

**UNION
CARBIDE***ms RFD*
INTERNAL CORRESPONDENCE**CHEMICALS DIVISION**

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To (Name) Mr. J. F. Erdmann
Company
Location Texas City Plant

Date April 10, 1967
Originating Dept. Research and Development

Answering letter date

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Mr. R. G. Baier, 512
Dr. F. E. Bailey, 511
Mr. J. F. Burgess, 512
Dr. R. H. Harding, 511
Mr. L. P. McCartney, 511
Mr. D. E. Richardson, 515
Mr. R. H. Rehm, NYO-31
Mr. J. K. Rose, 511
~~Mr. R. N. Wheeler, 514~~

Subject CELLOSIZ Hydroxyethyl
Cellulose WP-300: Texas City
Plant

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R. N. Wheeler

Dear Jack:

Attached are the data you requested on blends of CELLOSIZ hydroxyethyl cellulose WP-300 used as suspending agents in Process Seven resin production.

Table I gives volatiles, insolubles, ash, and glyoxal contents. Included also are viscosity data determined with the Hoesppler (single-point) and Haake (multi-point) viscometers. Flow curves for the 6 blends, plotted from the Haake data, are shown in Figures 1 through 6.

The test procedure, using the Haake, measures solution viscosity at shear rate intervals over the range of 1.59 to 259 reciprocal seconds (10 readings) and back to 1.59 reciprocal seconds (9 readings). For CELLOSIZ HEC WP-300, four per cent solutions are used, which concentration will help to magnify any differences in flow properties between samples.

CELLOSIZ HEC solutions are pseudoplastic. Even the low molecular weight grades (WP-09) will exhibit some pseudoplasticity if the solution concentration is high enough. The apparent viscosity of such solutions decreases as the shear rate increases. Some thixotropy may also be evidenced, and in this case, once sheared, a time interval is required for structure to re-build and for the original viscosity to be re-gained.

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In addition to molecular weight grade and solution concentration, the molecular weight distribution can also affect the flow properties (pseudoplasticity and thixotropy) of CELLOSIZ EEC solutions. Hence, the possibility that flow property measurements will give some idea of the molecular weight distribution of the WP-300's, which distribution could have some effect on the properties of the resins made with them.

The method of reporting the Haake viscosity data in terms of A, B, and C values is described in Appendix A, and in Figure 1.

I hope the flow-property data will be of some help in correlating results in your process. I believe the actual blend compositions may be more meaningful, and these are given in Table II. Conceivably, some minor constituent of a blend might not significantly affect solution flow properties, but might have some effect on resin particle size, or other process variables.

Very truly yours,

W. W. McGaughy
W. W. McGaughy

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Attachments
2 Tables
6 Figures

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APPENDIX A

Definition of A, B, and C Values as Determined with the Haake Rotovisco Viscometer

The entire series of values determined in the Haake test is simplified by reporting three values (A, B, and C) as follows:

- A = Thixotropy-free viscosity, taken at 1.59 reciprocal seconds. This is the 19th (last) viscosity reading. Presumably, thixotropic structure has been predominately eliminated by the previous shear history.
- B = Pseudoplasticity Index. The 19th reading (low-shear viscosity) is divided by the 10th reading (high-shear viscosity) to provide a measure of the extent to which apparent viscosity drops with increasing shear.
- C = Thixotropy, per cent. The difference between the first and last readings (both taken at 1.59 reciprocal seconds) expressed as a per cent of the last reading. This number gives an indication of the extent to which structure is present in solutions.

Pseudoplasticity and thixotropy usually increase as the molecular weight and molecular weight distribution of CELLOSIZES HEC increases. There are other variables (such as molar substitution level) which can affect pseudoplasticity and/or thixotropy.

