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EVALUATION OF "49 PROCESS"

1000 GALLON MIXER

J-34

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MARSHALL R&D LABORATORY

ABSTRACT

Evaluation of the high speed 1000 gallon "49 Process" mixer to prove satisfactory impeller design through manufacture of representative 253 Line tintings and Black "Duco" Lacquer.

EVALUATION OF "49 PROCESS"

1000 GALLON MIXER

J-34

SUMMARY

PROBLEM

Dispersion studies on the manufacture of Black "Duco" and certain tinting solutions by "49 Process" have established the existing mixer design as inadequate for producing the desired quality. Present mixers in use have, in general, large, slow speed impellers which produce high flow, general turbulence, and eventual dissipation of power input as widely spread and low intensity frictional shear.

A series of impeller changes were made in which the attempt was made to supply a minimum flow effect necessary to bring all the process material repeatedly through the impeller shear zone. In order to allow input of maximum power as high intensity shear to this zone, the bottom impeller diameter was reduced, the speed increased, and all other impellers except the bottom one were removed. The result provided better dispersion and color development.

This project, was undertaken to manufacture a series of batches in the new mixer. The object was: To determine the quality obtainable by "49 Process" dispersion of Black "Duco" and the tintings that are successfully dispersed in slow speed mixers. To determine the performance of the mixer in dissolving Roll Stock and Vacuum Stock in the manufacture of tinting solutions. Finally, to verify previously estimated cooling water and jacket requirements.

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RESULTS AND RECOMMENDATIONS

The series of batches manufactured were selected as representing a cross section of the tintings which will be manufactured in the new mixer. The formulas included both fine and large particle size pigments dispersed by "49 Process", Black Refinish and Automotive "Duco", and tintings from RX and VX stocks. The batches were closely followed throughout the cycle to observe agitation, temperature, power and resulting quality. Results are as follows:

1. Working capacity of the 1000 gallon mixer can be extended to 1100 gallons without splashing.
2. The present "49 Process" formulas for 253-0913 and 253-0953 as employed in slow speed mixers may be used in the new mixers. Quality was 100 mesh wire filtration. No cooling water was needed.
3. The 253-001 formula required the addition of resin during the first portion to prevent excessive motor overload. This tinting carries double the quality of pigment contained in the above tintings. Quality was 100 mesh wire filtration. No cooling water was needed. The formula has been revised to incorporate the resin in the first portion.
4. "49 Process" dispersion of 253-064 in slow speed mixers was discontinued due to gritty product and lengthy filtration requirements. This same formula in the new mixer returned a higher gloss and cleaner color compared to ball mill standard. Quality was 100 mesh wire filtration. No cooling water was required.

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5. The 253-0785 and 253-025 as developed are satisfactory. Quality was 100 mesh wire filtration. Cooling water at the rate of 10 GPM should be employed throughout the cycle.

* 6. The 253-059 formula was revised (J-253-X-011923) to load the N/C in one portion. This formula has resulted in gritty product requiring F&N filtration when manufactured in slow speed mixers. Quality in the new mixer was 100 mesh wire filtration. Color was clean compared to ball mill standard. Temperature of the batch could not be controlled using 8 GPM cooling water which was the maximum obtainable due to physical limitations of the original water line installation. Approximately 30 GPM during the first portion will be required based on the performance of 253-056.

* 7. The two Milori Blue tintings, 253-051 and 253-056, were excessively gritty. "49 Processing" of these pigments should not be considered without first passing the pigment and liquids through a sand grind unit to reduce the agglomerates. Most practical dispersion method is "Slurry Grinding".

* 8. The two tintings manufactured from stocks, 253-0751 (VX) and 253-0485 (RX) offered the only serious objection from the standpoint of power requirements - 45 HP peak with the motor horsepower input curve remaining above the 30 HP level for 1.5 to 4 hours. Quality was 100 mesh wire as compared to normal F&N filtration requirements returned by slow speed mixers. Since these two

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tintings were formulated at the maximum viscosity/power allowable in slow speed mixers, the formulas were revised to depress the high power peaks. Addition of alkyd resin in the stock dissolving cycle resulted in a lower and permissible power curve. In addition, it was shown that the nine hour overall batch cycle, in the case of 253-0751, could be reduced to five hours. Quality in each case was 100 mesh wire filtration. Cooling water requirements throughout the cycle were 10 GPM.

9. Production of 246-2048 Refinish Black from Roll Stock presented no difficulty. Cooling water at the rate of 10-15 GPH was required.
10. "49 Process" manufacture of J-253-X-11904 (253-2247) and J-253-X-11681 (246-2048) in the new mixer resulted in color equal to the blackest color development in laboratory bathces and considerably blacker than that obtained in the 1500 gallon mixer, which in turn is slightly blacker than standard. The overall cycle was reduced to 13 hours. Cooling water at the rate of 10-25 GPM was required.
11. The 1000 gallon mixer impeller is satisfactory at 55" diameter, 15° pitch and 3" projected blade height.
12. Mixer shells should have the bottom row of four baffle brackets removed and ground smooth.

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13. Cooling water jackets should cover the bottom and as much of the side that structural steel permits. Jackets should be provided with cooling water available at the rate of 30 GPM. Inlet water lines to the jacket are to be made at two places on the shell and equipped with nozzles for directing flow in a swirl pattern to eliminate the need for internal baffling. Overall heat transfer coefficients of 18-20 BTU/hr/^{o}F/sq.ft. were obtained during first portion mixing of Black "Duco".
14. Control Laboratory test results, power and temperature curves of the batches are presented in the appendix.
15. Drawings of the present 1000 gallon experimental mixer, drive and impeller are presented in the appendix.

*Note problems encountered with these pigments.

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APPENDIX

Power Curves (motor HP input registered on Esterline)

1. Agitator power at 100 gallon water increments
2. 253-0913 White Tinting "49 Process"
3. 253-0953 " " " "
4. 253-001 " " " "
5. 253-0485 Hydrous Iron Oxide (from RX-0485)
6. 253-064 Ferrite Yellow Tinting "49 Process"
7. 253-0785 Monastral Green Tinting "49 Process"
8. J-253-X-011923 (253-059) Monastral Blue "49-P"
9. J-253-X-011739 (253-051) Milori Blue "49-P"
10. 253-0751 Chromium Tetrahydroxide (from VX-0751)
11. 253-025 Molacco Black Tinting "49-P"
12. J-253-X-11904 (253-2247) Auto. Black "Duco" "49-P"
13. 246-2048 Refinish Black "Duco (from RX stock)
14. J-246-X-11681 (246-2048) Ref. Black "Duco" "49-P"
15. J-253-X-011747 (253-056) Red Milori Blue "49-P"
16. J-253-X-11904 (253-2247) Made in 1500 Gal. Mixer "49-P"
17. J-246-X-11681 (246-2048) Reduced Cycle "49-P"
18. 253-0751 (from VX-0751) Reduced Power
19. 253-0751 Reduced Power and Reduced Cycle
20. 253-0485 (from RX-0485) Reduced Power

Control Laboratory Test Results

Drawings - 1000 Gallon Experimental Mixer Details

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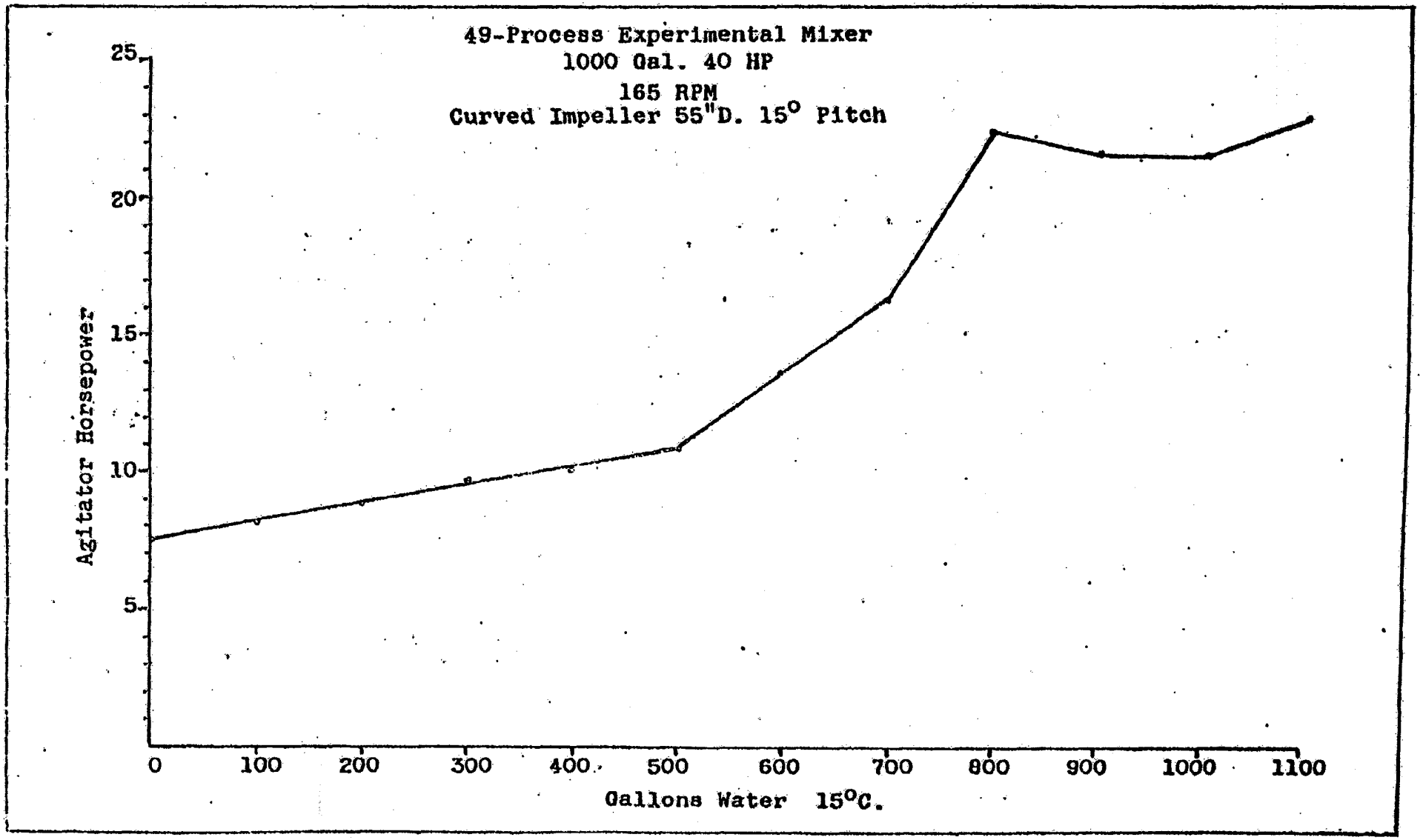

