NATIONAL BUREAU OF STANDARDS REPORT

7062

on

Interlaboratory Intercomparisons

of

96-Inch T 12 Cool-White and White
Fluorescent Lamps

by

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Photometry and Colorimetry Section
Metrology Division

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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Interlaboratory Intercomparisons of 96-Inch T 12 Cool-White and White Fluorescent Lamps

ABSTRACT

Two groups of F96T12 lamps were measured by each of six laboratories. One group consists of six cool-white lamps and the other group consists of six white lamps. The line voltage was held constant at 625 volts across the lamp in series with a reactor having 1280 ohms impedance and 7 to 8 % power factor. The luminous flux, lamp current, lamp volts, and lamp watts were measured. The results of the measurements made by the individual laboratories and an analysis of the results are given in this report.

1. Introduction

This intercomparison was undertaken to determine the uniformity of measurements on 96-inch T 12 cool-white and white fluorescent lamps made at the participating laboratories. The laboratories participating and the order of reading are as follows:

I General Electric
II Sylvania
III Champion
IV Duro Test
V Westinghouse
VI Interlectric

The order in which the laboratories made their measurements was chosen to reduce shipment of the lamps as much as possible. Each laboratory followed its own customary procedure in making the measurements. Measurements in each laboratory were obtained while holding the line voltage at 625 volts. A reference ballast adjusted to 1280 ohms impedance and 7 to 8% power factor was used.

The lamps were damaged in shipment to the Electrical Testing Laboratories after the other six laboratories had measured them. Two of the lamps were completely shattered, two had phosphor removed from the lamp coating. When ETL measured the lamps that were still operative some had electrical characterics so different from previous measurements as to indicate internal damage. At the request of ETL their results are not used in this analysis.

II Results of Measurements.

The results are given in tables I through 10. The averages reported for each lamp and for each group of lamps at each laboratory are given. The difference between the averages for each group of lamps at each laboratory and the averages for each group of lamps at all the laboratories is also given in the tables.

III Analysis of the Results

An analysis of the results of the measurements has been made following a modification of the method described by W. J. Youden (1), (2) and (3). The modified method is described in in National Bureau of Standards Report No. 6605 "Interlaboratory Intercomparisons of 32-Watt T 12 Cool-White Circline Lamps" and No. 6698" Interlaboratory Intercomparisons of 40-Watt T 12 Cool-White Fluorescent Lamps". The analysis is shown on the following graphs. The points representing the measurements by an individual laboratory are designated by the first letter in the laboratory name. The point representing the average of all laboratories is designated by the letter A.

(1) Graphical Diagnosis of Interlaboratory Test Results; Industrial Quality Control Vol.XV No.11, May 1959.

(2) Product Specifications and Test Procedures; Industrial and Engineering Chemistry, Vol.50 page 914, October 1958.

(3) Circumstances Alter the Cases; Industrial and Engineering Chemistry, Vol. 50 page 77A, December 1958.

Table I.
96-Inch T 12 Cool-White Lamps
Lumens

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
CW 1	4615	4810	4516	4532	4609	4572	4609.0
CW 2	4913	5095	4756	4862	4887	4885	4899.7
CW 3	4646	4820	4512	4569	4627	4606	4630.0
CW 4	4701	4860	4560	4640	4698	4645	4684.0
CW 5	4985	5200	4836	4920	4969	4963	4978.8
CW 6	4683	4850	4540	4640	4660	4615	4664.7
Ave	4757.2	4939.2	4620.0	4693.8	4741.7	4714.3	4744.4
Δ	+ 12.8	+ 194.8	-124.4	- 50.6	- 2.7	- 30.1	
% Δ	+ .27%	+ 4.11%	- 2.62%	- 1.07%	- .06%	- .63%	

Table 2.
96-Inch T 12 White Lamps
Lumens

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
W 1	5152	5465	5048	5080	5231	5124	5183.3
W 2	5196	5475	5088	5138	5256	5137	5215.0
W 3	5218	5480	5132	5148	5288	5207	5245.5
W 4	5182	5460	5092	5143	5254	5165	5216.0
W 5	5245	5585	5120	5202	5318	5225	5282.5
W 6	5287	5585	5160	5231	5352	5263	5313.0
Ave	5213.3	5508.3	5106.7	5157.0	5283.2	5186.8	5242.6
Δ	- 29.3	+ 265.7	- 135.9	- 85.6	+ 40.6	- 55.8	
% Δ	- .56%	+ 5.07%	- 2.59%	- 1.63%	+ .77%	- 1.06%	

Table 3.
96-Inch T 12 Cool-White Lamps
Amperes

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
CW 1	.420	.419	.420	.421	.422	.421	.4205
CW 2	.427	.426	.425	.427	.427	.428	.4267
CW 3	.426	.425	.426	.427	.426	.429	.4265
CW 4	.427	.422	.423	.427	.425	.428	.4253
CW 5	.424	.420	.422	.425	.424	.425	.4233
CW 6	.425	.423	.423	.424	.424	.425	.4240
Ave	.4248	.4225	.4232	.4252	.4247	.4260	.4244
Δ	+ .0004	- .0019	- .0012	+ .0008	+ .0003	+.0016	
% Δ	+ .09%	- .45%	- .28%	+ .19%	+ .07%	+.38%	

Table 4.

96-Inch T 12 White Lamps

Amperes

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
W 1	.424	.421	.421	.424	.423	.423	.4227
W 2	.424	.420	.421	.423	.423	.423	.4223
W 3	.425	.422	.422	.425	.424	.425	.4238
W 4	.426	.424	.424	.427	.426	.428	.4258
W 5	.427	.424	.425	.427	.426	.427	.4260
W 6	.423	.425	.420	.423	.422	.421	.4223
Ave	.4248	.4227	.4222	.4248	.4240	.4245	.4238
Δ	+ .0010	- .0011	- .0016	+ .0010	+ .0002	+ .0007	
%Δ	+ .24%	- .26%	- .38%	+ .24%	+ .05%	+ .17%	

Table 5.