TABLE I
"CELLOSIZES" HYDROXYETHYL CELLULOSE WP-300
BLENDS USED AT TEXAS CITY PLANT

Blend No.	W-5039HH	W-1037H	W-1039H	W-1043H	W-1055H	W-1065H
Volatiles, % (when packaged)	4.7	4.7	4.7	4.9	4.4	5.1
Hoeppler Viscosity, cps (20°C, 2%, Dry Basis)	310	382	378	337	391	371
Insolubles, %	0.01	0.10	0.03	0.03	0.04	0.05
(1) Ash %, As Sod. Carbonate	2.7	2.75	2.7	2.3	2.1	2.8
As Sod. Acetate	4.17	4.26	4.17	3.57	3.26	4.34
Glyoxal, %	0.31	0.09	0.14	0.13	0.12	0.24
<u>Haake Viscosity Data</u> <u>(25°C, 4% Solutions)</u>						
A. Thixotropy-Free Viscosity at 1.59 seconds ⁻¹ , cps	6940	6767	6732	5742	7018	7337
B. Pseudoplasticity Index	5.6	4.1	4.1	3.6	4.0	5.3
C. Thixotropy, %	4.5	0	0.52	1.1	1.4	1.3

(1) Ash is reported as sodium carbonate, is actually present as sodium acetate.

TABLE II
 "CELLOSIZ" HYDROXYETHYL CELLULOSE WP-300
 BLEND COMPOSITIONS

Blend	Lots	Grade	Cps (1) 2%	Amt., %	Haake Date		
					A	B	C%
W-5039HH (310 cps)	W-1023H	-	955	50	6940	5.6	4.5
	W-1002E	WP-40	105	18			
	W-5000EE	WP-40	113	32			
W-1037H (382 cps)	W-1012J	QP-300	731	4.3	6767	4.1	0
	W-1032H	WP-300	173	10.7			
	W-1034H	WP-300	248	36.3			
	W-1038H	WP-300	514	48.7			
W-1039H (378 cps)	Same as W-1037H				6732	4.1	0.52
W-1043H (337 cps)	W-1012J	QP-300	731	3.6	5742	3.64	1.1
	W-1032H	WP-300	173	8.9			
	W-1036H	WP-300	306	49.4			
	W-1040H	WP-300	523	25.4			
	W-1042H	WP-300	349	12.7			
W-1055H (391 cps)	W-1052H	WP-300	289	42.8	7018	4.0	1.36
	W-1046H	WP-300	404	44.2			
	W-1048H	WP-300	571	13.0			
W-1065H (371 cps)	W-1024H	WP-300	238	47.6	7337	5.25	1.30
	W-1034H	WP-300	248	6.6			
	W-1036H	WP-300	306	12.7			
	W-1040H	WP-300	523	6.6			
	W-1081L	QP-4400	4400	1.2			
	W-1082L	QP-4400	4800	1.1			
	W-1008K	WP-4400	5983	2.8			
	W-1012K	WP-4400	6894	2.4			
	(3)RRP	mostly WP&QP-300		19.0			

- (1) All viscosities determined on a dry sample basis.
 (2) Composition of blend W-5000EE (used in Blend W-5039HH) now unknown.
 (3) Returned product, but met specifications.

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CELLULOSE HYDROLYTHIC CELLULOSE M.P. - 300