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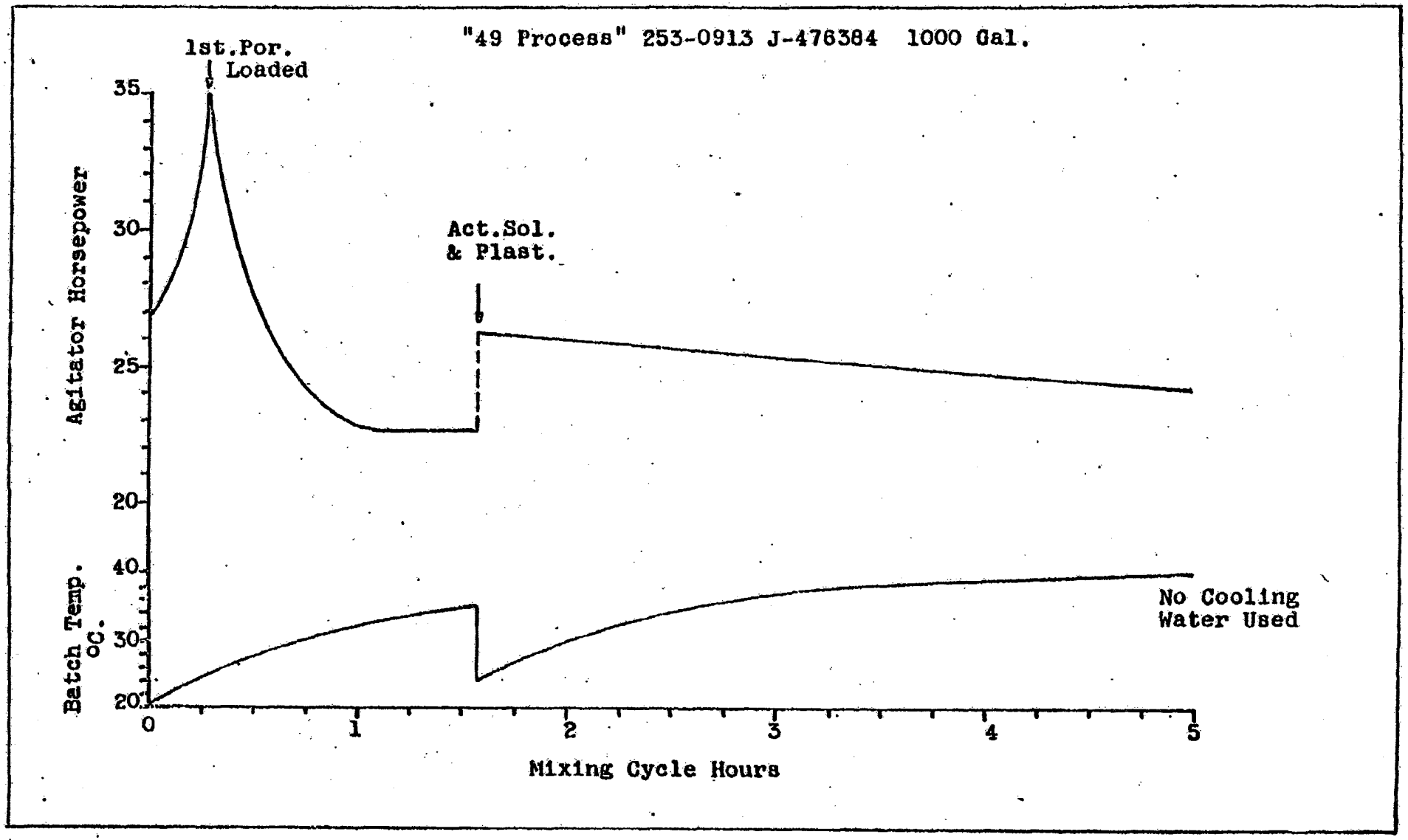

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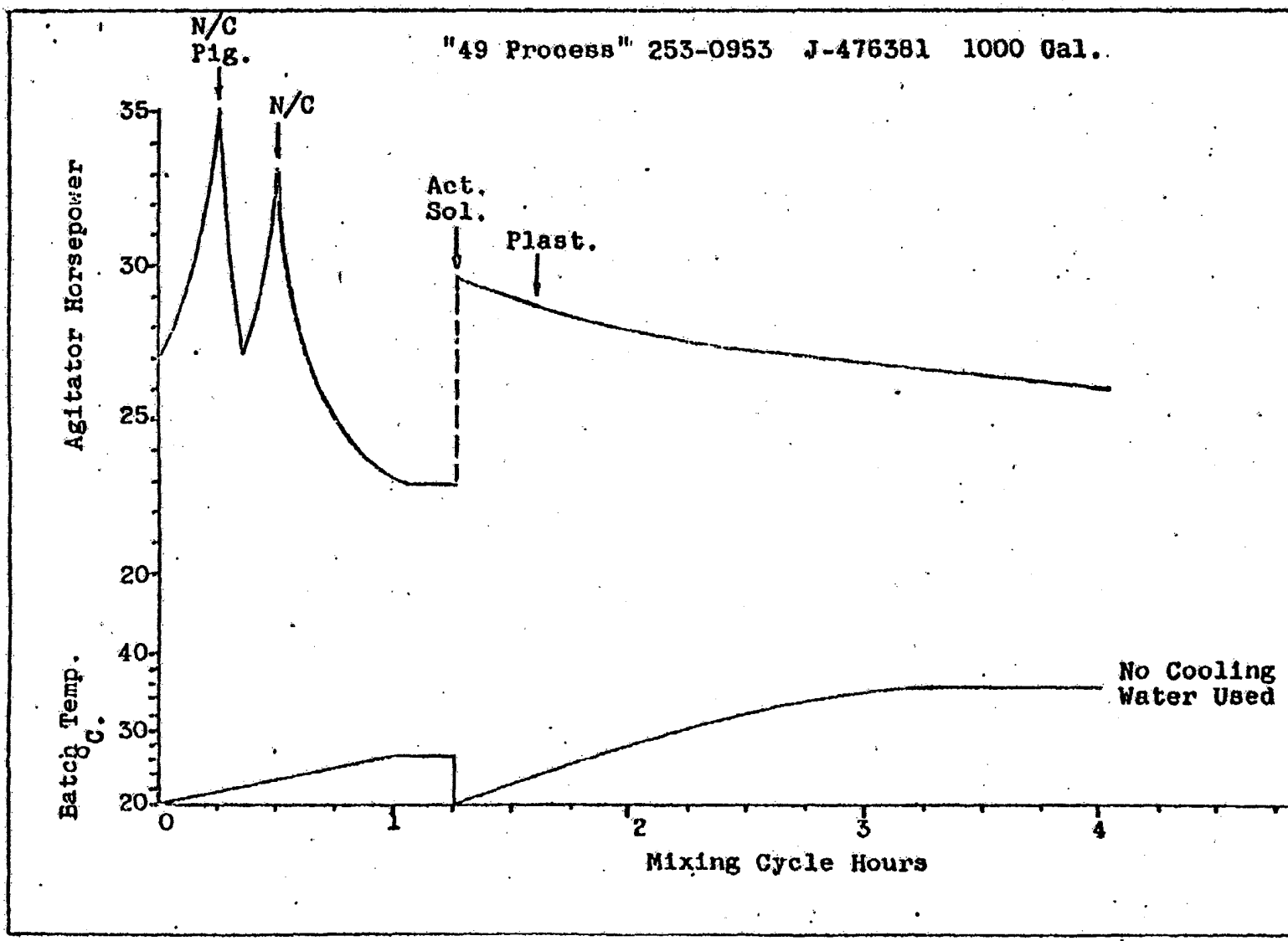

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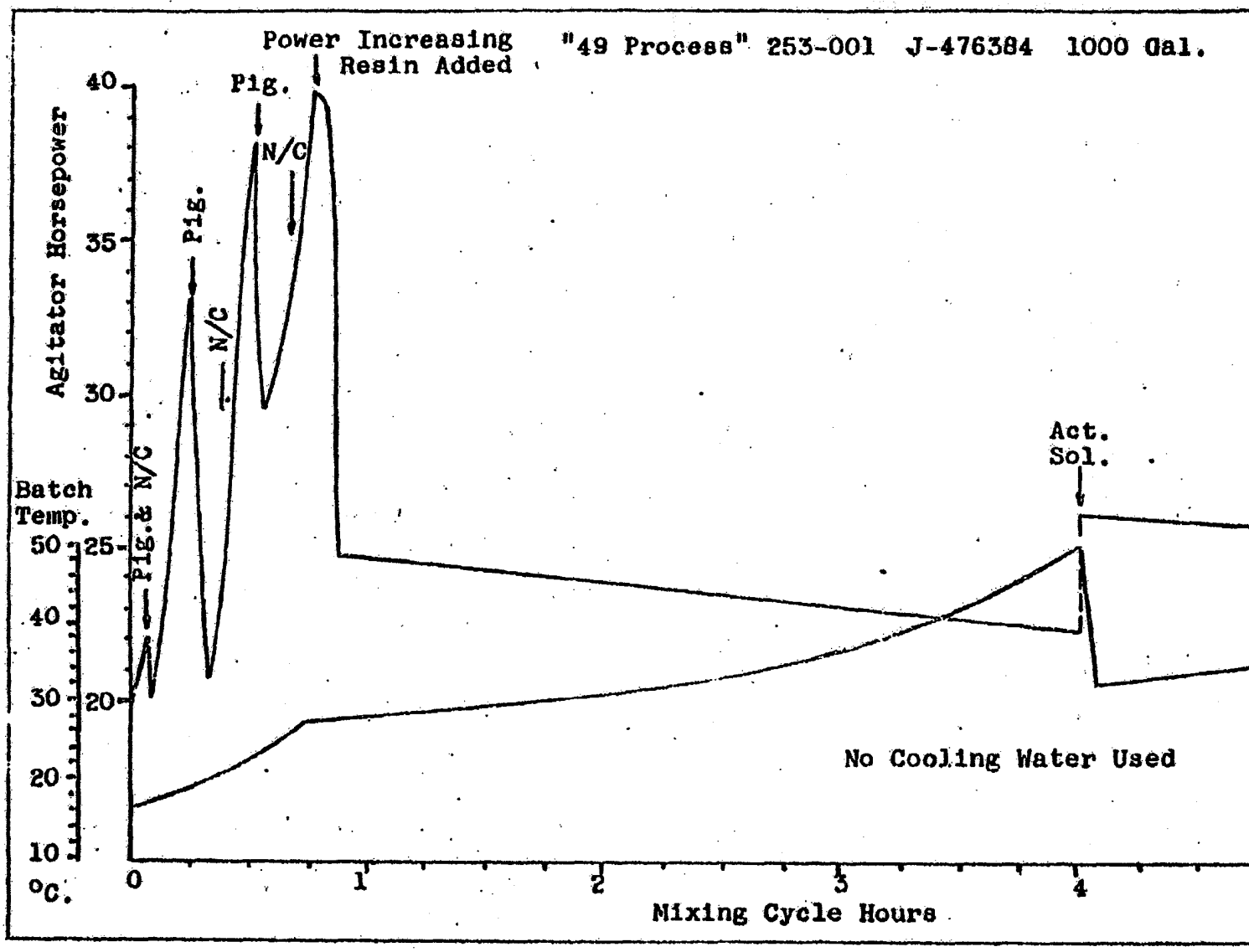