96-Inch T 12 Cool-White Lamps

Lamp Volts

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
CW 1	202.3	203	201.6	201.0	204	203	202.48
CW 2	193.5	194	192.2	192.0	195	195	193.62
CW 3	193.4	193	192.0	191.4	195	194	193.13
CW 4	193.7	194	194.0	193.7	197	196	194.73
CW 5	197.4	199	196.2	196.0	200	199	197.93
CW 6	197.7	198	196.2	195.4	200	199	197.72
Ave	196.33	196.83	195.37	194.92	198.50	197.67	196.60
Δ	- .27	+ .23	- 1.23	- 1.68	+ 1.90	+ 1.07	
%Δ	- .14%	+ .12%	- .63%	- .85%	+ .97%	+ .54%	

Table 6.

96-Inch T 12 White Lamps

Lamp Volts

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
W 1	198.4	204	198.0	198.6	200	201	200.00
W 2	198.0	201	197.4	197.2	200	200	198.93
W 3	196.4	199	196.4	196.0	198	200	197.63
W 4	193.6	197	192.2	192.3	195	196	194.35
W 5	193.0	196	192.0	192.0	195	197	194.17
W 6	200.1	203	200.0	199.6	201	203	201.12
Ave	196.58	200.00	196.00	195.95	198.17	199.50	197.70
Δ	- 1.12	+ 2.30	- 1.70	- 1.75	+ .47	+ 1.80	
%Δ	- .51%	+ 1.16%	.86%	- .89%	+ .24%	+ .91%	

Table 7.

96-Inch T 12 Cool-White Lamps
Lamp Watts

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
CW 1	75.8	77.0	75.7	76.5	76.9	75.5	76.23
CW 2	73.3	75.0	73.5	74.0	74.5	73.1	73.90
CW 3	73.4	74.5	73.3	73.8	75.0	72.7	73.78
CW 4	73.4	74.5	73.5	74.4	75.5	73.2	74.08
CW 5	75.0	76.0	74.5	75.0	76.4	74.1	75.17
CW 6	75.1	76.0	74.5	75.2	76.1	73.9	75.13
Ave	74.33	75.50	74.17	74.82	75.73	73.75	74.72
Δ	- .39	+ .78	- .55	+ .10	+ 1.01	- .97	
% Δ	- .52%	+ 1.04%	- .74%	+ .13%	+ 1.35%	- 1.30%	

Table 8.

96-Inch T 12 White Lamps
Lamp Watts

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
W 1	75.1	78.0	74.9	75.2	76.0	74.5	75.62
W 2	74.9	76.5	74.5	75.1	76.1	73.9	75.17
W 3	74.3	76.0	74.3	74.2	75.5	73.8	74.68
W 4	73.3	75.5	72.9	73.4	74.1	72.6	73.63
W 5	73.2	75.5	72.9	73.2	74.8	72.8	73.73
W 6	75.3	77.5	75.1	75.4	76.6	75.0	75.82
Ave	74.35	76.50	74.10	74.42	75.52	73.77	74.78
Δ	- .43	+ 1.72	- .68	- .36	+ .74	- 1.01	
% Δ	- .58%	+ 2.30%	- .91%	- .48%	+ .99%	- 1.35%	

Table 9.

96-Inch T 12 Cool White Lamps
Lumens per Watt

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
CW 1	60.9	62.5	59.7	59.2	59.9	60.6	60.47
CW 2	67.0	67.9	64.7	65.7	65.6	66.8	66.28
CW 3	63.3	64.7	61.6	61.9	61.7	63.4	62.77
CW 4	64.0	65.2	62.0	62.3	62.2	63.5	63.20
CW 5	66.5	68.4	64.9	65.6	65.0	67.0	66.23
CW 6	62.2	63.8	60.9	61.7	61.2	62.4	62.03
Ave	63.98	65.42	62.30	62.73	62.60	63.95	63.50
Δ	+ .48	+ 1.92	- 1.20	- .77	- .90	+ .45	
% Δ	+ .76%	+ 3.02%	- 1.89%	- 1.21%	- 1.42%	+ .71%	

Table 10.

96-Inch T 12 White Lamps
Lumens per Watt

Lamp No.	G.E.	Syl	Champ	Duro T	West	Interl	Ave
W 1	68.6	70.1	67.4	67.5	68.8	68.8	68.53
W 2	69.4	71.6	68.3	68.4	69.1	69.5	69.38
W 3	70.2	72.1	69.1	69.4	70.0	70.6	70.23
W 4	70.7	72.3	69.8	70.1	70.9	71.1	70.82
W 5	71.7	74.0	70.2	71.1	71.1	71.8	71.65
W 6	70.2	72.1	68.7	69.3	69.9	70.2	70.07
Ave	70.13	72.03	68.92	69.30	69.97	70.33	70.11
Δ	+ .02	+ 1.92	- 1.19	- .81	- .14	+ .22	
%Δ	+ .03%	+ 2.74%	- 1.70%	- 1.16%	- .20%	+ .31%	