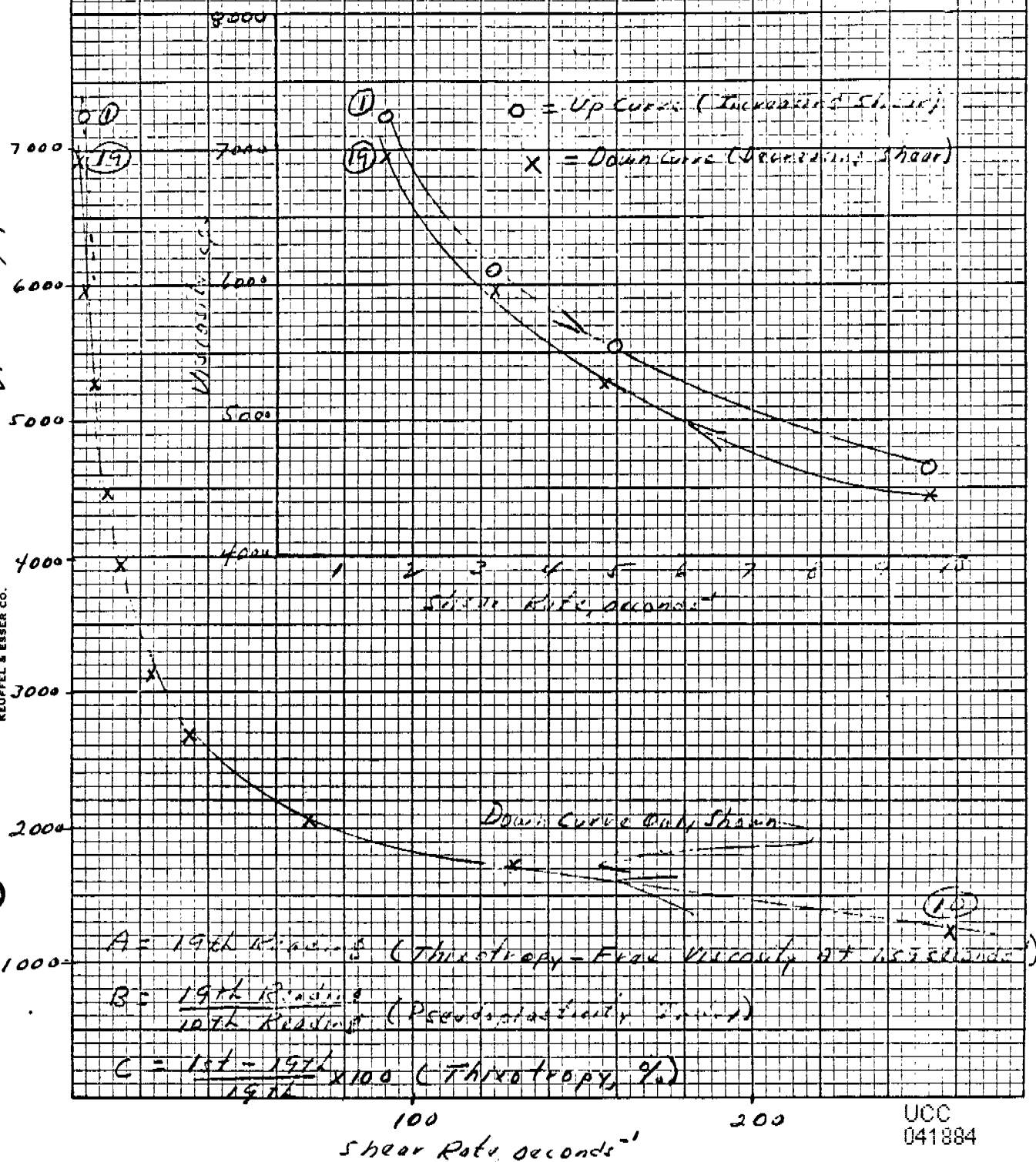
Viscosity Versus Shear Rate

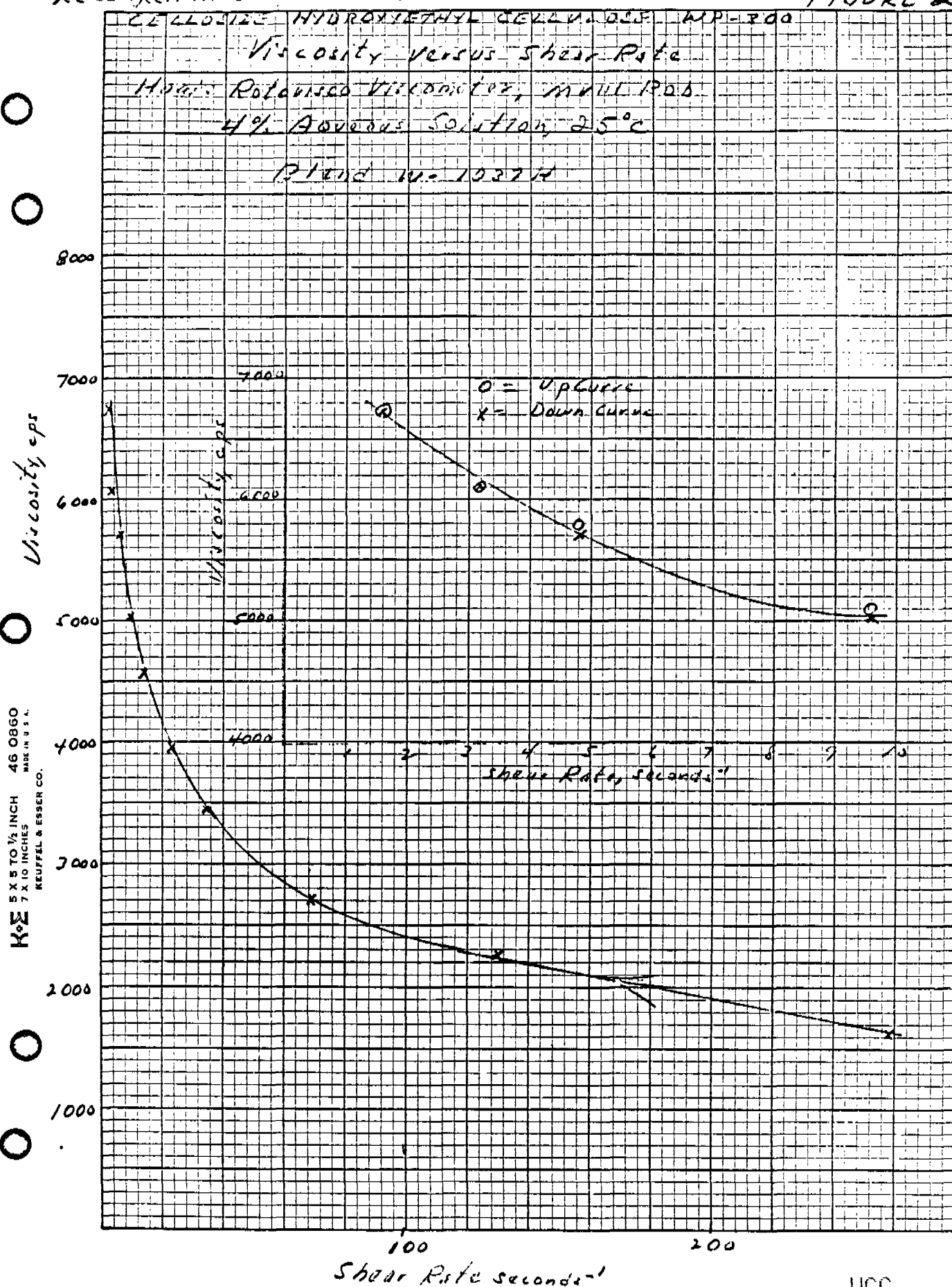
Hosokawa Viscometer, Model 25.6

4% Aqueous Solution 55°C

R150 W-5029 HB

Viscosity, cps