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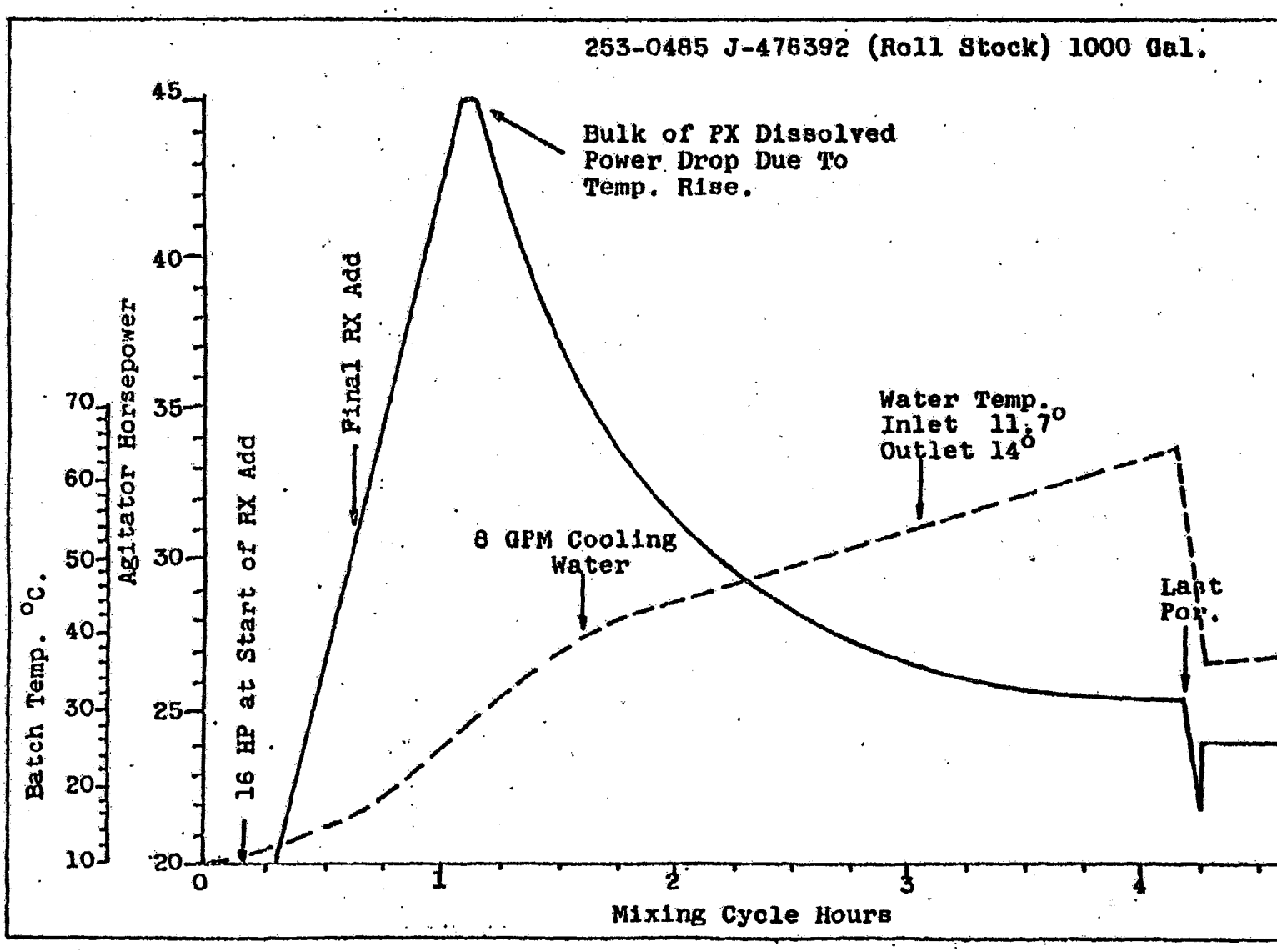

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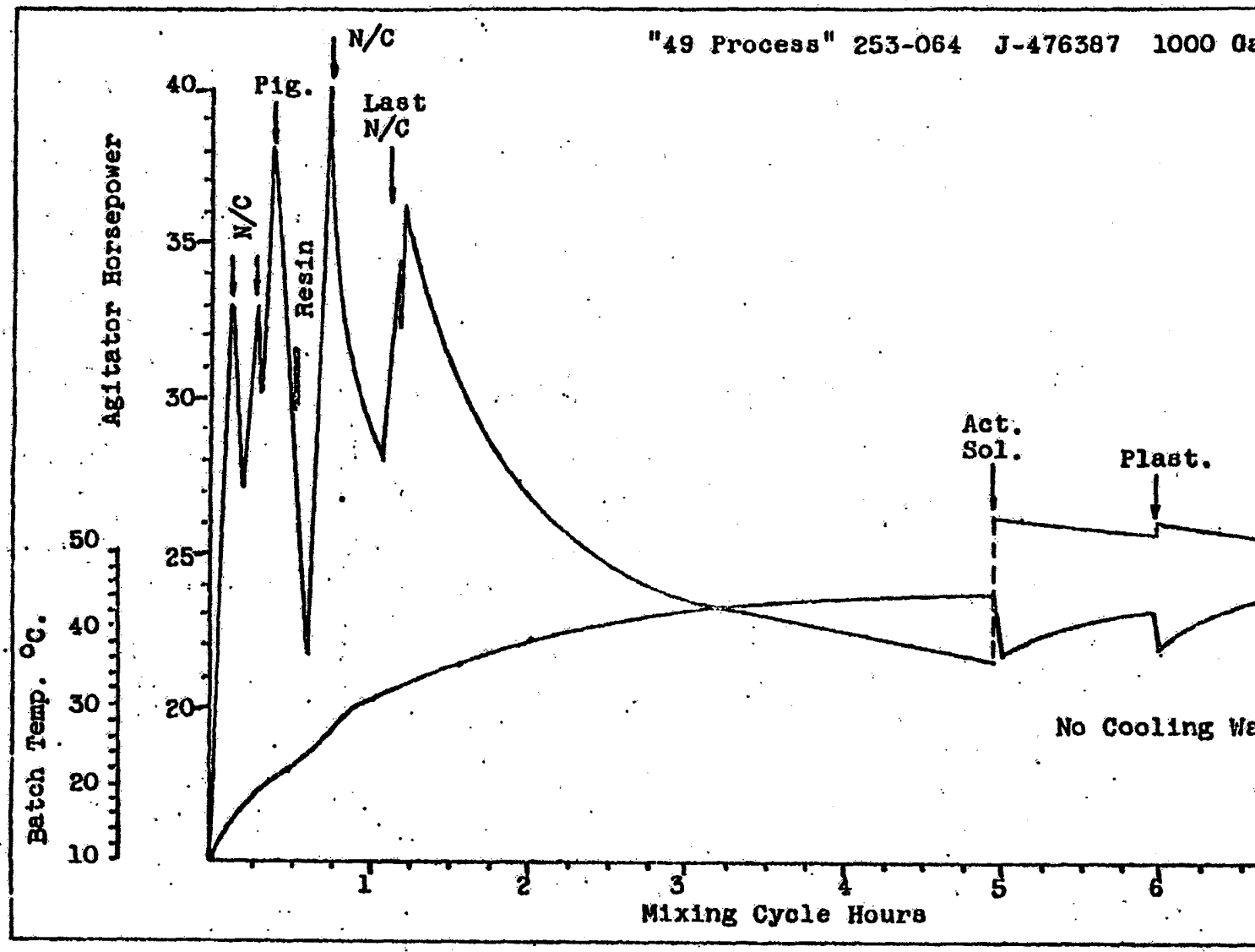

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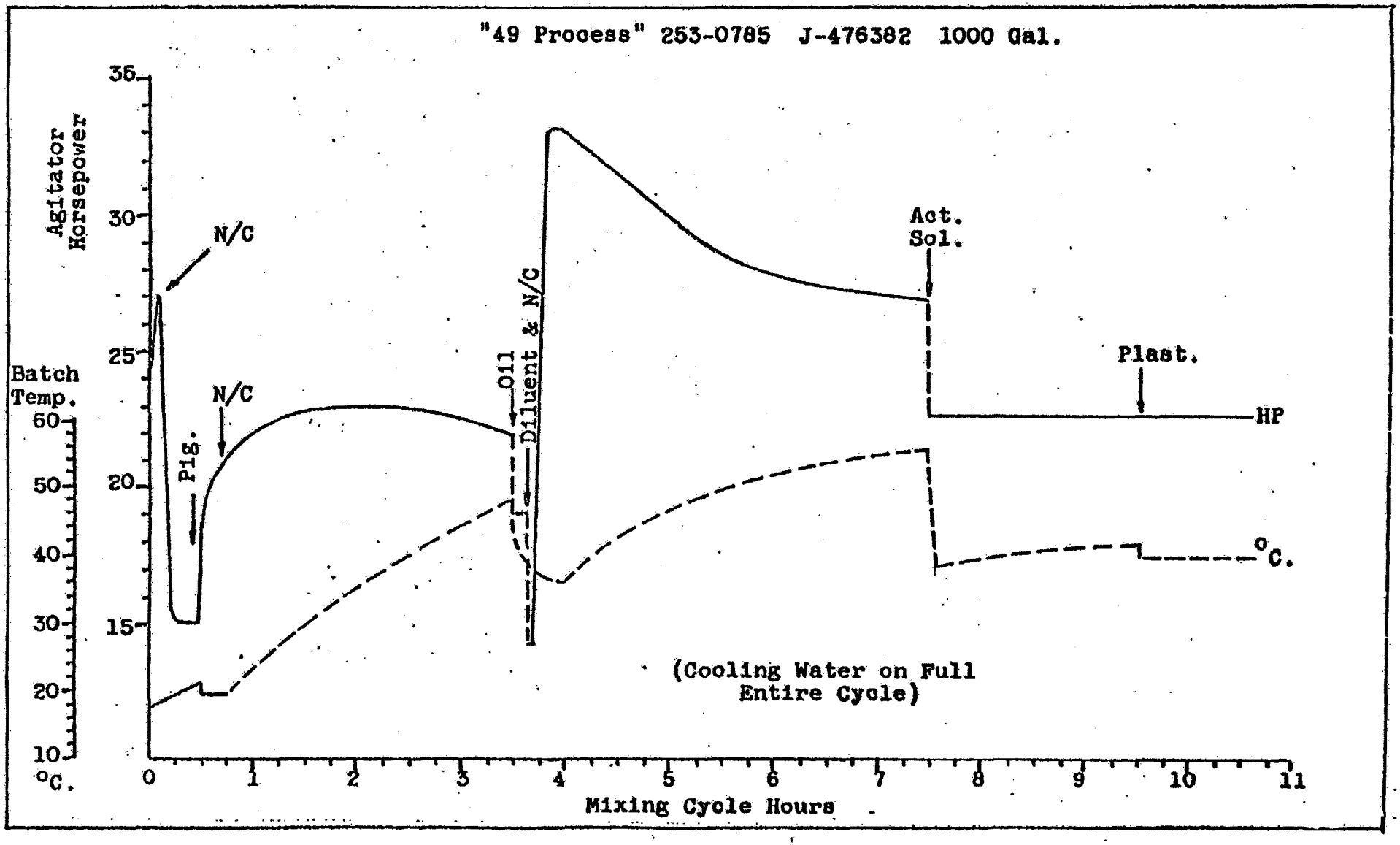