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Figure 1

Lumens

F96T12/Cool White Lamps

Figure 2

Lumens

F96T12/White Lamps

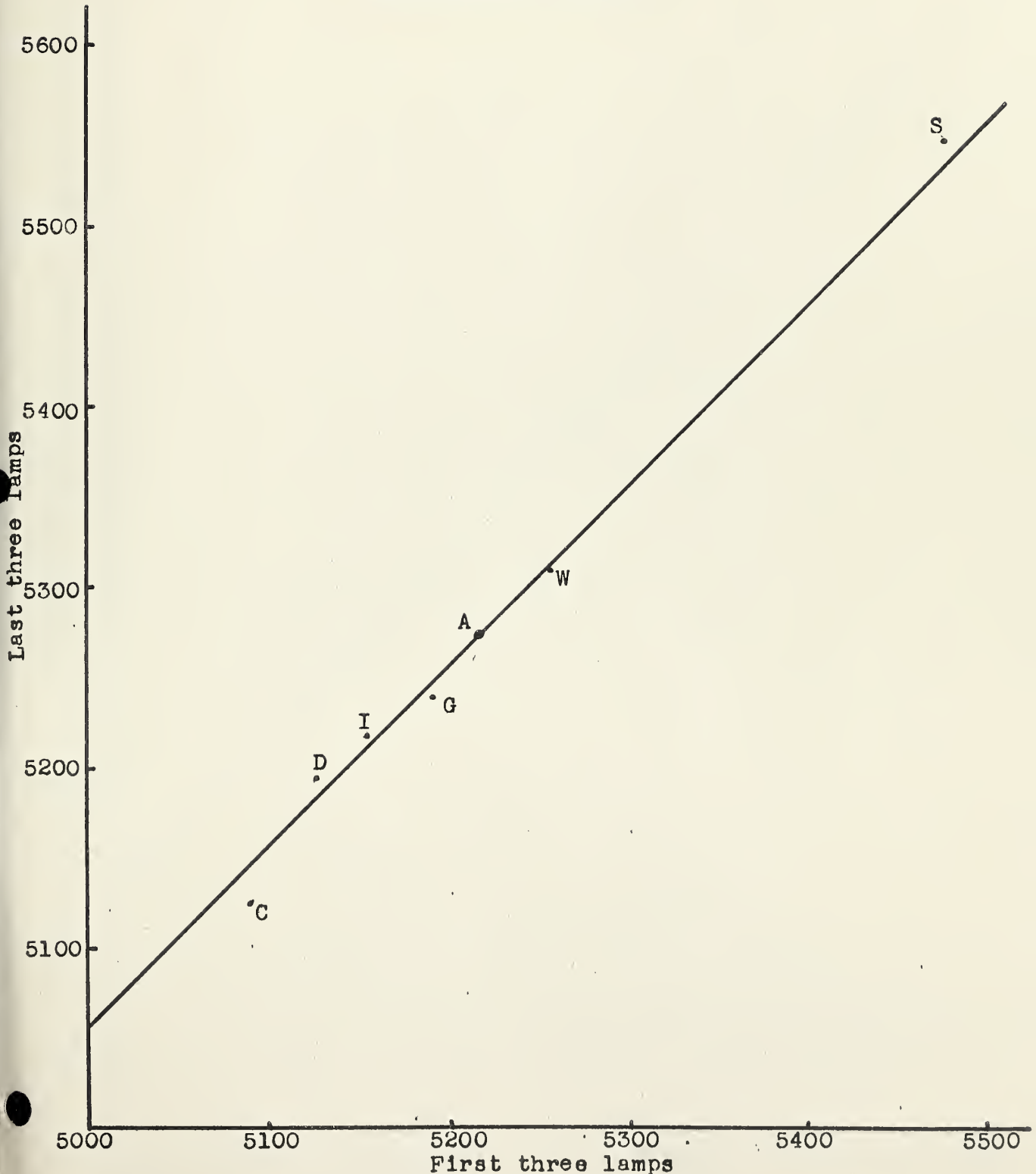


Figure 3

Amperes

F96T12/Cool White Lamps

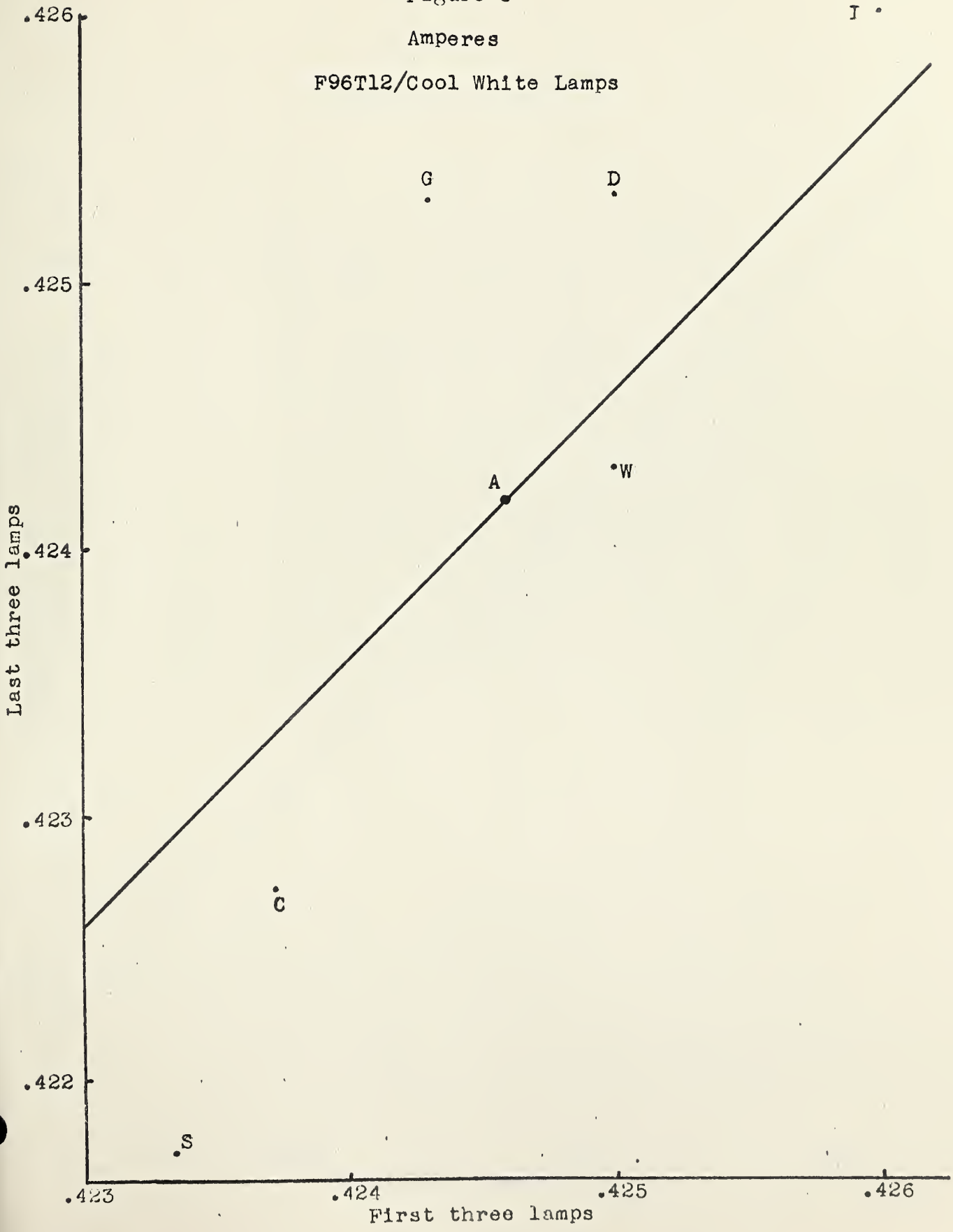


Figure 4

Amperes

F96T12/White Lamps

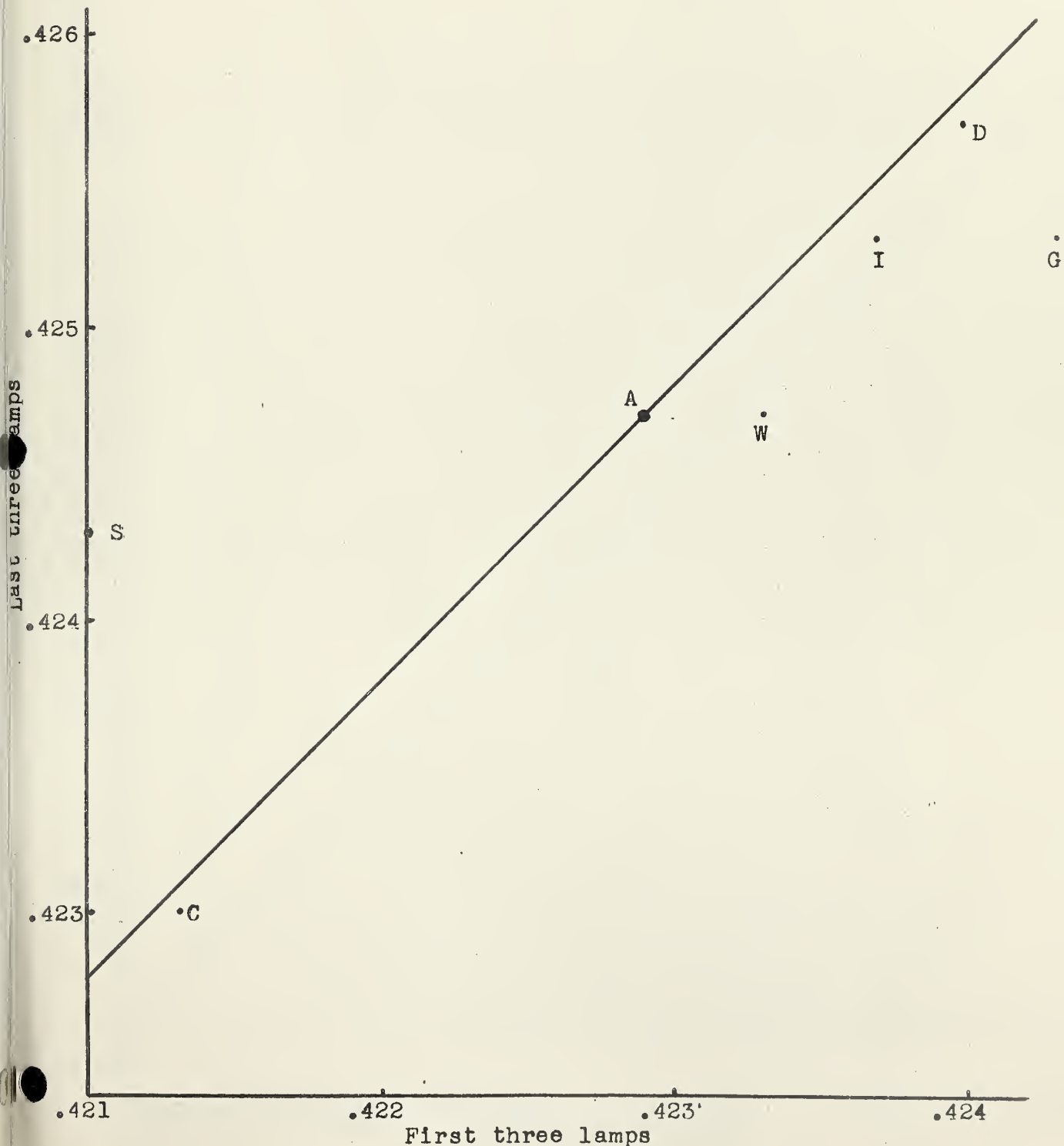


Figure 5

Volts

F96T12/Cool White Lamps

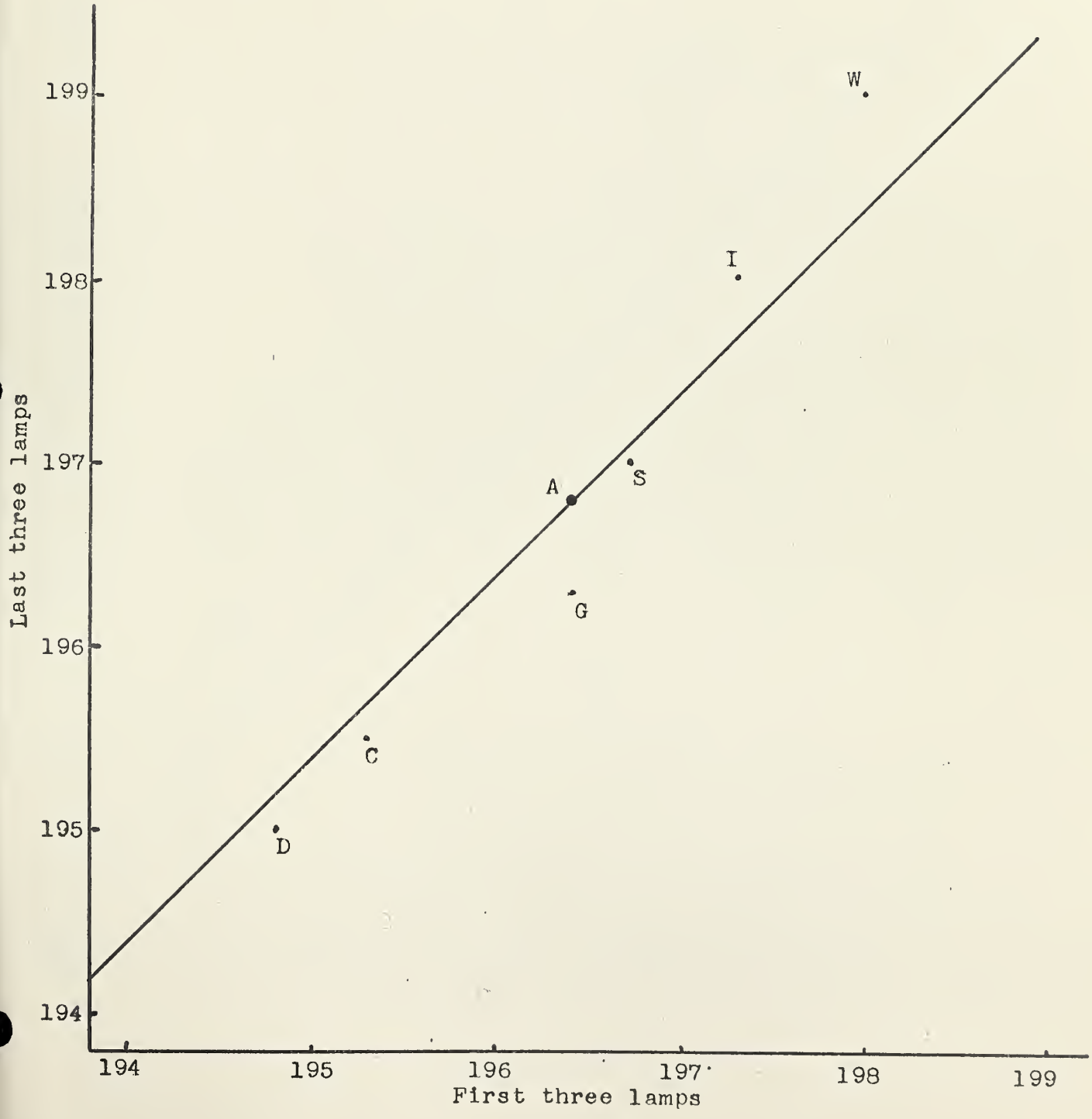