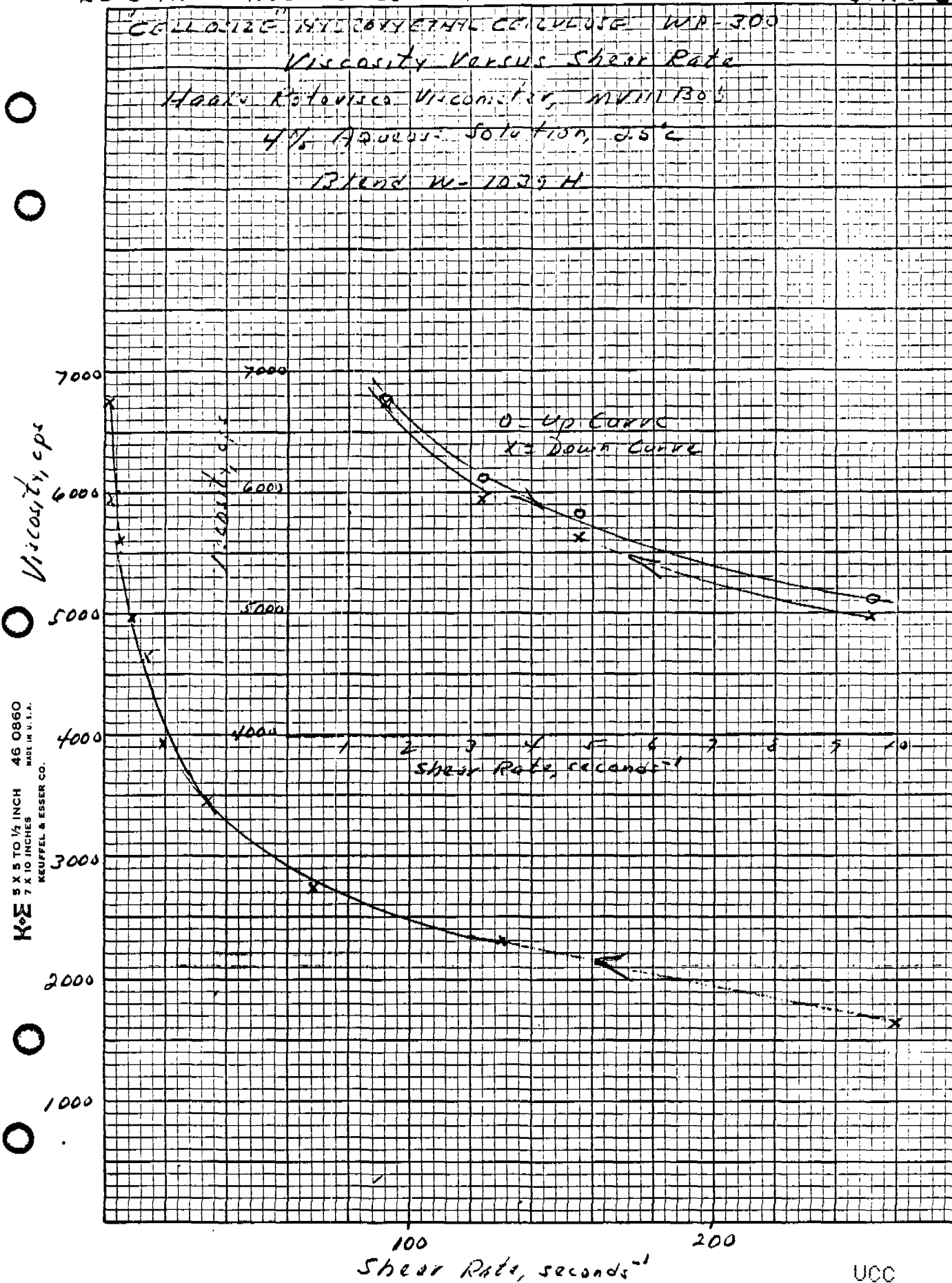
K&E
5 X 5 TO 1/2 INCH
7 X 10 INCHES
MADE IN U.S.A.
KEUFFEL & ESSER CO.UCC
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K&E 5 X 5 TO 1/2 INCH 46 0860
7 X 10 INCHES
MADE IN U.S.A.
KEUFFEL & ESSER CO.

Shear Rate seconds⁻¹

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KE 5 X 5 TO 1/2 INCH 46 0860
 7 X 10 INCHES
 MADE IN U.S.A.
 KEUFFEL & ESSER CO.