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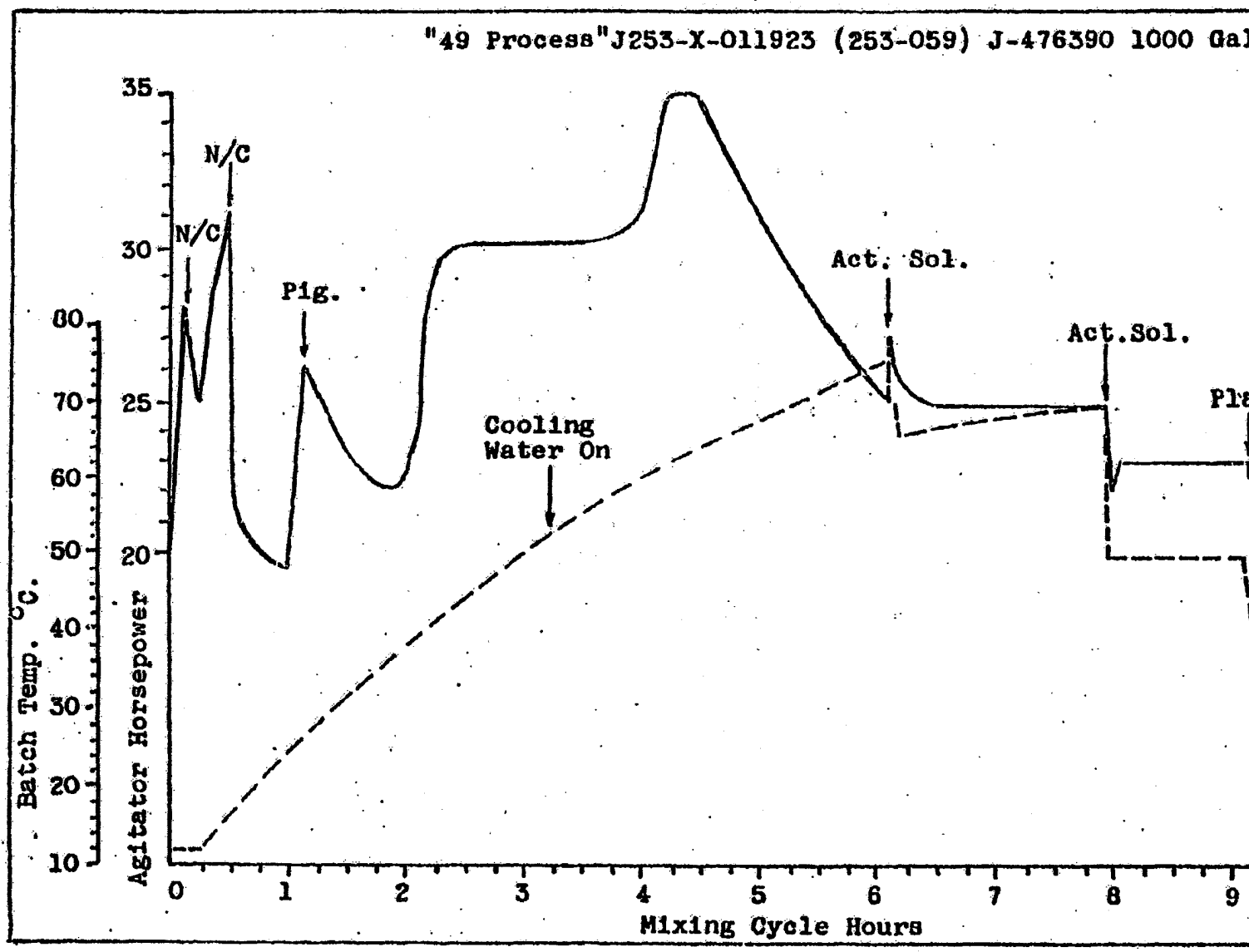

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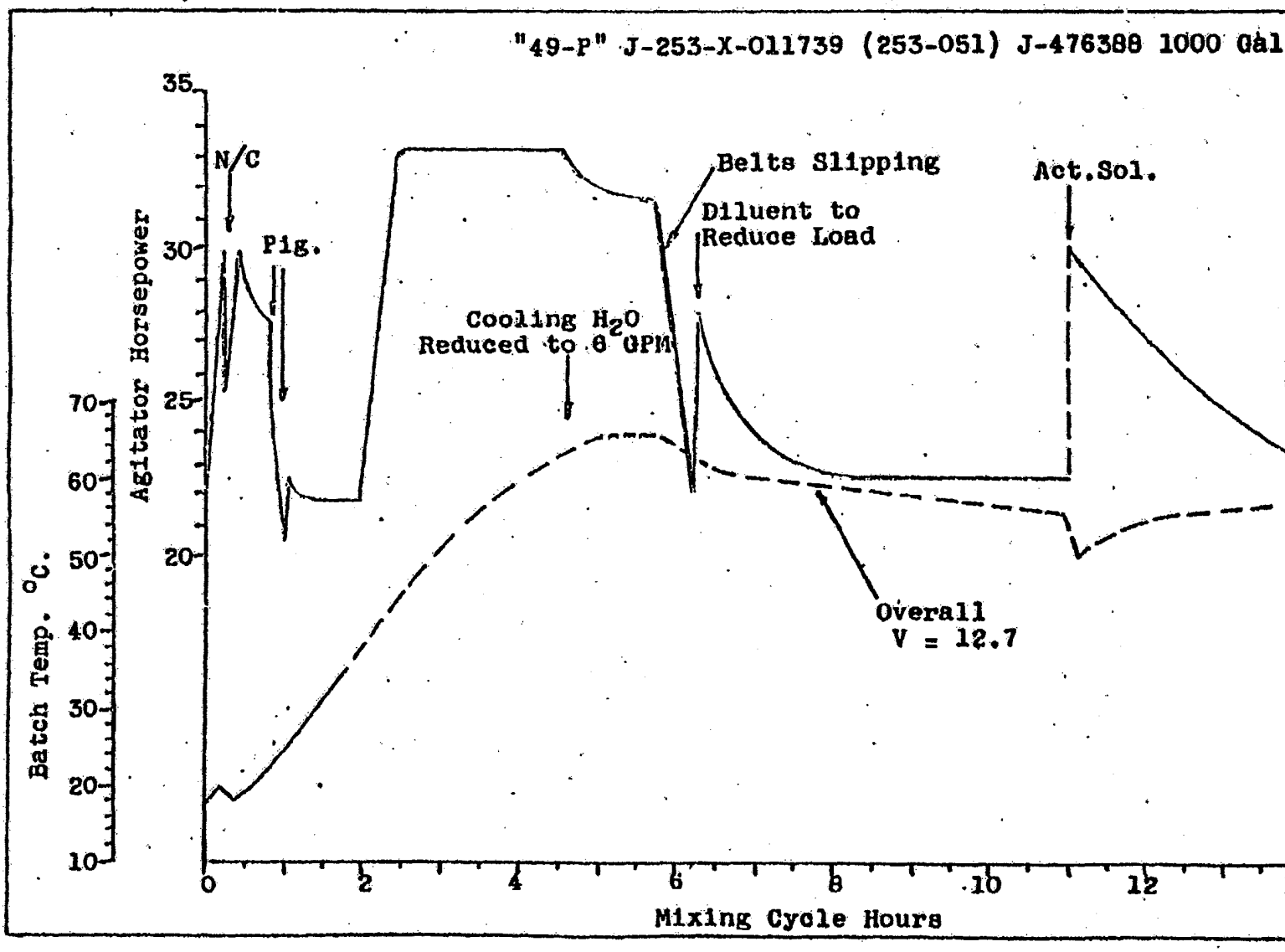

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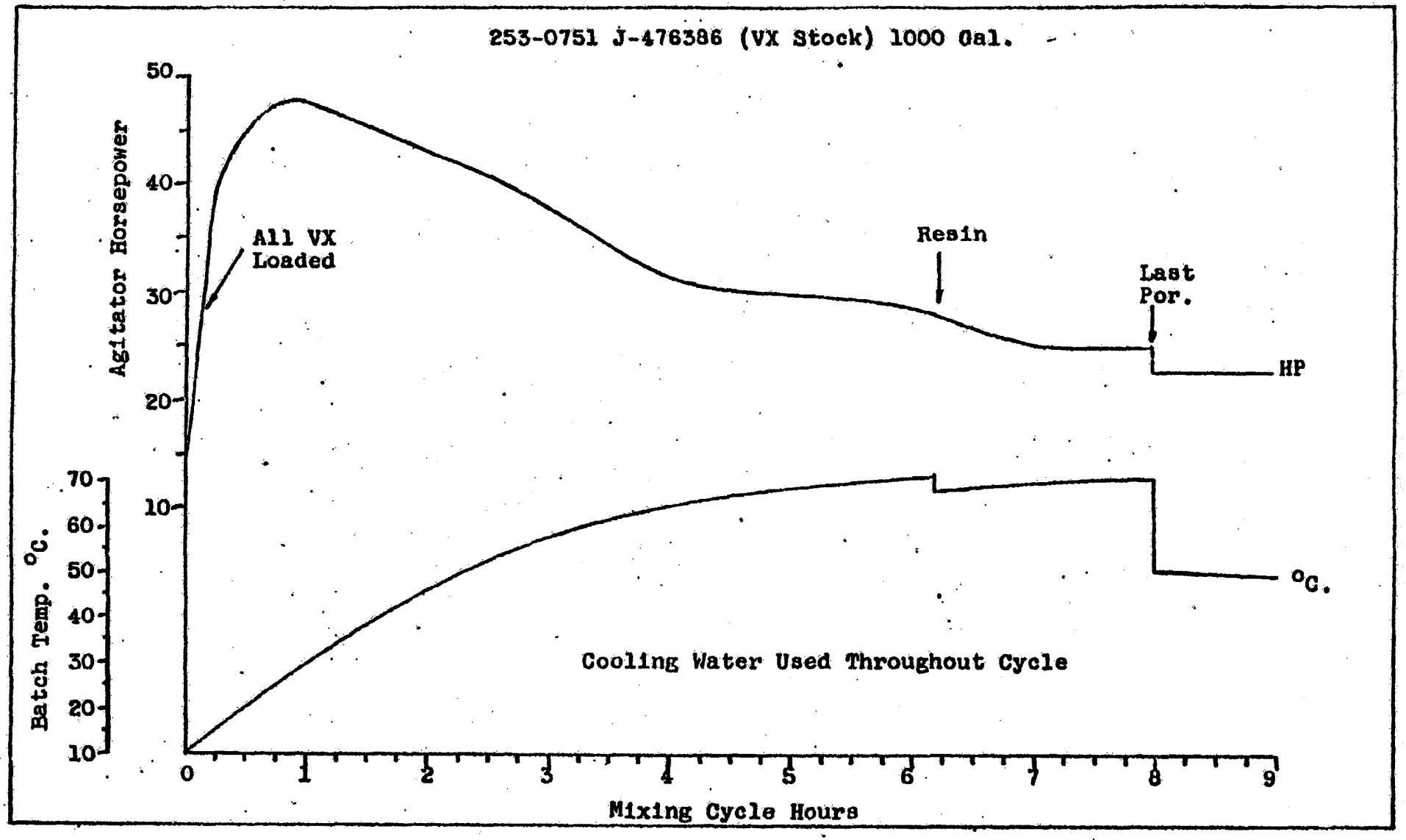

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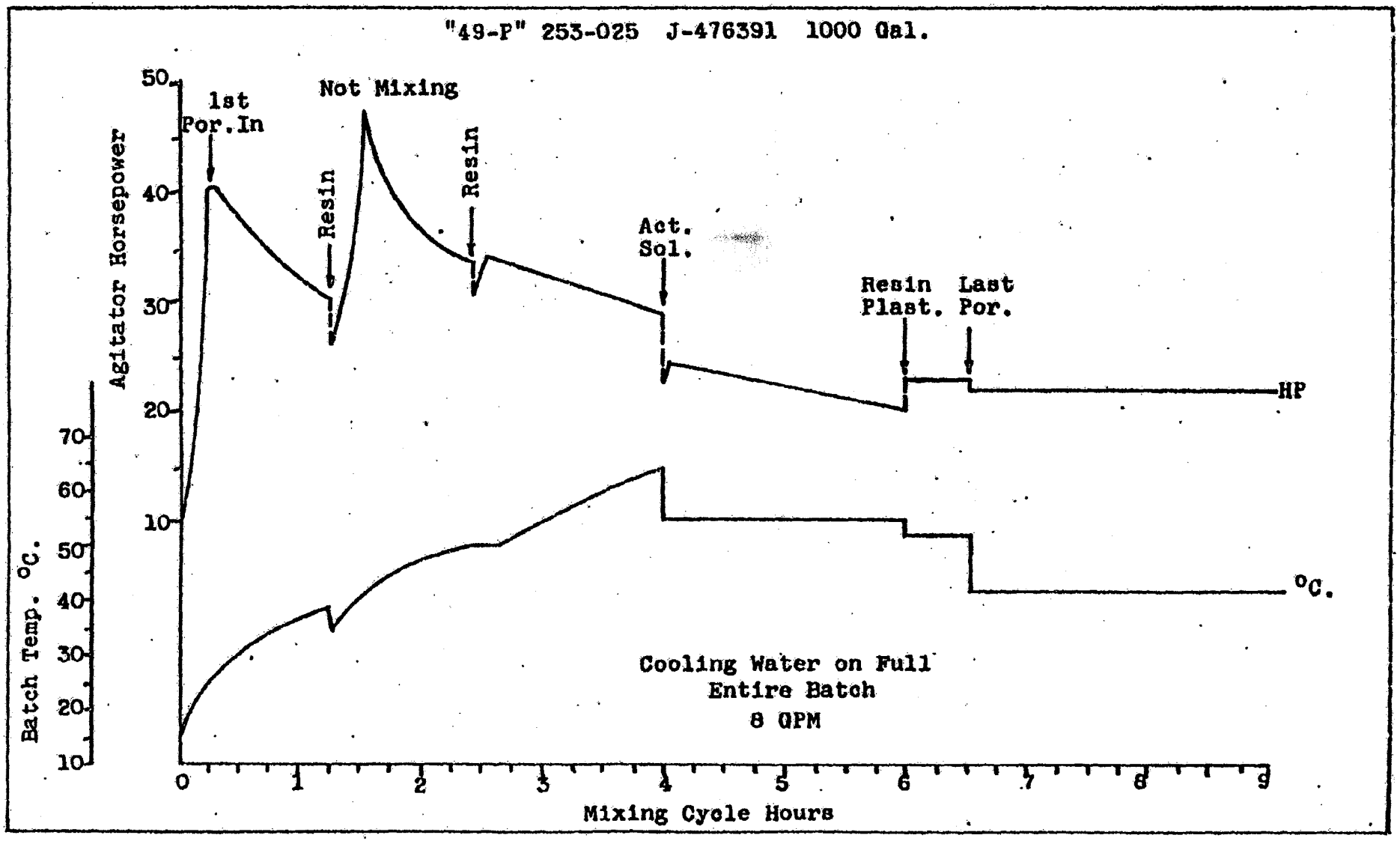

