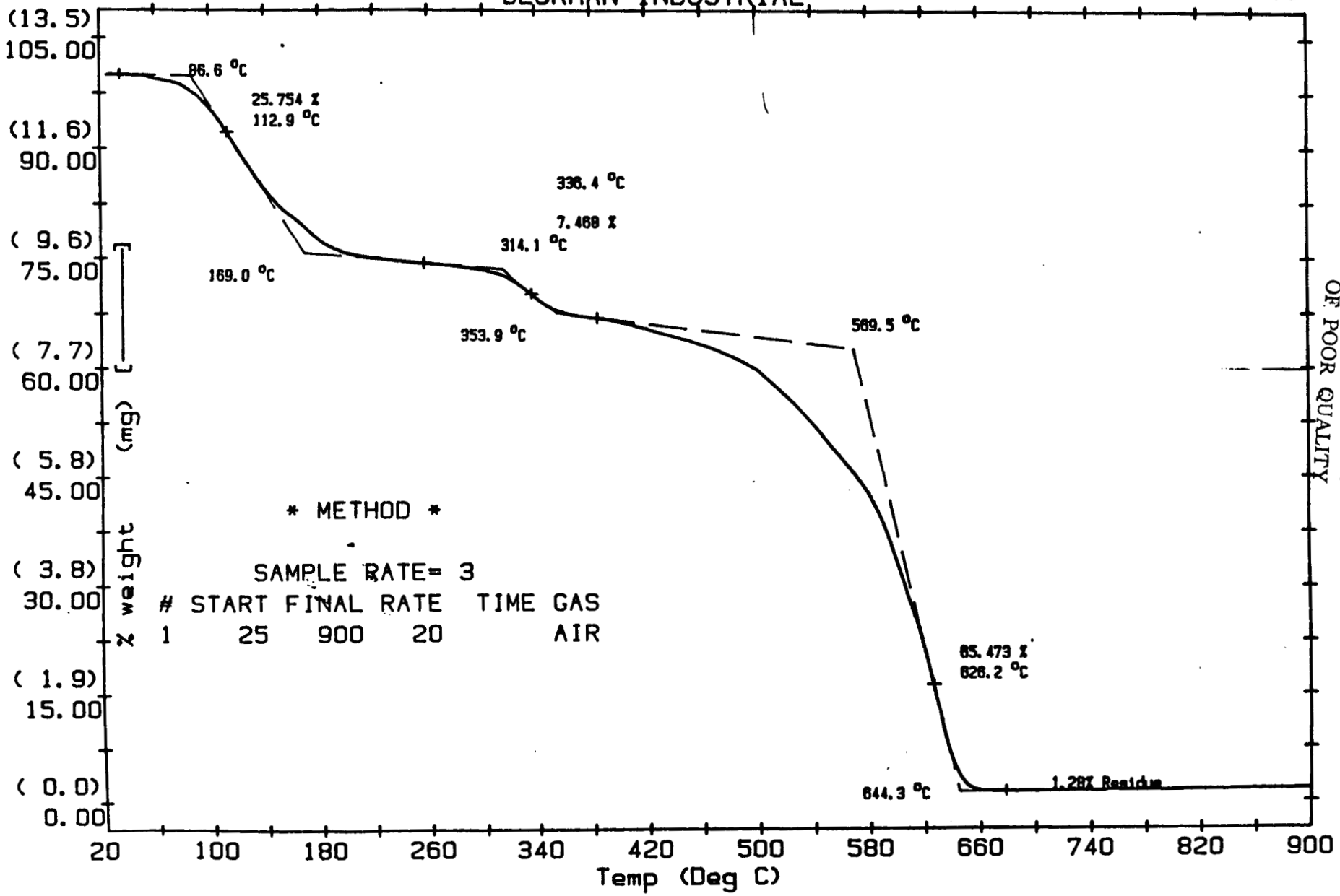


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CHART 7A

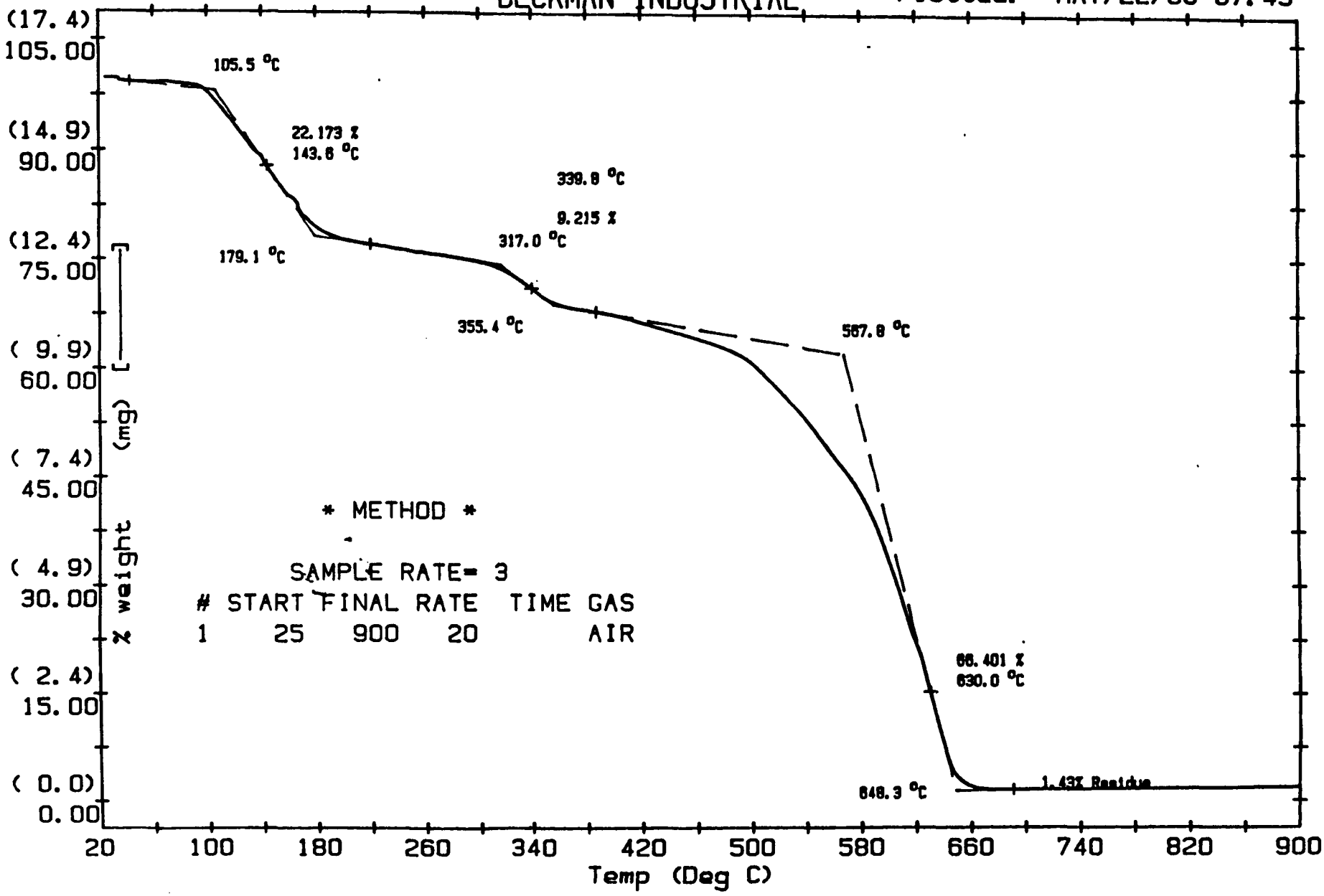
Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

Sample: USP39A71108 1-2
Size: 16.572 mg
Run No: MIR #13079 (I2)
Date: MAY/21/86 08:28

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 33.DAT V2.1
Plotted: MAY/22/86 07:45



Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

CHART 7B

PART NO. 990088

CHART 8A

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RUN NO. ____ DATE 4/3/86

OPERATOR [illegible]

SAMPLE: 1-1

ATM He @ 1 atm.

FLOW RATE 40 ml/min.

T-AXIS

SCALE, °C/in 50

PROG. RATE, °C/min 20

HEAT / COOL ____ ISO ____

SHIFT, in 0

-1° ΔC°

DTA-DSC

SCALE, °C/in 1.0/5

(mcal/sec)/in ____

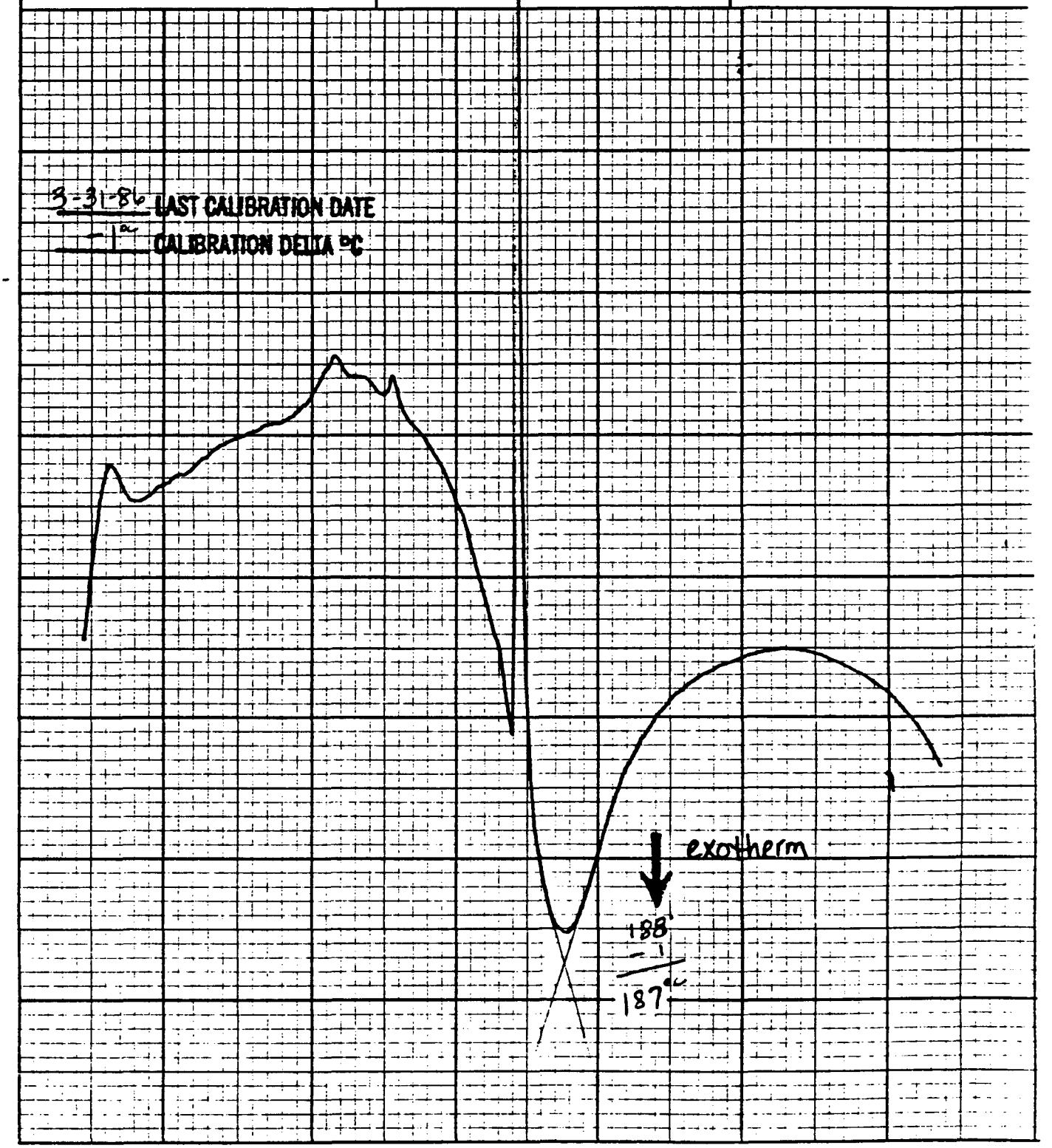
WEIGHT, mg 3.4

REFERENCE

1 Al cup & sea

3-31-86 LAST CALIBRATION DATE

-1° CALIBRATION DELTA °C



MEASURED VARIABLE ____

DUPONT Instruments

PART NO. 990088

CHART 8B

RUN NO.____ DATE 4/3/86

OPERATOR [illegible]

SAMPLE: 1-2

ATM He @ 1 atm.

FLOW RATE 40 ml/min

T-AXIS

SCALE, °C/in 50

PROG. RATE, °C/min 20

HEAT ✓ COOL ____ ISO ____

SHIFT, in 0

-1° ΔC°

DTA-DSC

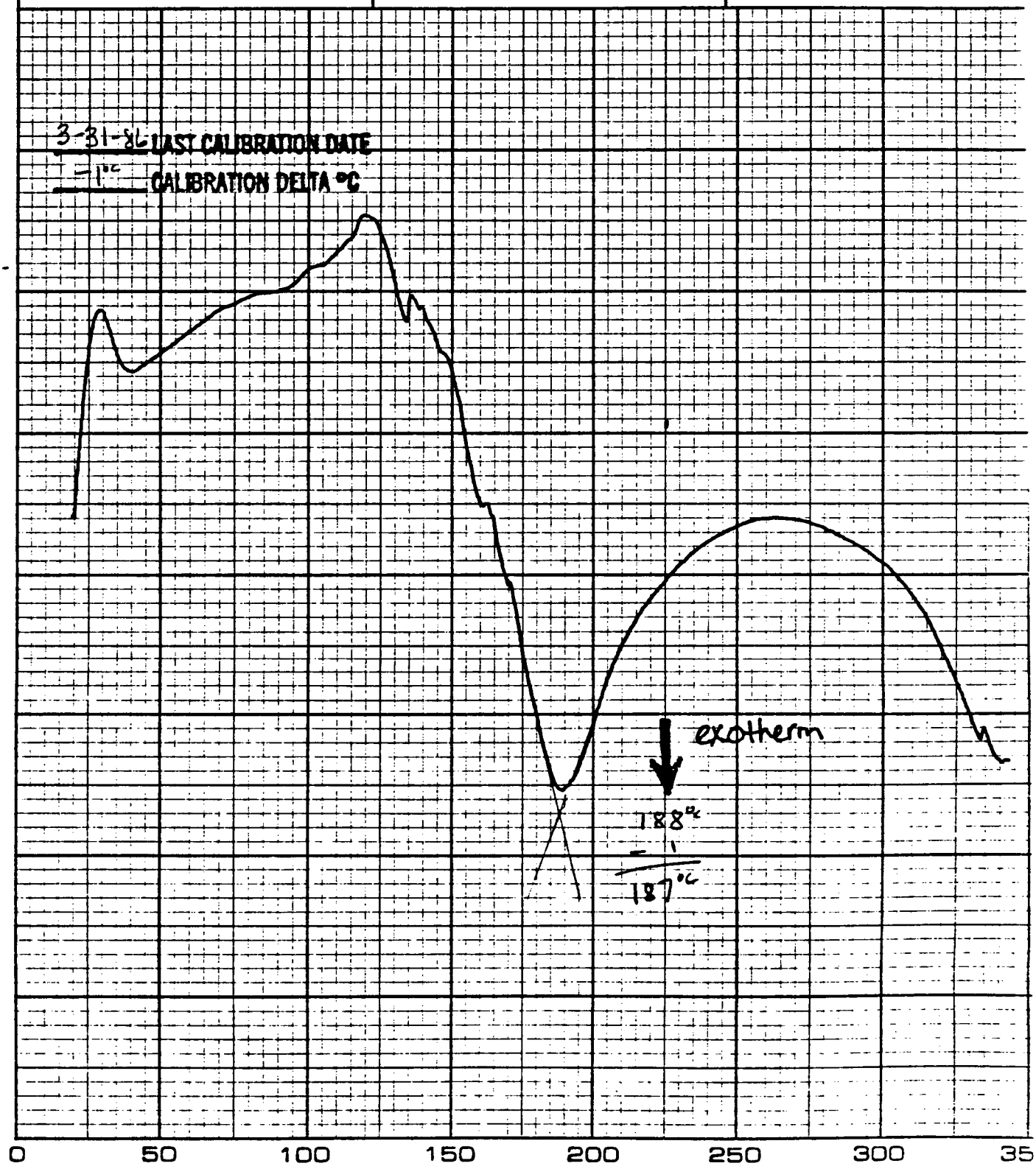
SCALE, °C/in 1.0/5

(mcal/sec)/in ____

WEIGHT, mg 3.4

REFERENCE ____

1 AL CUP & SEAL



DUPONT Instruments

MEASURED VARIABLE ____

ethod recorded in file: A:PHENOLIC.MET

CHART 9A

ATA FILE A:PHENO26.HDR TAKEN 09-05-1986 11:06:32

********* AREA PERCENT REPORT *********

```
*****************************************************************************
 Sample Name: USP39A,1-1,C=6.54                    Operator Initials: JGZ      *
 Date:  09-05-1986 11:06:32 Method:PHENOLIC     DATA FILE: A:PHENO26.PTS      *
 Interface: 4                Cycle#:  26          Channel#: 0    Vial#: N.A.  *
 Starting Peak Width:  10    Threshold:  .01                                 *
*****************************************************************************
  Instrument Type: BECKMAN HPLC            Column Type: MICROBONDAPAK C-18   *
            Solvent Description: THF/WATER, 2:1 BY WEIGHT                   *
   Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN                          *
             Detector 0: 220NM/.5AU          Detector 1:                    *
     Misc. Information:  LENGTH=25                                          *
*****************************************************************************
```

tarting Delay: 0.00 Ending Retention Time: 10.00

k o.	Ret Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
1	0.70	2030	1.1563	1	510	2.103	4.0
2	1.80	76982	43.8499	2	4940	79.736	15.6
3	2.05	96545	54.9937	2	5248	100.000	18.4

otal Area: 175557 Area Reject: 1000 One sample per 1.000 sec.

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DATA FILE=PHEN026 FROM 0.00 MIN. TO 10.00 MIN. LOW SCALE= 5.400 Mv. HIGH SCALE= 10.790 Mv.
USP-39A, 1-1, C=6.54 MG/ML, 9/5/86, JGZ

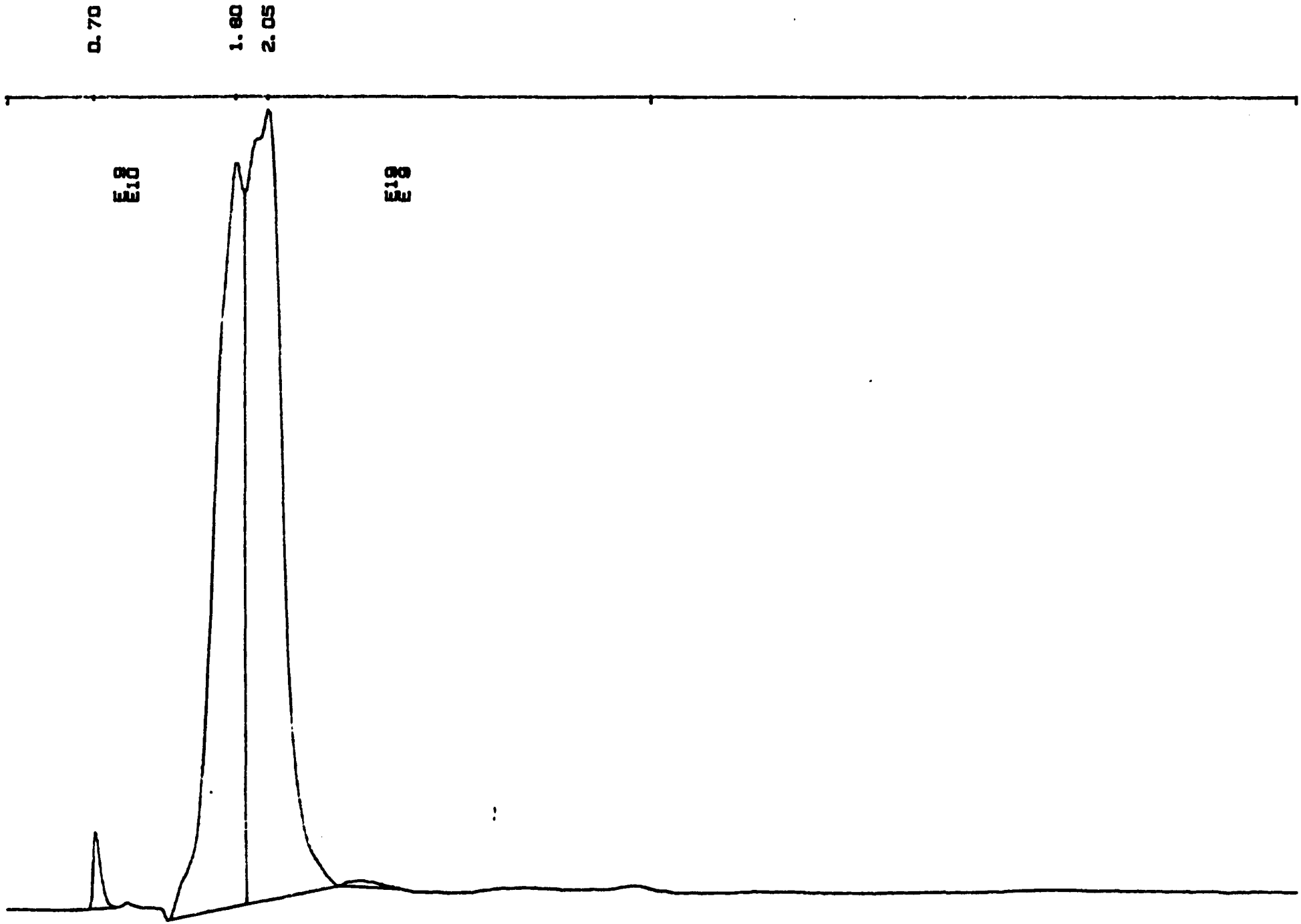

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CHART 9B

FILE A:PHEND19.HDR TAKEN 09-01-1986 13:18:26

********* AREA PERCENT REPORT *********

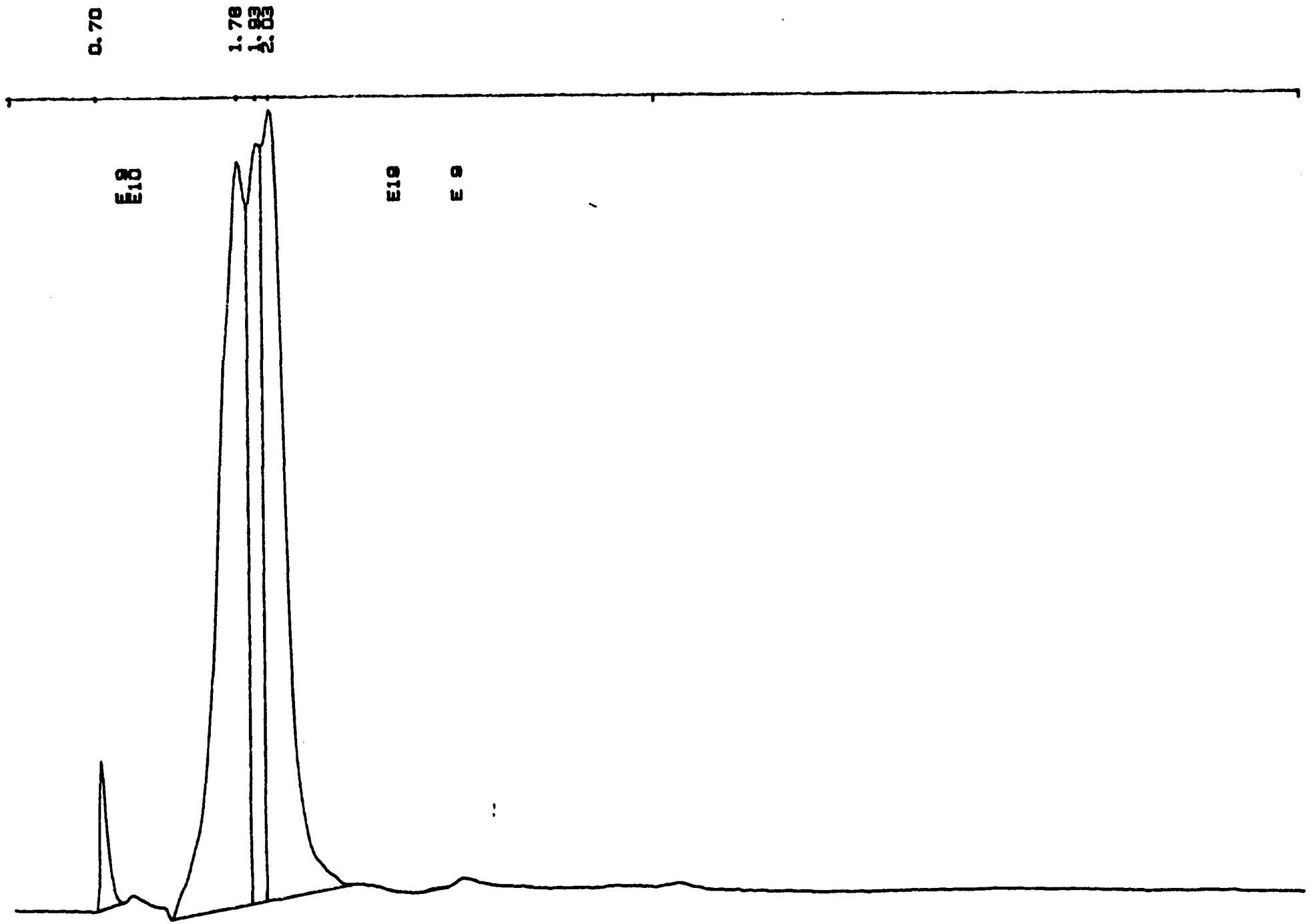
```
*************************************************************************
Sample Name: USP39A,1-2,C=5.07                Operator Initials: JGZ      *
Date:  09-01-1986 13:18:26 Method:PHENOLIC   DATA FILE: A:PHEND19.PTS    *
Interface: 4                Cycle#:  19       Channel#: 0    Vial#: N.A.  *
Starting Peak Width:  10   Threshold:  .01                               *
*************************************************************************
Instrument Type: BECKMAN HPLC            Column Type: MICROBONDAPAK C-18  *
          Solvent Description: THF/WATER, 2:1 BY WEIGHT                  *
 Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN                         *
          Detector 0: 220NM/.5AU          Detector 1:                    *
   Misc. Information:  LENGTH=25                                         *
*************************************************************************
Starting Delay:   0.00                      Ending Retention Time:   10.00
```

	Ret Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
	0.70	4065	2.2807	1	1019	5.202	4.0
2	1.78	78141	43.8419	2	5072	100.000	15.4
3	1.93	34258	19.2209	2	5165	43.841	6.6
	2.03	61769	34.6565	2	5379	79.049	11.5

Total Area: 178233 Area Reject: 1000 One sample per 1.000 sec.

DATA FILE=PHEN019 FROM 0.00 MIN. TO 10.00 MIN. LOW SCALE [redacted] 5.[redacted] MV. HIGH SCALE [redacted] 10.[redacted] MV. [redacted]

USP-38A, 1-2, C=5.07 MG/ML, 9/2/86, JGZ



GPC CALIBRATION PLOT

*** Calibration Data ***
Calibration Name:
Misc Information:

Fit Type: 3
Log Mol Wt = A + Bx + Cx^2 + Dx^3
A= 2.538977 B= 2.115815 C= -.5646824 D= 3.606432E-02
Coefficient of Determination: 0.9902

Ret Time	Molecular Weight	Log Mol Wt
3.50	35000	4.544
4.33	15000	4.176
4.83	3600	3.556
5.09	2350	3.371
6.00	570	2.756
7.17	92	1.964
7.50	72	1.857

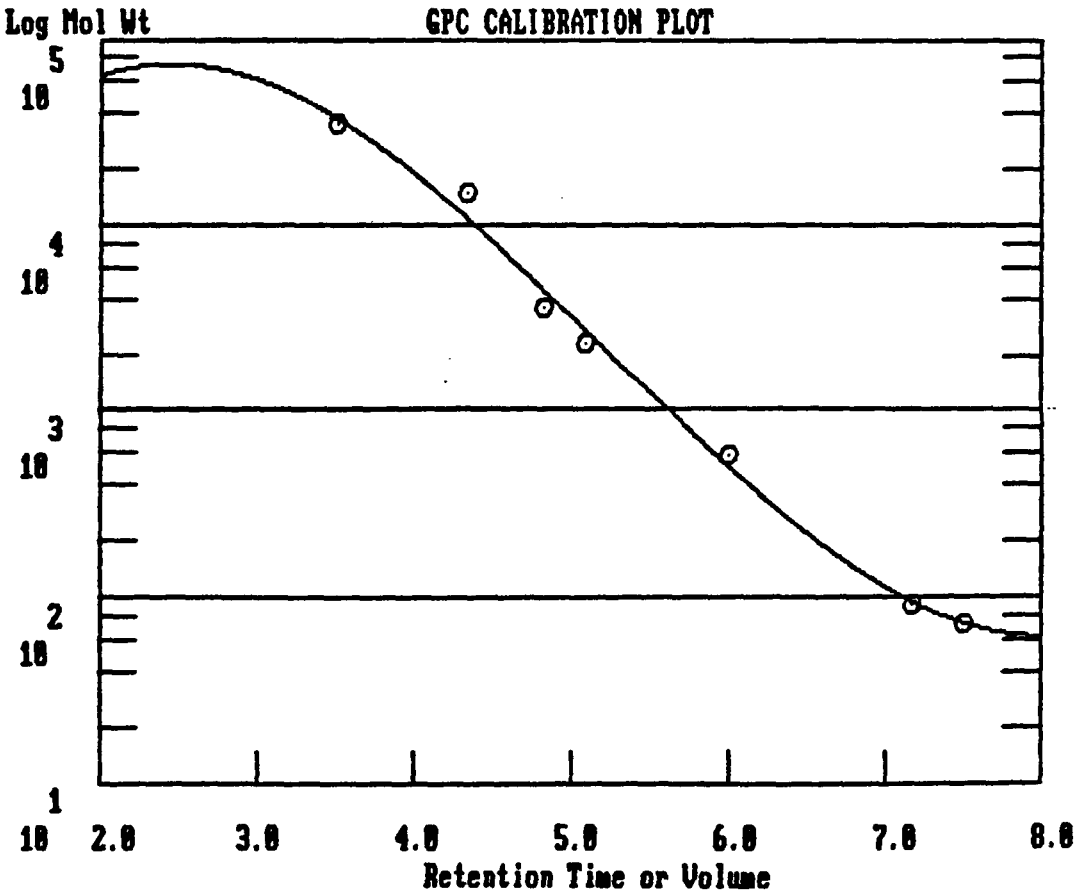


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CHART 10A

TA FILE A:GPC31.HDR TAKEN 08-05-1986 17:39:57

********* GPC REPORT *********

```
*****************************************************************************
 Sample Name: USP39A 1-1=2.68                    Operator Initials: GBF       *
Date:  08-05-1986 15:00:24 Method:               DATA FILE: A:GPC31.PTS       *
Interface: 5                Cycle#:  31          Channel#: 0    Vial#: N.A.   *
 Starting Peak Width:  60   Threshold:  0                                     *
*****************************************************************************
 Instrument Type: HPLC/BECKMAN            Column Type: ULTRASTYRAGEL 500A     *
            Solvent Description: THF                                          *
   Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                             *
           Detector 0: 254NM/.1AU          Detector 1:                        *
     Misc. Information: CALIBRATION/GPC                                       *
*****************************************************************************
arting Delay:   0.00                      Ending Retention Time:   10.00
ibration file: GPCPHEN
olecular Weight Distribution Averages
aseline TIMES:    3.85 to   10.00   MW:      22295 to          2
ocess  TIMES:     3.85 to   10.00   MW:      22295 to          2
tal Area:        211188
w=                 1231
=                   312
/Mn=             3.9362
z=                 3069
=                  1076
```

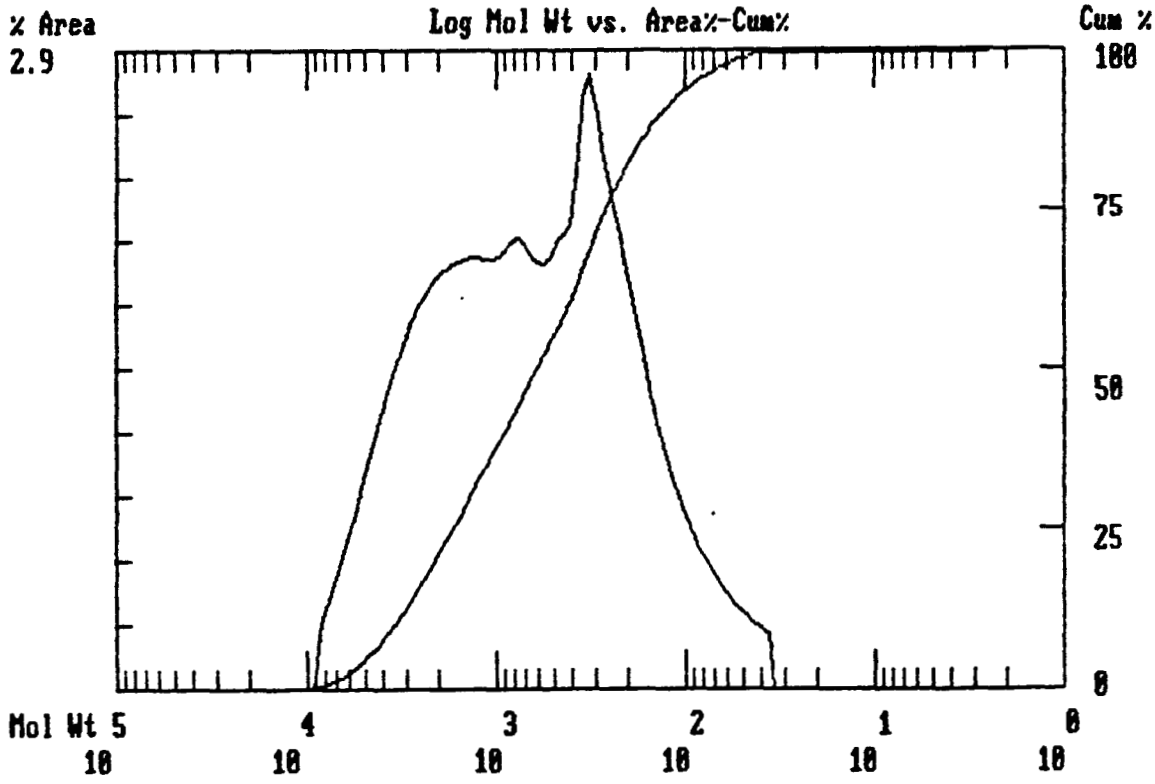

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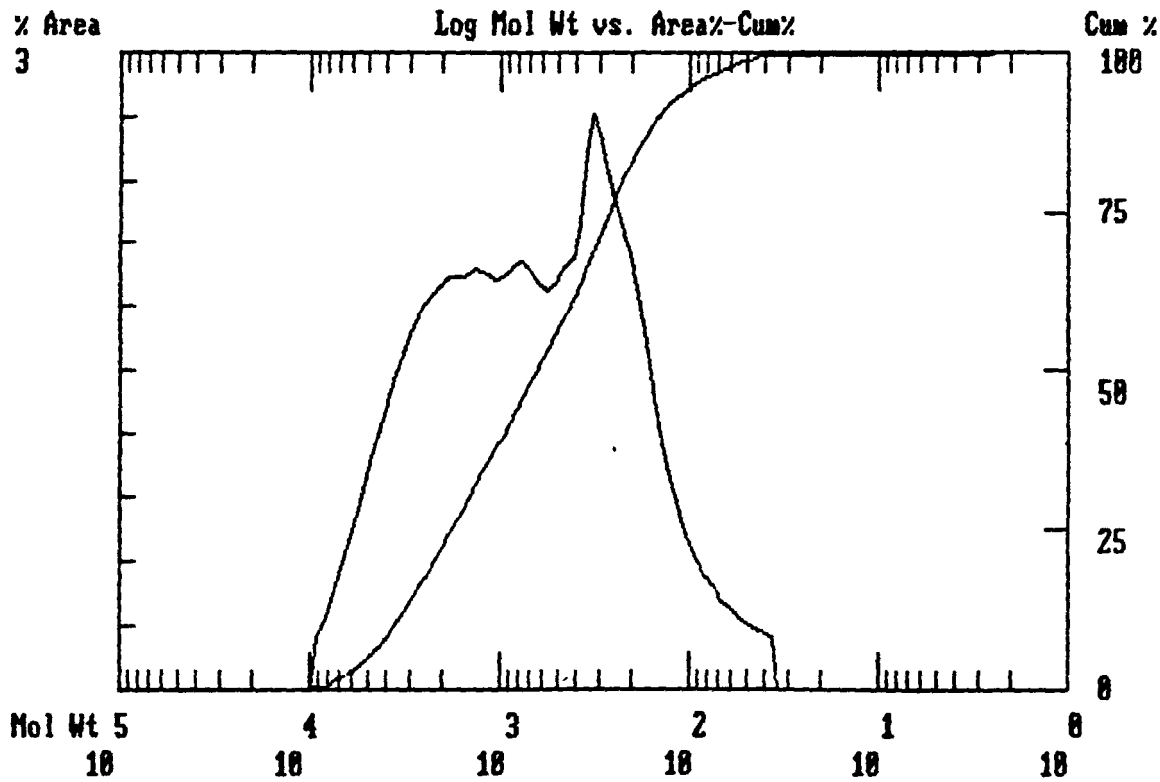
CHART 10B

FILE A:GPC32.HDR TAKEN 08-05-1986 17:44:23

********* GPC REPORT *********

```
*************************************************************************
ple Name: USP39A 1-2=2.68                    Operator Initials: GBF       *
e:  08-05-1986 15:15:18 Method:              DATA FILE: A:GPC32.PTS       *
erface: 5                Cycle#:  32         Channel#: 0    Vial#: N.A.   *
rting Peak Width:  60    Threshold:  0                                   *
*************************************************************************
nstrument Type: HPLC/BECKMAN            Column Type: ULTRASTYRAGEL 500A   *
          Solvent Description: THF                                       *
Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                           *
         Detector 0: 254NM/.1AU          Detector 1:                     *
  Misc. Information: CALIBRATION/GPC                                     *
*************************************************************************
ting Delay:   0.00                     Ending Retention Time:   10.00
bration file: GPCPHEN
cular Weight Distribution Averages
line TIMES:    3.85 to   10.00   MW:      22295 to          2
ess  TIMES:    3.85 to   10.00   MW:      22295 to          2
l Area:       211824
                1291
                 324
In=           3.9783
                3246
                1126
```



NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-1

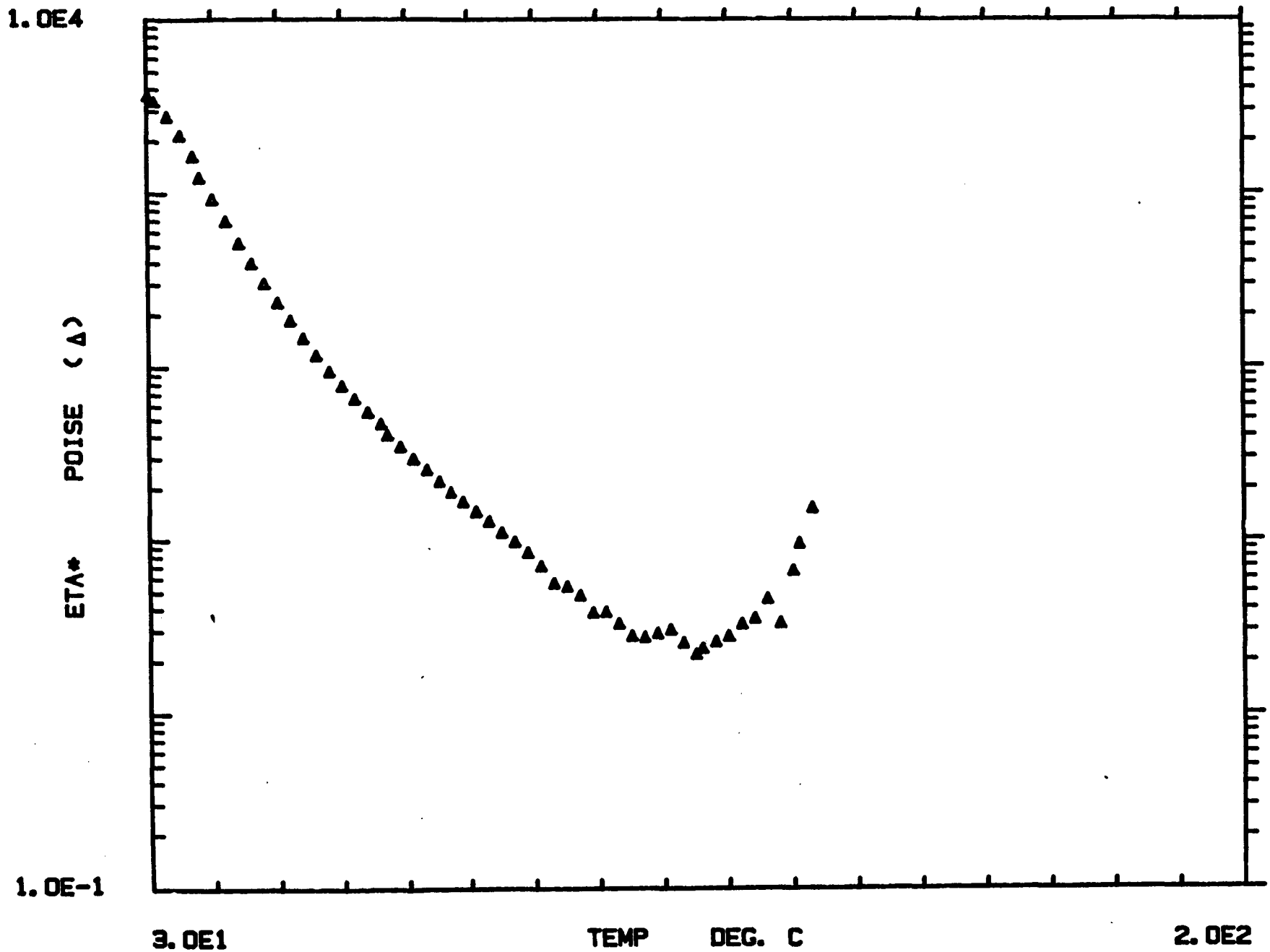


CHART 14A

Rheometrics RECAP II

---

eriment No. : 8 Sample No. : 1

le:
A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-1

rator :CP

e and Time : Monday, August 18, 1986 - 15:30:51

rating Mode : DYNAMIC

ep Type : CURE

metry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

es :
AIN =50%
QUENCY =10 RAD/SEC

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5A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-1

.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	3.813e+003	3.813e+003	6.049e+001	4.876e+002	2.000e-001	3.000e+001
2	3.514e+003	3.514e+003	6.792e+001	4.490e+002	1.000e+000	3.100e+001
3	2.873e+003	2.873e+003	4.505e+001	3.658e+002	2.000e+000	3.300e+001
4	2.233e+003	2.232e+003	4.101e+001	2.837e+002	3.000e+000	3.500e+001
5	1.691e+003	1.690e+003	3.527e+001	2.144e+002	4.000e+000	3.700e+001
6	1.277e+003	1.277e+003	3.445e+001	1.615e+002	5.000e+000	3.800e+001
7	9.594e+002	9.588e+002	3.542e+001	1.211e+002	6.000e+000	4.000e+001
8	7.177e+002	7.169e+002	3.398e+001	9.048e+001	7.000e+000	4.200e+001
9	5.372e+002	5.368e+002	2.240e+001	6.768e+001	8.000e+000	4.400e+001
10	4.111e+002	4.104e+002	2.378e+001	5.171e+001	9.000e+000	4.600e+001
11	3.153e+002	3.144e+002	2.382e+001	3.963e+001	1.000e+001	4.800e+001
12	2.442e+002	2.432e+002	2.197e+001	3.070e+001	1.100e+001	5.000e+001
13	1.934e+002	1.921e+002	2.259e+001	2.429e+001	1.200e+001	5.200e+001
14	1.529e+002	1.514e+002	2.136e+001	1.921e+001	1.300e+001	5.400e+001
15	1.214e+002	1.200e+002	1.858e+001	1.524e+001	1.400e+001	5.600e+001
16	9.808e+001	9.666e+001	1.659e+001	1.232e+001	1.500e+001	5.800e+001
17	8.082e+001	7.951e+001	1.448e+001	1.015e+001	1.600e+001	6.000e+001
18	6.811e+001	6.697e+001	1.242e+001	8.554e+000	1.700e+001	6.200e+001
19	5.720e+001	5.620e+001	1.064e+001	7.178e+000	1.800e+001	6.400e+001
20	4.908e+001	4.819e+001	9.274e+000	6.157e+000	1.900e+001	6.600e+001
21	4.220e+001	4.139e+001	8.188e+000	5.291e+000	2.000e+001	6.700e+001
22	3.613e+001	3.546e+001	6.922e+000	4.536e+000	2.100e+001	6.900e+001
23	3.089e+001	3.033e+001	5.841e+000	3.879e+000	2.200e+001	7.100e+001
24	2.675e+001	2.623e+001	5.276e+000	3.358e+000	2.300e+001	7.300e+001
25	2.282e+001	2.244e+001	4.144e+000	2.867e+000	2.400e+001	7.500e+001
26	1.974e+001	1.940e+001	3.659e+000	2.477e+000	2.500e+001	7.700e+001
27	1.732e+001	1.699e+001	3.366e+000	2.175e+000	2.600e+001	7.900e+001
28	1.517e+001	1.488e+001	2.933e+000	1.903e+000	2.700e+001	8.100e+001
29	1.335e+001	1.317e+001	2.145e+000	1.676e+000	2.800e+001	8.300e+001
30	1.149e+001	1.132e+001	1.950e+000	1.442e+000	2.900e+001	8.500e+001
31	1.013e+001	9.893e+000	2.167e+000	1.272e+000	3.000e+001	8.700e+001
32	8.766e+000	8.654e+000	1.396e+000	1.100e+000	3.100e+001	8.900e+001
33	7.337e+000	7.274e+000	9.610e-001	9.215e-001	3.200e+001	9.100e+001
34	5.831e+000	5.798e+000	6.145e-001	7.324e-001	3.300e+001	9.300e+001
35	5.574e+000	5.555e+000	4.656e-001	6.994e-001	3.400e+001	9.500e+001
36	4.962e+000	4.953e+000	3.040e-001	6.234e-001	3.500e+001	9.700e+001
37	3.948e+000	3.939e+000	2.647e-001	4.954e-001	3.600e+001	9.900e+001
38	3.987e+000	3.985e+000	1.262e-001	5.009e-001	3.700e+001	1.010e+002
39	3.405e+000	3.405e+000	0.723e-001	4.275e-001	3.800e+001	1.030e+002
40	2.898e+000	2.898e+000	0.000e+000	3.642e-001	3.900e+001	1.050e+002
41	2.857e+000	2.853e+000	1.393e-001	3.589e-001	4.000e+001	1.070e+002
42	3.003e+000	2.947e+000	5.728e-001	3.770e-001	4.100e+001	1.090e+002
43	3.157e+000	2.947e+000	1.133e+000	3.967e-001	4.200e+001	1.110e+002
44	2.663e+000	2.398e+000	1.157e+000	3.342e-001	4.300e+001	1.130e+002
45	2.290e+000	1.969e+000	1.135e+000	2.874e-001	4.400e+001	1.150e+002
46	2.477e+000	2.312e+000	8.892e-001	3.106e-001	4.500e+001	1.160e+002
47	2.705e+000	2.249e+000	1.504e+000	3.394e-001	4.600e+001	1.180e+002
48	2.911e+000	2.580e+000	1.347e+000	3.653e-001	4.700e+001	1.200e+002
49	3.417e+000	3.001e+000	1.634e+000	4.284e-001	4.800e+001	1.220e+002
50	3.687e+000	3.239e+000	1.761e+000	4.625e-001	4.900e+001	1.240e+002

FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-1

	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
	4.786e+000	4.450e+000	1.759e+000	5.999e-001	5.000e+001	1.260e+002
2	3.464e+000	3.193e+000	1.343e+000	4.344e-001	5.100e+001	1.280e+002
3	6.979e+000	6.453e+000	2.657e+000	8.741e-001	5.200e+001	1.300e+002
4	1.003e+001	9.418e+000	3.457e+000	1.258e+000	5.300e+001	1.310e+002
5	1.616e+001	1.532e+001	5.138e+000	2.025e+000	5.400e+001	1.330e+002

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NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-2

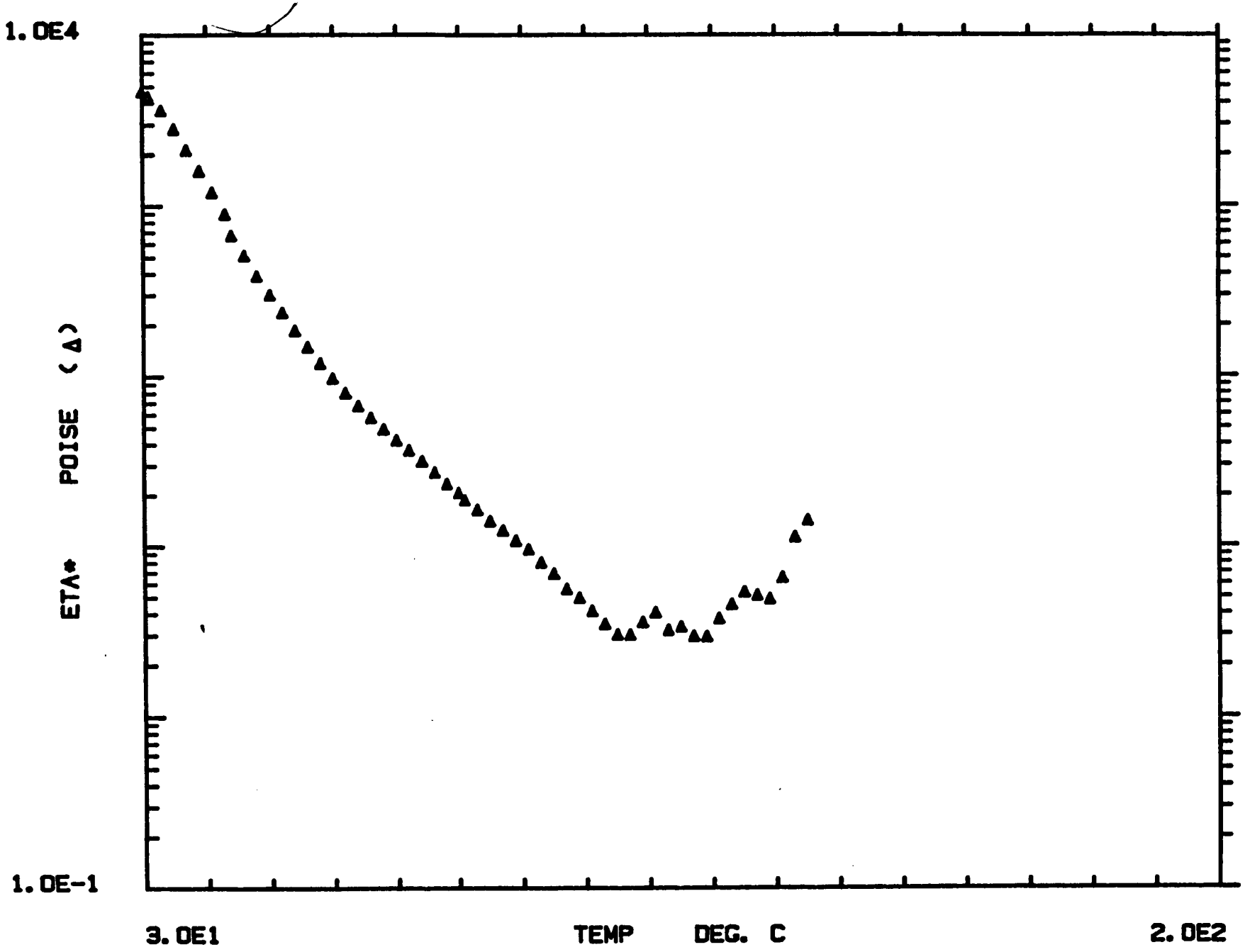

CHART 14B

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Rheometrics RECAP II

---

eriment No. : 7 Sample No. : 1

le:
A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-2

rator :CP

e and Time : Monday, August 18, 1986 - 13:42:09

rating Mode : DYNAMIC

ep Type : CURE

metry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

es :
AIN =50%
QUENCY =10 RAD/SEC

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6A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-2

O.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	4.660e+003	4.659e+003	9.050e+001	5.983e+002	2.000e-001	3.000e+001
2	4.371e+003	4.371e+003	6.109e+001	5.612e+002	1.000e+000	3.100e+001
3	3.598e+003	3.598e+003	5.110e+001	4.600e+002	2.000e+000	3.300e+001
4	2.798e+003	2.797e+003	3.594e+001	3.569e+002	3.000e+000	3.500e+001
5	2.107e+003	2.107e+003	3.108e+001	2.679e+002	4.000e+000	3.700e+001
6	1.583e+003	1.583e+003	3.224e+001	2.006e+002	5.000e+000	3.900e+001
7	1.190e+003	1.190e+003	3.339e+001	1.505e+002	6.000e+000	4.100e+001
8	8.865e+002	8.859e+002	3.148e+001	1.118e+002	7.000e+000	4.300e+001
9	6.653e+002	6.647e+002	2.780e+001	8.385e+001	8.000e+000	4.400e+001
10	5.079e+002	5.071e+002	2.798e+001	6.388e+001	9.000e+000	4.600e+001
11	3.852e+002	3.844e+002	2.502e+001	4.841e+001	1.000e+001	4.800e+001
12	2.984e+002	2.975e+002	2.327e+001	3.747e+001	1.100e+001	5.000e+001
13	2.342e+002	2.331e+002	2.289e+001	2.939e+001	1.200e+001	5.200e+001
14	1.840e+002	1.827e+002	2.245e+001	2.308e+001	1.300e+001	5.400e+001
15	1.473e+002	1.458e+002	2.082e+001	1.848e+001	1.400e+001	5.600e+001
16	1.183e+002	1.167e+002	1.911e+001	1.484e+001	1.500e+001	5.800e+001
17	9.661e+001	9.513e+001	1.683e+001	1.211e+001	1.600e+001	6.000e+001
18	7.932e+001	7.792e+001	1.482e+001	9.949e+000	1.700e+001	6.200e+001
19	6.663e+001	6.543e+001	1.260e+001	8.349e+000	1.800e+001	6.400e+001
20	5.676e+001	5.578e+001	1.050e+001	7.120e+000	1.900e+001	6.600e+001
21	4.854e+001	4.761e+001	9.465e+000	6.078e+000	2.000e+001	6.800e+001
22	4.177e+001	4.119e+001	6.924e+000	5.237e+000	2.100e+001	7.000e+001
23	3.651e+001	3.587e+001	6.826e+000	4.579e+000	2.200e+001	7.200e+001
24	3.142e+001	3.086e+001	5.898e+000	3.941e+000	2.300e+001	7.400e+001
25	2.703e+001	2.655e+001	5.087e+000	3.392e+000	2.400e+001	7.600e+001
26	2.308e+001	2.266e+001	4.377e+000	2.874e+000	2.500e+001	7.800e+001

7.	2.043e+001	2.006e+001	3.877e+000	2.564e+000	2.600e+001	8.000e+001
8	1.849e+001	1.810e+001	3.730e+000	2.317e+000	2.700e+001	8.100e+001
9	1.622e+001	1.590e+001	3.207e+000	2.036e+000	2.800e+001	8.300e+001
0	1.393e+001	1.366e+001	2.742e+000	1.747e+000	2.900e+001	8.500e+001
1	1.222e+001	1.199e+001	2.329e+000	1.533e+000	3.000e+001	8.700e+001
2	1.063e+001	1.038e+001	2.294e+000	1.332e+000	3.100e+001	8.900e+001
3	9.435e+000	9.306e+000	1.554e+000	1.183e+000	3.200e+001	9.100e+001
4	7.880e+000	7.823e+000	9.476e-001	9.897e-001	3.300e+001	9.300e+001
5	6.772e+000	6.706e+000	9.418e-001	8.497e-001	3.400e+001	9.500e+001
6	5.496e+000	5.459e+000	6.397e-001	6.900e-001	3.500e+001	9.700e+001
7	4.882e+000	4.861e+000	4.551e-001	6.127e-001	3.600e+001	9.900e+001
8	4.092e+000	4.089e+000	1.699e-001	5.140e-001	3.700e+001	1.010e+002
9	3.417e+000	3.417e+000	0.000e+000	4.292e-001	3.800e+001	1.030e+002
0	2.973e+000	2.954e+000	3.373e-001	3.735e-001	3.900e+001	1.050e+002
1	2.970e+000	2.929e+000	4.913e-001	3.727e-001	4.000e+001	1.070e+002
2	3.516e+000	3.200e+000	1.458e+000	4.412e-001	4.100e+001	1.090e+002
3	4.011e+000	3.256e+000	2.343e+000	5.040e-001	4.200e+001	1.110e+002
4	3.159e+000	2.754e+000	1.547e+000	3.966e-001	4.300e+001	1.130e+002
5	3.304e+000	2.921e+000	1.544e+000	4.144e-001	4.400e+001	1.150e+002
6	2.910e+000	2.125e+000	1.988e+000	3.649e-001	4.500e+001	1.170e+002
7	2.898e+000	2.125e+000	1.971e+000	3.637e-001	4.600e+001	1.190e+002
8	3.698e+000	2.828e+000	2.383e+000	4.639e-001	4.700e+001	1.210e+002
9	4.482e+000	3.486e+000	2.817e+000	5.620e-001	4.800e+001	1.230e+002
0	5.299e+000	4.021e+000	3.451e+000	6.639e-001	4.900e+001	1.250e+002

6A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT1-2

p.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
51	5.075e+000	4.159e+000	2.908e+000	6.364e-001	5.000e+001	1.270e+002
52	4.836e+000	3.218e+000	3.610e+000	6.067e-001	5.100e+001	1.290e+002
53	6.447e+000	5.135e+000	3.898e+000	8.098e-001	5.200e+001	1.310e+002
54	1.123e+001	9.521e+000	5.956e+000	1.411e+000	5.300e+001	1.330e+002
55	1.413e+001	1.201e+001	7.434e+000	1.773e+000	5.400e+001	1.350e+002

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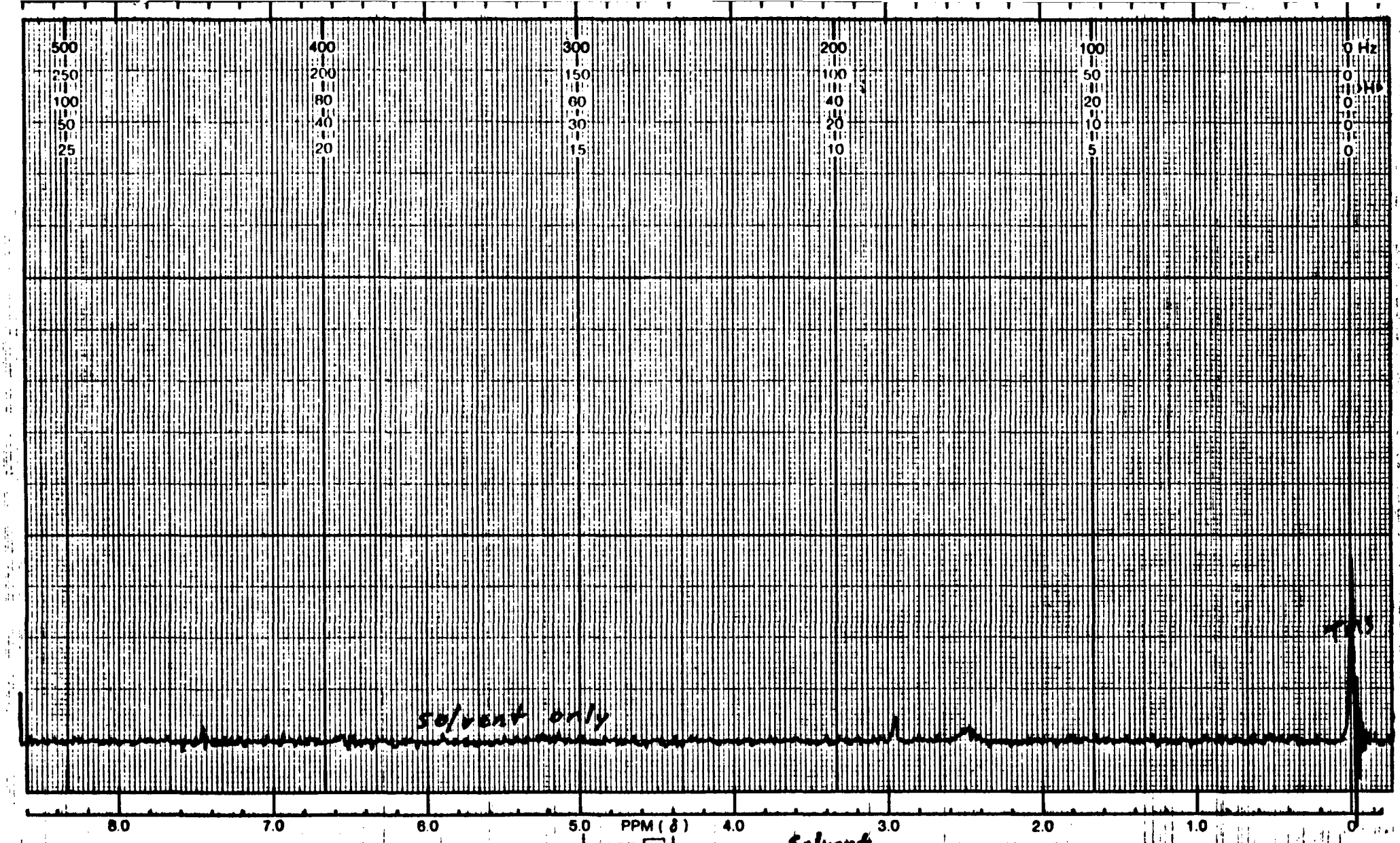


SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: —
SPINNING RATE (RPS): 30

MANUAL | AUTO ☐
SWEEP TIME (SEC): 50 250 500 1000 (250)
SWEEP WIDTH (Hz): 25 50 100 250 500 (500)
FILTER: 1 2 3 4 5 6 7 8 (2)
RF POWER LEVEL: 0.30 (.05)

SAMPLE: Solvent
SOLVENT: Unisol-d + 0.02% TMS
DEC. LEVEL

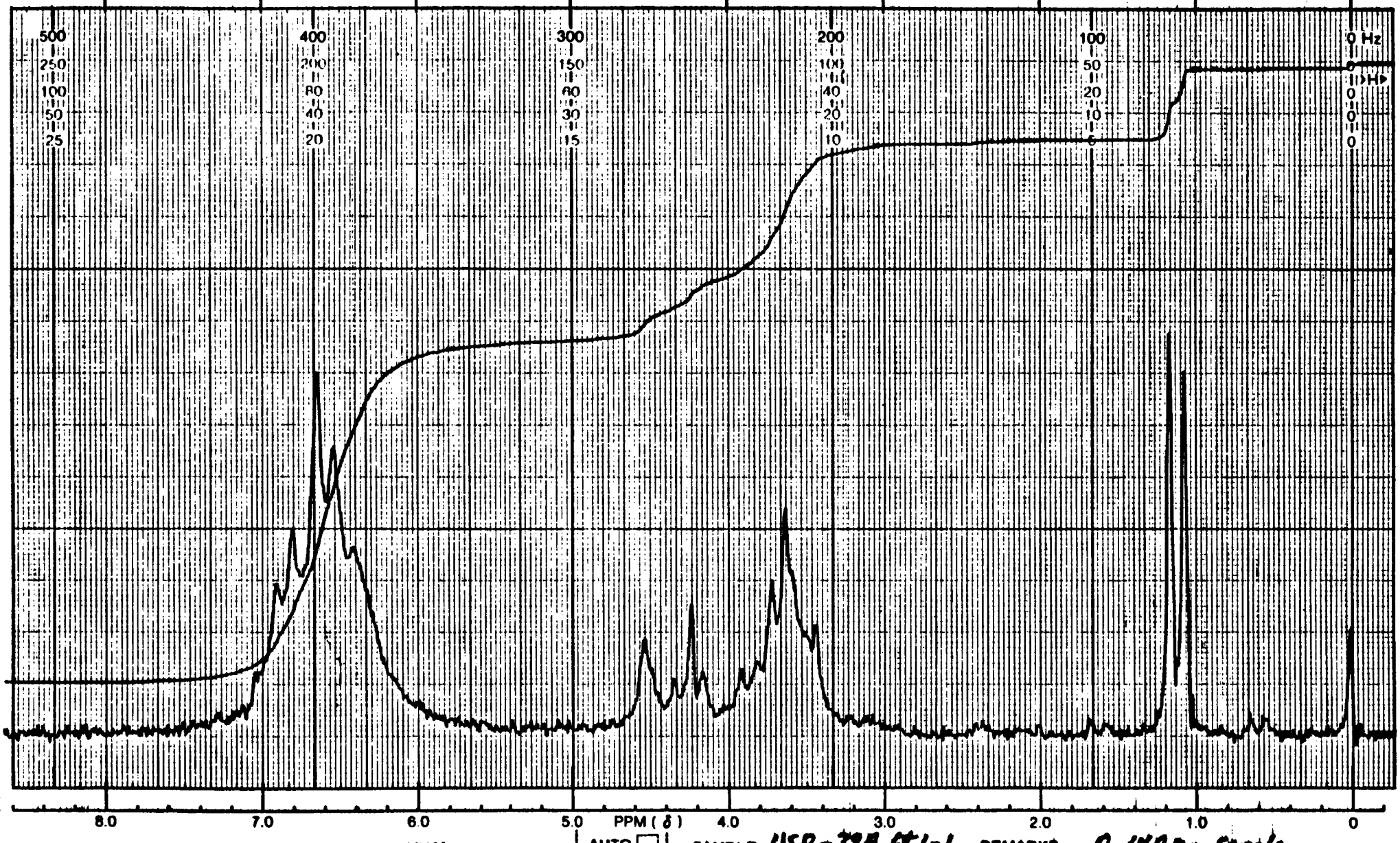
REMARKS:

ORIGINAL PAGE IS OF POOR QUALITY

SOLVENT ONLY SCAN

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86 OPERATOR DGW SPECTRUM NO. 1A of 7
solvent scan



SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: 5.0
SPINNING RATE (RPS): 30

MANUAL

SWEEP TIME (SEC): 30 250 500 1000
SWEEP WIDTH (Hz): 25 50 100 250 500
FILTER: 1 2 3 4 5 6 7 8
RF POWER LEVEL: 0.25

AUTO ☐
(250)
(500)
(2)
(.05)

SAMPLE: USP-39A Lot 1-1
SOLVENT: Anisol-d + 0.52TMS
DEC. LEVEL

REMARKS: 0.140 gm sample
0.698 gm solvent

CHART 15A

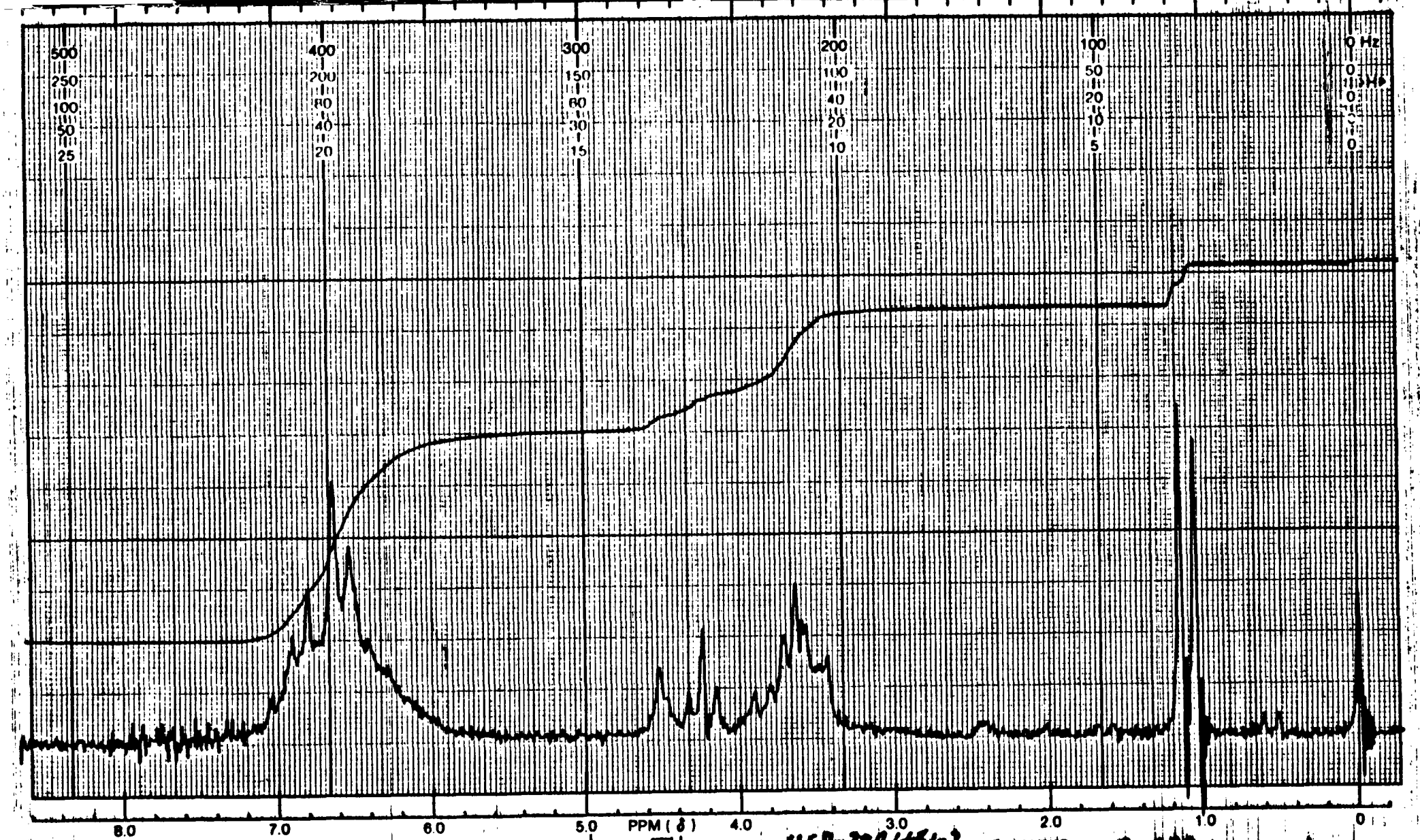
ORIGINAL PAGE IS
OF POOR QUALITY

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86

OPERATOR DGW

SPECTRUM NO. 1 of 7 USP-39A
Lot #1-1



SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: 5.0
SPINNING RATE (RPS): 30

MANUAL
SWEEP TIME (SEC): 50 250 500 1000
SWEEP WIDTH (Hz): 25 50 100 250 500
FILTER: 1 2 3 4 5 6 7 8
RF POWER LEVEL: 0.25

AUTO ☐
(250)
(500)
(2)
(.05)

SAMPLE: USP-39A Lot #1-2
SOLVENT: Unisol-d + 0.5% TMS
DEC. LEVEL

REMARKS: 0.099 gm sample
0.817 gm solvent

ORIGINAL PAGE IS
OF POOR QUALITY

DATE: 3-21-96
OPERATOR DGW
SPECTRUM NO. 2 of 7 USP-39A Lot #1-2

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

CHART 15B

TABLE OF CONTENTS

FABRIC TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

WCA Fabric for NASA Lot# 1 (HITCO)

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1b.	Breaking Strength, FILL	1
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2b.	Hydrogen Assay	1
2c.	Nitrogen Assay	1
3.	Visual Inspection	1
4.	Specific Gravity	1
5.	pH	2
6.	TGA	2
7a.	Atomic Absorption	2
7b.	Moisture Content	2
7c.	Ash Content	2
8a.	Filament diameter, WARP	2
8b.	Filament diameter, FILL	2
9a.	Thread Count, WARP	3
9b.	Thread Count, FILL	3
10a.	Areal weight	3
10b.	Volatiles	3
10c.	Weight Change on Acetone Wash	3

CHARTS

Visual Inspection ..... 3A - 3B

TGA ..... 6A - 6C

U.S. Polymeric

FABRIC TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

WCA Fabric for NASA Lot# 1 (HITCO)

1a. Breaking Strength, lbs/in, WARP
ASTM D1682

	#1-1S	#1-1E	#1-2S	LOT1 AVG
PICK	50	46	38	44.7
CENTER	56	39	44	46.3
PLAIN	60	42	48	50.0
AVG.	55.3	42.3	43.3	47.0

1b. Breaking Strength, lbs/inch, FILL
ASTMD 1682

PICK	14	7	15	12.0
CENTER	15	9	12	12.0
PLAIN	14	12	14	13.3
AVG.	14.3	9.3	13.7	12.4

2a. Carbon Assay, %
MDQAI 5560

PICK	99.3	99.9	99.8	99.67
CENTER	99.7	99.9	99.9	99.83
PLAIN	99.6	99.8	99.8	99.73
AVG.	99.53	99.87	99.83	99.74

2b. Hydrogen Assay, %
MDQAI 5560

PICK	<.01	<.01	<.01	EST .001
CENTER	<.01	<.01	<.01	EST .001
PLAIN	.01	<.01	<.01	EST .004
AVG.	EST .004	EST .001	EST .001	EST .002

2c. Nitrogen Assay, %
MDQAI 5560

PICK	.30	.10	.20	.200
CENTER	.04	.08	.10	.073
PLAIN	.03	.05	.10	.060
AVG.	.123	.077	.133	.111

3. Visual Inspection
QCi-102

See Charts 3A-3B

4. Specific Gravity, Units
PTM-84

PICK	1.6487	1.6606	1.6345	1.6479
CENTER	1.6029	1.6529	1.6248	1.6269
PLAIN	1.6003	1.6846	1.6351	1.6400
AVG.	1.617	1.666	1.631	1.638

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

WCA Fabric for NASA Lot# 1 (HITCO)

5. pH, Units
CTM-24B

	#1-1S	#1-1E	#1-2S	LOT1 AVG
	6.6	6.4	6.6	6.53
	6.4	6.3	6.6	6.43
AVG.	6.5	6.35	6.6	6.48

6. TGA, °C at 50% Weight Loss
CTM-51 (AIR)

SET UP# 1		SET UP# 2	
1-1S	935	1-1E	855
1-2S	936		
AVG.	936		

See Chart 6A-6C

7a. Atomic Absorption, ppm
CTM-53B

	#1-1S	#1-1E	#1-2S	LOT1 AVG
Na	18	23	6	15.7
K	1	0	0	0.3
Ca	8	8	7	7.7
Mg	1	0	1	0.7
Li	0	0	0	0.0
AVG.	28	31	14	24.3

7b. Moisture Content, %
CTM-53B

	.025	.015	.010	.017

7c. Ash Content, %
CTM-53B

	.010	.020	.020	.017

8a. Filament diameter, microns, WARP
S.E.M. (Diameters are an average of 10 measurements)

AVERAGE	10.88	11.54	11.77	11.40
Minimum	10.00	9.95	10.10	9.95
Maximum	12.45	13.00	13.95	13.95
Std. Dev	0.79	1.02	1.18	1.05

8b. Filament diameter, microns, FILL
S.E.M. (Diameters are an average of 10 measurements)

AVERAGE	10.07
Minimum	7.95
Maximum	13.05
Std. Dev	1.48

WCA Fabric for NASA Lot# 1 (HITCO)

9a. Thread Count, per inch, WARP
PTM-5A

	#1-1S	#1-1E	#1-2S	LOT1 AVG
	30	29	29	29.3
	30	29	29	29.3
	30	29	29	29.3
	30	29	29	29.3
	30	29	29	29.3
AVG.	30.0	29.0	29.0	29.3

9b. Thread Count, per inch, FILL
PTM-5A

	23	22	22	22.3
	23	22	22	22.3
	23	22	22	22.3
	23	22	22	22.3
	23	22	22	22.3
AVG.	23.0	22.0	22.0	22.3

10a. Areal Weight as received, gm/4x4
PTM-3A

LEFT	2.566	2.538	2.523	2.542
CENTER	2.520	2.528	2.488	2.512
RIGHT	2.578	2.566	2.524	2.556
AVG.	2.555	2.544	2.512	2.537

10b. Volatiles as received, %
PTM-3A

LEFT	.43	.43	.44	.43
CENTER	.24	.28	.36	.29
RIGHT	.47	.58	.79	.61
AVG.	.38	.43	.53	.45

10c. Weight change on Acetone wash, %
PTM-3A

LEFT	.35	.36	.28	.33
CENTER	-.04	-.08	.00	-.04
RIGHT	.31	.43	.56	.43
AVG.	.21	.24	.28	.24

U.S. Polymeric

Hamid M. Quraishi

Hamid M. Quraishi, Manager
Quality Assurance Department

USP NO. CHART 3A

DATE 3/17/66

FABRIC THORNEL WCA GRAPHITE

MFG. UNION CARBIDE

ROLL NO. 849 12CSWCA-7

YARDS 180

POUNDS 101

ORDER NO. OE71108

SPECIFICATION Various

Q.C. FILE # NASA 1-1

FOOTAGE -

START SAMPLE

LEFT

4W
2W
9W
5W
12W
20W
24W
31W
32W
41W
53W
75W
83W
86W
90W
91W
92W
105W
108W
121W
126W
157-158W
168
166-170W
180
207W
211W
215W
230W
237W
239
259 splice

TREATER OPERATOR READ UP

SYMBOLS

- TEAR
- SPOTS OR STAINS
- FOLDS
- EDGE CURL
- TIGHT WEAVE OR SELVAGE
- WEAVE DISTORTION
- VISIBLE PUCKERS
- ONE PUCKER CREASING
- TWO OR MORE CREASINGS

REMARKS Continued -

205W
231W
277W
288W
290W
299W
304W
314W
321W
331W
339W
342W
345-347W
390W
415W
425
437W
450 SPLICE
462W
469
485W
516W
523W

534

GRADE Group C

END SAMPLE

ORIGINAL PAGE IS
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USP NO. CHART 3B

DATE 3/17/86

FABRIC THORNEL WCA GRAPHITE CLOTH

MFG. UNION CARBIDE

ROLL NO. 850 PCSWCA-7

YARDS 180

POUNDS 99

ORDER NO. OE 71108

SPECIFICATION Various

~~Q.C. FILE~~ # NASA 1-2

FOOTAGE

START Sample

LEFT

TREATER OPERATOR READ UP

SYMBOLS

- TEAR
- SPOTS OR STAINS
- FOLDS
- EDGE CURL
- TIGHT WEAVE OR SELVAGE
- WEAVE DISTORTION
- VISIBLE PUCKERS
- ONE PUCKER CREASING
- TWO OR MORE CREASINGS

