

# NATIONAL BUREAU OF STANDARDS REPORT

8989

on  
Interlaboratory Intercomparison  
of  
100-Watt Incandescent Lamps

by  
Velma I. Burns  
Photometry and Colorimetry Section  
Metrology Division



U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS

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NBS PROJECT

2120113

October 15, 1965

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U. S. DEPARTMENT OF COMMERCE  
NATIONAL BUREAU OF STANDARDS



Interlaboratory Intercomparison  
of  
100-Watt Incandescent Lamps

ABSTRACT

A group of twelve 100-watt incandescent lamps was measured by each of nine laboratories. The voltage across each lamp was held at 120.0 volts while the luminous flux and current were measured. The results of the measurements made by the individual laboratories and an analysis of the results are given in this report.

INTRODUCTION

This intercomparison was undertaken to determine the uniformity of measurements on 100-watt incandescent lamps made at the participating laboratories. The laboratories participating and the order of reading are as follows:

1. Duro Test
2. Westinghouse
3. Electrical Testing Laboratories
4. General Electric
5. Verd-A-Ray
6. Sylvania
7. Champion
8. El Tronics
9. National Bureau of Standards
10. Duro Test

Duro Test measured the lamps first and again at the end of the intercomparison. Both sets of measurements are reported here.

Each laboratory followed its own customary procedure in making the measurements. In each laboratory the voltage across each lamp was held constant at 120.0 volts while readings of luminous flux and current were taken.

RESULTS OF THE MEASUREMENTS

The results are reported in tables 1 through 4. The averages reported for each lamp and for each laboratory are also given. The difference,  $\Delta$ , between the average for each laboratory and the average for all the laboratories for all the lamps is also given in the tables.



## ANALYSIS OF 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 modification is described in National Bureau of Standards Report No. 6605, Interlaboratory Intercomparisons of 32-watt T12 Cool-White Circline Lamps, and Report No. 6698, Interlaboratory Intercomparisons of 40-watt T12 Cool-White Fluorescent Lamps. The analysis is shown on the following graphs. The point representing the measurements of an individual laboratory is designated by the first or the first and second letters in the name of the laboratory. The point representing the average of all the 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 Specification and Test Procedures, Industrial and Engineering Chemistry, Vol. 50, page 914, October 1958.
- (3) Circumstances Alter Cases, Industrial and Engineering Chemistry, Vol. 50, page 77A, December 1958.





Table 1.

## Lumens

Lamp No.	Duro T 1964	West.	ETL	GE	VAR	Sy1	Champ	E1 T	NBS	Duro T 1965	Average
ET - 1	1228	1237	1222	1244	1232	1234	1230	1241	1218	1210	1230
ET - 2	1218	1240	1235	1243	1243	1224	1240	1248	1207	1220	1232
ET - 3	1248	1264	1240	1265	1263	1259	1255	1268	1244	1245	1255
ET - 4	1234	1246	1227	1245	1235	1230	1230	1239	1228	1219	1233
ET - 5	1245	1260	1241	1262	1253	1250	1238	1254	1238	1234	1248
ET - 6	1246	1251	1235	1248	1254	1236	1238	1249	1230	1223	1241
ET - 7	1230	1241	1222	1243	1232	1232	1231	1239	1232	1218	1232
ET - 8	1247	1248	1237	1256	1251	1241	1247	1263	1248	1233	1247
ET - 9	1247	1255	1240	1263	1252	1247	1246	1256	1239	1240	1248
ET -10	1232	1246	1227	1245	1237	1228	1234	1239	1232	1219	1234
ET -11	1250	1246	1224	1247	1248	1240	1248	1251	1229	1230	1241
ET -12	1261	1260	1251	1262	1255	1247	1260	1249	1241	1230	1252
Ave	1241	1250	1233	1252	1246	1239	1241	1250	1232	1227	1241
Δ	0	+ 9	- 8	+ 11	+ 5	- 2	0	+ 9	- 9	- 14	
%Δ	0	.73	.64	.89	.40	.16	0	.73	.73	1.13	



Table 2.