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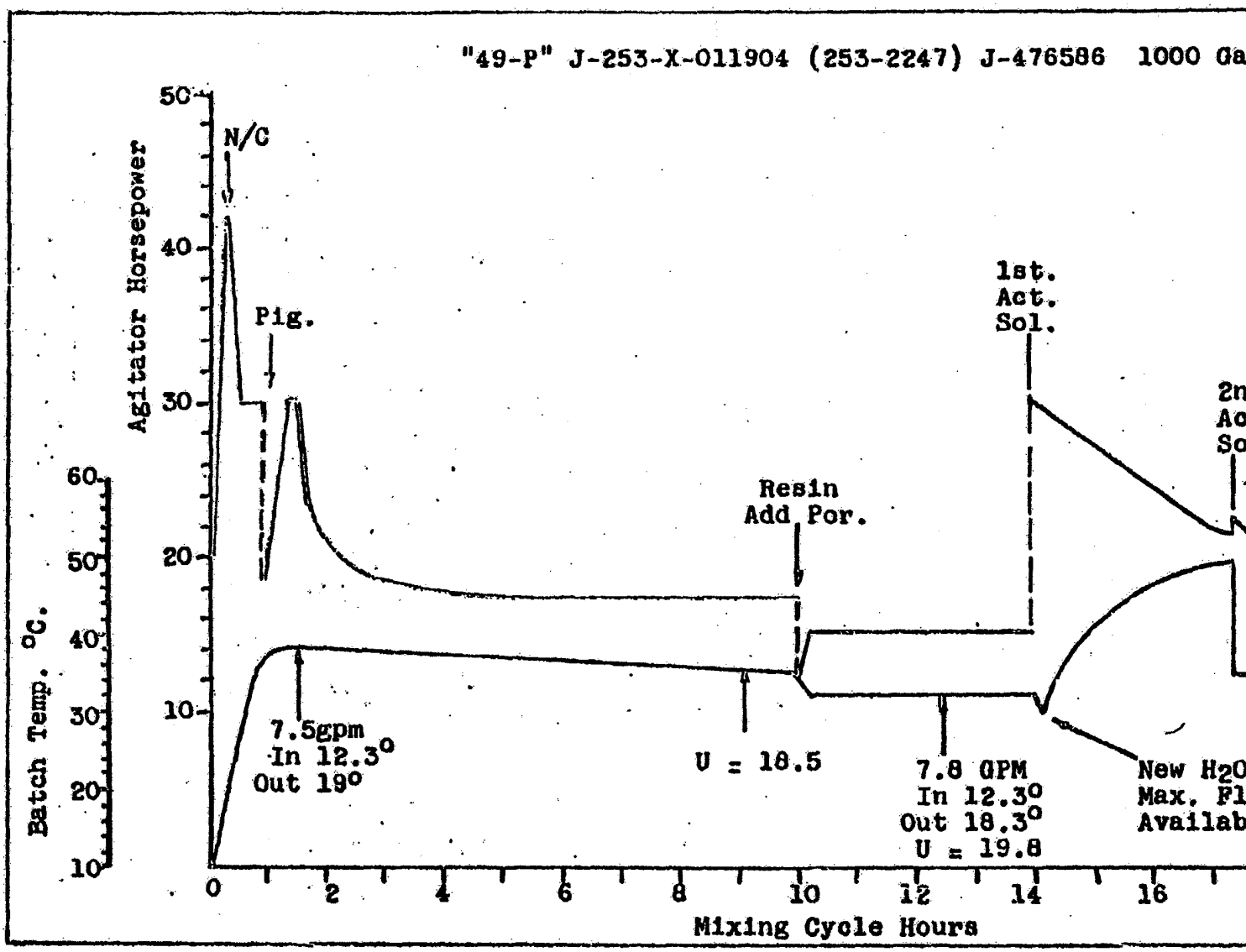

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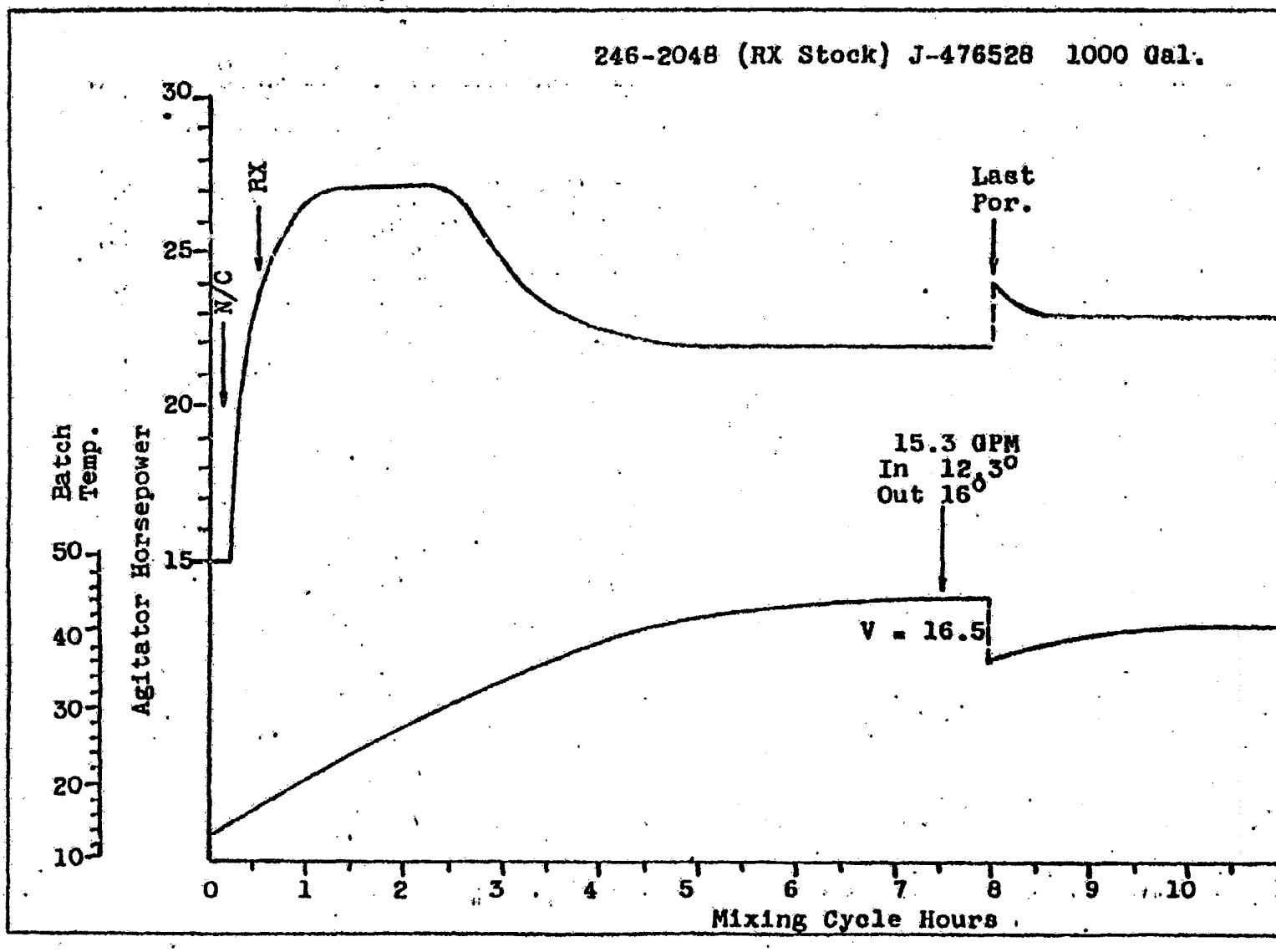

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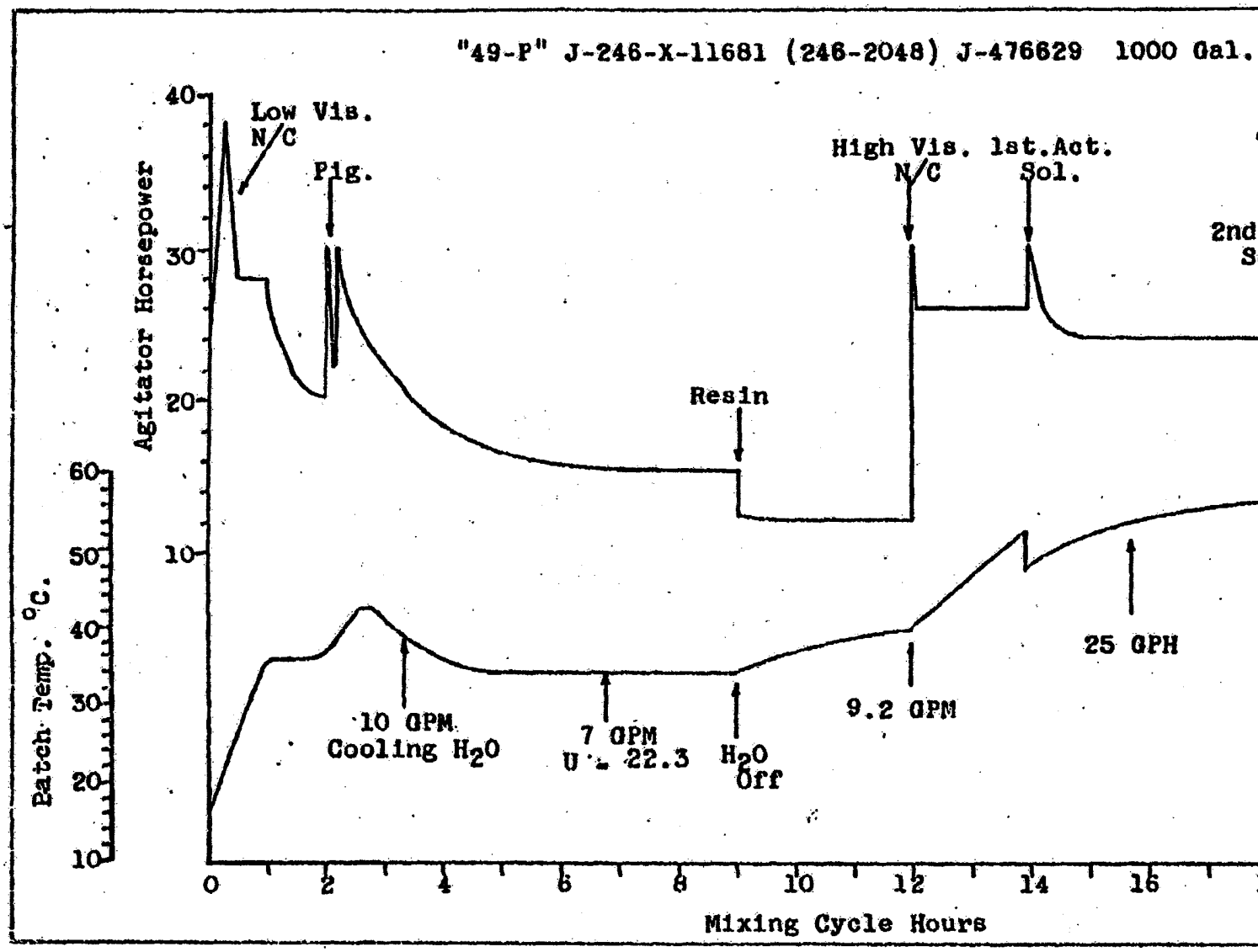