REMARKS

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GRADE Group C

END SAMPLE

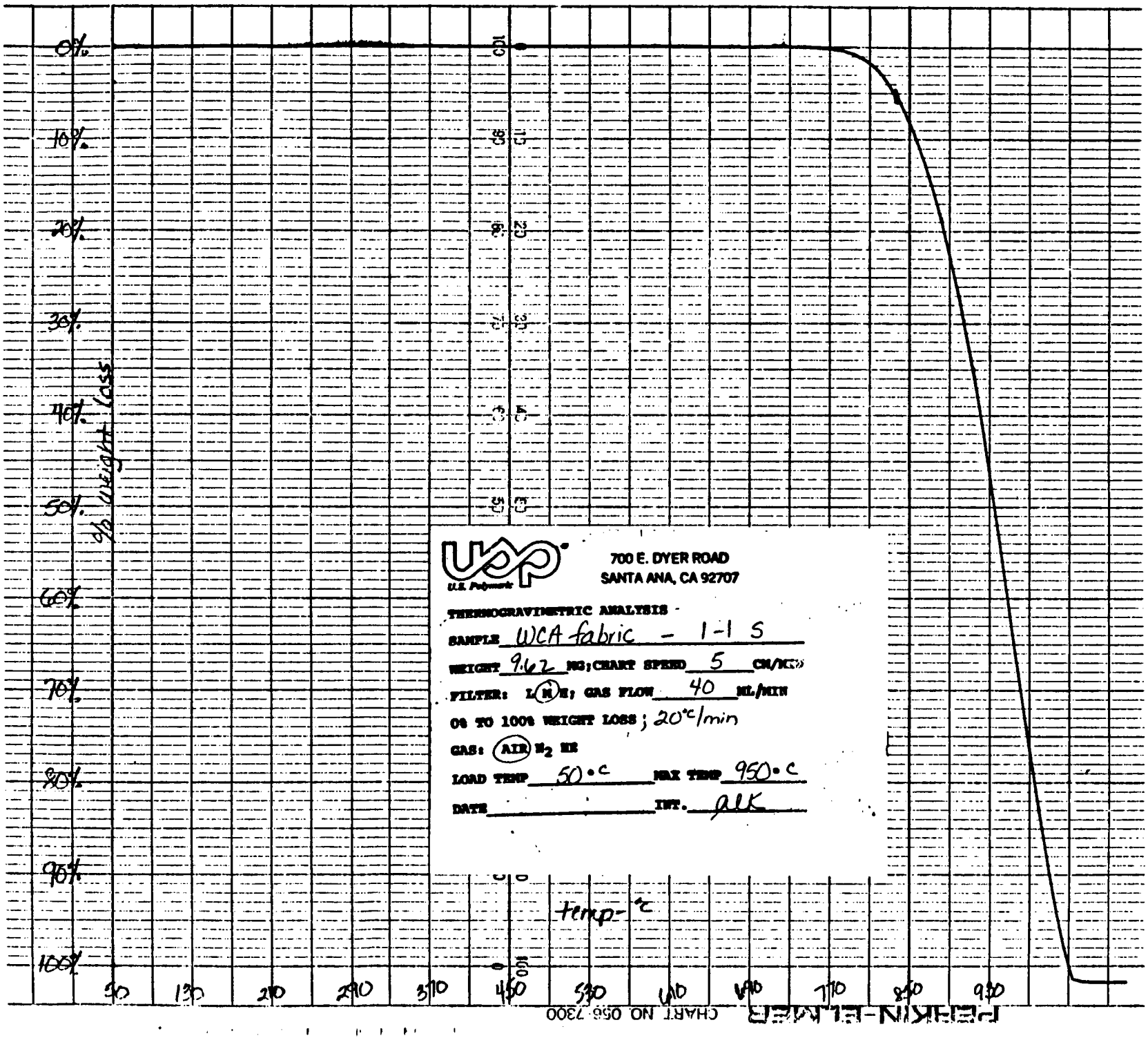

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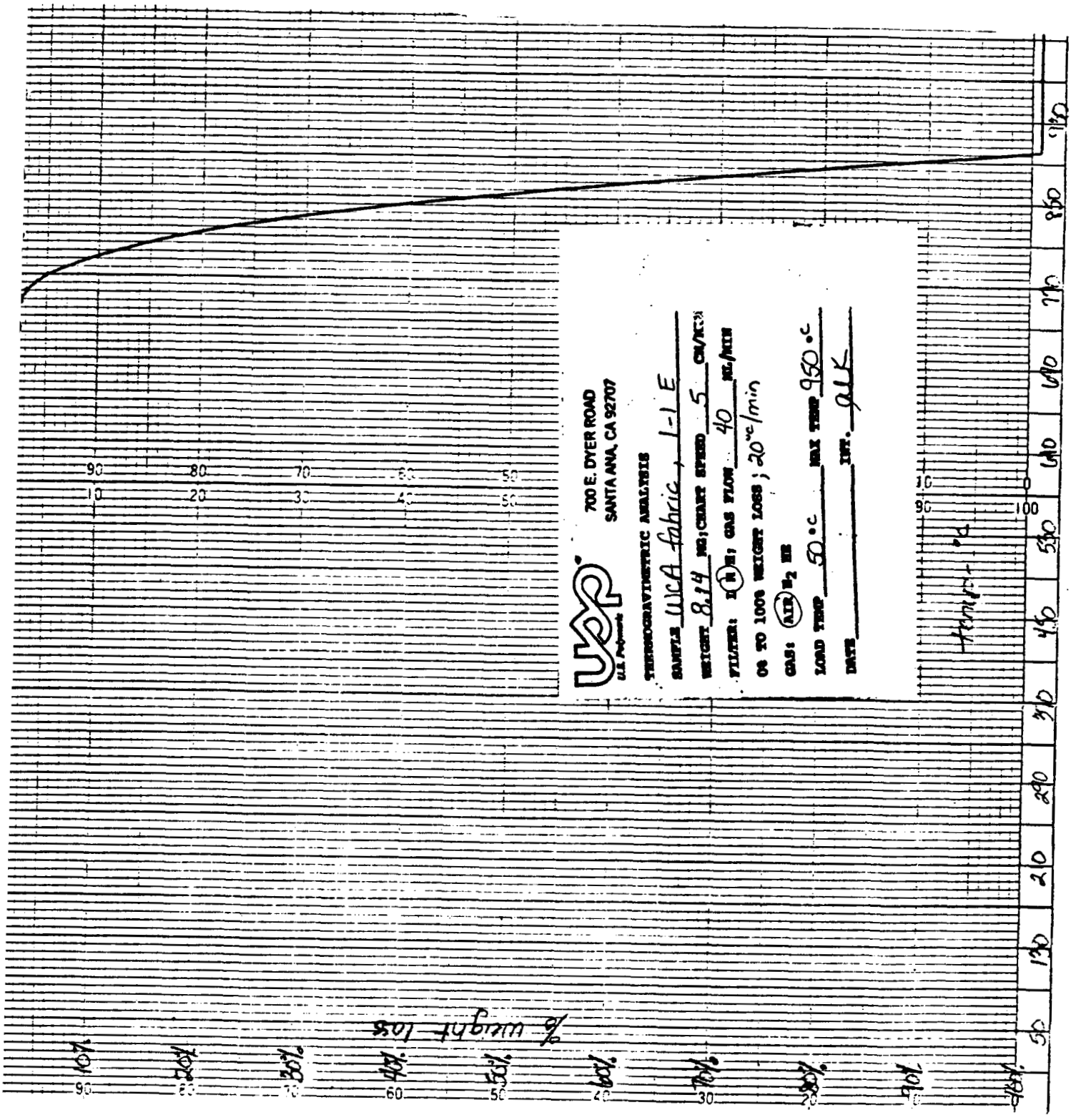
CHART 6A

ORIGINAL PAGE IS
OF POOR QUALITY



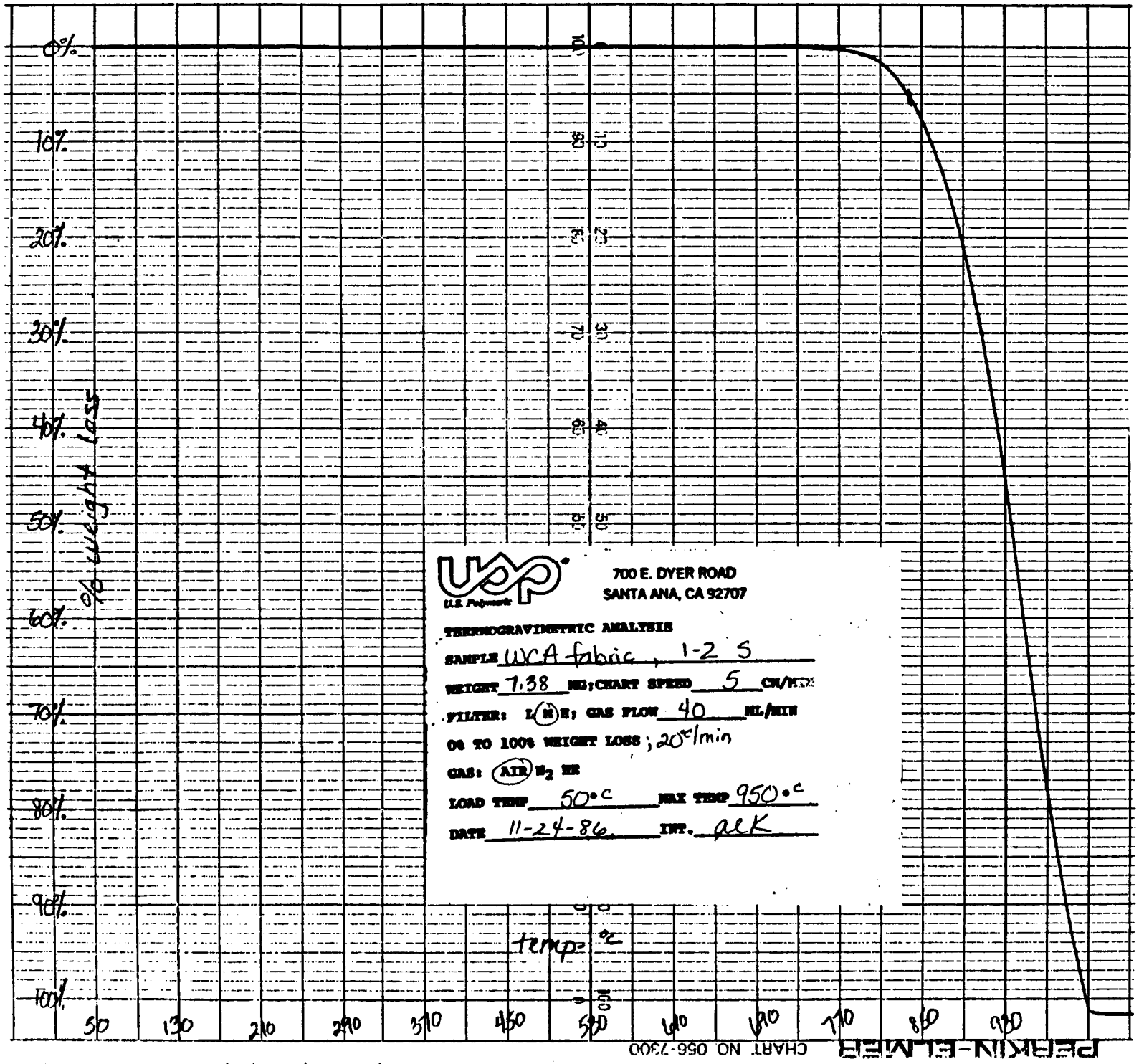


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CHART 6C

TABLE OF CONTENTS

PREPREG TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

FM 5064J NASA LOT# 1 U.S.P. LOT# C02134 (HITC0)

TEST		PAGE
1a.	Resin Content, Soxhlet	1
1b.	Filler Content, Soxhlet	1
1c.	Cloth Content, Soxhlet	1
2.	Volatile Content	1
3.	Flow	1
4.	Resin Content, Dry Basis	1
5.	Tack	1
6.	Gel Time	1
7a.	Atomic Absorption	2
7b.	Moisture Content	2
7c.	Ash Content	2
8.	TGA	2
9.	DSC	2
10.	Infrared (IRZB) Baseline	2
11.	Environmental History	2
12.	Specific Gravity	2
13a.	Tensile Strength	3
13b.	Tensile Modulus	3
13c.	Tensile Elongation	3
14a.	Flexural Strength	3
14b.	Flexural Modulus	3
15a.	Compressive Strength	3
15b.	Compressive Modulus	4
16.	Double Shear Strength	4
17.	Barcol Hardness	4
18.	Residual Volatiles	4
19.	Resin Content, Pyrolysis	4
20.	Acetone Extraction	4
21a.	CTE, with ply	4
21b.	CTE, crossply	5

CHARTS

TGA	8A - 8D
DSC	9A - 9D
Infrared (IRZB) Baseline	10A - 10D
CTE	21A - 21D

U.S. Polymeric

PREPREG TESTING

NAS8-36298

U.S. POLYMERIC O.E.71108

FM 5064J NASA LOT# 1 U.S.P. LOT# C02134 (HITCO)

		ROLL#1 START	ROLL#1 END	ROLL#2 START	ROLL#2 END
1a. Resin Content, Soxhlet, % CTM-6D		35.8	35.3	34.9	36.3
		34.8	34.2	34.5	34.3
		35.4	34.4	34.0	34.7
	AVG.	35.3	34.6	34.5	35.1
			NASA LOT# 1	AVERAGE	34.9
1b. Filler Content, Soxhlet, % CTM-6D		14.7	14.5	14.3	14.9
		14.3	14.0	14.2	14.1
		14.5	14.1	14.0	14.2
	AVG.	14.5	14.2	14.2	14.4
			NASA LOT# 1	AVERAGE	14.3
1c. Cloth Content, Soxhlet, % CTM-6D		49.5	50.2	50.8	48.8
		50.9	51.8	51.3	51.6
		50.1	51.5	52.0	51.1
	AVG.	50.2	51.2	51.4	50.5
			NASA LOT# 1	AVERAGE	50.8
2. Volatile Content, % PTM-17B		3.4	2.9	3.0	3.2
		3.3	3.0	2.9	3.0
		3.4	3.1	2.8	3.0
	AVG.	3.4	3.0	2.9	3.1
			NASA LOT# 1	AVERAGE	3.1
3. Flow, % PTM-19G		14.3	10.2	12.1	14.6
		13.7	10.8	10.2	13.9
		15.1	11.7	9.2	13.6
	AVG.	14.4	10.9	10.5	14.0
			NASA LOT# 1	AVERAGE	12.5
4. Resin Content, Dry Basis, % PTM-16F, Type II		34.0	33.4	34.0	34.9
		33.3	33.5	33.9	34.8
		34.0	33.8	33.7	35.2
	AVG.	33.8	33.6	33.9	35.0
			NASA LOT# 1	AVERAGE	34.0
5. Tack, lbs PTM-80		55	50	35	58
			NASA LOT# 1	AVERAGE	50
6. Gel Time, Seconds PTM-20E		96	84	69	64
			NASA LOT# 1	AVERAGE	78

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

FM 5064J NASA LOT# 1 U.S.P. LOT# C02134 (HITCO)

7a. Atomic Absorption, ppm
CTM-53B

	ROLL#1 START	ROLL#1 END	ROLL#2 START	ROLL#2 END	LOT#1 AVG.
Na	4	3	4	7	5
K	0	0	0	1	0
Ca	1	1	1	0	1
Mg	3	2	1	1	2
Li	0	0	0	0	0
TOTAL	8	6	6	9	7

7b. Moisture Content, %
CTM-53B

ROLL1# START	ROLL#1 END	ROLL#2 START	ROLL#2 END
2.11	2.08	1.96	1.90
	NASA LOT# 1	AVERAGE	2.01

7c. Ash Content, %
CTM-53B

.20	.20	.08	.22
	NASA LOT# 1	AVERAGE	.17

8. TGA, % Weight Loss at 500°C
CTM-51 (Nitrogen)

7.9	6.6	6.4	10.5
	NASA LOT# 1	AVERAGE	7.9

See Chart 8A-8D

9. DSC, °C
CTM-50A

181	183	183	182
	NASA LOT# 1	AVERAGE	182

See Chart 9A-9D

10. Infrared (IRZB) Baseline
CTM-21C

.82	.76	.81	.83
	NASA LOT# 1	AVERAGE	.80

See Chart 10A-10D

11. Environmental History

Date manufactured: 1 May 1986
Packaged in: MIL-B-131 class I bag supported in cardboard carton
Date shipped: 16 June 1986 in 40°F truck

12. Specific Gravity, Cured Units
ASTM D792

	ROLL#1 START	ROLL#1 END	ROLL#2 START	ROLL#2 END
	1.422	1.424	1.425	1.425
	1.422	1.424	1.426	1.425
	1.422	1.424	1.426	1.426
AVG.	1.422	1.424	1.426	1.425
		NASA LOT# 1	AVERAGE	1.424

FM 5064J NASA LOT# 1 U.S.P. LOT# C02134 (HITCO)

		ROLL#1 START	ROLL#1 END	ROLL#2 START	ROLL#2 END
13a. Tensile Strength, ksi, WARP FTMS 406-1011		18.65	18.67	20.09	20.89
		19.88	19.11	18.58	20.62
		19.58	18.94	19.20	20.59
		19.31	19.66	18.48	20.58
		19.69	19.25	18.96	21.30
	AVG.	19.42	19.13	19.06	20.79
			NASA LOT# 1	AVERAGE	19.60
13b. Tensile Modulus, msi, WARP FTMS 406-1011		1.93	1.98	1.98	2.07
		1.96	1.90	1.94	2.02
		2.04	1.97	1.81	2.15
		1.98	1.97	1.91	2.06
		2.09	1.89	1.94	2.08
	AVG.	2.00	1.94	1.92	2.08
			NASA LOT# 1	AVERAGE	1.98
13c. Tensile Elongation, %, WARP FTMS 40C-1011		1.27	1.22	1.40	1.49
		1.46	1.32	1.28	1.52
		1.36	1.28	1.41	1.35
		1.32	1.36	1.32	1.47
		1.40	1.37	1.32	1.48
	AVG.	1.36	1.31	1.35	1.46
			NASA LOT# 1	AVERAGE	1.37
14a. Flexural Strength, ksi, WARP FTMS 406-1031		27.64	27.81	26.10	24.98
		29.19	26.36	24.82	28.41
		29.05	25.38	26.02	26.61
		28.56	27.94	24.28	24.69
		26.00	26.13	26.24	26.94
	AVG.	27.69	26.72	25.49	26.33
			NASA LOT# 1	AVERAGE	26.56
14b. Flexural Modulus, msi, WARP FTMS 406-1031		1.60	1.68	1.70	1.84
		1.71	1.72	1.67	1.76
		1.59	1.58	1.66	1.67
		1.67	1.85	1.58	1.80
		1.69	1.59	1.59	1.68
	AVG.	1.65	1.68	1.64	1.75
			NASA LOT# 1	AVERAGE	1.68
15a. Compressive Strength, ksi, WARP FTMS 406-1021		18.07	12.34	16.18	21.49
		16.16	19.88	17.12	20.82
		16.29	19.61	16.14	18.62
		20.66	11.83	15.27	20.07
		20.22	14.76	17.23	17.69
	AVG.	18.28	15.68	16.39	19.74
			NASA LOT# 1	AVERAGE	17.52

FM 5064J NASA LOT# 1 U.S.P. LOT# C02134 (HITCO)

	ROLL#1 START	ROLL#1 END	ROLL#2 START	ROLL#2 END
15b. Compressive Modulus, msi, WARP FTMS 406-1021	2.20	2.26	2.03	2.14
	2.40	2.22	2.37	2.19
	2.31	2.19	2.06	2.15
	2.27	2.30	2.04	2.11
	2.30	2.20	1.93	2.09
AVG.	2.30	2.23	2.09	2.14
		NASA LOT# 1	AVERAGE	2.19
16. Double Shear Strength, ksi FTMS 406-1041A	2.54	2.58	2.35	2.27
	2.31	2.68	2.31	2.46
	2.44	2.68	2.42	2.56
	2.47	2.49	2.49	2.44
	2.53	2.41	2.58	2.54
AVG.	2.46	2.57	2.43	2.45
		NASA LOT# 1	AVERAGE	2.48
17. Barcol Hardness, Units ASTM D-2583 (Average of 10 determinations)	61.8	61.5	62.4	63.4
		NASA LOT# 1	AVERAGE	62.3
18. Residual Volatiles, % PTM-98	1.65	1.69	1.83	1.74
	1.75	1.72	1.86	1.58
	1.78	1.54	1.83	1.78
AVG.	1.72	1.65	1.84	1.70
		NASA LOT# 1	AVERAGE	1.73
19. Resin Content, Pyrolysis, % CTM-14B	31.22	32.54	32.55	32.23
	31.48	32.34	32.35	31.75
	31.49	32.26	31.69	32.08
AVG.	31.39	32.38	32.20	32.02
		NASA LOT# 1	AVERAGE	32.00
20. Acetone Extraction, % CTM-18A	6.50	7.69	7.09	7.49
	6.03	7.24	8.54	6.98
	7.02	7.16	6.14	6.50
AVG.	6.52	7.36	7.26	6.99
		NASA LOT# 1	AVERAGE	7.03
21a. CTE, in/in °F, with PLY PTM-61B	-1.33	3.60	3.69	3.59
	-.80	2.87	2.73	2.07
AVG.	-1.07	3.24	3.21	2.83
		NASA LOT# 1	AVERAGE	2.05

FM 5064J NASA LOT# 1 U.S.P. LOT# C02134 (HITCO)

21b. CTE, in/in °F, Cross PLY
PTM-61B

	ROLL#1 START	ROLL#1 END	ROLL#2 START	ROLL#2 END
	2.80	6.88	9.01	6.58
	4.72	10.02	4.51	6.19
AVG.	3.76	8.45	6.76	6.39

NASA LOT# 1 AVERAGE 6.34

See Chart 21A-21D

U. S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

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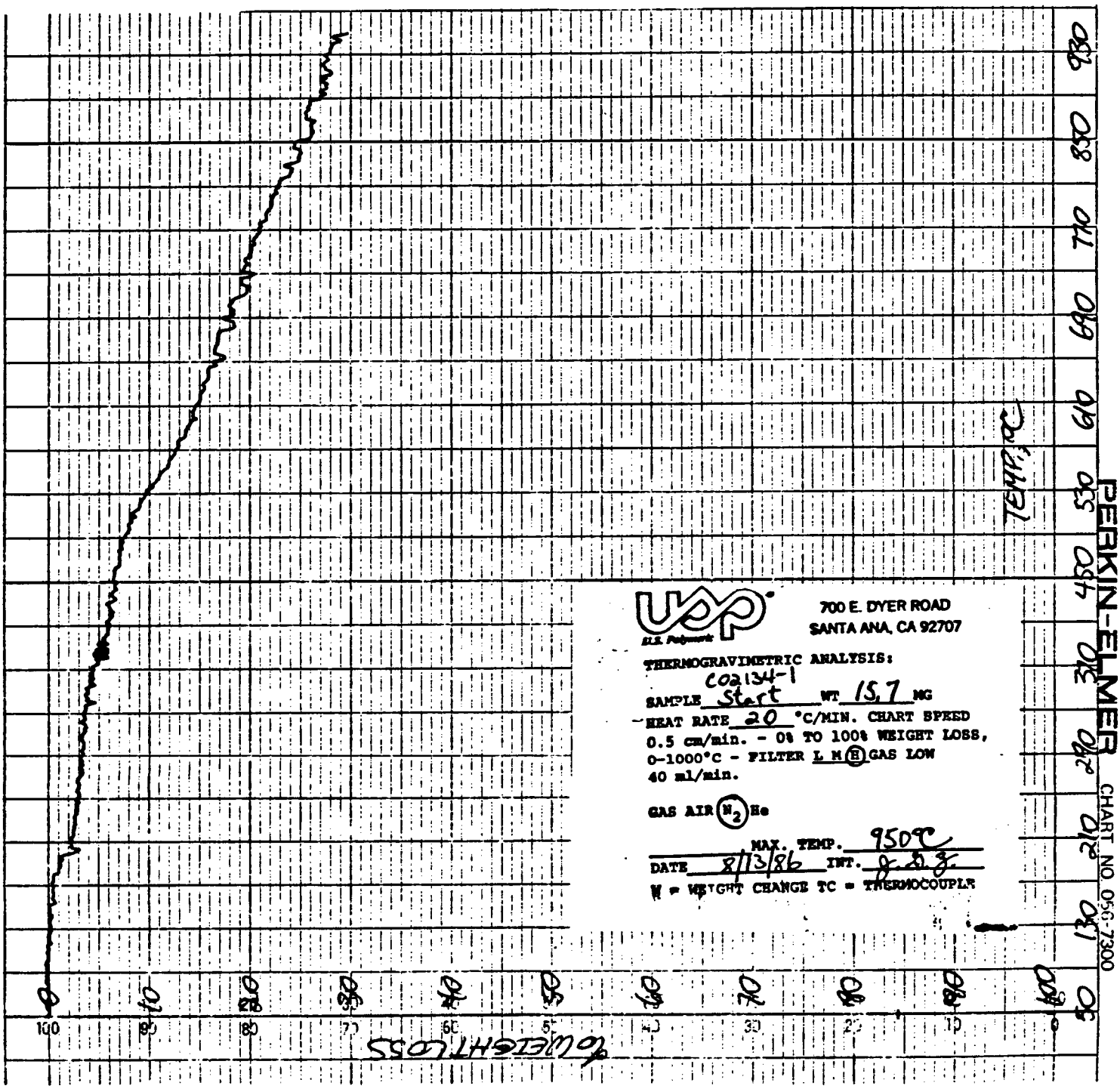

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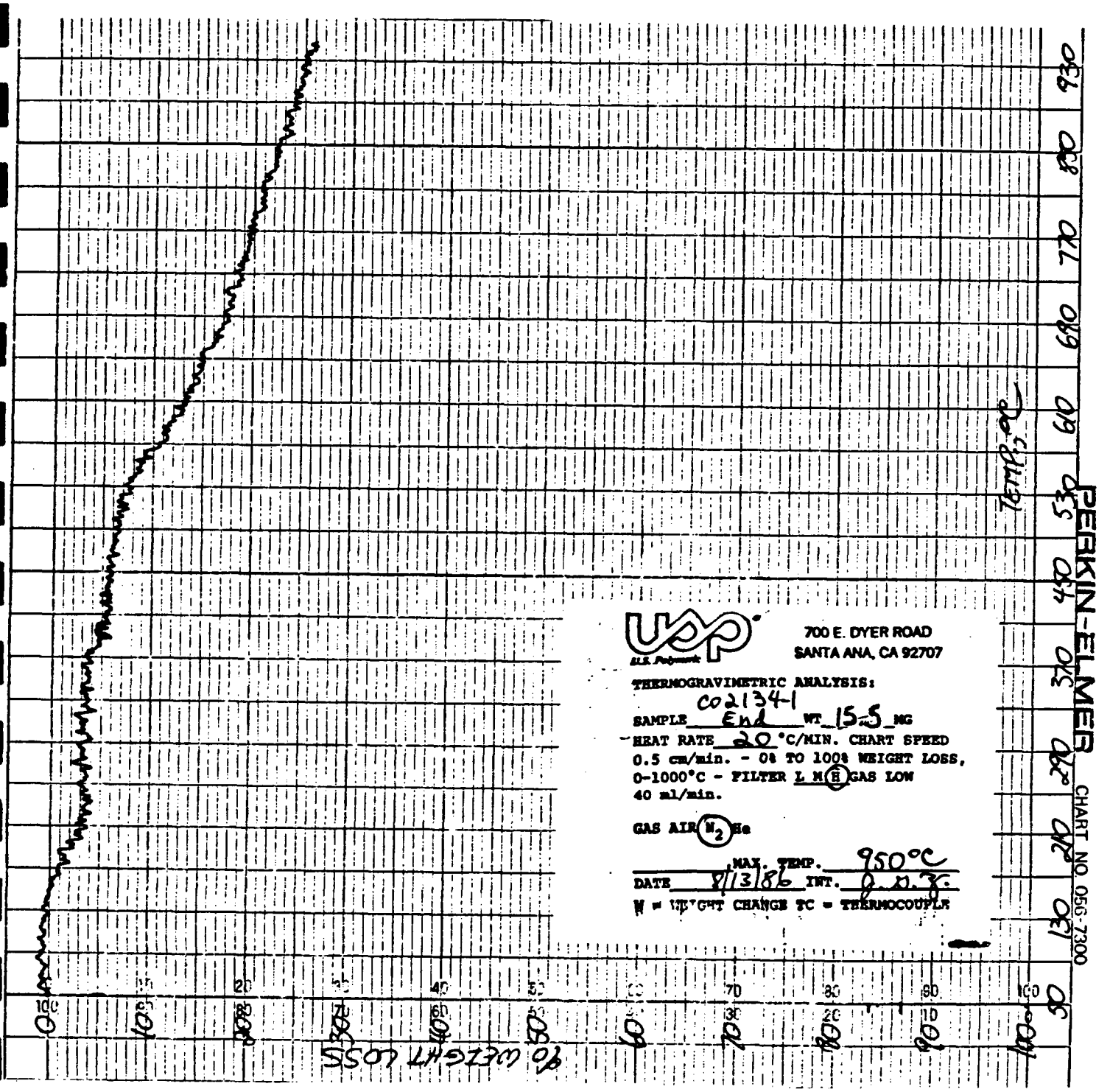

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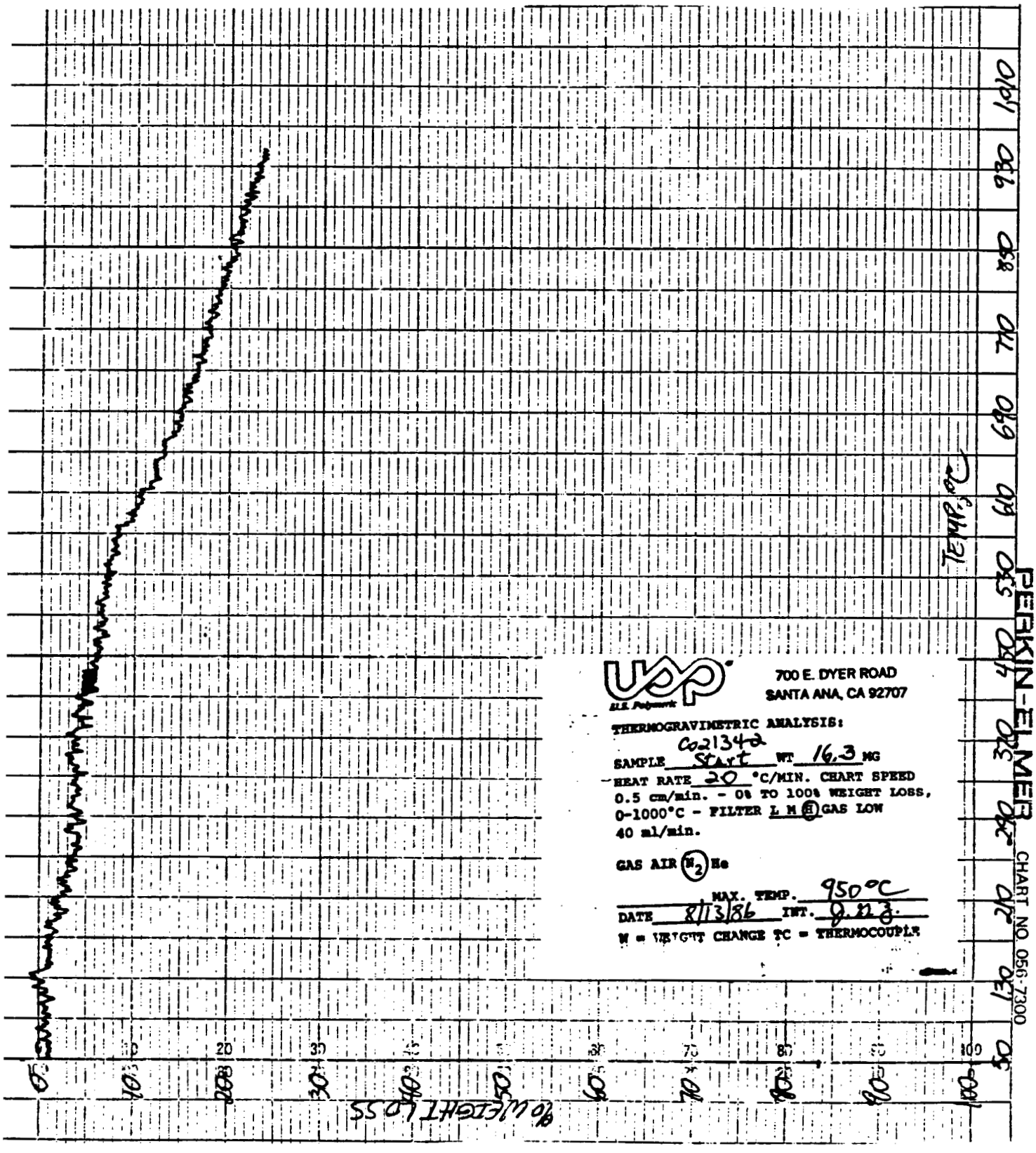

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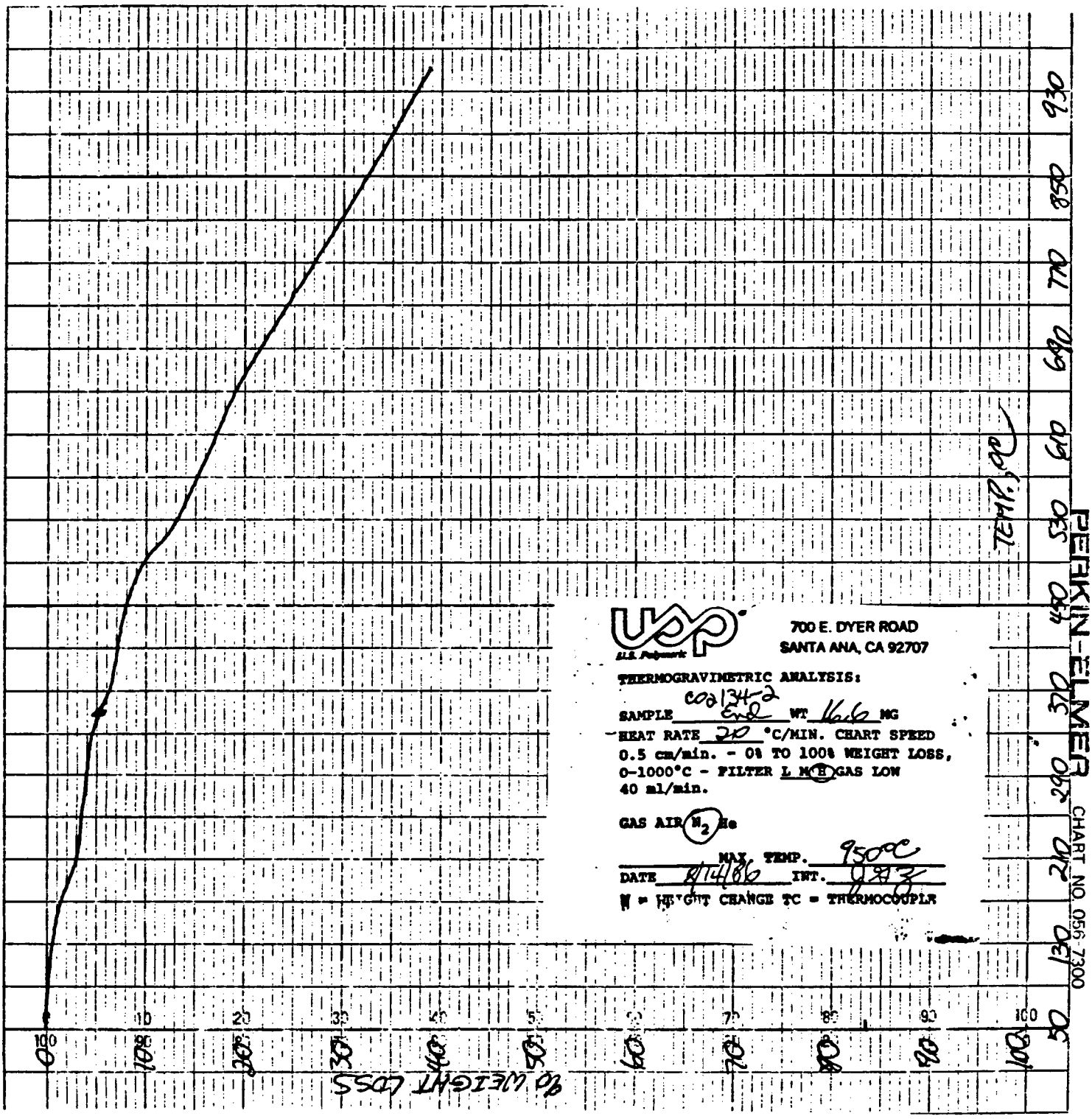
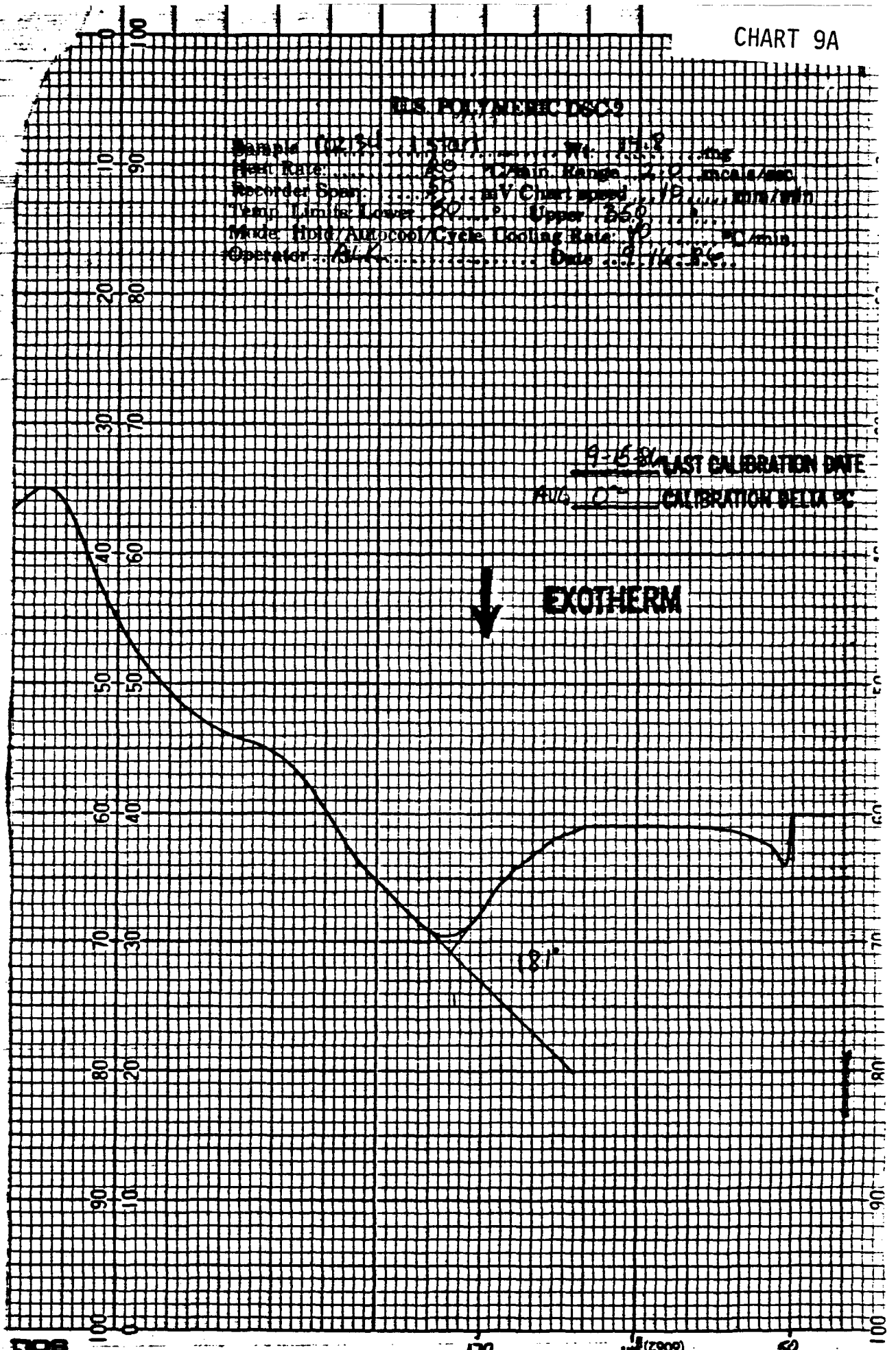


CHART 9A



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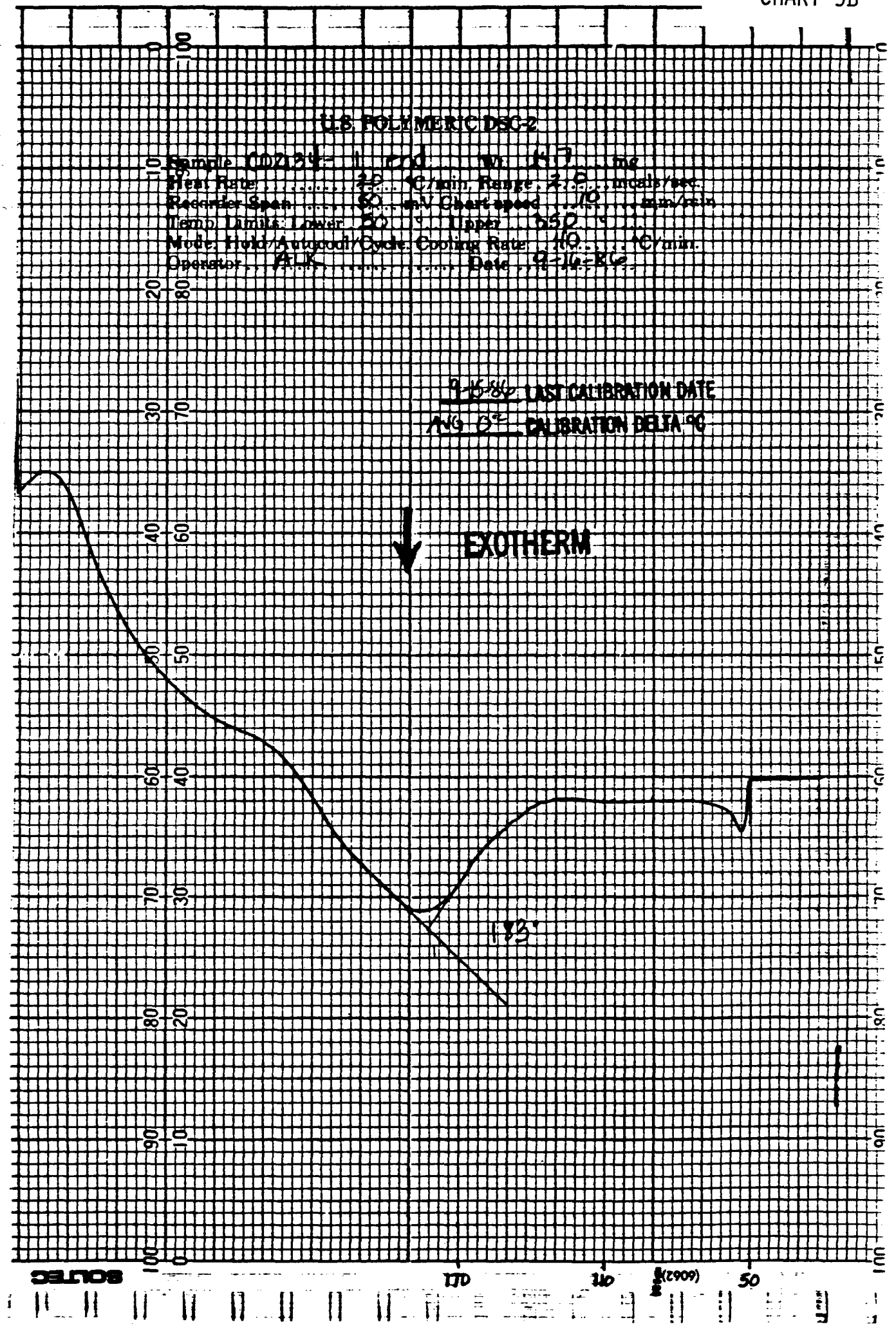

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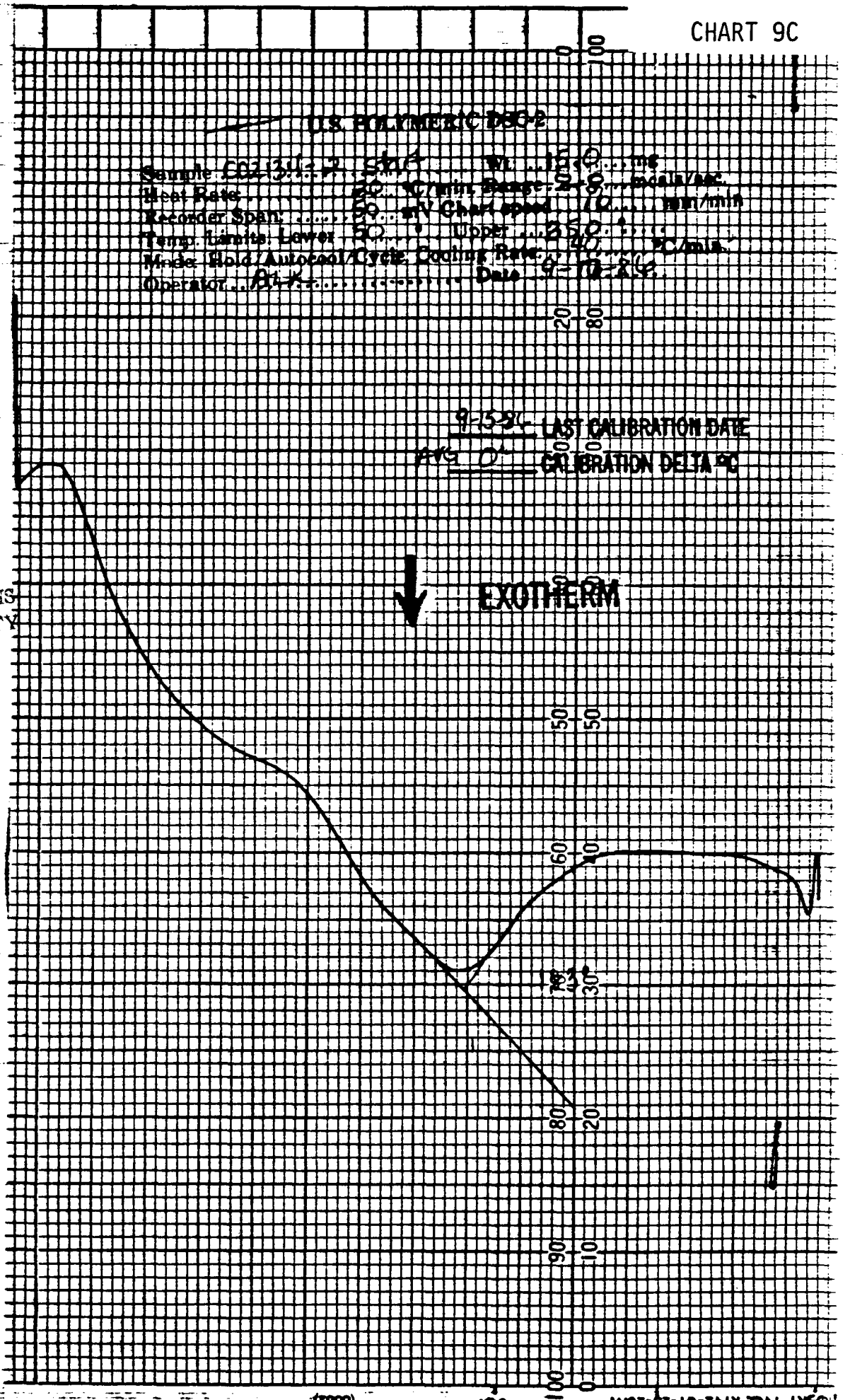

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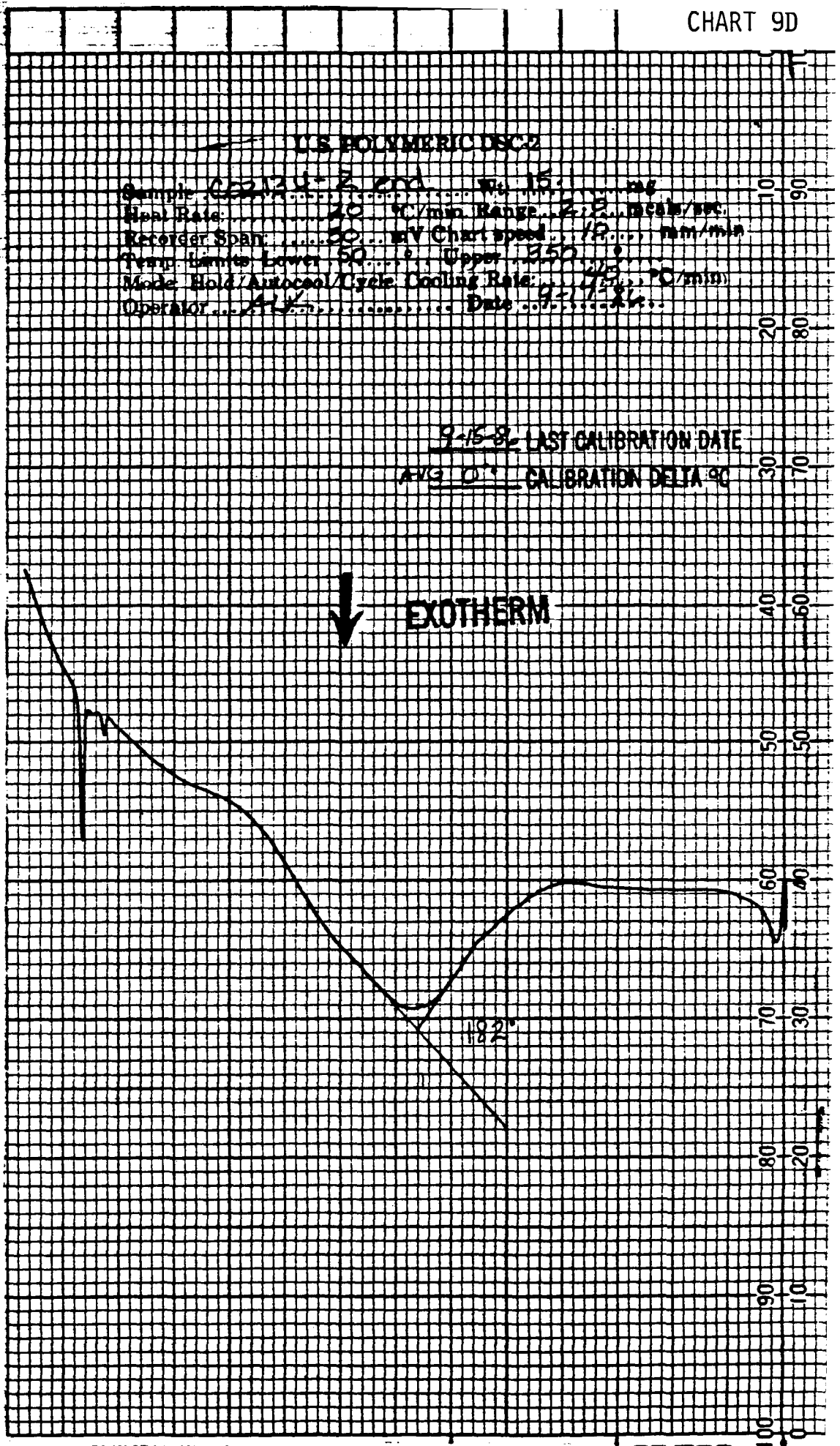

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SPECTRUM NO. 15181
DATE 7-07-86
SAMPLE FM5064J
C02134 # ST.-1

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 30-50 %T
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST V. MIRANDA

Beckman®
INFRARED
SPECTROPHOTOMETER

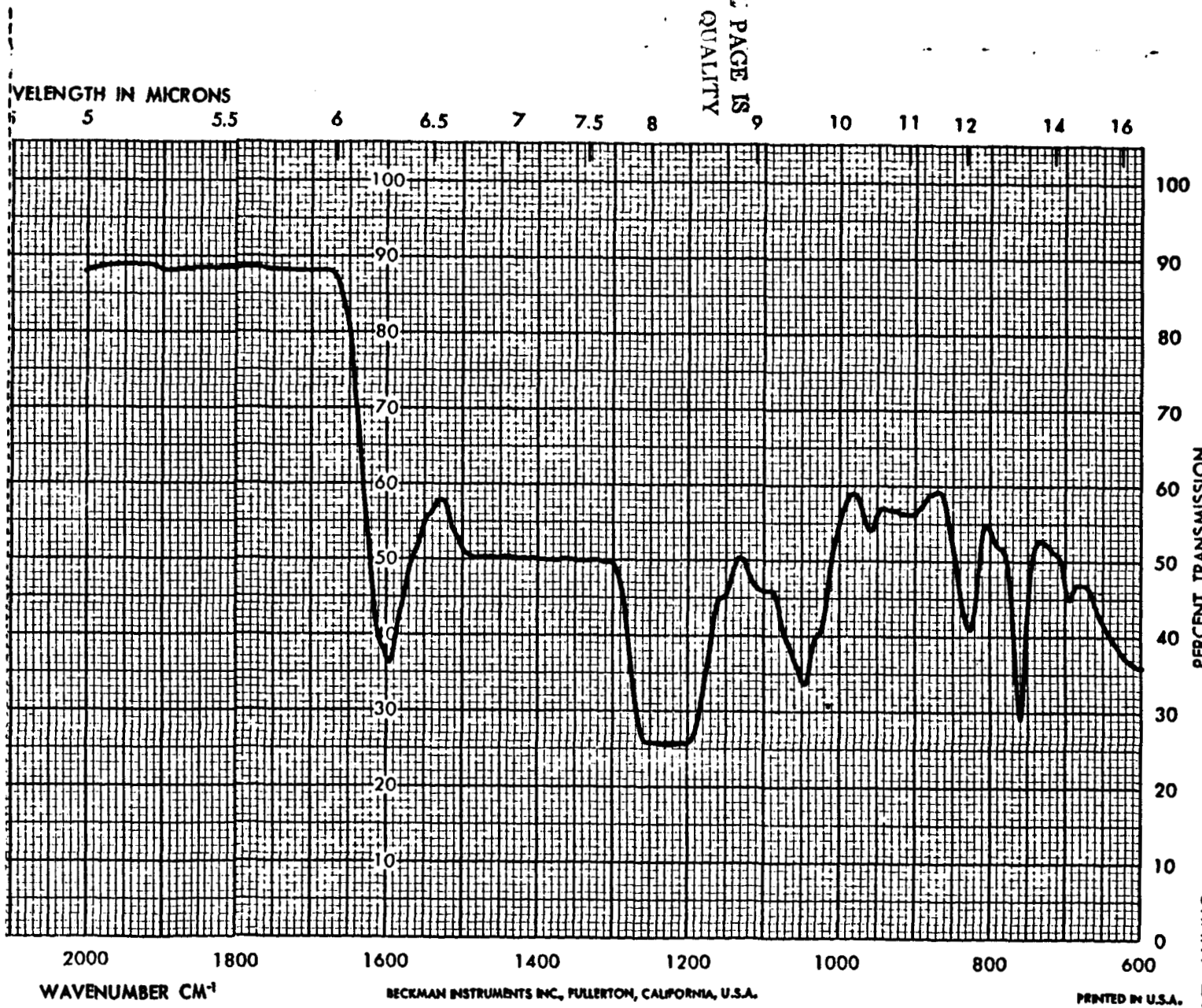

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CHART 10A

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SPECTRUM NO. 15182
DATE 7-07-86
SAMPLE FM 5064 J
C02134 # E-1

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 30-50%T
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST Y. MIRANDA

Beckman®

INFRARED
SPECTROPHOTOMETER

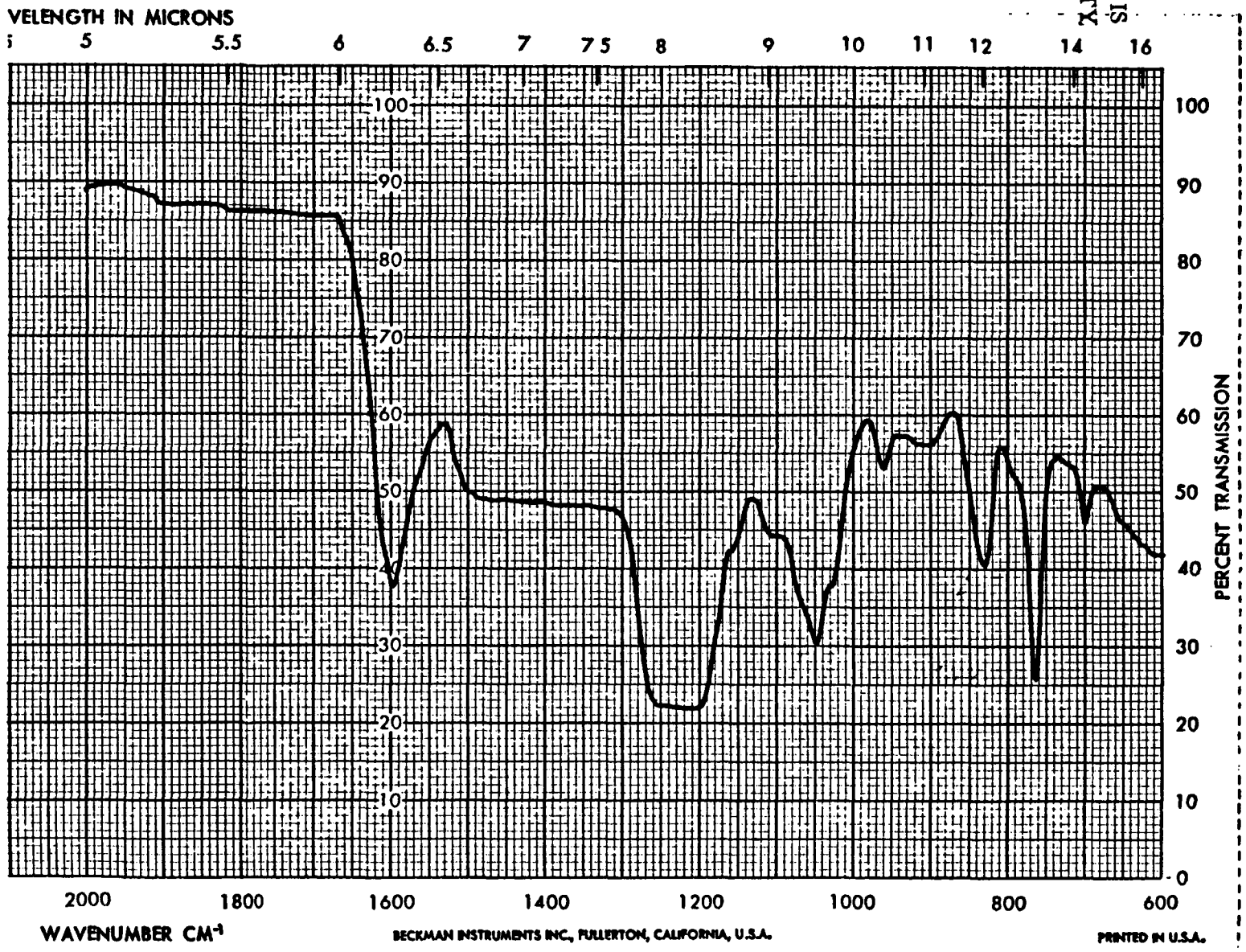

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CHART 10B

SPECTRUM NO. 15183

DATE 7-07-86

SAMPLE FM 5064 J

C02134 # ST. 2

SOURCE

STRUCTURE

PATH 0.2 mm NACL

SOLVENT ACETONE

CONCENTRATION 30-50%T

PHASE 3

COMMENTS PRE-PREG MATERIAL

ANALYST Y. MIRANDA

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CHART 10C

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SPECTRUM NO. 15184
DATE 7-07-86
SAMPLE FM 5064 J
C02134 # E-2

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 80-50%T
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST V. MIRANDA

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SPECTROPHOTOMETER

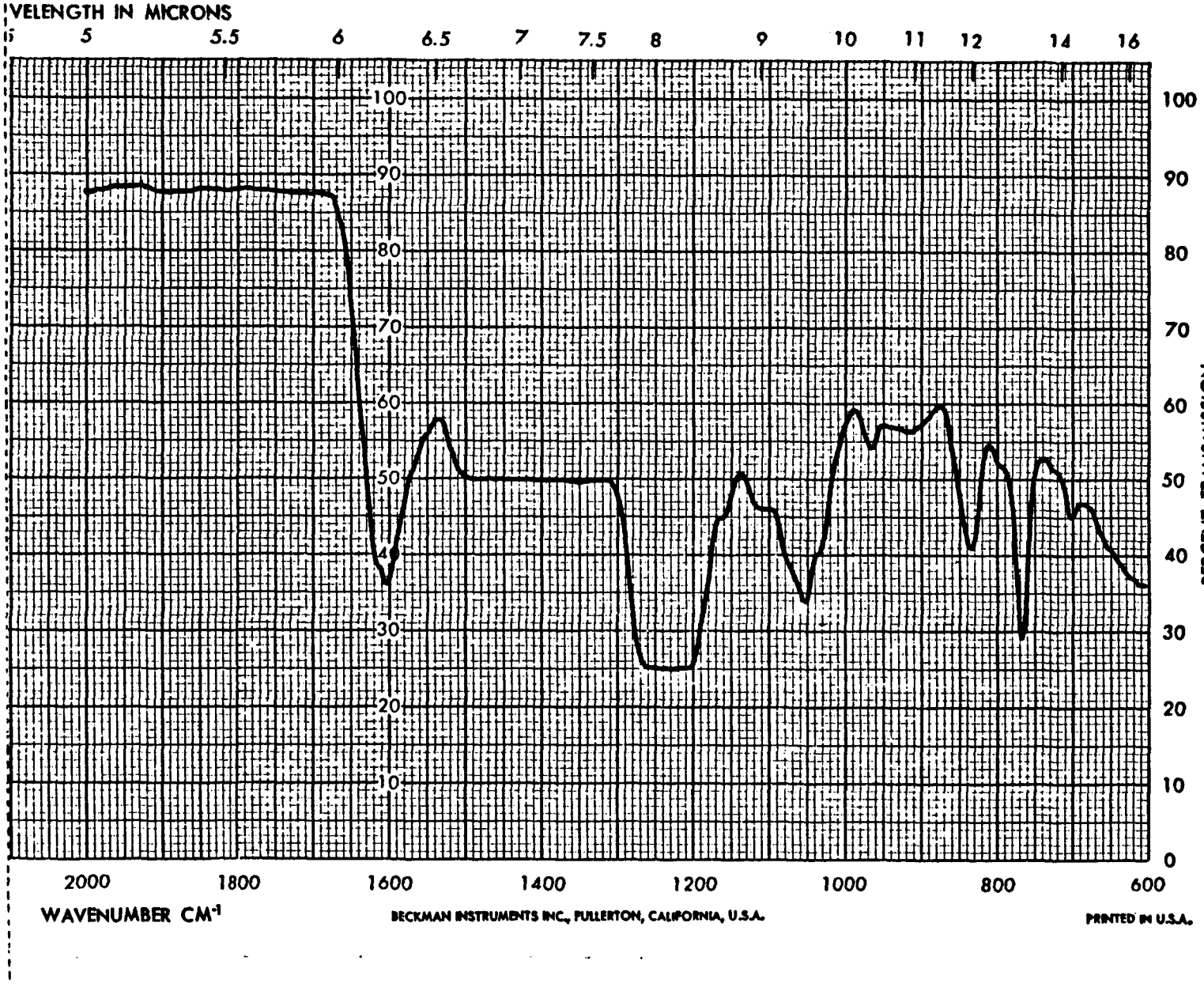


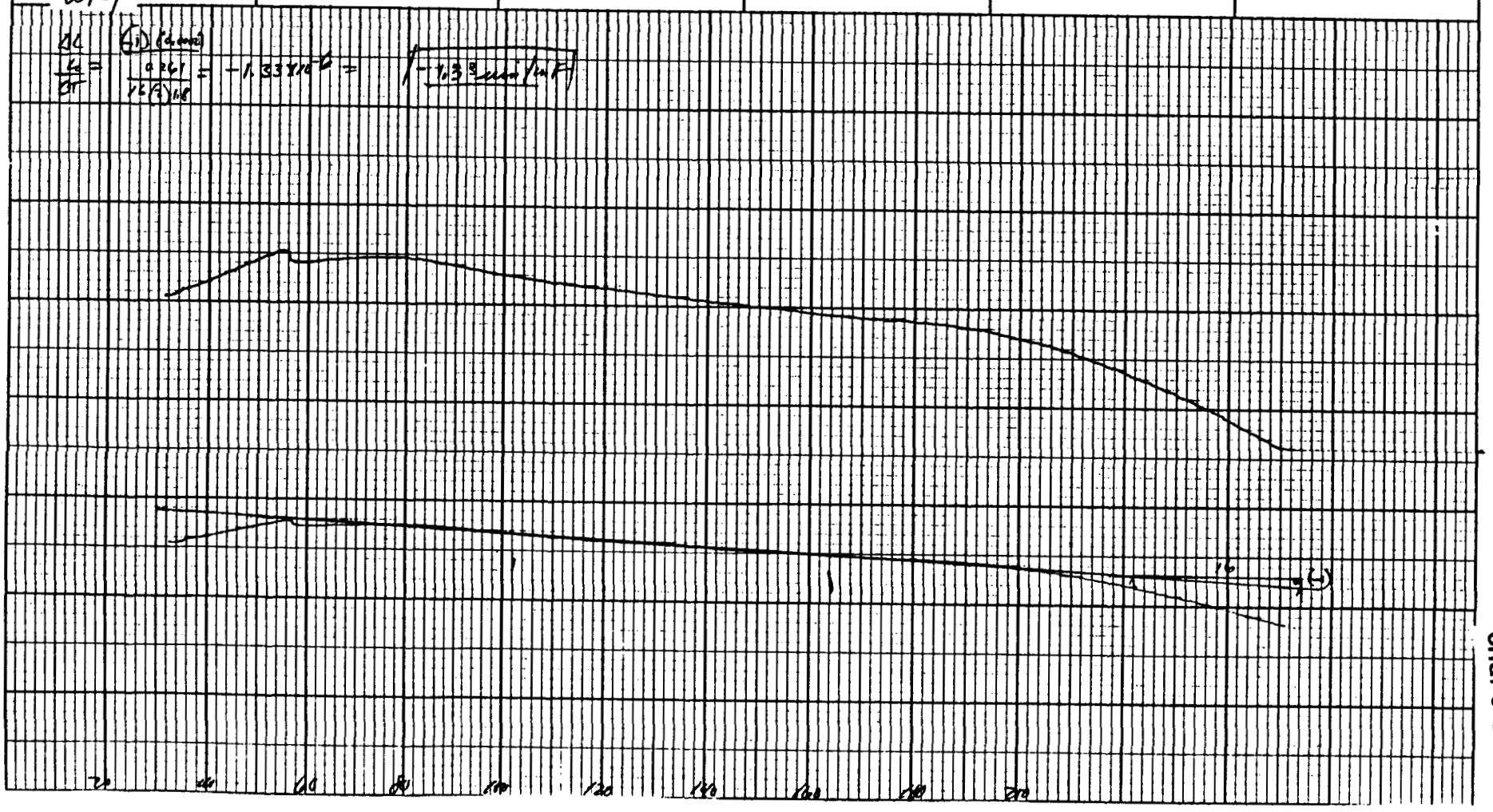
CHART 10D

PART NO. 990088

RUN NO ___ DATE 9/16/92	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in ~~30~~ 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
C0213 - 1 - Sample - (1)	HEAT ___ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.261	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

WPY

$\frac{\Delta L}{\Delta T} = \frac{0.261}{12.5 \times 10} = -1.33 \times 10^{-6} = \boxed{-1.33 \text{ mil/min}}$



MEASURED VARIABLE

DUPONT Instruments

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Chart 21A1

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DUPONT Instruments

MEASURED VARIABLE

PART NO. 990088-

RUN NO. ___ DATE 9/16/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/6.6	
SAMPLE: C02134-1-Sinter-(2)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ___ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.257	
FLOW RATE 3 SSCCM	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
w/Ply			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

$\frac{\Delta L}{L_0 \Delta T} = \frac{(2.1)(0.0062)}{0.257 \; 29(2)10} = -8.0 \times 10^{-5} = \boxed{-.80 \text{ mils/in °F}}$

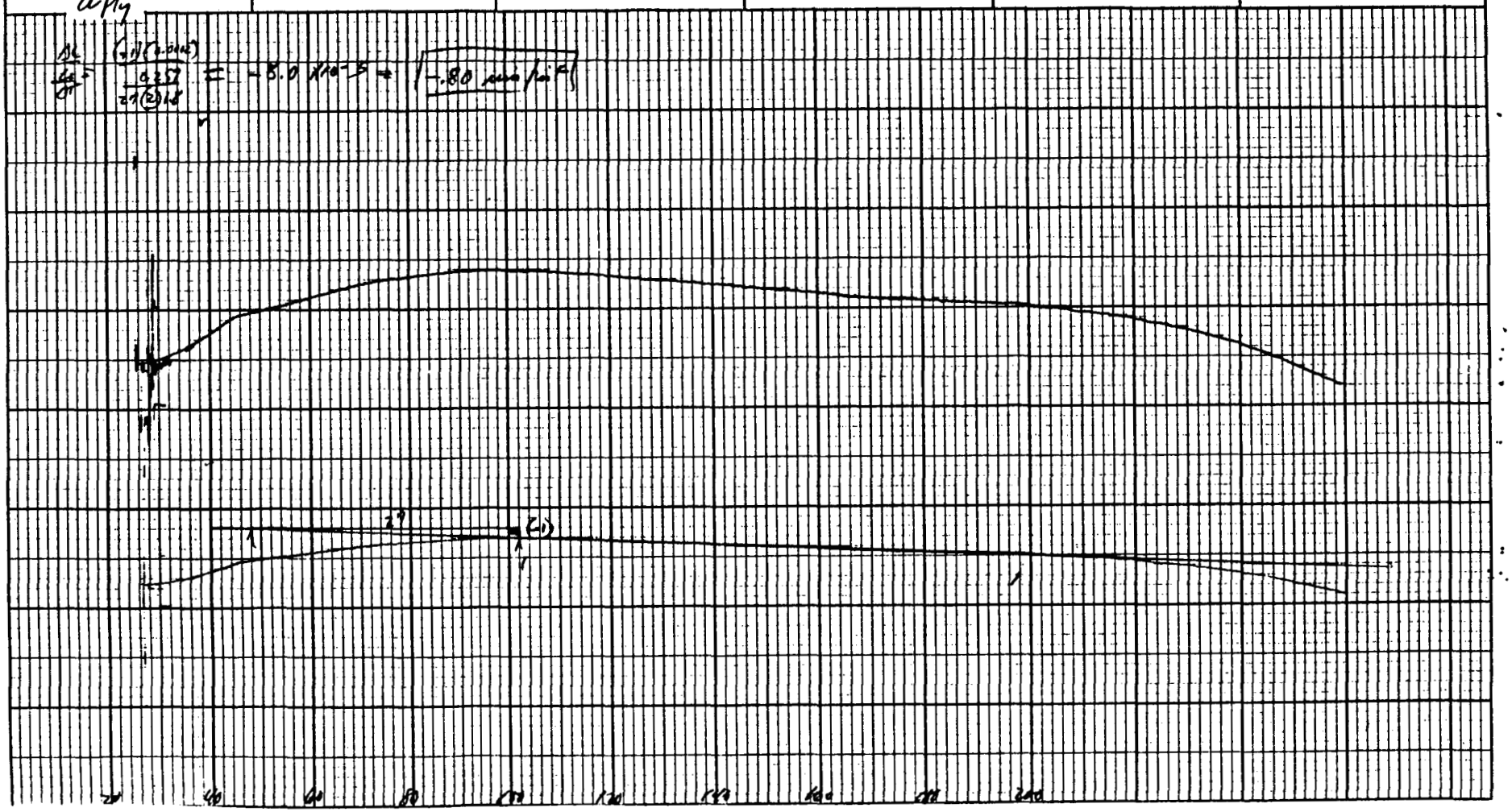

Chart 21A2

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PART NO. 990088

RUN NO. ___ DATE 9/16/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TD	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/1.2	
SAMPLE: CO2134-1-SMPLT-(4)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
ATM Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.124	
FLOW RATE 3-SCFH	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
			dY, (mg/min)/in	dY, (10X), (mils/min)/in	

MEASURED VARIABLE

DUPONT Instruments

Chart 21A3

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DUPONT Instruments

MEASURED VARIABLE

PART NO. 990088

RUN NO. ___ DATE 9/17/94	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in ~~80~~ 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/02	
SAMPLE: CO 2134-1-SMMT-(5)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.124	
FLOW RATE 3-5 SCFH	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
Xply			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

(for 1 mil)

$\frac{\Delta L}{L_0 \Delta T} = \frac{.126\,(\text{cm})}{\frac{0.124}{19.3}\,(2)\,16} = 4.73\times10^{-2} = \boxed{4.72\ \text{cm/in}\,°F}$

(for 185°C)

$= \frac{.126\,(\text{cm})}{\frac{0.124}{19.3}\,(2)\,18} = 5.29\times10^{-2} = \boxed{5.27\ \text{cm/in}\,°F}$

Chart 21A4

ORIGINAL PAGE IS OF POOR QUALITY

DUPONT Instruments

MEASURED VARIABLE

PART NO. 990088

RUN NO. ___ DATE 9/14/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR DH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: CO2134-1-END-(1)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
ATM AIR @ XP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.257	
FLOW RATE 3-5SCFH	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

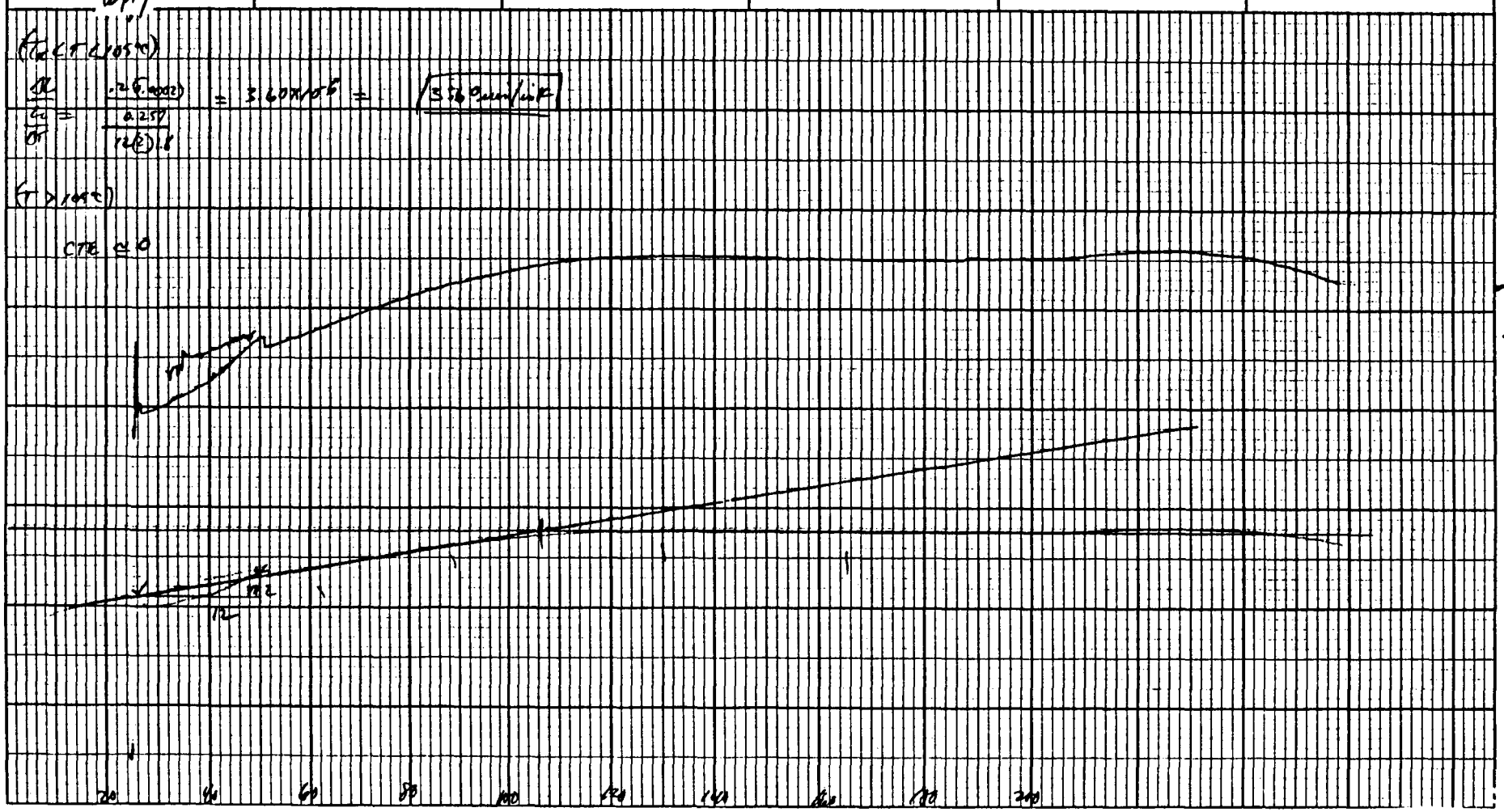

Chart 21B1

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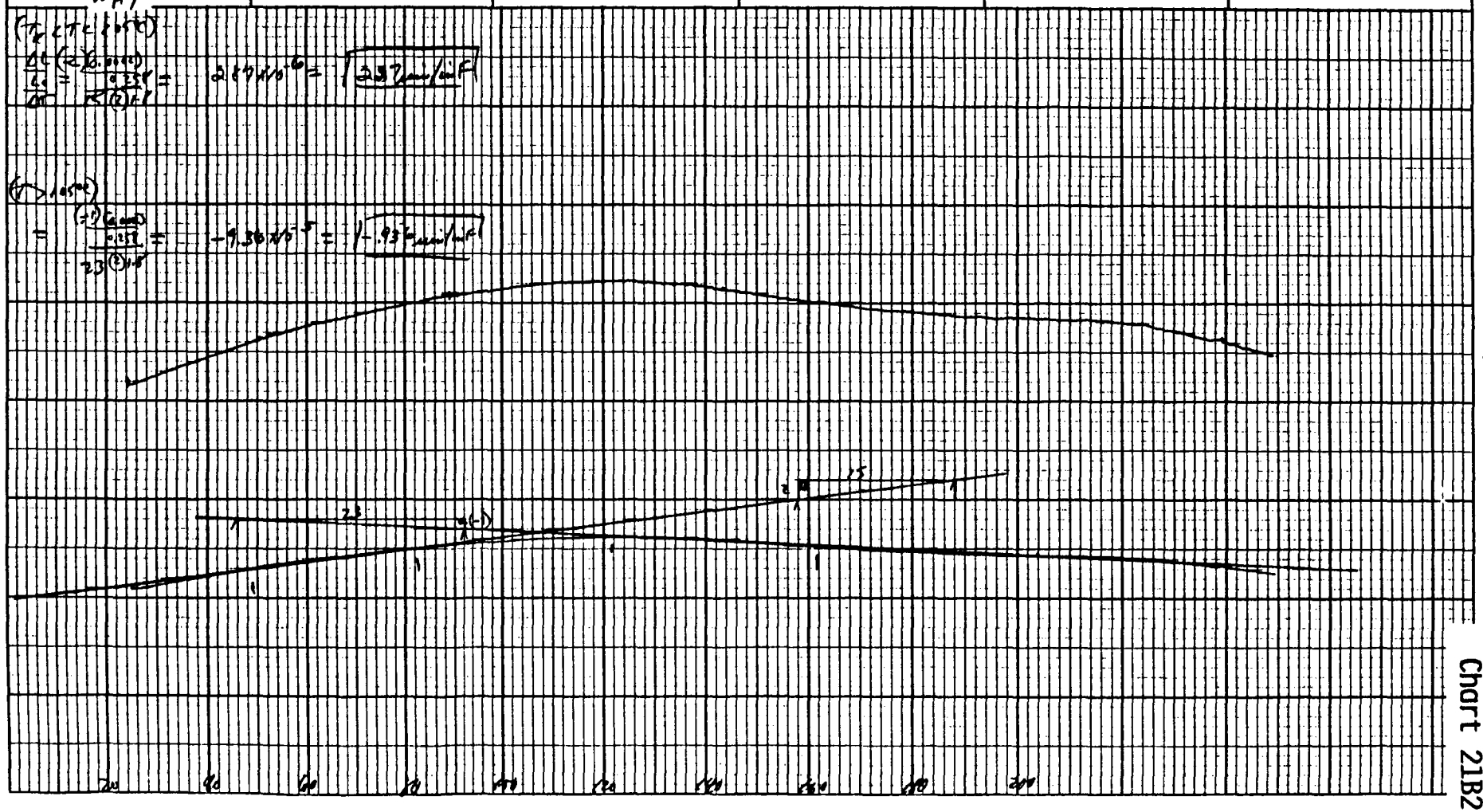
PART NO. 990088

	T-AXIS	DTA-DSC	TGA	TMA	
RUN NO. ___ DATE 9/17/84	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
OPERATOR TH	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
SAMPLE: CO2134-1-END-(2)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.258	
ATM Air @ 30	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	



MEASURED VARIABLE

du Pont Instruments

Chart 21B2

PART NO. 990088

RUN NO. ___ DATE 9/12/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR DJ	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/62	
SAMPLE: C02134-1E10-(4)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.131	
FLOW RATE 3-5 X4	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 60	
			dY, (mg/min)/in	dY, (10X), (mils/min)/in	