Figure 6

Volts

F96T12/White Lamps

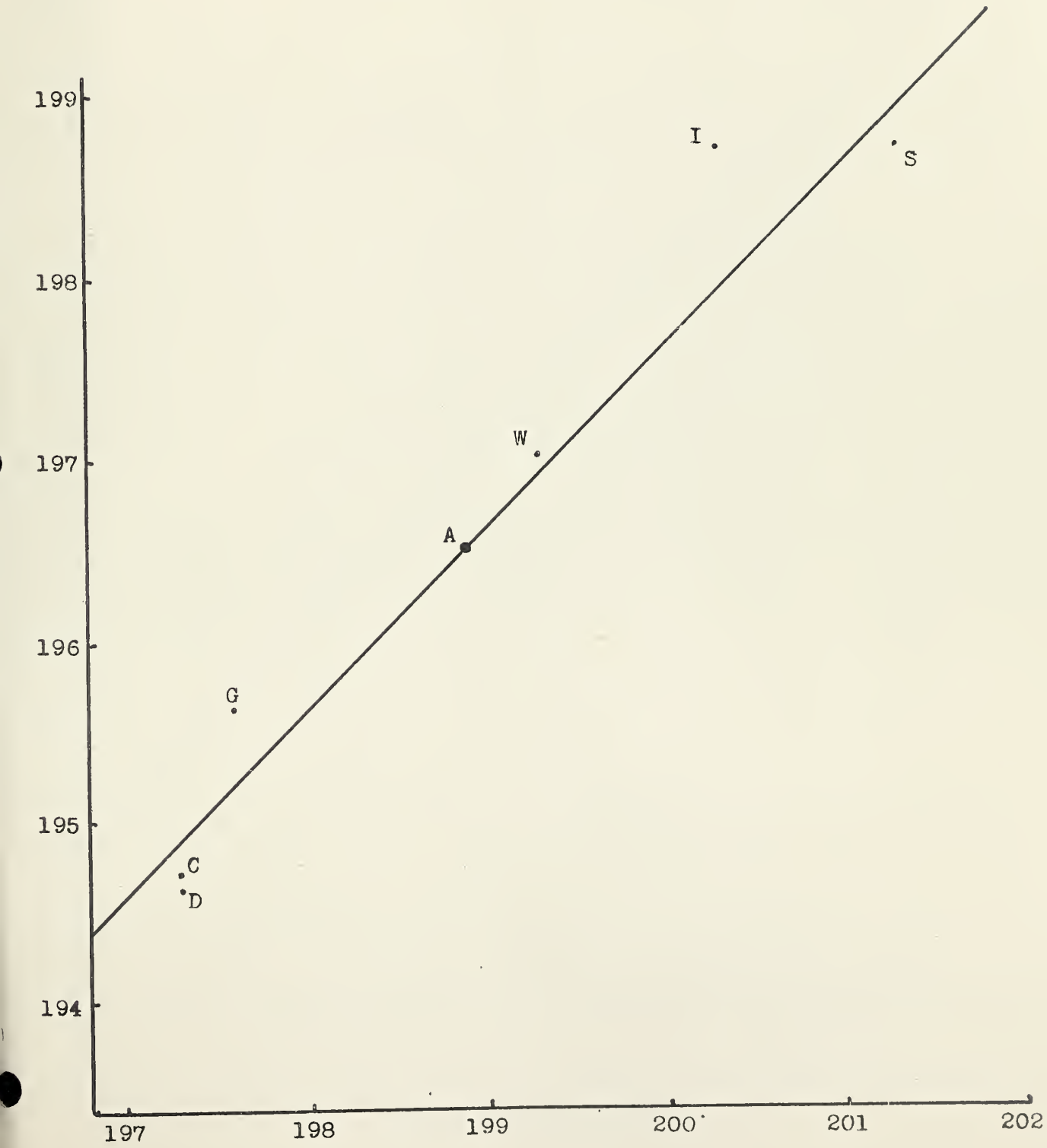


Figure 7

Watts

F96T12/Cool White Lamps

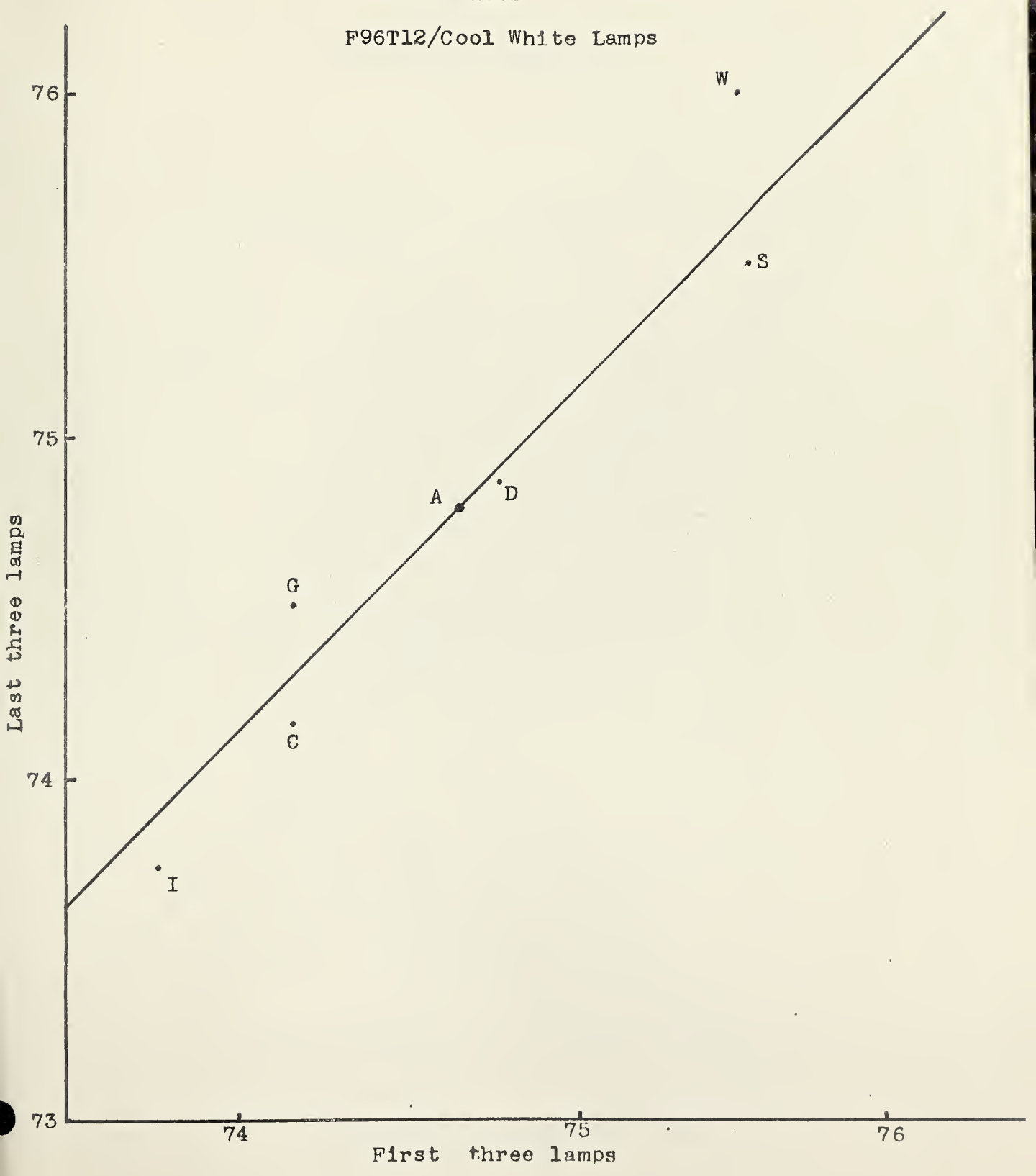


Figure 8

Watts

F96T12/White Lamps

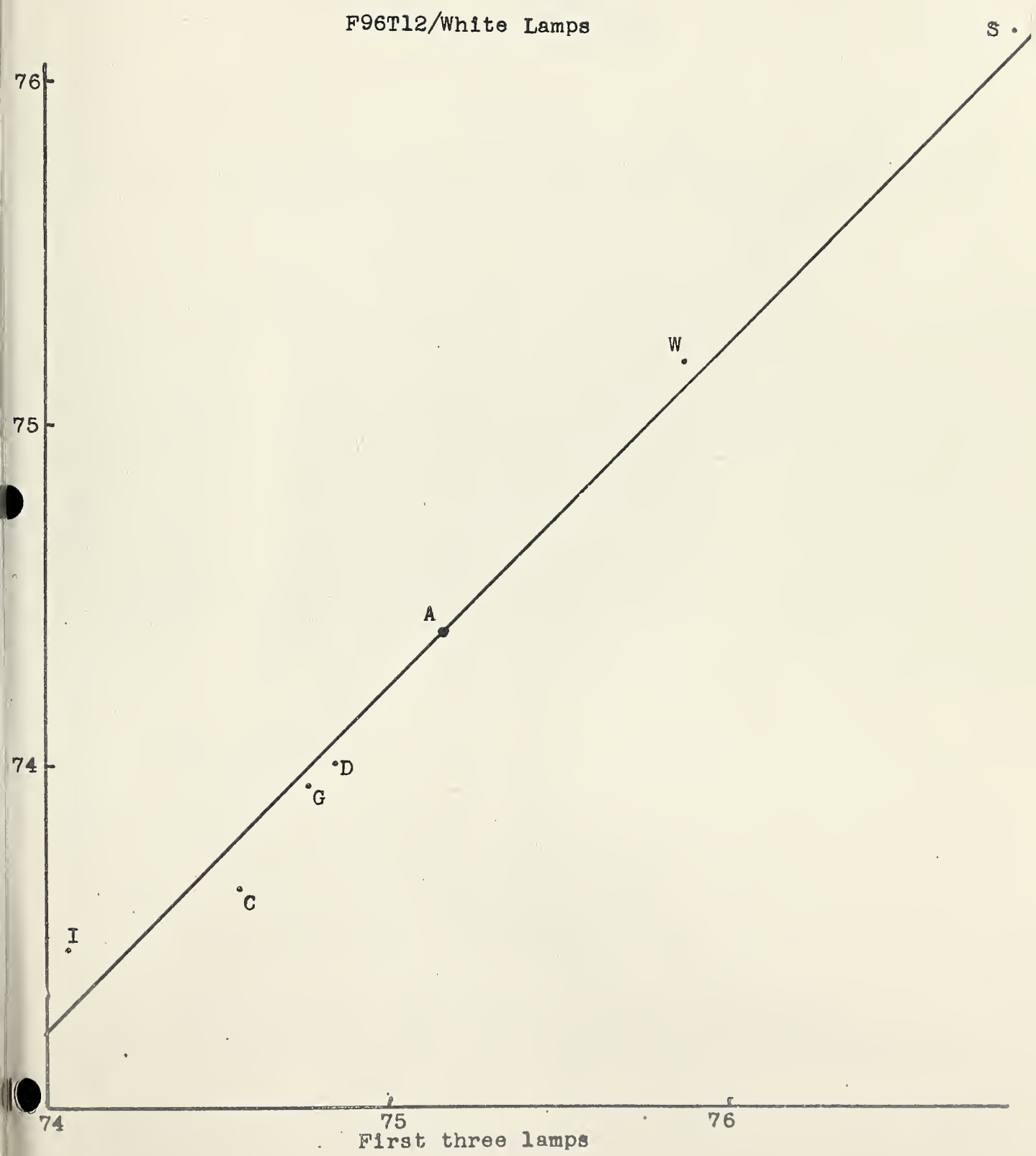


Figure 9

Lumens per Watt

F96T12/Cool White Lamps

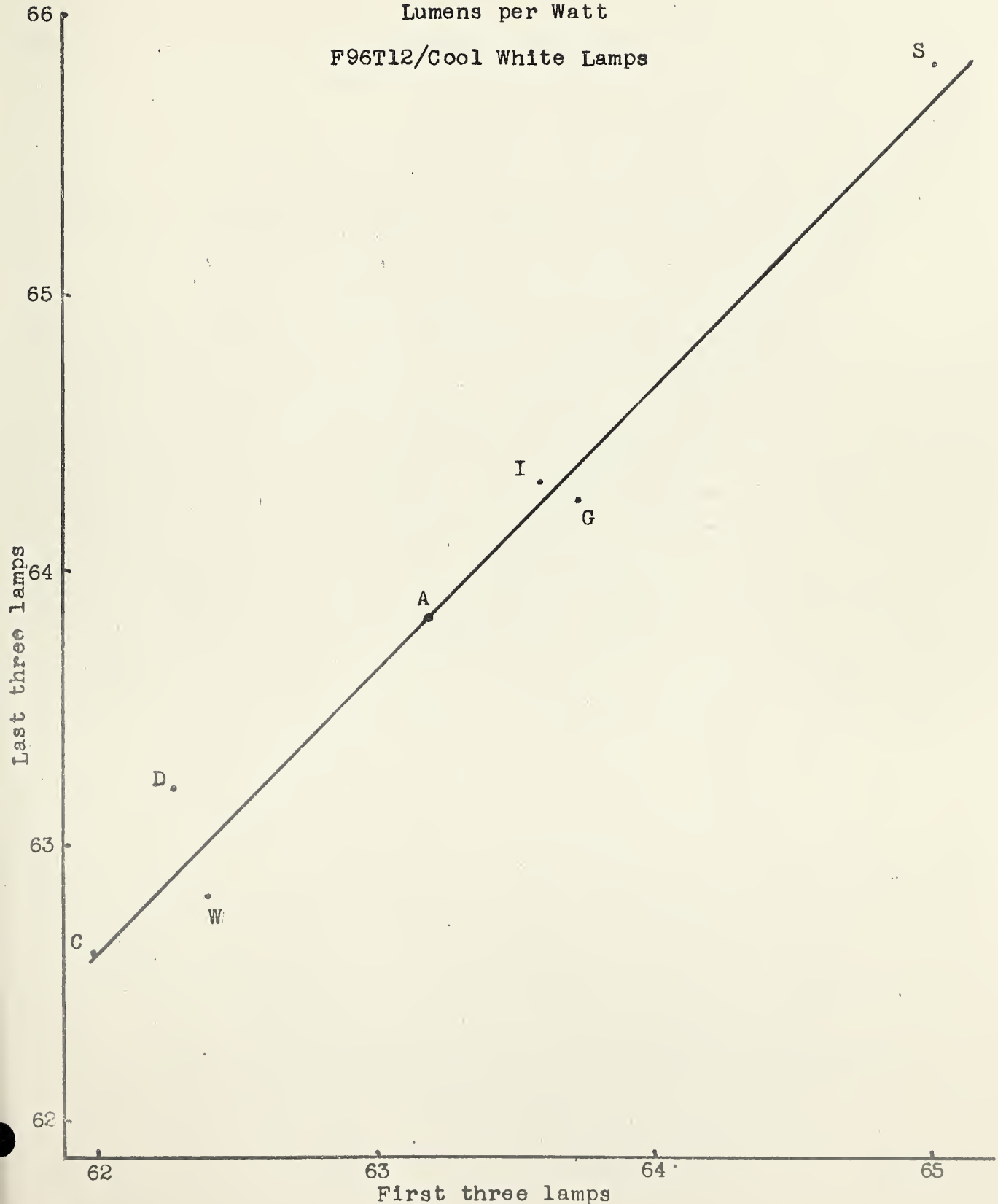
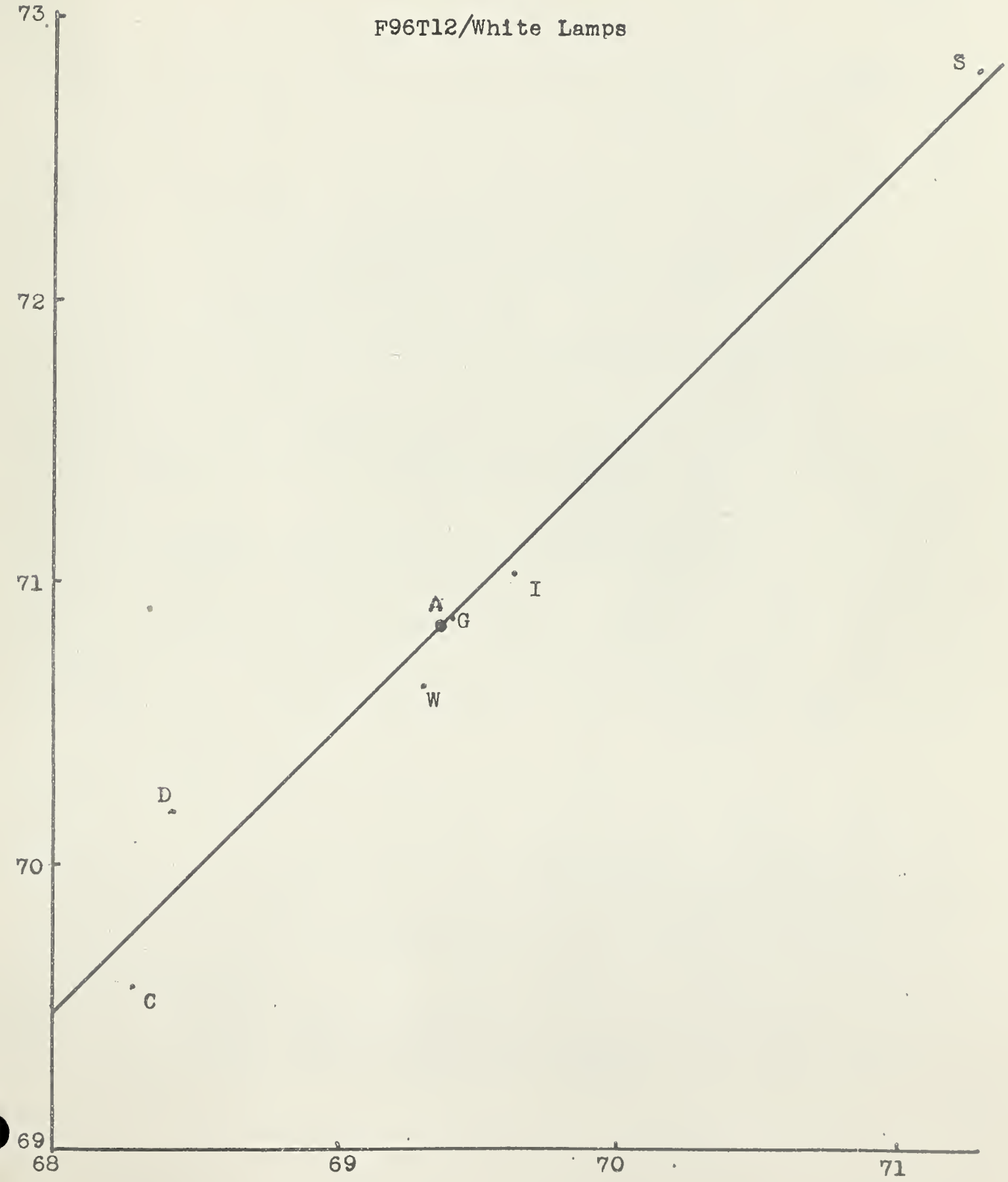


Figure 10

Lumens per Watt

F96T12/White Lamps