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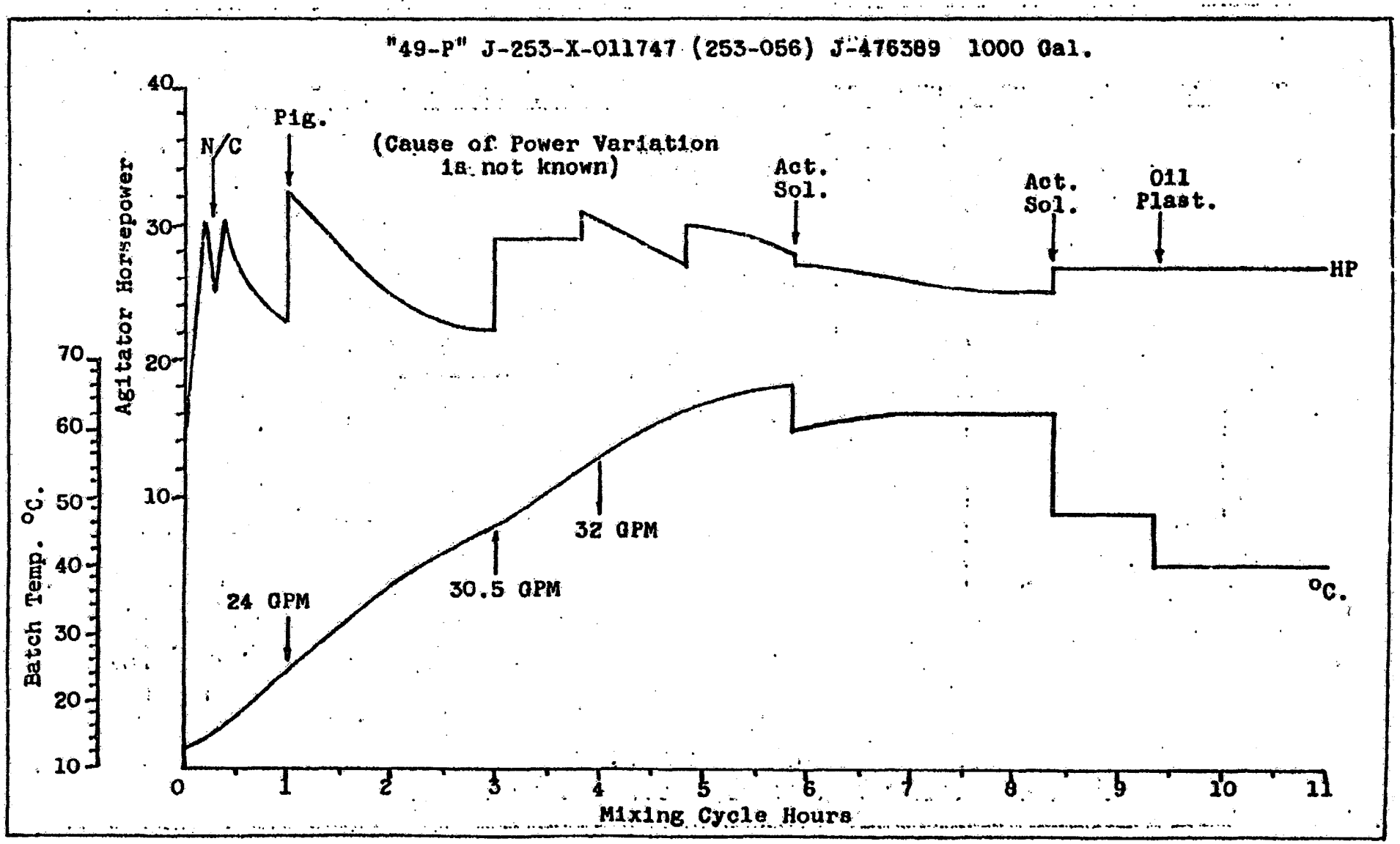

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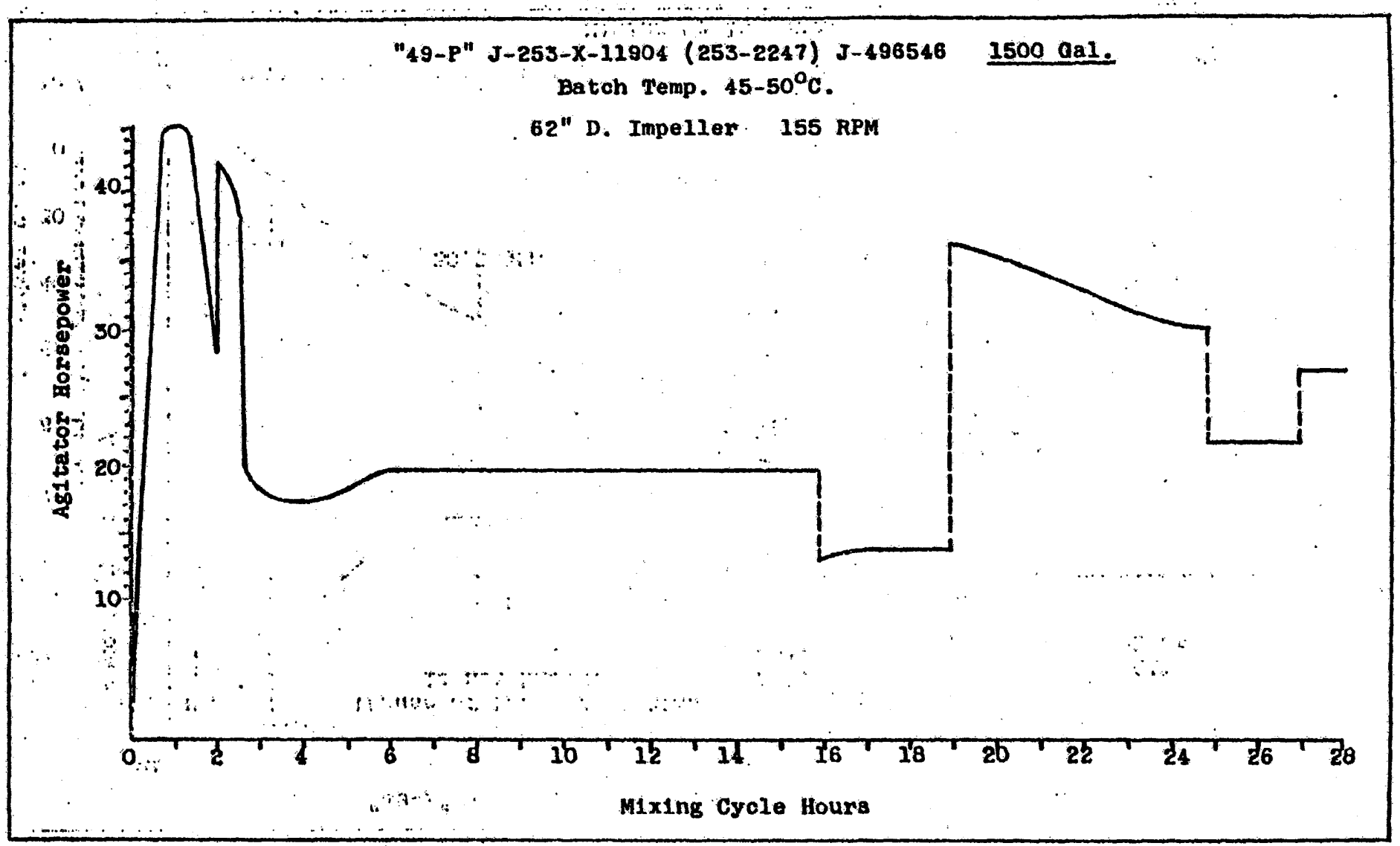

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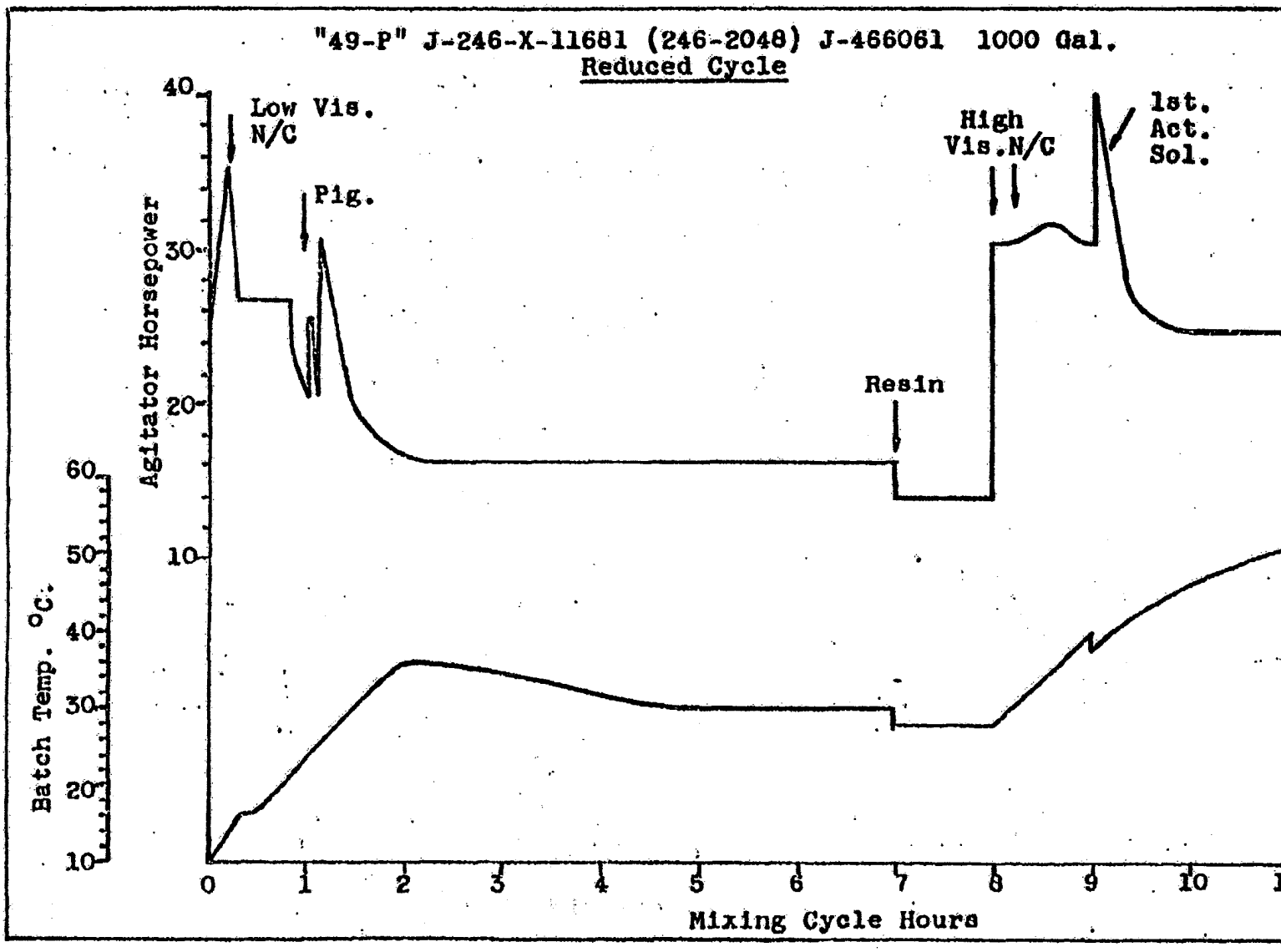