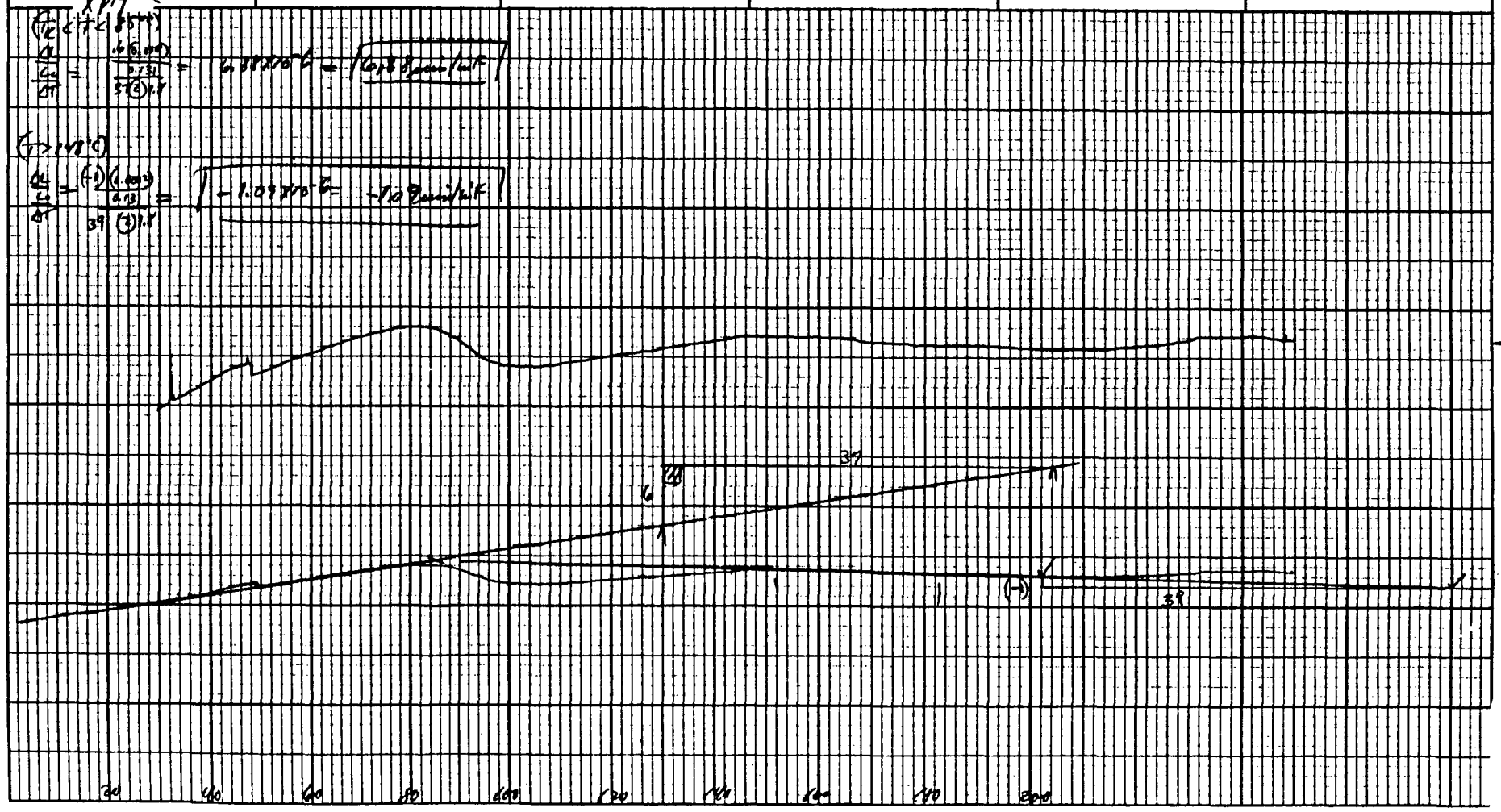
XPly

(T < 148°C)

$$\frac{\Delta L}{L\,\Delta T} = \frac{(+1)(0.0016)}{\frac{0.131}{5(2)}\,1.8} = 6.88\times10^{-6} = \boxed{6.88\ \text{ppm/°C}}$$

(T > 148°C)

$$\frac{\Delta L}{L\,\Delta T} = \frac{(-1)(0.0009)}{\frac{0.131}{39}\,(2)\,1.8} = \boxed{-1.09\times10^{-6} = -1.0\ \text{ppm/°C}}$$



MEASURED VARIABLE

DUPONT Instruments

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Chart 21B3

PART NO. 990088

	T-AXIS	DTA-DSC	TGA	TMA	
RUN NO. ___ DATE 9/17/86	SCALE, °C/in 50 10	SCALE, °C/in ___	SCALE, mg/in ___	SCALE, mils/in 0.1/0.2	
OPERATOR TH	PROG. RATE, °C/min 10	(mcal/sec)/in ___	SUPPRESSION, mg ___	MODE Expansion	
SAMPLE: CO 2134-1-END-(5)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg ___	WEIGHT, mg ___	SAMPLE SIZE 0.132	
ATM Air @ STP	SHIFT, in 0	REFERENCE ___	TIME CONST., sec ___	LOAD, g 10	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in ___	dY, (10X), (mils/min) /in ___	

XP14

(T < T_g (190°C))

$$\frac{\Delta L}{L_0 \Delta T} = \frac{\frac{1.56\,(0.0004)}{0.132}}{21(3)10^{-6}} = 1.0202\times10^{-3} = \boxed{1020\ \text{ppm/°F}}$$

(T > 190°C)

$$= \frac{\frac{1.26\,(0.0004)}{0.132}}{18(3)10^{-6}} = 4.6848\times10^{-6} = \boxed{4.68\ \text{ppm/°F}}$$

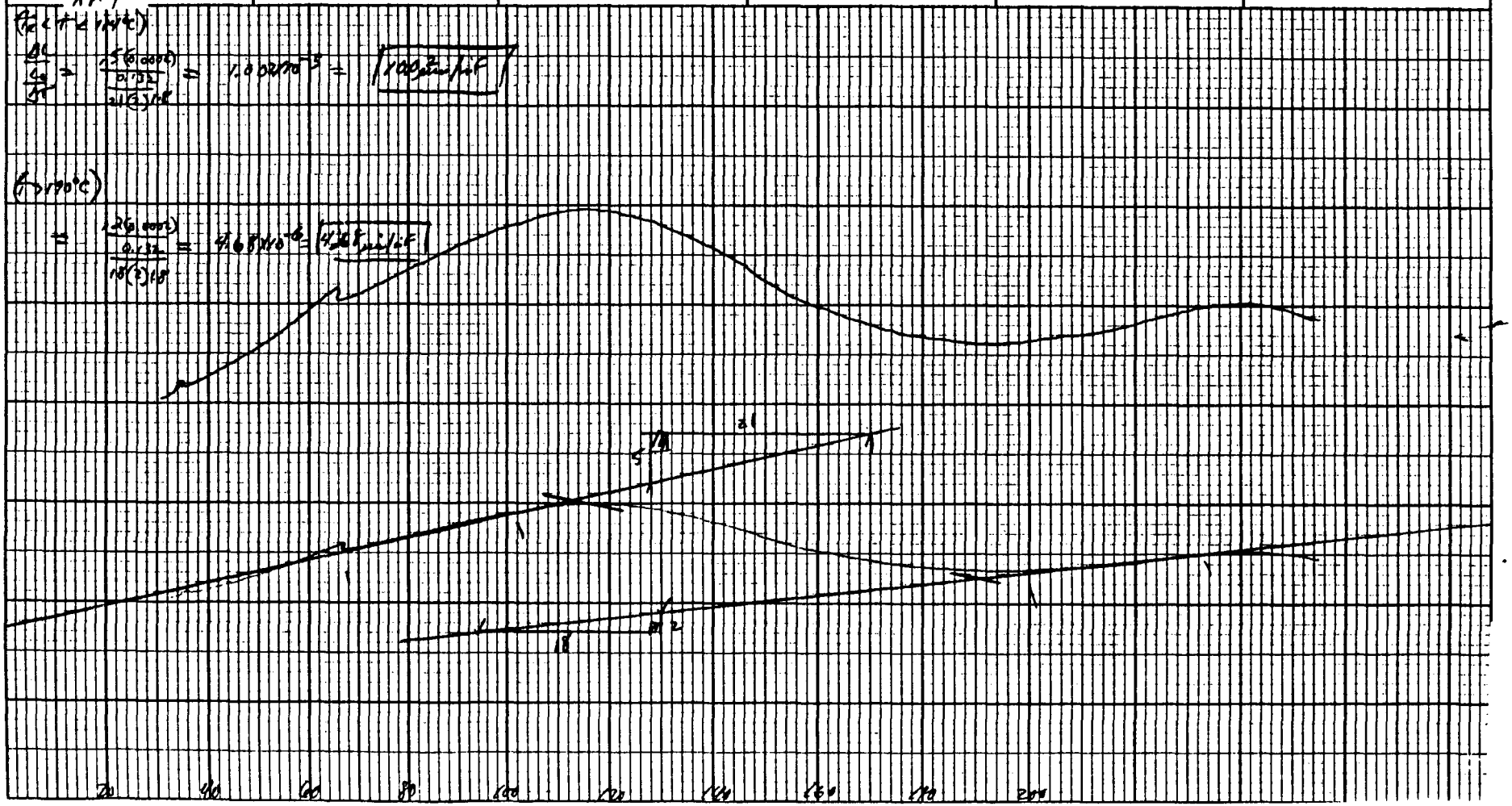

Chart 21B4

MEASURED VARIABLE

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MEASURED VARIABLE

PART NO. 990088

RUN NO. ___ DATE 9/20/80	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TA	SCALE, °C/in 50/70	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: C02134-2-STRAIN-(1)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
	HEAT / COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.262	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3.5 scfh			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

W p/y

(T < TC 92°C)

$\frac{\Delta L}{L_0 \Delta T} = \frac{9(0.002)}{0.262\ 23(2)1.8} = 3.39\ \mu in/in°F$

(T > 52°C)

CTE ≅ 0

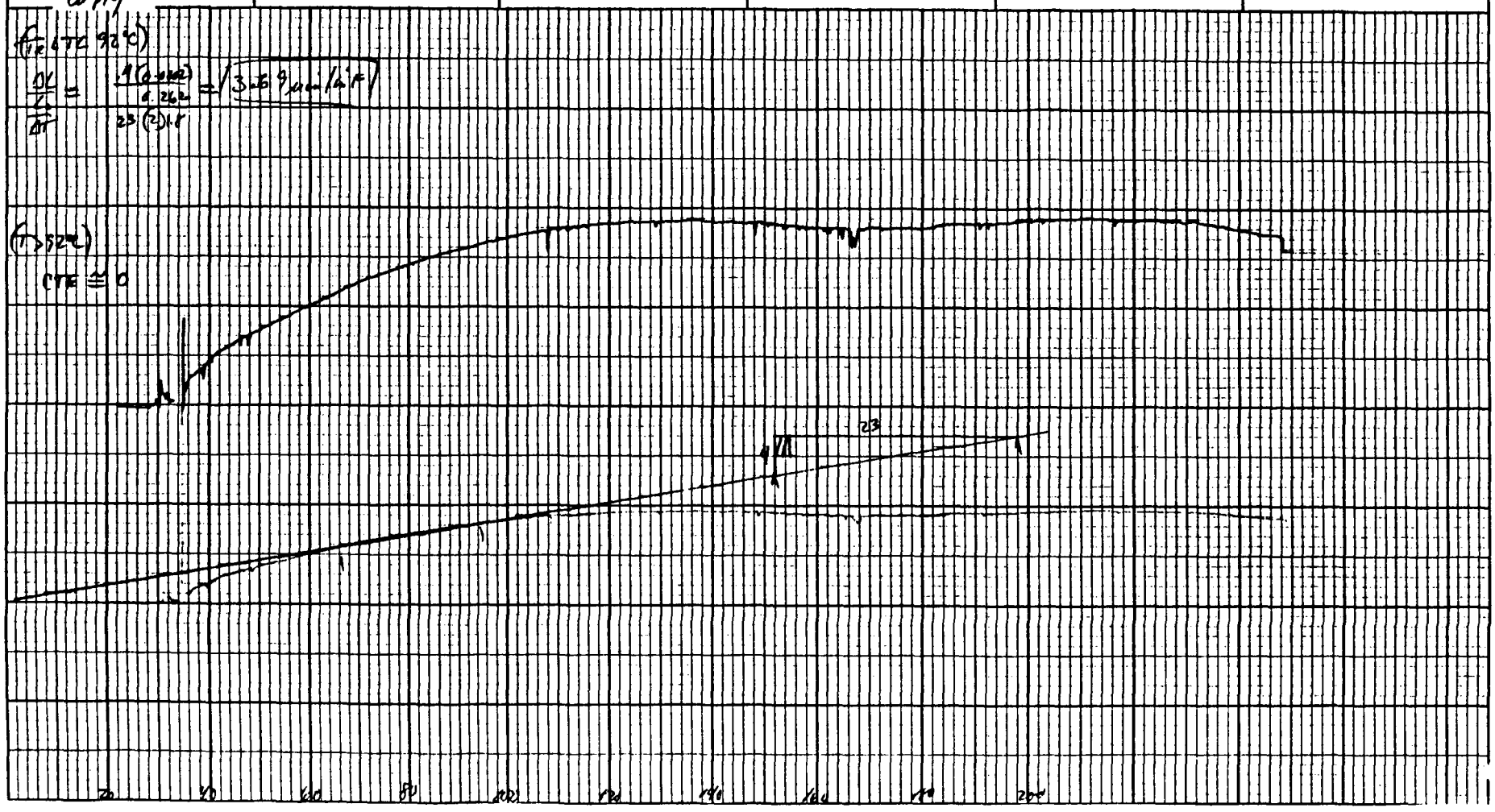

Chart 21C1

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Chart 21C2

PART NO. 990088

RUN NO. ___ DATE 9/20/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 50 V	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.1	
SAMPLE: C02134-2-SMART-(2)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.254	
ATM AIR @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5XCO			dY, (mg/min)/in	dY, (10X), (mils/min)/in	

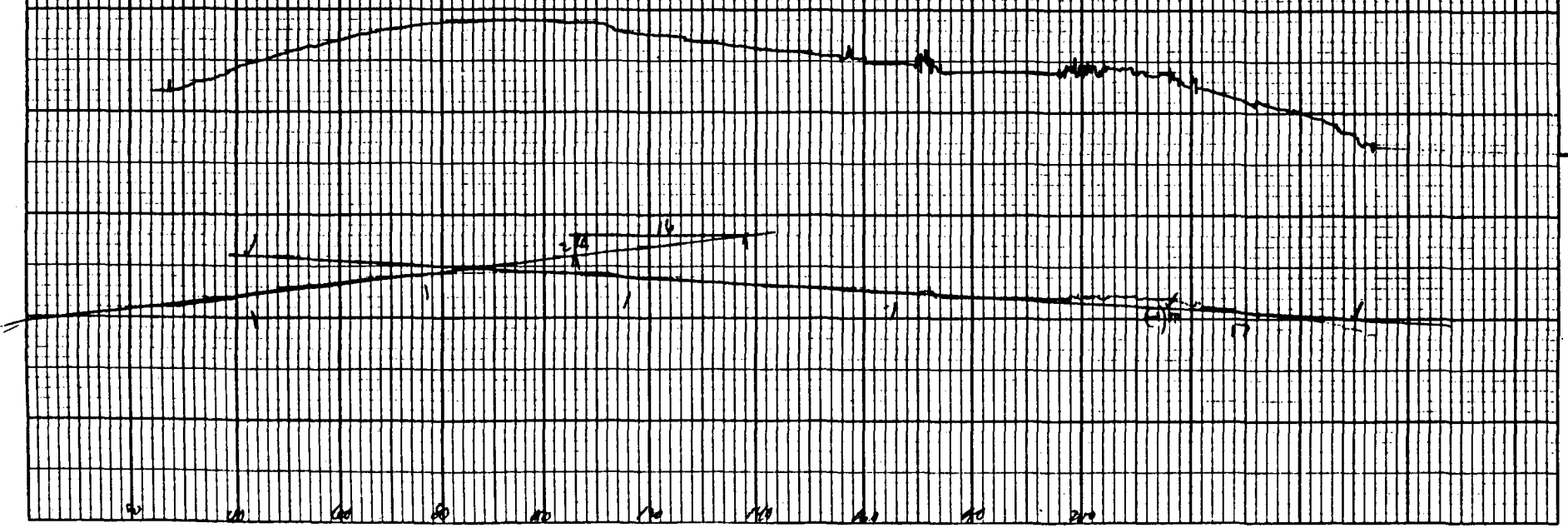
WPG

(T < 87°C)

$$\frac{\frac{dV}{V_0}}{dT} = \frac{\frac{(0.002)}{0.254}}{(T)(10)} = \boxed{3.73\ \mu in/in\,°F}$$

(T > 87°C)

$$= \frac{\frac{(T)(0.002)}{0.254}}{(T)(10)\,°F} = \boxed{1.02\ \mu in/in\,°F}$$



MEASURED VARIABLE _____

DuPont Instruments

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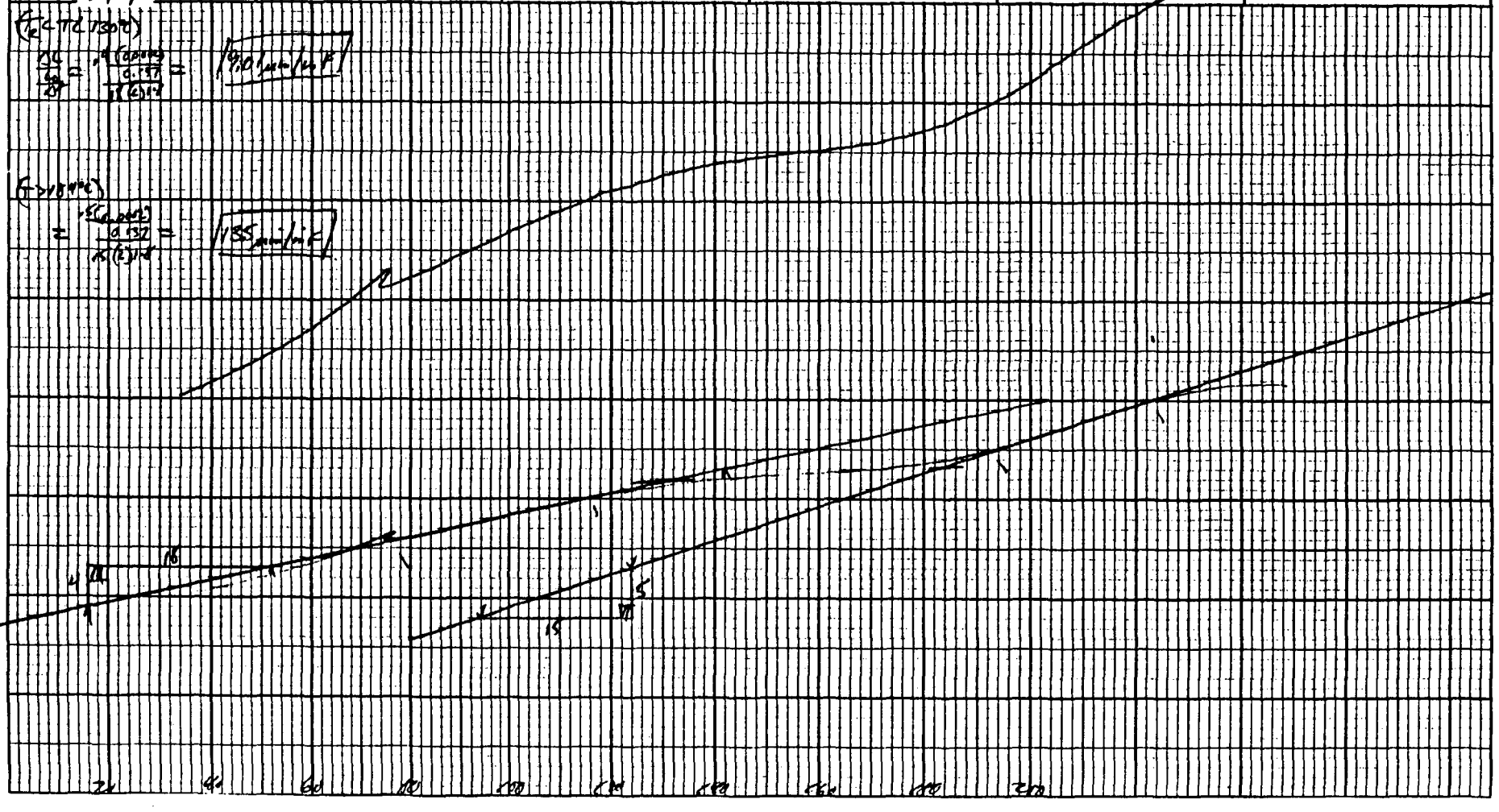
PART NO. 990088

RUN NO.___ DATE 9/17/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 30-20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
C02134-2-Sample-(4)	HEAT COOL ISO	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.137	
ATM Air @ Std	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 XCFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

Xply



MEASURED VARIABLE

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Chart 21C3

PART NO. 990088

RUN NO. ___ DATE 9/17/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: C02134-2-START-(5)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.137	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 1	
FLOW RATE 3-5SCCM			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

Xp/y

$\sqrt{\frac{\Delta L}{L}}$ (T+273°C)

$\frac{\Delta L}{L} = \frac{\frac{26\,(mils)}{0.137}}{18(2)18} = \sqrt{4.31\ \mu in/in\,°F}$

(72.75°C)

$= \frac{\frac{26\,(mils)}{0.137}}{24(2)18} = \sqrt{3.36\ \mu in/in\,°F}$

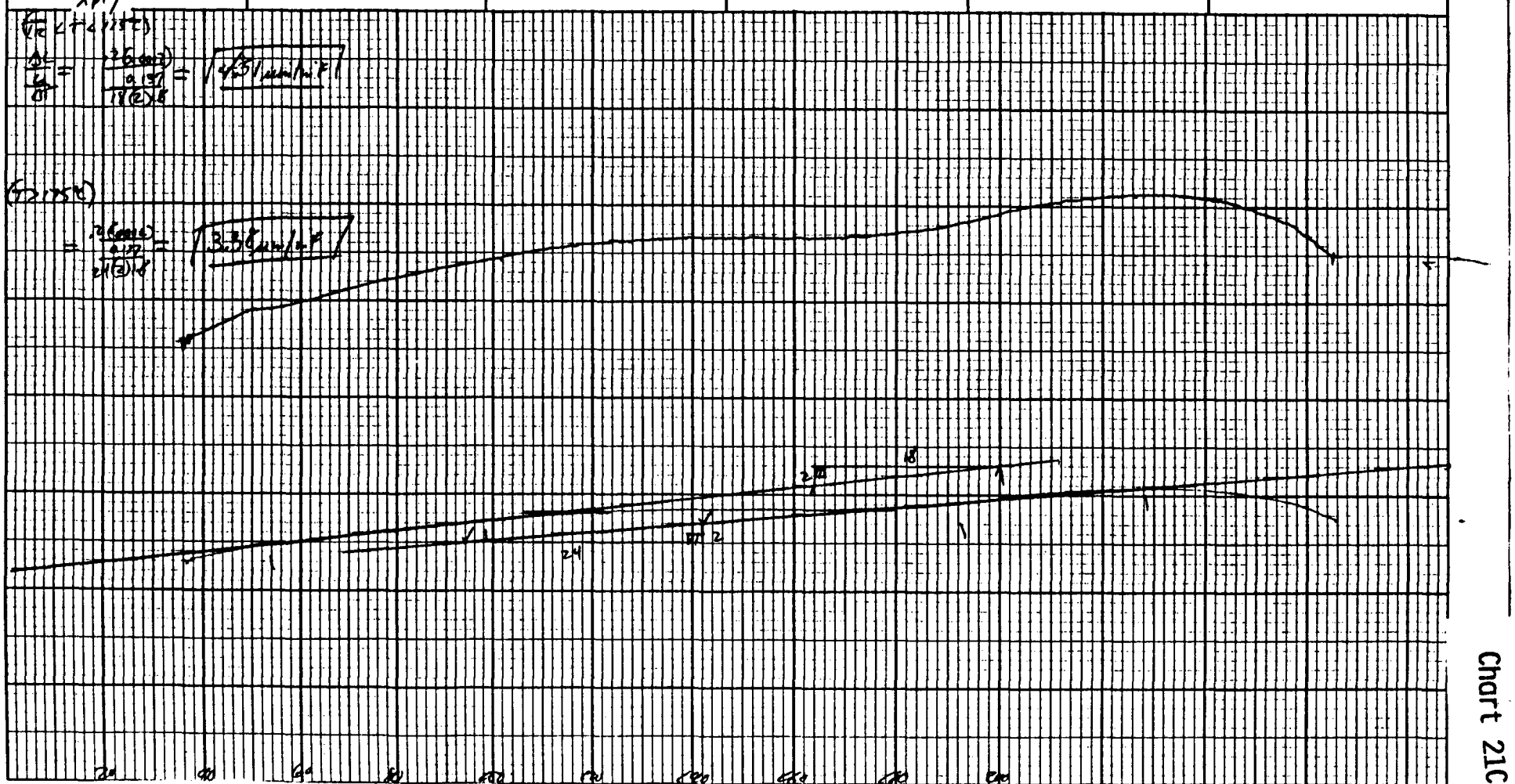

Chart 21C4

MEASURED VARIABLE

DUPONT Instruments

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DuPont Instruments

MEASURED VARIABLE

PART NO. 990088

RUN NO. ___ DATE 7/22/84 OPERATOR TLD SAMPLE: CO2134-2-FAND-(1) ATM Air @ 50P FLOW RATE 2-55LPM w/ply	T-AXIS SCALE, °C/in 20 PROG. RATE, °C/min 10 HEAT ✓ COOL ___ ISO ___ SHIFT, in 0	DTA-DSC SCALE, °C/in ___ (mcal/sec)/in ___ WEIGHT, mg ___ REFERENCE ___	TGA SCALE, mg/in ___ SUPPRESSION, mg ___ WEIGHT, mg ___ TIME CONST., sec ___ dY, (mg/min) /in ___	TMA SCALE, mils/in 6.1/62 MODE Expansion SAMPLE SIZE 0.258 LOAD, g 10 dY, (10X), (mils/min) /in ___	

(T < 72/102°C)

$\frac{\Delta l}{l_0} = \frac{(.26\,mm)}{(.258)(10)} = \boxed{1.39\,mm/in/°F}$

(T > 102°C)

$= \frac{.5(.0005)}{(.258)(60)(2)} = \boxed{1.08\,mm/in/°F}$

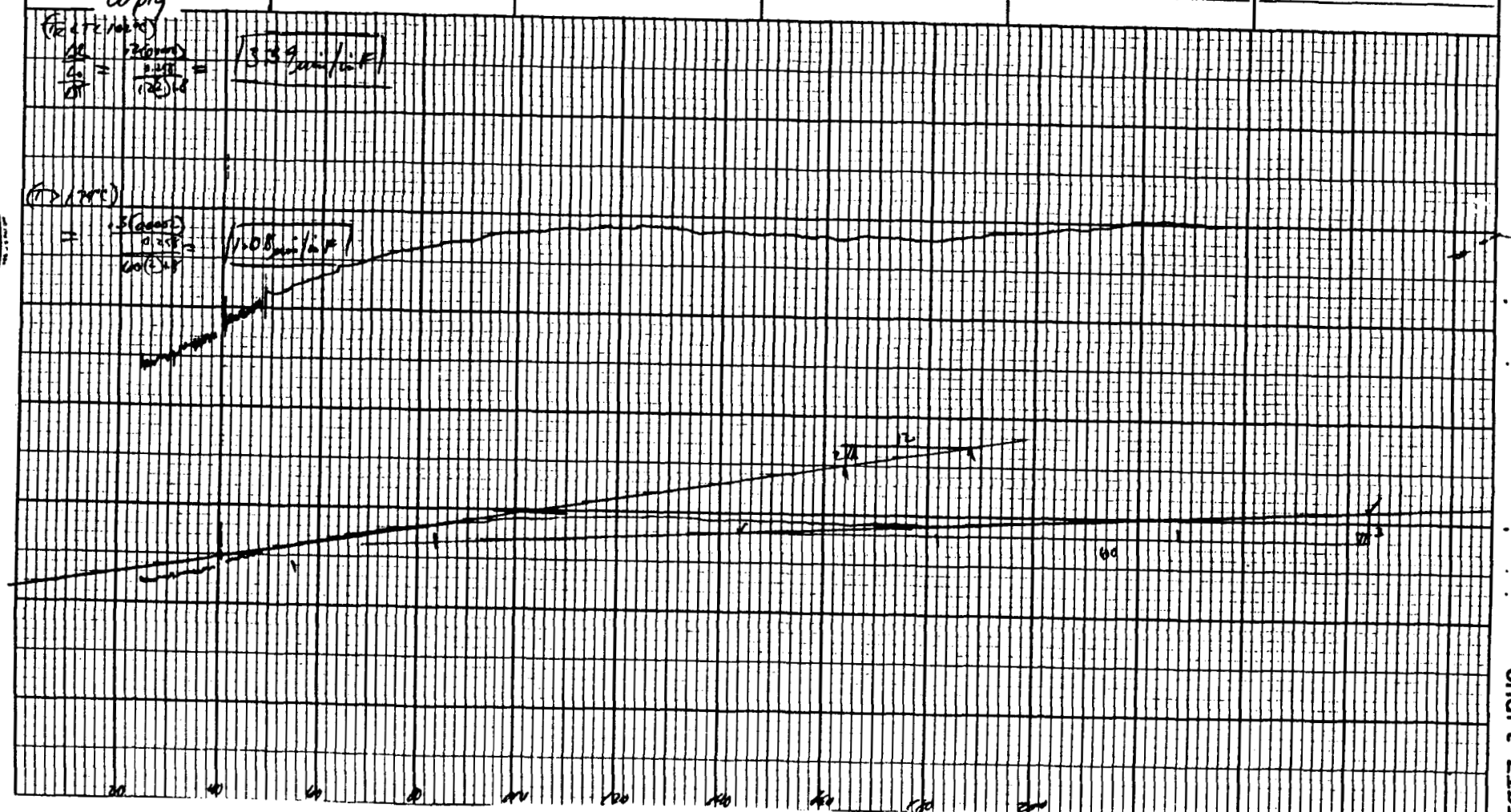

Chart 21D1

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PART NO. 990088

RUN NO. ___ DATE 9/22/92	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: CO2134-2-Exp-(2)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
	HEAT ___ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.256	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 1 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

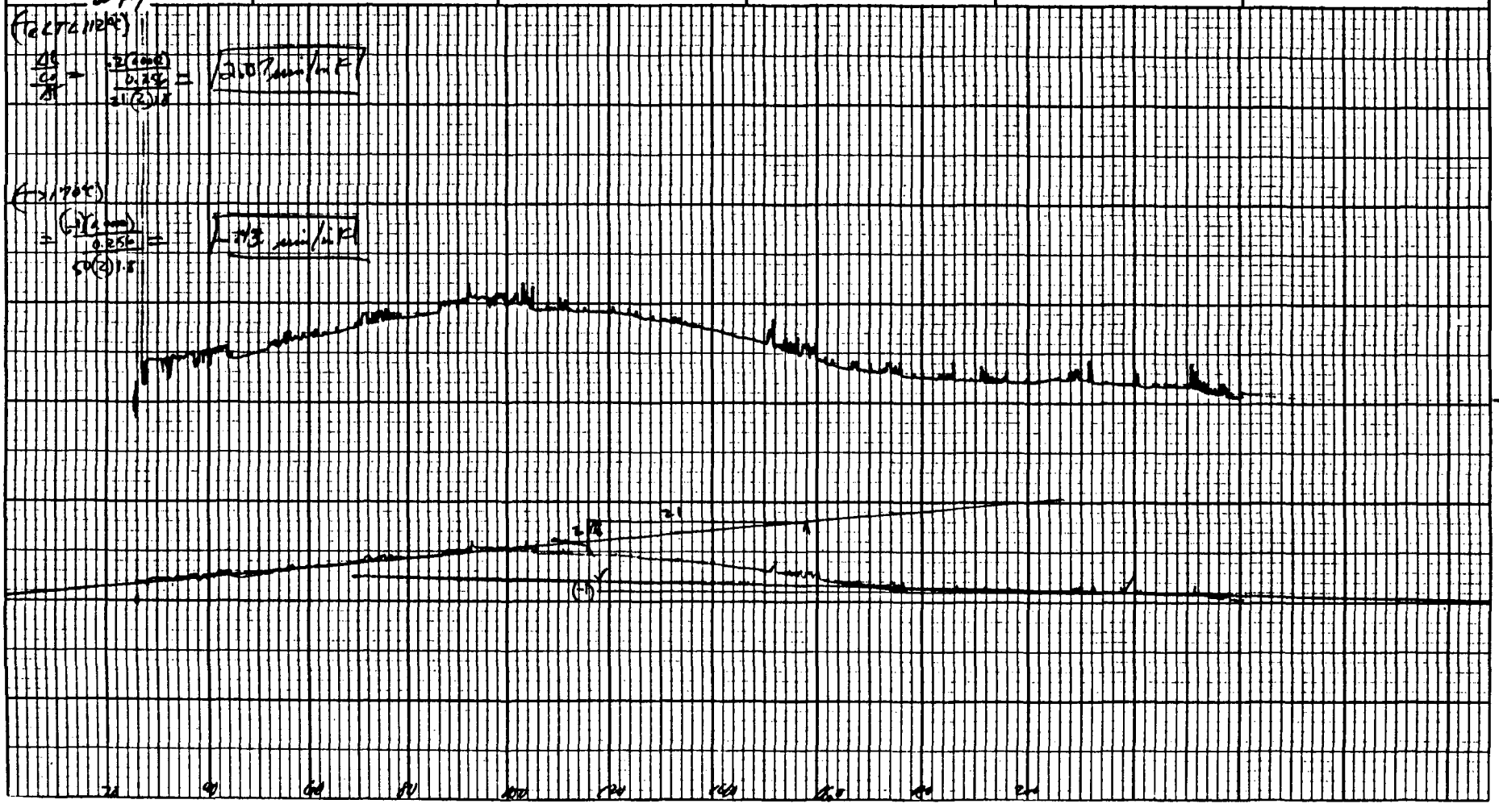
W ply

(T < 1120°C)

$\frac{\Delta l}{l_0 \Delta T} = \frac{.2(1000)}{\frac{0.256}{50(2)1.8}} = \boxed{2.07 \text{ mils/in °F}}$

(T > 1700°C)

$= \frac{(-.3)(1000)}{\frac{0.256}{50(2)1.8}} = \boxed{-2.93 \text{ mils/in °F}}$



DuPont Instruments

MEASURED VARIABLE

Chart 21D2

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DUPONT Instruments

MEASURED VARIABLE

PART NO. 990088

RUN NO. ___ DATE 9/17/82	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR DH	SCALE, °C/in 5020	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: C02134-2-FLD-(4)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
ATM. Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.132	
FLOW RATE 3-5 SCFH	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

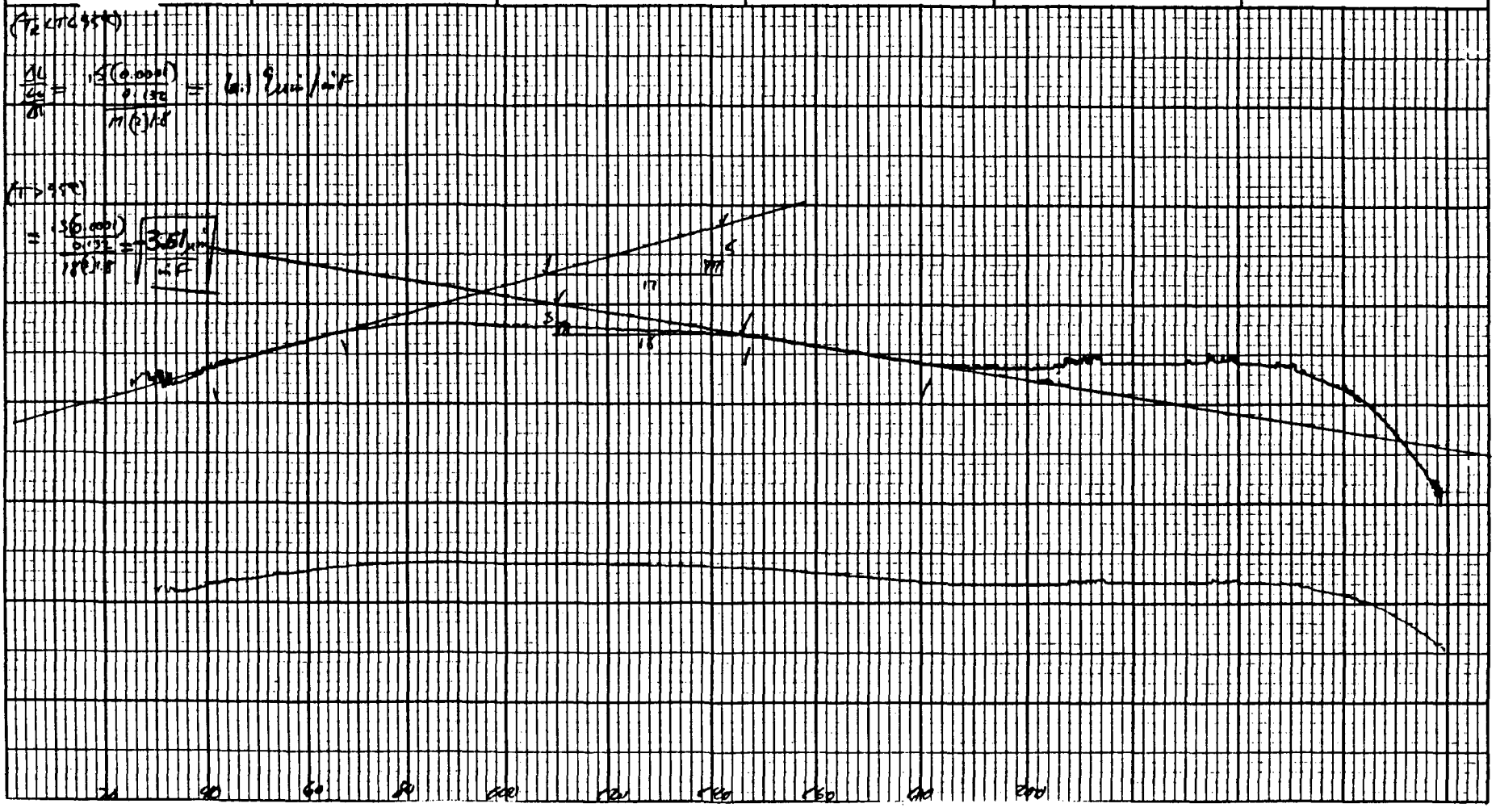

Chart 21D3

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DUPONT Instruments

MEASURED VARIABLE

PART NO. 990088

RUN NO. ___ DATE 9/17/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 6·1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
C02134-2-END-(5)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.132	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 X 90			dY, (mg/min)/in	dY, (10X), (mils/min)/in	

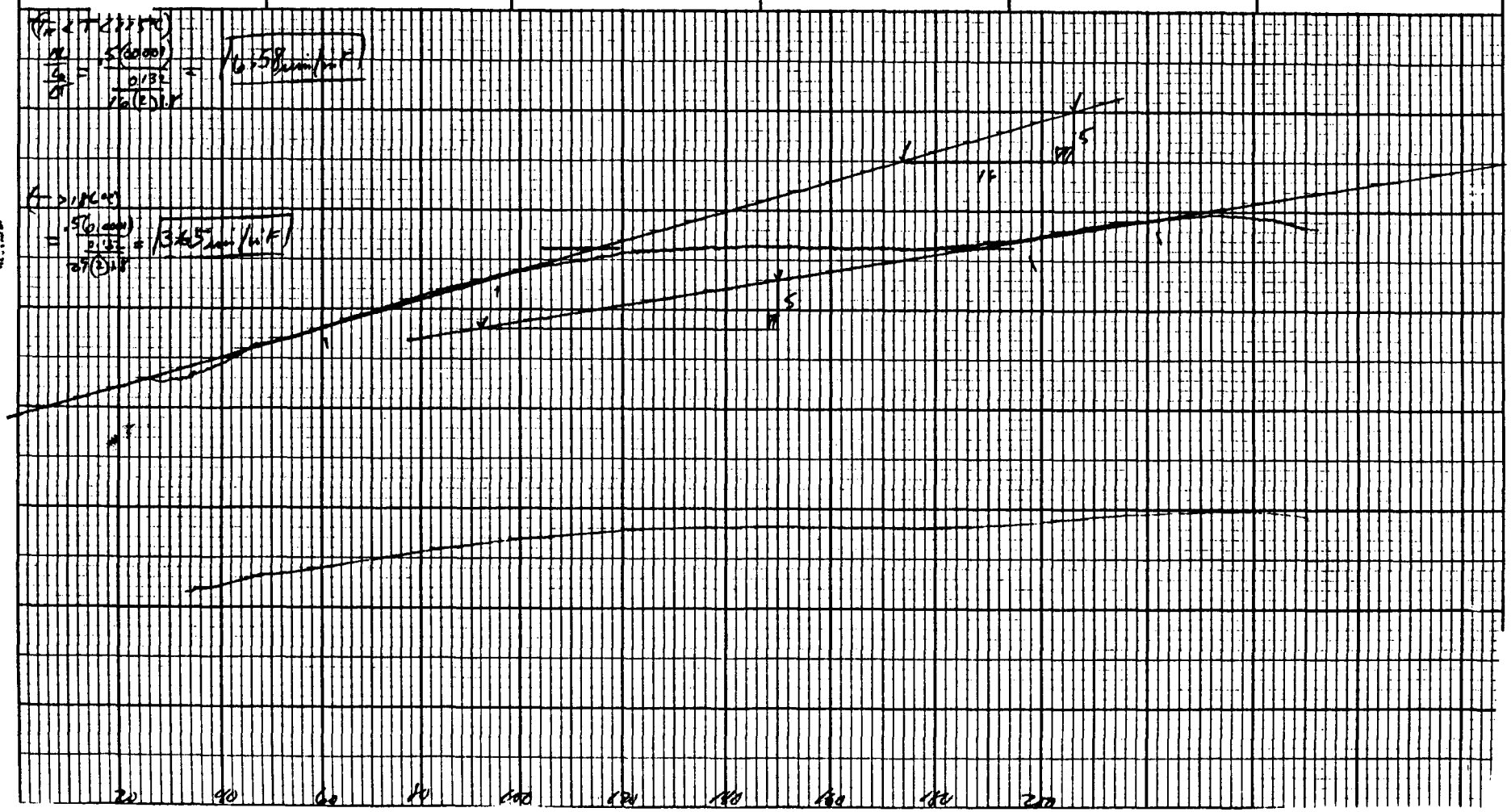

Chart 21D4

TABLE OF CONTENTS

FILLER TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

Filler Lot for NASA Lot# 2

TEST		PAGE
1.	Carbon Content	1
2.	Ash Content	1
3.	Atomic Absorption	1
3a.	Moisture Content	1
3b.	Ash Content	1
4.	pH	1
5.	Particle Size, S.E.M. procedure	1
6a.	TGA, °C at 50% Loss	1
6b.	TGA	2
7.	Particle Size Distribution	2
7a.	Particle Size, Horiba	2

CHARTS

TGA..... 6A - 6C

Particle Size Distribution..... 7A - 7C

U.S. Polymeric

FILLER TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

Filler Lot for NASA Lot# 2

1. Carbon Content, %
   QAI-5560

	SAMPLE #2A-1	#2A-2	#2A-3
	99.31	99.18	99.40
NASA LOT# 2		AVERAGE	99.30

2. Ash Content, %
   PTM-71B

	0.0	0.0	0.0
	0.0	0.0	0.0
AVG.	0.0	0.0	0.0
NASA LOT# 2		AVERAGE	0.0

3. Atomic Absorption, ppm
   CTM-53B
   (Values are average of 2 determinations)

	#2A-1	#2A-2	#2A-3	LOT#2 AVG.
Na	7.0	7.5	9.0	7.8
K	1.5	1.0	2.5	1.7
Ca	2.5	1.5	2.0	2.0
Mg	0.0	0.0	0.0	0.0
Li	0.0	0.0	0.0	0.0
TOTAL	11.0	10.0	13.5	11.5

3a. Moisture Content, %
   CTM-53B

	.041	.034	.039
	.031	.020	.045
AVG.	.036	.027	.042
NASA LOT# 2		AVERAGE	.035

3b. Ash Content, %
   CTM-53B

	0.005	0.000	0.015
	0.000	0.025	0.000
AVG.	0.003	0.013	0.008
NASA LOT# 2		AVERAGE	0.008

4. pH, Units
   ASTM D1512

	4.60	4.40	4.50
	4.60	4.60	4.70
AVG.	4.60	4.50	4.60
NASA LOT# 2		AVERAGE	4.57

5. Particle Size, microns
   S.E.M. procedure
   (Average values are of 20 determinations)

AVG.	.56	.57	.52
Maximum	.90	1.25	1.17
Minimum	.23	.20	.25
Std. Dev	.22	.28	.24
NASA LOT# 2 AVERAGE SIZE			.55

6a. TGA, °C at 50% Loss
   CTM-51

	842	850	857
NASA LOT# 2		AVERAGE	850

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

Filler Lot for NASA Lot# 2

6b. TGA
CTM-51

See Charts 6A-6C

7. Particle Size Distribution
CTM-72

See Charts 7A-7C

7a. Particle Size, microns
CTM-72

	#2A-1	#2A-2	#2A-3
	.86	.97	.95
	.85	1.08	.92
AVG.	.86	1.02	.94
NASA LOT# 2		AVERAGE	.94

U.S. Polymeric

Hamid M. Qureishi, Manager
Quality Assurance Department

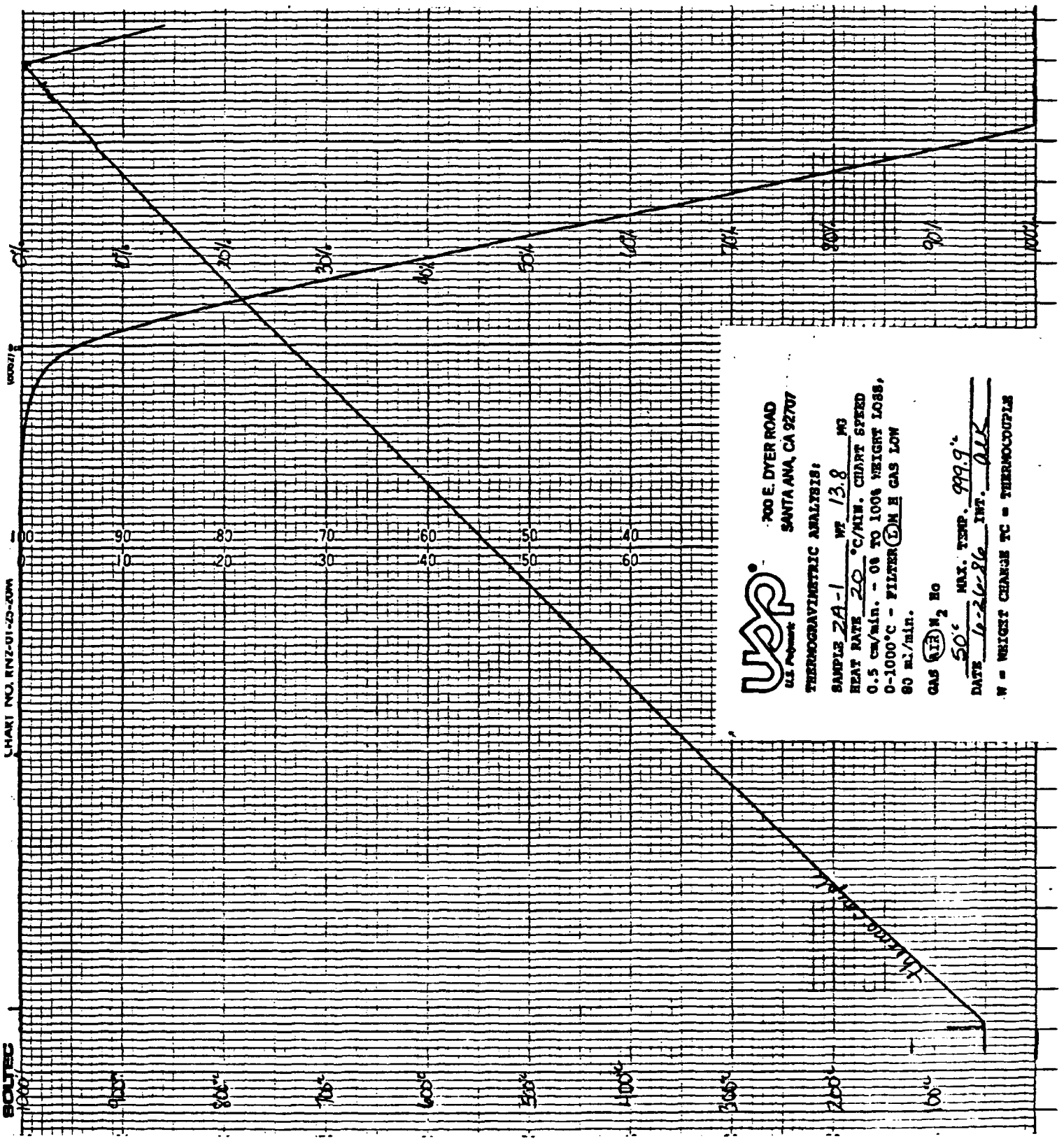

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CHART 6B

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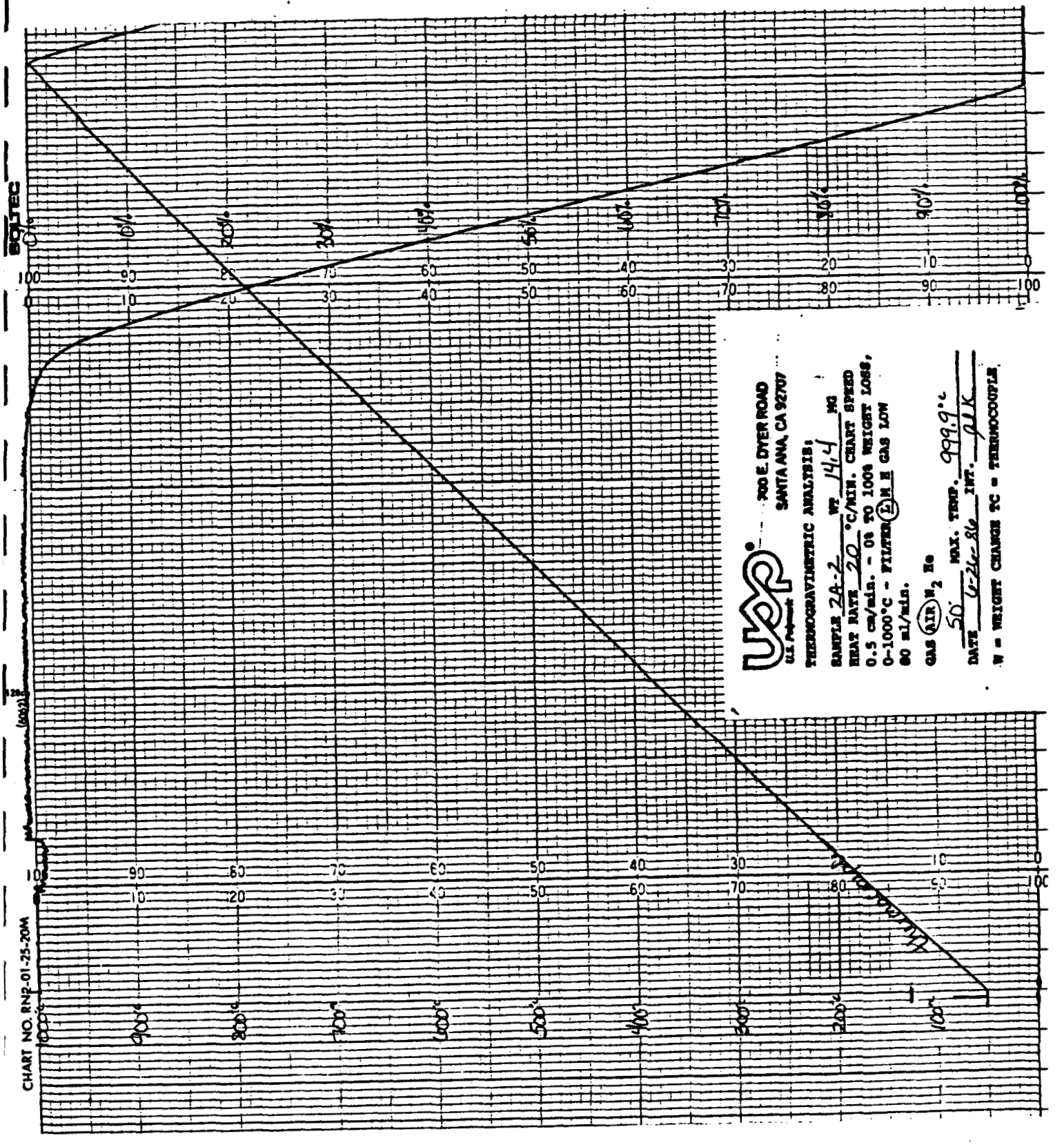

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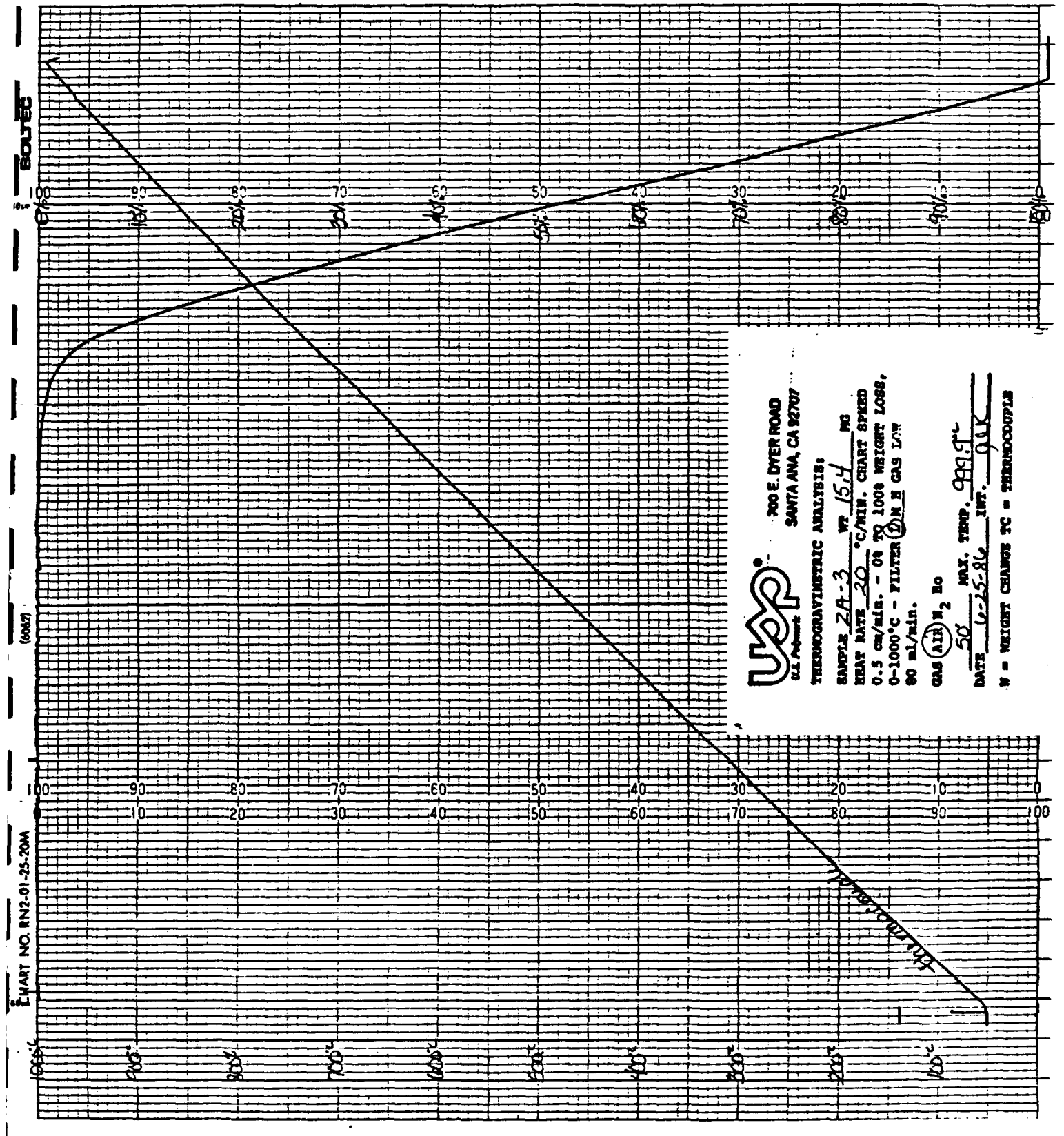


HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-24-86
#1 SAMPLE NASA LOT#2A-1
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

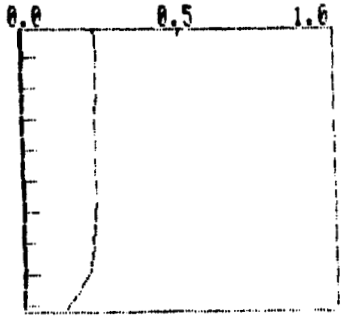
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

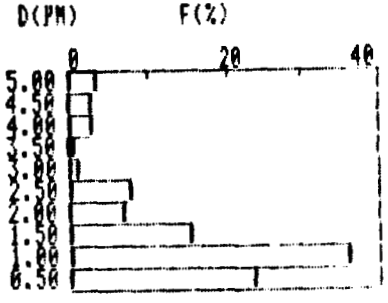


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	3.3	3.3
4.50-4.00	2.6	5.9
4.00-3.50	2.7	8.7
3.50-3.00	0.5	9.2
3.00-2.50	0.9	10.0
2.50-2.00	7.8	17.8
2.00-1.50	7.0	24.7
1.50-1.00	15.2	39.9
1.00-0.50	36.1	76.0
0.50-0.00	24.0	100.0

D(AVE) 0.86 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#2A-1
Sample #1

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HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-24-86
#2 SAMPLE NASA LOT#2A-1
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

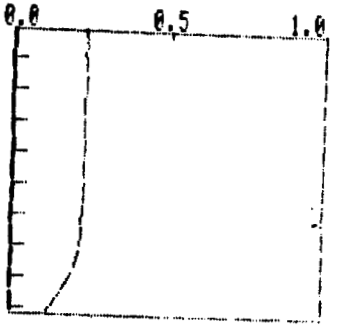
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

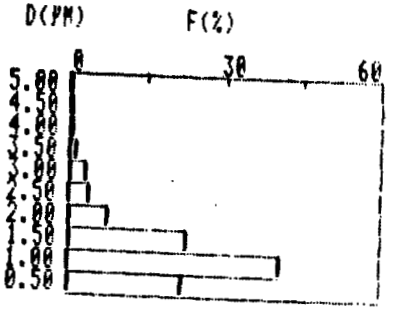


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.0	0.0
3.50-3.00	1.1	1.1
3.00-2.50	3.0	4.1
2.50-2.00	3.8	7.8
2.00-1.50	7.4	15.2
1.50-1.00	22.4	37.6
1.00-0.50	40.8	78.3
0.50-0.00	21.7	100.0

D(AVE) 0.85 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#2A-1
Sample#2

CHART 7A

HORIBA CAPA-500
PARTICLE ANALYZER

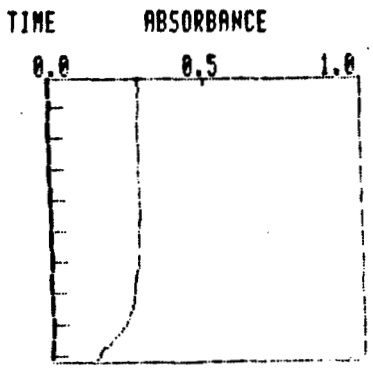
DATE 5-24-86
#1 SAMPLE NASA LOT#2A-2
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

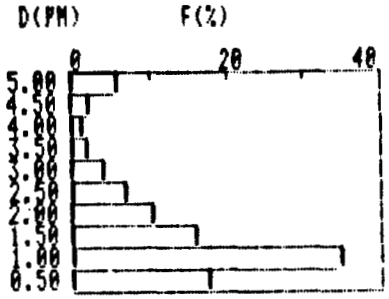


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	5.7	5.7
4.50-4.00	2.2	7.9
4.00-3.50	1.2	9.1
3.50-3.00	1.7	10.8
3.00-2.50	4.0	14.8
2.50-2.00	6.7	21.5
2.00-1.50	10.2	31.7
1.50-1.00	16.0	47.7
1.00-0.50	34.8	82.5
0.50-0.00	17.5	100.0

D(AVE) 0.97 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#2A-2
Sample#1

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HORIBA CAPA-500
PARTICLE ANALYZER

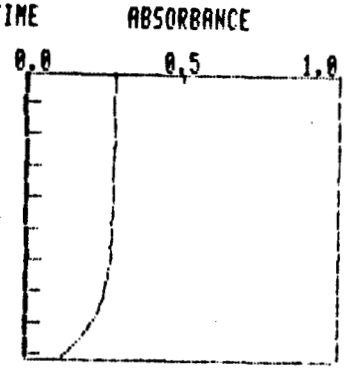
DATE 5-24-86
#2 SAMPLE NASA LOT#2A-2
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

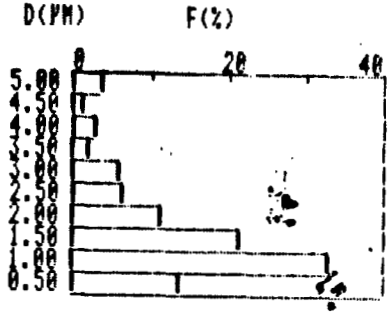


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	3.5	3.5
4.50-4.00	1.0	4.5
4.00-3.50	2.8	7.3
3.50-3.00	2.0	9.3
3.00-2.50	5.7	14.9
2.50-2.00	6.1	21.0
2.00-1.50	11.2	32.2
1.50-1.00	21.2	53.5
1.00-0.50	33.0	86.4
0.50-0.00	13.6	100.0

D(AVE) 1.08 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#2A-2
Sample#2

CHART 7B

HORIBA CAPA-500
PARTICLE ANALYZER

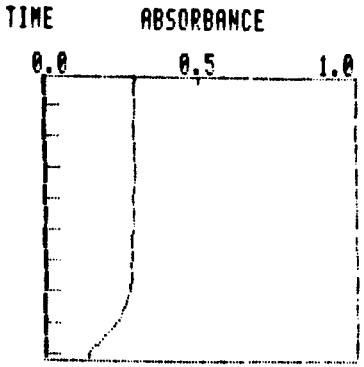
DATE 5-24-86
#1 SAMPLE NASA LOT#2A-3
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (μM)
D(MIN)	0.01(μM)
D(DIV)	0.50(μM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

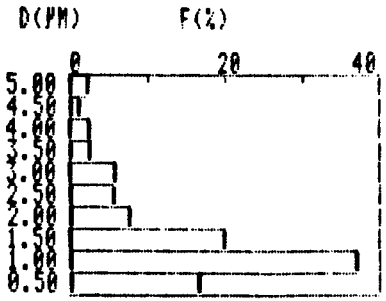


* DISTRIBUTION TABLE (BY VOL.)

D(μM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	2.0	2.0
4.50-4.00	0.9	2.9
4.00-3.50	2.3	5.2
3.50-3.00	2.2	7.5
3.00-2.50	5.7	13.2
2.50-2.00	5.6	18.8
2.00-1.50	7.5	26.3
1.50-1.00	19.9	46.2
1.00-0.50	37.2	83.4
0.50-0.00	16.6	100.0

D(AVE) 0.95 (μM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#2A-3
Sample #1

HORIBA CAPA-500
PARTICLE ANALYZER

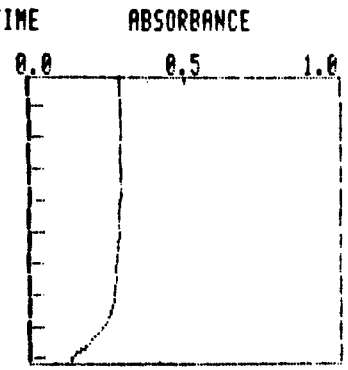
DATE 5-24-86
#2 SAMPLE NASA LOT#2A-3
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (μM)
D(MIN)	0.01(μM)
D(DIV)	0.50(μM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

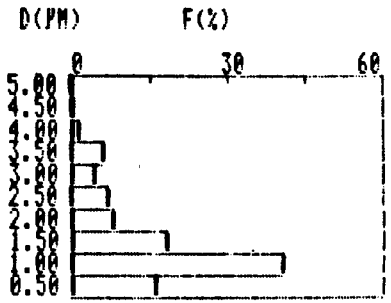


* DISTRIBUTION TABLE (BY VOL.)

D(μM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	1.1	1.1
3.50-3.00	5.8	6.9
3.00-2.50	4.1	11.1
2.50-2.00	6.9	18.0
2.00-1.50	7.7	25.7
1.50-1.00	17.8	43.4
1.00-0.50	40.7	84.1
0.50-0.00	15.9	100.0

D(AVE) 0.92 (μM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#2A-3
Sample#2

CHART 7C

TABLE OF CONTENTS

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 2

TEST		PAGE
1.	Resin Solids	1
2.	Specific Gravity	1
3.	Brookfield Viscosity	1
4.	Gel Time	1
5.	Atomic Absorption	1
6.	Gas Chromatography	1
7.	TGA	1
8.	DSC	1
9.	HPLC	1
10.	GPC	1
11.	pH	2
12.	Phenol Content	2
13.	Chang's Index	2
14.	RDS	2
15.	NMR	2

CHARTS

Gas Chromatography	6A - 6B
TGA	7A - 7B
DSC	8A - 8B
HPLC	9A - 9B
GPC	10A - 10B
RDS	14A - 14B
NMR	15A - 15B

U.S. Polymeric

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 2

		#2-1	#2-2	
1. Resin Solids, % PTM-7C		78.8	78.7	
		78.7	79.3	
		79.1	79.6	
	AVG.	78.9	79.2	
	Lot# 2	AVERAGE	79.1	
2. Specific Gravity @ 25°C PTM-29C		1.189	1.193	
	Lot# 2	AVERAGE	1.191	
3. Viscosity, Brookfield, cps. @ 22.8°C PTM-14C		17,400	16,800	
	Lot# 2	AVERAGE	17,100	
4. Gel Time, min:sec PTM-47B		4:00	4:20	
	Lot# 2	AVERAGE	4:10	
5. Atomic Absorption, ppm CTM-53B (Values are averages of four determinations)		#2-1	#2-2	LOT2 AVG
	Na	25.0	20.8	22.9
	K	1.0	0.5	0.8
	Ca	7.5	7.0	7.3
	Mg	2.0	2.0	2.0
	Li	0.0	0.0	0.0
	AVG.	35.5	30.3	32.9
6. Volatiles, Gas Chromatography CTM-55		See Charts 6A-6B		
7. TGA, % Weight Loss at 500°C CTM-51 (AIR)		39.4	38.2	
	Lot# 2	AVERAGE	38.8	
		See Chart 7A-7B		
8. DSC, temperature °C CTM-50A		190	189	
	Lot# 2	AVERAGE	190	
		See Chart 8A-8B		
9. HPLC CTM-49A		See Chart 9A-9B		
10. GPC, Average molecular wt. CTM-49A		1800	1631	
	Lot# 2	AVERAGE	1716	
		See Chart 10A-10B		

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2407

USP-39A Resin Lot for NASA Lot# 2

11. pH, units
    CTM-1B

	#2-1	#2-2
	8.4	8.5
Lot# 2 AVERAGE		8.5

12. Phenol Content, %
    CTM-55 Appendix 1

	13.29	13.65
	12.94	13.31
AVG.	13.12	13.48
Lot# 2 AVERAGE		13.30

13. Chang's Index, ml.
    CTM-5B

	23.6	23.8
Lot# 2 AVERAGE		23.7

14. RDS, Minimum Viscosity, cps.
    CTM-57A

	Min. Visc.	°C
#2-1	172	114
#2-2	124	114
AVG.	148	114

See Charts 14A-14B

15. NMR
    Vendor procedure

See Charts 15A-15B

U. S. Polymeric

Hamid M. Quraishi

Hamid M. Quraishi, Manager
Quality Assurance Department

TYPICAL GAS CHROMATOGRAPH SET-UP

Operator Q.Z.J.	Date 12/11/86
Column	Detector FID
Length 6ft.	Voltage
Dia. 1/4 in.	Sensit.
Liquid Phase AT1000	Flow Rates, ml/min
Wt. % 0.1	Hydrogen 60 Air 96
Support GRAPHPAC	Scavenge
Mesh 80/100	Split
Carrier Gas: He	Temperature, °C
Rotameter	Det. 220 Inj. 200
Inlet Press 60 psig	Column Initial 60
Rate 30 ml/min	Final 210
CHART SPEED	Rate 5°C/MIN.
SAMPLE USP34A,2-1	Solvent THF
Size 0.1 µl	Concn. 0.1/10 g/ml

GAS CHROMATOGRAPHY STANDARD SOLVENT

TEST METHOD CTM-55

STANDARD SOLVENT/MONOMER	RETENTION TIME (MINS.)
MEOH	.6
ETHANOL	1.18
MECL2	1.28
ACETONE	1.45
IPA	1.83
THF	3.08
ACETONITRILE	3.2
CRESOL	4.03
MEK	4.08
FURFURAL	15.03
TOLUENE	17.98
CHLOROBENZENE	19.6
PHENOL	22.08

NOTE: THF WAS USED TO DILUTE THE RESIN SAMPLES.

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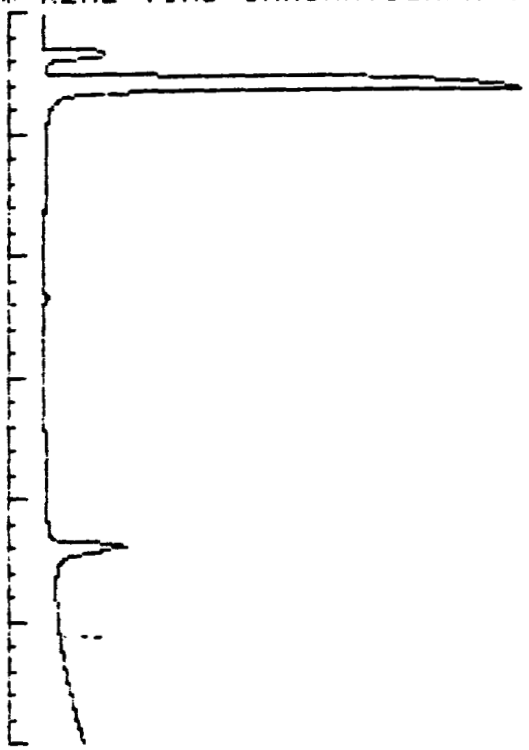
CHART 6A

*** REAL TIME CHROMATOGRAM ***



FINAL FULL SCALE MV.=1000 00

SAMPLE: USP39A 2-1
MISC. C=0.11190 GMS/ML

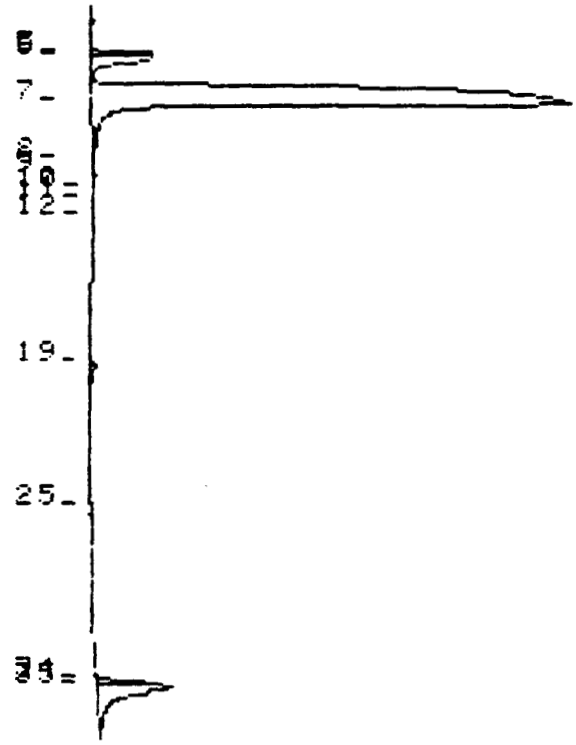
TIME: 12:59
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
2	.63	3064	.075	3	358
5	1.65	79730	1.953	2	11467
6	1.78	201690	4.940	2	11452
7	3.30	3335700	81.708	3	90562
8	5.08	6073	.149	4	251
9	5.55	5751	.141	4	417
10	6.03	4291	.105	4	182
11	6.38	4282	.105	4	172
12	6.95	1101	.027	4	80
19	11.70	13778	.337	3	767
25	16.23	1076	.026	2	61
34	21.85	68060	1.667	2	10096
35	22.00	357860	8.766	2	14615

TOTAL AREA= 4082456
THRESHOLD= 1
MIN PK.WIDTH= 15
AREA REJECT= 1000

VERTICAL SCALE FACTOR: 1X



SAMPLE: USP39A 2-1
MISC C=0.11190 GMS/ML

TIME 12:59
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
5	1 65	79730	1.965	2	11467
6	1.78	201690	4.972	2	11452
7	3 30	3335700	82.225	3	90562
19	11.70	13778	.340	3	767
34	21.85	68060	1.678	2	10096
35	22.00	357860	8.821	2	14615

TOTAL AREA= 4056818
THRESHOLD= 1
MIN PK.WIDTH= 15
AREA REJECT= 10000

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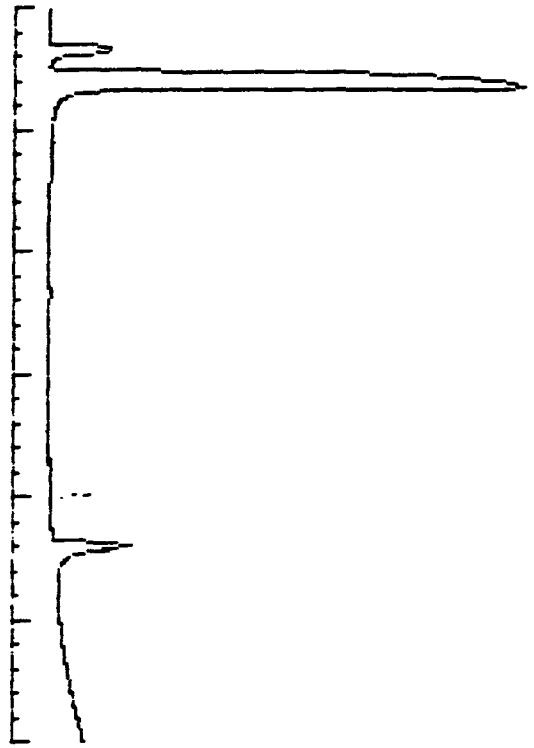
*** REAL TIME CHROMATOGRAM ***



FINAL FULL SCALE MV.=1000.00

SAMPLE: USP39A 2-2
MISC: C=0.10080 GMS/ML

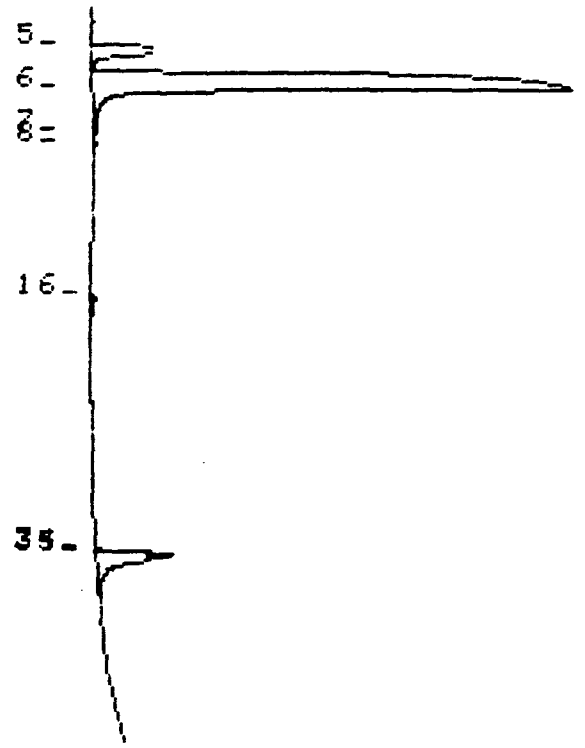
TIME: 14:47
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
2	.63	2693	.061	3	360
5	1.68	298230	6.703	2	11370
6	3.38	3695300	83.049	3	89961
7	5.08	4838	.109	4	199
8	5.58	4532	.102	2	478
16	11.70	14184	.319	3	714
34	21.88	53228	1.196	2	10083
35	22.03	376520	8.462	3	14774

TOTAL AREA= 4449524
THRESHOLD= 1
MIN.PK.WIDTH= 15
AREA REJECT= 1000

VERTICAL SCALE FACTOR 1%



SAMPLE: USP39A 2-2
MISC.: C=0.10080 GMS/ML

TIME: 14:47
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
5	1.68	298230	6.742	2	11370
6	3.38	3695300	83.542	3	89961
34	21.88	53228	1.203	2	10083
35	22.03	376520	8.512	3	14774

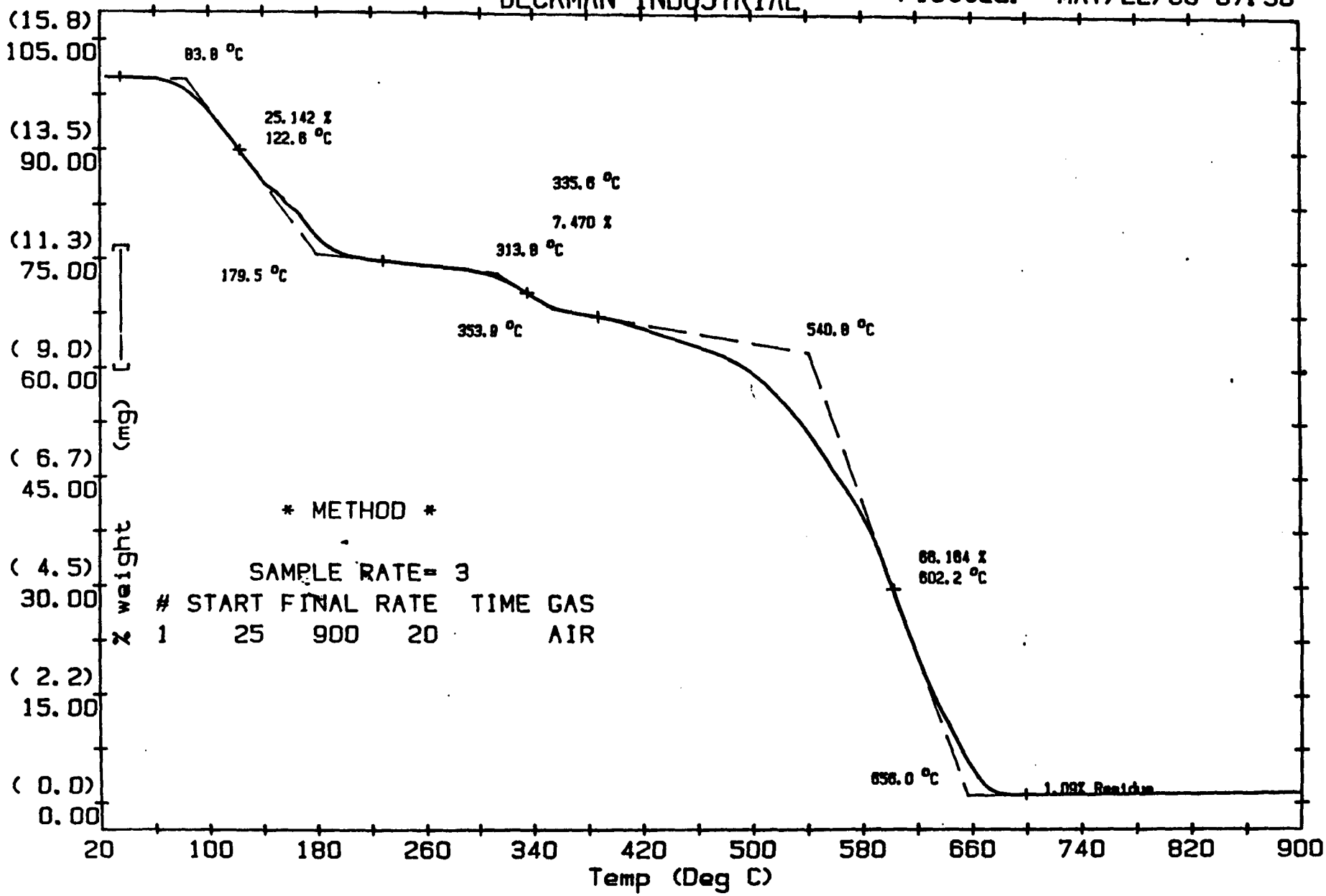
TOTAL AREA= 4423278
THRESHOLD= 1
MIN.PK.WIDTH= 15
AREA REJECT= 15000

Sample: USP39A71108 2-1
Size: 15.101 mg
Run No: MIR #13079 (I2)
Date: MAY/21/86 10:28

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 34.DAT V2.1
Plotted: MAY/22/86 07:50



Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

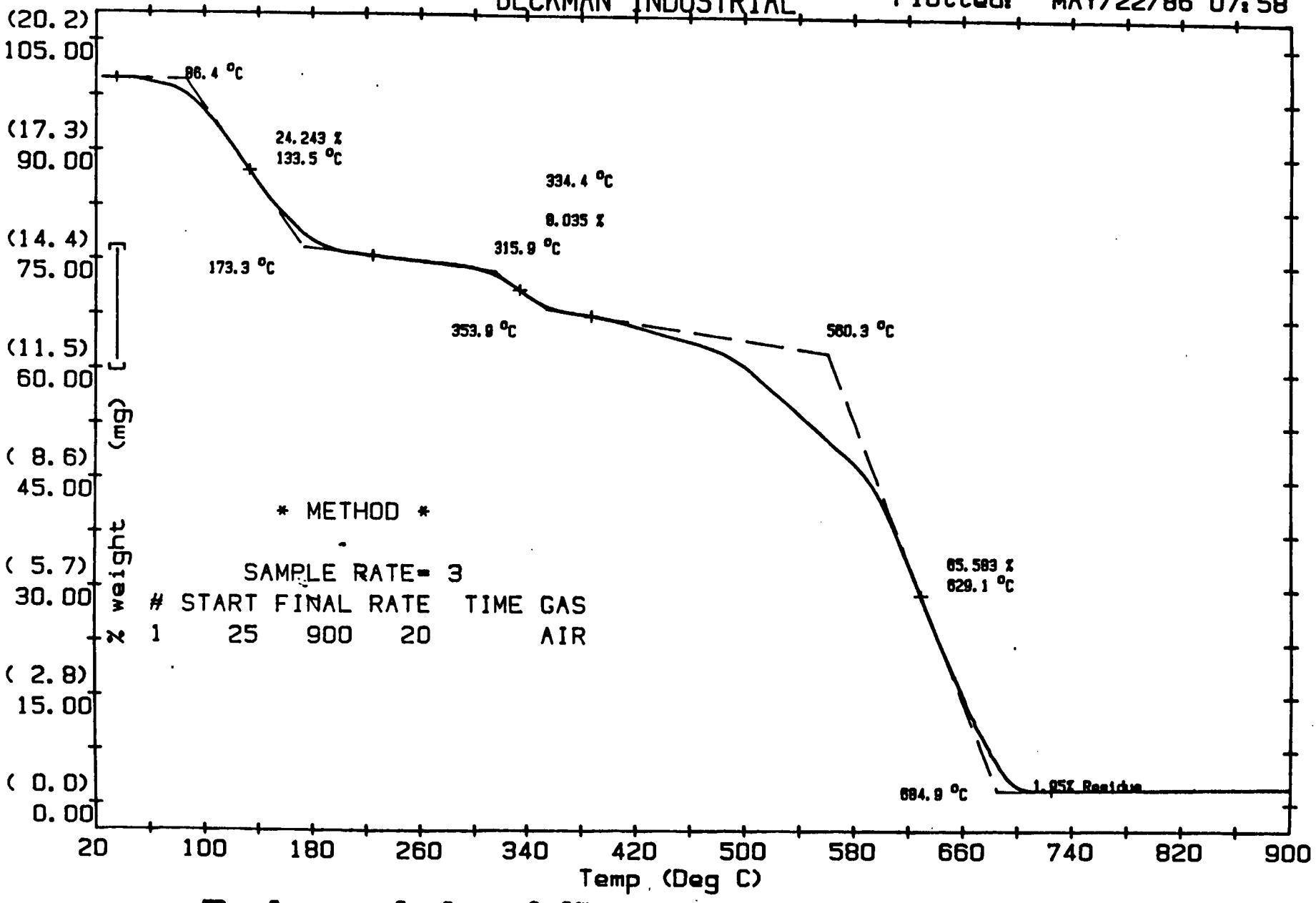
CHART 7A

Sample: USP39A71108 2-2
Size: 19.294 mg
Run No: MIR #13079 (I2)
Date: MAY/21/86 11:43

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 35.DAT V2.1
Plotted: MAY/22/86 07:58



Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

CHART 7B

PART NO. 990088

CHART 8A

RUN NO. ____ DATE 4/3/86

OPERATOR ____

SAMPLE: 2 ℓ

ATM He @ 1 atm.