Amperes

Lamp No.	Duro T 1964	West.	ETL	GE	VAR	Syl	Champ	EI T	NBS	Duro T 1965	Ave
ET - 1	.821	.822	.820	.8226	.821	.821	.821	.8215	.8203	.821	.8211
ET - 2	.822	.824	.824	.8242	.823	.822	.824	.8236	.8206	.822	.8229
ET - 3	.830	.832	.829	.8313	.831	.832	.831	.8317	.8308	.832	.8311
ET - 4	.820	.820	.818	.8189	.820	.818	.819	.8179	.8184	.819	.8189
ET - 5	.827	.828	.825	.8268	.828	.826	.825	.8256	.8254	.824	.8261
ET - 6	.823	.825	.822	.8233	.822	.821	.824	.8223	.8225	.823	.8228
ET - 7	.829	.829	.826	.8281	.829	.827	.828	.8274	.8285	.829	.8281
ET - 8	.828	.828	.826	.8280	.828	.826	.828	.8282	.8286	.829	.8278
ET - 9	.822	.824	.822	.8236	.822	.822	.823	.8220	.8220	.822	.8225
ET - 10	.821	.822	.820	.8207	.821	.819	.822	.8197	.8215	.822	.8209
ET - 11	.828	.829	.825	.8273	.828	.826	.829	.8275	.8268	.828	.8275
ET - 12	.829	.828	.827	.8275	.829	.827	.829	.8259	.8263	.826	.8275
Ave	.8250	.8259	.8237	.8252	.8252	.8239	.8252	.8244	.8243	.8248	.8248
$\Delta$	+0.0002	+0.0011	-0.0011	+0.0004	+0.0004	-0.0009	+0.0004	-0.0004	-0.0005	.0000	
% $\Delta$	.02	.13	.13	.05	.05	.11	.05	.05	.06	0	



Table 3.

Watts

Lamp No.	Duro T 1964	West.	ETL	GE	VAR	Sy1	Champ	El T	NBS	Duro T 1965	Ave
ET - 1	98.5	98.6	98.4	98.7	98.5	98.5	98.5	98.58	98.44	98.5	98.52
ET - 2	98.6	98.9	98.9	98.9	98.8	98.6	98.9	98.84	98.47	98.6	98.75
ET - 3	99.6	99.8	99.5	99.8	99.7	99.8	99.7	99.80	99.70	99.8	99.72
ET - 4	98.4	98.4	98.2	98.3	98.4	98.2	98.3	98.15	98.21	98.3	98.29
ET - 5	99.2	99.4	99.0	99.2	99.4	99.1	99.0	99.07	99.05	98.9	99.13
ET - 6	98.8	99.0	98.6	98.8	98.6	98.5	98.9	98.67	98.70	98.8	98.74
ET - 7	99.5	99.5	99.1	99.4	99.5	99.2	99.4	99.28	99.42	99.5	99.38
ET - 8	99.4	99.4	99.1	99.4	99.4	99.1	99.4	99.38	99.43	99.5	99.35
ET - 9	98.6	98.9	98.6	98.8	98.6	98.6	98.8	98.64	98.64	98.6	98.68
ET - 10	98.5	98.6	98.4	98.5	98.5	98.3	98.7	98.36	98.58	98.6	98.50
ET - 11	99.4	99.5	99.0	99.3	99.4	99.1	99.5	99.24	99.22	99.4	99.31
ET - 12	99.5	99.4	99.2	99.3	99.5	99.2	99.5	99.11	99.16	99.1	99.30
Ave	99.00	99.12	98.83	99.03	99.02	98.85	99.05	98.93	98.92	98.97	98.97
Δ	+ .03	+ .15	- .14	+ .06	+ .05	- .12	+ .08	- .04	- .05	.00	
%Δ	.03	.15	.14	.06	.05	.12	.08	.04	.05	0	



Table 4.