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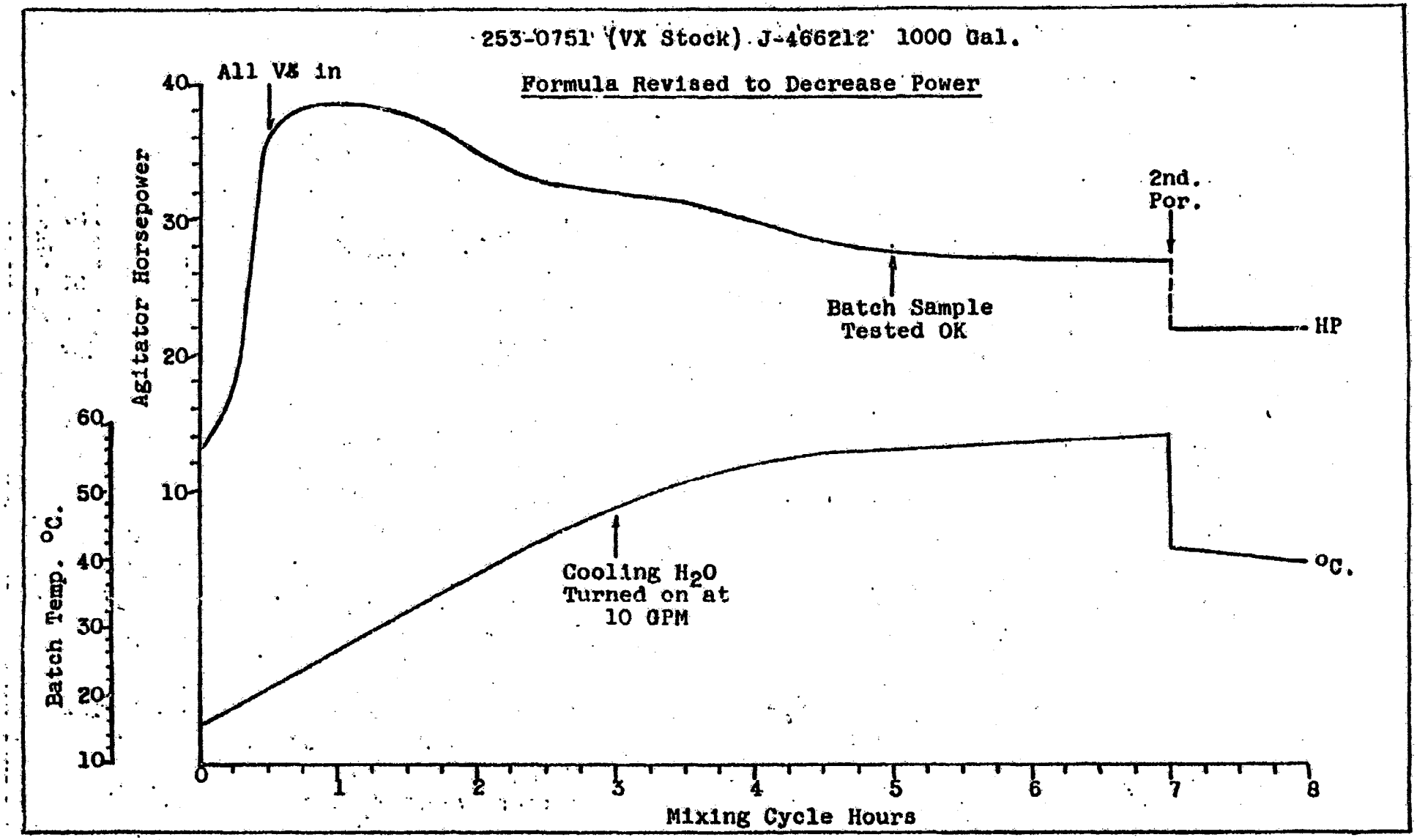

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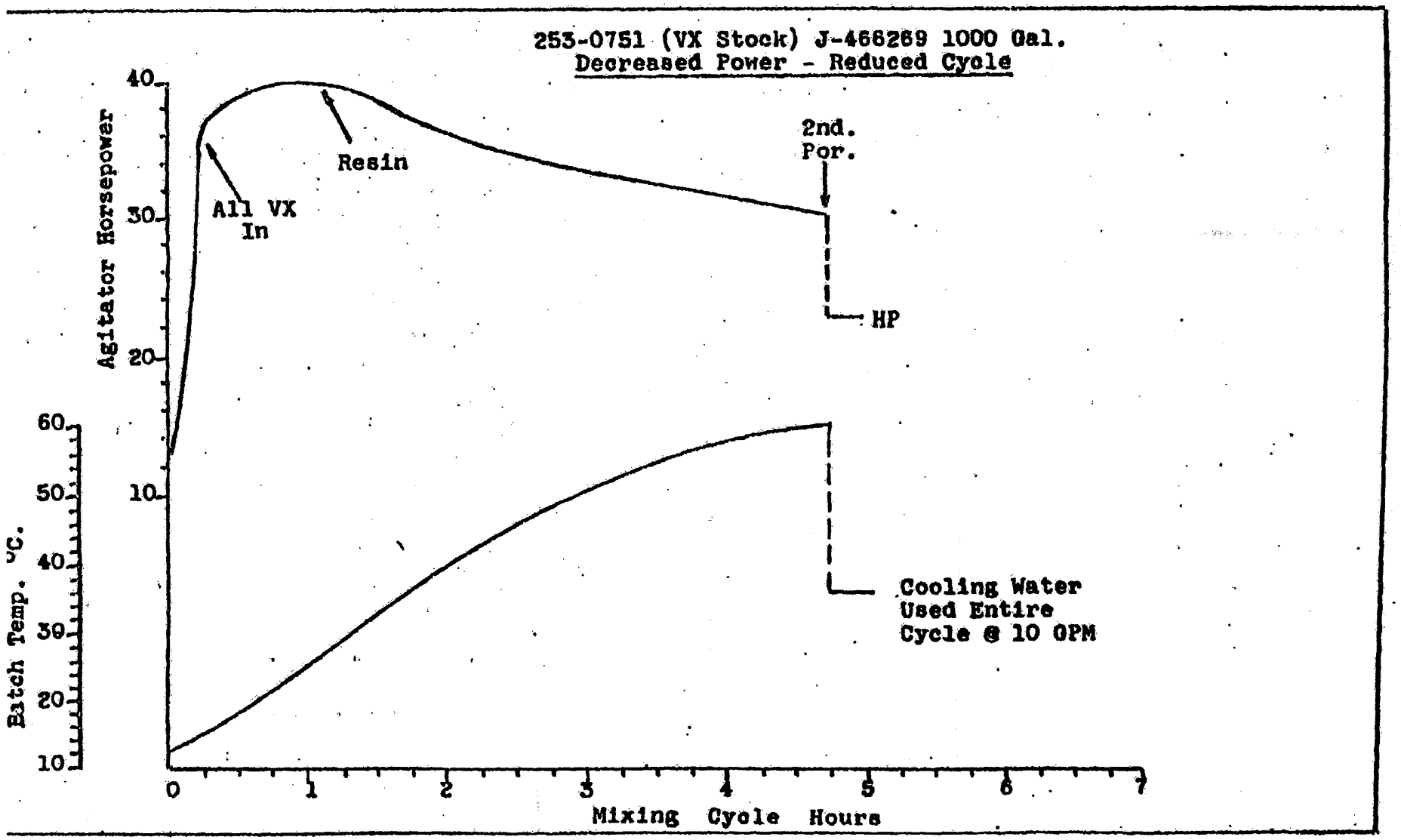

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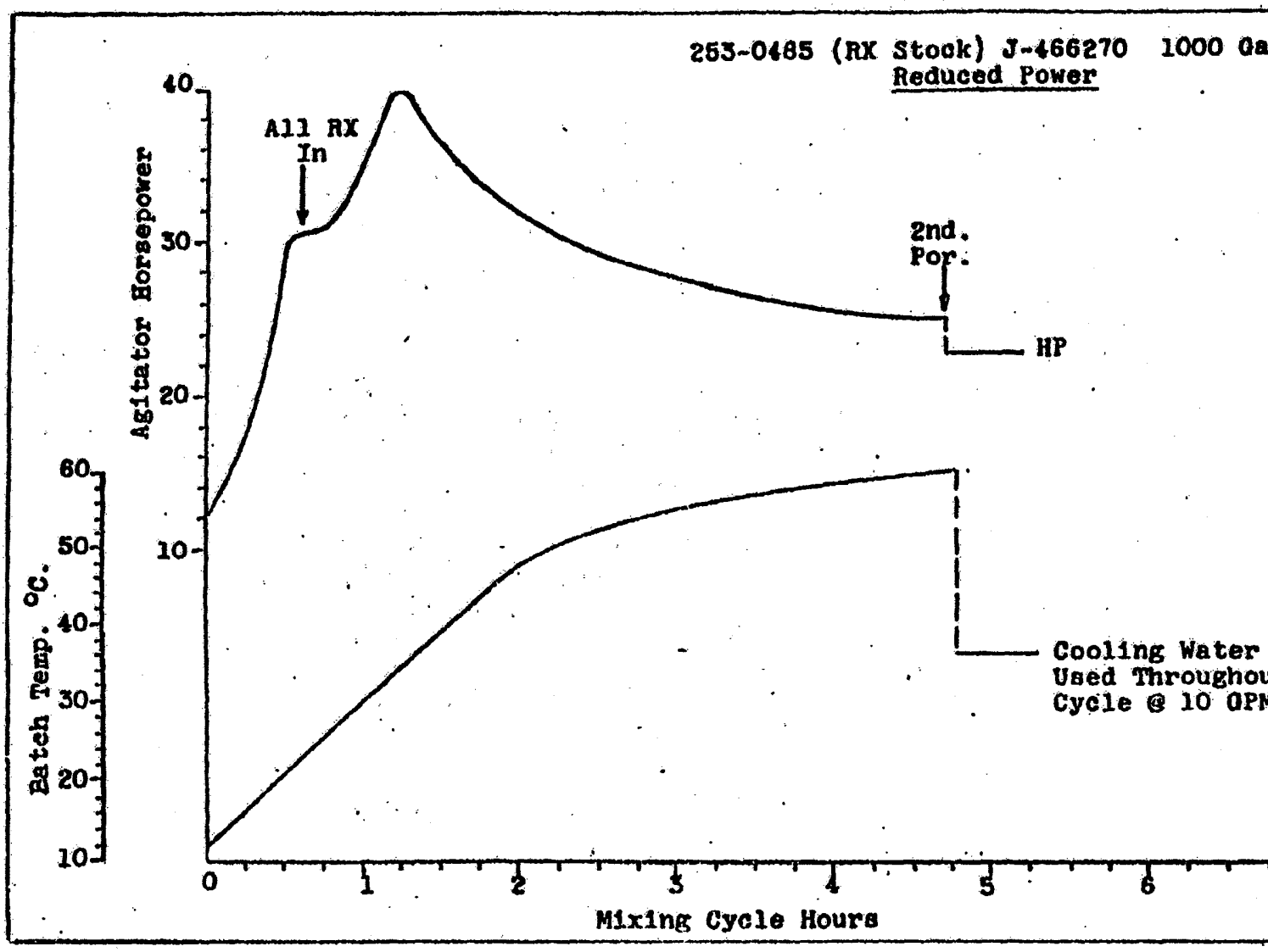