FLOW RATE 40 ml/min

T-AXIS

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SCALE, °C/in 50

PROG. RATE, °C/min 20

HEAT ✓ COOL ____ ISO ____

SHIFT, in 0

− 1 °1C°

DTA-DSC

SCALE, °C/in 1.0/5

(mcal/sec)/in ____

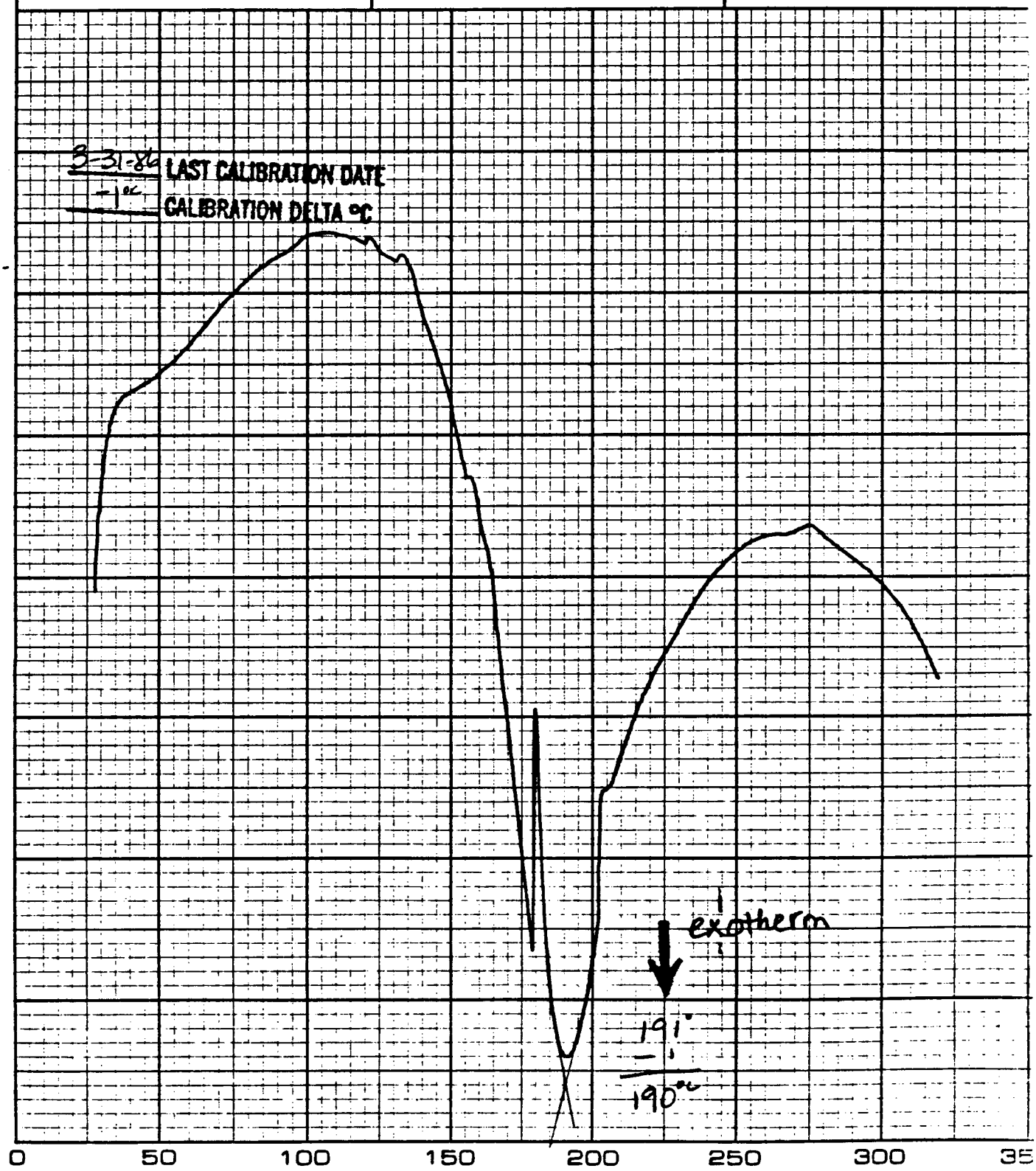
WEIGHT, mg 4.5

REFERENCE ____

1 AL CUP PLUS SE.

DUPONT Instruments

MEASURED VARIABLE ____



TEMPERATURE, °C (CHRO

PART NO. 990088

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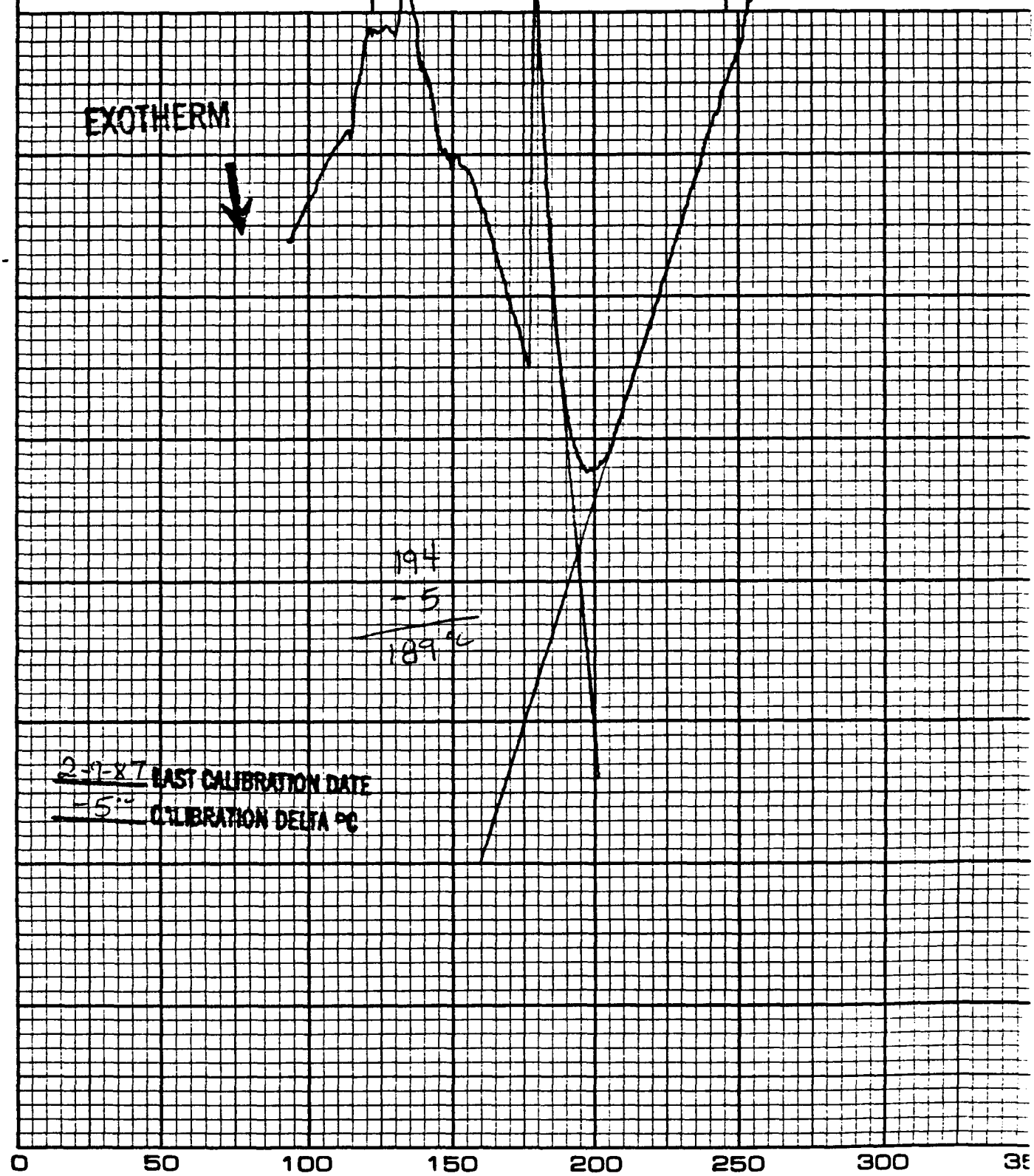
CHART 8B

RUN NO. ____ DATE 2-23-87
OPERATOR alk
SAMPLE: 2-2
USP 39A
ATM N2 @ 1atm
FLOW RATE 40ml/min

T-AXIS
SCALE, °C/in 50
PROG. RATE, °C/min 20°
HEAT ✓ COOL ____ ISO ____
SHIFT, in 0

DTA-DSC
SCALE, °C/in 1.0/5x
(mcal/sec)/in ____
WEIGHT, mg 3.1
REFERENCE 1 alum seal



MEASURED VARIABLE ____

DU PONT Instruments

CHART 9A

DATA FILE A:PHENO20.HDR TAKEN 09-01-1986 15:13:56

********* AREA PERCENT REPORT *********

```
*****************************************************************************
* Sample Name: USP39A,2-1,C=5.555                  Operator Initials: JGZ
* Date:  09-01-1986 15:13:56 Method:PHENOLIC     DATA FILE: A:PHENO20.PTS
* Interface: 4                 Cycle#:  20          Channel#: 0     Vial#: N.A.
* Starting Peak Width:  10   Threshold:  .01
*****************************************************************************
*  Instrument Type: BECKMAN HPLC              Column Type: MICROBONDAPAK C-18
*              Solvent Description: THF/WATER, 2:1 BY WEIGHT
*   Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN
*             Detector 0: 220NM/.5AU            Detector 1:
*     Misc. Information:  LENGTH=25
*****************************************************************************
Starting Delay:   0.00                          Ending Retention Time:   10.00
```

Pk No.	Ret Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
1	0.73	2256	1.2208	1	562	2.392	4.0
2	1.82	94314	51.0355	2	5417	100.000	17.4
3	1.97	29598	16.0160	2	5094	31.382	5.8
4	2.07	58633	31.7278	2	5278	62.168	11.1

Total Area: 184801 Area Reject: 1000 One sample per 1.000 sec.

DATA FILE=PHEN020 FROM 0.00 MIN. TO 10.00 MIN. LOW SCALE= 5.401 Mv. HIGH SCALE= 10.930 Mv.
USP-39A, 2-1, C=5.555 MG/ML, 8/2/88, JGZ

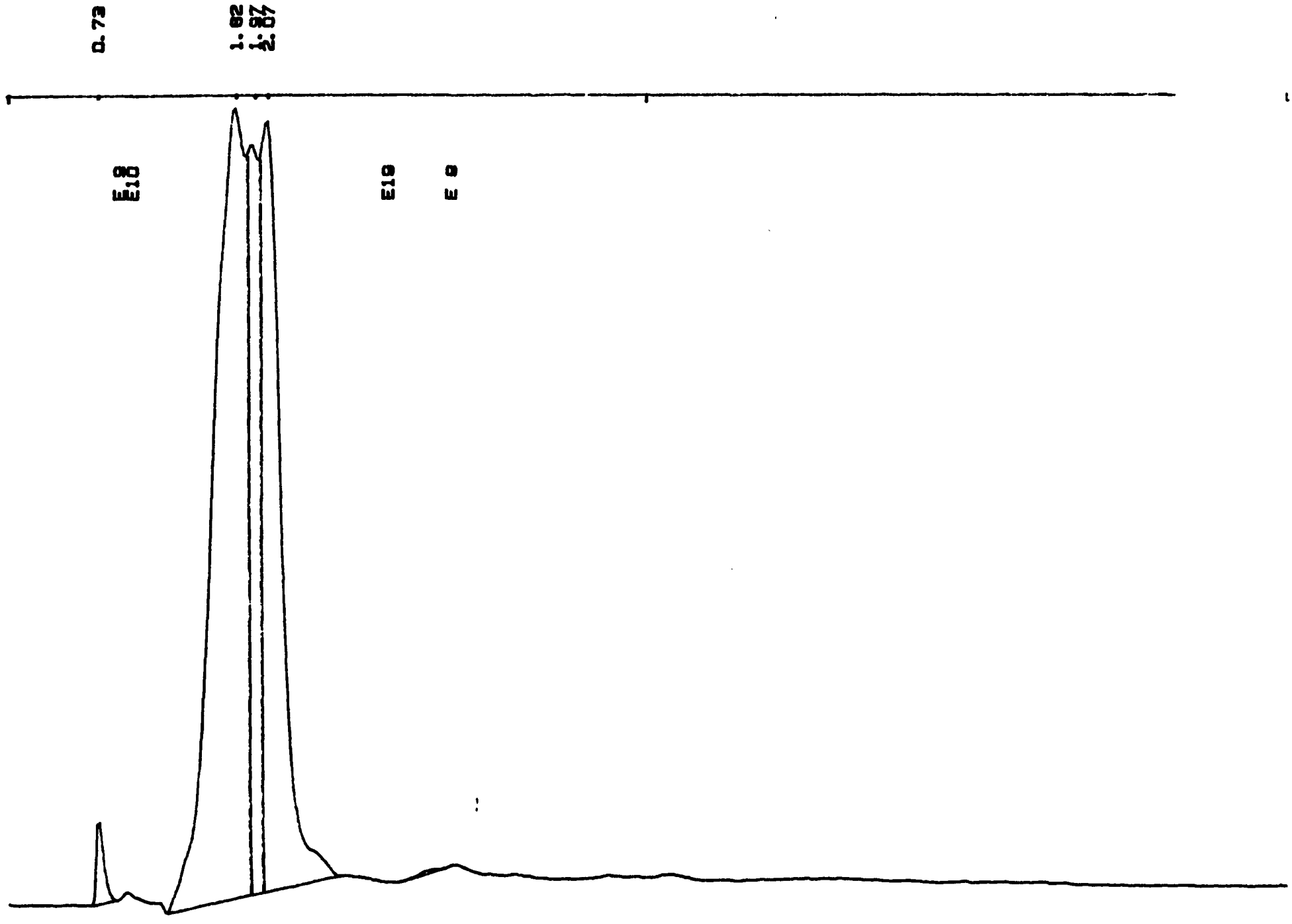


CHART 9B

DATA FILE A:PHENO27.HDR TAKEN 09-05-1986 11:31:38

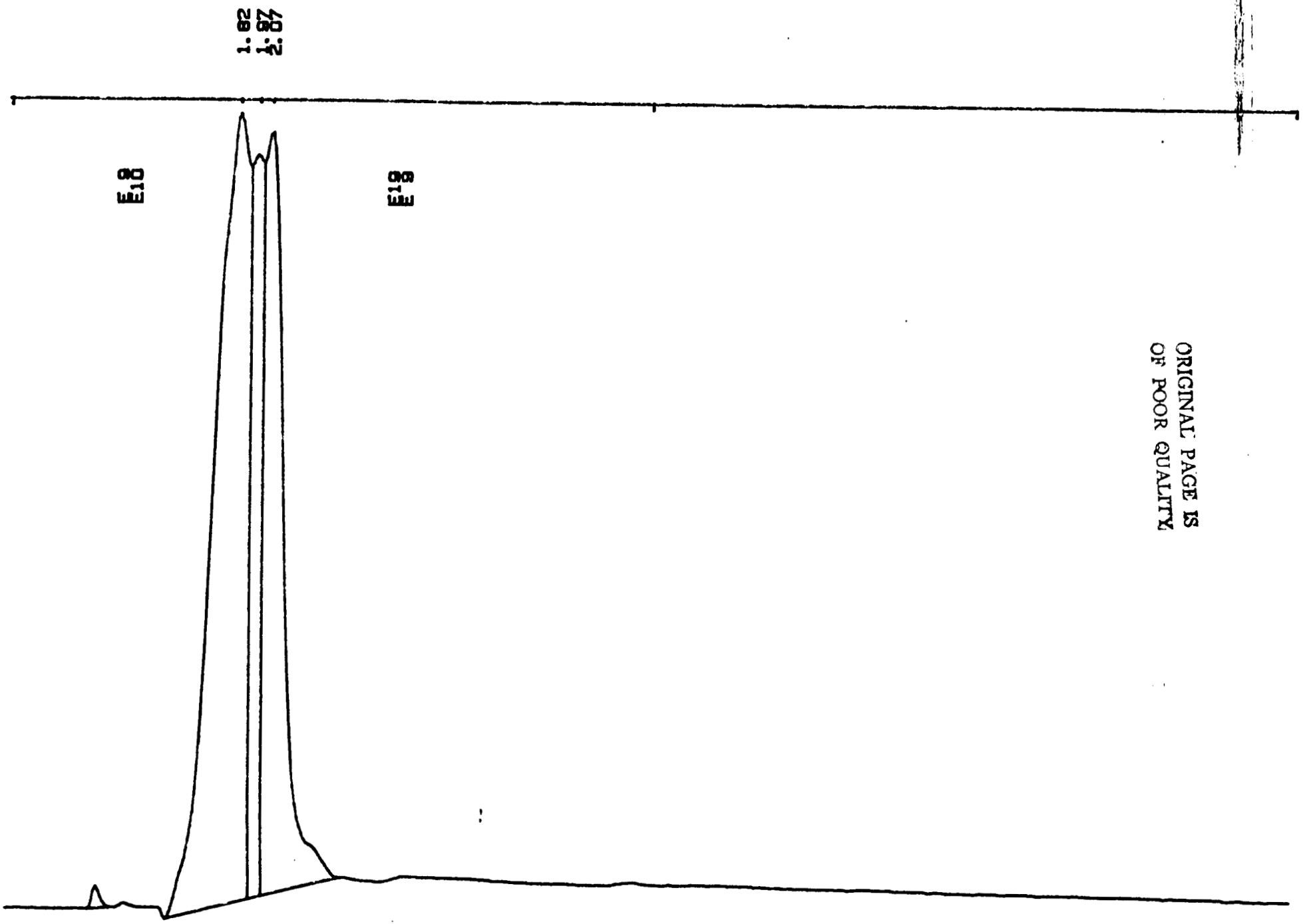
********* AREA PERCENT REPORT *********

```
*****************************************************************************
* Sample Name: USP39A,2-2,C=6.99                  Operator Initials: JGZ
* Date:  09-05-1986 11:31:38 Method:PHENOLIC    DATA FILE: A:PHENO27.PTS
* Interface: 4                Cycle#:  27         Channel#: 0    Vial#: N.A.
* Starting Peak Width:  10   Threshold:  .01
*****************************************************************************
*  Instrument Type: BECKMAN HPLC            Column Type: MICROBONDAPAK C-18
*              Solvent Description: THF/WATER, 2:1 BY WEIGHT
*   Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN
*             Detector 0: 220NM/.5AU           Detector 1:
*     Misc. Information:  LENGTH=25
*****************************************************************************
Starting Delay:   0.00                        Ending Retention Time:   10.00
```

Pk No.	Ret Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
2	1.82	96860	53.0012	2	5305	100.000	18.3
3	1.97	28712	15.7109	2	4980	29.643	5.8
4	2.07	57179	31.2879	2	5119	59.032	11.2

Total Area: 182750 Area Reject: 1000 One sample per 1.000 sec.

USP-39A, 2-2, C=6.88 MG/ML, 8/5/86, JGZ



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OF POOR QUALITY

*** Calibration Data ***
Calibration Name:
Misc Information:

Fit Type: 3
Log Mol Wt = A + Bx + Cx^2 + Dx^3
A= 2.538977 B= 2.115815 C= -.5646824 D= 3.606432E-02
Coefficient of Determination: 0.9902

Ret Time	Molecular Weight	Log Mol Wt
3.50	35000	4.544
4.33	15000	4.176
4.83	3600	3.556
5.09	2350	3.371
6.00	570	2.756
7.17	92	1.964
7.50	72	1.857

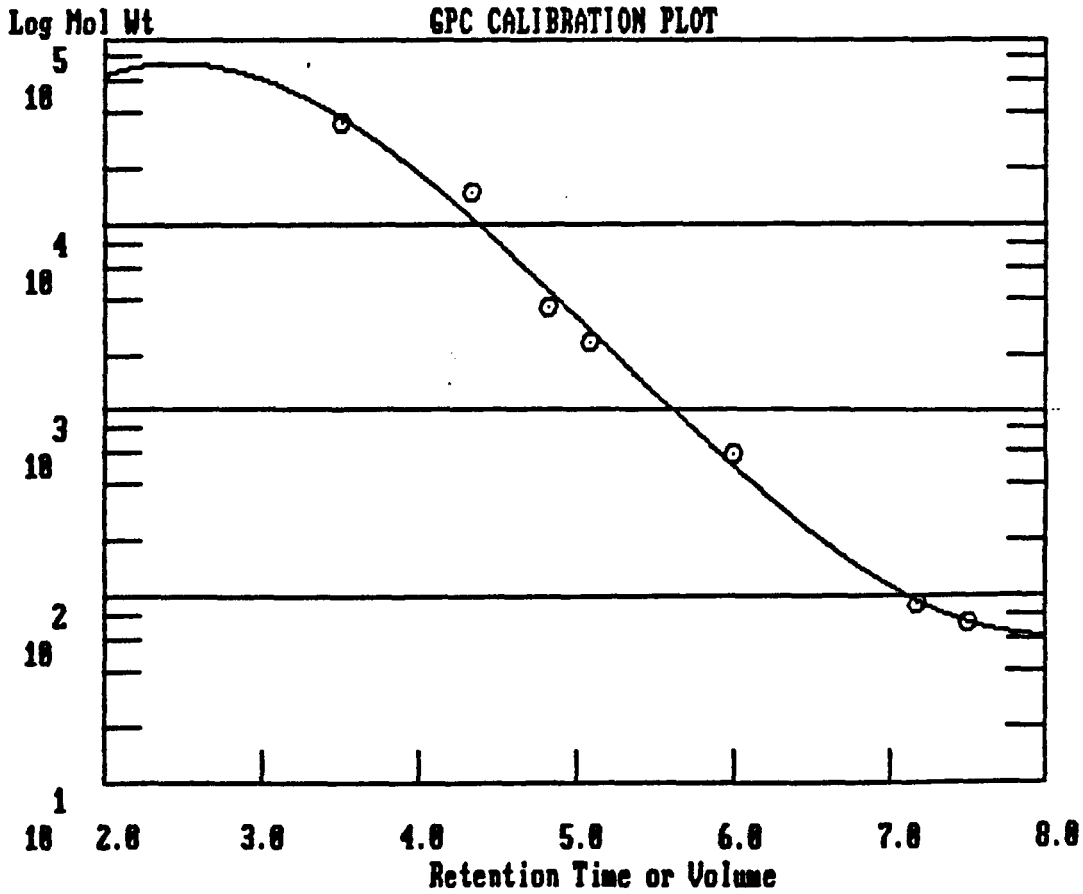

CHART 10A

DATA FILE A:GPC33.HDR TAKEN 08-05-1986 17:47:28

********* GPC REPORT *********

```
*************************************************************************
* Sample Name: USP39A 2-1=2.68                  Operator Initials: GBF  *
* Date:  08-05-1986 15:48:25 Method:            DATA FILE: A:GPC33.PTS  *
* Interface: 5              Cycle#:  33         Channel#: 0   Vial#: N.A.  *
* Starting Peak Width:  60  Threshold:  0                               *
*************************************************************************
*  Instrument Type: HPLC/BECKMAN          Column Type: ULTRASTYRAGEL 500A  *
*            Solvent Description: THF                                    *
*   Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                       *
*            Detector 0: 254NM/.1AU          Detector 1:                 *
*     Misc. Information: CALIBRATION/GPC                                *
*************************************************************************
Starting Delay:   0.00                    Ending Retention Time:   10.00
Calibration file: GPCPHEN
Molecular Weight Distribution Averages
Baseline TIMES:    3.85 to   10.00   MW:      22295 to          2
Process  TIMES:    3.85 to   10.00   MW:      22295 to          2
Total Area:       243177
Mw=                 1800
Mn=                  334
Mw/Mn=            5.3756
Mz=                 4852
Mv=                 1551
```

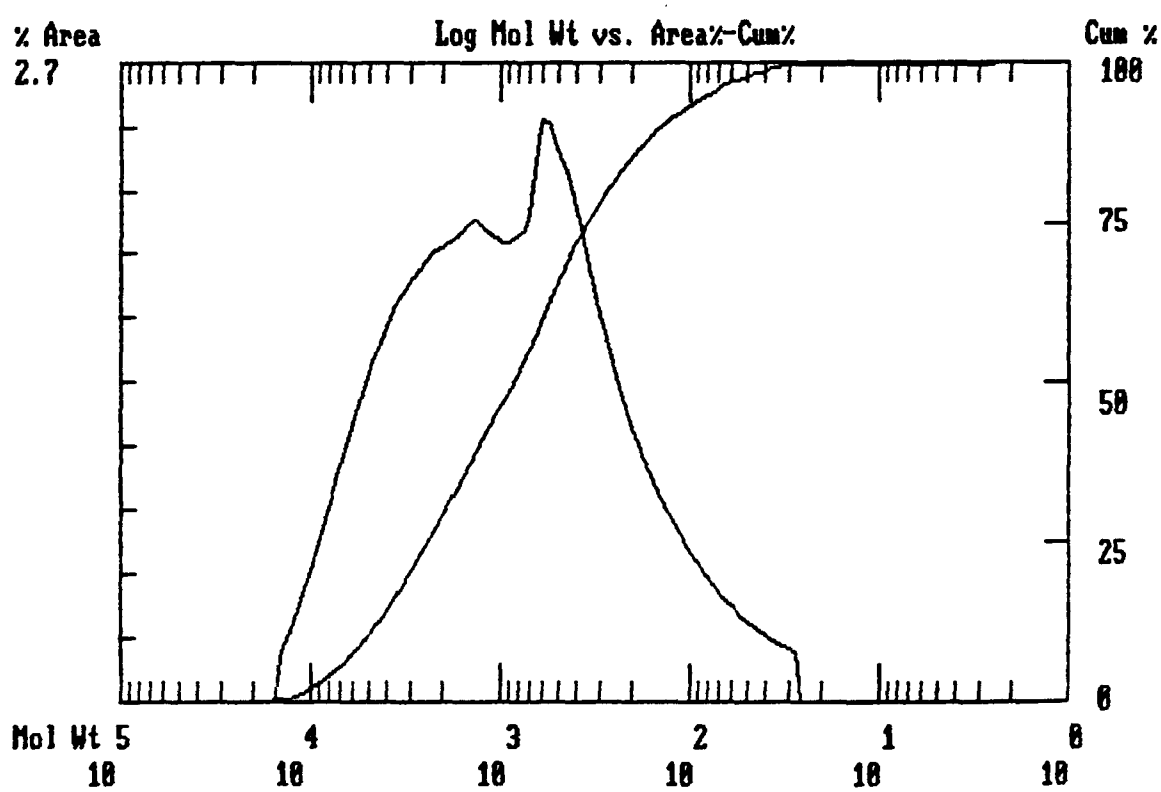

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CHART 10B

TA FILE A:GPC34.HDR TAKEN 08-05-1986 17:50:20

********* GPC REPORT *********

```
*************************************************************************
 Sample Name: USP39A 2-2=2.68                    Operator Initials: GBF      *
 Date:  08-05-1986 16:04:45 Method:              DATA FILE: A:GPC34.PTS      *
 Interface: 5                Cycle#:  34         Channel#: 0    Vial#: N.A.  *
 Starting Peak Width:  60    Threshold:  0                                  *
*************************************************************************
 Instrument Type: HPLC/BECKMAN            Column Type: ULTRASTYRAGEL 500A    *
              Solvent Description: THF                                      *
   Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                           *
            Detector 0: 254NM/.1AU          Detector 1:                     *
     Misc. Information: CALIBRATION/GPC                                     *
*************************************************************************
arting Delay:    0.00                     Ending Retention Time:    10.00
ibration file: GPCPHEN
olecular Weight Distribution Averages
aseline TIMES:    3.85 to    10.00    MW:      22295 to          2
ocess TIMES:      3.85 to    10.00    MW:      22295 to          2
otal Area:       198243
w=                 1631
=                   328
/Mn=             4.9600
z=                 4349
=                  1407
```

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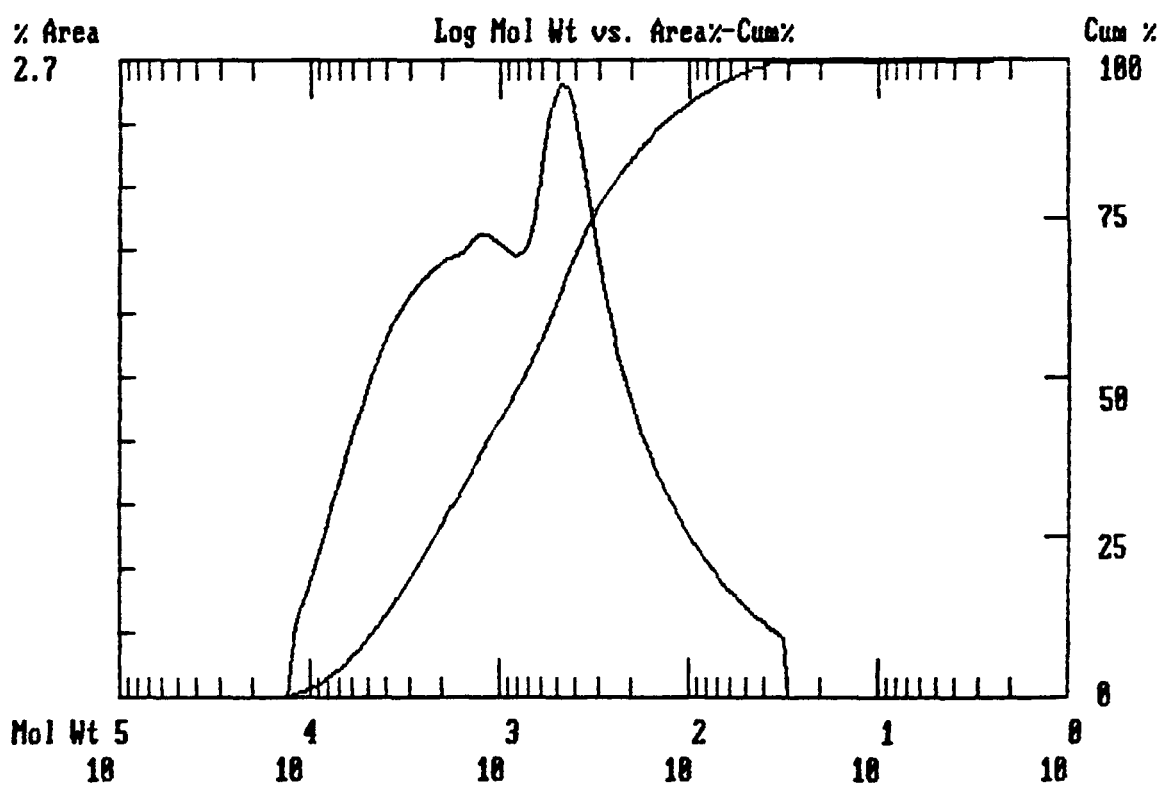
OF POOR QUALITY



NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-1

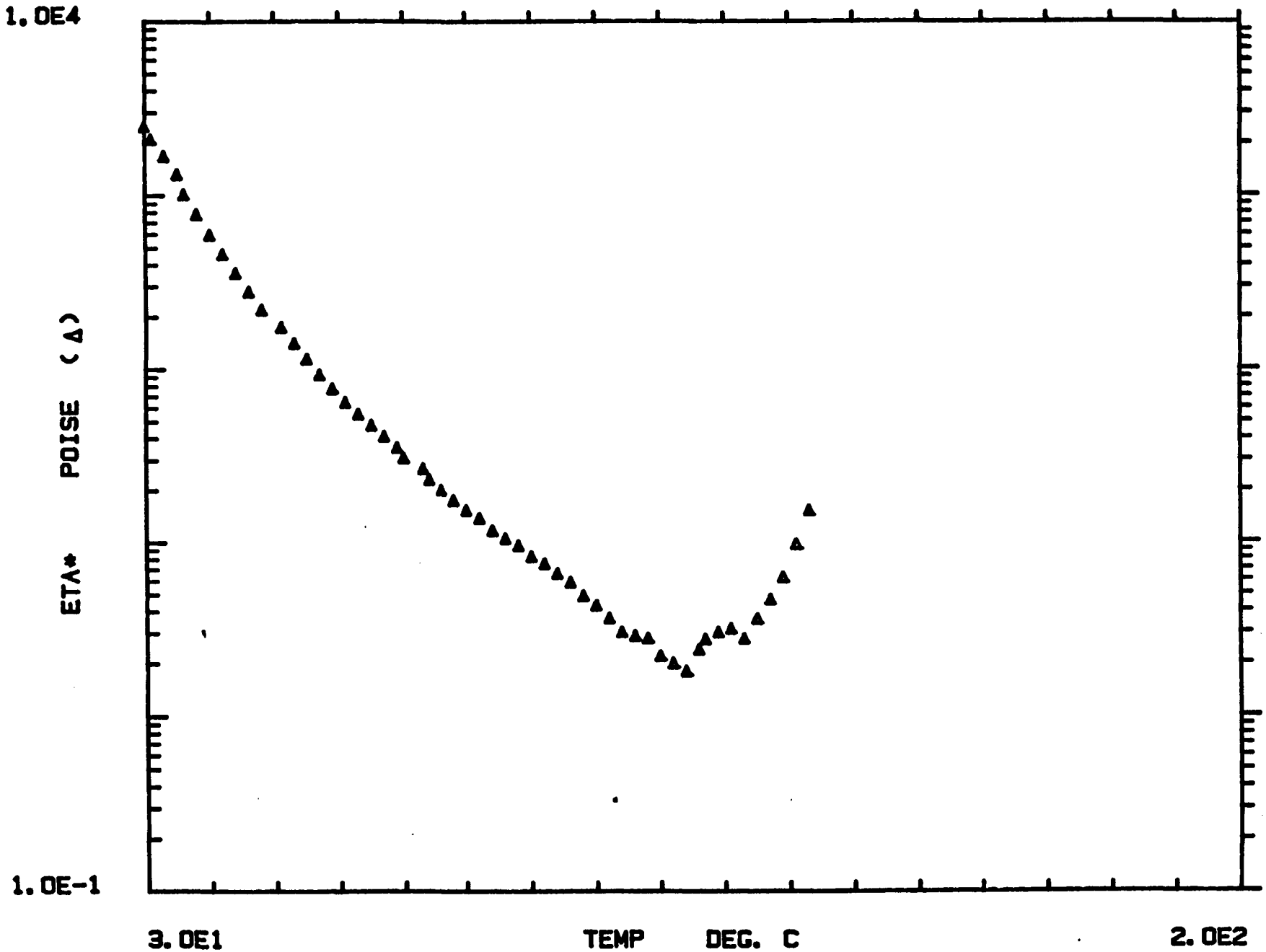


CHART 14A

Rheometrics RECAP II

---

eriment No. : 2 Sample No. : 1

itle:
A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-1

perator :CP

e and Time : Friday, August 15, 1986 - 12:30:37

perating Mode : DYNAMIC

eep Type : CURE

metry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

tes :
TRAIN =50%
EQUENCY =10 RAD/SEC

ORIGINAL PAGE IS
OF POOR QUALITY

O.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	2.489e+003	2.488e+003	4.844e+001	3.172e+002	2.000e-001	2.800e+001
2	2.642e+003	2.641e+003	4.082e+001	3.370e+002	1.000e+000	2.900e+001
3	2.428e+003	2.428e+003	3.159e+001	3.095e+002	2.000e+000	3.000e+001
4	2.051e+003	2.051e+003	3.626e+001	2.607e+002	3.000e+000	3.100e+001
5	1.636e+003	1.636e+003	3.612e+001	2.076e+002	4.000e+000	3.300e+001
6	1.283e+003	1.282e+003	3.520e+001	1.625e+002	5.000e+000	3.500e+001
7	9.853e+002	9.849e+002	3.027e+001	1.245e+002	6.000e+000	3.600e+001
8	7.555e+002	7.550e+002	2.754e+001	9.537e+001	7.000e+000	3.800e+001
9	5.786e+002	5.780e+002	2.598e+001	7.296e+001	8.000e+000	4.000e+001
10	4.479e+002	4.473e+002	2.357e+001	5.638e+001	9.000e+000	4.200e+001
11	3.477e+002	3.469e+002	2.268e+001	4.376e+001	1.000e+001	4.400e+001
12	2.715e+002	2.706e+002	2.171e+001	3.414e+001	1.100e+001	4.600e+001
13	2.136e+002	2.126e+002	2.044e+001	2.686e+001	1.200e+001	4.800e+001
14	1.693e+002	1.680e+002	2.056e+001	2.126e+001	1.300e+001	5.100e+001
15	1.371e+002	1.356e+002	2.031e+001	1.723e+001	1.400e+001	5.300e+001
16	1.110e+002	1.094e+002	1.889e+001	1.394e+001	1.500e+001	5.500e+001
17	9.041e+001	8.878e+001	1.708e+001	1.135e+001	1.600e+001	5.700e+001
18	7.490e+001	7.343e+001	1.478e+001	9.399e+000	1.700e+001	5.900e+001
19	6.248e+001	6.116e+001	1.280e+001	7.843e+000	1.800e+001	6.100e+001
20	5.336e+001	5.221e+001	1.105e+001	6.692e+000	1.900e+001	6.300e+001
21	4.604e+001	4.506e+001	9.437e+000	5.777e+000	2.000e+001	6.500e+001
22	3.975e+001	3.897e+001	7.829e+000	4.985e+000	2.100e+001	6.700e+001
23	3.419e+001	3.357e+001	6.480e+000	4.291e+000	2.200e+001	6.900e+001
24	2.971e+001	2.916e+001	5.717e+000	3.731e+000	2.300e+001	7.000e+001
25	2.574e+001	2.522e+001	5.128e+000	3.229e+000	2.400e+001	7.300e+001
26	2.230e+001	2.191e+001	4.110e+000	2.800e+000	2.500e+001	7.400e+001
27	1.940e+001	1.907e+001	3.540e+000	2.434e+000	2.600e+001	7.600e+001
28	1.690e+001	1.657e+001	3.298e+000	2.121e+000	2.700e+001	7.800e+001
29	1.480e+001	1.453e+001	2.816e+000	1.857e+000	2.800e+001	8.000e+001
30	1.328e+001	1.299e+001	2.741e+000	1.667e+000	2.900e+001	8.200e+001
31	1.125e+001	1.105e+001	2.093e+000	1.411e+000	3.000e+001	8.400e+001
32	1.007e+001	9.917e+000	1.751e+000	1.264e+000	3.100e+001	8.600e+001
33	9.185e+000	9.050e+000	1.573e+000	1.153e+000	3.200e+001	8.800e+001
34	7.912e+000	7.827e+000	1.152e+000	9.930e-001	3.300e+001	9.000e+001
35	7.192e+000	7.145e+000	8.195e-001	9.030e-001	3.400e+001	9.200e+001
36	6.315e+000	6.283e+000	6.316e-001	7.925e-001	3.500e+001	9.400e+001
37	5.609e+000	5.600e+000	3.201e-001	7.044e-001	3.600e+001	9.600e+001
38	4.670e+000	4.658e+000	3.331e-001	5.860e-001	3.700e+001	9.800e+001
39	4.120e+000	4.120e+000	0.000e+000	5.175e-001	3.800e+001	1.000e+002
40	3.470e+000	3.470e+000	4.507e-002	4.352e-001	3.900e+001	1.020e+002
41	2.889e+000	2.889e+000	0.000e+000	3.627e-001	4.000e+001	1.040e+002
42	2.743e+000	2.724e+000	3.160e-001	3.445e-001	4.100e+001	1.060e+002
43	2.657e+000	2.581e+000	6.310e-001	3.335e-001	4.200e+001	1.080e+002
44	2.102e+000	2.053e+000	4.494e-001	2.642e-001	4.300e+001	1.100e+002
45	1.906e+000	1.852e+000	4.519e-001	2.394e-001	4.400e+001	1.120e+002
46	1.720e+000	1.672e+000	4.072e-001	2.162e-001	4.500e+001	1.140e+002
47	2.296e+000	2.202e+000	6.523e-001	2.884e-001	4.600e+001	1.160e+002
48	2.627e+000	2.569e+000	5.507e-001	3.301e-001	4.700e+001	1.170e+002
49	2.883e+000	2.783e+000	7.547e-001	3.621e-001	4.800e+001	1.190e+002
50	3.024e+000	2.803e+000	1.135e+000	3.799e-001	4.900e+001	1.210e+002

ORIGINAL PAGE IS
OF POOR QUALITY

NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-1

NO.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
51	2.642e+000	2.503e+000	8.451e-001	3.320e-001	5.000e+001	1.230e+002
52	3.438e+000	3.279e+000	1.035e+000	4.316e-001	5.100e+001	1.250e+002
53	4.448e+000	4.263e+000	1.269e+000	5.588e-001	5.200e+001	1.270e+002
54	5.984e+000	5.761e+000	1.618e+000	7.514e-001	5.300e+001	1.290e+002
55	9.317e+000	8.988e+000	2.454e+000	1.171e+000	5.400e+001	1.310e+002
56	1.470e+001	1.401e+001	4.424e+000	1.845e+000	5.500e+001	1.330e+002

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OF POOR QUALITY

NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-2

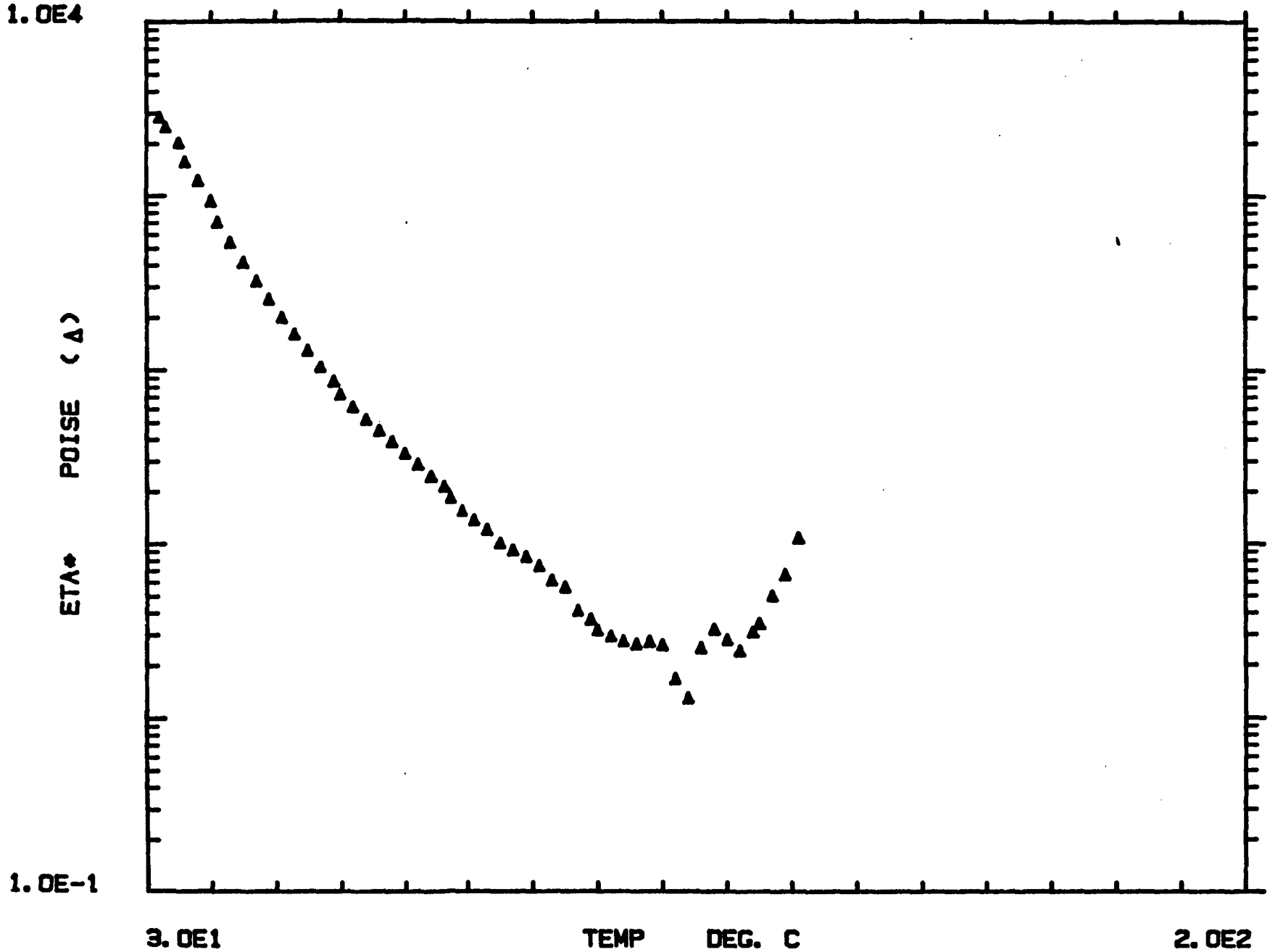

CHART 14B

Rheometrics RECAP II

---

xperiment No. : 3 Sample No. : 1

ile:
ASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-2

rator :CP

ate and Time : Friday, August 15, 1986 - 13:50:53

erating Mode : DYNAMIC

ep Type : CURE

ometry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

es :
AIN =50%
EQUENCY =10 RAD/SEC

ORIGINAL PAGE IS
OF POOR QUALITY

ASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-2

No.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	2.748e+003	2.747e+003	4.963e+001	3.500e+002	2.000e-001	3.200e+001
2	2.751e+003	2.750e+003	5.589e+001	3.503e+002	1.000e+000	3.200e+001
3	2.407e+003	2.407e+003	4.550e+001	3.062e+002	2.000e+000	3.300e+001
4	1.952e+003	1.952e+003	4.134e+001	2.476e+002	3.000e+000	3.500e+001
5	1.521e+003	1.520e+003	3.489e+001	1.925e+002	4.000e+000	3.600e+001
6	1.181e+003	1.180e+003	3.659e+001	1.493e+002	5.000e+000	3.800e+001
7	9.014e+002	9.010e+002	2.717e+001	1.137e+002	6.000e+000	4.000e+001
8	6.851e+002	6.845e+002	2.800e+001	8.640e+001	7.000e+000	4.100e+001
9	5.225e+002	5.219e+002	2.522e+001	6.579e+001	8.000e+000	4.300e+001
10	4.013e+002	4.007e+002	2.174e+001	5.052e+001	9.000e+000	4.500e+001
11	3.136e+002	3.129e+002	2.112e+001	3.947e+001	1.000e+001	4.700e+001
12	2.457e+002	2.449e+002	2.013e+001	3.090e+001	1.100e+001	4.900e+001
13	1.938e+002	1.928e+002	1.994e+001	2.436e+001	1.200e+001	5.100e+001
14	1.561e+002	1.549e+002	1.938e+001	1.961e+001	1.300e+001	5.300e+001
15	1.257e+002	1.244e+002	1.839e+001	1.580e+001	1.400e+001	5.500e+001
16	1.014e+002	1.003e+002	1.543e+001	1.273e+001	1.500e+001	5.700e+001
17	8.340e+001	8.234e+001	1.320e+001	1.047e+001	1.600e+001	5.900e+001
18	7.033e+001	6.940e+001	1.145e+001	8.840e+000	1.700e+001	6.000e+001
19	5.969e+001	5.884e+001	1.001e+001	7.496e+000	1.800e+001	6.200e+001
20	5.047e+001	4.972e+001	8.644e+000	6.340e+000	1.900e+001	6.400e+001
21	4.340e+001	4.276e+001	7.440e+000	5.447e+000	2.000e+001	6.600e+001
22	3.759e+001	3.701e+001	6.560e+000	4.720e+000	2.100e+001	6.800e+001
23	3.215e+001	3.168e+001	5.477e+000	4.034e+000	2.200e+001	7.000e+001
24	2.777e+001	2.736e+001	4.723e+000	3.486e+000	2.300e+001	7.200e+001
25	2.370e+001	2.333e+001	4.172e+000	2.977e+000	2.400e+001	7.400e+001
26	2.079e+001	2.049e+001	3.492e+000	2.609e+000	2.500e+001	7.600e+001
27	1.794e+001	1.770e+001	2.927e+000	2.253e+000	2.600e+001	7.700e+001
28	1.506e+001	1.483e+001	2.647e+000	1.890e+000	2.700e+001	7.900e+001
29	1.327e+001	1.309e+001	2.197e+000	1.666e+000	2.800e+001	8.100e+001
30	1.166e+001	1.154e+001	1.650e+000	1.463e+000	2.900e+001	8.300e+001
31	9.738e+000	9.579e+000	1.748e+000	1.222e+000	3.000e+001	8.500e+001
32	8.840e+000	8.742e+000	1.311e+000	1.110e+000	3.100e+001	8.700e+001
33	8.088e+000	7.995e+000	1.222e+000	1.015e+000	3.200e+001	8.900e+001
34	7.169e+000	7.105e+000	9.554e-001	9.000e-001	3.300e+001	9.100e+001
35	5.902e+000	5.868e+000	6.306e-001	7.406e-001	3.400e+001	9.300e+001
36	5.403e+000	5.353e+000	7.368e-001	6.783e-001	3.500e+001	9.500e+001
37	3.945e+000	3.945e+000	3.298e-002	4.951e-001	3.600e+001	9.700e+001
38	3.514e+000	3.503e+000	2.691e-001	4.410e-001	3.700e+001	9.900e+001
39	3.057e+000	3.055e+000	1.028e-001	3.835e-001	3.800e+001	1.000e+002
40	2.824e+000	2.824e+000	5.250e-002	3.546e-001	3.900e+001	1.020e+002
41	2.639e+000	2.638e+000	5.008e-002	3.310e-001	4.000e+001	1.040e+002
42	2.532e+000	2.532e+000	0.000e+000	3.180e-001	4.100e+001	1.060e+002
43	2.625e+000	2.619e+000	1.781e-001	3.298e-001	4.200e+001	1.080e+002
44	2.504e+000	2.427e+000	6.148e-001	3.143e-001	4.300e+001	1.100e+002
45	1.607e+000	1.519e+000	5.247e-001	2.019e-001	4.400e+001	1.120e+002
46	1.244e+000	1.234e+000	1.583e-001	1.560e-001	4.500e+001	1.140e+002
47	2.421e+000	2.362e+000	5.321e-001	3.040e-001	4.600e+001	1.160e+002
48	3.097e+000	2.937e+000	9.815e-001	3.888e-001	4.700e+001	1.180e+002
49	2.684e+000	2.593e+000	6.906e-001	3.370e-001	4.800e+001	1.200e+002
50	2.321e+000	2.208e+000	7.159e-001	2.914e-001	4.900e+001	1.220e+002

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OF POOR QUALITY

NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT2-2

NO.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
51	2.992e+000	2.793e+000	1.074e+000	3.755e-001	5.000e+001	1.240e+002
52	3.334e+000	3.139e+000	1.123e+000	4.188e-001	5.100e+001	1.250e+002
53	4.823e+000	4.690e+000	1.125e+000	6.053e-001	5.200e+001	1.270e+002
54	6.376e+000	6.167e+000	1.617e+000	8.006e-001	5.300e+001	1.290e+002
55	1.043e+001	9.972e+000	3.074e+000	1.309e+000	5.400e+001	1.310e+002

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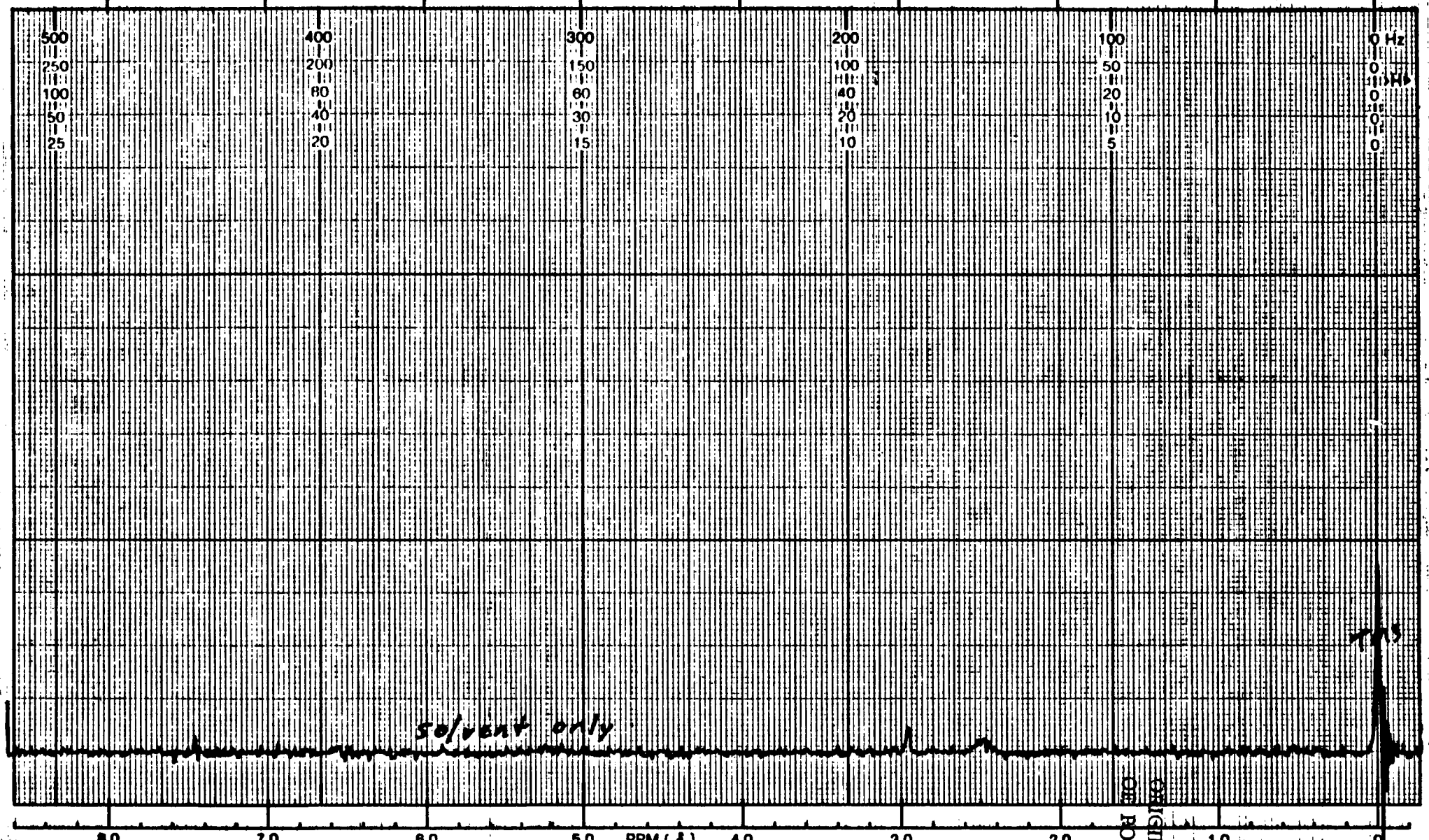
OF POOR QUALITY



SOLVENT ONLY SCAN

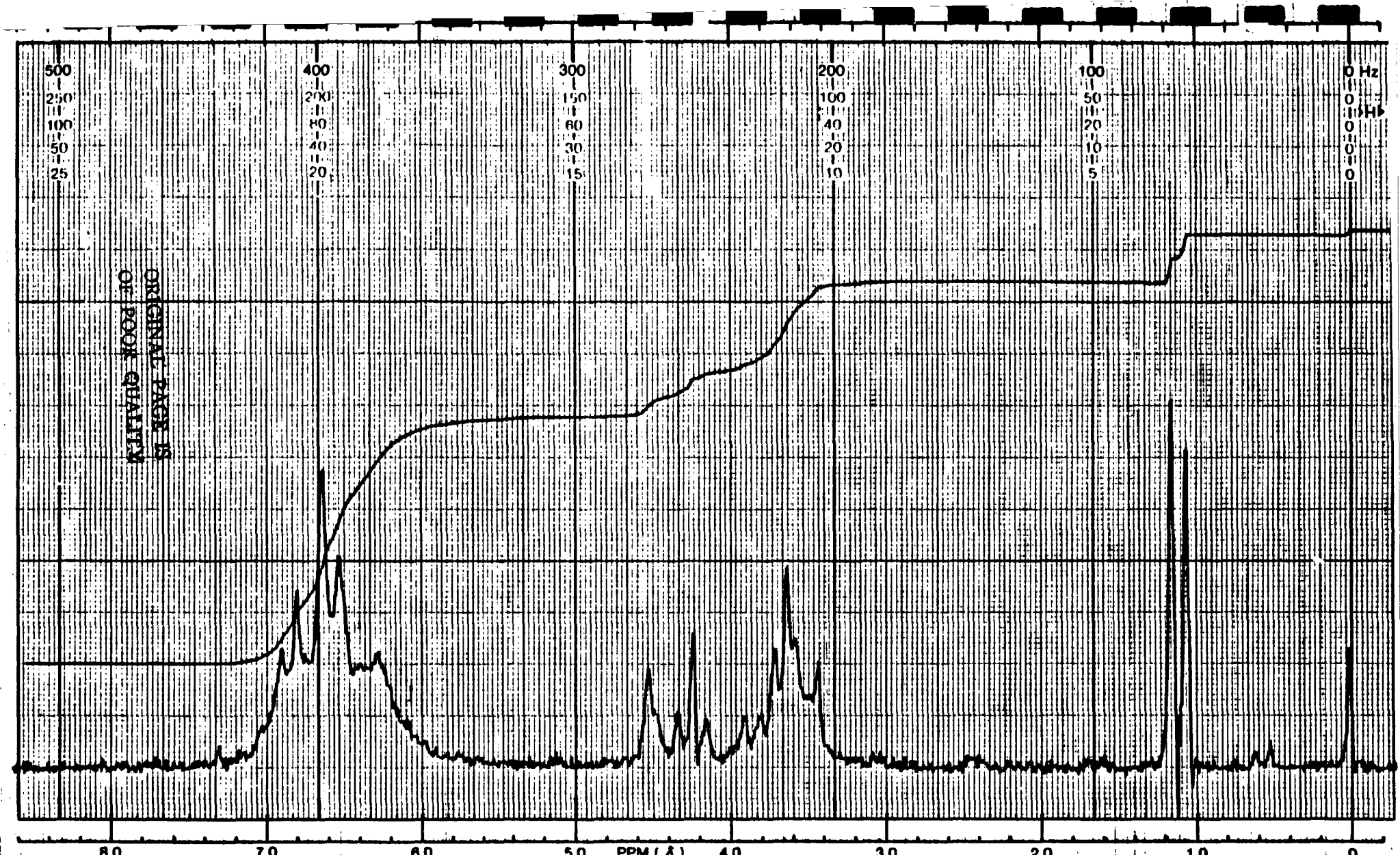
ORIGINAL PAGE IS OF POOR QUALITY

SWEEP OFFSET (Hz): 0	MANUAL	AUTO ☐	
SPECTRUM AMPLITUDE: 8.0	SWEEP TIME (SEC): 30 250 500 1000	(250)	SAMPLE: Solvent
INTEGRAL AMPLITUDE: —	SWEEP WIDTH (Hz): 25 50 100 250 500	(500)	SOLVENT: Unisol-d + 0.52 TMS
SPINNING RATE (RPS): 30	FILTER: 1 2 3 4 5 6 7 8	(2)	DEC. LEVEL
	RF POWER LEVEL: 0.30	(.05)	REMARKS:

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86 OPERATOR DGW SPECTRUM NO. 1A of 7

solvent scan



ORIGINAL PAGE IS OF POOR QUALITY

		MANUAL	AUTO ☐
SWEEP OFFSET (Hz): 0	SWEEP TIME (SEC):	30 / 250 / 500 / 1000	(250)
SPECTRUM AMPLITUDE: 8.0	SWEEP WIDTH (Hz):	25 / 50 / 100 / 250 / 500	(500)
INTEGRAL AMPLITUDE: 5.0	FILTER:	1 2 3 4 5 6 7 8	(2)
SPINNING RATE (RPS): 30	RF POWER LEVEL: 0.25		(.05)

SAMPLE: USP-39A Lot #2-1

SOLVENT: Unisol-d + 0.5% TMS

DEC. LEVEL

REMARKS: 0.130 gm sample
0.888 gm solvent

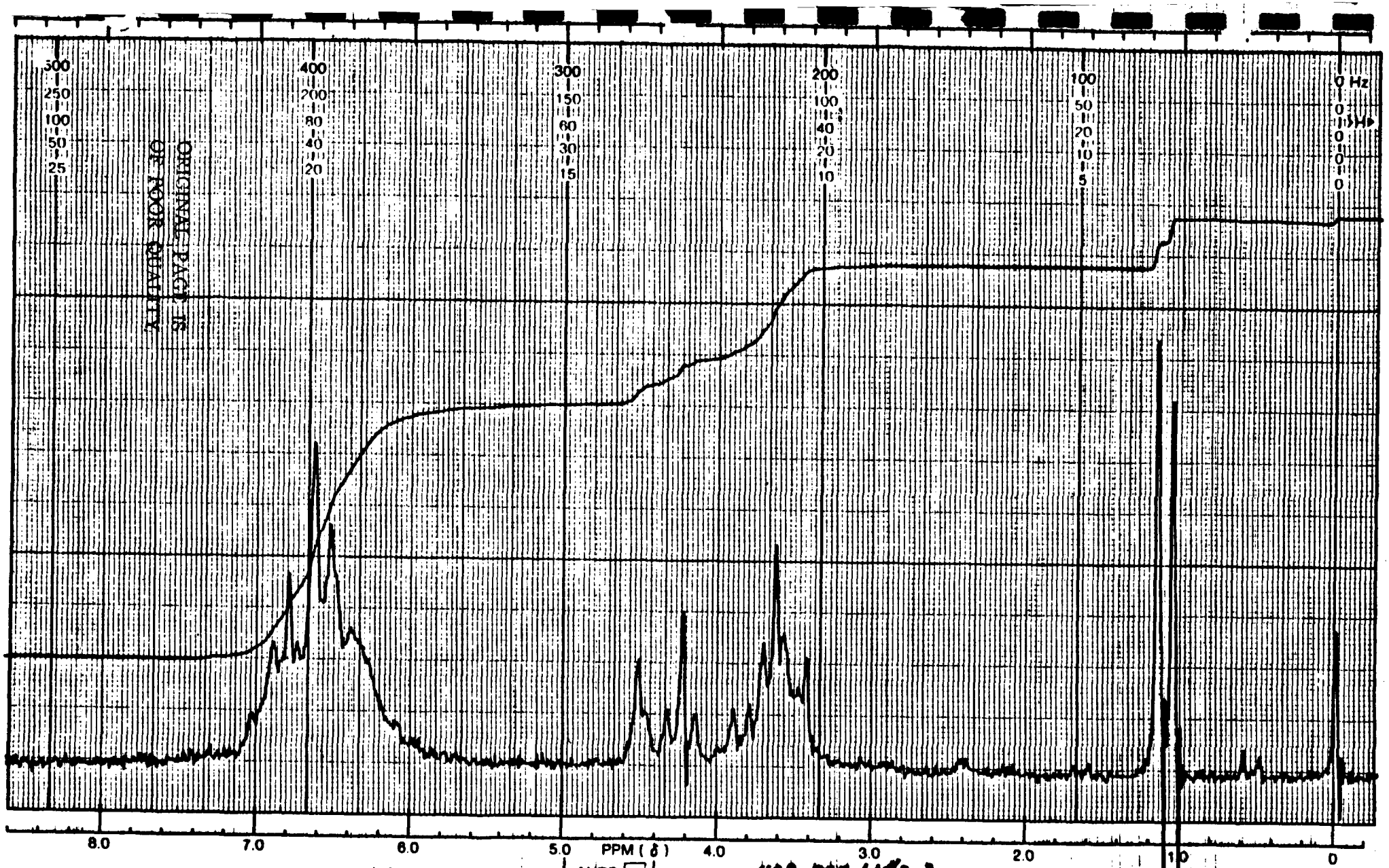
CHART 15A

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86

OPERATOR DGW

SPECTRUM NO. 3 of 7 USP-39A Lot #2-1



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SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: 5.0
SPINNING RATE (RPS): 20

MANUAL
SWEEP TIME (SEC): 30 250 500 1000
SWEEP WIDTH (Hz): 25 50 100 250 500
FILTER: 1 2 3 4 5 6 7 8
RF POWER LEVEL: 0.25

AUTO ☐
(250)
(500)
(2)
(.05)

SAMPLE: USP-39A Lot #2-2
SOLVENT: Unisol-d + 0.5% TMS
DEC. LEVEL

REMARKS: 0.162 gm sample
1.072 gm solvent

CHART 15B

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86 OPERATOR DGW SPECTRUM NO. 4 of 7 USP-39A Lot # 2-2

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NAS8-36298

U.S. Polymeric O.E. 71108

WCA Fabric for NASA Lot# 2 (HITCO)

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1b.	Breaking Strength, FILL	1
2a.	Carbon Assay	1
2b.	Hydrogen Assay	1
2c.	Nitrogen Assay	1
3.	Visual Inspection	1
4.	Specific Gravity	1
5.	pH	2
6.	TGA	2
7a.	Atomic Absorption	2
7b.	Moisture Content	2
7c.	Ash Content	2
8a.	Filament diameter, WARP	2
8b.	Filament diameter, FILL	2
9a.	Thread Count, WARP	2
9b.	Thread Count, FILL	3
10a.	Areal weight	3
10b.	Volatiles	3
10c.	Weight Change on Acetone Wash	3

CHARTS

Visual Inspection 3A

TGA ..... 6A - 6B

U.S. Polymeric

FABRIC TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

WCA Fabric for NASA Lot# 2 (HITCO)

1a. Breaking Strength, lbs/in, WARP
ASTM D1682

	#2-1S	#2-1E	LOT2 AVG
PICK	47	42	44.5
CENTER	52	49	50.5
PLAIN	64	57	60.5
AVG.	54.3	49.3	51.8

1b. Breaking Strength, lbs/inch, FILL
ASTM D1682

PICK	30	16	23.0
CENTER	27	16	21.5
PLAIN	44	25	34.5
AVG.	33.7	19.0	26.3

2a. Carbon Assay, %
MDQAI 5560

PICK	99.4	99.4	99.40
CENTER	99.6	99.5	99.50
PLAIN	99.8	99.5	99.65
AVG.	99.6	99.47	99.53

2b. Hydrogen Assay, %
MDQAI 5560

PICK	.03	.02	.025
CENTER	.03	.01	.020
PLAIN	.01	.02	.015
AVG.	.023	.017	.020

2c. Nitrogen Assay, %
MDQAI 5560

PICK	.10	.20	.15
CENTER	.10	.20	.15
PLAIN	.10	.10	.10
AVG.	.10	.17	.13

3. Visual Inspection
QCi-102

See Charts 3A

4. Specific Gravity, Units
PTM-84

PICK	1.6122	1.6644	1.6383
CENTER	1.6379	1.6827	1.6603
PLAIN	1.6166	1.6599	1.6383
AVG.	1.622	1.669	1.646

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

WCA Fabric for NASA Lot# 2 (HITCO)

5. pH, Units
CTM-24B

	#2-1S	#2-1E	LOT2 AVG
	6.3	6.7	6.50
	6.3	6.8	6.55
AVG.	6.3	6.75	6.53

6. TGA, °C at 50% Weight Loss
CTM-51 (AIR)

SET UP# 1		SET UP# 2	
#2-1S	943	#2-1E	868

See Chart 6A-6B

7a. Atomic Absorption, ppm
CTM-53B

	#2-1S	#2-1E	LOT2 AVG
Na	27	19	23.0
K	0	0	0.0
Ca	8	8	8.0
Mg	0	0	0.0
Li	0	0	0.0
AVG.	35	27	31.0

7b. Moisture Content, %
CTM-53B

	.025	.015	.020

7c. Ash Content, %
CTM-53B

	.010	.030	.020

8a. Filament diameter, microns, WARP
S.E.M. (Diameters are an average of 10 measurements)

AVERAGE	10.28	10.63	10.45
Minimum	8.00	9.25	8.00
Maximum	14.55	11.80	14.55
Std. Dev	1.81	0.75	1.36

8b. Filament diameter, microns, FILL
S.E.M. (Diameters are an average of 10 measurements)

AVERAGE	10.48
Minimum	9.05
Maximum	12.50
Std. Dev	0.97

9a. Thread Count, per inch, WARP
PTM-5A

	#2-1S	#2-1E	LOT2 AVG
	29	29	29
	29	29	29
	30	29	29.5
	29	29	29
	29	29	29
AVG.	29.2	29.0	29.1

WCA Fabric for NASA Lot# 2 (HITCO)

9b. Thread Count, per inch, FILL
PTM-5A

	#2-1S	#2-1E	LOT2 AVG
	22	22	22
	22	22	22
	22	22	22
	22	22	22
	22	22	22
AVG.	22.0	22.0	22.0

10a. Areal Weight as received, gm/4x4
PTM-3A

LEFT	2.446	2.539	2.493
CENTER	2.416	2.511	2.464
RIGHT	2.469	2.546	2.508
AVG.	2.444	2.532	2.488

10b. Volatiles as received, %
PTM-3A

LEFT	.70	.51	.60
CENTER	.46	.44	.45
RIGHT	.04	.04	.04
AVG.	.40	.33	.36

10c. Weight change on Acetone wash, %
PTM-3A

LEFT	.58	.28	.43
CENTER	.00	.04	.02
RIGHT	-.16	-.12	-.14
AVG.	.14	.07	.10

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

FOOTAGE

START SAMPLE

3 W

13 S

20 W

SPLICE

33 ~~BREAK~~

38 SPLICE

79 ●●

126 SPLICE

124 ●●

219 S

268 S

307 ●●

333 ●●

367 SPLICE

475 ●●

END 518 END SAMPLE

N C S

LEFT

TREATER OPERATOR READ UP

RIGHT

USP NO. —

CHART 3A

DATE 5-20-86

FABRIC UCA GRAPHITE

MFG. UNION CARBIDE

ROLL NO. 292 4C6WCA-2

YARDS 180.0

POUNDS 99.0

ORDER NO. O.E. 71108

SPECIFICATION VARIOUS

Q.C. FILE # NASA 2-1

SYMBOLS

- TEAR
- SPOTS OR STAINS
- FOLDS
- EDGE CURL
- TIGHT WEAVE OR SELVAGE
- WEAVE DISTORTION
- VISIBLE PUCKERS
- ONE PUCKER CREASING
- TWO OR MORE CREASINGS

REMARKS

GRADE Grap C

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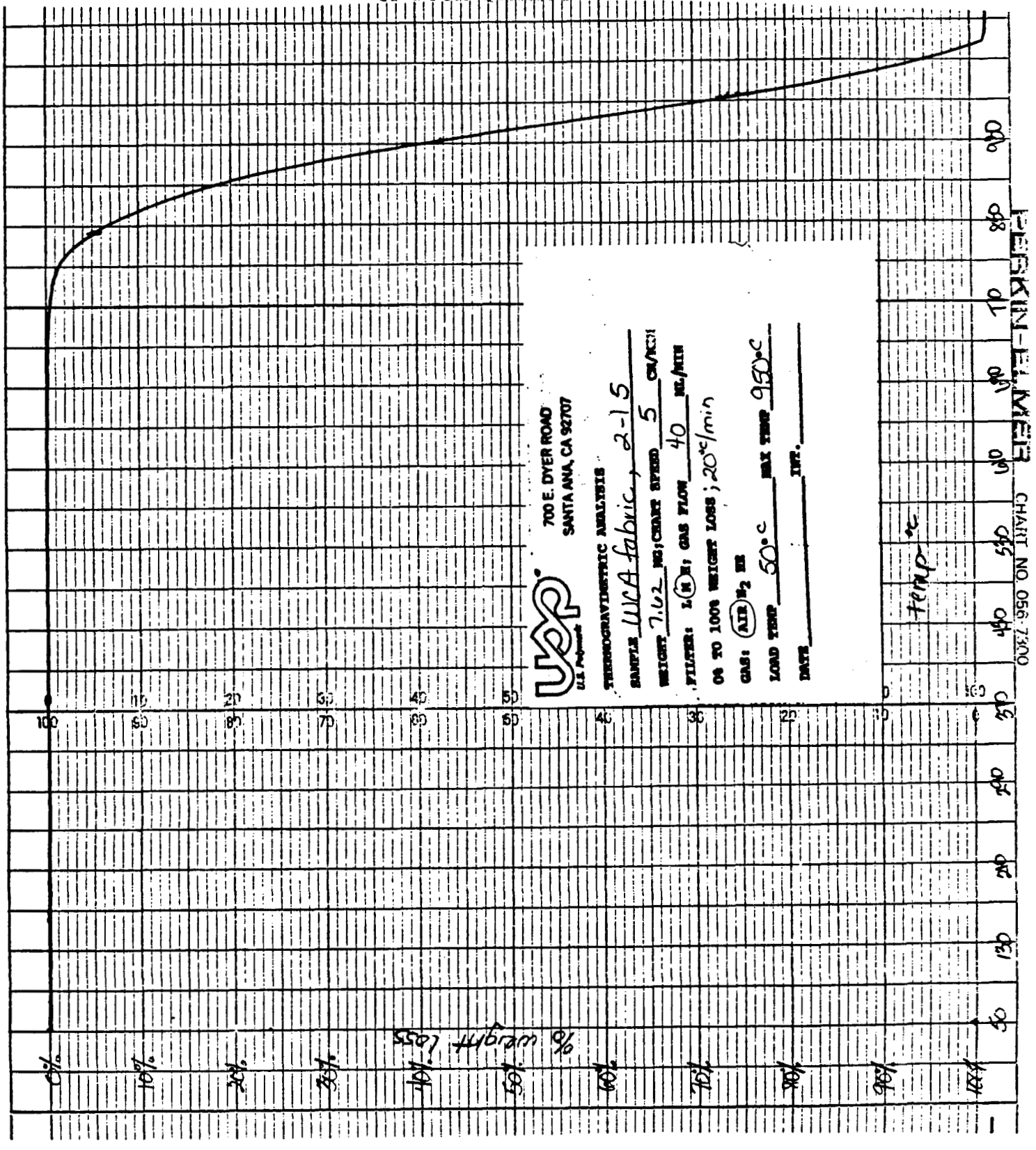

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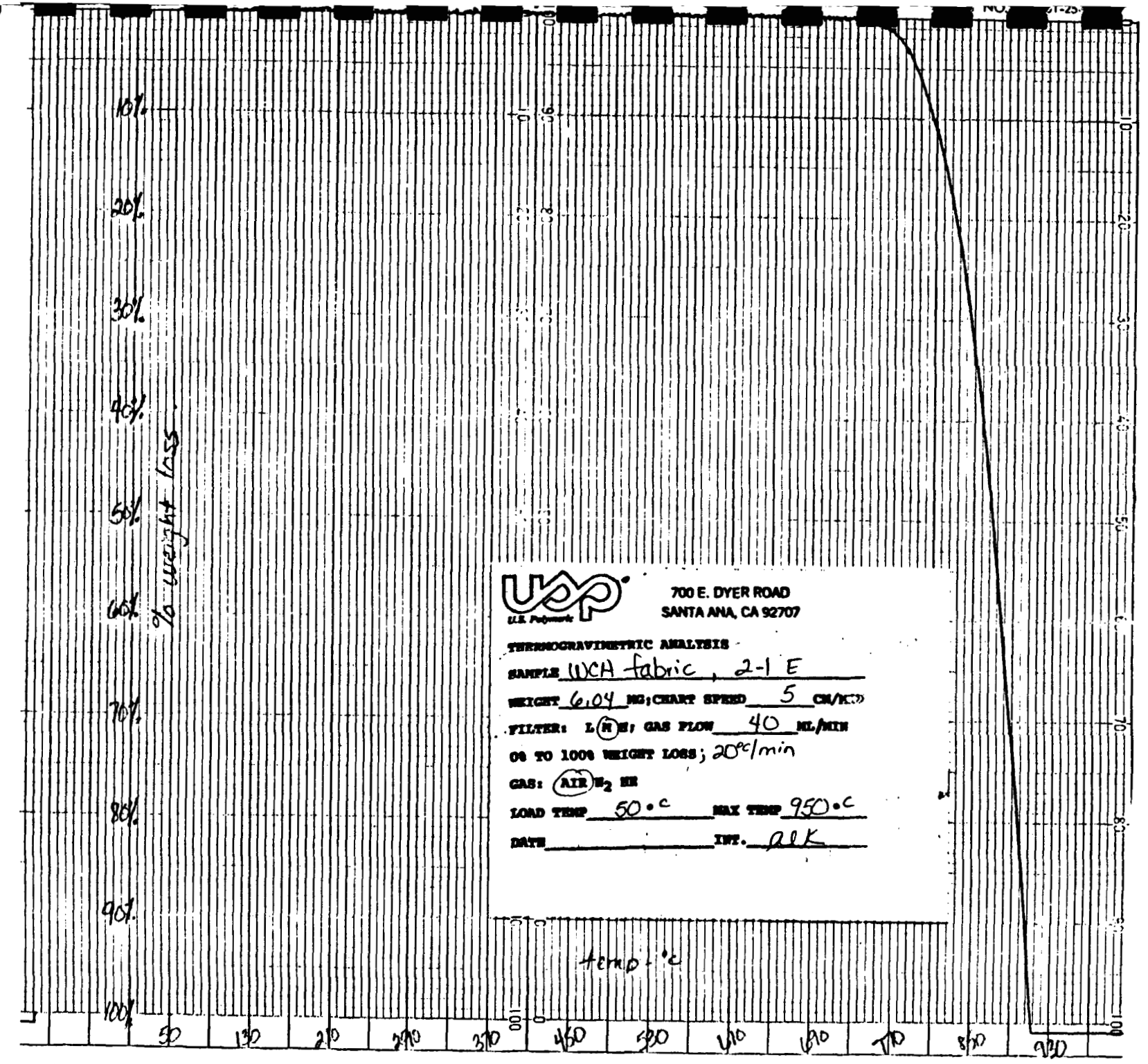

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CHART 6B

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PREPREG TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

FM 5064J NASA LOT# 2 U.S.P. LOT# D09279 (HITCO)

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1b.	Filler Content, Soxhlet	1
1c.	Cloth Content, Soxhlet	1
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3.	Flow	1
4.	Resin Content, Dry Basis	1
5.	Tack	1
6.	Gel Time	1
7a.	Atomic Absorption	1
7b.	Moisture Content	1
7c.	Ash Content	2
8.	TGA	2
9.	DSC	2
10.	Infrared (IRZB) Baseline	2
11.	Environmental History	2
12.	Specific Gravity	2
13a.	Tensile Strength	2
13b.	Tensile Modulus	2
13c.	Tensile Elongation	2
14a.	Flexural Strength	2
14b.	Flexural Modulus	3
15a.	Compressive Strength	3
15b.	Compressive Modulus	3
16.	Double Shear Strength	3
17.	Barcol Hardness	3
18.	Residual Volatiles	3
19.	Resin Content, Pyrolysis	3
20.	Acetone Extraction	3
21a.	CTE, with ply	3
21b.	CTE, crossply	4