U.S. DEPARTMENT OF COMMERCE
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THE NATIONAL BUREAU OF STANDARDS

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HEAT. Temperature Physics. Heat Measurements. Cryogenic Physics. Rheology. Molecular Kinetics. Free Radicals Research. Equation of State. Statistical Physics. Molecular Spectroscopy.

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CHEMISTRY. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

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INSTRUMENTATION. Engineering Electronics. Electron Devices. Electronic Instrumentation. Mechanical Instruments. Basic Instrumentation.

Office of Weights and Measures.

BOULDER, COLO.

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IONOSPHERE RESEARCH AND PROPAGATION. Low Frequency and Very Low Frequency Research. Ionosphere Research. Prediction Services. Sun-Earth Relationships. Field Engineering. Radio Warning Services.

RADIO PROPAGATION ENGINEERING. Data Reduction Instrumentation. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Propagation-Terrain Effects. Radio-Meteorology. Lower Atmosphere Physics.

RADIO STANDARDS. High frequency Electrical Standards. Radio Broadcast Service. Radio and Microwave Materials. Atomic Frequency and Time Standards. Electronic Calibration Center. Millimeter-Wave Research. Microwave Circuit Standards.

RADIO SYSTEMS. High Frequency and Very High Frequency Research. Modulation Research. Antenna Research. Navigation Systems. Space Telecommunications.

UPPER ATMOSPHERE AND SPACE PHYSICS. Upper Atmosphere and Plasma Physics. Ionosphere and Exosphere Scatter. Airglow and Aurora. Ionospheric Radio Astronomy.


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