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		Total Solids	Visc.	W/Gal.	Color	Gloss	Phy.Prop.	H_2O Content	SPECIFICATIONS Total Solids	Visc.		Gloss	H_2O Content	Wt/Gal
253-0913	476384	36.1	37"	-	OK	86	OK	-	34.4-38.0	35-45	15 Cup	80 min.	-	8.11
253-001	476385	42.5	43"	-	OK	68	"	-	40.0-44.2	35-45	15 Cup	70 min.	-	8.52
253-0485	476392	33.4	47"	-	OK	97	OK	(1.09 (1.01	33.8 Theo.	45-60	15 Cup	80 min.	2.0 max.	7.91
253-084	476387	39.9	39"	-	OK	56	OK	-	38.2-42.0	35-45	15 Cup	60 min.	-	8.47
253-0785	476382	34.8	35"	7.88	OK	38	OK	-	32.5-35.9	35-45	15 Cup	30 min.	-	7.90
J-253-X-011923	476590	32.9	42"	-	OK	68	OK	-	31.5-34.9	35-45	15 Cup	55 min.	-	7.83
J-253-X-011739	476388	35.6	32"	-	Dark	90	OK	-	34.6-38.2	35-45	15 Cup	80 min.	-	7.89
253-0751	476386	36.5	42"	-	OK	93	OK	-	35.1-38.9	35-45	15 Cup	80 min.	-	8.18
253-025	476391	32.1	40"	-	OK	84	OK	-	30.1-33.3	35-45	15 Cup	80 min.	-	7.78
J-253-X-11904	476586	28.4	63"	7.72	Blacker	95	OK	.51 .51	26.2-29.0	55-65	15 Cup	-	-	7.72
J-246-X-11681	476629	31.1	52"	-	OK	99	OK	-	29.98-33.14	55-70	15 Cup	93 * 2	1.25 max.	7.68
J-246-X-11681	466061	31.3	48"	7.81	OK	98	OK	.840 .846	29.98-33.14	55-70	15 Cup	93 * 2	1.25 max.	7.68
J-253-X-011747	476389	35.8	35"	7.95	OK	-	OK	-	34.8-38.4	35-45	15 Cup	80 min.	-	7.99
246-2048*	476523	31.0	70"	7.78	Slt. Gray	99	OK	-	29.8-33.0	55-70	15 Cup	93 * 2	1.25 max.	7.68
253-0953	476381	37.0	43"	-	OK	84	OK	-	40.0 Theo.	35-45	15 Cup	85 min.	-	8.23
253-0751	466241	36.8	36"	-	Light	96	OK	-	35.1-38.9	35-45	15 Cup	80 min.	-	8.18

*Rework RX stock used.

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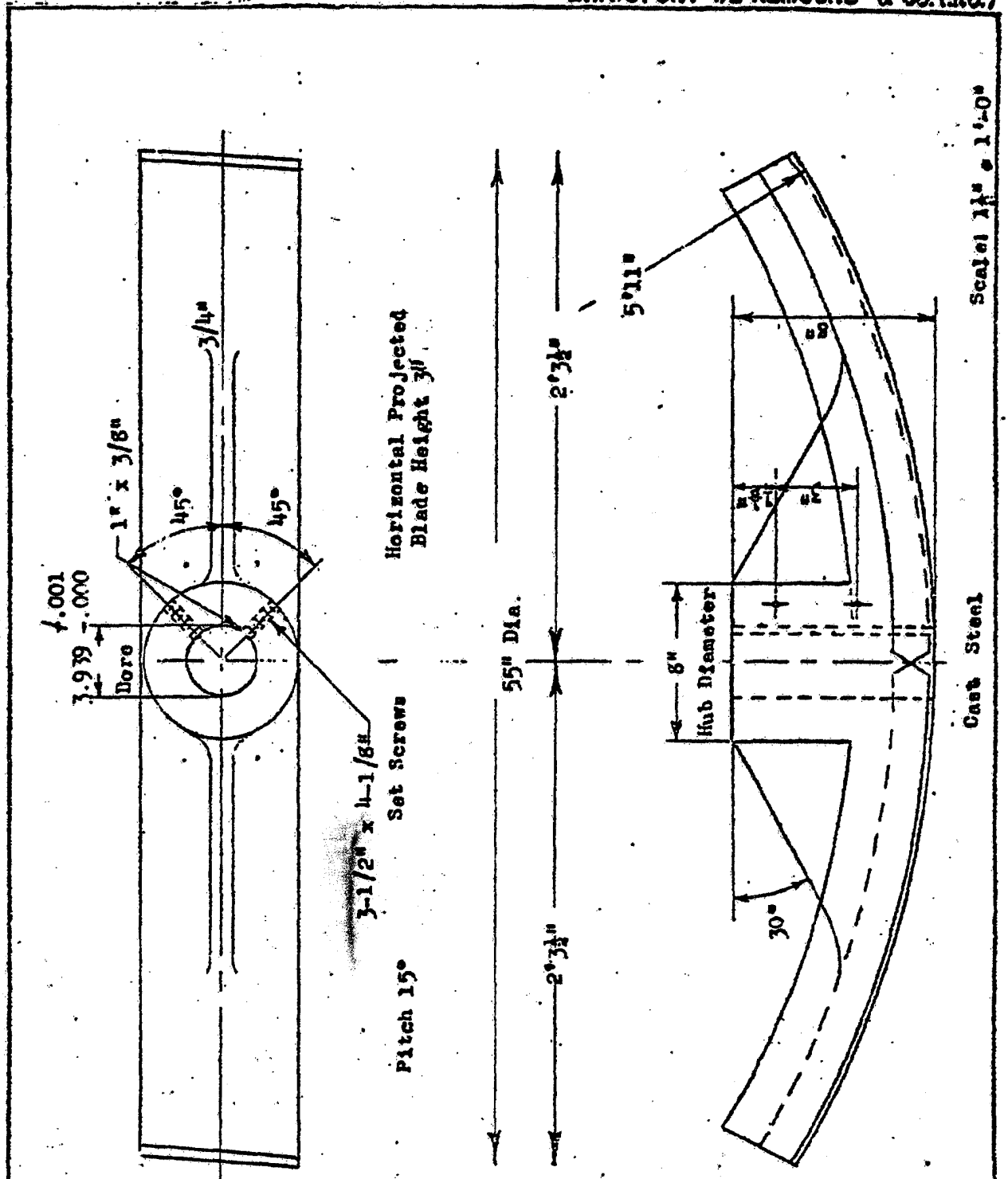

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SUBJECT: Lower Agitator	PROJ. NO. J-34
DIVISION F&F / PLANT Parlin	NO. X 2510

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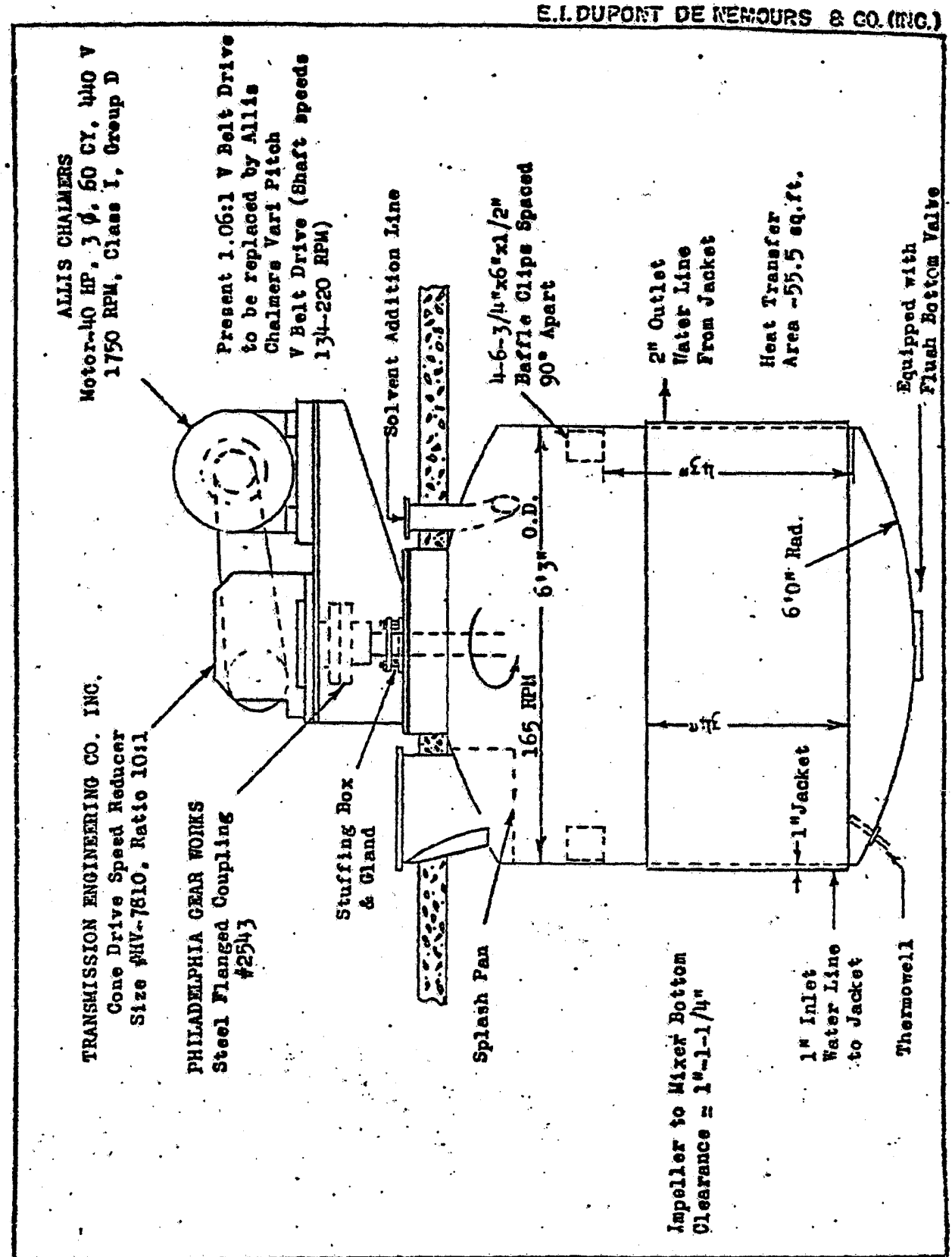

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SUBJECT: Installation Detail			PROJ. NO. J-34
DIVISION F & F	PLANT Parlin		NO. X 2502

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TYPICAL FORMULAS:

The formulas included on the following pages are typical of the products which offer the best utilization of the "49 Process".

Formulas shown are:

233-1538 Nitrocellulose Primer, Brown

233-1912 Nitrocellulose Primer Surfacer, Lt. Gray

253-Y-050 Nitrocellulose Tinting Lacquer, White

253-0222 Nitrocellulose Tinting Lacquer, Black

253-0312 Nitrocellulose Tinting Lacquer, Thio Fast Red

253-0505 Nitrocellulose Tinting Lacquer, Monastral® Blue

253-0630 Nitrocellulose Tinting Lacquer, Ferrite Yellow

253-0785 Nitrocellulose Tinting Lacquer, Monastral® Green

B-613 Nitrocellulose Base Lacquer

*NOTE: Where the code 3214 appears in a formula it represents the following solvent blend, (on a weight basis).

Petroleum Naphtha (88-142°C)	55.0
Toluene	45.0
	100.0

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