CHARTS

TGA 8A
DSC 9A
Infrared (IRZB) Baseline 10A
CTE 21A

U.S. Polymeric

PREPREG TESTING

NAS8-36298

U.S. POLYMERIC O.E.71108

FM 5064J NASA LOT# 2 U.S.P. LOT# D09279 (HITCO)

		ROLL#1-S
1a. Resin Content, Soxhlet, % CTM-6D		35.2
		34.0
		34.8
	AVG.	34.7
1b. Filler Content, Soxhlet, % CTM-6D		14.4
		14.0
		14.3
	AVG.	14.2
1c. Cloth Content, Soxhlet, % CTM-6D		50.4
		52.0
		50.9
	AVG.	51.1
2. Volatile Content, % PTM-17B		3.6
		3.6
		3.4
	AVG.	3.5
3. Flow, % PTM-19G		15.0
		15.1
		14.8
	AVG.	15.0
4. Resin Content, Dry basis, % PTM-16F, Type II		35.3
		35.1
		35.1
	AVG.	35.2
5. Tack, lbs PTM-80		25
6. Gel Time, seconds PTM-20E		91
7a. Atomic Absorption, ppm CTM-53B	Na	7
	K	0
	Ca	11
	Mg	2
	Li	0
	TOTAL	20
7b. Moisture Content, % CTM-53B		2.17

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

FM 5064J NASA LOT# 2 U.S.P. LOT# D09279 (HITCO)

		ROLL#1-S
7c. Ash Content, % CTM-53B		.06
8. TGA, % Weight Loss at 500°C CTM-51 (Nitrogen)	See Chart 8A	8.8
9. DSC, °C CTM-50A	First Temp See Chart 9A	184
10. Infrared (IRZB) Baseline CTM-21C	See Chart 10A	.82
11. Environmental History	Date manufactured: 30 May 1986 Packaged in: MIL-B-131 Class I bag supported in cardboard carton Date shipped: 14 June 1986 in 40°F truck	
12. Specific Gravity, Cured, Units ASTM D792		1.431 1.431 1.431 1.431
	AVG.	1.431
13a. Tensile Strength, ksi, WARP FTMS 406-1011		18.74 20.19 18.82 18.71 19.36
	AVG.	19.16
13b. Tensile Modulus, msi, WARP FTMS 406-1011		1.91 1.87 1.86 1.71 1.72
	AVG.	1.81
13c. Tensile Elongation, %, WARP FTMS 406-1011		1.23 1.24 1.13 1.24 1.23
	AVG.	1.21
14a. Flexural Strength, ksi, WARP FTMS 406-1031		28.25 26.52 27.08 27.66 27.64
	AVG.	27.43

FM 5064J NASA LOT# 2 U.S.P. LOT# D09279 (HITCO)

		ROLL#1-S
14b. Flexural Modulus, msi, WARP FTMS 406-1031		1.89
		1.80
		1.90
		1.91
		1.85
	AVG.	1.87
15a. Compressive Strength, ksi, WARP FTMS 406-1021		17.01
		16.71
		15.89
		15.70
		13.74
	AVG.	15.81
15b. Compressive Modulus, msi, WARP FTMS 406-1021		2.04
		2.12
		2.11
		1.94
		2.13
	AVG.	2.07
16. Double Shear Strength, ksi FTMS 406-1041A		2.61
		2.45
		2.65
		2.67
		2.62
	AVG.	2.60
17. Barcol Hardness, Units ASTM D-2583 (Average of 10 determinations)		52.4
18. Residual Volatiles, % PTM-98		1.32
		1.19
		1.33
	AVG.	1.28
19. Resin Content, Pyrolysis, % CTM-14B		32.29
		31.97
		32.80
	AVG.	32.35
20. Acetone Extraction, % CTM-18A		6.84
		5.89
		5.66
	AVG.	6.13
21a. CTE, in/in •F with PLY PTM-61B		2.56
		2.70
	AVG.	2.63

FM 5064J NASA LOT# 2 U.S.P. LOT# D09279 (HITCO)

21b. CTE, in/in •F Cross PLY PTM-61B		3.61
		8.53
	AVG.	6.07

See Chart 21A

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

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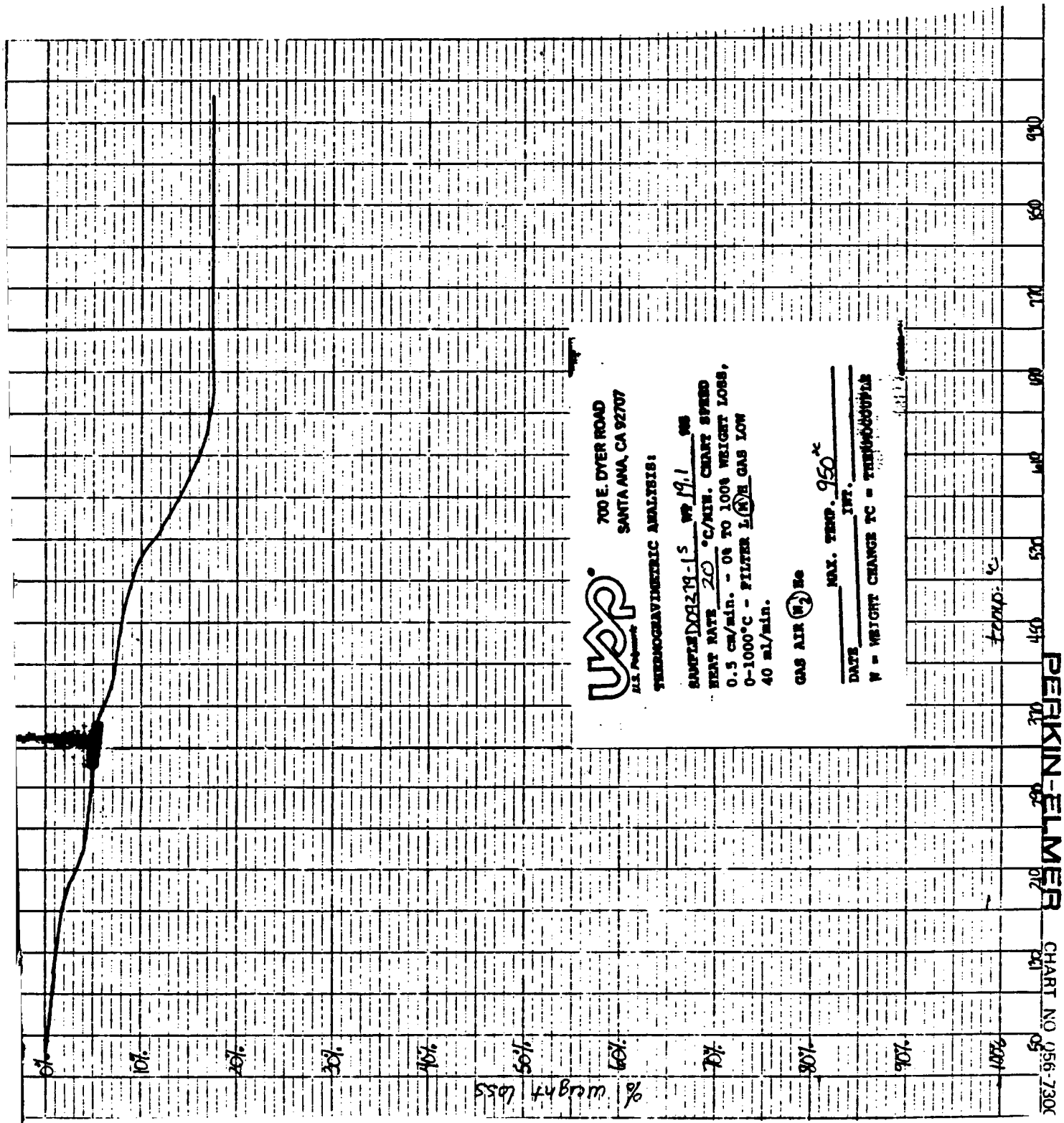
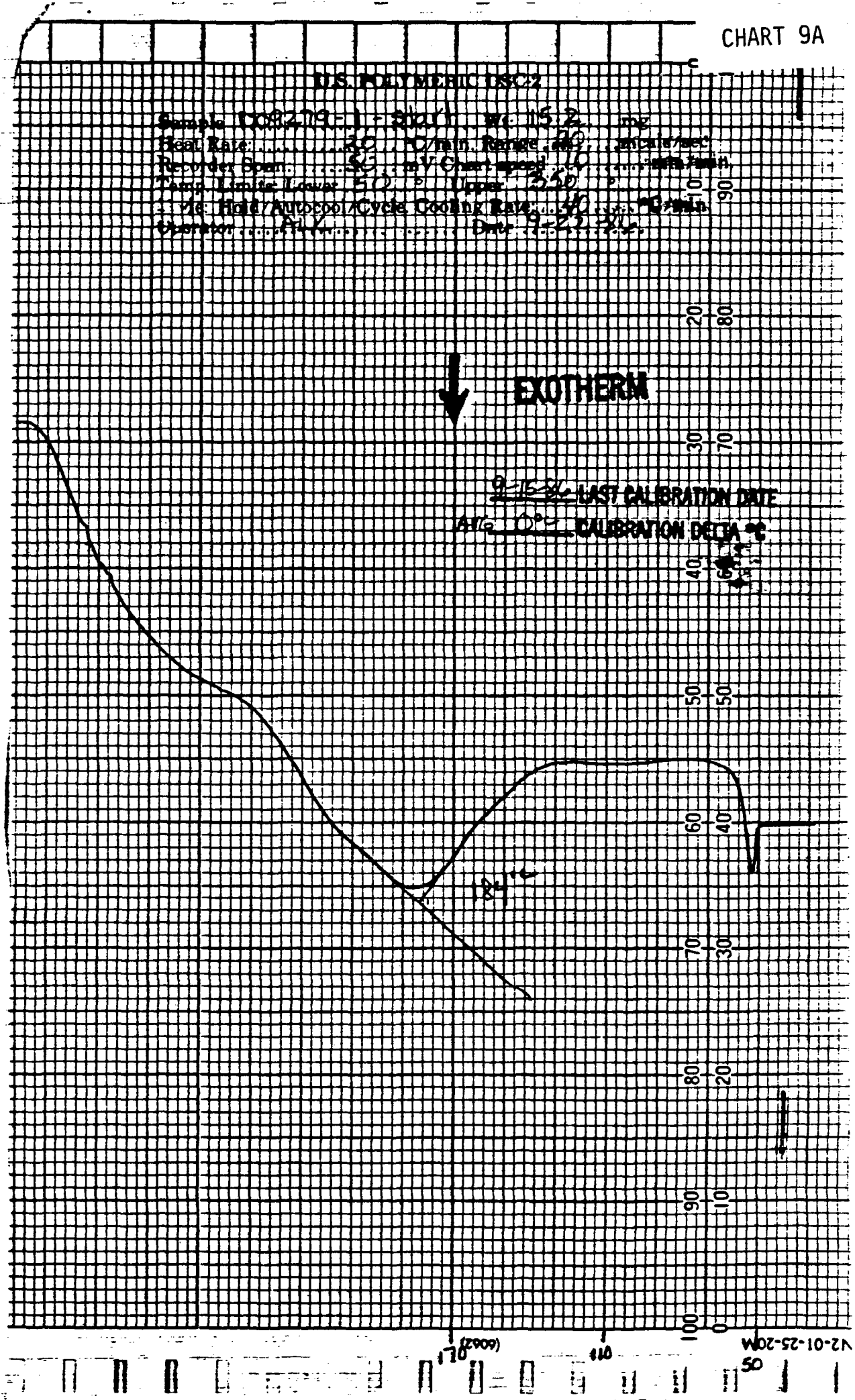


CHART 9A



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SPECTRUM NO. 15188
DATE 7-07-86
SAMPLE FM 5064 J
D09279 # 1

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 30-50%
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST Y. MIRANDA

Beckman®
INFRARED
SPECTROPHOTOMETER

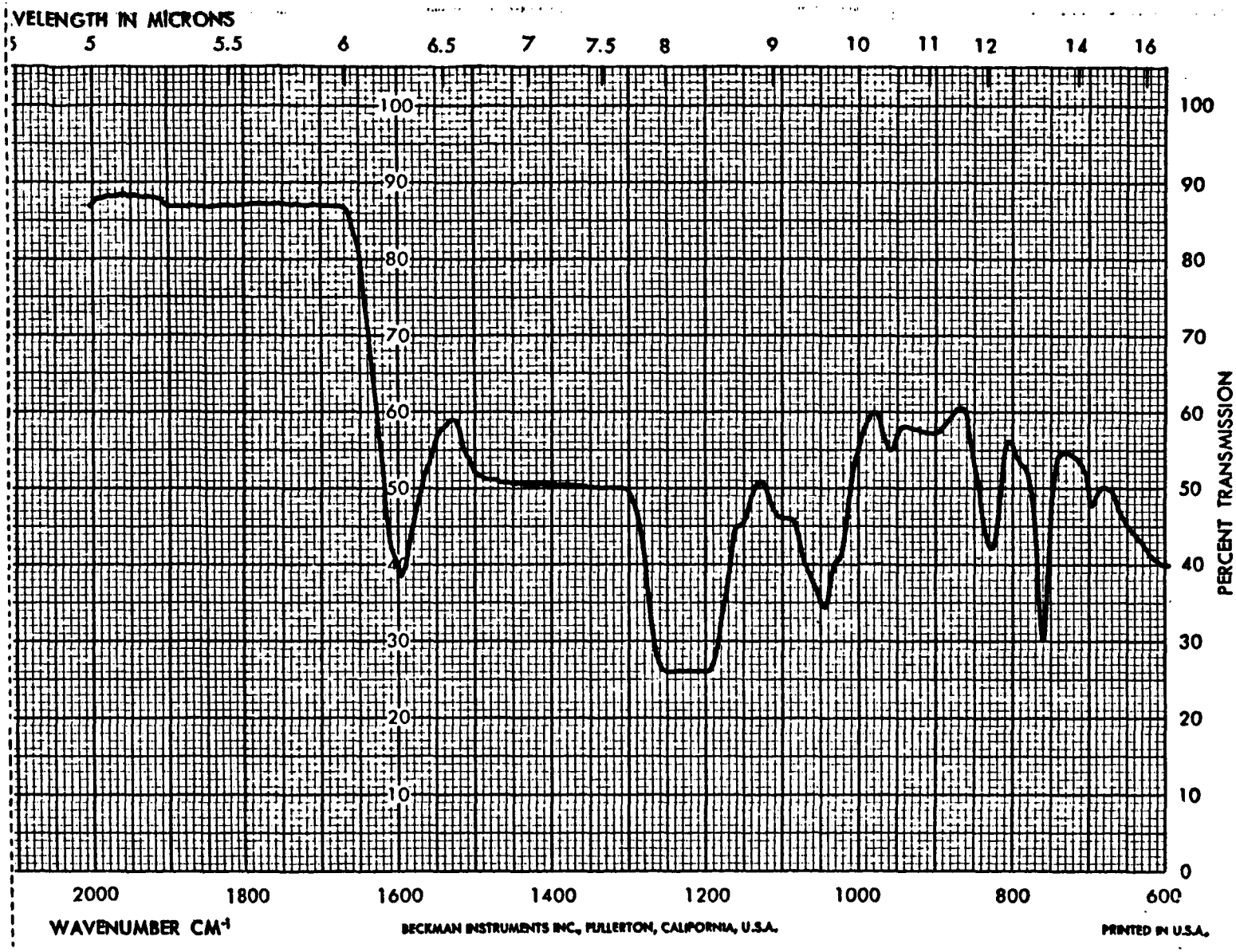

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CHART 10A

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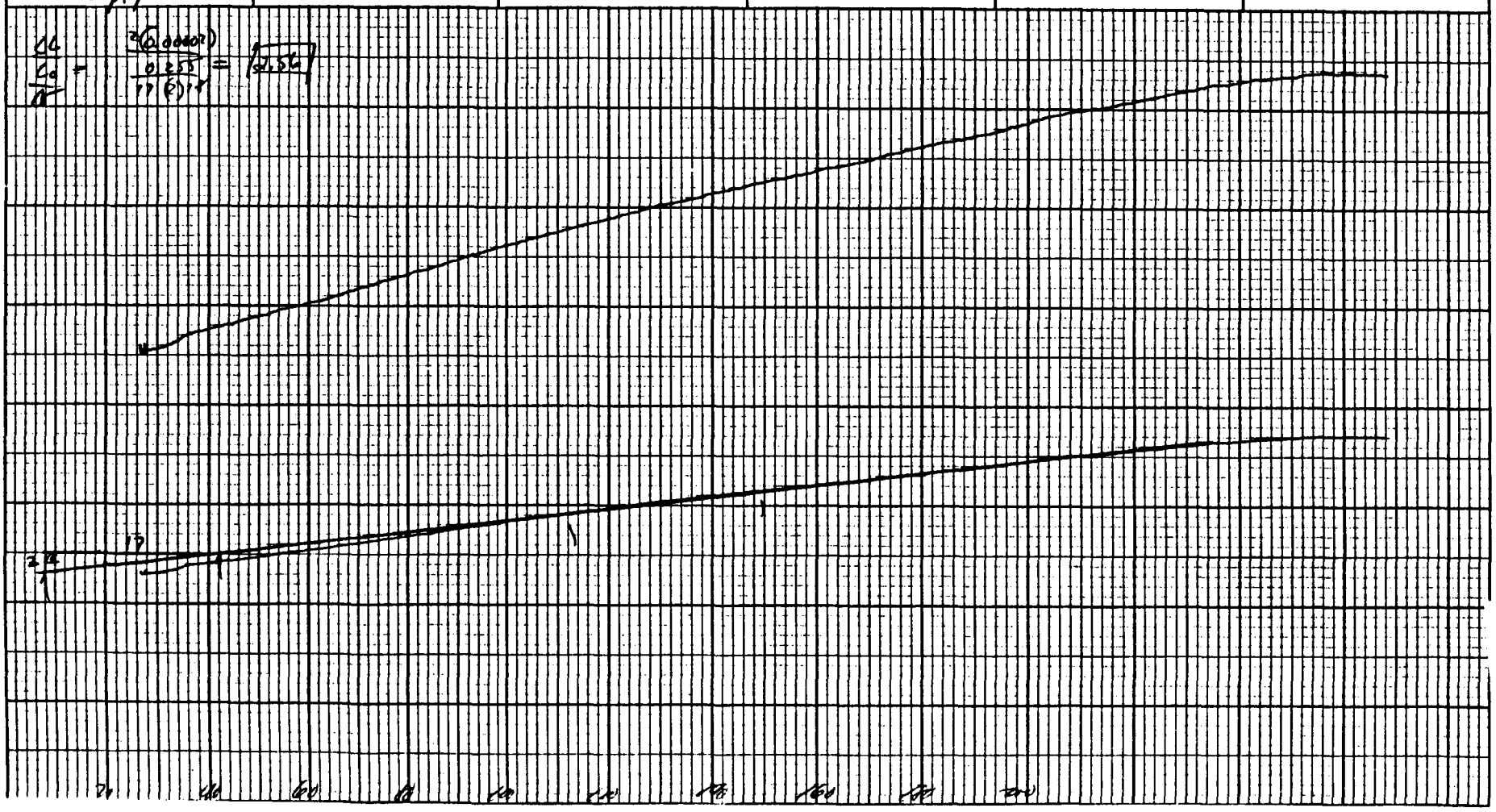
PART NO. 990088

RUN NO. ___ DATE 11/1/86	T-AXIS	DTA-DSC	TGA	TMA (Semi/in F)	
OPERATOR TD	SCALE, °C/in ~~50~~ 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: Do 9279-1-Sample-(1)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Ar @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.255	
FLOW RATE 3-5 scc/m	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
w/ply			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

$\frac{\Delta L}{L_0} = \frac{2(0.00602)}{0.255} = 47.56$



MEASURED VARIABLE

DUPONT Instruments

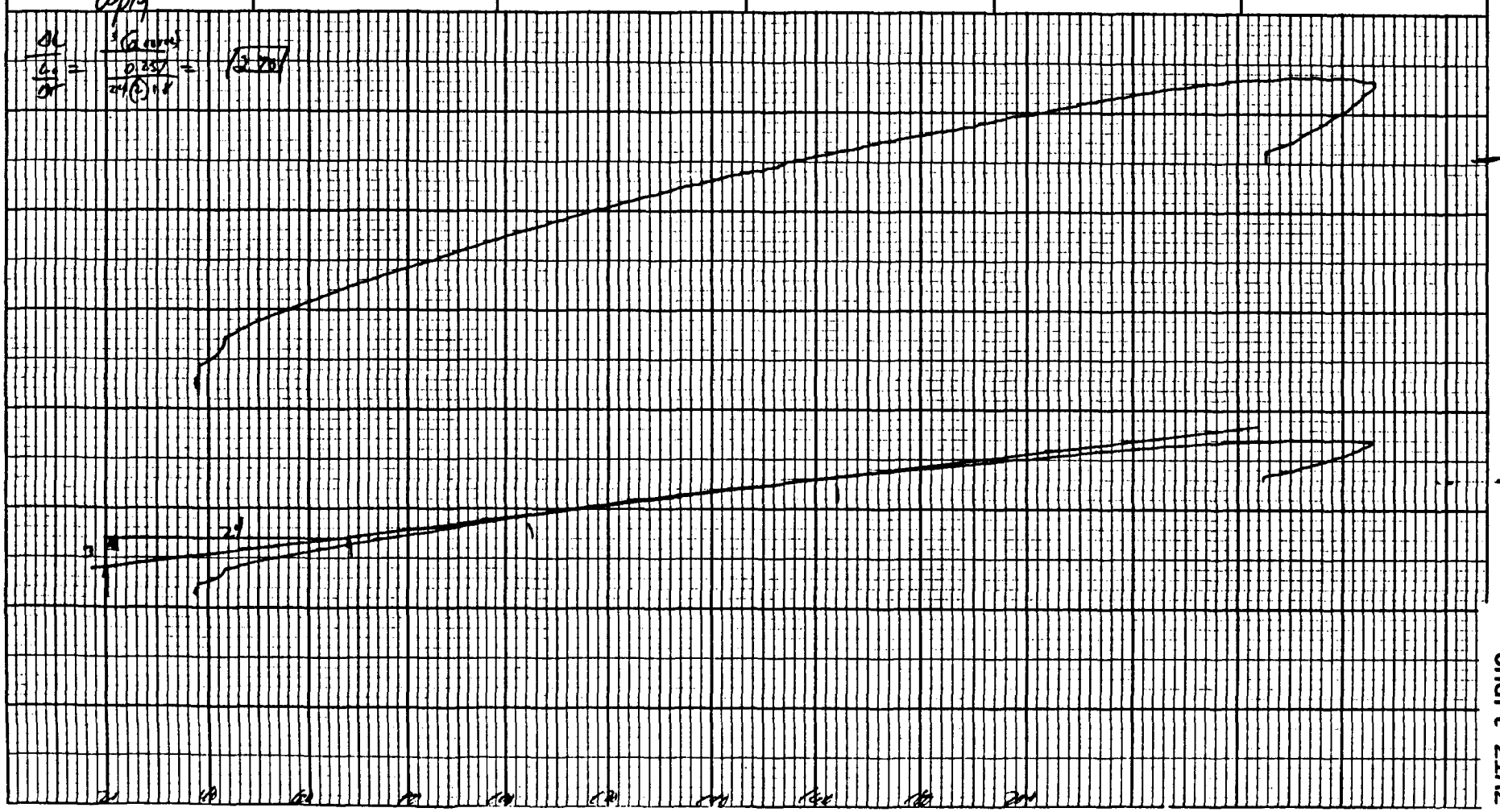
Chart 21A1

PART NO. 990088

RUN NO. ___ DATE 10/1/14	T-AXIS	DTA-DSC	TGA	TMA (μin/in F)	
OPERATOR TL	SCALE, °C/in ~~80~~ 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
D09279-1-smart-(2)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.257	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 scfh			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

upfly

$$\frac{\frac{dL}{L_0}}{dT} = \frac{\frac{3\ (\text{Gauge})}{0.257}}{24(\text{°C})\ 10\ \text{s}} = \boxed{2.70}$$



DUPONT Instruments

MEASURED VARIABLE

Chart 21A2

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DU PONT Instruments

MEASURED VARIABLE _____

PART NO. 990088

RUN NO. ___ DATE 11/3/86	T-AXIS	DTA-DSC	TGA	TMA (mm/inf)	
OPERATOR TH	SCALE, °C/in ~~50~~ 20	SCALE, °C/in ___	SCALE, mg/in ___	SCALE, mils/in 0.1/0.2	
SAMPLE: D09279 - 1-stmer-(3)	PROG. RATE, °C/min 10	(mcal/sec)/in ___	SUPPRESSION, mg ___	MODE EXPANSION	
	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg ___	WEIGHT, mg ___	SAMPLE SIZE 0.123	
ATM Ar @ STP	SHIFT, in 0	REFERENCE ___	TIME CONST., sec ___	LOAD, g 10	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in ___	dY, (10X), (mils/min) /in ___	

X p/y

$\frac{\Delta L}{L_0} = \frac{2(0.00097)}{0.123} = 15.61$

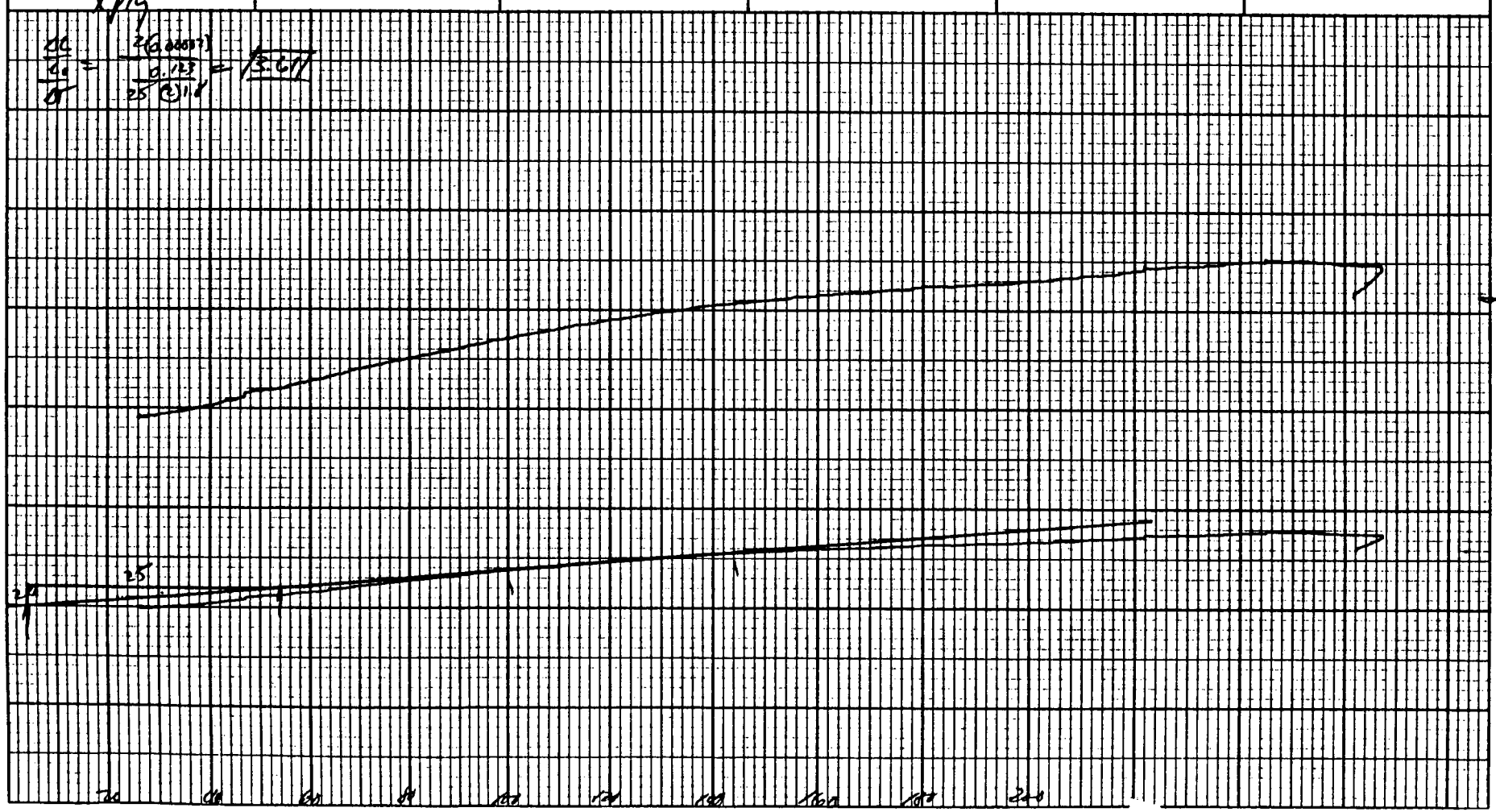


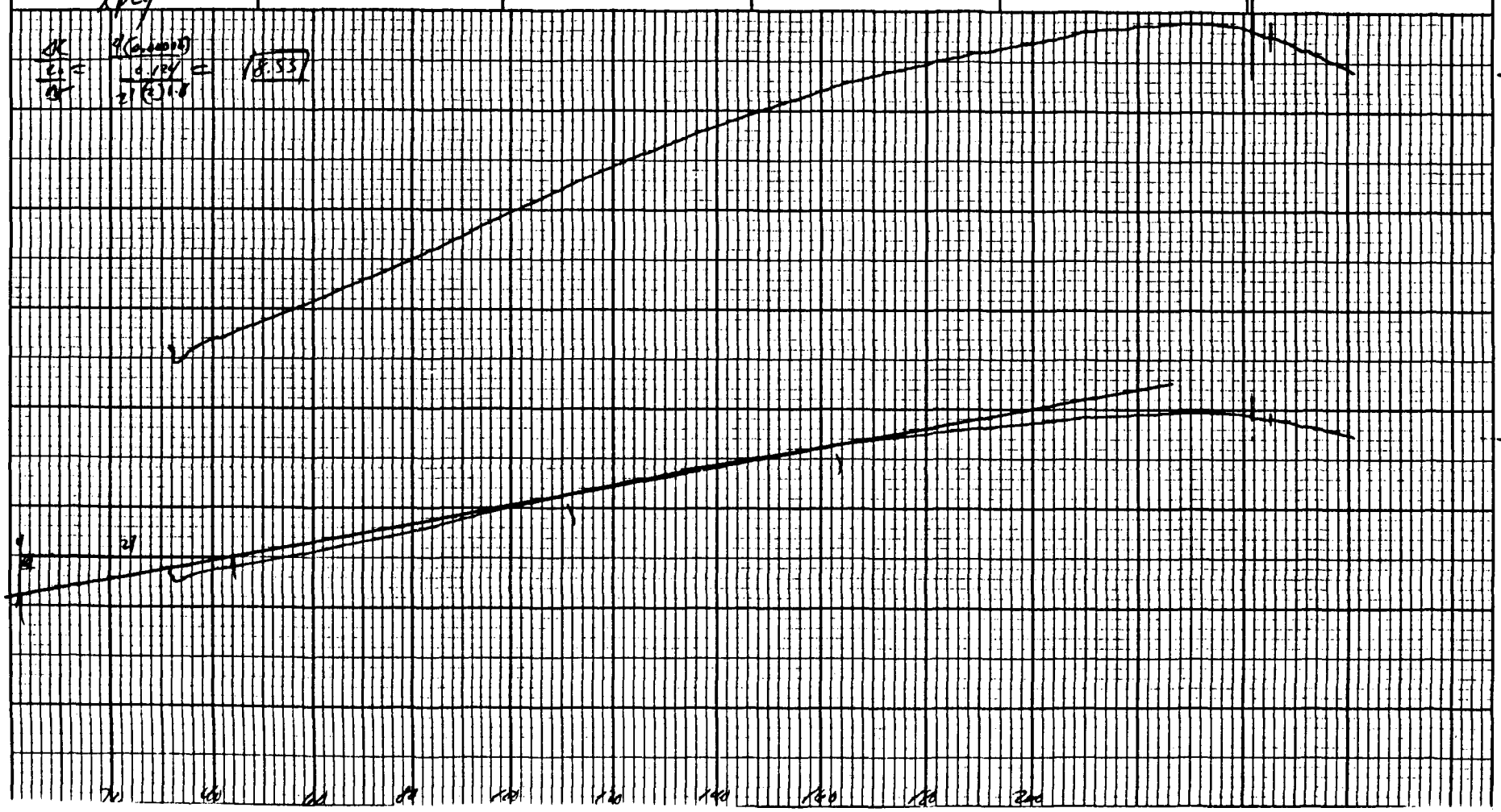
Chart 27A

PART NO. 990088

RUN NO. ___ DATE 11/3/96	T-AXIS	DTA-DSC	TGA	TMA (μm/in°F)	
OPERATOR TA	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: D09279-1-SMART-4	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.124	
ATM AIR @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

XPLY

$\frac{dL}{L_0} = \frac{\alpha(\Delta T)}{2} = \frac{0.124}{2(3)1.8} = \boxed{8.55}$



DUPONT Instruments

MEASURED VARIABLE

Chart 21A4

TABLE OF CONTENTS

FILLER TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

Filler Lot for NASA Lot# 3

TEST		PAGE
1.	Carbon Content	1
2.	Ash Content	1
3.	Atomic Absorption	1
3a.	Moisture Content	1
3b.	Ash Content	1
4.	pH	1
5.	Particle Size, S.E.M. procedure	1
6a.	TGA, °C at 50% Loss	1
6b.	TGA	2
7.	Particle Size Distribution	2
7a.	Particle Size, Horiba	2

CHARTS

TGA..... 6A - 6C

Particle Size Distribution..... 7A - 7C

U.S. Polymeric

FILLER TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

Filler Lot for NASA Lot# 3

		SAMPLE		
1. Carbon Content, % QAI-5560		#3A-1	#3A-2	#3A-3
		99.40	99.32	99.44
	NASA LOT# 3		AVERAGE	99.39
2. Ash Content, % PTM-71B		0.000	0.000	0.000
		0.000	0.000	0.005
	AVG.	0.000	0.000	0.002
	NASA LOT# 3		AVERAGE	0.001

3. Atomic Absorption, ppm CTM-53B (Values are average of 2 determinations)		#3A-1	#3A-2	#3A-3	LOT#3 AVG.
	Na	6.0	6.0	6.0	6.0
	K	2.5	1.0	2.0	1.8
	Ca	2.5	2.5	2.0	2.3
	Mg	0.0	0.0	0.0	0.0
	Li	0.0	0.0	0.0	0.0
	TOTAL	11.0	9.5	10.0	10.2

3a. Moisture Content, % CTM-53B		.010	.015	0.000
		.005	.020	0.000
	AVG.	.008	.018	0.000
	NASA LOT# 3		AVERAGE	.008
3b. Ash Content, % CTM-53B		.025	.000	.000
		.025	.010	.000
	AVG.	.025	.005	.000
	NASA LOT# 3		AVERAGE	.010
4. pH, Units ASTM D1512		4.80	4.75	4.85
		4.95	4.80	4.80
	AVG.	4.88	4.78	4.82
	NASA LOT# 3		AVERAGE	4.83
5. Particle Size, microns S.E.M. procedure (Average values are of 20 determinations)	AVG.	.51	.51	.42
	Maximum	.99	.88	.85
	Minimum	.20	.18	.15
	Std. Dev	.23	.20	.17
	NASA LOT# 3 AVERAGE SIZE			.48
6a. TGA, °C at 50% Loss CTM-51		864	860	850
	NASA LOT# 3		AVERAGE	858

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Filler Lot for NASA Lot# 3

6b. TGA
CTM-51 — See Charts 6A-6C

7. Particle Size Distribution
CTM-72 — See Charts 7A-7C

7a. Particle Size, microns
CTM-72

	#3A-1	#3A-2	#3A-3
	.89	.94	.89
	.94	.83	.86
AVG.	.92	.88	.88
NASA LOT# 3		AVERAGE	.89

U.S. Polymeric

Hamid M. Quraishi

Hamid M. Quraishi, Manager
Quality Assurance Department

CHART 6A

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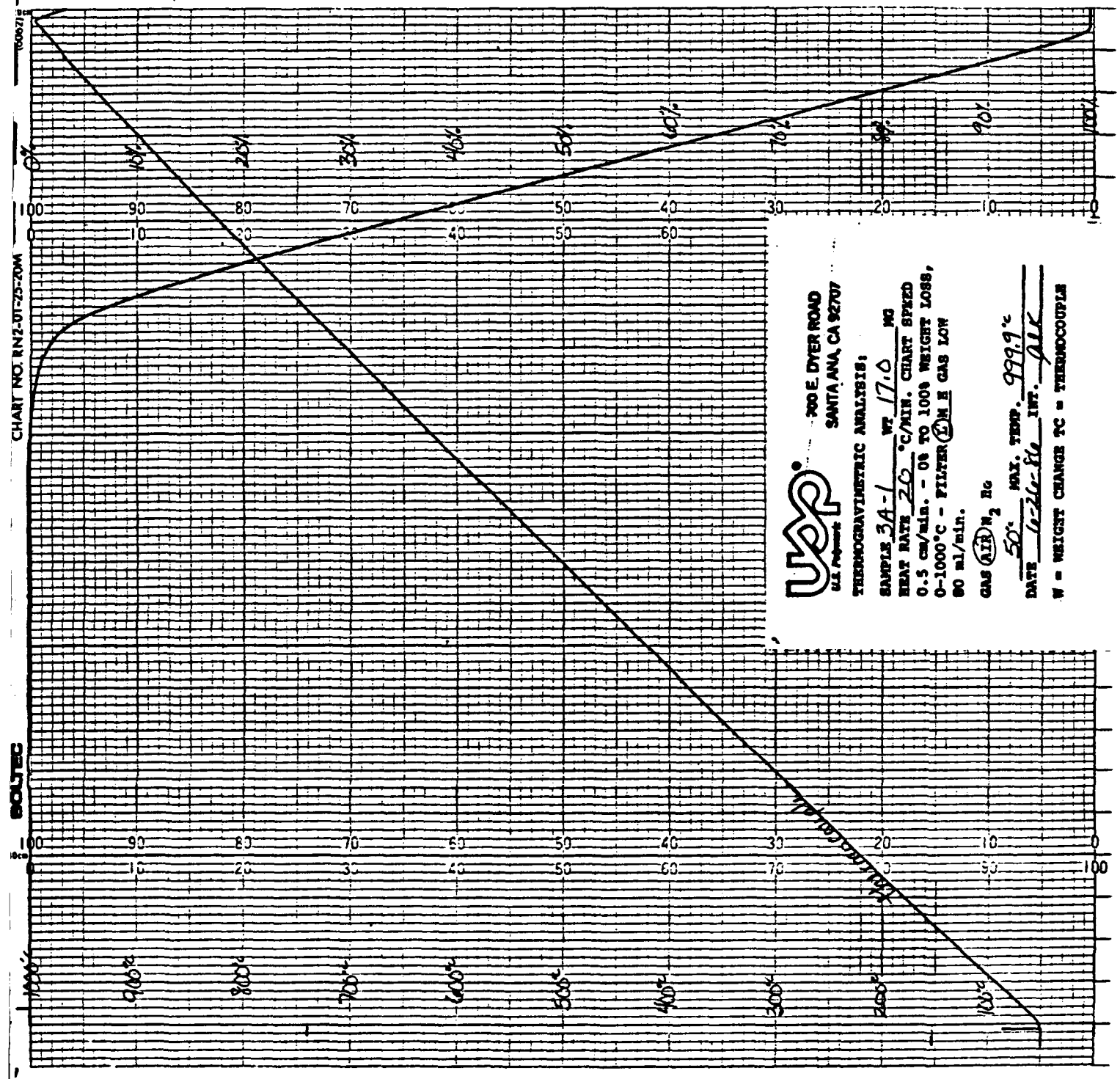

CHART 6B

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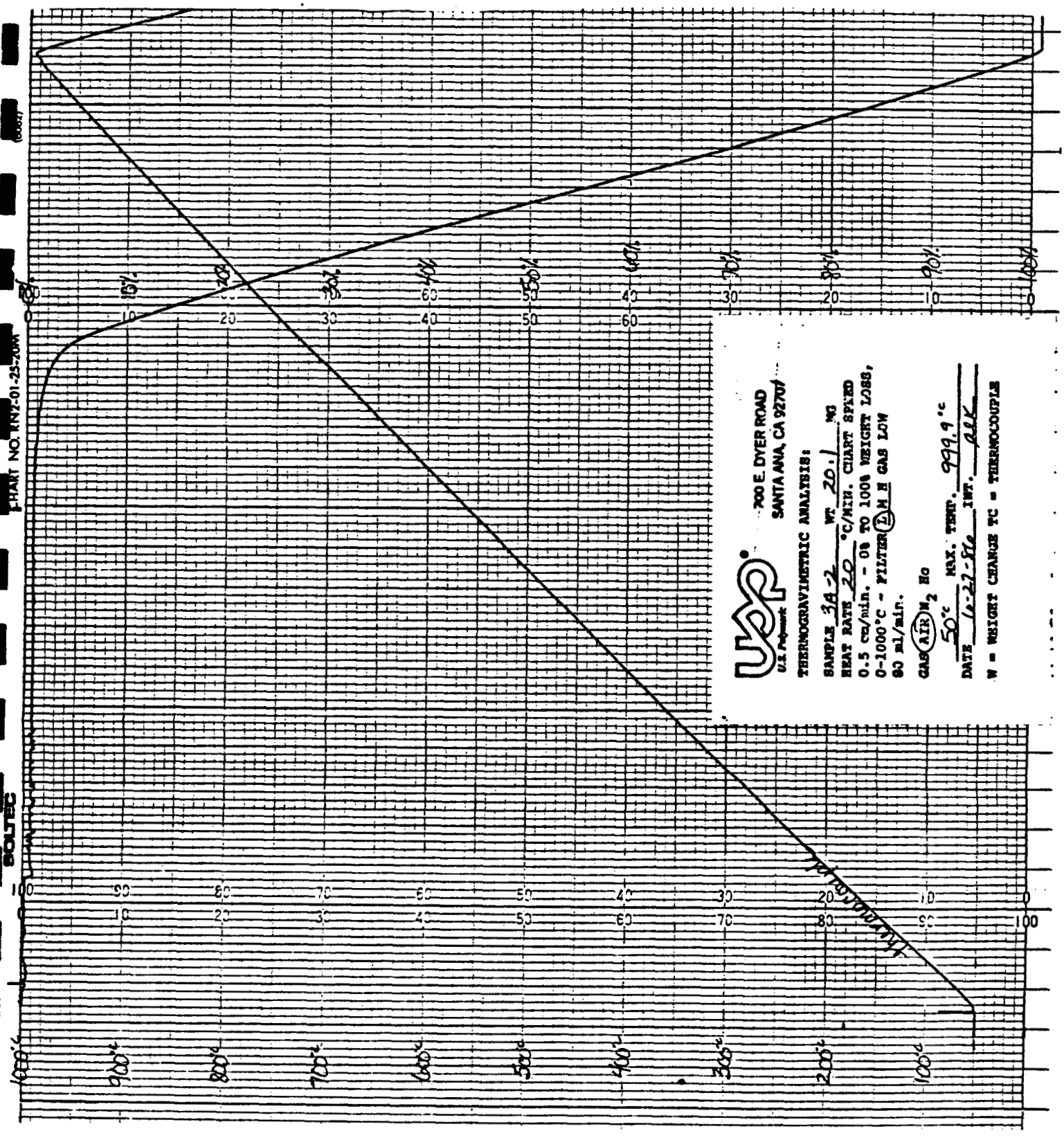

CHART 6C

ORIGINAL PAGE IS
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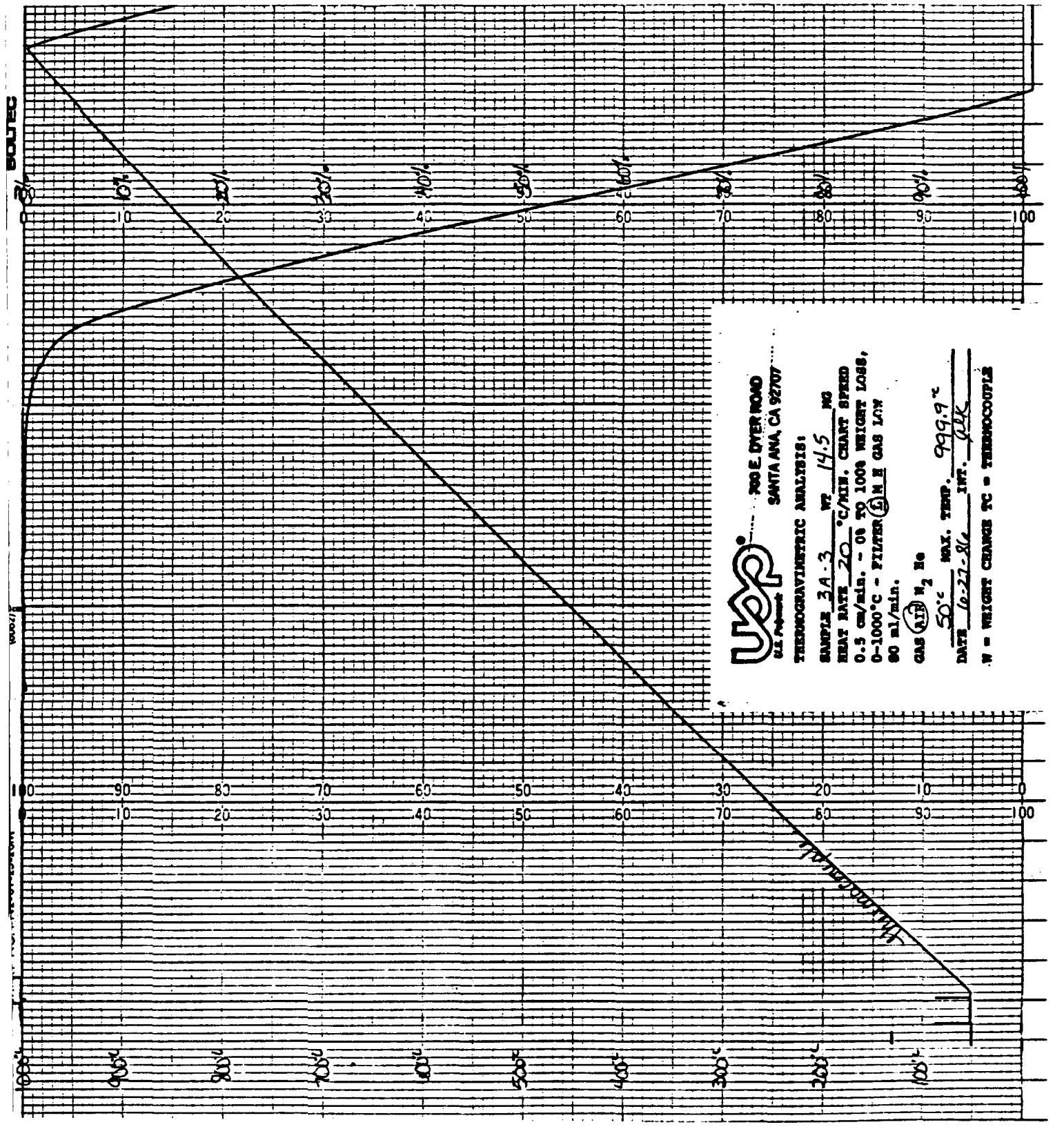


HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-27-86
#1 SAMPLE NASA LOT#3A1
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

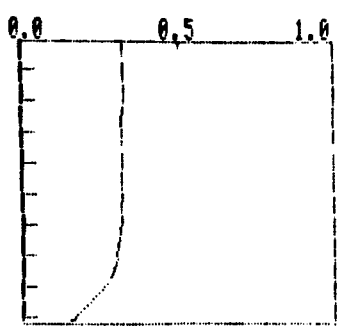
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

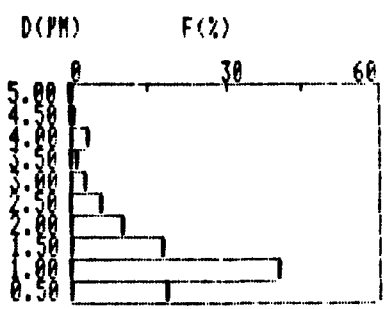


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.5	0.5
4.00-3.50	3.2	3.6
3.50-3.00	1.0	4.7
3.00-2.50	2.5	7.2
2.50-2.00	6.0	13.1
2.00-1.50	10.2	23.3
1.50-1.00	17.5	40.8
1.00-0.50	40.7	81.5
0.50-0.00	18.5	100.0

D(AVE) 0.89 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#3A-1
Sample#1

HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-27-86
#2 SAMPLE NASA LOT#3A1
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

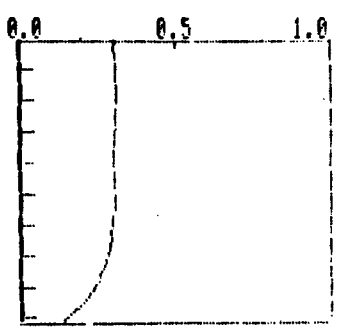
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

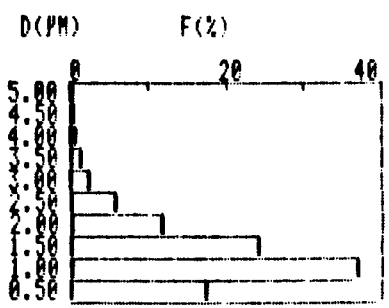


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.6	0.6
3.50-3.00	1.2	1.8
3.00-2.50	2.3	4.1
2.50-2.00	5.6	9.7
2.00-1.50	11.8	21.5
1.50-1.00	24.2	45.7
1.00-0.50	37.0	82.7
0.50-0.00	17.3	100.0

D(AVE) 0.94 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot 3A-1
Sample#2

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CHART 7A

HORIBA CAPA-500
PARTICLE ANALYZER

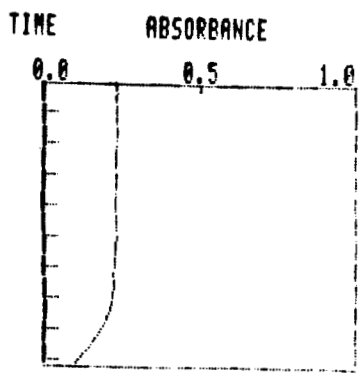
DATE 5-23-86
SAMPLE NASA LOT# 3A-2
#1 SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

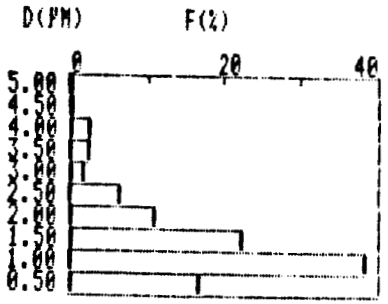


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	2.3	2.3
3.50-3.00	2.4	4.7
3.00-2.50	1.5	6.2
2.50-2.00	6.2	12.5
2.00-1.50	10.6	23.1
1.50-1.00	22.3	45.4
1.00-0.50	38.4	83.8
0.50-0.00	16.2	100.0

D(AVE) 0.94 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#3A2
Sample#1

HORIBA CAPA-500
PARTICLE ANALYZER

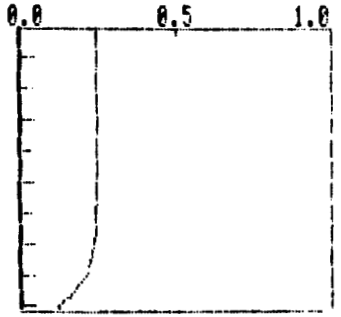
DATE 5-23-86
SAMPLE NASA LOT# 3A-2
#2 SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

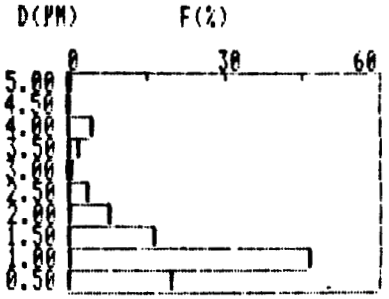


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	4.2	4.2
3.50-3.00	1.6	5.9
3.00-2.50	0.6	6.4
2.50-2.00	3.6	10.0
2.00-1.50	7.8	17.8
1.50-1.00	16.3	34.2
1.00-0.50	46.3	80.5
0.50-0.00	19.5	100.0

D(AVE) 0.83 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#3A-2
Sample#2

CHART 7B

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HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-23-86
#1 SAMPLE NASA LOT#3A-3
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

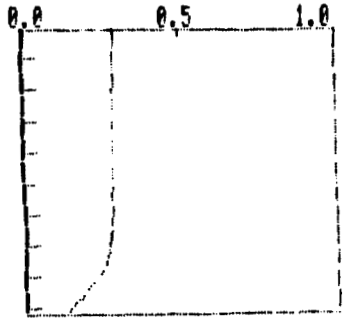
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (μM)
D(MIN)	0.01(μM)
D(DIV)	0.50(μM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

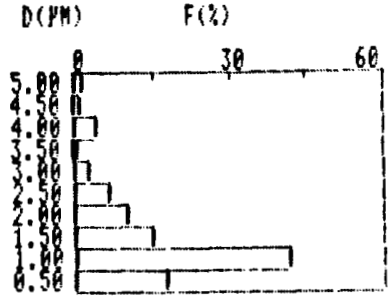


* DISTRIBUTION TABLE (BY VOL.)

D(μM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	1.4	1.4
4.50-4.00	0.9	2.3
4.00-3.50	4.2	6.5
3.50-3.00	0.3	6.9
3.00-2.50	2.5	9.4
2.50-2.00	6.5	15.9
2.00-1.50	10.0	25.9
1.50-1.00	14.8	40.7
1.00-0.50	41.7	82.3
0.50-0.00	17.7	100.0

D(AVE) 0.89 (μM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT# 3A-3
Sample #1

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HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-23-86
#2 SAMPLE NASA LOT#3A-3
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

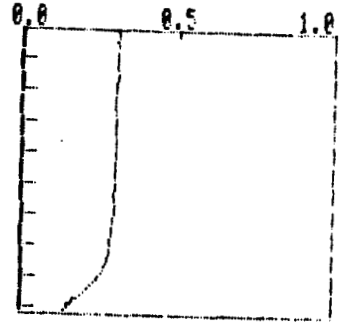
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (μM)
D(MIN)	0.01(μM)
D(DIV)	0.50(μM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

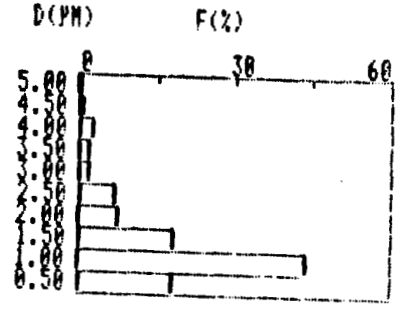


* DISTRIBUTION TABLE (BY VOL.)

D(μM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.5	0.5
4.00-3.50	2.3	2.8
3.50-3.00	1.8	4.5
3.00-2.50	1.8	6.3
2.50-2.00	6.6	12.9
2.00-1.50	7.5	20.3
1.50-1.00	17.8	38.1
1.00-0.50	44.0	82.1
0.50-0.00	17.9	100.0

D(AVE) 0.86 (μM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot #3A-3
Sample #2

CHART 7C

TABLE OF CONTENTS

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 3

TEST		PAGE
1.	Resin Solids	1
2.	Specific Gravity	1
3.	Brookfield Viscosity	1
4.	Gel Time	1
5.	Atomic Absorption	1
6.	Gas Chromatography	1
7.	TGA	1
8.	DSC	1
9.	HPLC	1
10.	GPC	1
11.	pH	1
12.	Phenol Content	2
13.	Chang's Index	2
14.	RDS	2
15.	NMR	2

CHARTS

Gas Chromatography	6A
TGA	7A
DSC	8A
HPLC	9A
GPC	10A
RDS	14A
NMR	15A

U.S. Polymeric

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 3

1. Resin Solids, % PTM-7C		#3-1
		79.3
		78.1
		77.2
	AVG.	78.2
2. Specific Gravity @ 25°C PTM-29C		1.181
3. Viscosity, Brookfield, cps. @ 22.8°C PTM-14C		15,000
4. Gel Time, min:sec PTM-47B		4:22
5. Atomic Absorption, ppm CTM-53B (Values are averages of four determinations)	Na	18.0
	K	1.8
	Ca	5.8
	Mg	1.3
	Li	0.0
	TOTAL	26.8
6. Volatiles, Gas Chromatography CTM-55		See Charts 6A
7. TGA, % Weight Loss at 500°C CTM-51 (AIR)		39.9
		See Chart 7A
8. DSC, temperature °C CTM-50A		185
		See Chart 8A
9. HPLC CTM-49A		See Chart 9A
10. GPC, Average molecular wt. CTM-49A		1932
		See Chart 10A
11. pH, units CTM-1B		8.2

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USP-39A Resin Lot for NASA Lot# 3

12. Phenol Content, %
    CTM-55 Appendix 1

	#3-1
	11.64
	12.02
AVG.	11.83

13. Chang's Index, ml.
    CTM-5B

22.2

14. RDS, Minimum Viscosity, cps.
    CTM-57A

	Min. Visc.	°C
#3-1	175	111

See Charts 14A

15. NMR
    Vendor procedure

See Charts 15A

U. S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

TYPICAL GAS CHROMATOGRAPH SET-UP

Operator	Q.M.Z.	Date	12/16/86
Column		Detector	FID
Length	6 ft.	Voltage	
Dia.	1/4 in.	Sensit.	
Liquid Phase	AT-1000	Flow Rates, ml/min	
Wt. %	0.1	Hydrogen	60 Air 96
Support	GRAPHPAC	Scavenge	
Mesh	80/100	Split	
Carrier Gas	He	Temperature, °C	
Rotameter		Det.	220 Inj. 200
Inlet Press	60 psig	Column Initial	60
Rate	30 ml/min	Final	210
CHART SPEED		Rate	5°C/MIN
SAMPLE	USP39A, 3-1	Solvent	THF
Size	0.05 ul	Concn.	0.0892 g/ml

GAS CHROMATOGRAPHY STANDARD SOLVENT

TEST METHOD CTM-55

STANDARD SOLVENT/MONOMER	RETENTION TIME (MINS.)
MEOH	.6
ETHANOL	1.18
MECL2	1.28
ACETONE	1.45
IPA	1.83
THF	3.08
ACETONITRILE	3.2
CRESOL	4.03
MEK	4.08
FURFURAL	15.03
TOLUENE	17.98
CHLOROBENZENE	19.6
PHENOL	22.08

NOTE: THF WAS USED TO DILUTE THE RESIN SAMPLES.

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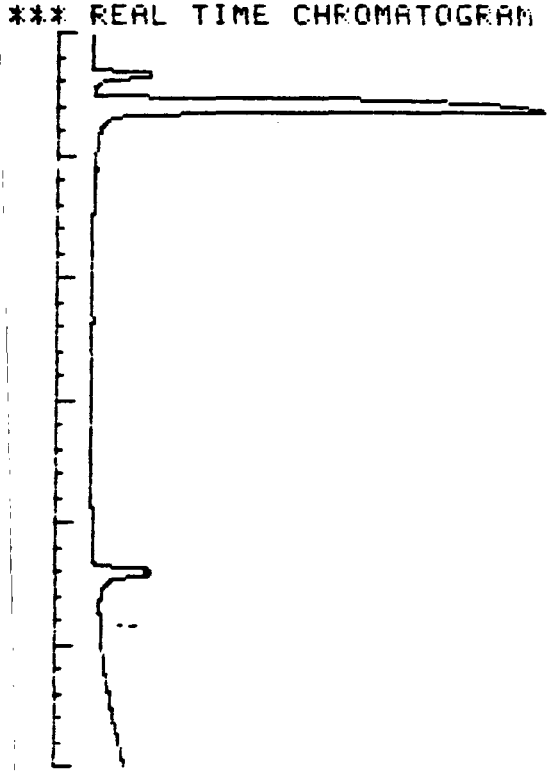
*** REAL TIME CHROMATOGRAM ***



INAL FULL SCALE MV.=1000.00

AMPLE: USP39A 3-1
ISC.: C=0.10892 GMS/ML

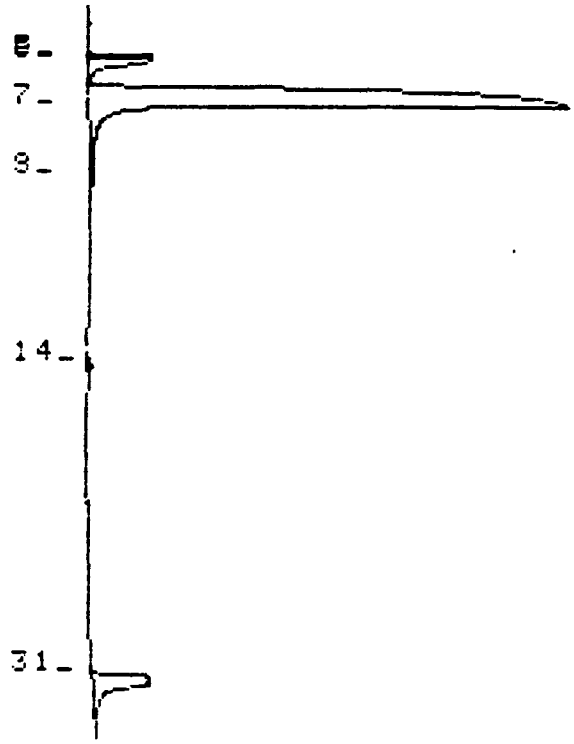
IME: 15:29
ATE: 12/11/86
PERATOR: JGZ

UN TIME: 30.00 MINUTES
ELAY TIME: 0.00
HAN: 0

K O.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
2	.65	1477	.041	2	220
5	1.70	76001	2.105	2	11151
6	1.80	187200	5.164	2	11148
7	3.30	2984100	82.637	2	85858
3	5.60	8003	.222	3	589
4	11.75	11088	.307	1	635
1	21.97	343230	9.505	3	10407

OTAL AREA= 3611099
HRESHOLD= 1
IN.PK WIDTH= 15
REA REJECT= 1000

VERTICAL SCALE FACTOR: 1%



SAMPLE: USP39A 3-1
MISC.: C=0.10892 GMS/ML

TIME: 15:29
DATE: 12/11/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
5	1.70	76001	2.117	2	11151
6	1.80	187200	5.214	2	11148
7	3.30	2984100	83.110	2	85858
31	21.93	343230	9.559	3	10407

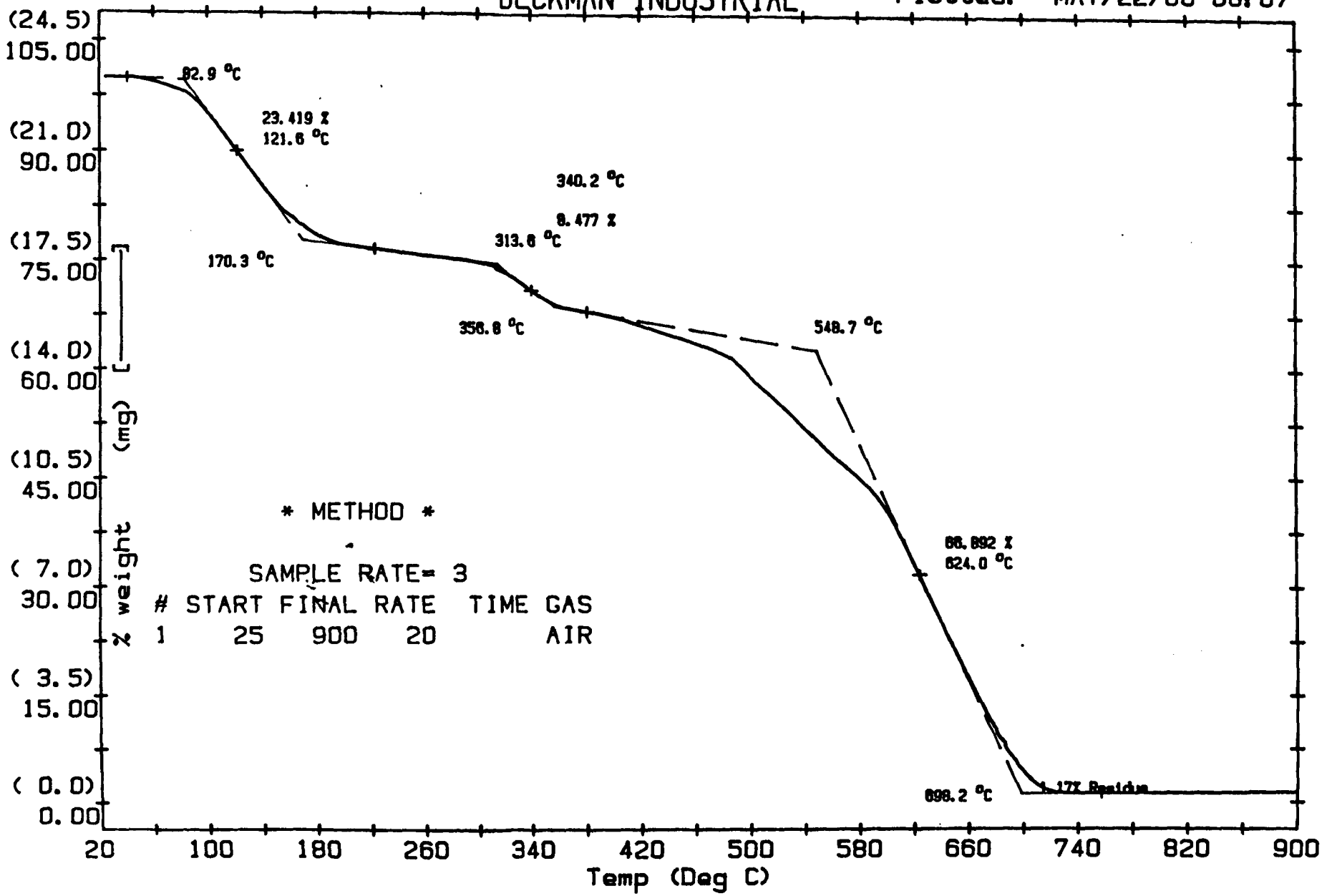
TOTAL AREA= 3590531
THRESHOLD= 1
MIN PK.WIDTH= 15
AREA REJECT= 12000

Sample: USP39A71108 3-1
Size: 23.424 mg
Run No: MIR #13079 (I2)
Date: MAY/21/86 12:58

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 36.DAT V2.1
Plotted: MAY/22/86 08:07



Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

CHART 7A

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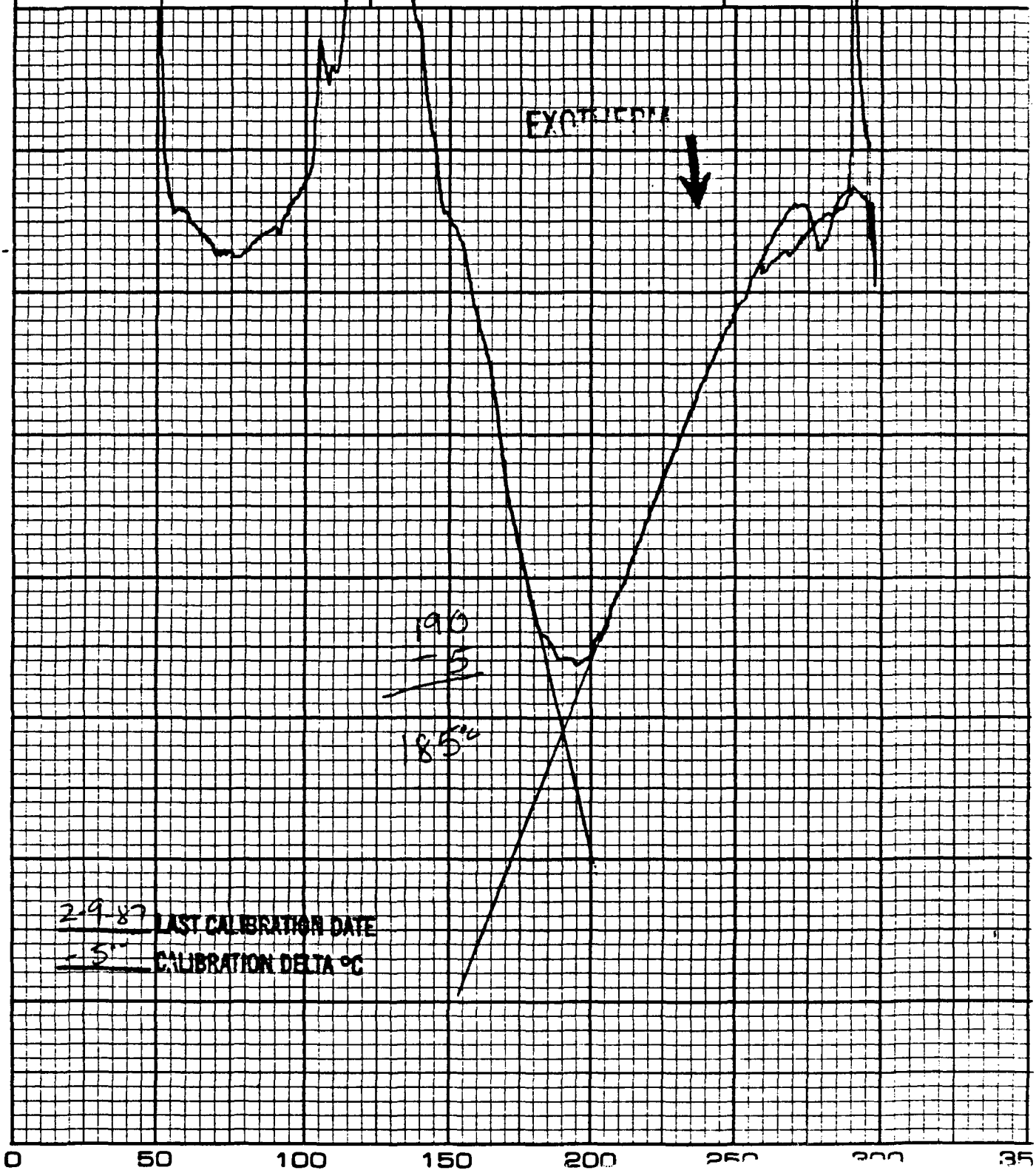
PART NO. 990088

CHART 8A

RUN NO. ___ DATE 2-23-87	T-AXIS	DTA-DSC
OPERATOR gsK	SCALE, °C/in 50	SCALE, °C/in 1.0/5X
SAMPLE: 3-1	PROG. RATE, °C/min 20°	(mcal/sec)/in ___
usp39A	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg 3.8
ATM N2 @ 1atm	SHIFT, in 0	REFERENCE
FLOW RATE 40ml/min		1atm seal



DUPONT Instruments

MEASURED VARIABLE

DATA FILE A:PHEN028.HDR TAKEN 09-05-1986 11:46:23

********* AREA PERCENT REPORT *********

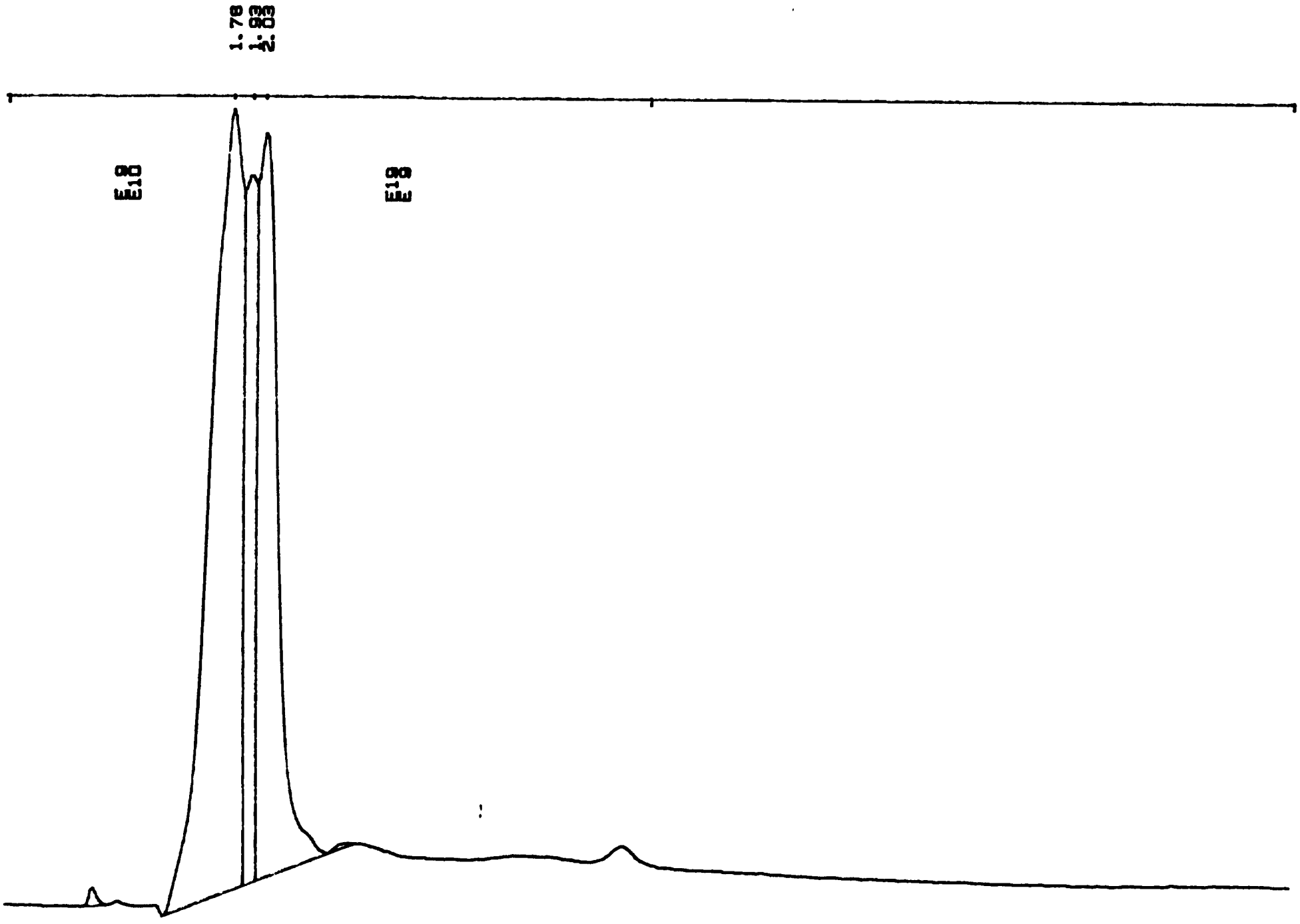
```
*************************************************************************
* Sample Name: USP39A,3-1,C=6.93                Operator Initials: JGZ  *
* Date:  09-05-1986 11:46:23 Method:PHENOLIC    DATA FILE: A:PHEN028.PTS *
* Interface: 4                Cycle#:  28       Channel#: 0    Vial#: N.A. *
* Starting Peak Width:  10   Threshold:  .01                            *
*************************************************************************
*  Instrument Type: BECKMAN HPLC          Column Type: MICROBONDAPAK C-18 *
*              Solvent Description: THF/WATER, 2:1 BY WEIGHT             *
*   Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN                      *
*             Detector 0: 220NM/.5AU          Detector 1:                *
*     Misc. Information:  LENGTH=25                                      *
*************************************************************************
Starting Delay:   0.00                        Ending Retention Time:   10.00
```

Pk No.	Ret Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
2	1.78	89260	53.0494	2	5100	100.000	17.5
3	1.93	25796	15.3310	2	4619	28.899	5.6
4	2.03	53203	31.6196	2	4863	59.604	10.9

Total Area: 168258 Area Reject: 1000 One sample per 1.000 sec.