100 200
 Shear Rate, seconds⁻¹

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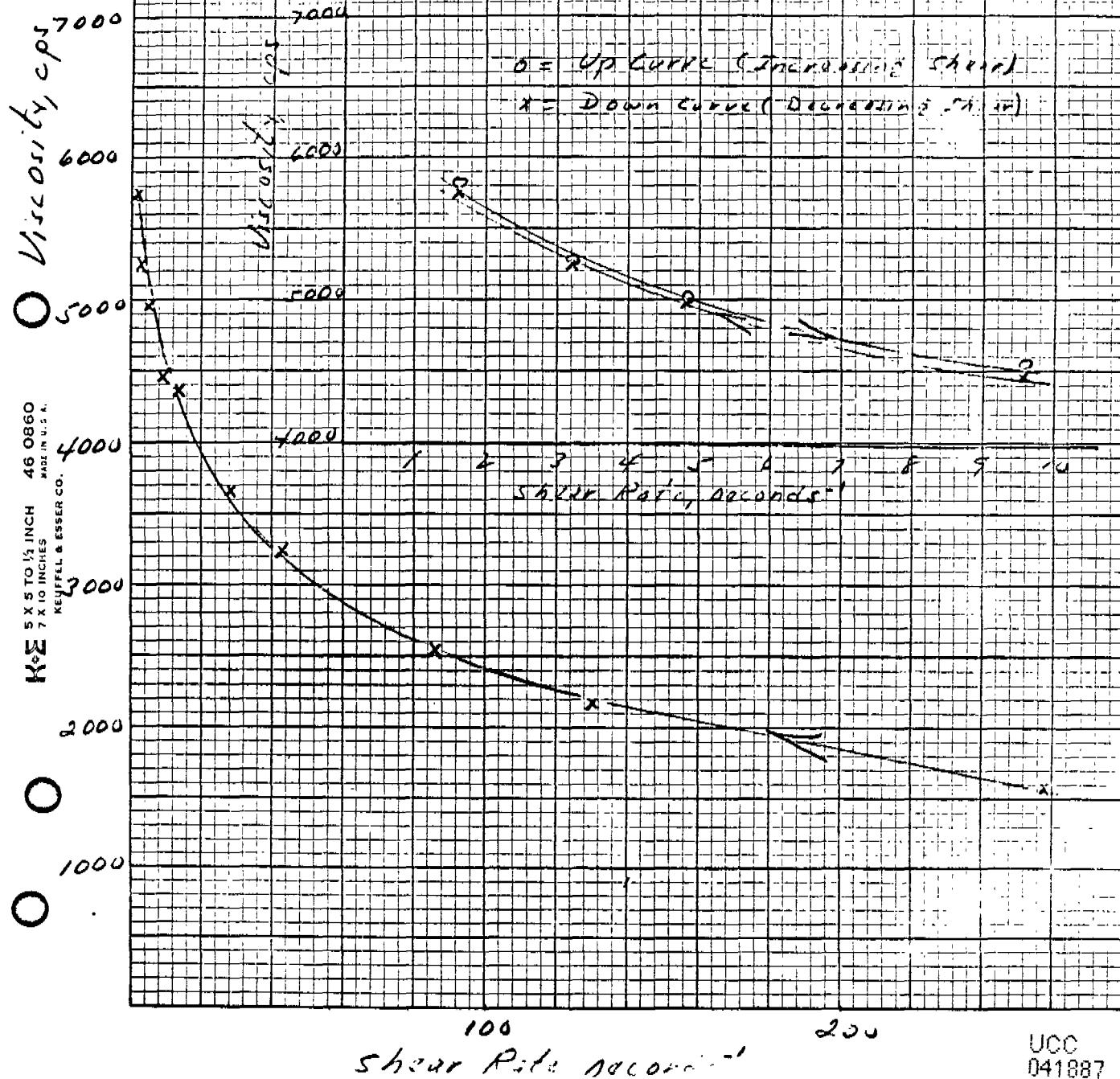
CELLULOSE 3-HYDROXYETHYL CELLULOSE MP-300

Viscosity Versus Shear Rate

HAAKE ROTAVISC VISCOMETER, MPVH 300

4% Aqueous Solution, 25°C

Blend W-10-13 H



CELLOSIZ® HYDROXYETHYL CELLULOSE WP-300
Viscosity Versus Shear Rate
Harkn Rotavisco Viscometer, MVIII-206
4% Aqueous Solution, 25°C
Blend N-1055 H