10.00 MIN. LOW SCALE= 5.422 Mv. HIGH SCALE= 10.700 Mv.

USP-39A, 3-1, C=6.93 MG/ML, 9/5/86, JGZ



*** Calibration Data ***
Calibration Name:
Misc Information:

Fit Type: 3
Log Mol Wt = A + Bx + Cx^2 + Dx^3
A= 2.538977 B= 2.115815 C= -.5646824 D= 3.606432E-02
Coefficient of Determination: 0.9902

Ret Time	Molecular Weight	Log Mol Wt
3.50	35000	4.544
4.33	15000	4.176
4.83	3600	3.556
5.09	2350	3.371
6.00	570	2.756
7.17	92	1.964
7.50	72	1.857

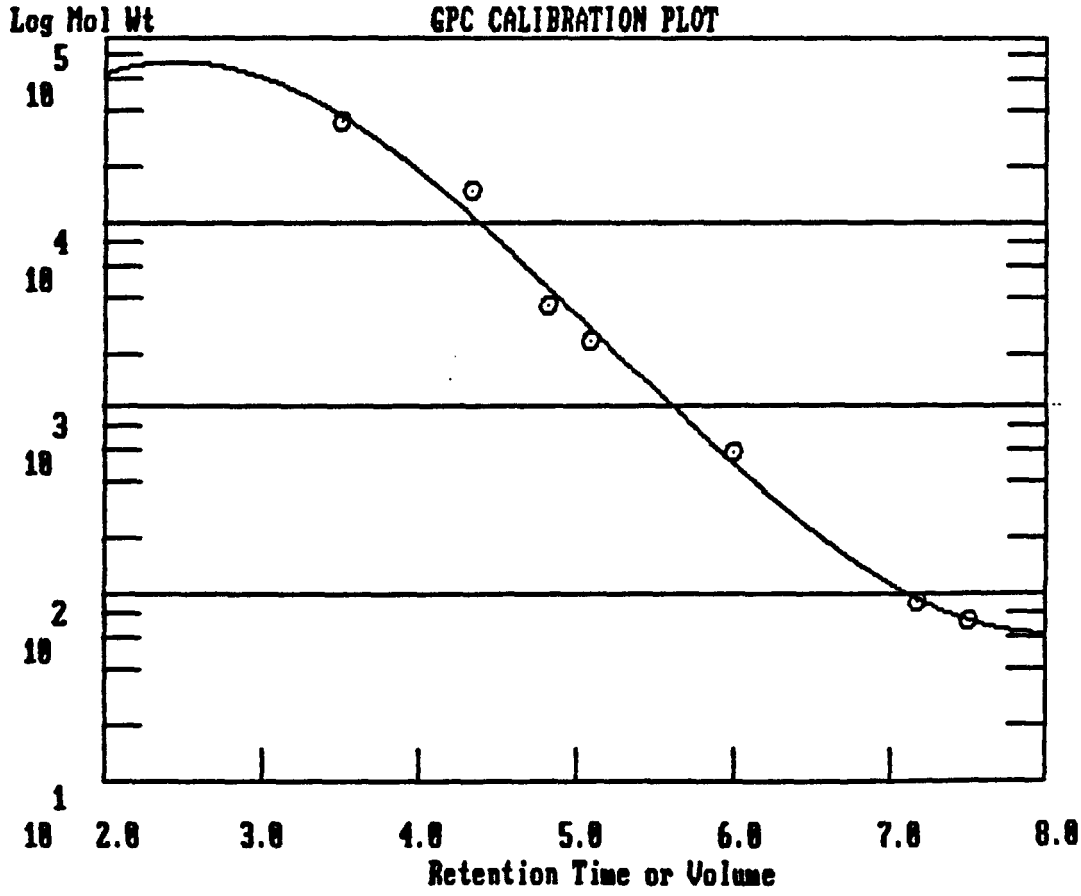


CHART 10A

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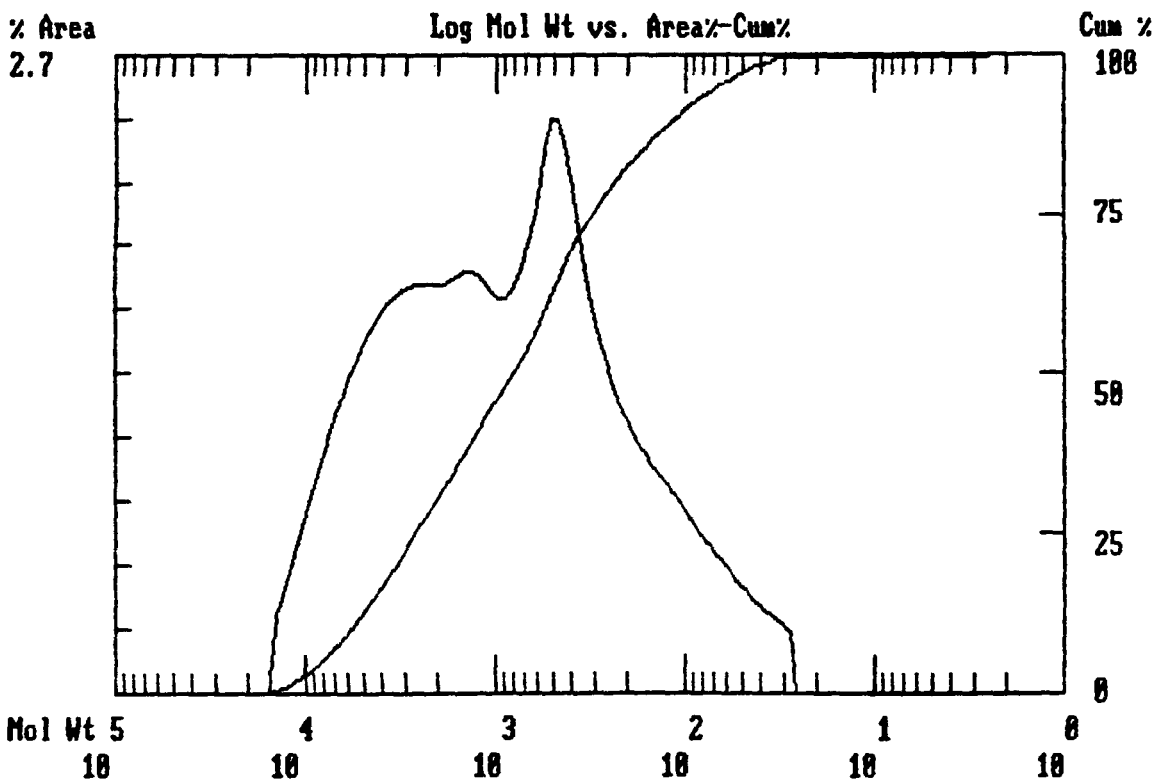
OF POOR QUALITY

FILE A:GPC35.HDR TAKEN 08-05-1986 17:53:34

********* GPC REPORT *********

```
*************************************************************************
mple Name: USP39A 3-1=2.68                    Operator Initials: GBF      *
te:  08-05-1986 16:21:21 Method:              DATA FILE: A:GPC35.PTS      *
terface: 5                Cycle#:  35         Channel#: 0    Vial#: N.A.  *
arting Peak Width:  60    Threshold:  0                                  *
*************************************************************************
nstrument Type: HPLC/BECKMAN            Column Type: ULTRASTYRAGEL 500A   *
          Solvent Description: THF                                       *
Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                           *
         Detector 0: 254NM/.1AU          Detector 1:                     *
  Misc. Information: CALIBRATION/GPC                                     *
*************************************************************************
ting Delay:   0.00                      Ending Retention Time:   10.00
bration file: GPCPHEN
cular Weight Distribution Averages
line TIMES:    3.85 to   10.00   MW:      22295 to          2
ess  TIMES:    3.85 to   10.00   MW:      22295 to          2
l Area:       203112
                1932
                 297
n=            6.5017
                5426
                1642
```



NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT 3-1

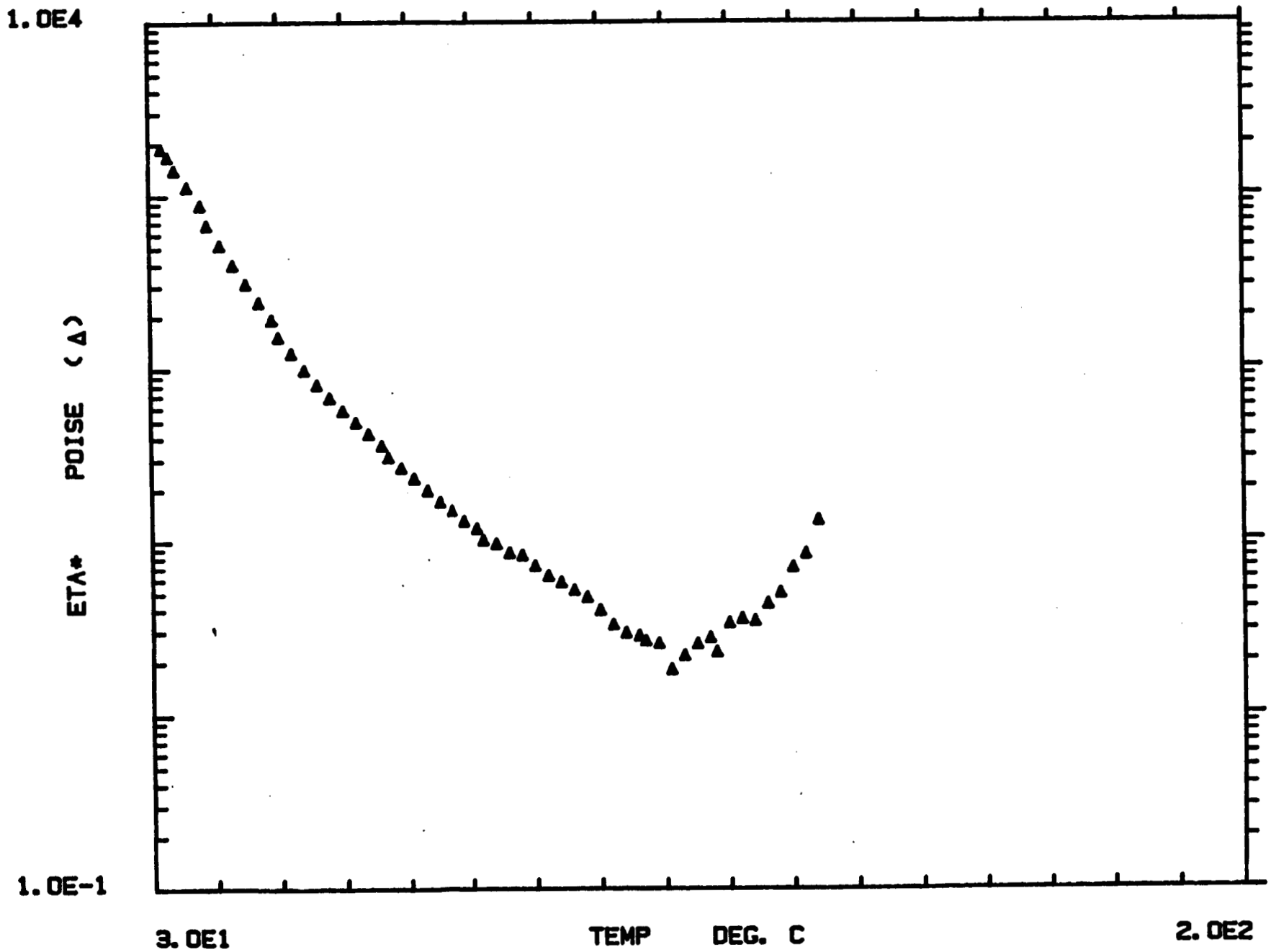


CHART 14A

Rheometrics RECAP II

Experiment No. : 4 Sample No. : 1

Title:
NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT 3-1

Operator :CP

Date and Time : Friday, August 15, 1986 - 15:26:35

Operating Mode : DYNAMIC

Sweep Type : CURE

Geometry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

Notes :
STRAIN =50%
FREQUENCY =10 RAD/SEC

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OF POOR QUALITY

NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT 3-1

NO.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	1.827e+003	1.826e+003	4.904e+001	2.316e+002	2.000e-001	3.200e+001
2	1.830e+003	1.829e+003	3.896e+001	2.321e+002	1.000e+000	3.200e+001
3	1.640e+003	1.640e+003	3.551e+001	2.080e+002	2.000e+000	3.300e+001
4	1.376e+003	1.376e+003	3.174e+001	1.742e+002	3.000e+000	3.400e+001
5	1.096e+003	1.096e+003	2.514e+001	1.385e+002	4.000e+000	3.600e+001
6	8.598e+002	8.596e+002	2.120e+001	1.086e+002	5.000e+000	3.800e+001
7	6.593e+002	6.589e+002	2.233e+001	8.311e+001	6.000e+000	3.900e+001
8	5.063e+002	5.058e+002	2.205e+001	6.380e+001	7.000e+000	4.100e+001
9	3.902e+002	3.897e+002	2.009e+001	4.915e+001	8.000e+000	4.300e+001
10	3.032e+002	3.026e+002	2.016e+001	3.815e+001	9.000e+000	4.500e+001
11	2.362e+002	2.354e+002	2.004e+001	2.972e+001	1.000e+001	4.700e+001
12	1.873e+002	1.862e+002	2.007e+001	2.354e+001	1.100e+001	4.900e+001
13	1.488e+002	1.476e+002	1.913e+001	1.871e+001	1.200e+001	5.000e+001
14	1.200e+002	1.186e+002	1.818e+001	1.507e+001	1.300e+001	5.200e+001
15	9.599e+001	9.484e+001	1.479e+001	1.206e+001	1.400e+001	5.400e+001
16	7.890e+001	7.793e+001	1.230e+001	9.907e+000	1.500e+001	5.600e+001
17	6.639e+001	6.550e+001	1.082e+001	8.341e+000	1.600e+001	5.800e+001
18	5.590e+001	5.513e+001	9.240e+000	7.026e+000	1.700e+001	6.000e+001
19	4.797e+001	4.733e+001	7.814e+000	6.021e+000	1.800e+001	6.200e+001
20	4.102e+001	4.046e+001	6.764e+000	5.151e+000	1.900e+001	6.400e+001
21	3.510e+001	3.463e+001	5.702e+000	4.404e+000	2.000e+001	6.600e+001
22	3.006e+001	2.968e+001	4.734e+000	3.774e+000	2.100e+001	6.700e+001
23	2.608e+001	2.573e+001	4.225e+000	3.272e+000	2.200e+001	6.900e+001
24	2.257e+001	2.228e+001	3.622e+000	2.834e+000	2.300e+001	7.100e+001
25	1.929e+001	1.904e+001	3.129e+000	2.424e+000	2.400e+001	7.300e+001
26	1.656e+001	1.636e+001	2.552e+000	2.077e+000	2.500e+001	7.500e+001
27	1.472e+001	1.454e+001	2.270e+000	1.850e+000	2.600e+001	7.700e+001
28	1.290e+001	1.262e+001	2.161e+000	1.607e+000	2.700e+001	7.900e+001
29	1.155e+001	1.135e+001	2.176e+000	1.451e+000	2.800e+001	8.100e+001
30	9.881e+000	9.736e+000	1.688e+000	1.240e+000	2.900e+001	8.200e+001
31	9.387e+000	9.266e+000	1.504e+000	1.179e+000	3.000e+001	8.400e+001
32	8.299e+000	8.216e+000	1.170e+000	1.043e+000	3.100e+001	8.600e+001
33	8.047e+000	7.971e+000	1.102e+000	1.010e+000	3.200e+001	8.800e+001
34	6.981e+000	6.935e+000	8.019e-001	8.771e-001	3.300e+001	9.000e+001
35	6.092e+000	6.035e+000	8.276e-001	7.648e-001	3.400e+001	9.200e+001
36	5.588e+000	5.549e+000	6.617e-001	7.020e-001	3.500e+001	9.400e+001
37	5.038e+000	5.020e+000	4.197e-001	6.330e-001	3.600e+001	9.600e+001
38	4.581e+000	4.579e+000	1.556e-001	5.751e-001	3.700e+001	9.800e+001
39	3.851e+000	3.846e+000	1.960e-001	4.837e-001	3.800e+001	1.000e+002
40	3.181e+000	3.171e+000	2.447e-001	3.992e-001	3.900e+001	1.020e+002
41	2.850e+000	2.840e+000	2.398e-001	3.580e-001	4.000e+001	1.040e+002
42	2.731e+000	2.716e+000	2.852e-001	3.428e-001	4.100e+001	1.060e+002
43	2.562e+000	2.464e+000	7.029e-001	3.219e-001	4.200e+001	1.070e+002
44	2.467e+000	2.107e+000	1.283e+000	3.095e-001	4.300e+001	1.090e+002
45	1.750e+000	1.578e+000	7.560e-001	2.198e-001	4.400e+001	1.110e+002
46	2.104e+000	1.951e+000	7.875e-001	2.644e-001	4.500e+001	1.130e+002
47	2.460e+000	2.178e+000	1.143e+000	3.089e-001	4.600e+001	1.150e+002
48	2.662e+000	2.344e+000	1.262e+000	3.343e-001	4.700e+001	1.170e+002
49	2.198e+000	1.876e+000	1.146e+000	2.759e-001	4.800e+001	1.180e+002
50	3.229e+000	2.684e+000	1.796e+000	4.056e-001	4.900e+001	1.200e+002

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FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT 3-1

ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
3.422e+000	2.934e+000	1.761e+000	4.297e-001	5.000e+001	1.220e+002
3.324e+000	2.903e+000	1.619e+000	4.175e-001	5.100e+001	1.240e+002
4.180e+000	3.654e+000	2.032e+000	5.247e-001	5.200e+001	1.260e+002
4.842e+000	4.446e+000	1.918e+000	6.081e-001	5.300e+001	1.280e+002
6.760e+000	6.299e+000	2.453e+000	8.497e-001	5.400e+001	1.300e+002
8.108e+000	7.529e+000	3.010e+000	1.018e+000	5.500e+001	1.320e+002
1.276e+001	1.180e+001	4.853e+000	1.603e+000	5.600e+001	1.340e+002

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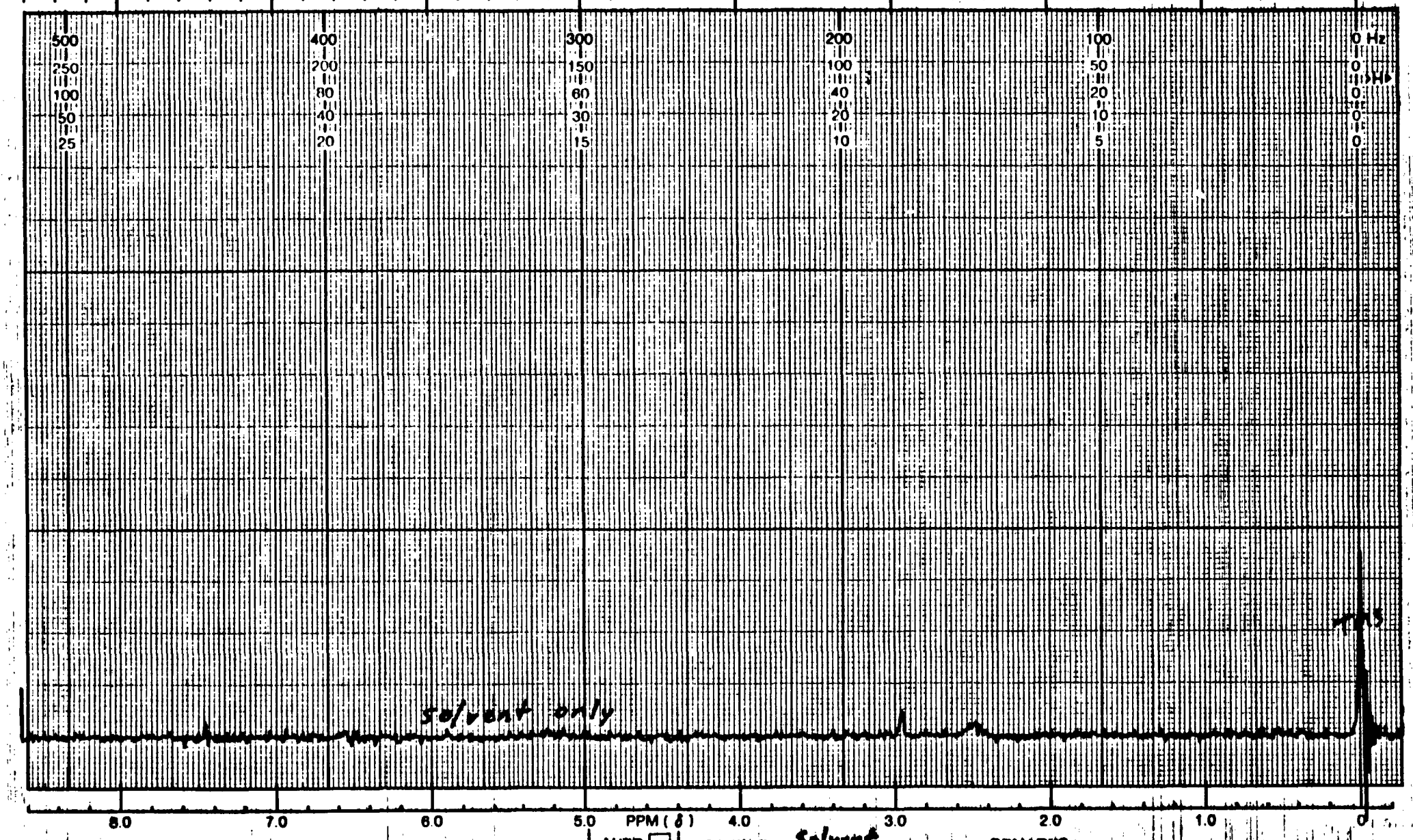


SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: —
SPINNING RATE (RPS): 30

MANUAL | AUTO ☐
SWEEP TIME (SEC): 50 250 500 1000 (250)
SWEEP WIDTH (Hz): 25 50 100 250 500 (500)
FILTER: 1 2 3 4 5 6 7 8 (.2)
RF POWER LEVEL: 0.30 (.05)

SAMPLE: Solvent
SOLVENT: Unisol-d + 0.02% TMS
DEC. LEVEL

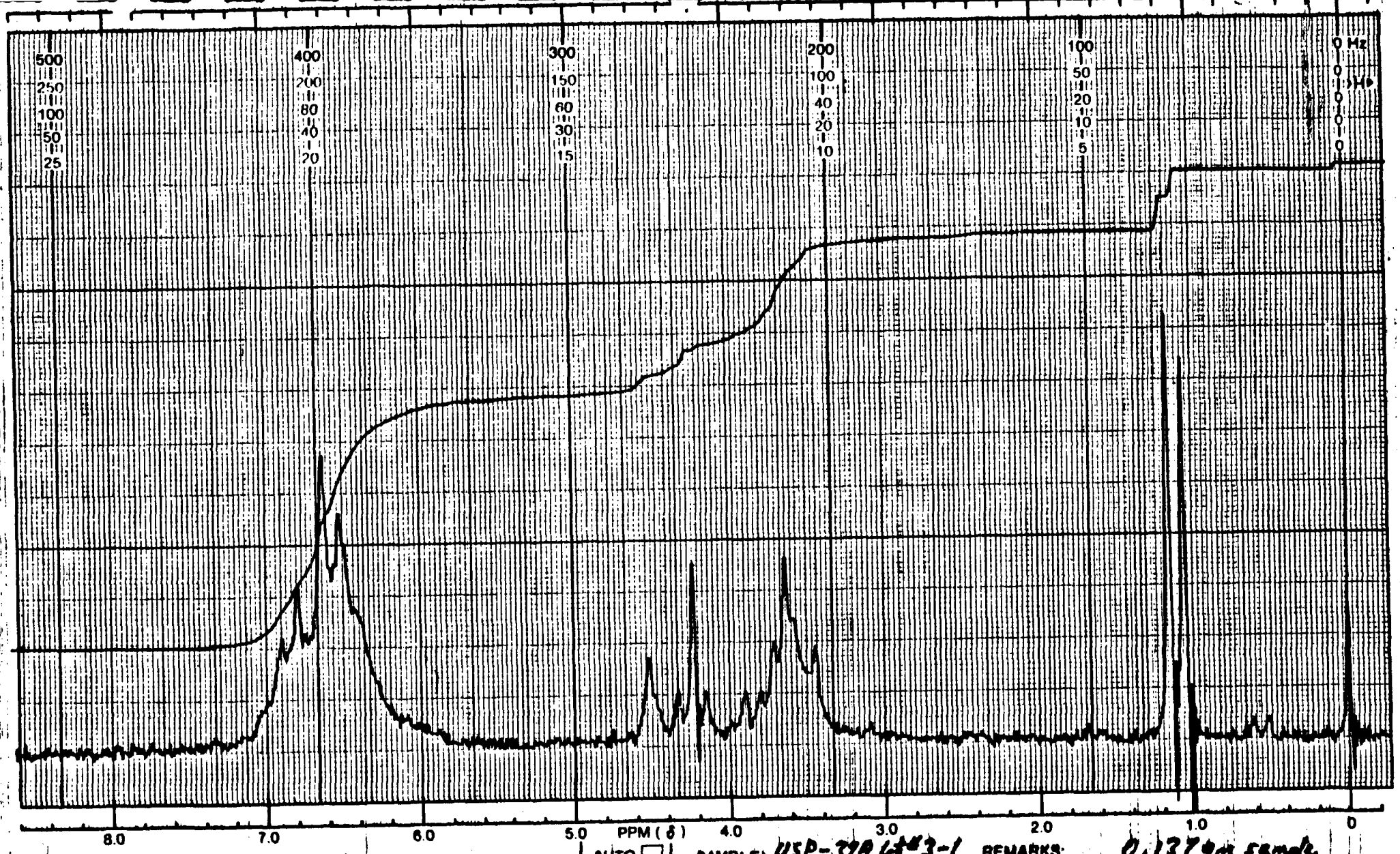
REMARKS:

ORIGINAL PAGE IS OF POOR QUALITY

SOLVENT ONLY SCAN

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-85 OPERATOR DGW SPECTRUM NO. 1A of 7
solvent scan



SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: 5.0
SPINNING RATE (RPS): 30

MANUAL
SWEEP TIME (SEC): 50 250 500 1000
SWEEP WIDTH (Hz): 25 50 100 250 500
FILTER: 1 2 3 4 5 6 7 8
RF POWER LEVEL: 0.25

AUTO ☐
(250)
(500)
(2)
(.05)

SAMPLE: USP-39A Lot#3-1
SOLVENT: Unisol-d + 0.5% TMS
DEC. LEVEL

REMARKS: 0.137 gm sample
0.937 gm solvent

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OF POOR QUALITY

DATE: 3-21-86
OPERATOR: DOW
SPECTRUM NO. 5 of 7 USP-39A Lot#3-1

CHART 15A

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

TABLE OF CONTENTS

FABRIC TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

WCA Fabric for NASA Lot# 3 (HITCO)

TEST		PAGE
1a.	Breaking Strength, WARP	1
1b.	Breaking Strength, FILL	1
2a.	Carbon Assay	1
2b.	Hydrogen Assay	1
2c.	Nitrogen Assay	1
3.	Visual Inspection	1
4.	Specific Gravity	1
5.	pH	1
6.	TGA	1
7a.	Atomic Absorption	2
7b.	Moisture Content	2
7c.	Ash Content	2
8a.	Filament diameter, WARP	2
8b.	Filament diameter, FILL	2
9a.	Thread Count, WARP	2
9b.	Thread Count, FILL	2
10a.	Areal weight	2
10b.	Volatiles	2
10c.	Weight Change on Acetone Wash	3

CHARTS

Visual Inspection 3A

TGA 6A

U.S. Polymeric

FABRIC TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

WCA Fabric for NASA Lot# 3 (HITCO)

1a. Breaking Strength, lbs/in, WARP			#3-1S
ASTM D1682		PICK	43
		CENTER	61
		PLAIN	53
		AVG.	52.3
1b. Breaking Strength, lbs/in, FILL			
ASTM D1682		PICK	16
		CENTER	16
		PLAIN	22
		AVG.	18.0
2a. Carbon Assay, %			
MDQAI 5560		PICK	99.7
		CENTER	99.9
		PLAIN	99.1
		AVG.	99.57
2b. Hydrogen Assay, %			
MDQAI 5560		PICK	<.01
		CENTER	.01
		PLAIN	<.01
		AVG.	EST .004
2c. Nitrogen Assay, %			
MDQAI 5560		PICK	.2
		CENTER	.04
		PLAIN	<.05
		AVG.	EST .08
3. Visual Inspection		See Chart 3A	
QCi-102			
4. Specific Gravity, Units			
PTM-84			1.6247
			1.6975
			1.6674
		AVG.	1.663
5. pH, Units			
CTM-24B			6.4
			6.4
		AVG.	6.4
6. TGA, °C at 50% Weight Loss	SET UP #1		
CTM-51 (AIR)	#3-1S	951	
	See Chart 6A		

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

WCA Fabric for NASA Lot# 3 (HITCO)

7a. Atomic Absorption, ppm
CTM-53B

	#3-1S
Na	10
K	0
Ca	6
Mg	2
Li	0
AVG.	18

7b. Moisture Content, %
CTM-53B

.000

7c. Ash Content, %
CTM-53B

.005

8a. Filament diameter, microns, WARP
S.E.M. procedure
(diameters are an average
10 measurements)

	#3-1S
AVERAGE	9.33
Minimum	8.00
Maximum	10.30
Std. Dev	0.77

8b. Filament diameter, microns, FILL
S.E.M. procedure
(diameters are an average
of 10 measurements)

	#3-1S
AVERAGE	9.36
Minimum	7.10
Maximum	10.55
Std. Dev	1.17

9a. Thread Count, per inch, WARP
PTM-5A

	#3-1S
	29
	29
	29
	29
	29
AVG.	29.0

9b. Thread Count, per inch, FILL
PTM-5A

	22
	22
	22
	22
	22
AVG.	22.0

10a. Areal weight as received, gm/4x4
PTM-3A

LEFT	2.508
CENTER	2.455
RIGHT	2.496
AVG.	2.486

10b. Volatiles as received, %
PTM-3A

LEFT	.28
CENTER	.24
RIGHT	.32
AVG.	.28

WCA Fabric for NASA Lot# 3 (HITCO)

10c. Weight Change on Acetone Wash, %
PTM-3A

	#3-1S
LEFT	.04
CENTER	-.04
RIGHT	.04
AVG.	.01

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

USP NO. CHART 3A

DATE 8/17/86

FABRIC WCA GRAPHITE

MFG. UNION CARBIDE

ROLL NO. 804 12C5 WCA-2

YARDS 180

POUNDS 100

ORDER NO. OE71108

SPECIFICATION VARIOUS

Q.C. FILE # NASA 3-1

FOOTAGE

RIGHT — START — Sample — LEFT

14 W
20 W
30 W
36 W
47 W
77
88 SPLICE
99 W
102 W – B
110 W – 113 W
126 W
133 W
136 – 147 W
150 W
170 W
183 – 184 W
199 W
210
215 W
227 W
236 W
243 W
259 W
263

TREATER OPERATOR READ UP

SYMBOLS

- TEAR
- SPOTS OR STAINS
- FOLDS
- EDGE CURL
- TIGHT WEAVE OR SELVAGE
- WEAVE DISTORTION
- VISIBLE PUCKERS
- ONE PUCKER CREASING
- TWO OR MORE CREASINGS

REMARKS

272 W
282 W
290 W
296 W
301 W
309 W
313 W
324 a
334 SPLICE
336 W
348 W
357
355 W
360 W
364 W
366 W
374 W
377 W
391 W
400 W
404 W
406 – 7 W
422 W
424 W
432 W
449 W
451 W
464
472 W
475
480
480
485 W
492 W
498 W
510 W
511 W
518 W
524 W

GRADE Group C

END Sample

530

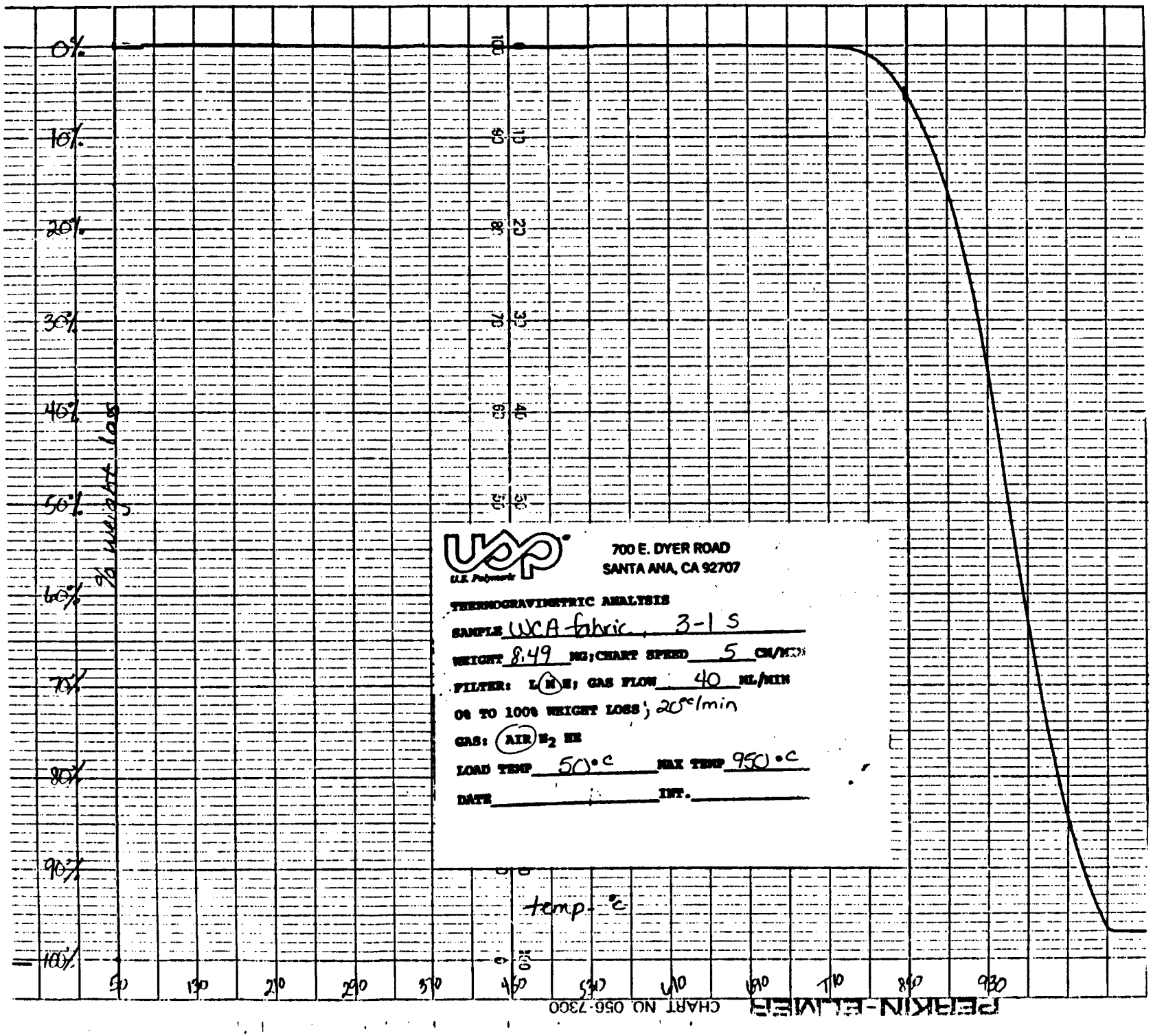

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CHART 6A

TABLE OF CONTENTS

PREPREG TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

FM 5064JB NASA LOT# 3 U.S.P. LOT# C02137 (HITCO)

TEST		PAGE
1a.	Resin Content, Soxhlet	1
1b.	Filler Content, Soxhlet	1
1c.	Cloth Content, Soxhlet	1
2.	Volatile Content	1
3.	Flow	1
4.	Resin Content, Dry Basis	1
5.	Tack	1
6.	Gel Time	1
7a.	Atomic Absorption	1
7b.	Moisture Content	1
7c.	Ash Content	2
8.	TGA	2
9.	DSC	2
10.	Infrared (IRZB) Baseline	2
11.	Environmental History	2
12.	Specific Gravity	2
13a.	Tensile Strength	2
13b.	Tensile Modulus	2
13c.	Tensile Elongation	2
14a.	Flexural Strength	2
14b.	Flexural Modulus	3
15a.	Compressive Strength	3
15b.	Compressive Modulus	3
16.	Double Shear Strength	3
17.	Barcol Hardness	3
18.	Residual Volatiles	3
19.	Resin Content, Pyrolysis	3
20.	Acetone Extraction	3
21a.	CTE, with ply	3
21b.	CTE, crossply	4

CHARTS

TGA 8A
DSC 9A
Infrared (IRZB) Baseline 10A
CTE 21A

U.S. Polymeric

PREPREG TESTING

NAS8-36298

U.S. POLYMERIC O.E.71108

FM 5064J NASA LOT# 3 U.S.P. LOT# C02137 (HITCO)

		ROLL#1-S
1a. Resin Content, Soxhlet, % CTM-6D		34.2
		33.7
		33.2
	AVG.	33.7
1b. Filler Content, Soxhlet, % CTM-6D		14.0
		13.8
		13.6
	AVG.	13.8
1c. Cloth Content, Soxhlet, % CTM-6D		51.8
		52.5
		53.2
	AVG.	52.5
2. Volatile Content, % PTM-17B		3.0
		2.9
		2.8
	AVG.	2.9
3. Flow, % PTM-19G		12.0
		11.7
		10.7
	AVG.	11.5
4. Resin Content, Dry basis, % PTM-16F, Type II		34.3
		34.6
		33.8
	AVG.	34.2
5. Tack, lbs PTM-80		30
6. Gel Time, seconds PTM-20E		46
7a. Atomic Absorption, ppm CTM-53B	Na	5
	K	0
	Ca	0
	Mg	3
	Li	0
	TOTAL	8
7b. Moisture Content, % CTM-53B		2.04

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

FM 5064J NASA LOT# 3 U.S.P. LOT# C02137 (HITCO)

			ROLL#1-S
7c. Ash Content, % CTM-53B			.25
8. TGA, % Weight Loss at 500°C CTM-51 (Nitrogen)	See Chart 8A		10.1
9. DSC, °C CTM-50A	First Temp		182
	See Chart 9A		
10. Infrared (IRZB) Baseline CTM-21C			.82
	See Chart 10A		
11. Environmental History	Date manufactured: 2 May 1986 Packaged in: MIL-B-131 Class I bag supported in cardboard carton Date shipped: 16 June 1986 in 40°F truck		
12. Specific Gravity, Cured, Units ASTM D792			1.430
			1.430
			1.430
			1.430
		AVG.	1.430
13a. Tensile Strength, ksi, WARP FTMS 406-1011			20.38
			21.27
			20.46
			20.88
			16.69
		AVG.	19.93
13b. Tensile Modulus, msi, WARP FTMS 406-1011			2.02
			2.03
			1.99
			1.84
			1.89
		AVG.	1.95
13c. Tensile Elongation, %, WARP FTMS 406-1011			1.33
			1.41
			1.17
			1.26
			1.16
		AVG.	1.27
14a. Flexural Strength, ksi, WARP FTMS 406-1031			27.10
			30.21
			27.79
			28.12
			29.19
		AVG.	28.48

FM 5064J NASA LOT# 3 U.S.P. LOT# C02137 (HITCO)

		ROLL#1-S
14b. Flexural Modulus, msi, WARP FTMS 406-1031		1.69
		1.84
		1.58
		1.49
		1.39
	AVG.	1.60
15a. Compressive Strength, ksi, WARP FTMS 406-1021		16.16
		20.12
		17.49
		18.49
		19.37
	AVG.	18.33
15b. Compressive Modulus, msi, WARP FTMS 406-1021		2.25
		2.34
		2.38
		2.15
		2.17
	AVG.	2.26
16. Double Shear Strength, ksi FTMS 406-1041A		2.51
		2.33
		2.37
		2.38
		2.63
	AVG.	2.45
17. Barcol Hardness, Units ASTM D-2583 (Average of 10 determinations)		61.9
18. Residual Volatiles, % PTM-98		1.57
		1.55
		1.32
	AVG.	1.48
19. Resin Content, Pyrolysis, % CTM-14B		32.40
		31.65
		31.92
	AVG.	31.99
20. Acetone Extraction, % CTM-18A		3.50
		4.13
		4.22
	AVG.	3.95
21a. CTE, in/in °F with PLY PTM-61B		3.26
		4.70
	AVG.	3.98

FM 5064J NASA LOT# 3 U.S.P. LOT# C02137 (HITCO)

21b. CTE, in/in °F Cross PLY
PTM-61B

	16.88
	11.75
AVG.	14.32

See Chart 21A

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

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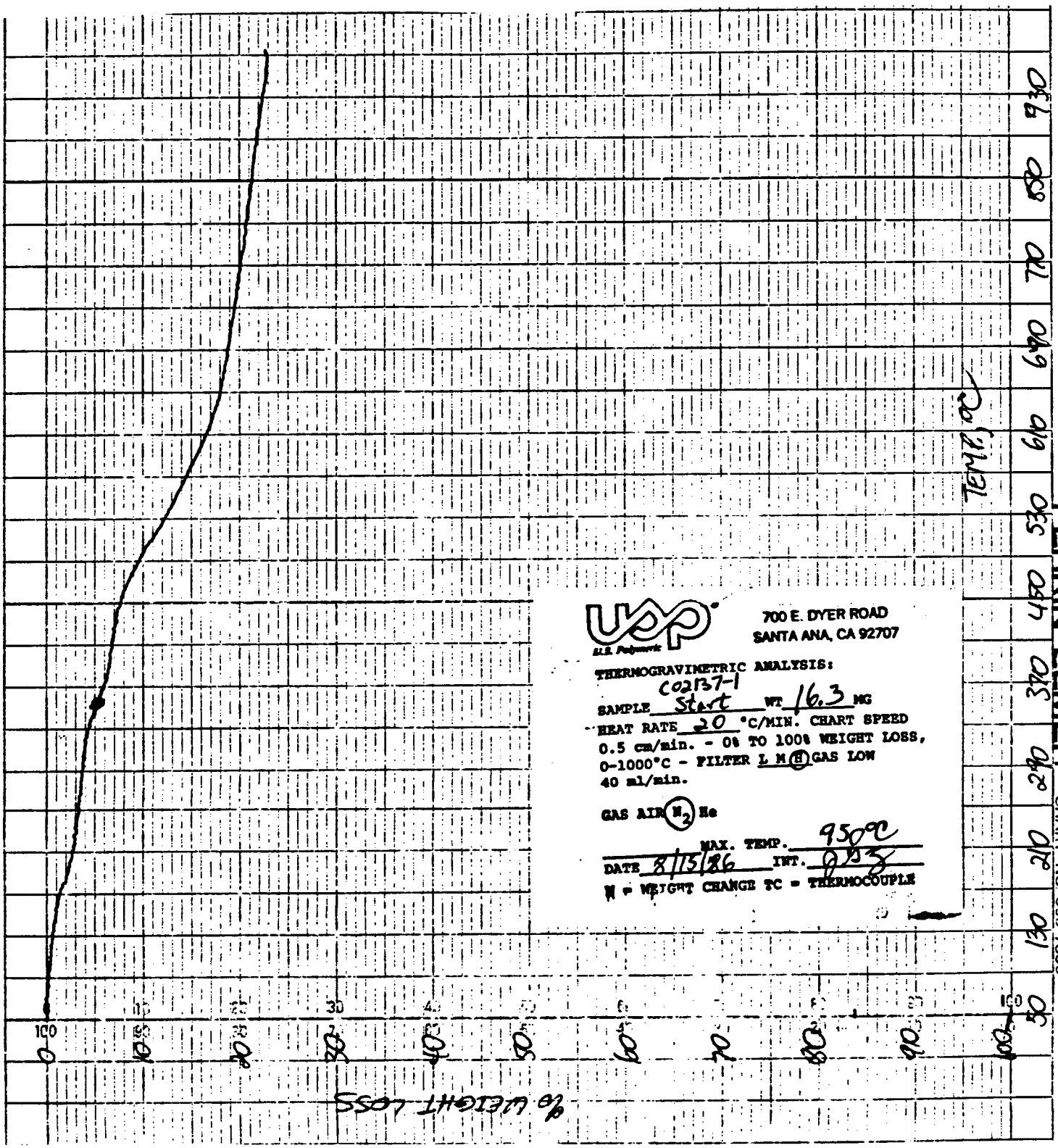
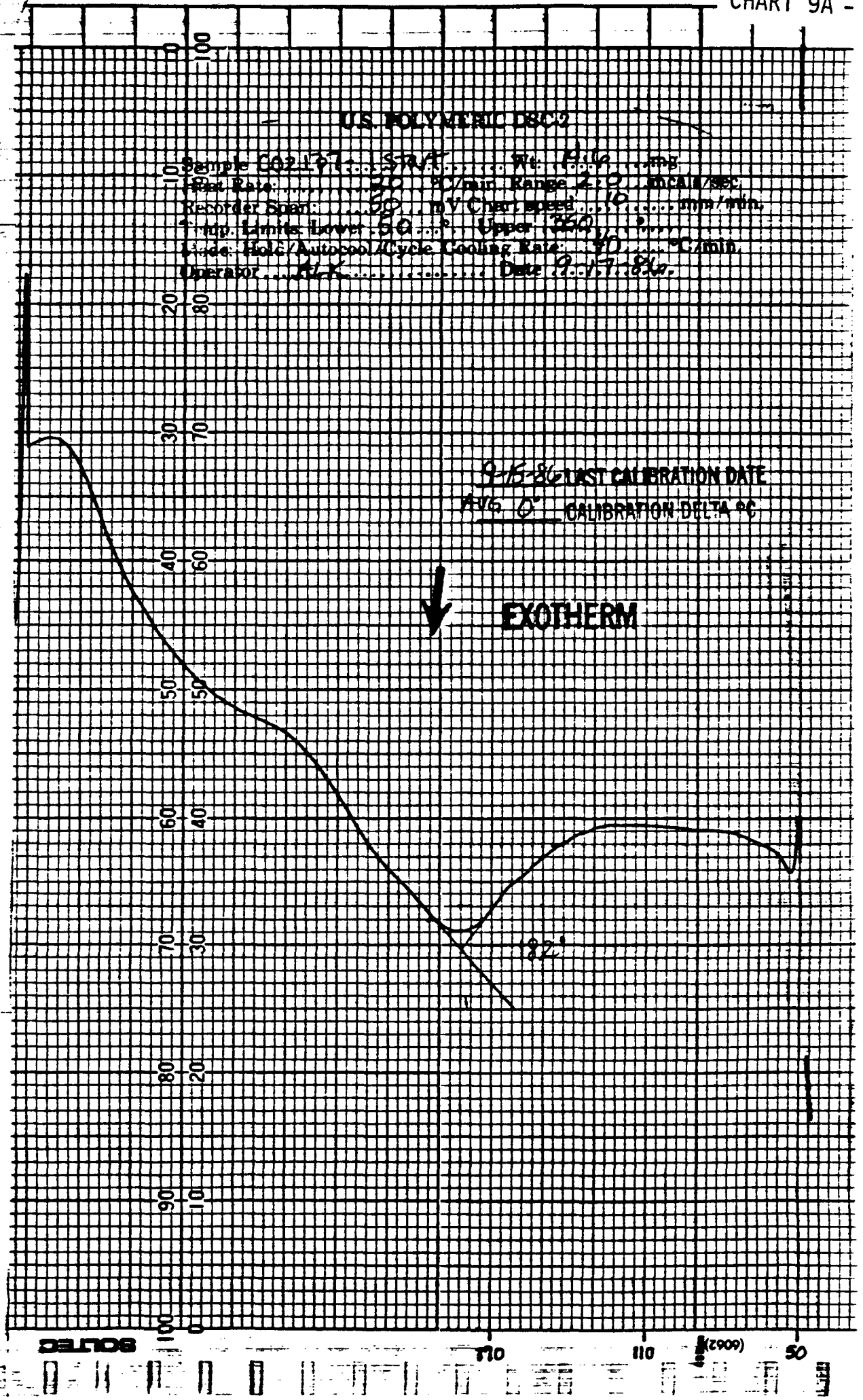


CHART 9A -



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SPECTRUM NO. 15186
DATE 7-07-86
SAMPLE FM 5064 J
CO2137 # 1

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 30-50%T
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST V. MIRANDA

Beckman®
INFRARED
SPECTROPHOTOMETER

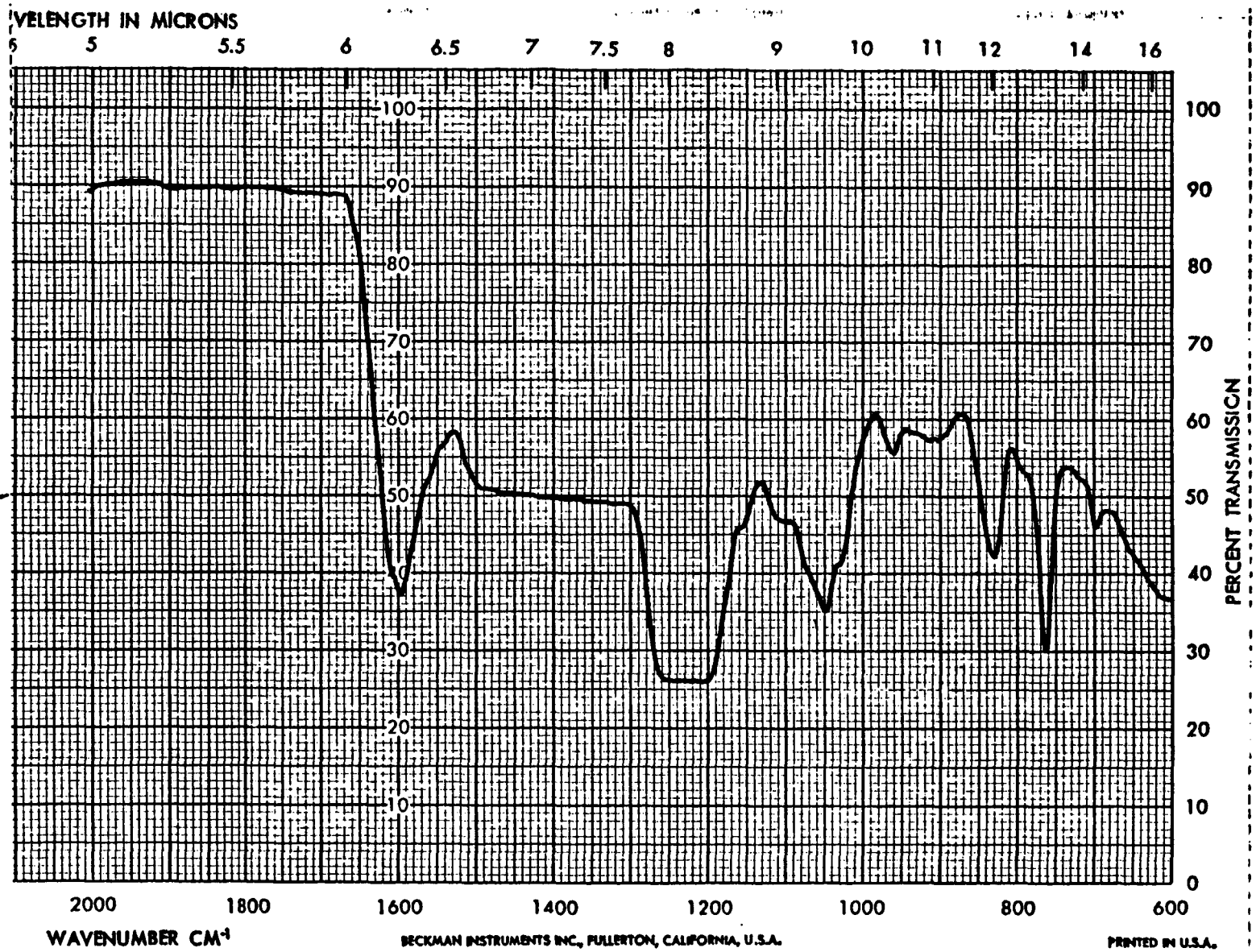

CHART 10A

PART NO. 990088

RUN NO. ___ DATE 9/20/84	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/in	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
C02137-1-STRIP-(1)	HEAT / COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.256	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 1	
FLOW RATE 3.53 CFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

wply

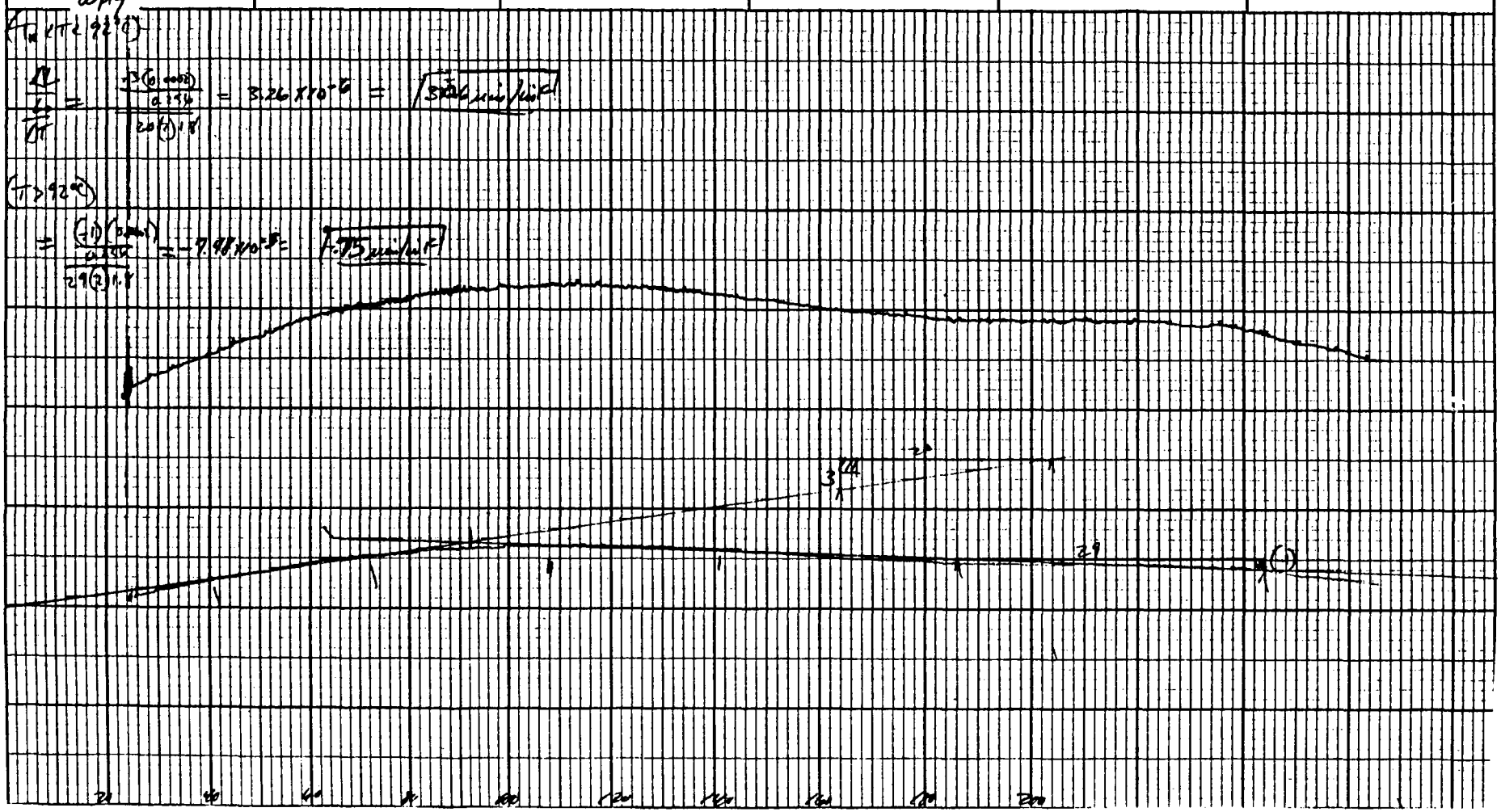

Chart 21A1

MEASURED VARIABLE

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DuPont Instruments

PART NO. 990088

RUN NO ___ DATE 9/20/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/4.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
CO2137-1-START-(2)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.257	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 1	
FLOW RATE 3-5SCFH			dY, (mg/min) /in	dY,(10X),(mils/min)/in	

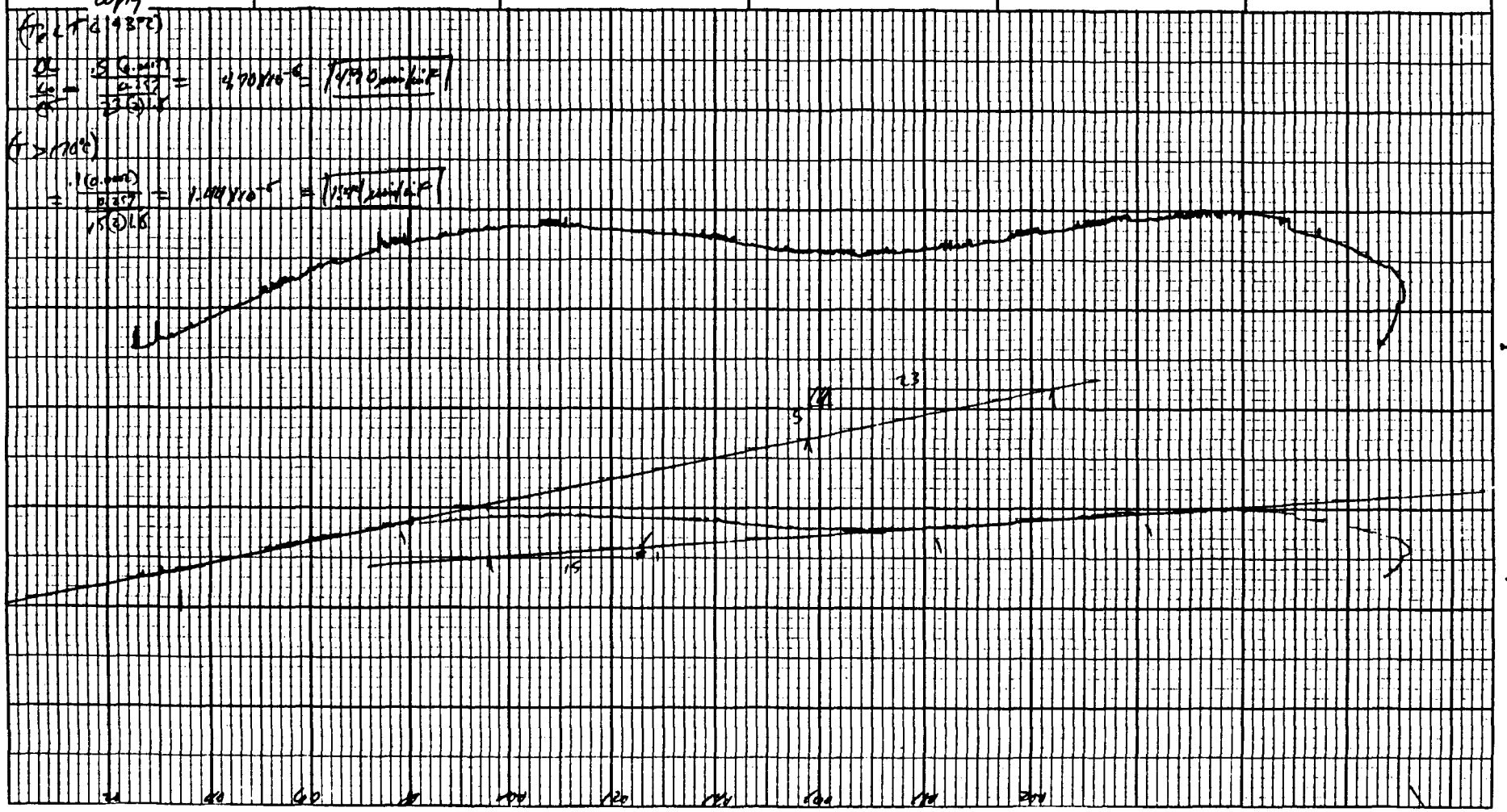
uply

(T < T(143°C))

$\frac{dL}{L_0 dT} = \frac{.5\,(0.001)}{0.257} = 4.70 \times 10^{-6} = \boxed{4.70\ \mu\text{mil/in}}$

(T > 110°C)

$= \frac{.1\,(0.001)}{0.257} = 1.44 \times 10^{-5} = \boxed{14.4\ \mu\text{mil/in}}$



MEASURED VARIABLE

DUPONT Instruments

Chart 21A2

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PART NO. 990088

RUN NO ___ DATE 9/15/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE EXPANSION	
CO2137-1-Smar-(4)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.128	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

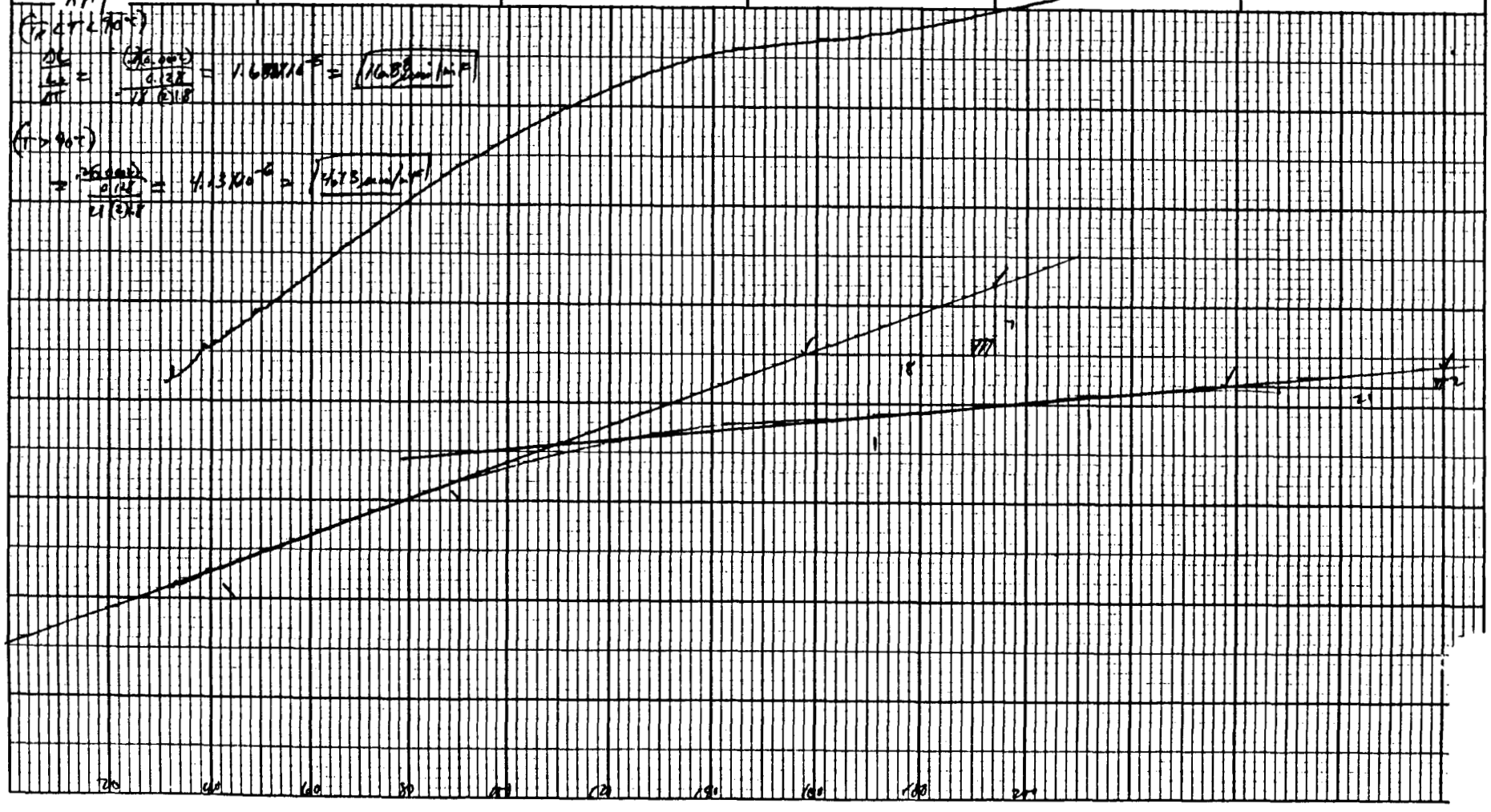
Xply

(T < 40°C)

$$\frac{\Delta L}{L_0 \Delta T} = \frac{(26.000)}{\frac{0.128}{(2)(1.8)}} = 1.6\ 88 \times 10^{-5} = \boxed{16.88\ \mu m/m/°F}$$

(T > 40°C)

$$= \frac{(26.000)}{\frac{0.128}{(2)(1.8)}} = 4.13 \times 10^{-6} = \boxed{4.13\ \mu m/m/°F}$$



DUPONT Instruments

MEASURED VARIABLE

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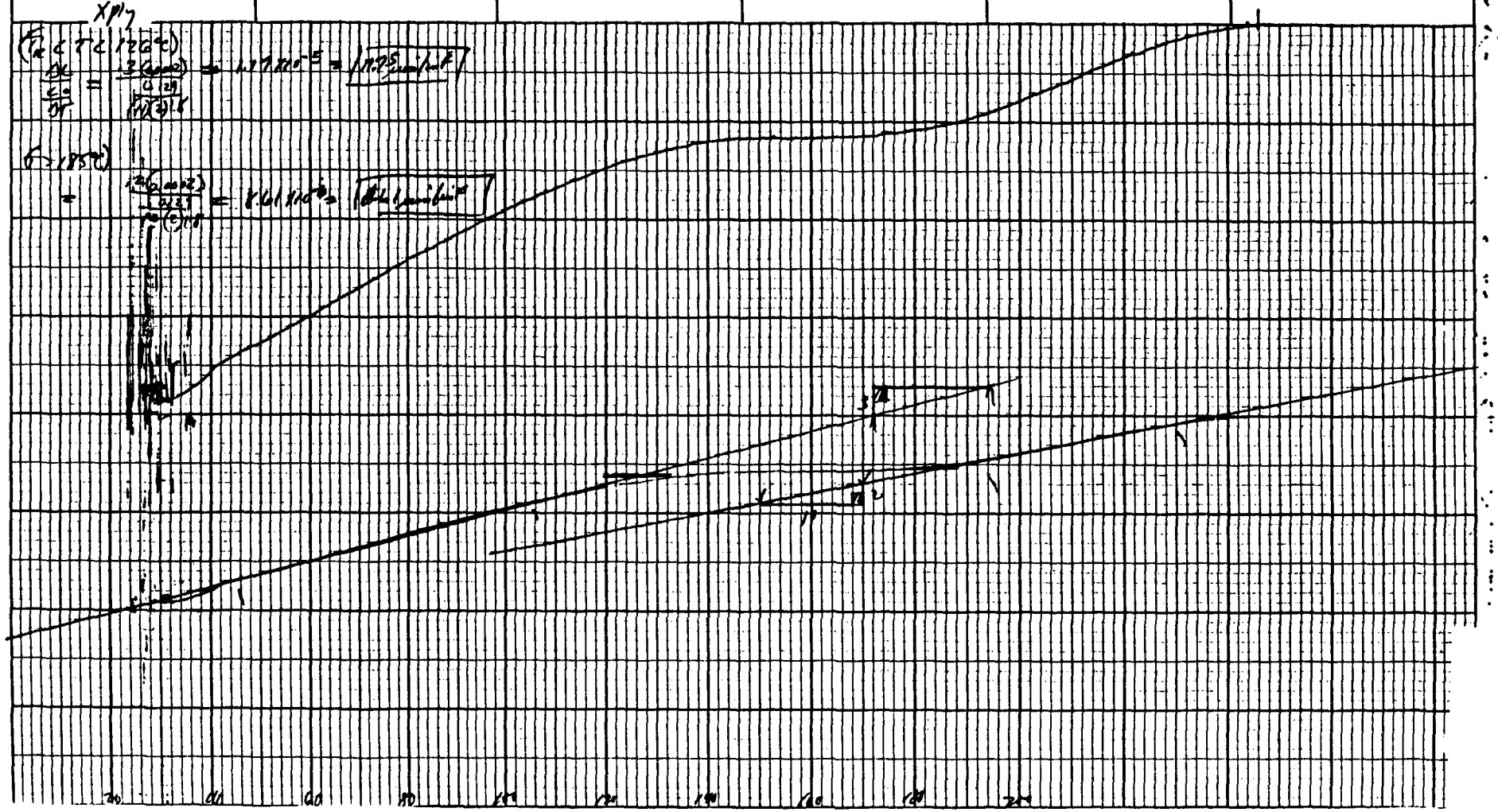
Chart 21A3

PART NO. 990088

RUN NO ___ DATE 9/19/86	T-AXIS	DTA-DSC	TGA	TMA	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/02	
SAMPLE: C02137-1-Smart-(5)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.129	
FLOW RATE 3-5SCFH	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g	
			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

Xply



MEASURED VARIABLE

DUPONT Instruments

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CHART 1 JOB 4

TABLE OF CONTENTS

FILLER TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

Filler Lot for NASA Lot# 4

TEST		PAGE
1.	Carbon Content	1
2.	Ash Content	1
3.	Atomic Absorption	1
3a.	Moisture Content	1
3b.	Ash Content	1
4.	pH	1
5.	Particle Size, S.E.M. procedure	1
6a.	TGA, °C at 50% Loss	1
6b.	TGA	2
7.	Particle Size Distribution	2
7a.	Particle Size, Horiba	2

CHARTS

TGA..... 6A - 6C

Particle Size Distribution..... 7A - 7C

U.S. Polymeric

FILLER TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

Filler Lot for NASA Lot# 4

		SAMPLE #4-1	SAMPLE #4-2	SAMPLE #4-3	
1. Carbon Content, % QAI-5560		99.75	99.57	99.17	
	NASA LOT# 4 AVERAGE			99.50	
2. Ash Content, % PTM-71B		.005	.000	.010	
		.021	.015	.005	
	AVG.	.013	.008	.008	
	NASA LOT# 4 AVERAGE			.010	
3. Atomic Absorption, ppm CTM-53B (Values are average of 2 determinations)		#4-1	#4-2	#4-3	LOT#4 AVG.
	Na	2.0	2.0	1.0	1.7
	K	1.5	2.0	1.0	1.5
	Ca	1.5	0.5	1.5	1.2
	Mg	1.0	1.0	0.0	0.7
	Li	0.0	0.0	0.0	0.0
	TOTAL	6.0	5.5	3.5	5.0
3a. Moisture Content, % CTM-53B		0.018	0.005	0.010	
		0.030	0.015	0.015	
	AVG.	0.024	0.010	0.013	
	NASA LOT# 4 AVERAGE			0.016	
3b. Ash Content, % CTM-53B		0.005	0.005	0.000	
		0.000	0.005	0.000	
	AVG.	0.003	0.005	0.000	
	NASA LOT# 4 AVERAGE			0.003	
4. pH, Units ASTM D1512		4.70	4.80	4.80	
		4.80	4.85	4.65	
	AVG.	4.75	4.82	4.72	
	NASA LOT# 4 AVERAGE			4.76	
5. Particle Size, microns S.E.M. procedure (Average values are of 10 determinations)	AVG.	.42	.38	.43	
	Maximum	.56	.73	.70	
	Minimum	.20	.20	.23	
	Std. Dev	.08	.05	.08	
	NASA LOT# 4 AVERAGE SIZE			.41	
6a. TGA, °C at 50% Loss CTM-51		701	688	697	
	NASA LOT# 4 AVERAGE			695	

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

Filler Lot for NASA Lot# 4

6b. TGA
CTM-51 — See Charts 6A-6C

7. Particle Size Distribution
CTM-72 — See Charts 7A-7C

7a. Particle Size, microns
CTM-72

	#4-1	#4-2	#4-3
	.94	.79	.98
	.94	.82	.91
AVG.	.94	.80	.94

NASA LOT# 4 AVERAGE .89

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

Sample: 4-1
Size: 17.543 mg
Run No: MIR #12831 (I2)
Date: FEB/04/86 07:06

TGA.

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #93
File No: D 44.DAT V2.1
Plotted: FEB/04/86 10:23

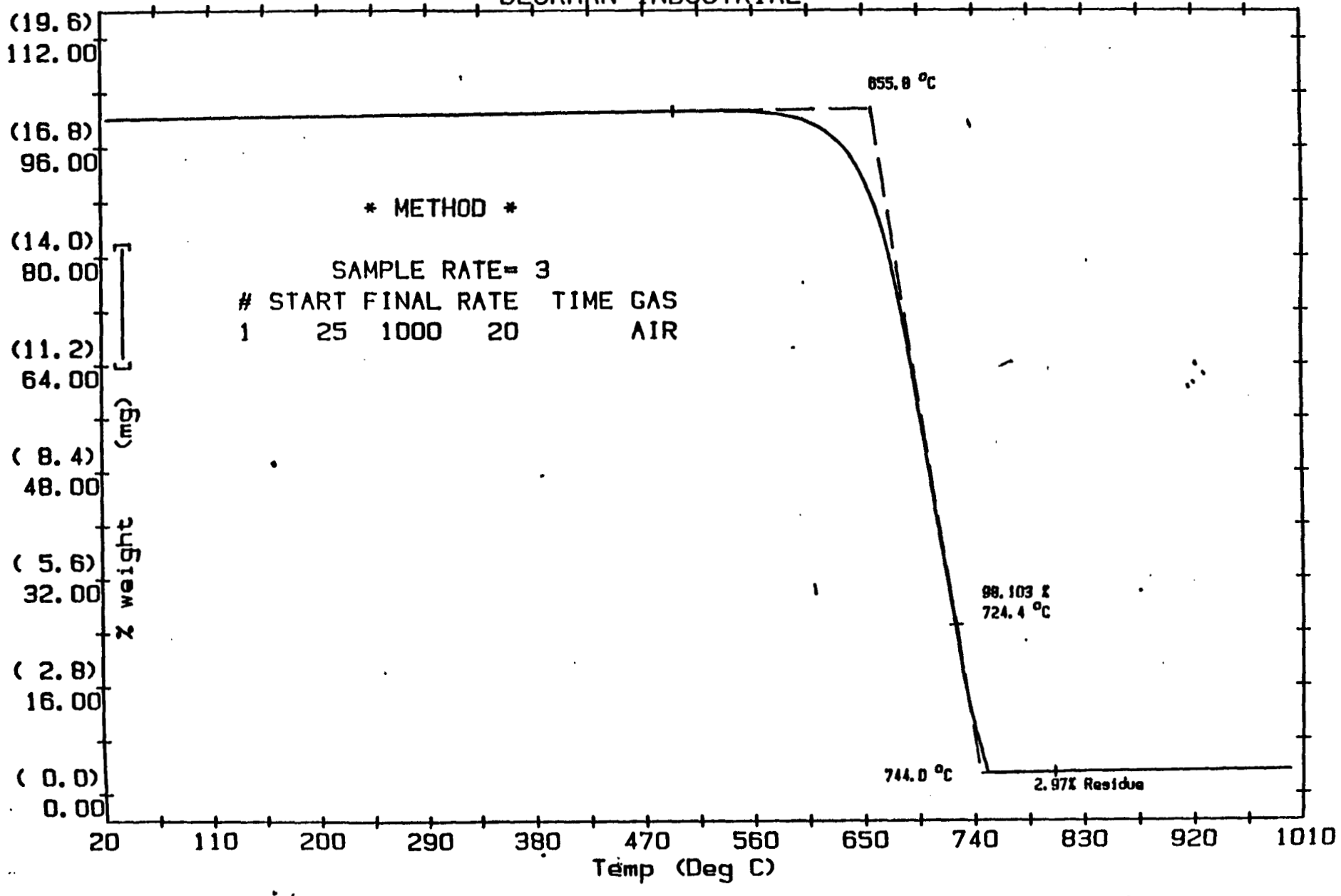

CHART 6A

Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

Sample: 4-2
Size: 19.186 mg
Run No: MIR #12831 (I2)
Date: FEB/04/86 08:21

TGA.

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #93
File No: D 45.DAT V2.1
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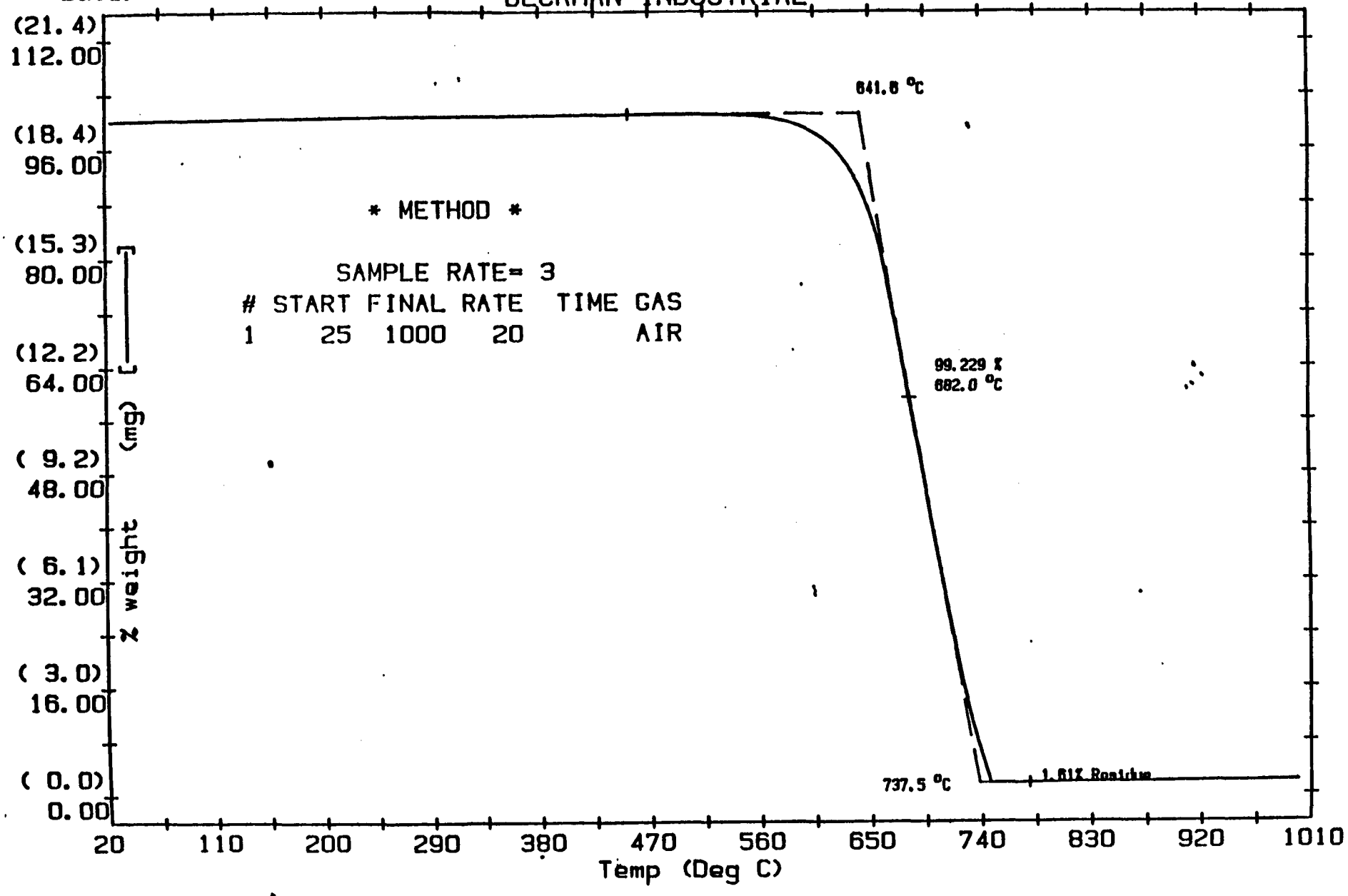


CHART 6B

Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

Sample: 4-3
Size: 15.594 mg
Run No: MIR #12831 (I2)
Date: FEB/04/86 10:14

TGA.

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #93
File No: D 46.DAT V2.1
Plotted: FEB/04/86 11:43

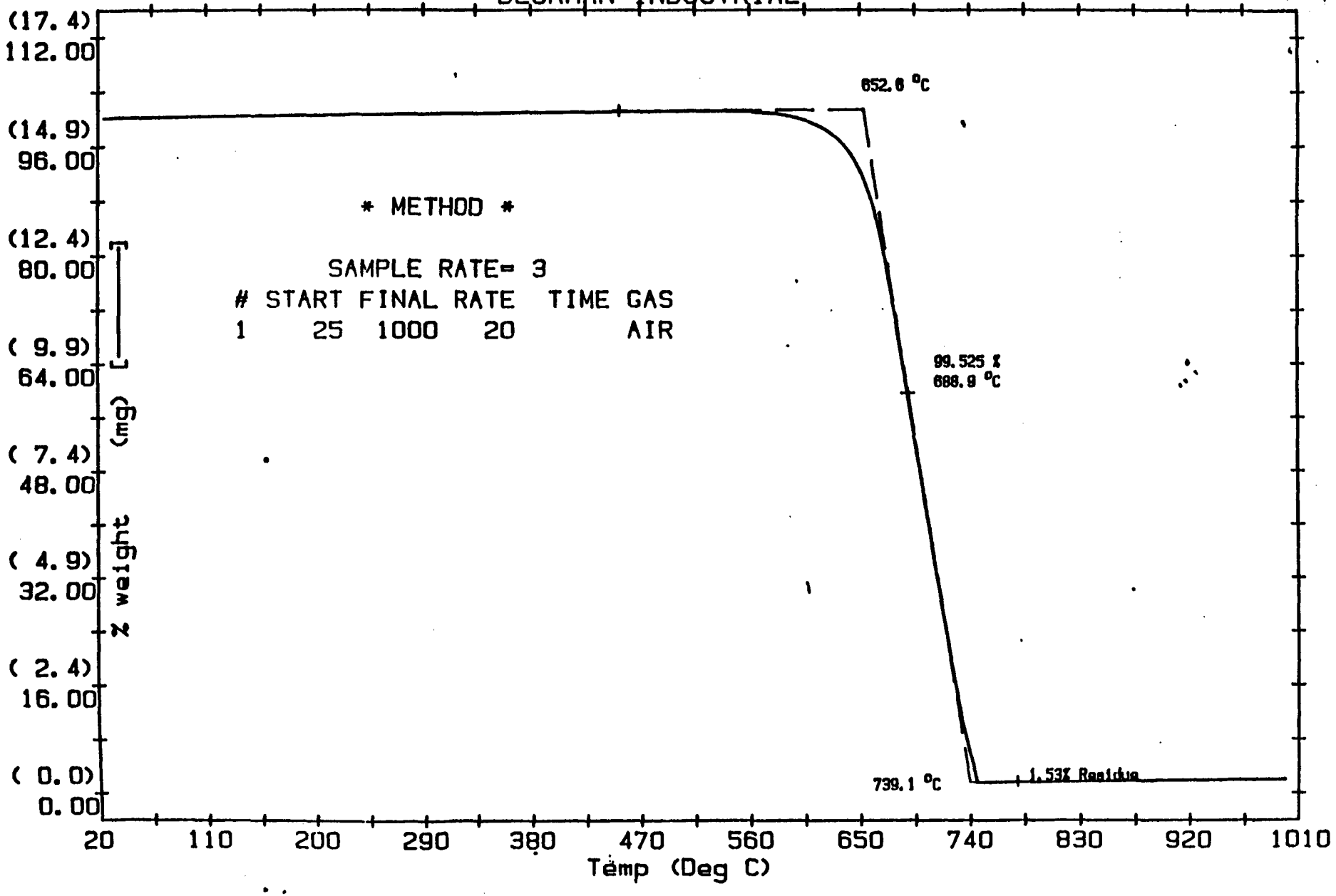


CHART 6C

Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-27-86
#1 SAMPLE NASA LOT#4-1
SOLVENT ETHYL GLYCOL
C=0.01 mg/mL

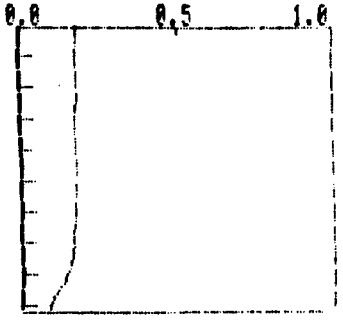
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

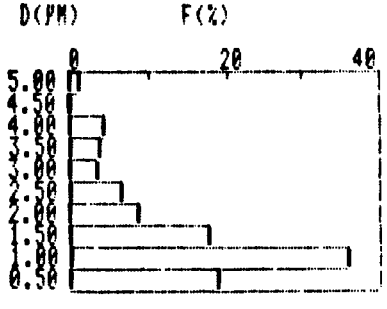


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	1.1	1.1
4.50-4.00	0.0	1.1
4.00-3.50	4.4	5.5
3.50-3.00	3.8	9.3
3.00-2.50	3.4	12.7
2.50-2.00	6.5	19.2
2.00-1.50	8.6	27.9
1.50-1.00	17.5	45.4
1.00-0.50	35.8	81.2
0.50-0.00	18.8	100.0

D(AVE) 0.94 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#4-1
Sample#1

HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-27-86
#2 SAMPLE NASA LOT#4-1
SOLVENT ETHYL GLYCOL
C=0.01 mg/mL

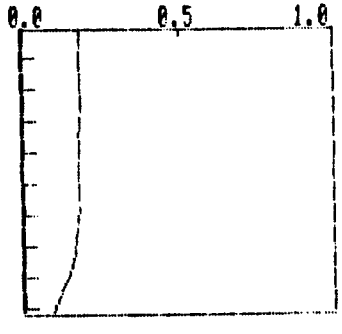
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

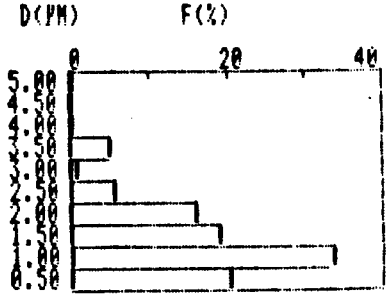


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.0	0.0
3.50-3.00	5.1	5.1
3.00-2.50	0.6	5.7
2.50-2.00	5.5	11.2
2.00-1.50	16.0	27.2
1.50-1.00	18.8	46.0
1.00-0.50	33.7	79.7
0.50-0.00	20.3	100.0

D(AVE) 0.94 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#4-1
Sample#2

CHART 7A

HORIBA CAPA-500
PARTICLE ANALYZER

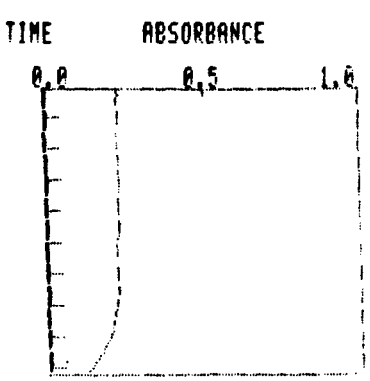
DATE 5-27-86
#2 SAMPLE NASA LOT#4-2
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

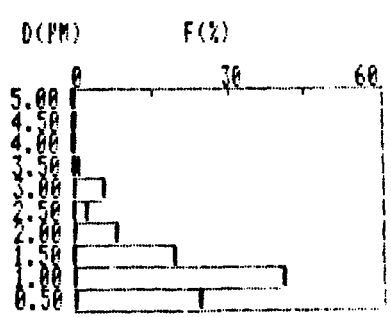


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.0	0.0
3.50-3.00	0.7	0.7
3.00-2.50	5.5	6.2
2.50-2.00	2.2	8.4
2.00-1.50	7.9	16.3
1.50-1.00	19.2	35.5
1.00-0.50	41.1	76.5
0.50-0.00	23.5	100.0

D(AVE) 0.82 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#4-2
Sample#2

HORIBA CAPA-500
PARTICLE ANALYZER

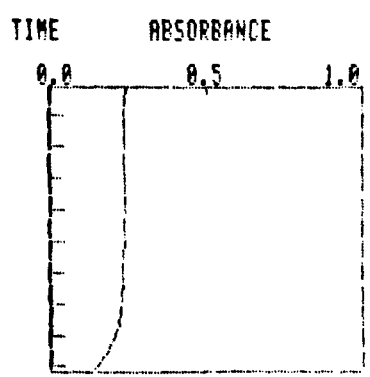
DATE 5-27-86
#1 SAMPLE NASA LOT#4-2
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

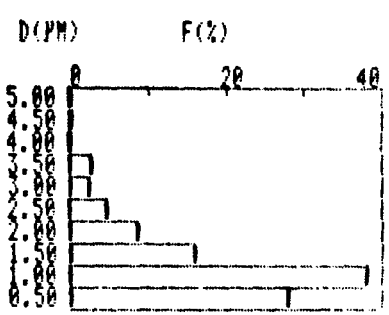


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.0	0.0
3.50-3.00	2.7	2.7
3.00-2.50	2.4	5.1
2.50-2.00	4.7	9.8
2.00-1.50	8.4	18.2
1.50-1.00	15.7	33.9
1.00-0.50	38.1	72.0
0.50-0.00	28.0	100.0

D(AVE) 0.79 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



LOT#4-2
Sample#1

CHART 7B

HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-27-86
#1 SAMPLE NASA LOT#43
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

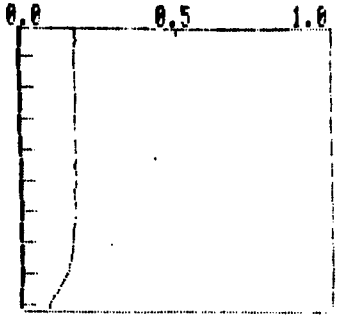
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

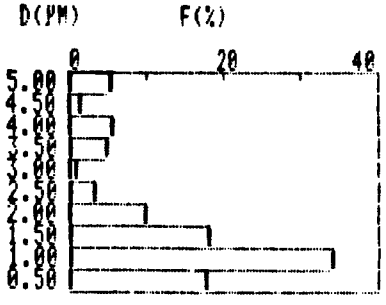


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	5.3	5.3
4.50-4.00	1.3	6.6
4.00-3.50	5.5	12.2
3.50-3.00	4.6	16.8
3.00-2.50	0.7	17.5
2.50-2.00	3.0	20.5
2.00-1.50	9.9	30.4
1.50-1.00	18.0	48.4
1.00-0.50	34.1	82.4
0.50-0.00	17.6	100.0

D(AVE) 0.98 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#43 Sample#1

HORIBA CAPA-500
PARTICLE ANALYZER

DATE 5-27-86
#2 SAMPLE NASA LOT#43
SOLVENT ETHYL GLYCOL
C=0.01 mg/ml

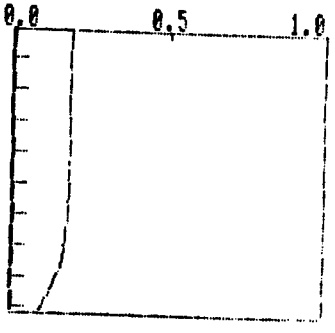
* CONDITIONS

SOLV.VISC	19.90(CP)
SOLV.DENS	1.11(G/CC)
SAMP.DENS	1.90(G/CC)
D(MAX)	5.0 (PM)
D(MIN)	0.01(PM)
D(DIV)	0.50(PM)
SPEED	5000. (RPM)

* TIME 0 H 11 MIN 31 SEC

* DATA

TIME ABSORBANCE

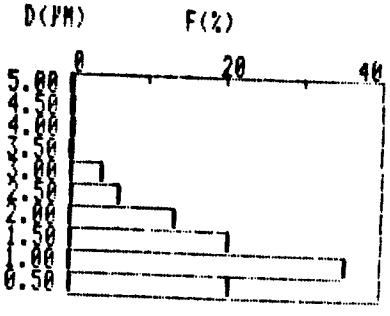


* DISTRIBUTION TABLE (BY VOL.)

D(PM)	F(%)	R(%)
5.00 <	0.0	0.0
5.00-4.50	0.0	0.0
4.50-4.00	0.0	0.0
4.00-3.50	0.0	0.0
3.50-3.00	0.0	0.0
3.00-2.50	3.8	3.8
2.50-2.00	6.2	10.0
2.00-1.50	13.5	23.6
1.50-1.00	20.3	43.8
1.00-0.50	35.6	79.4
0.50-0.00	20.6	100.0

D(AVE) 0.91 (PM)

* DISTRIBUTION GRAPH (BY VOL.)



Lot#43 Sample#2

CHART 7C

TABLE OF CONTENTS

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 4

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3.	Brookfield Viscosity	1
4.	Gel Time	1
5.	Atomic Absorption	1
6.	Gas Chromatography	1
7.	TGA	1
8.	DSC	1
9.	HPLC	1
10.	GPC	1
11.	pH	2
12.	Phenol Content	2
13.	Chang's Index	2
14.	RDS	2
15.	NMR	2

CHARTS

Gas Chromatography	6A - 6B
TGA	7A - 7B
DSC	8A - 8B
HPLC	9A - 9B
GPC	10A - 10B
RDS	14A - 14B
NMR	15A - 15B

U.S. Polymeric

RESIN TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

USP-39A Resin Lot for NASA Lot# 4

		#4-1	#4-2	
1. Resin Solids, % PTM-7C		83.0	82.8	
		83.6	83.2	
		82.4	83.5	
	AVG.	83.0	83.2	
	Lot# 4	AVERAGE	83.1	
2. Specific Gravity @ 25°C PTM-29C		1.167	1.169	
	Lot# 4	AVERAGE	1.168	
3. Viscosity, Brookfield, cps. @ 22.8°C PTM-14C		13,750	13,500	
	Lot# 4	AVERAGE	13,625	
4. Gel Time, min:sec PTM-47B		4:15	4:05	
	Lot# 4	AVERAGE	4:10	
5. Atomic Absorption, ppm CTM-53B (Values are averages of two determinations)		#4-1	#4-2	LOT4 AVG
	Na	91.0	100.0	95.5
	K	3.0	3.0	3.0
	Ca	12.5	14.5	13.5
	Mg	4.0	3.5	3.8
	Li	0.0	0.0	0.0
	AVG.	110.5	121.0	115.8
6. Volatiles, Gas Chromatography CTM-55		See Charts 6A-6B		
7. TGA, % Weight Loss at 500°C CTM-51 (AIR)		42.8	42.5	
	Lot# 4	AVERAGE	42.7	
		See Chart 7A-7B		
8. DSC, temperature °C CTM-50A		186	188	
	Lot# 4	AVERAGE	187	
		See Chart 8A-8B		
9. HPLC CTM-49A		See Chart 9A-9B		
10. GPC, Average molecular wt. CTM-49A		1679	1577	
	Lot# 4	AVERAGE	1628	
		See Chart 10A-10B		

C-3

RHITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2407

USP-39A Resin Lot for NASA Lot# 4

11. pH, units
    CTM-1B

	#4-1	#4-2
	8.18	8.20
Lot# 4	AVERAGE	8.19

12. Phenol Content, %
    CTM-55 Appendix 1

	12.83	12.93
	12.55	12.84
AVG.	12.69	12.88
Lot# 4	AVERAGE	12.79

13. Chang's Index, ml.
    CTM-5B

	24.9	24.6
Lot# 4	AVERAGE	24.8

14. RDS, Minimum Viscosity, cps.
    CTM-57A

	Min. Visc.	°C
#4-1	148	106
#4-2	143	106
AVG.	145	106

See Charts 14A-14B

15. NMR
    Vendor procedure

See Charts 15A-15B

U. S. Polymeric

Hamid M. Quraishi

Hamid M. Quraishi, Manager
Quality Assurance Department

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TYPICAL GAS CHROMATOGRAPH SET-UP

Operator J.S.Z.	Date 12/16/86
Column	Detector FID
Length 6 ft.	Voltage
Dia. 1/4 in.	Sensit.
Liquid Phase AT-1000	Flow Rates, ml/min
Wt. % 0.1	Hydrogen 60 Air 96
Support GRAPHPAC	Scavenge
Mesh 80/100	Split
Carrier Gas He.	Temperature, °C
Rotameter	Det. 220 Inj. 200
Inlet Press 60 psig	Column Initial 60
Rate 30 ml/min	Final 210
CHART SPEED	Rate 8°C/MIN
SAMPLE USP39A,4-1	Solvent THF
Size 0.05 µl	Concn. 0.1163 gm/ml

GAS CHROMATOGRAPHY STANDARD SOLVENT

TEST METHOD CTM-55

STANDARD SOLVENT/MONOMER	RETENTION TIME (MINS.)
MEOH	.6
ETHANOL	1.18
MECL2	1.28
ACETONE	1.45
IPA	1.83
THF	3.08
ACETONITRILE	3.2
CRESOL	4.03
MEK	4.08
FURFURAL	15.03
TOLUENE	17.98
CHLOROBENZENE	19.6
PHENOL	22.08

NOTE: THF WAS USED TO DILUTE THE RESIN SAMPLES.

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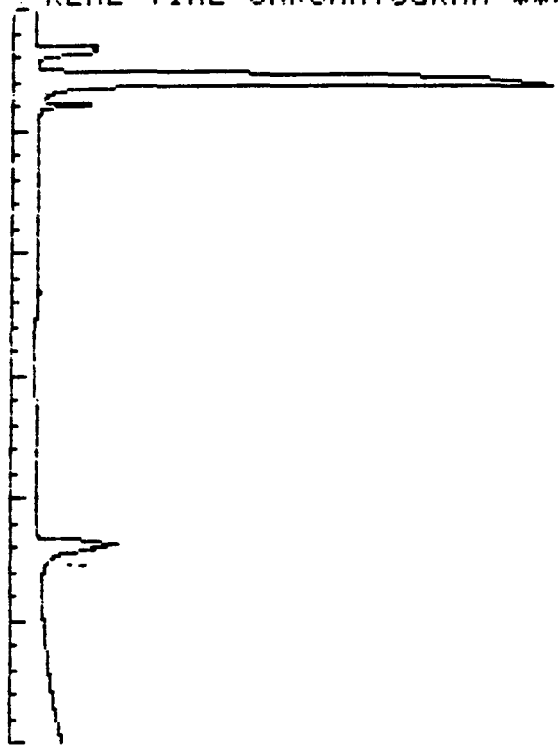
REAL TIME CHROMATOGRAM ***



FINAL FULL SCALE MV =1000.00

SAMPLE: USP39A 4-1
MISC.: C=0.11631 GMS/ML

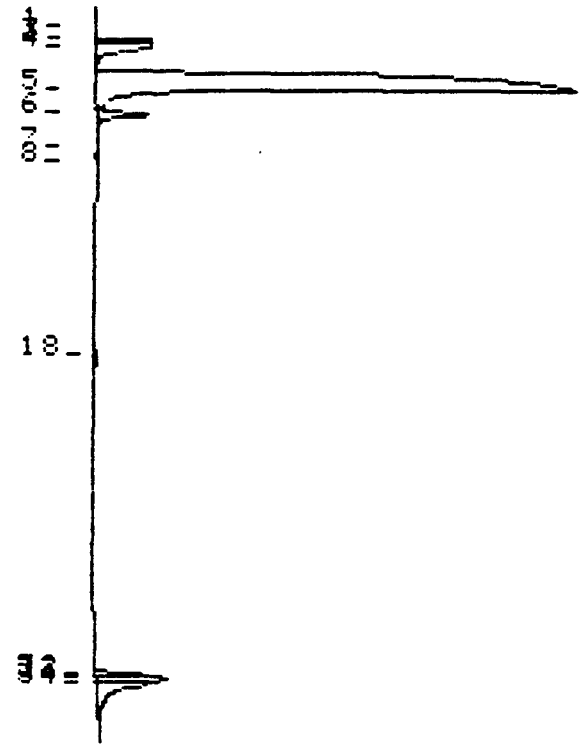
TIME: 12:34
DATE: 12/16/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
1	.63	1162	.029	1	191
3	1.60	76625	1.922	2	11349
4	1.80	191960	4.815	2	11360
5	3.20	3118800	78.236	2	97574
6	3.98	136680	3.429	3	10372
7	5.03	3086	.077	4	153
8	5.50	3265	.082	2	326
18	11.63	13890	.348	2	675
32	21.78	54611	1.370	2	10649
33	21.90	178710	4.483	2	14799
34	22.10	207590	5.207	2	10581

TOTAL AREA= 3986379
THRESHOLD= 1
MIN.PK.WIDTH= 15
AREA REJECT= 1000

VERTICAL SCALE FACTOR:1X



SAMPLE: USP39A 4-1
MISC.: C=0.11631 GMS/ML

TIME: 12:34
DATE: 12/16/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
3	1.60	76625	1.933	2	11349
4	1.80	191960	4.841	2	11360
5	3.20	3118800	78.659	2	97574
6	3.98	136680	3.447	3	10372
32	21.78	54611	1.377	2	10649
33	21.90	178710	4.507	2	14799
34	22.10	207590	5.236	2	10581

TOTAL AREA= 3964976
THRESHOLD= 1
MIN.PK.WIDTH= 15
AREA REJECT= 15000

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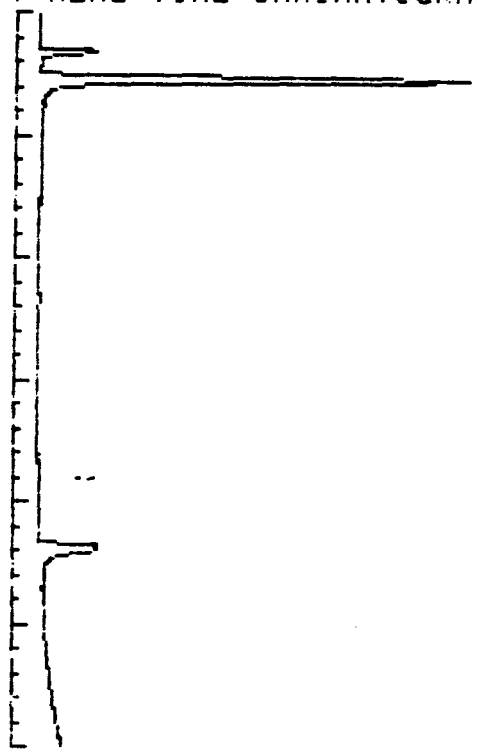
*** REAL TIME CHROMATOGRAM ***



FINAL FULL SCALE MV.=1000.00

SAMPLE: USP39A 4-2
MISC.: C=0.10199 GMS/ML

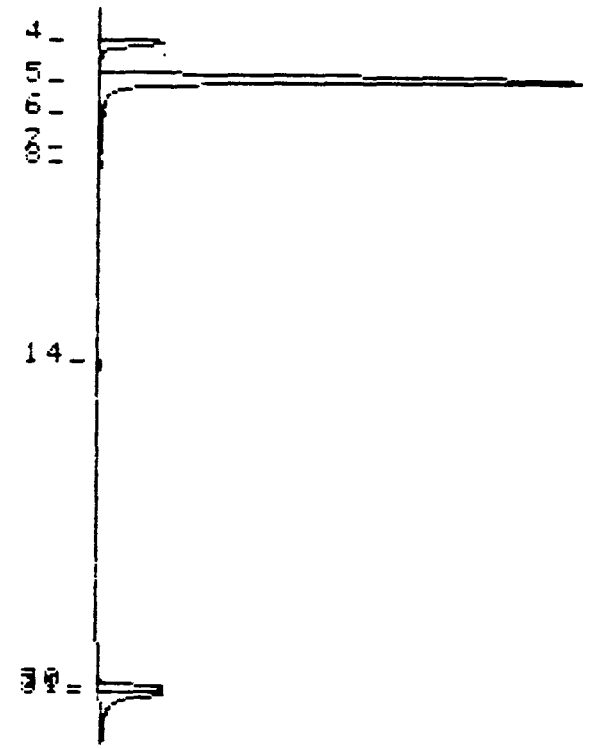
TIME: 14:04
DATE: 12/16/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
4	1 65	139370	7.563	2	10853
5	2.90	1343400	72.896	3	81323
6	3.88	16833	.913	4	843
7	4.98	2075	.113	4	123
8	5.48	2769	.150	3	235
14	11.65	9910	.538	1	512
30	21 85	121440	6.590	2	10620
31	22.03	207110	11.238	2	10643

TOTAL AREA= 1842907
THRESHOLD= 1
MIN.PK.WIDTH= 15
AREA REJECT= 1000

VERTICAL SCALE FACTOR:1X



SAMPLE: USP39A 4-2
MISC.: C=0.10199 GMS/ML

TIME: 14:04
DATE: 12/16/86
OPERATOR: JGZ

RUN TIME: 30.00 MINUTES
DELAY TIME: 0.00
CHAN: 0

PK NO.	RET TIME	PEAK AREA	AREA %	B L	PEAK HT.
4	1.65	139370	7.694	2	10853
5	2.90	1343400	74.167	3	81323
30	21.85	121440	6.705	2	10620
31	22.03	207110	11.434	2	10643

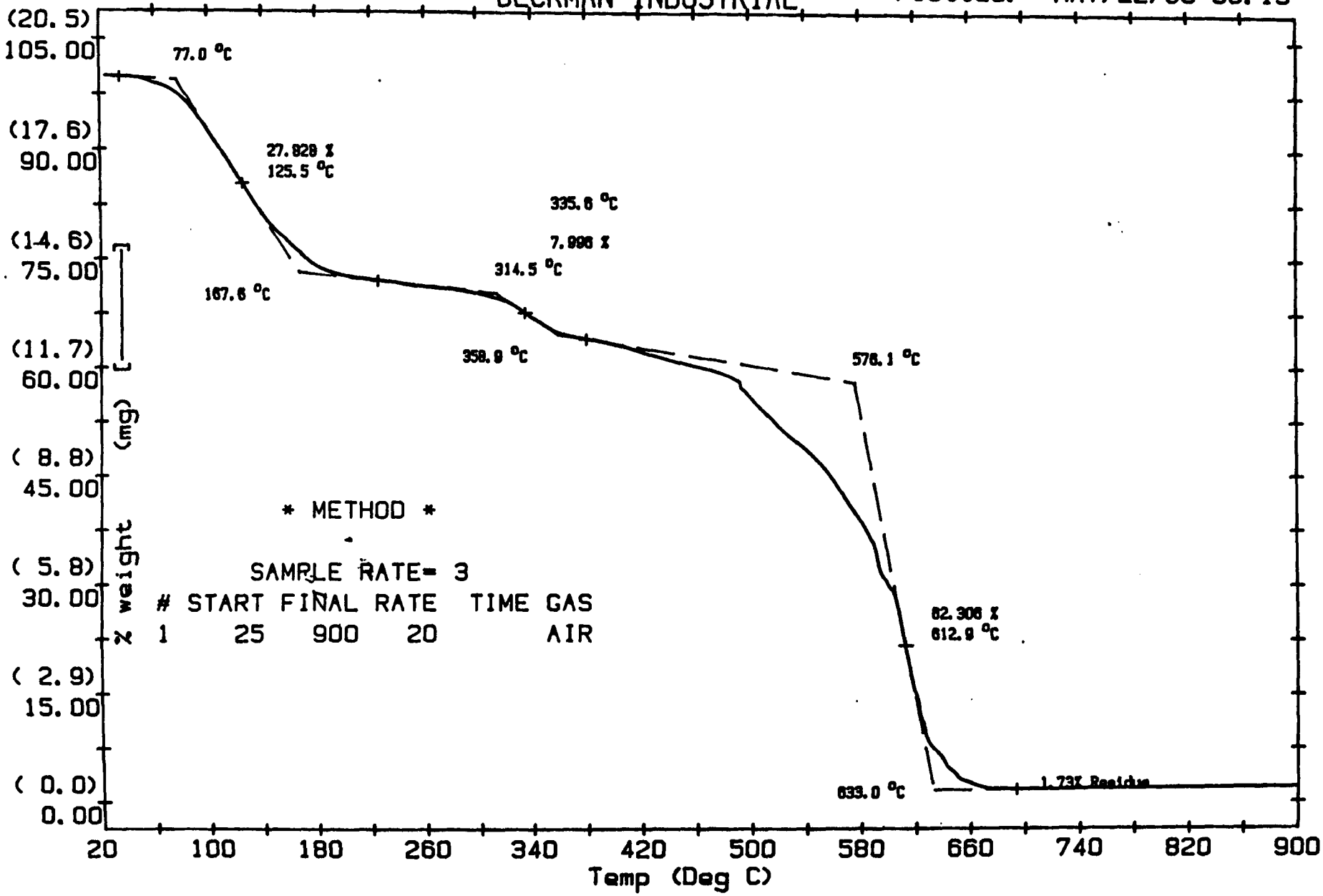
TOTAL AREA= 1811320
THRESHOLD= 1
MIN PK.WIDTH= 15
AREA REJECT= 17000

Sample: SUP39A71108 4-1
Size: 19.594 mg
Run No: MIR #13079 (I2)
Date: MAY/21/86 14:16

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 37.DAT V2.1
Plotted: MAY/22/86 08:15



Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

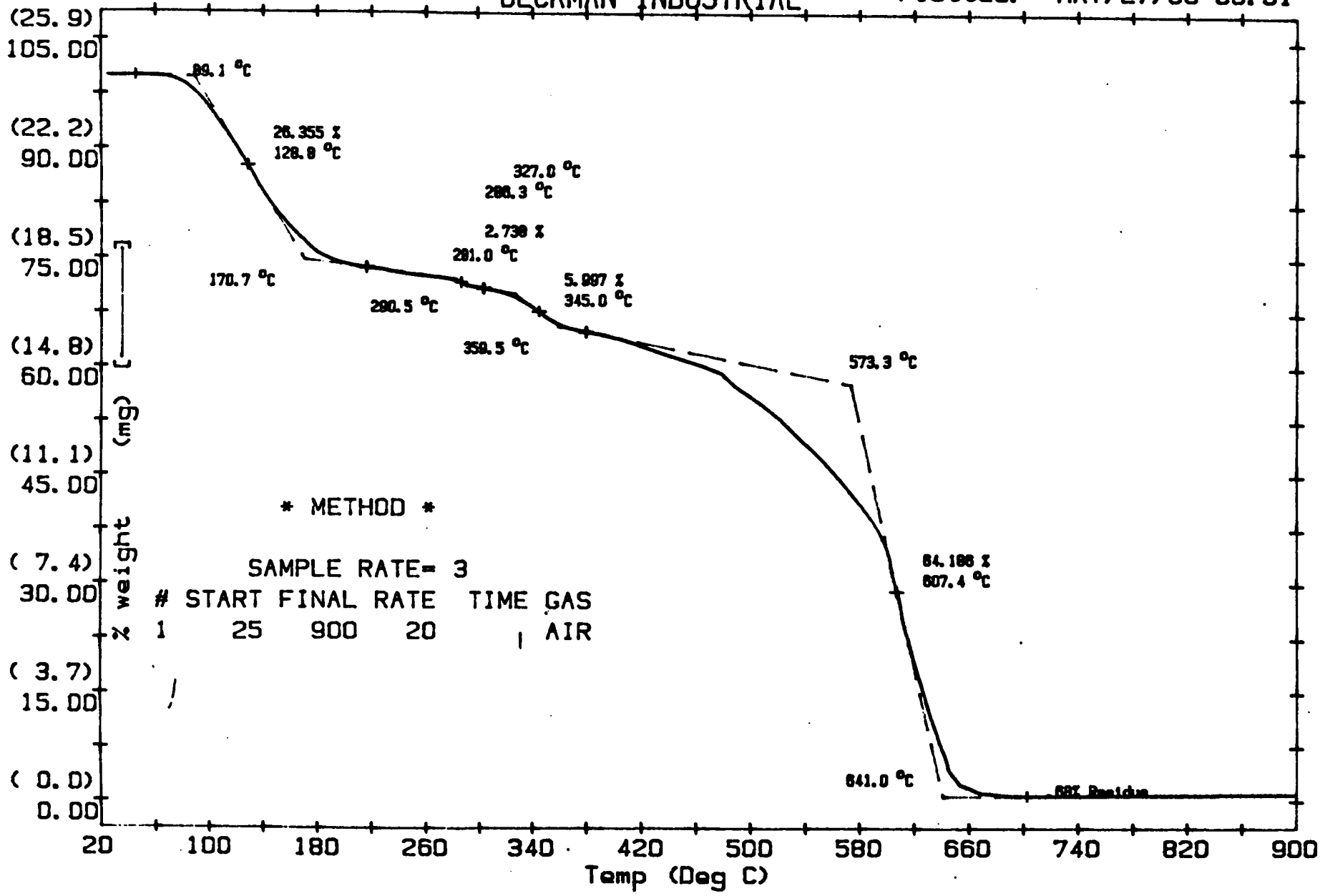
CHART 7A

Sample: USP39A71108 4-2
Size: 24.694 mg
Run No: MIR #13080 (I2)
Date: MAY/22/86 07:18

TGA

OMNITHERM DATA SYSTEM
BECKMAN INDUSTRIAL

Operator: M. WEGENER
Disk ID: DATA DISK #107
File No: D 46.DAT V2.1
Plotted: MAY/27/86 08:01



Beckman Industrial™ ANALYTICAL LABORATORY SERVICES

CHART 7B

PART NO. 990088

CHART 8A

RUN NO ____ DATE 2-23-87

OPERATOR aLK

SAMPLE: 4-1

USP 39A

ATM N2 @ 1atm

FLOW RATE 40ml/min

T-AXIS

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SCALE, °C/in 50

PROG. RATE, °C/min 20°

HEAT ✓ COOL ____ ISO ____

SHIFT, in 0

DTA-DSC

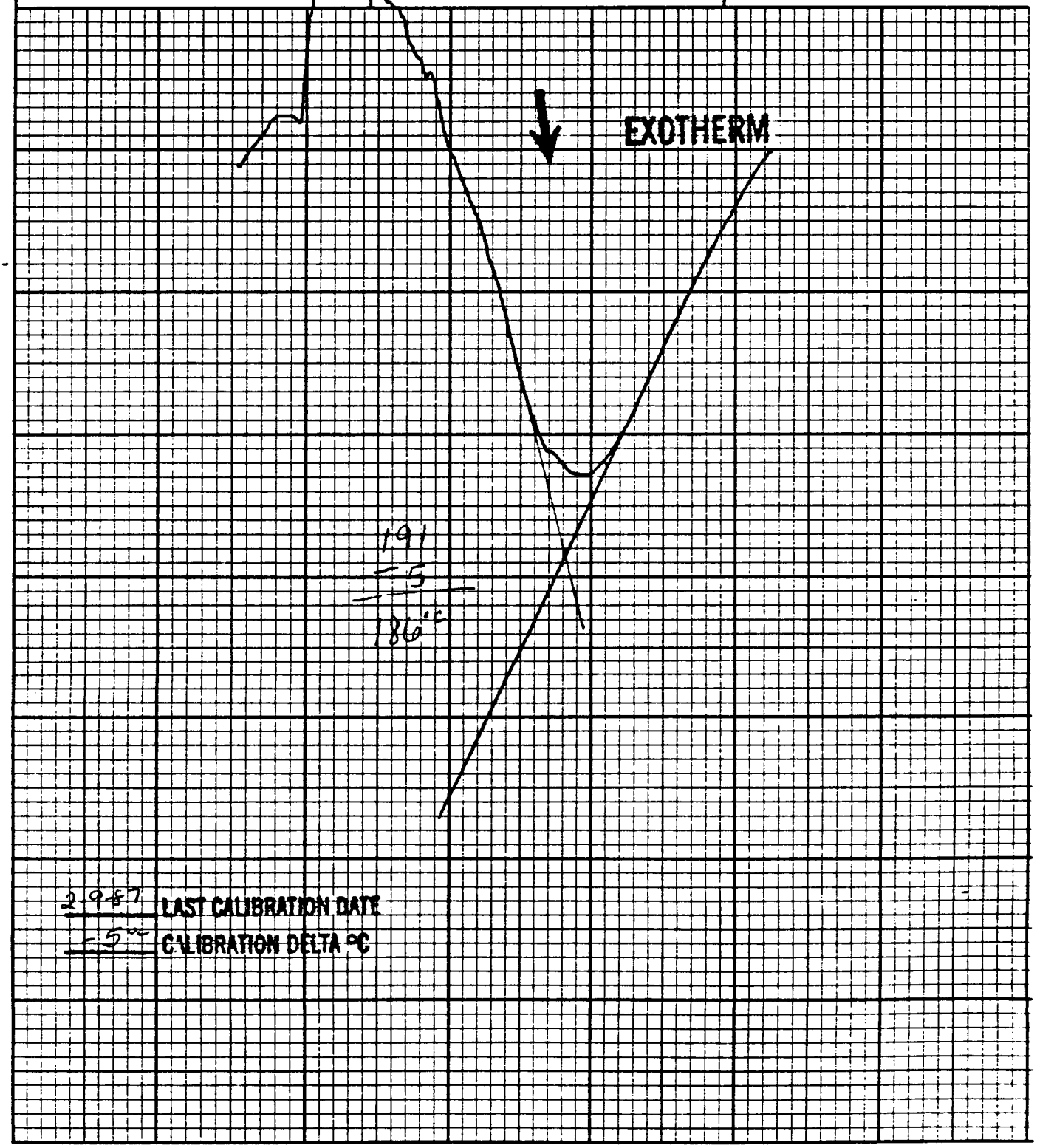
SCALE, °C/in 1.0/5X

(mcal/sec)/in ____

WEIGHT, mg 3.2

REFERENCE

1 alum seal



MEASURED VARIABLE

DUPONT Instruments

PART NO. 990088

CHART 8B

RUN NO. ____ DATE 2-23-87

OPERATOR gek

SAMPLE: USP 39A 4-2

ATM N_2 @ latm

FLOW RATE 40ml/min

T-AXIS

SCALE, °C/in 50

PROG. RATE, °C/min 20°

HEAT ✓ COOL ____ ISO ____

SHIFT, in 0

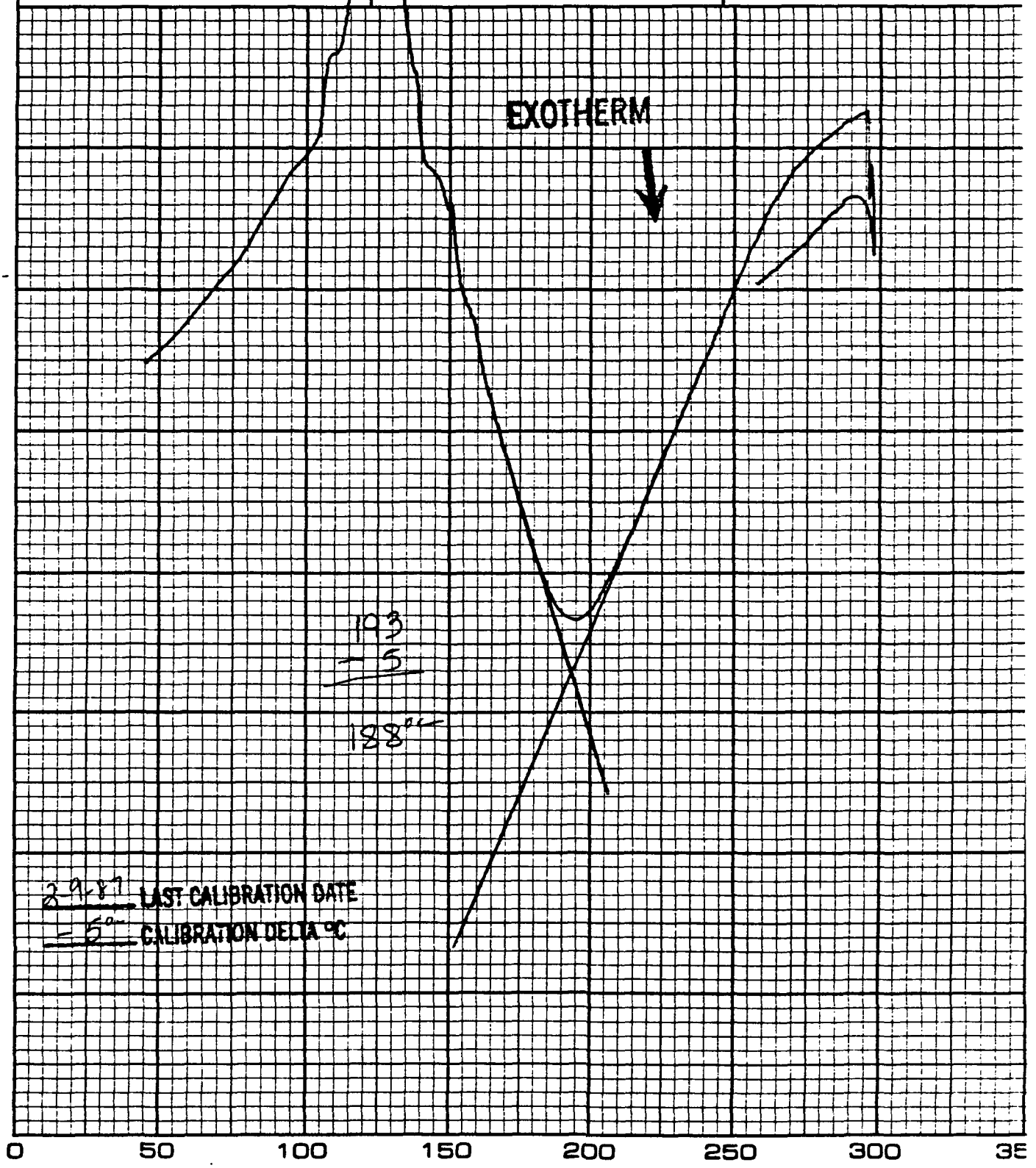
DTA-DSC

SCALE, °C/in 1.0/5x

(mcal/sec)/in ____

WEIGHT, mg 3.9

REFERENCE Talum seal



DUPONT Instruments

MEASURED VARIABLE ____

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CHART 9A

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********* AREA PERCENT REPORT *********

```
*************************************************************************
* Sample Name: USP39A,4-1,C=6.67                Operator Initials: JGZ  *
* Date:  09-05-1986 12:02:14 Method:PHENOLIC    DATA FILE: A:PHENO29.PTS *
* Interface: 4                Cycle#:  29       Channel#: 0   Vial#: N.A. *
* Starting Peak Width:  10   Threshold:  .01                            *
*************************************************************************
*  Instrument Type: BECKMAN HPLC          Column Type: MICROBONDAPAK C-18 *
*              Solvent Description: THF/WATER, 2:1 BY WEIGHT             *
*   Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN                      *
*             Detector 0: 220NM/.5AU          Detector 1:                *
*     Misc. Information:  LENGTH=25                                     *
*************************************************************************
Starting Delay:   0.00                      Ending Retention Time:   10.00
```

Pk No.	Ret. Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
2	1.80	89195	51.2031	2	4841	100.000	18.4
3	2.07	85003	48.7969	2	4793	95.301	17.7

Total Area: 174198 Area Reject: 1000 One sample per 1.000 sec.

DATA FILE=PHEN029 FROM 0.00 MIN. TO 10.00 MIN. LOW SCALE= 5.416 Mv. HIGH SCALE= 10.398 Mv.
USP-39A, 4-1, C=6.67 MG/ML, 9/5/86, JGZ

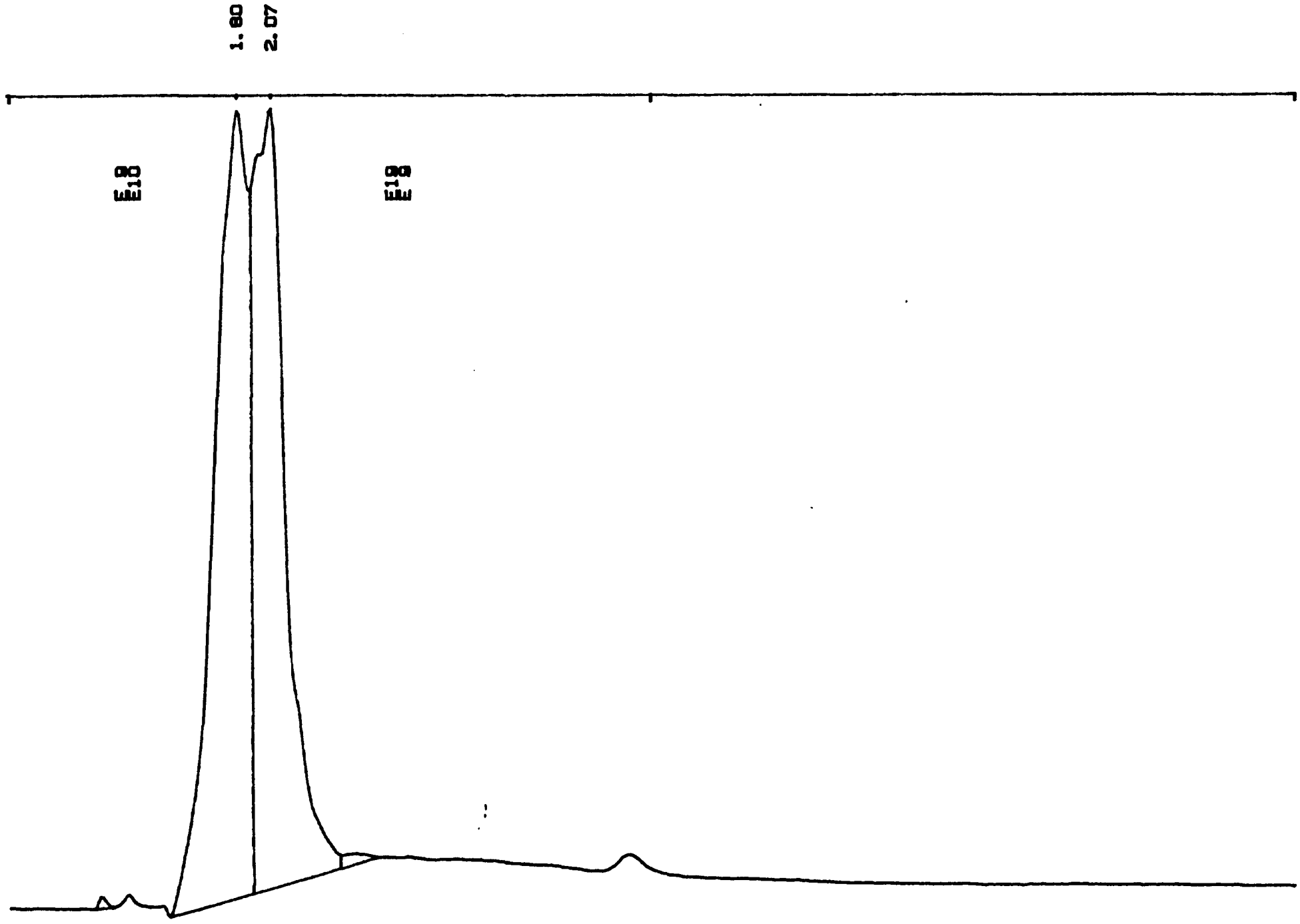

CHART 9B

********* AREA PERCENT REPORT *********

```
*****************************************************************************
* Sample Name: USP39A,4-2,C=4.96                  Operator Initials: JGZ     *
* Date:  09-01-1986 15:58:03 Method:PHENOLIC    DATA FILE: A:PHEND21.PTS     *
* Interface: 4                Cycle#:  21         Channel#: 0    Vial#: N.A.  *
* Starting Peak Width:  10    Threshold:  .01                                *
*****************************************************************************
*  Instrument Type: BECKMAN HPLC            Column Type: MICROBONDAPAK C-18  *
*              Solvent Description: THF/WATER, 2:1 BY WEIGHT                 *
*   Operating Conditions: R.T., FLOWRATE=1.5 ML/MIN                          *
*             Detector 0: 220NM/.5AU          Detector 1:                    *
*     Misc. Information:  LENGTH=25                                          *
*****************************************************************************
Starting Delay:   0.00                        Ending Retention Time:   10.00
```

Pk No.	Ret Time	Peak Area	Area %	B L	Peak Ht.	Normalized %	Area/ Height
2	1.80	81017	49.7413	2	4923	100.000	16.5
3	1.95	22173	13.6137	2	4605	27.369	4.8
4	2.05	59686	36.6450	2	5071	73.671	11.8

Total Area: 162876 Area Reject: 1000 One sample per 1.000 sec.

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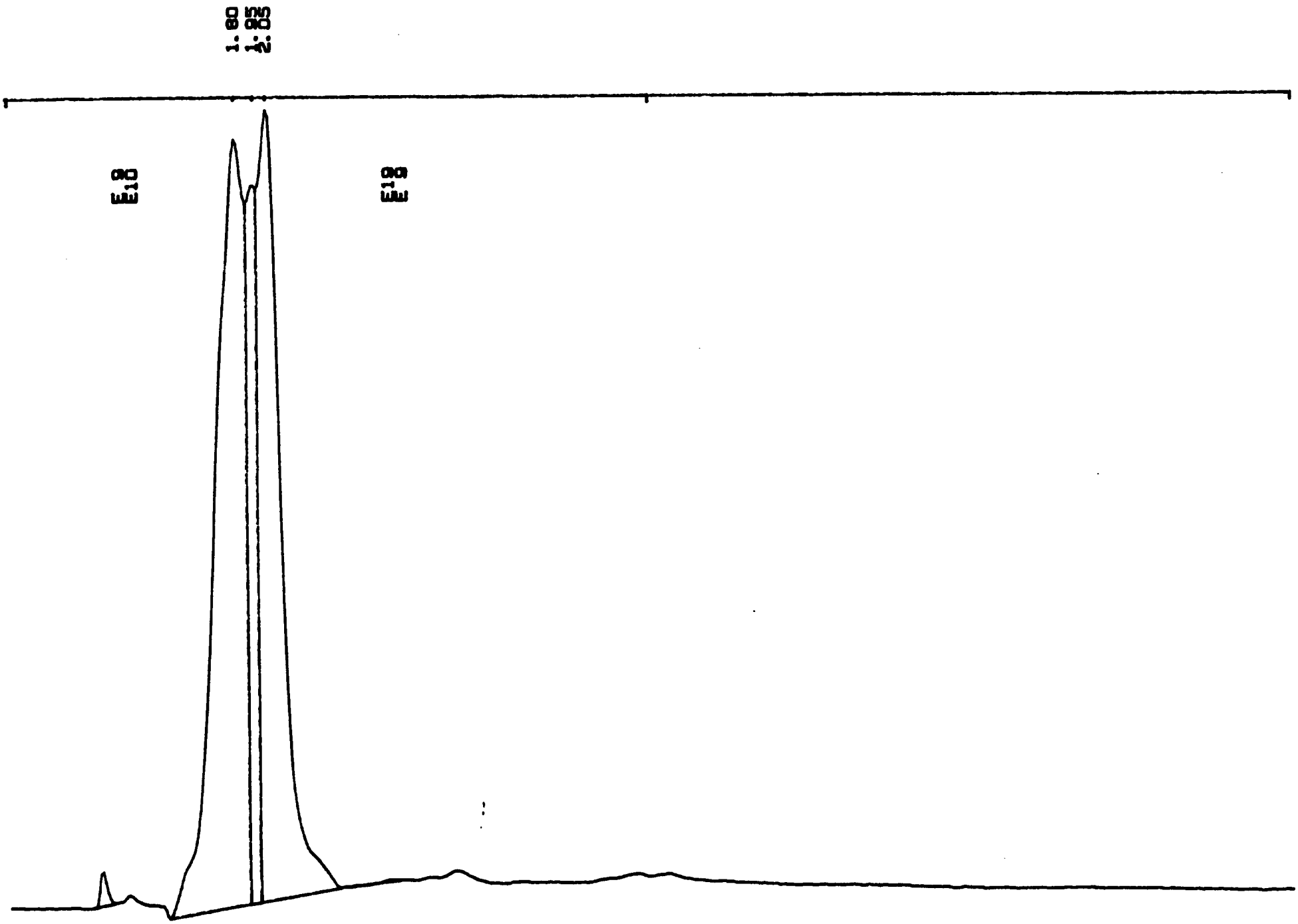
DATA FILE=PHEN021 FROM 0.00 MIN. TO 10.00 MIN. LOW SCALE= 5.445 Mv. HIGH SCALE= 10.836 Mv.
USP-39A, 4-2, C=4.96 MG/ML, 9/2/86, JGZ



*** Calibration Data ***
Calibration Name:
Misc Information:

Fit Type: 3
Log Mol Wt = A + Bx + Cx^2 + Dx^3
A= 2.538977 B= 2.115815 C= -.5646824 D= 3.606432E-02
Coefficient of Determination: 0.9902

Ret Time	Molecular Weight	Log Mol Wt
3.50	35000	4.544
4.33	15000	4.176
4.83	3600	3.556
5.09	2350	3.371
6.00	570	2.756
7.17	92	1.964
7.50	72	1.857

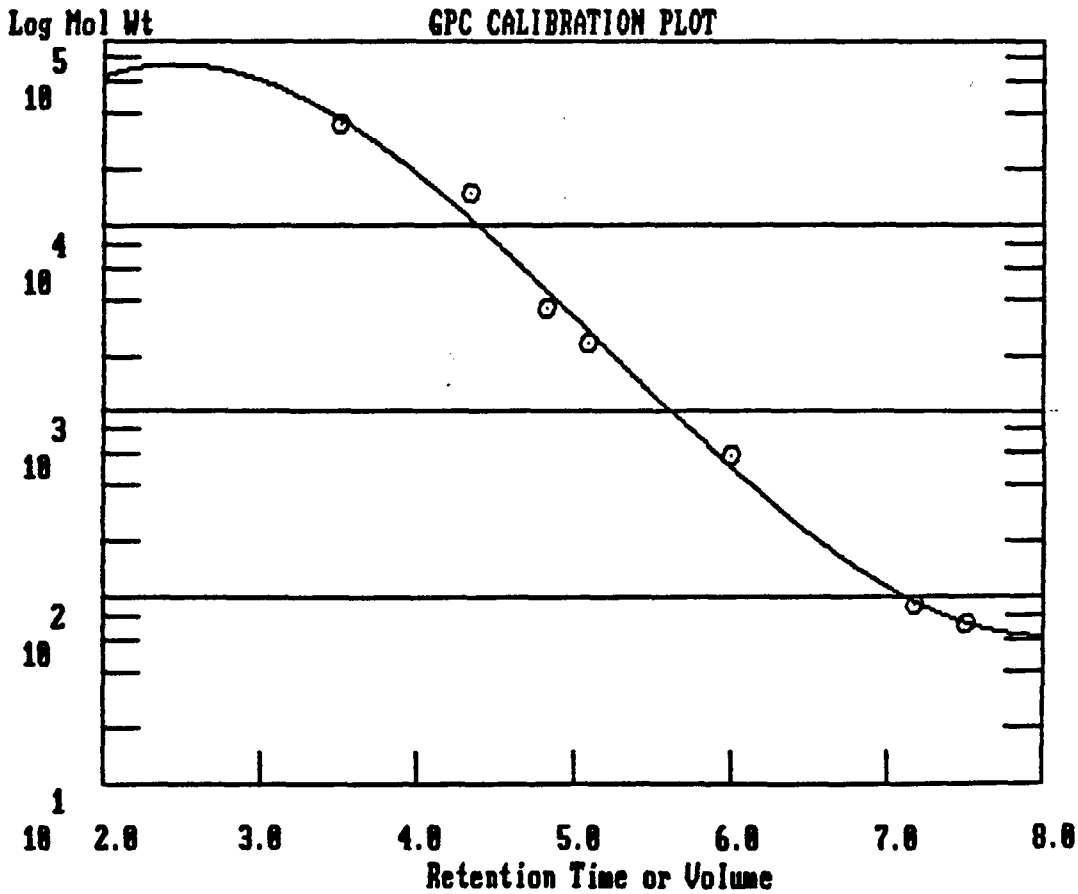


CHART 10A

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A FILE A:GPC36.HDR TAKEN 08-05-1986 17:56:32

********* GPC REPORT *********

```
*************************************************************************
ample Name: USP39A 4-1=2.68                    Operator Initials: GBF      *
ate:  08-05-1986 16:34:28 Method:              DATA FILE: A:GPC36.PTS      *
nterface: 5                Cycle#:  36         Channel#: 0    Vial#: N.A.  *
tarting Peak Width:  60    Threshold:  0                                  *
*************************************************************************
Instrument Type: HPLC/BECKMAN            Column Type: ULTRASTYRAGEL 500A   *
          Solvent Description: THF                                        *
Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                            *
         Detector 0: 254NM/.1AU          Detector 1:                      *
  Misc. Information: CALIBRATION/GPC                                      *
*************************************************************************
ting Delay:   0.00                     Ending Retention Time:   10.00
bration file: GPCPHEN
ecular Weight Distribution Averages
eline TIMES:    3.85 to   10.00   MW:      22295 to          2
ess -TIMES:     3.85 to   10.00   MW:      22295 to          2
l Area:        229203
                 1679
                  422
n=             3.9799
                 4462
                 1459
```

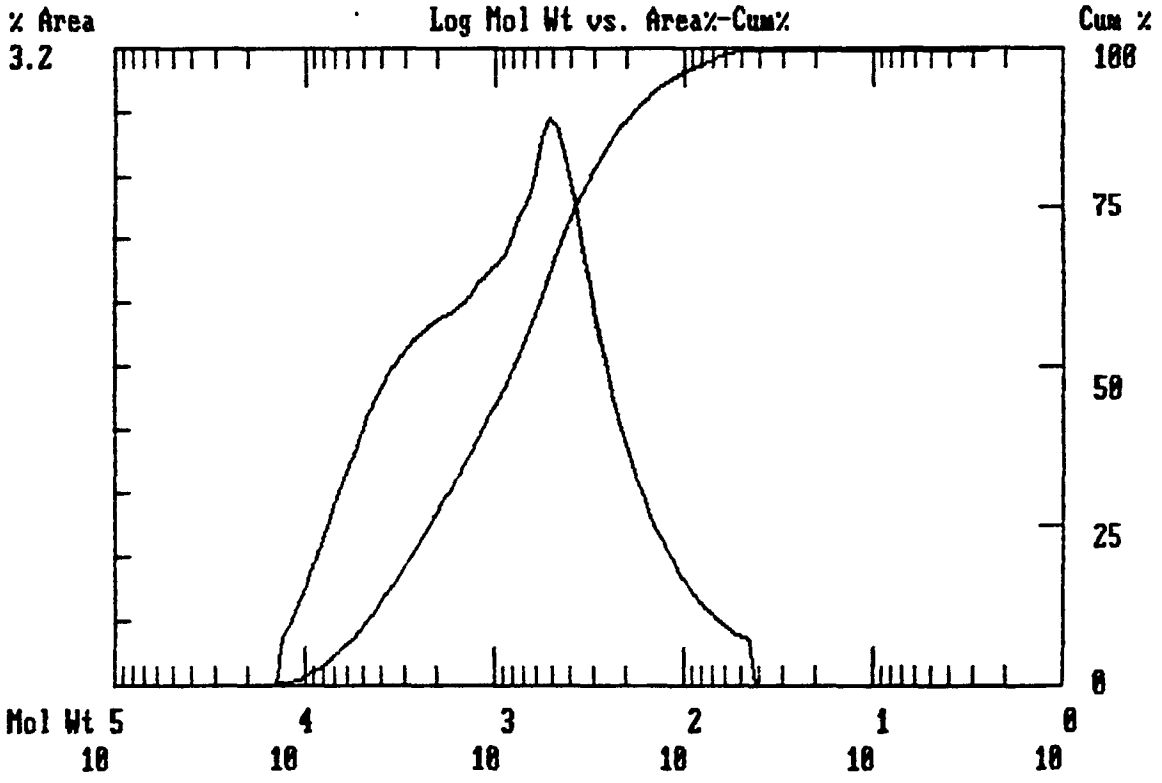

CHART 10B

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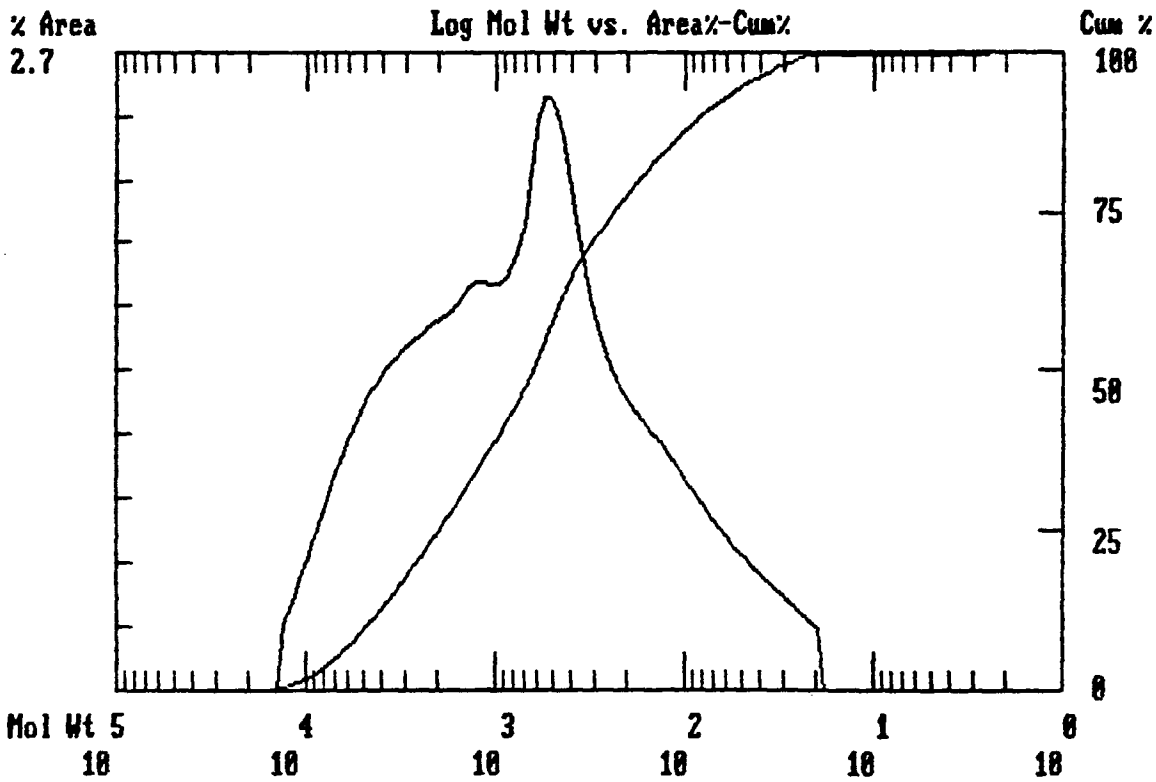
FILE A:GPC37.HDR TAKEN 08-05-1986 17:59:34

********* GPC REPORT *********

```
*****************************************************************************
Sample Name: USP39A 4-2=2.68                    Operator Initials: GBF        *
Date:  08-05-1986 16:46:38 Method:              DATA FILE: A:GPC37.PTS        *
Interface: 5                Cycle#:  37         Channel#: 0    Vial#: N.A.    *
Starting Peak Width:  60    Threshold:  0                                     *
*****************************************************************************
Instrument Type: HPLC/BECKMAN            Column Type: ULTRASTYRAGEL 500A      *
          Solvent Description: THF                                            *
Operating Conditions: T=35C FLOWRATE=2.0ML/MIN                                *
         Detector 0: 254NM/.1AU          Detector 1:                          *
  Misc. Information: CALIBRATION/GPC                                          *
*****************************************************************************
Starting Delay:   0.00                    Ending Retention Time:   10.00
Calibration file: GPCPHEN
Molecular Weight Distribution Averages
Baseline TIMES:    3.85 to   10.00   MW:      22295 to          2
Process TIMES:     3.85 to   10.00   MW:      22295 to          2
Total Area:       192576
Mw=                 1577
Mz=                  217
Mn=               7.2524
                    4789
Mv=                 1326
```



NASA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT4-1

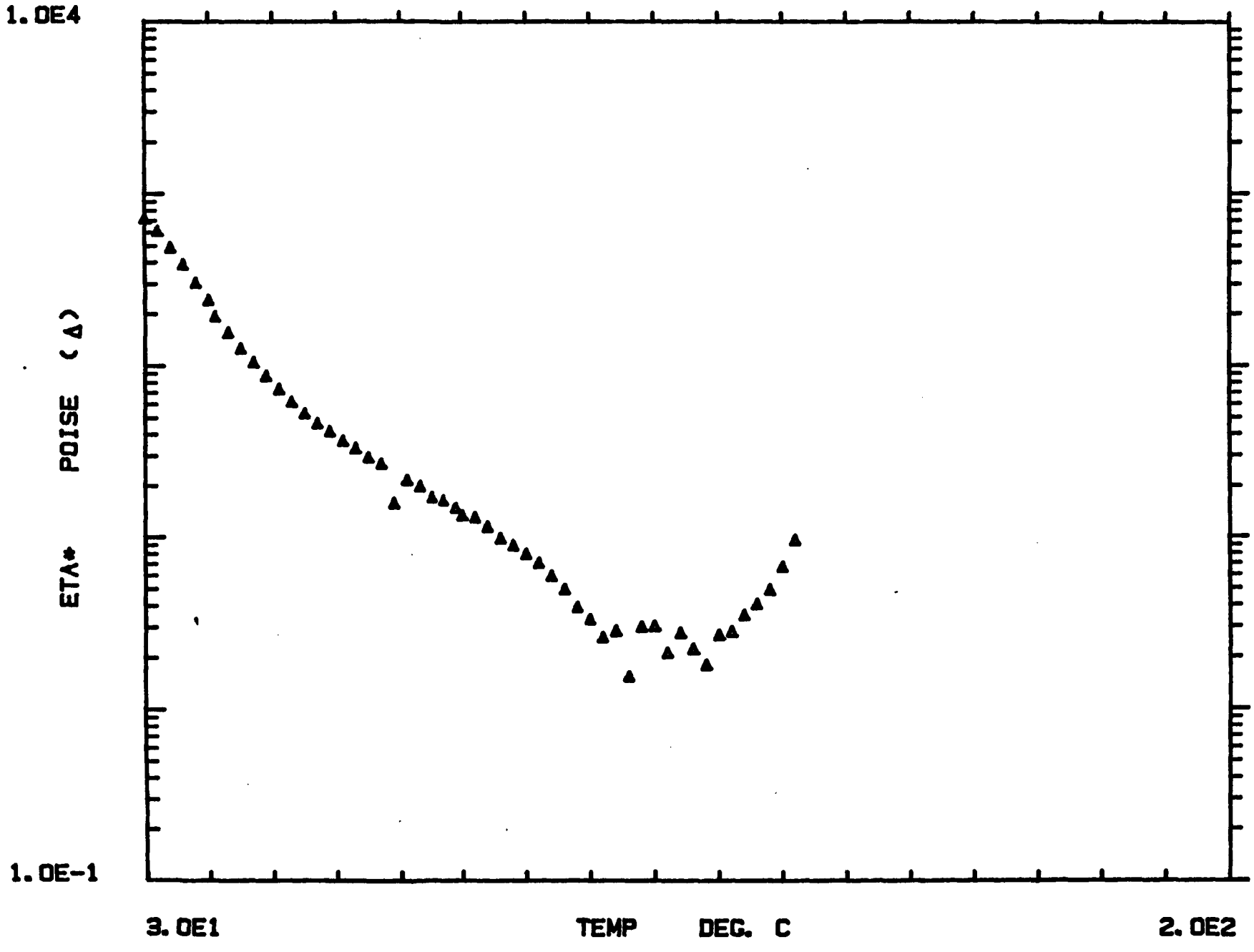


CHART 14A

ORIGINAL PAGE IS
OF POOR QUALITY

Rheometrics RECAP II

---

eriment No. : 5 Sample No. : 1

le:
A FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT4-1

rator :cp

e and Time : Monday, August 18, 1986 - 10:37:58

rating Mode : DYNAMIC

ep Type : CURE

metry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

es :
AIN =50%
QUENCY =10 RAD/SEC

ORIGINAL PAGE IS
OF POOR QUALITY

SA FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT4-1

O.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	7.356e+002	7.347e+002	3.604e+001	9.281e+001	2.000e-001	2.900e+001
2	6.972e+002	6.962e+002	3.653e+001	8.800e+001	1.000e+000	3.000e+001
3	5.909e+002	5.901e+002	3.035e+001	7.450e+001	2.000e+000	3.200e+001
4	4.739e+002	4.732e+002	2.555e+001	5.973e+001	3.000e+000	3.400e+001
5	3.764e+002	3.753e+002	2.849e+001	4.741e+001	4.000e+000	3.600e+001
6	2.946e+002	2.931e+002	2.905e+001	3.704e+001	5.000e+000	3.800e+001
7	2.327e+002	2.314e+002	2.503e+001	2.927e+001	6.000e+000	4.000e+001
8	1.876e+002	1.859e+002	2.533e+001	2.357e+001	7.000e+000	4.100e+001
9	1.507e+002	1.487e+002	2.445e+001	1.893e+001	8.000e+000	4.300e+001
10	1.215e+002	1.193e+002	2.343e+001	1.527e+001	9.000e+000	4.500e+001
11	1.010e+002	9.834e+001	2.309e+001	1.268e+001	1.000e+001	4.700e+001
12	8.408e+001	8.084e+001	2.311e+001	1.055e+001	1.100e+001	4.900e+001
13	7.028e+001	6.723e+001	2.049e+001	8.813e+000	1.200e+001	5.100e+001
14	5.958e+001	5.642e+001	1.915e+001	7.477e+000	1.300e+001	5.300e+001
15	5.106e+001	4.824e+001	1.673e+001	6.413e+000	1.400e+001	5.500e+001
16	4.459e+001	4.208e+001	1.475e+001	5.599e+000	1.500e+001	5.700e+001
17	4.010e+001	3.795e+001	1.295e+001	5.030e+000	1.600e+001	5.900e+001
18	3.536e+001	3.360e+001	1.100e+001	4.437e+000	1.700e+001	6.100e+001
19	3.190e+001	3.052e+001	9.294e+000	3.999e+000	1.800e+001	6.300e+001
20	2.823e+001	2.706e+001	8.066e+000	3.540e+000	1.900e+001	6.500e+001
21	2.593e+001	2.497e+001	6.980e+000	3.254e+000	2.000e+001	6.700e+001
22	1.516e+001	1.340e+001	7.078e+000	1.902e+000	2.100e+001	6.900e+001
23	2.092e+001	2.021e+001	5.397e+000	2.625e+000	2.200e+001	7.100e+001
24	1.918e+001	1.861e+001	4.625e+000	2.406e+000	2.300e+001	7.300e+001
25	1.646e+001	1.596e+001	4.031e+000	2.066e+000	2.400e+001	7.500e+001
26	1.582e+001	1.536e+001	3.810e+000	1.985e+000	2.500e+001	7.700e+001
27	1.428e+001	1.386e+001	3.450e+000	1.792e+000	2.600e+001	7.900e+001
28	1.286e+001	1.247e+001	3.145e+000	1.612e+000	2.700e+001	8.000e+001
29	1.250e+001	1.219e+001	2.770e+000	1.569e+000	2.800e+001	8.200e+001
30	1.103e+001	1.065e+001	2.864e+000	1.385e+000	2.900e+001	8.400e+001
31	9.406e+000	9.166e+000	2.113e+000	1.180e+000	3.000e+001	8.600e+001
32	8.563e+000	8.359e+000	1.860e+000	1.075e+000	3.100e+001	8.800e+001
33	7.639e+000	7.351e+000	2.078e+000	9.584e-001	3.200e+001	9.000e+001
34	6.766e+000	6.563e+000	1.644e+000	8.495e-001	3.300e+001	9.200e+001
35	5.684e+000	5.498e+000	1.444e+000	7.128e-001	3.400e+001	9.400e+001
36	4.764e+000	4.696e+000	8.022e-001	5.979e-001	3.500e+001	9.600e+001
37	3.731e+000	2.963e+000	2.268e+000	4.681e-001	3.600e+001	9.800e+001
38	3.183e+000	3.105e+000	6.963e-001	3.995e-001	3.700e+001	1.000e+002
39	2.505e+000	2.229e+000	1.143e+000	3.142e-001	3.800e+001	1.020e+002
40	2.716e+000	2.646e+000	6.147e-001	3.410e-001	3.900e+001	1.040e+002
41	1.481e+000	1.330e+000	6.518e-001	1.860e-001	4.000e+001	1.060e+002
42	2.881e+000	2.760e+000	8.249e-001	3.613e-001	4.100e+001	1.080e+002
43	2.905e+000	2.869e+000	4.572e-001	3.646e-001	4.200e+001	1.100e+002
44	2.030e+000	1.850e+000	8.377e-001	2.546e-001	4.300e+001	1.120e+002
45	2.647e+000	2.470e+000	9.504e-001	3.320e-001	4.400e+001	1.140e+002
46	2.124e+000	1.852e+000	1.040e+000	2.663e-001	4.500e+001	1.160e+002
47	1.724e+000	1.529e+000	7.970e-001	2.164e-001	4.600e+001	1.180e+002
48	2.573e+000	2.267e+000	1.219e+000	3.231e-001	4.700e+001	1.200e+002
49	2.691e+000	2.318e+000	1.368e+000	3.377e-001	4.800e+001	1.220e+002
50	3.367e+000	2.814e+000	1.849e+000	4.228e-001	4.900e+001	1.240e+002

ORIGINAL PAGE IS
OF POOR QUALITY

FINGERPRINT VISCOSITY PROFILE USP 39A RESIN NASA LOT4-1

ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
3.894e+000	3.271e+000	2.112e+000	4.887e-001	5.000e+001	1.260e+002
4.707e+000	3.972e+000	2.525e+000	5.911e-001	5.100e+001	1.280e+002
6.426e+000	5.930e+000	2.477e+000	8.062e-001	5.200e+001	1.300e+002
9.204e+000	8.352e+000	3.868e+000	1.156e+000	5.300e+001	1.320e+002

NASA FINGERPRINT VISCOSITY PROFILE USP 39ARESIN NASA LOT4-2

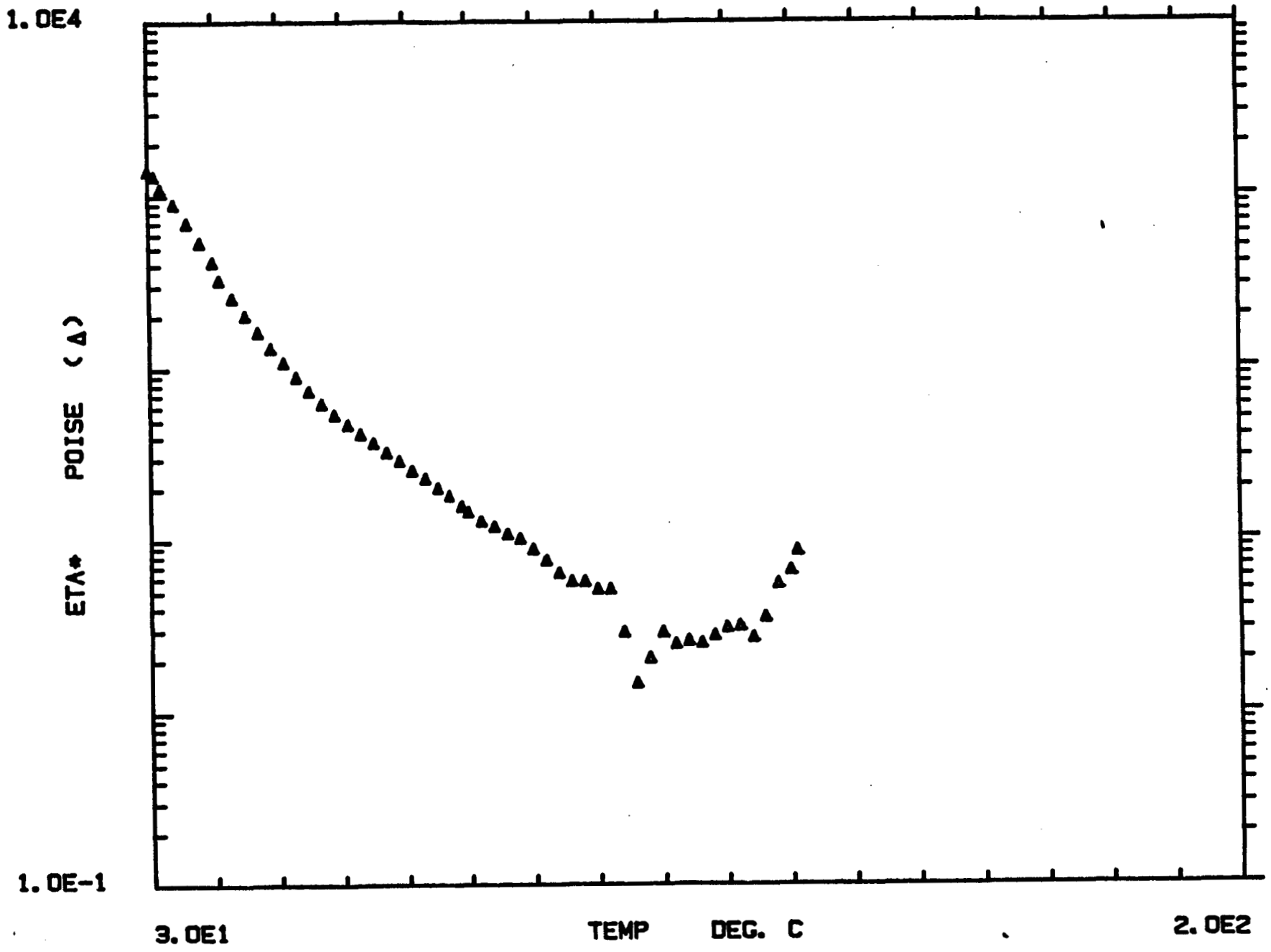


CHART 14B

Rheometrics RECAP II

Experiment No. : 6 Sample No. : 1

Title:
NASA FINGERPRINT VISCOSITY PROFILE USP 39ARESIN NASA LOT4-2

Operator :CP

Date and Time : Monday, August 18, 1986 - 12:16:20

Operating Mode : DYNAMIC

Sweep Type : CURE

Geometry : DISK & PLATE
RADIUS : 25.00
GAP : 0.50

Notes :
STRAIN =50%
FREQUENCY =10 RAD/SEC

ORIGINAL PAGE IS
OF POOR QUALITY

A FINGERPRINT VISCOSITY PROFILE UBP 39ARESIN NASA LOT4-2

ORIGINAL PAGE IS
~~OF POOR QUALITY~~

.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
1	1.376e+003	1.376e+003	4.762e+001	1.742e+002	2.000e-001	3.000e+001
2	1.278e+003	1.278e+003	4.150e+001	1.617e+002	1.000e+000	3.100e+001
3	1.080e+003	1.080e+003	3.796e+001	1.365e+002	2.000e+000	3.200e+001
4	8.738e+002	8.731e+002	3.545e+001	1.104e+002	3.000e+000	3.400e+001
5	6.808e+002	6.801e+002	3.189e+001	8.591e+001	4.000e+000	3.600e+001
6	5.270e+002	5.263e+002	2.742e+001	6.640e+001	5.000e+000	3.800e+001
7	4.063e+002	4.055e+002	2.577e+001	5.118e+001	6.000e+000	4.000e+001
8	3.184e+002	3.173e+002	2.581e+001	4.002e+001	7.000e+000	4.100e+001
9	2.503e+002	2.490e+002	2.551e+001	3.146e+001	8.000e+000	4.300e+001
0	1.979e+002	1.963e+002	2.496e+001	2.488e+001	9.000e+000	4.500e+001
1	1.583e+002	1.565e+002	2.356e+001	1.988e+001	1.000e+001	4.700e+001
2	1.275e+002	1.253e+002	2.335e+001	1.602e+001	1.100e+001	4.900e+001
3	1.055e+002	1.030e+002	2.283e+001	1.325e+001	1.200e+001	5.100e+001
4	8.678e+001	8.404e+001	2.163e+001	1.089e+001	1.300e+001	5.300e+001
5	7.219e+001	6.930e+001	2.022e+001	9.058e+000	1.400e+001	5.500e+001
6	6.079e+001	5.825e+001	1.737e+001	7.630e+000	1.500e+001	5.700e+001
7	5.253e+001	5.019e+001	1.553e+001	6.596e+000	1.600e+001	5.900e+001
8	4.614e+001	4.405e+001	1.374e+001	5.792e+000	1.700e+001	6.100e+001
9	4.050e+001	3.872e+001	1.186e+001	5.084e+000	1.800e+001	6.300e+001
0	3.587e+001	3.452e+001	9.737e+000	4.501e+000	1.900e+001	6.500e+001
1	3.161e+001	3.043e+001	8.555e+000	3.968e+000	2.000e+001	6.700e+001
2	2.825e+001	2.730e+001	7.263e+000	3.544e+000	2.100e+001	6.900e+001
3	2.474e+001	2.393e+001	6.270e+000	3.106e+000	2.200e+001	7.100e+001
4	2.225e+001	2.159e+001	5.389e+000	2.791e+000	2.300e+001	7.300e+001
5	1.955e+001	1.898e+001	4.673e+000	2.455e+000	2.400e+001	7.500e+001
6	1.766e+001	1.711e+001	4.373e+000	2.216e+000	2.500e+001	7.700e+001
7	1.533e+001	1.497e+001	3.306e+000	1.924e+000	2.600e+001	7.900e+001
8	1.419e+001	1.375e+001	3.507e+000	1.781e+000	2.700e+001	8.000e+001
9	1.251e+001	1.205e+001	3.343e+000	1.570e+000	2.800e+001	8.200e+001
0	1.159e+001	1.127e+001	2.722e+000	1.456e+000	2.900e+001	8.400e+001
	1.051e+001	1.023e+001	2.409e+000	1.318e+000	3.000e+001	8.600e+001
2	9.883e+000	9.514e+000	2.674e+000	1.240e+000	3.100e+001	8.800e+001
3	8.555e+000	8.397e+000	1.638e+000	1.073e+000	3.200e+001	9.000e+001
.	7.367e+000	7.234e+000	1.393e+000	9.245e-001	3.300e+001	9.200e+001
5	6.196e+000	6.091e+000	1.133e+000	7.771e-001	3.400e+001	9.400e+001
.	5.547e+000	5.406e+000	1.240e+000	6.961e-001	3.500e+001	9.600e+001
	5.524e+000	5.374e+000	1.278e+000	6.927e-001	3.600e+001	9.800e+001
	5.003e+000	4.947e+000	7.478e-001	6.278e-001	3.700e+001	1.000e+002
	4.991e+000	4.896e+000	9.667e-001	6.258e-001	3.800e+001	1.020e+002
	2.805e+000	2.645e+000	9.323e-001	3.519e-001	3.900e+001	1.040e+002
	1.425e+000	1.229e+000	7.202e-001	1.788e-001	4.000e+001	1.060e+002
	1.995e+000	1.774e+000	9.136e-001	2.504e-001	4.100e+001	1.080e+002
	2.815e+000	2.740e+000	6.471e-001	3.534e-001	4.200e+001	1.100e+002
	2.394e+000	2.342e+000	4.931e-001	3.003e-001	4.300e+001	1.120e+002
	2.505e+000	2.484e+000	3.215e-001	3.146e-001	4.400e+001	1.140e+002
	2.430e+000	2.340e+000	6.570e-001	3.049e-001	4.500e+001	1.160e+002
	2.698e+000	2.495e+000	1.000e+000	3.374e-001	4.600e+001	1.180e+002
	2.979e+000	2.814e+000	9.793e-001	3.741e-001	4.700e+001	1.200e+002
	3.045e+000	2.971e+000	6.678e-001	3.820e-001	4.800e+001	1.220e+002
	2.614e+000	2.449e+000	9.131e-001	3.281e-001	4.900e+001	1.240e+002

A FINGERPRINT VISCOSITY PROFILE USP 39ARESIN NASA LOT4-2

.	ETA* POISE	ETA' POISE	ETA" POISE	TORQUE GRAMS-CM	TIME MIN.	TEMP DEG. C
51	3.427e+000	3.307e+000	8.978e-001	4.300e-001	5.000e+001	1.260e+002
2	5.347e+000	5.018e+000	1.845e+000	6.710e-001	5.100e+001	1.280e+002
53	6.402e+000	6.055e+000	2.079e+000	8.032e-001	5.200e+001	1.300e+002
54	8.322e+000	7.985e+000	2.347e+000	1.045e+000	5.300e+001	1.310e+002

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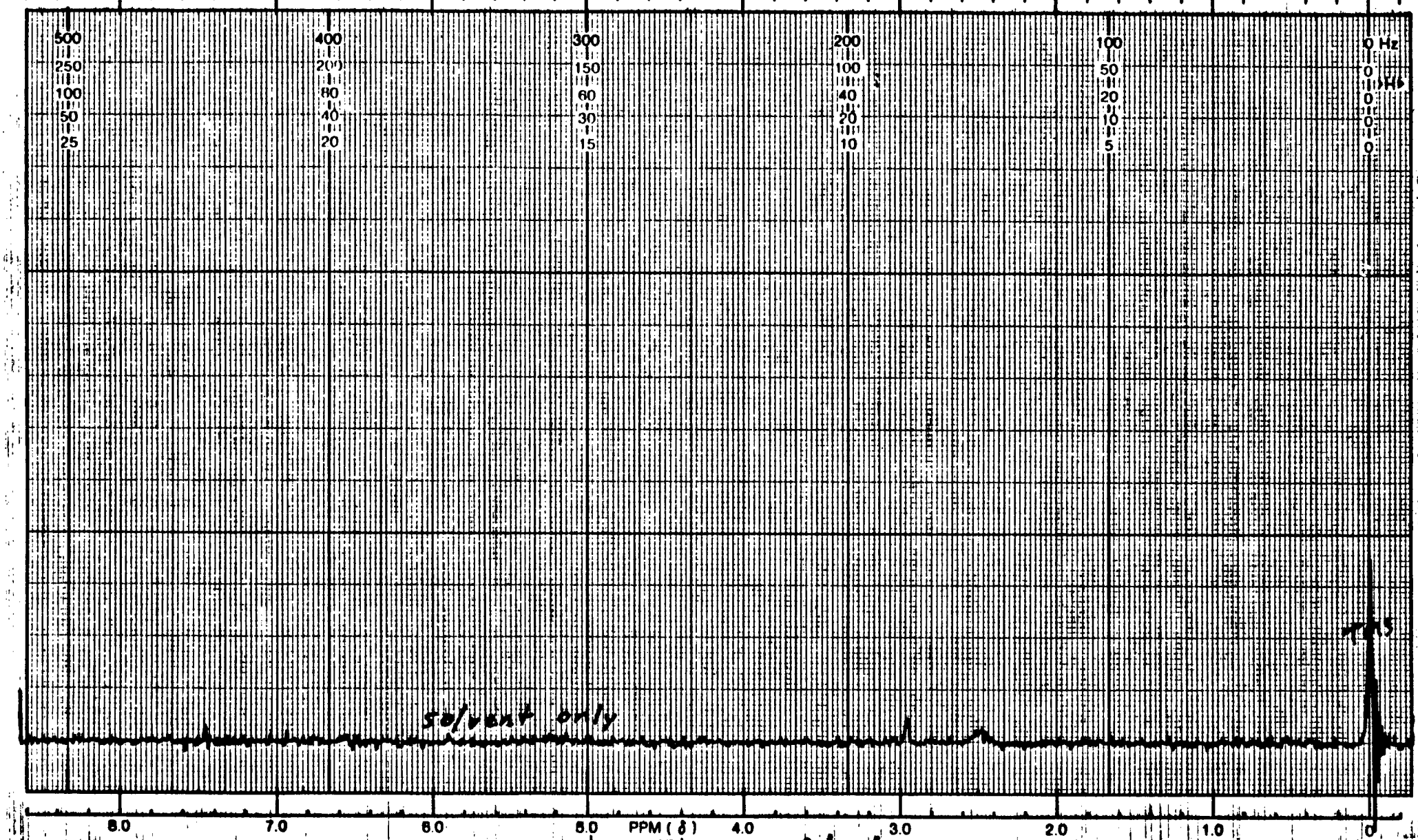
OF POOR QUALITY



SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: —
SPINNING RATE (RPS): 30

MANUAL | AUTO ☐

SWEEP TIME (SEC): 30 250 500 1000 (250)
SWEEP WIDTH (Hz): 25 50 100 250 500 (500)
FILTER: 1 2 3 4 5 6 7 8 (2)
RF POWER LEVEL: 0.30 (.05)

SAMPLE: Solvent
SOLVENT: Uniol-d4 0.52TMS
DEC. LEVEL

REMARKS:

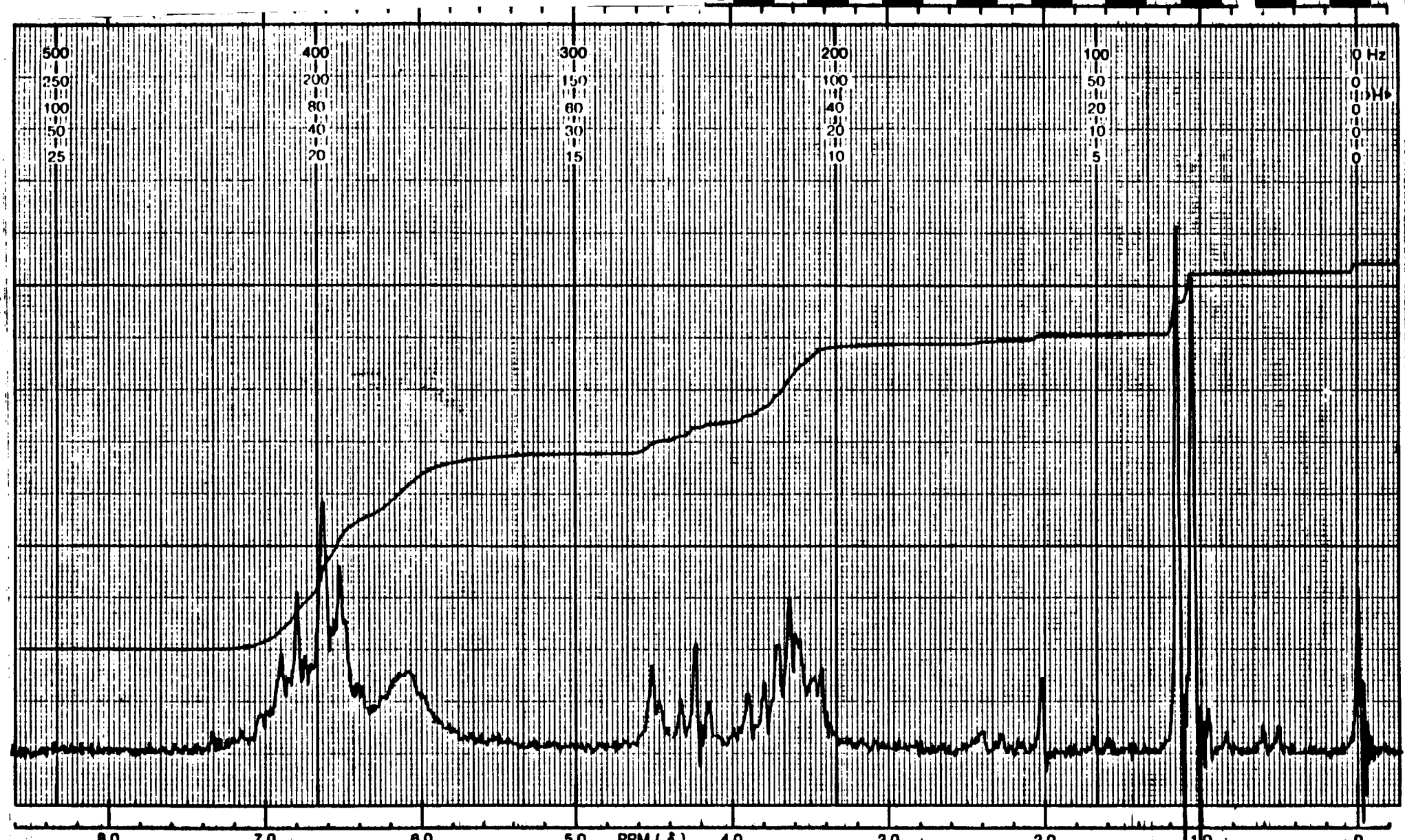
ORIGINAL PAGE IS OF POOR QUALITY

SOLVENT ONLY SCAN

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86 OPERATOR DGW SPECTRUM NO. 1A of 7

solvent scan



SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: 5.0
SPINNING RATE (RPS): 30

MANUAL
SWEEP TIME (SEC): 30 250 500 1000
SWEEP WIDTH (Hz): 25 50 100 250 500
FILTER: 1 2 3 4 5 6 7 8
RF POWER LEVEL: 0.25

AUTO ☐
(250)
(500)
(2)
(.05)

SAMPLE: USP-39A Lot#4-1
SOLVENT: Unisol-d + 0.52 TMS
DEC. LEVEL

REMARKS: 0.106 gm sample
0.906 gm solvent

ORIGINAL PAGE IS
OF POOR QUALITY

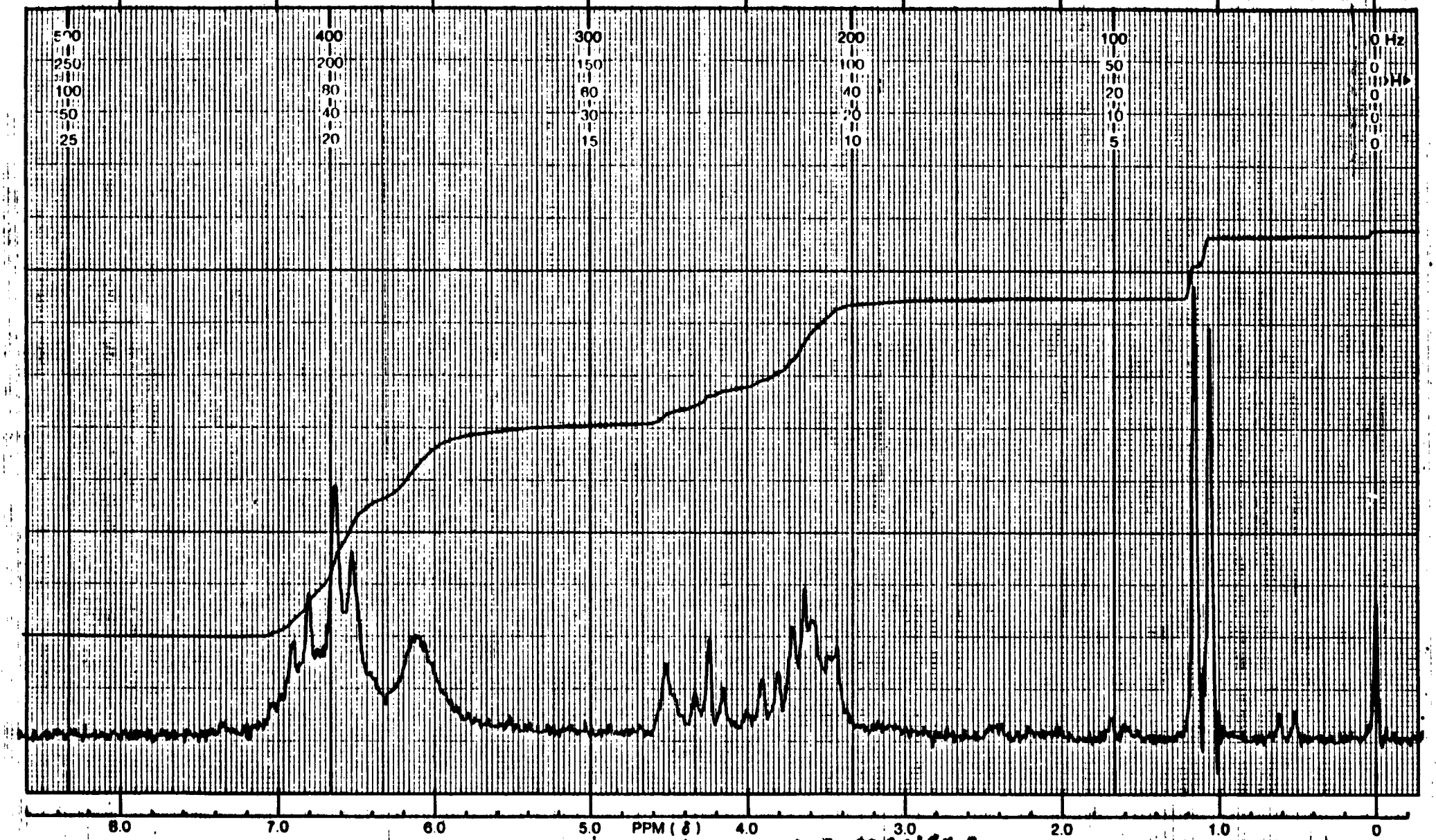
NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86

OPERATOR DFW

SPECTRUM NO. 6 of 7 USP-39A Lot#4-1

CHART 15A



SWEEP OFFSET (Hz): 0
SPECTRUM AMPLITUDE: 8.0
INTEGRAL AMPLITUDE: 5.0
SPINNING RATE (RPS): 20

MANUAL / AUTO ☐

SWEEP TIME (SEC): 30 250 500 1000 (250)
SWEEP WIDTH (Hz): 25 50 100 250 500 (500)
FILTER: 1 2 3 4 5 6 7 8 (2)
RF POWER LEVEL: 0.25 (.05)

SAMPLE: USP-394 Lot #4-2
SOLVENT: Unisol-d + 0.5% TMS
DEC. LEVEL

REMARKS: 0.108 gm sample
0.836 gm solvent

ORIGINAL PAGE IS
OF POOR QUALITY

NORELL, INC.
LANDISVILLE, N.J. 08326
T60 Phone: (609) 697-0020

DATE: 3-21-86 OPERATOR: DGW SPECTRUM NO. 7 of 7 USP-394 Lot # 4-2

CHART 15B

TABLE OF CONTENTS

FABRIC TESTING

NAS8-36298

U.S. Polymeric O.E. 71108

WCA Fabric for NASA Lot# 4 (HITCO)

TEST		PAGE
1a.	Breaking Strength, WARP	1
1b.	Breaking Strength, FILL	1
2a.	Carbon Assay	1
2b.	Hydrogen Assay	1
2c.	Nitrogen Assay	1
3.	Visual Inspection	1
4.	Specific Gravity	1
5.	pH	2
6.	TGA	2
7a.	Atomic Absorption	2
7b.	Moisture Content	2
7c.	Ash Content	2
8a.	Filament diameter, WARP	2
8b.	Filament diameter, FILL	2
9a.	Thread Count, WARP	2
9b.	Thread Count, FILL	3
10a.	Areal weight	3
10b.	Volatiles	3
10c.	Weight Change on Acetone Wash	3

CHARTS

Visual Inspection 3A

TGA ..... 6A - 6B

U.S. Polymeric

FABRIC TESTING

NAS8-36298

U.S. POLYMERIC O.E. 71108

WCA Fabric for NASA Lot# 4 (HITCO)

1a. Breaking Strength, lbs/in, WARP
ASTM D1682

	#4-1S	#4-1E	LOT4 AVG
PICK	52	28	40.0
CENTER	66	28	47.0
PLAIN	49	39	44.0
AVG.	55.7	31.7	43.7

1b. Breaking Strength, lbs/inch, FILL
ASTM D1682

PICK	33	11	22.0
CENTER	25	11	18.0
PLAIN	29	8	18.5
AVG.	29.0	10.0	19.5

2a. Carbon Assay, %
MDQAI 5560

PICK	99.9	99.6	99.75
CENTER	98.8	99.7	99.25
PLAIN	99.5	99.7	99.60
AVG.	99.4	99.67	99.53

2b. Hydrogen Assay, %
MDQAI 5560

PICK	.01	<.01	EST .006
CENTER	<.01	.02	EST .010
PLAIN	<.01	<.01	EST .001
AVG.	EST .004	EST .007	EST .006

2c. Nitrogen Assay, %
MDQAI 5560

PICK	.1	.2	.15
CENTER	.4	.1	.25
PLAIN	.5	.2	.35
AVG.	.33	.17	.25

3. Visual Inspection
QCi-102

See Charts 3A

4. Specific Gravity, Units
PTM-84

PICK	1.6075	1.6389	1.6232
CENTER	1.6065	1.6451	1.6258
PLAIN	1.6183	1.6441	1.6312
AVG.	1.611	1.643	1.627

HITCO MATERIALS DIVISION
700 E. DYER ROAD, SANTA ANA, CALIFORNIA 92707 • (714) 549-1101 • TWX (910) 595-1130 • FAX # (714) 549-2858-5-2437

WCA Fabric for NASA Lot# 4 (HITCO)

5. pH, Units
CTM-24B

	#4-1S	#4-1E	LOT4 AVG
	6.3	6.4	6.35
	6.3	6.4	6.35
AVG.	6.3	6.4	6.35

6. TGA, °C at 50% Weight Loss
CTM-51 (AIR)

SET UP# 1		SET UP# 2	
#4-1E	954	#4-1S	868

See Chart 6A-6B

7a. Atomic Absorption, ppm
CTM-53B

	#4-1S	#4-1E	LOT4 AVG
Na	10	9	9.5
K	0	0	0.0
Ca	6	5	5.5
Mg	3	2	2.5
Li	0	0	0.0
AVG.	19	16	17.5

7b. Moisture Content, %
CTM-53B

	.000	.015	.007

7c. Ash Content, %
CTM-53B

	.010	.010	.010

8a. Filament diameter, microns, WARP
S.E.M. (Diameters are an average of 10 measurements)

AVERAGE	10.46	10.12	10.29
Minimum	9.50	9.10	9.10
Maximum	12.00	11.00	12.00
Std. Dev	0.90	0.54	0.75

8b. Filament diameter, microns, FILL
S.E.M. (Diameters are an average of 10 measurements)

AVERAGE	9.21
Minimum	8.50
Maximum	10.35
Std. Dev	0.64

9a. Thread Count, per inch, WARP
PTM-5A

	#4-1S	#4-1E	LOT4 AVG
	29	29	29
	29	29	29
	29	29	29
	29	29	29
	29	29	29
AVG.	29.0	29.0	29.0

WCA Fabric for NASA Lot# 4 (HITCO)

9b. Thread Count, per inch, FILL
PTM-5A

	#4-1S	#4-1E	LOT4 AVG
	22	22	22
	22	22	22
	22	22	22
	22	22	22
	22	22	22
AVG.	22.0	22.0	22.0

10a. Areal Weight as received, gm/4x4
PTM-3A

LEFT	2.453	2.614	2.534
CENTER	2.408	2.585	2.497
RIGHT	2.463	2.608	2.536
AVG.	2.441	2.602	2.522

10b. Volatiles as received, %
PTM-3A

LEFT	.49	.50	.49
CENTER	.42	.46	.44
RIGHT	.45	.54	.49
AVG.	.45	.50	.47

10c. Weight change on Acetone wash, %
PTM-3A

LEFT	.00	-.08	-.04
CENTER	-.08	-.16	-.12
RIGHT	.08	.04	.06
AVG.	.00	-.06	-.03

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

CHART 3A

USP NO. ___

DATE 28 APR.86

FOOTAGE

START — Sample

BREAK

BREAK

BREAK

BREAK

BREAK

BREAK

PULL THREAD

BREAK

BREAK

END OF ROLL — sample

TREATER OPERATOR READ UP

FABRIC WCA GRAPHITE CLOTH

MFG. UNION CARBIDE

ROLL NO. 185 3C6 WCA-4

YARDS 143

POUNDS 83

ORDER NO. OE 71108

SPECIFICATION VARIOUS

Q.C. FILE # NASA 4-1

SYMBOLS

- TEAR
- SPOTS OR STAINS
- FOLDS
- EDGE CURL
- TIGHT WEAVE OR SELVAGE
- WEAVE DISTORTION
- VISIBLE PUCKERS
- ONE PUCKER CREASING
- TWO OR MORE CREASINGS

REMARKS

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GRADE Group B

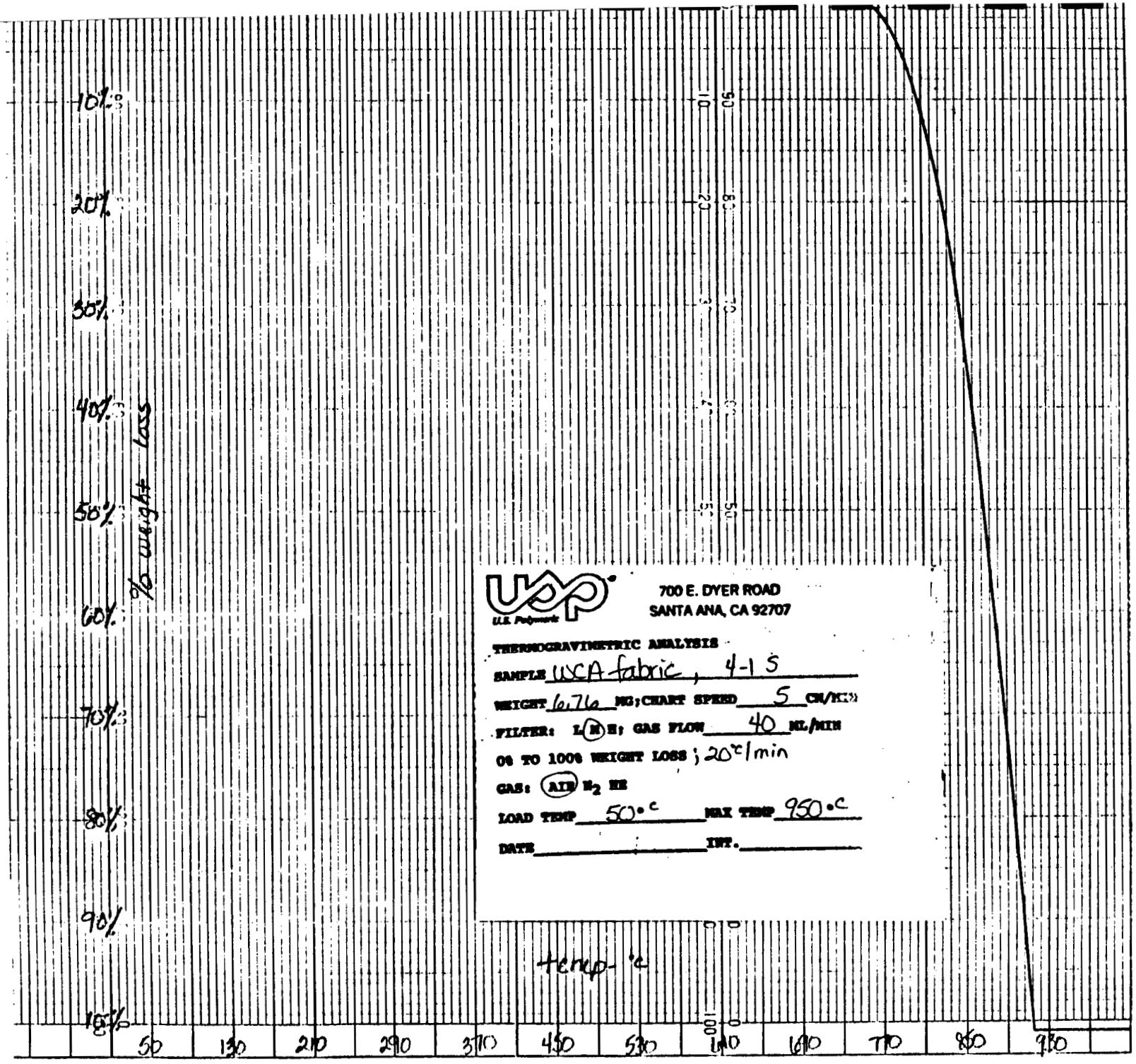

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CHART 0A

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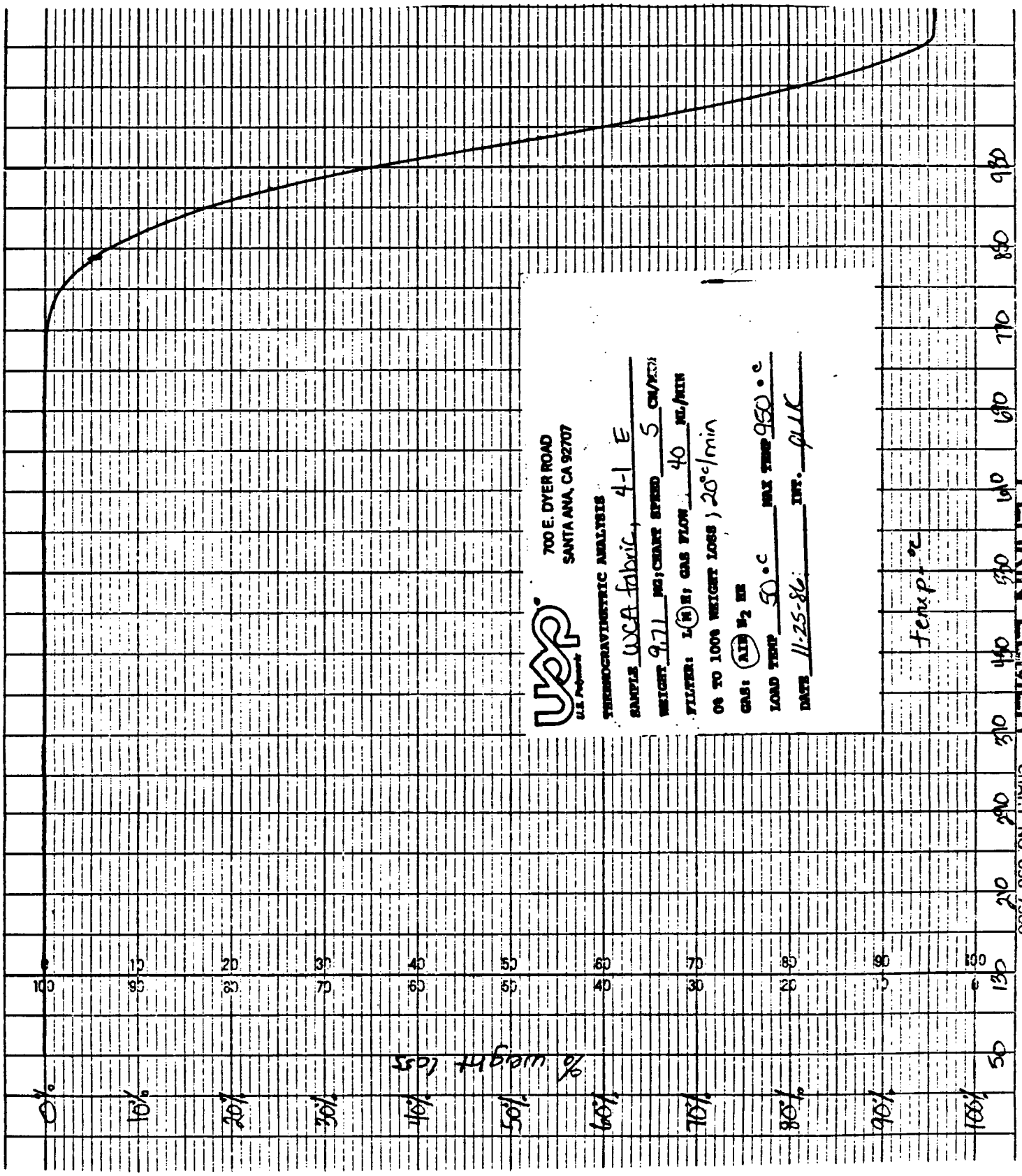

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NAS8-36298

U.S. Polymeric O.E. 71108

FM 5064J NASA LOT# 4 U.S.P. LOT# D09315 (HITCO)

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1b.	Filler Content, Soxhlet	1
1c.	Cloth Content, Soxhlet	1
2.	Volatile Content	1
3.	Flow	1
4.	Resin Content, Dry Basis	1
5.	Tack	1
6.	Gel Time	1
7a.	Atomic Absorption	2
7b.	Moisture Content	2
7c.	Ash Content	2
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11.	Environmental History	2
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CTE ..... 21A - 21B

U.S. Polymeric

PREPREG TESTING

NAS8-36298

U.S. POLYMERIC O.E.71108

FM 5064J NASA LOT# 4 U.S.P. LOT# D09315 (HITCO)

		ROLL#1-S	ROLL#1-E
1a. Resin Content, Soxhlet, % CTM-6D		33.5	33.2
		33.1	32.9
		33.9	33.7
	AVG.	33.5	33.3
	NASA LOT# 4 AVERAGE		33.4
1b. Filler Content, Soxhlet, % CTM-6D		14.2	14.1
		14.1	14.0
		14.4	14.3
	AVG.	14.2	14.1
	NASA LOT# 4 AVERAGE		14.2
1c. Cloth Content, Soxhlet, % CTM-6D		52.3	52.7
		52.8	53.1
		51.7	52.0
	AVG.	52.3	52.6
	NASA LOT# 4 AVERAGE		52.4
2. Volatile Content, % PTM-17B		3.1	3.0
		3.1	3.1
		3.1	3.4
	AVG.	3.1	3.2
	NASA LOT# 4 AVERAGE		3.1
3. Flow, % PTM-19G		8.0	12.5
		9.5	10.5
		9.8	13.5
	AVG.	9.1	12.2
	NASA LOT# 4 AVERAGE		10.6
4. Resin Content, Dry basis, % PTM-16F, Type II		33.7	35.1
		32.8	35.4
		33.5	34.5
	AVG.	33.3	35.0
	NASA LOT# 4 AVERAGE		34.2
5. Tack, lbs PTM-80		30	30
	NASA LOT# 4 AVERAGE		30
6. Gel Time, seconds PTM-20E		69	75
	NASA LOT# 4 AVERAGE		72

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FM 5064J NASA LOT# 4 U.S.P. LOT# D09315 (HITCO)

7a. Atomic Absorption, ppm
CTM-53B

	ROLL#1-S	ROLL#1-E	LOT#4 AVG.
Na	24	26	25
K	1	2	2
Ca	10	10	10
Mg	2	2	2
Li	0	0	0
TOTAL	37	40	39

7b. Moisture Content, %
CTM-53B

	ROLL#1-S	ROLL#1-E
	2.25	2.31
NASA LOT# 4 AVERAGE		2.28

7c. Ash Content, %
CTM-53B

	.03	.09
NASA LOT# 4 AVERAGE		.06

8. TGA, % Weight Loss at 500°C
CTM-51 (Nitrogen)

	10.5	10.9
NASA LOT# 4 AVERAGE		10.7

See Chart 8A-8B

9. DSC, °C
CTM-50A

	ROLL#1-S	ROLL#1-E	LOT#4 AVG.
First Temp	184	185	185

See Chart 9A-9B

10. Infrared (IRZB) Baseline
CTM-21C

	.82	.77	.80

See Chart 10A-10B

11. Environmental History

Date manufactured: 30 June 1986
Packaged in: MIL-B-131 Class I bag supported in cardboard carton
Date shipped: 14 July 1986 in 40°F truck

12. Specific Gravity, Cured, Units
ASTM D792

	ROLL#1-S	ROLL#1-E
	1.427	1.425
	1.429	1.424
	1.429	1.424
AVG.	1.428	1.424
NASA LOT# 4 AVERAGE		1.426

13a. Tensile Strength, ksi, WARP
FTMS 406-1011

	20.91	21.88
	19.92	20.16
	19.70	19.41
	21.10	21.33
	20.39	20.32
AVG.	20.40	20.62
NASA LOT# 4 AVERAGE		20.51

FM 5064J NASA LOT# 4 U.S.P. LOT# D09315 (HITCO)

		ROLL#1-S	ROLL#1-E
13b. Tensile Modulus, msi, WARP FTMS 406-1011		2.06	2.04
		2.21	2.06
		2.22	1.77
		2.13	2.03
		1.84	1.96
	AVG.	2.09	1.97
	NASA LOT# 4 AVERAGE		2.03
13c. Tensile Elongation, %, WARP FTMS 406-1011		1.43	1.22
		1.18	1.32
		1.17	1.29
		1.38	1.38
		1.28	1.27
	AVG.	1.29	1.30
	NASA LOT# 4 AVERAGE		1.29
14a. Flexural Strength, ksi, WARP FTMS 406-1031		25.82	29.08
		27.79	30.76
		27.59	30.52
		28.13	30.88
		26.88	28.48
	AVG.	27.24	29.94
	NASA LOT# 4 AVERAGE		28.59
14b. Flexural Modulus, msi, WARP FTMS 406-1031		1.97	2.21
		2.11	2.36
		1.92	2.18
		1.95	2.23
		2.03	2.30
	AVG.	2.00	2.26
	NASA LOT# 4 AVERAGE		2.13
15a. Compressive Strength, ksi, WARP FTMS 406-1021		14.71	19.84
		16.26	19.64
		13.02	20.45
		15.87	19.62
		15.31	19.59
	AVG.	15.03	19.83
	NASA LOT# 4 AVERAGE		17.43
15b. Compressive Modulus, msi, WARP FTMS 406-1021		2.07	2.00
		2.02	2.02
		2.07	2.06
		2.09	2.04
		2.03	2.06
	AVG.	2.06	2.04
	NASA LOT# 4 AVERAGE		2.05

FM 5064J NASA LOT# 4 U.S.P. LOT# D09315 (HITCO)

		ROLL#1-S	ROLL#1-E
16. Double Shear Strength, ksi FTMS 406-1041A		2.37	2.57
		2.49	2.77
		2.58	2.84
		2.47	2.68
		2.55	2.63
	AVG.	2.49	2.70
	NASA LOT# 4 AVERAGE		2.59
17. Barcol Hardness, Units ASTM D-2583 (Average of 10 determinations)		57.2	62.0
	NASA LOT# 4 AVERAGE		59.6
18. Residual Volatiles, % PTM-98		1.44	1.39
		1.48	1.44
		1.52	1.49
	AVG.	1.48	1.44
	NASA LOT# 4 AVERAGE		1.46
19. Resin Content, Pyrolysis, % CTM-14B		32.26	32.41
		32.37	32.05
		33.11	32.09
	AVG.	32.58	32.18
	NASA LOT# 4 AVERAGE		32.38
20. Acetone Extraction, % CTM-18A		4.19	5.27
		5.29	5.80
		4.79	6.10
	AVG.	4.75	5.72
	NASA LOT# 4 AVERAGE		5.24
21a. CTE, in/in °F with PLY PTM-61B		1.54	3.29
		3.80	2.69
	AVG.	2.67	2.99
	NASA LOT# 4 AVERAGE		2.83
21b. CTE, in/in °F Cross PLY PTM-61B		3.20	3.01
		1.84	3.10
	AVG.	2.52	3.06
	NASA LOT# 4 AVERAGE		2.79

See Chart 21A-21B

U.S. Polymeric

Hamid M. Quraishi, Manager
Quality Assurance Department

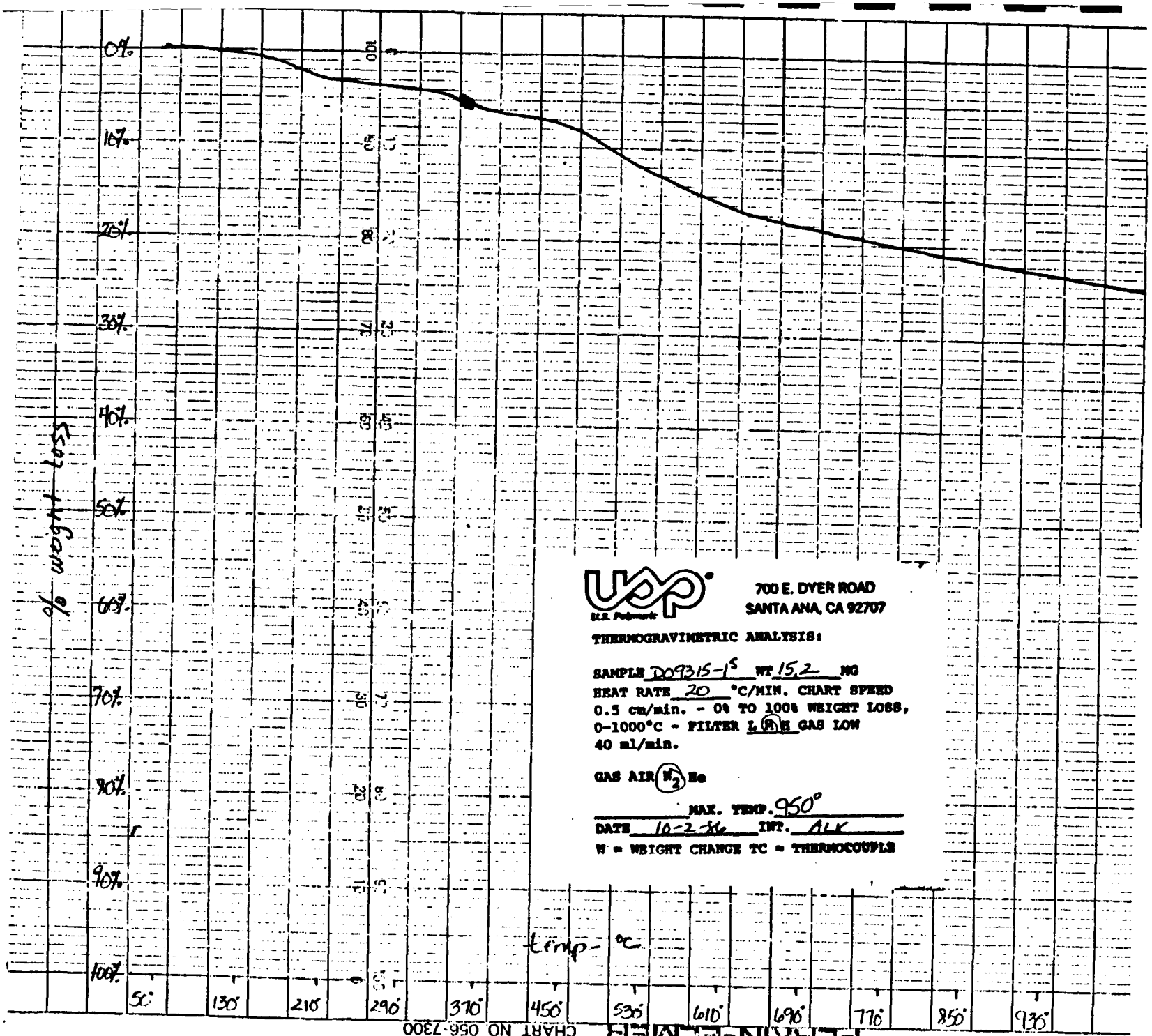

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CHART 8A

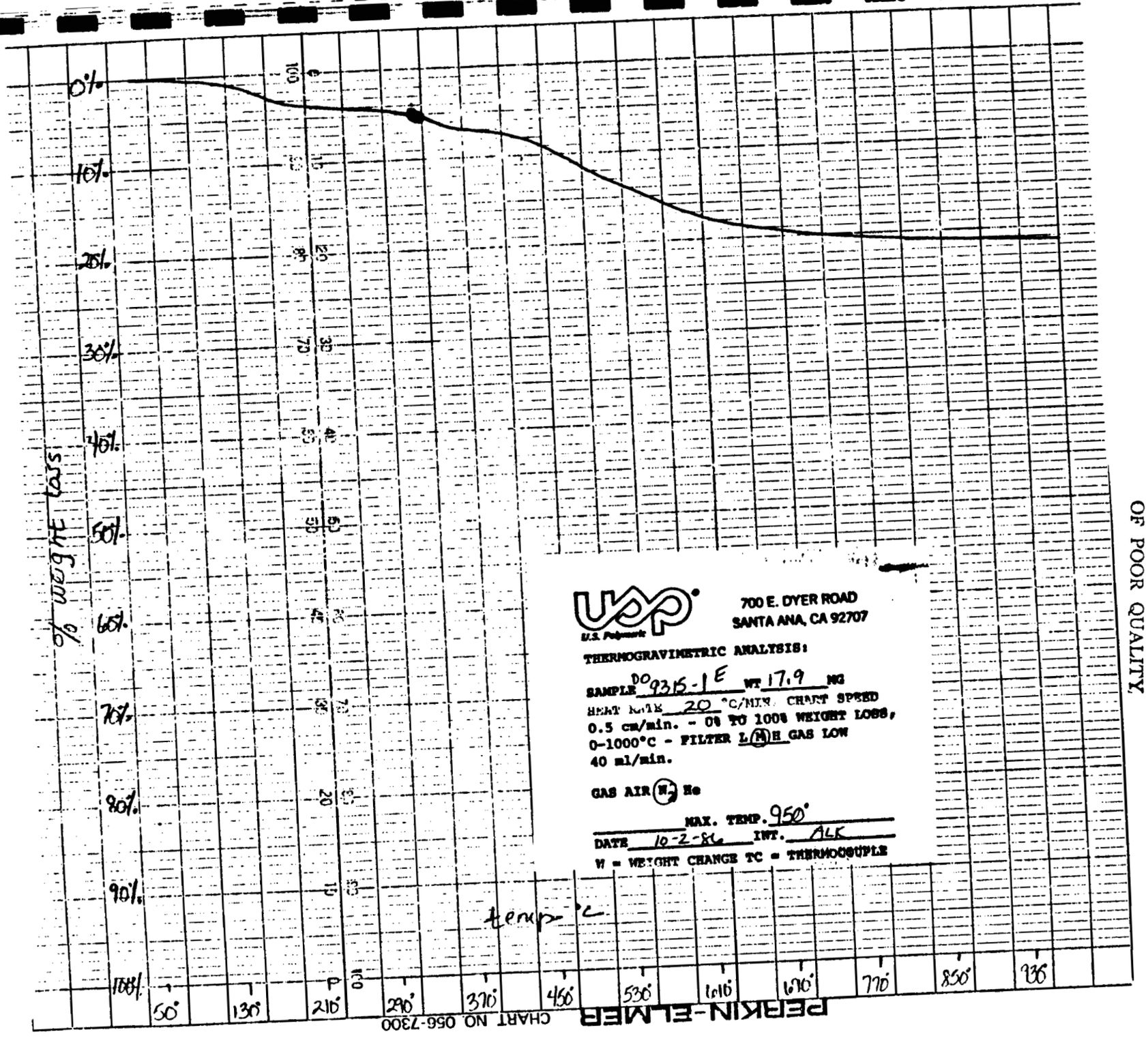

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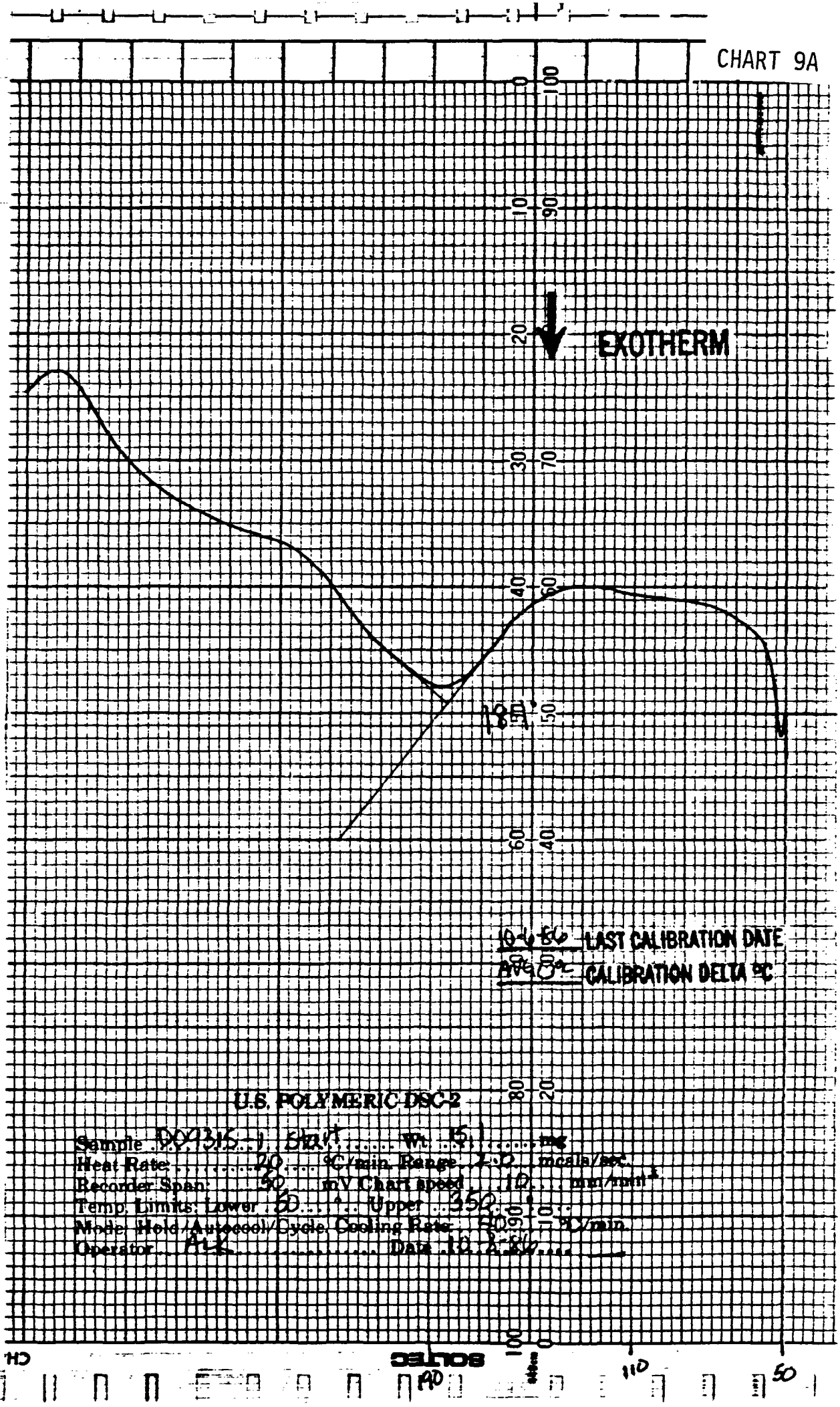
CHART 8B

CHART 9A



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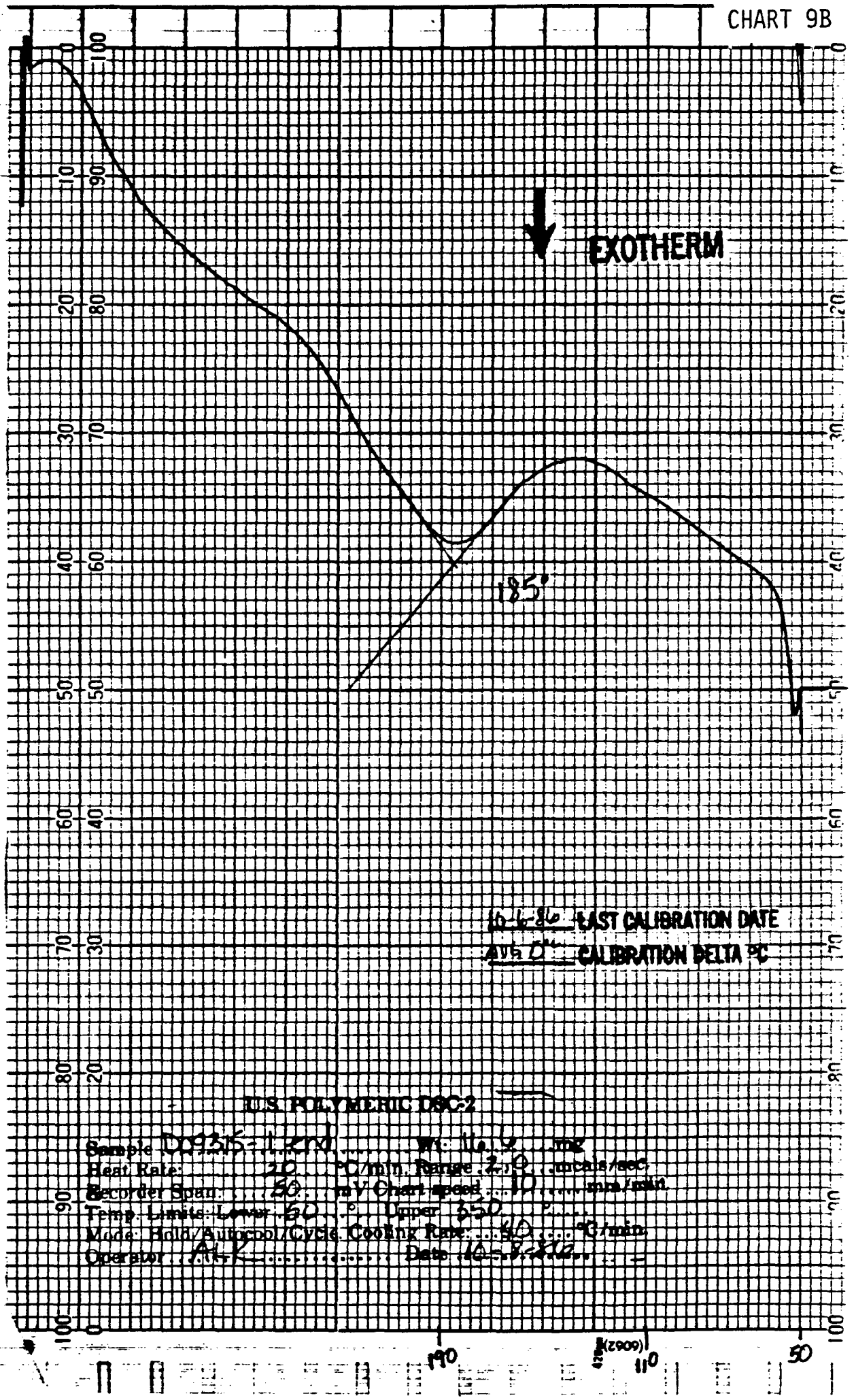

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SPECTRUM NO. 15195
DATE 7-07-86
SAMPLE FM 5064 J
D09315 # 6T-1

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 30-50%T
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST V. MIRANDA

Beckman®
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CHART 10A

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SPECTRUM NO. 15196
DATE 7-07-86
SAMPLE FM 5064 J
D09315 # E-1

SOURCE
STRUCTURE

PATH 0.2 mm NACL
SOLVENT ACETONE
CONCENTRATION 30-50%T
PHASE 3
COMMENTS PRE-PREG
MATERIAL

ANALYST V. MIRANDA

Beckman®
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SPECTROPHOTOMETER

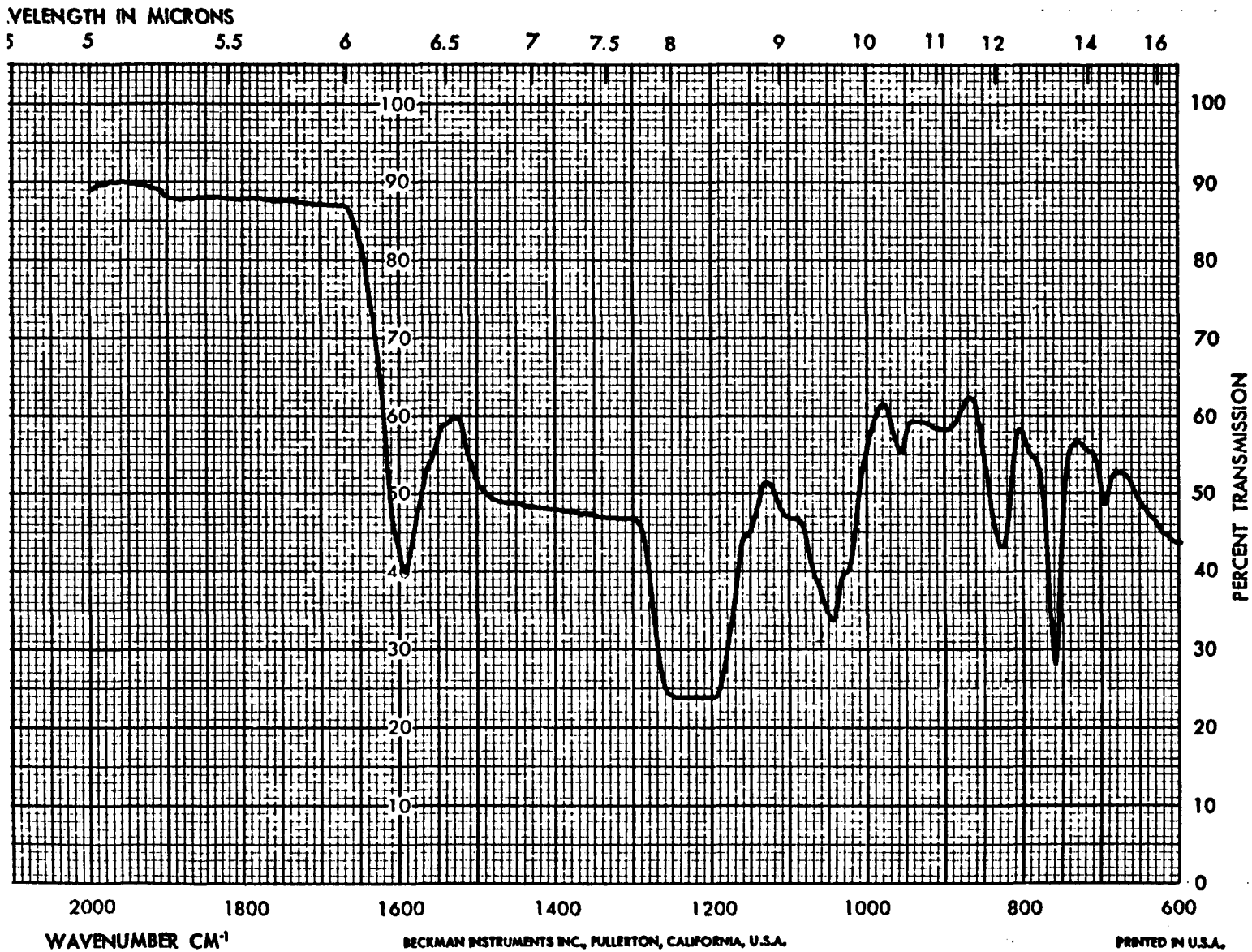

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CHART 10B

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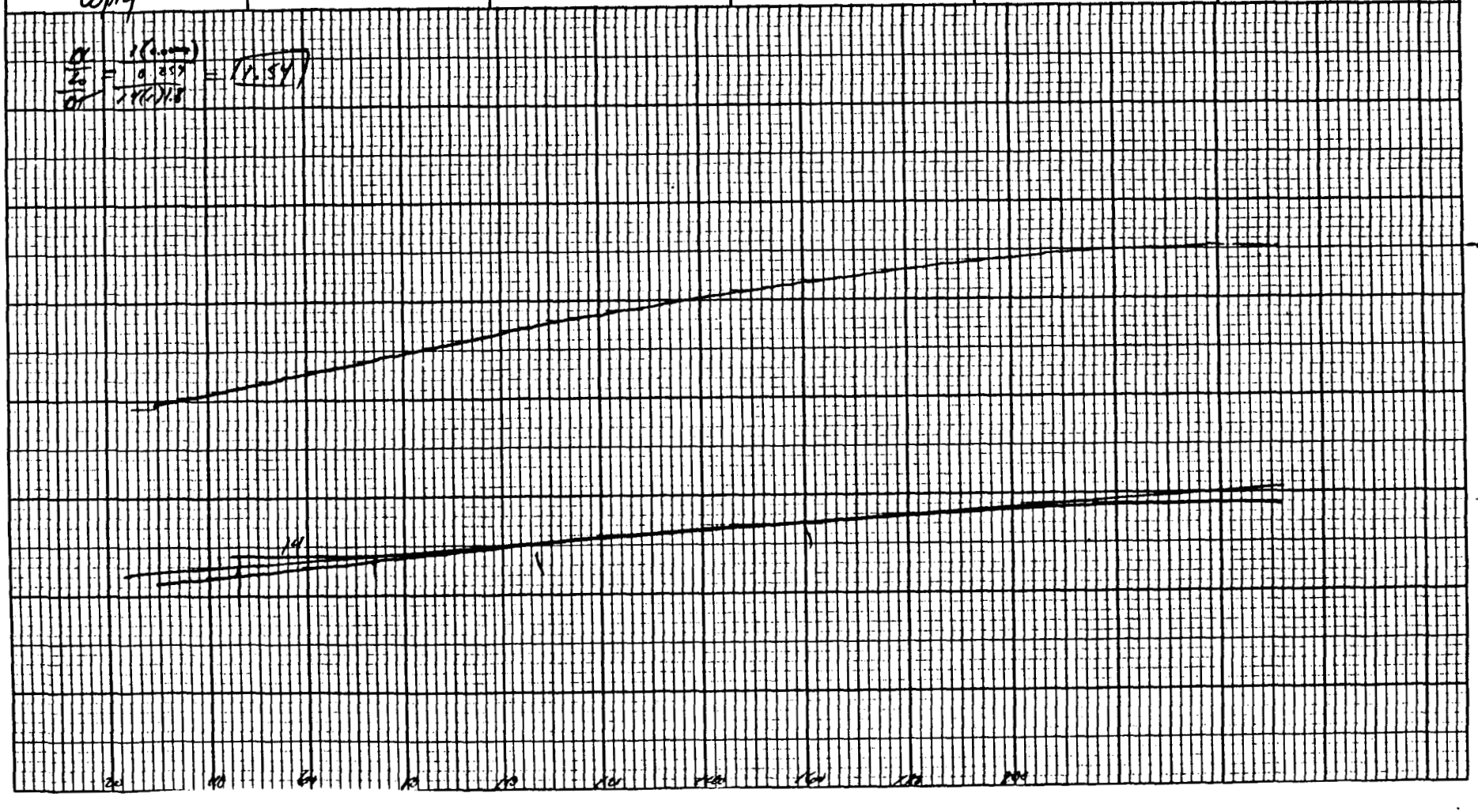
PART NO. 990088

RUN NO. ___ DATE 12/3/R	T-AXIS	DTA-DSC	TGA	TMA (μm/in F)	
OPERATOR DH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
DOS315-1-STAR-(1)	HEAT ___ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.257	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-CFH			dY, (mg/min) /in	dY, (10X), (mils/min)/in	
wply					

$\frac{\alpha}{\alpha_0} = \frac{1(0.257)}{0.257} = 1.54$



DUPONT Instruments

MEASURED VARIABLE

Chart 21A1

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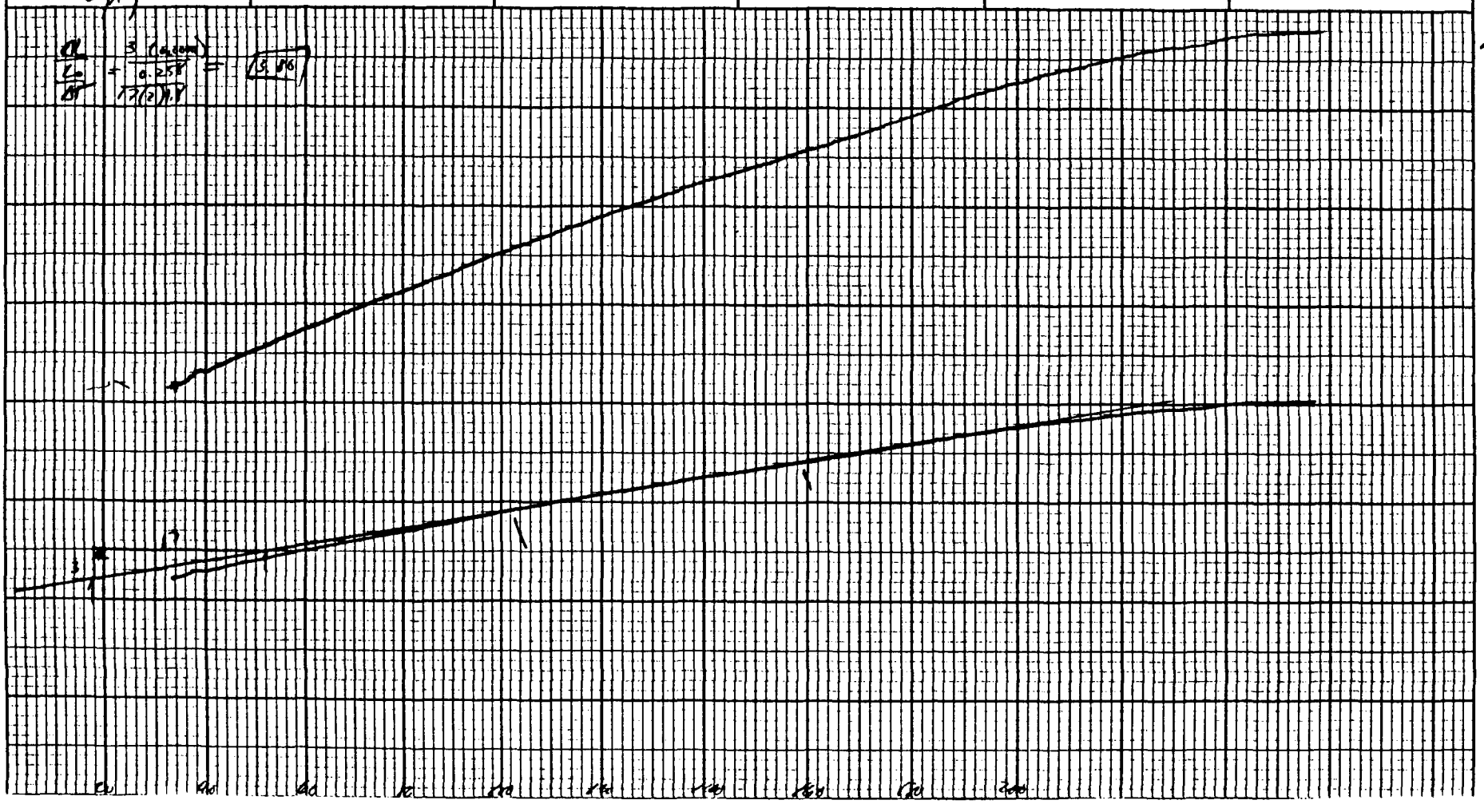
PART NO. 990088

RUN NO. ___ DATE 12/5/86	T-AXIS	DTA-DSC	TGA	TMA (min/in F)	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
DOS 315-1-Sinter-(2)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.258	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 18	
FLOW RATE 3-5 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

wply

$\frac{\Delta L}{L_0} = \frac{3\ (0.0001)}{0.258\ (12)(2.54)} = \boxed{3.86}$



MEASURED VARIABLE

DUPONT Instruments

Chart 21A2

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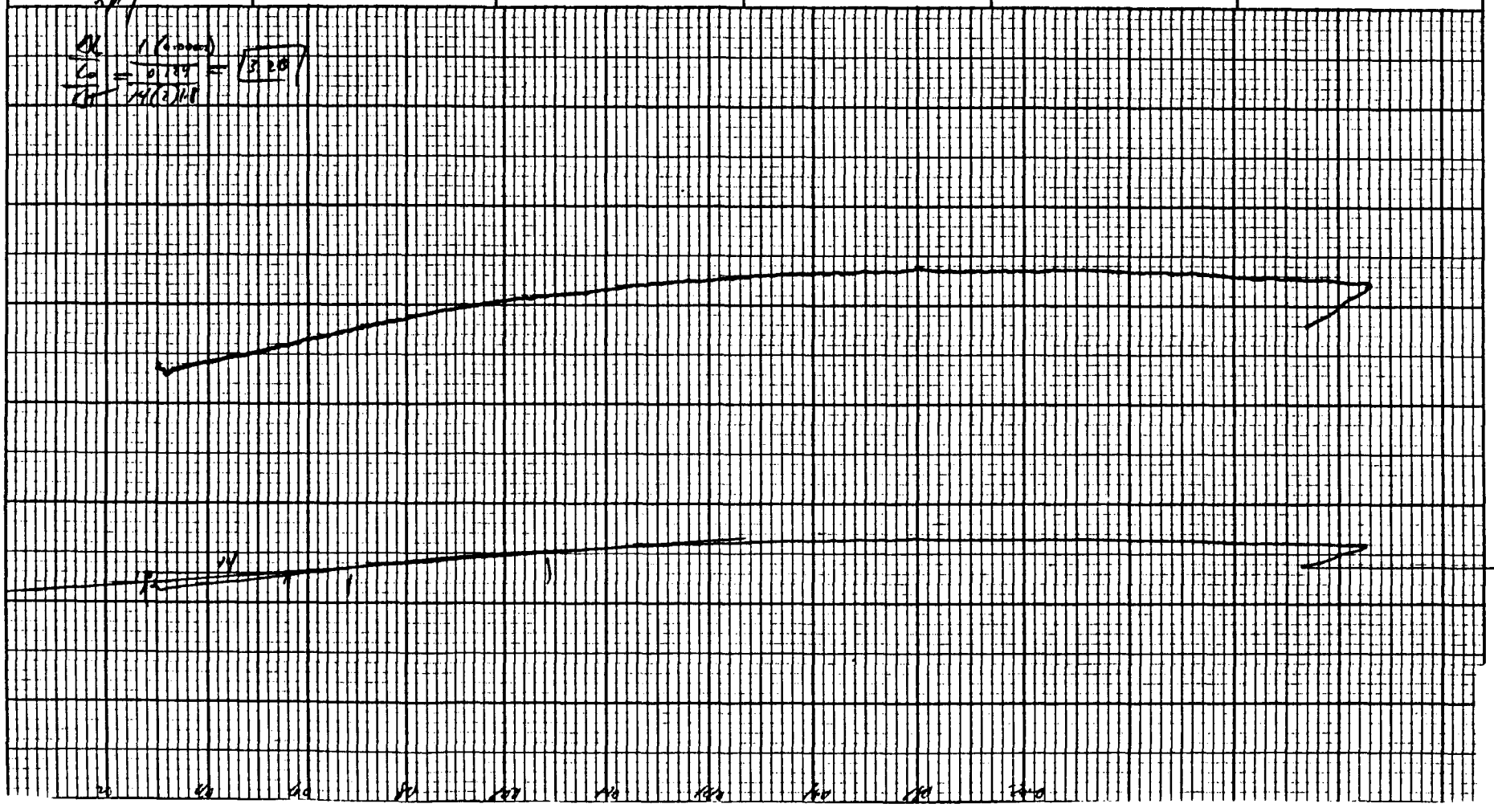
PART NO. 990088

RUN NO. ___ DATE 12/1/86	T-AXIS	DTA-DSC	TGA	TMA (μm/in)	
OPERATOR PH	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 5	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
D07 315-1-start-(3)	HEAT ___ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.124	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 6	
FLOW RATE 3-5 scfh			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

XPY

$\frac{\Delta L}{L_0} = \frac{1\,(0.0001)}{0.124} = 3.28$



MEASURED VARIABLE

DUPONT Instruments

CHART 1.000

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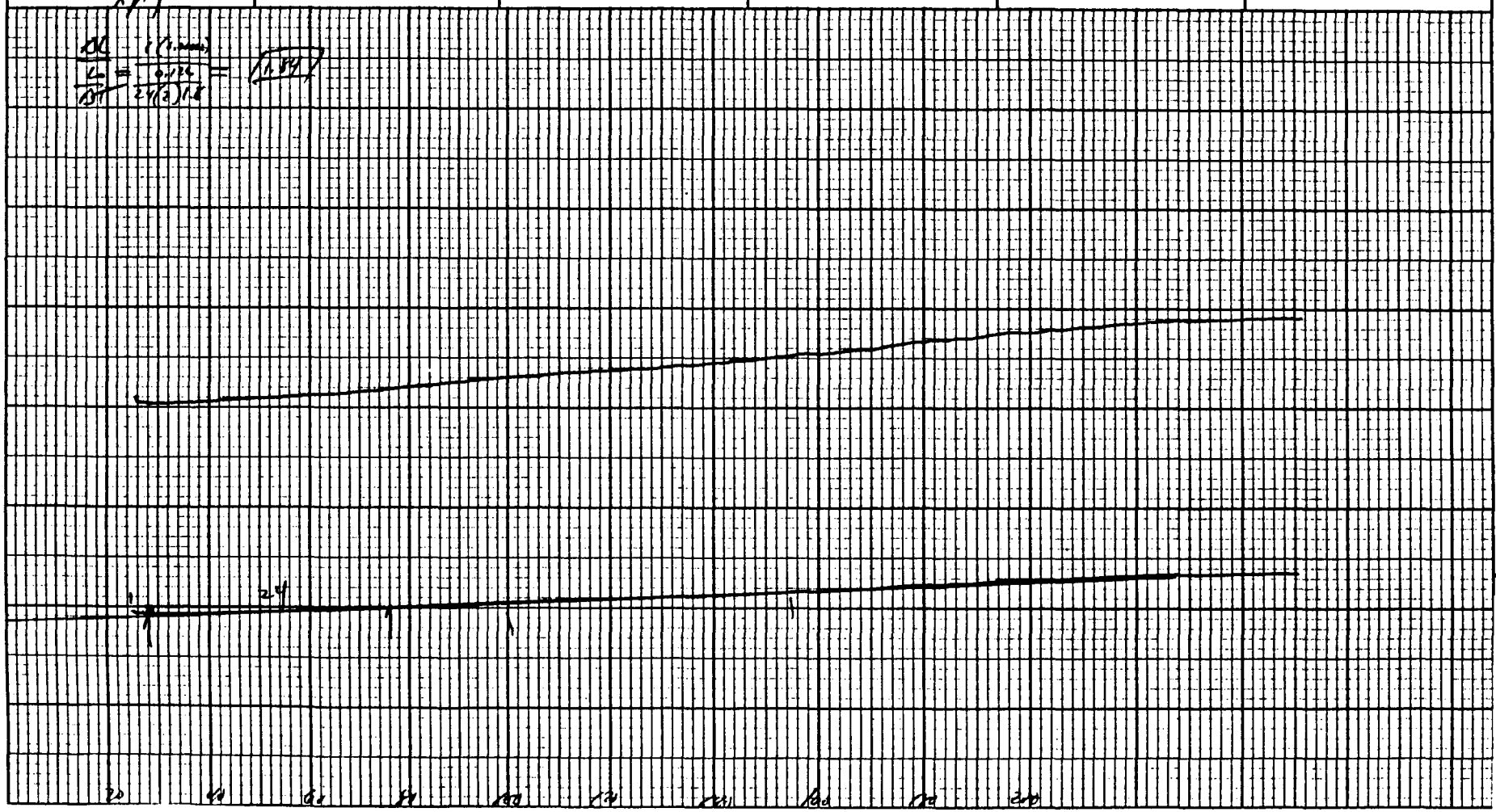
PART NO. 990088

RUN NO ___ DATE 12/2/86	T-AXIS	DTA-DSC	TGA	TMA (mm/min)	
OPERATOR D	SCALE, °C/in ~~50~~ 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1 6.2	
SAMPLE:	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
D0 9315 - 1 - 37 mm - (4)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.126	
ATM Ar @ 30P	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3.5 SCFH			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

Xy/y

$\frac{\Delta L}{L_0} = \frac{\Delta L (\text{mm})}{0.126} = \boxed{1.84}$



DUPONT Instruments

MEASURED VARIABLE

Chart 21A4

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PART NO. 990088

RUN NO. ___ DATE 12/3/90	T-AXIS	DTA-DSC	TGA	TMA (cm/min)	
OPERATOR TD	SCALE °C/in ~~30~~ 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/1.2	
SAMPLE: D0931S-1-FMD-1(1)	PROG. RATE °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ___ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.260	
FLOW RATE 75 SCCM	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
wpl7			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

$$\frac{\frac{dL}{L_0}}{dT} = \frac{2(0.00002)}{\frac{0.260}{13(2)1.8}} = 1.25$$

MEASURED VARIABLE

DUPONT Instruments

Chart 21B1

ORIGINAL PAGE IS
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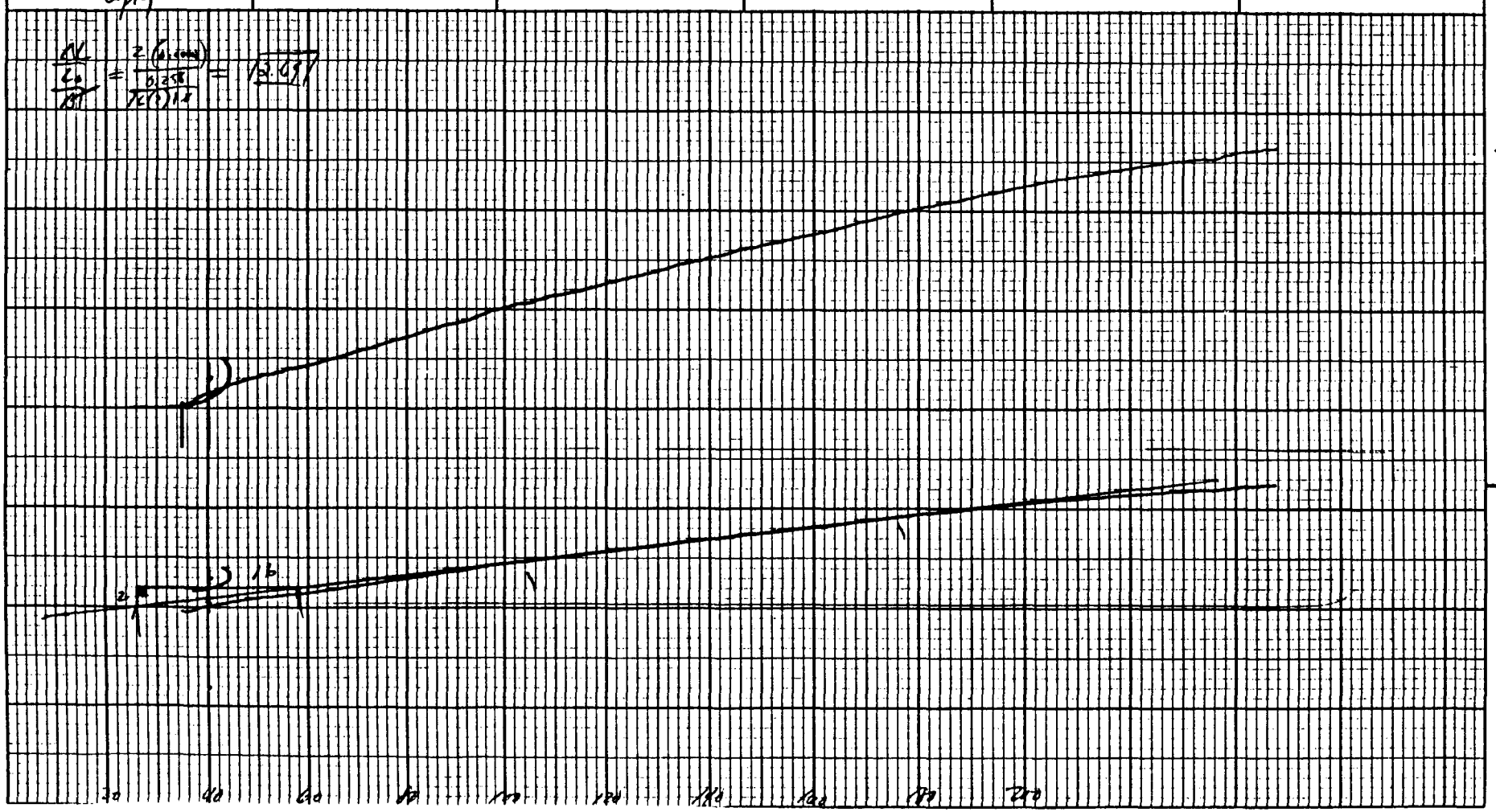
PART NO. 990088

RUN NO. ___ DATE 12/3/86	T-AXIS	DTA-DSC	TGA	TMA (μin/ink)	
OPERATOR TN	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: D09315-1-END-(2)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.258	
FLOW RATE 3.5 SCFH	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
Cuply			dY, (mg/min) /in	dY, (10X), (mils/min)/in	

$$\frac{\Delta L}{L_0} = \frac{2\,(0.004)}{0.258} = 13.95\%$$



MEASURED VARIABLE _____

DUPONT Instruments

Chart 21B2

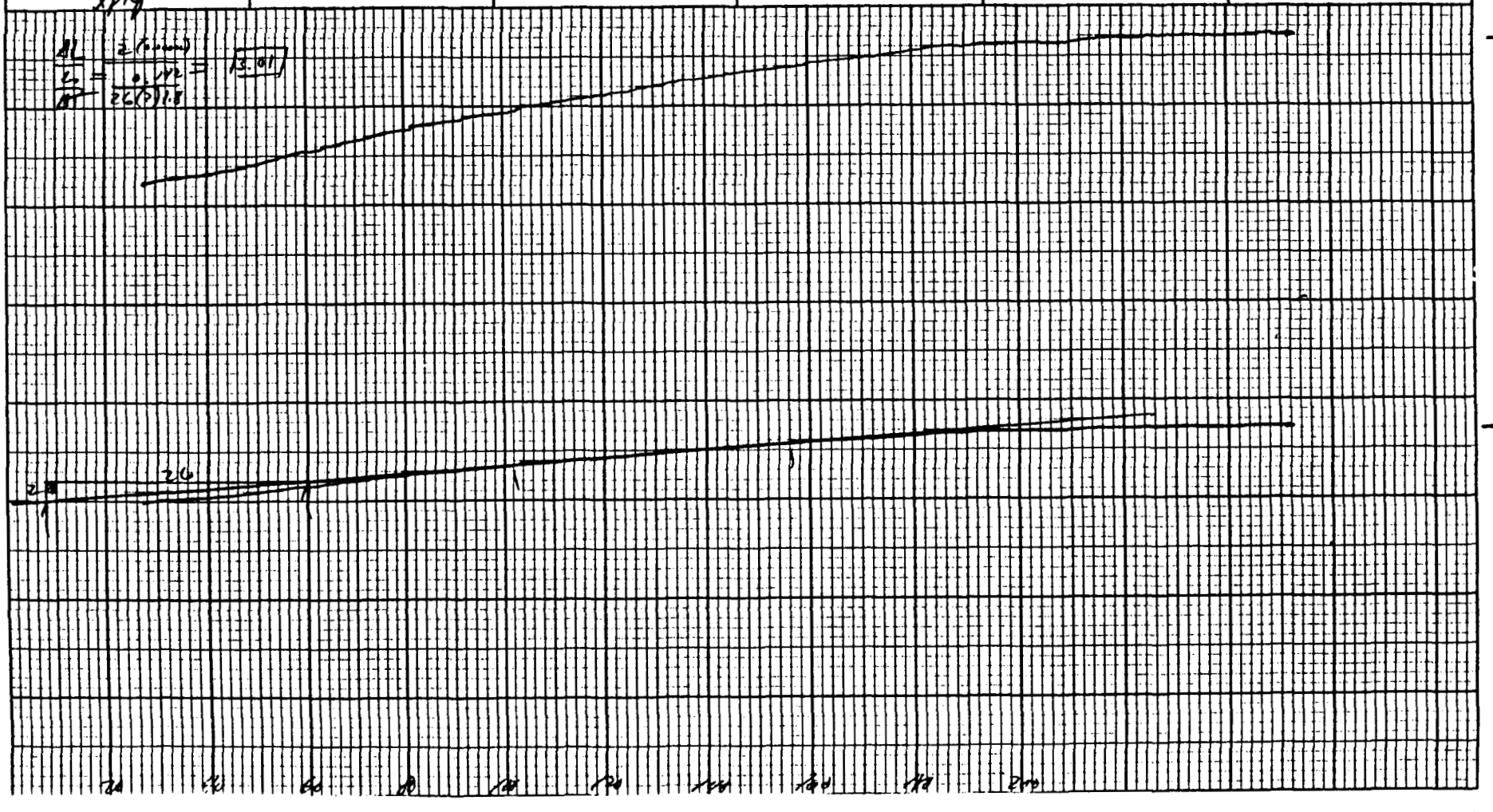
ORIGINAL PAGE IS
OF POOR QUALITY

PART NO. 990088

RUN NO. ___ DATE 12/2/86	T-AXIS	DTA-DSC	TGA	TMA (mil/inch)	
OPERATOR TH	SCALE, °C/in 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE:	PROG. RATE, °C/min 5	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
DOS315-1-Fill-(3)	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.142	
ATM Air @ STP	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
FLOW RATE 3-5SCFH			dY, (mg/min)/in	dY, (10X), (mils/min)/in	

XPly

$\frac{\Delta L}{L_0} = \frac{2\ (\text{mils})}{26(5)(1.8)} = 0.142 = \boxed{15.01}$



MEASURED VARIABLE

DUPONT Instruments

Chart 21B3

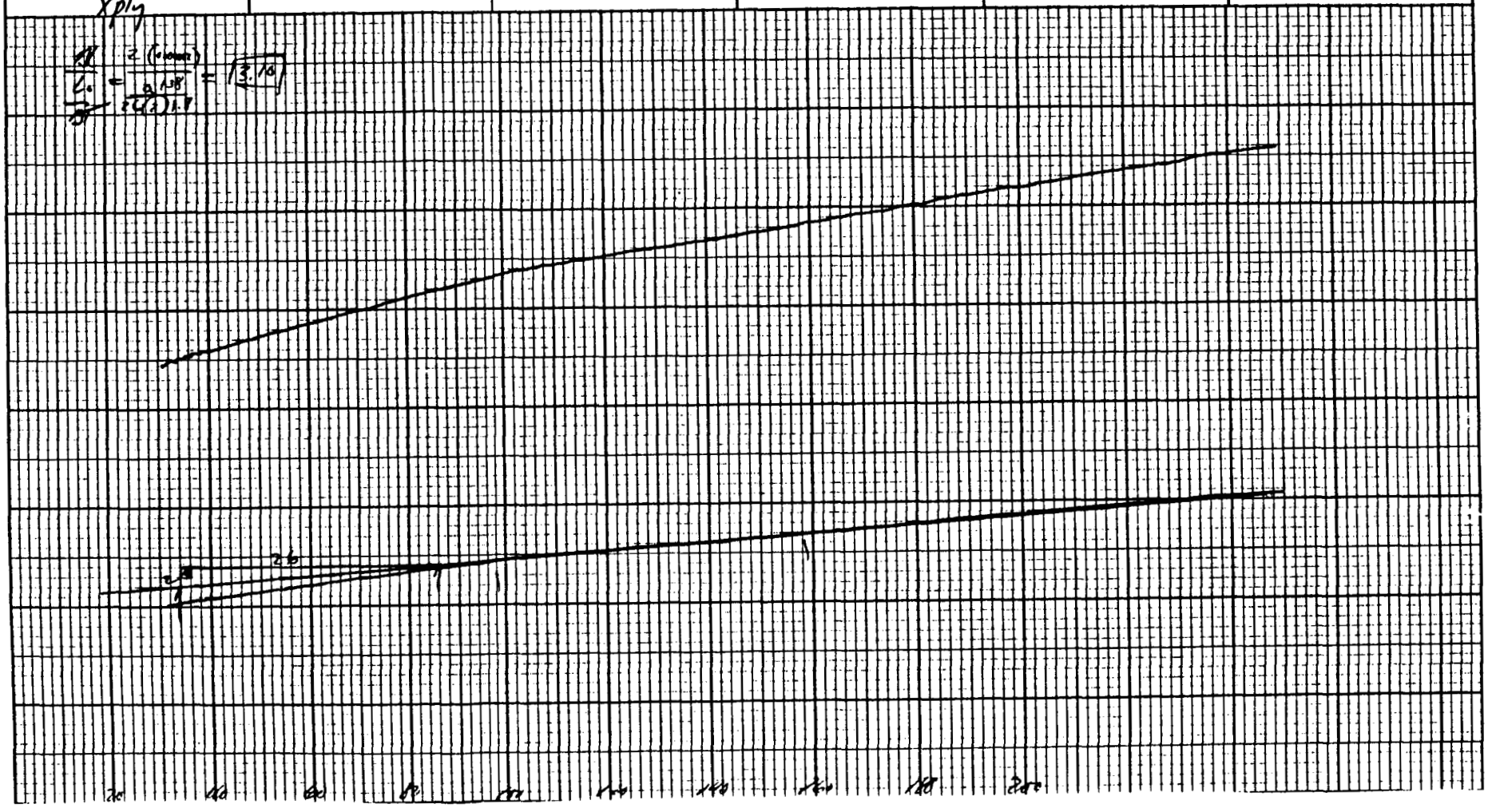
ORIGINAL PAGE IS
OF POOR QUALITY

PART NO. 990088

RUN NO. ___ DATE 12/2/84	T-AXIS	DTA-DSC	TGA	TMA (μin/min)	
OPERATOR [illegible]	SCALE, °C/in 50 20	SCALE, °C/in	SCALE, mg/in	SCALE, mils/in 0.1/0.2	
SAMPLE: D05315-1-FID-(4)	PROG. RATE, °C/min 10	(mcal/sec)/in	SUPPRESSION, mg	MODE Expansion	
ATM Air @ STP	HEAT ✓ COOL ___ ISO ___	WEIGHT, mg	WEIGHT, mg	SAMPLE SIZE 0.138	
FLOW RATE 35 SCCM	SHIFT, in 0	REFERENCE	TIME CONST., sec	LOAD, g 10	
			dY, (mg/min) /in	dY, (10X), (mils/min) /in	

Xply

$\frac{\Delta P}{L_0} = \frac{2\,(\text{volume})}{\text{sample}} = \boxed{3.10}$



DUPONT Instruments

MEASURED VARIABLE _____

Chart 21B4