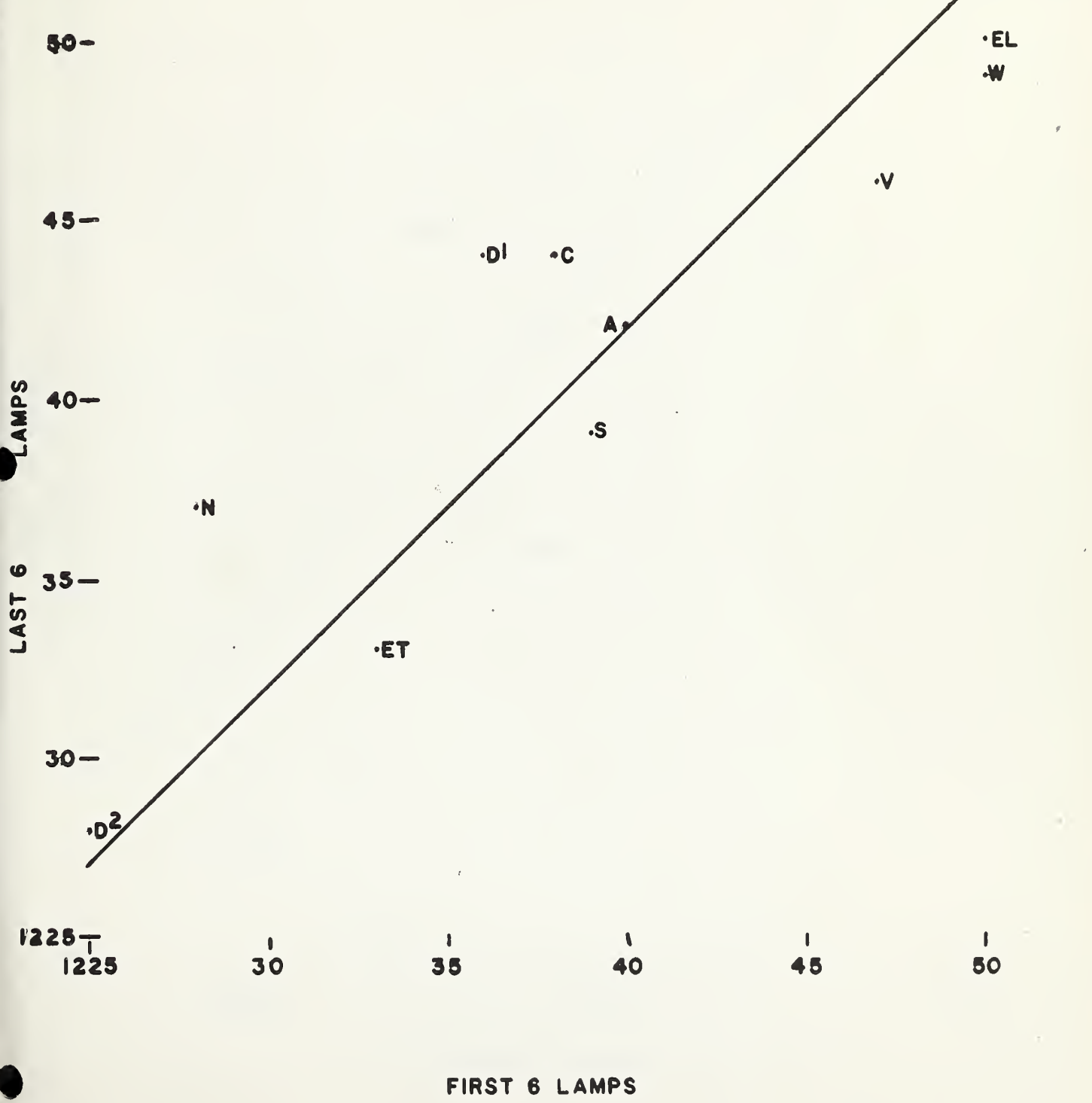
Lumens per Watt

Lamp No.	Duro T 1964	West.	ETL	GE	VAR	Syl	Champ	E1 T	NBS	Duro T 1965	Ave
ET - 1	12.47	12.55	12.42	12.60	12.51	12.53	12.50	12.59	12.37	12.28	12.48
ET - 2	12.35	12.54	12.49	12.57	12.58	12.41	12.55	12.63	12.26	12.37	12.48
ET - 3	12.53	12.67	12.46	12.68	12.67	12.62	12.59	12.71	12.48	12.47	12.59
ET - 4	12.54	12.66	12.49	12.67	12.56	12.53	12.51	12.62	12.50	12.40	12.55
ET - 5	12.55	12.68	12.54	12.72	12.60	12.61	12.50	12.65	12.50	12.49	12.58
ET - 6	12.61	12.64	12.53	12.63	12.69	12.55	12.51	12.66	12.46	12.38	12.57
ET - 7	12.36	12.47	12.33	12.51	12.38	12.42	12.40	12.48	12.39	12.24	12.40
ET - 8	12.55	12.56	12.48	12.64	12.58	12.52	12.53	12.71	12.55	12.39	12.55
ET - 9	12.65	12.69	12.58	12.78	12.69	12.65	12.60	12.74	12.56	12.57	12.65
ET - 10	12.51	12.64	12.47	12.64	12.56	12.49	12.50	12.59	12.50	12.36	12.53
ET - 11	12.58	12.52	12.36	12.56	12.55	12.51	12.52	12.60	12.39	12.37	12.50
ET - 12	12.67	12.68	12.61	12.71	12.62	12.57	12.68	12.60	12.52	12.42	12.61
Ave	12.53	12.61	12.48	12.64	12.58	12.53	12.53	12.63	12.46	12.40	12.54
Δ	- .01	+ .07	+ .06	+ .10	+ .04	- .01	+ .01	+ .09	- .08	- .14	
%Δ	.08	.56	.48	.80	.32	.08	.08	.72	.64	1.12	





FIGURE - I  
LUMENS





B27-

FIGURE - 2  
AMPERES

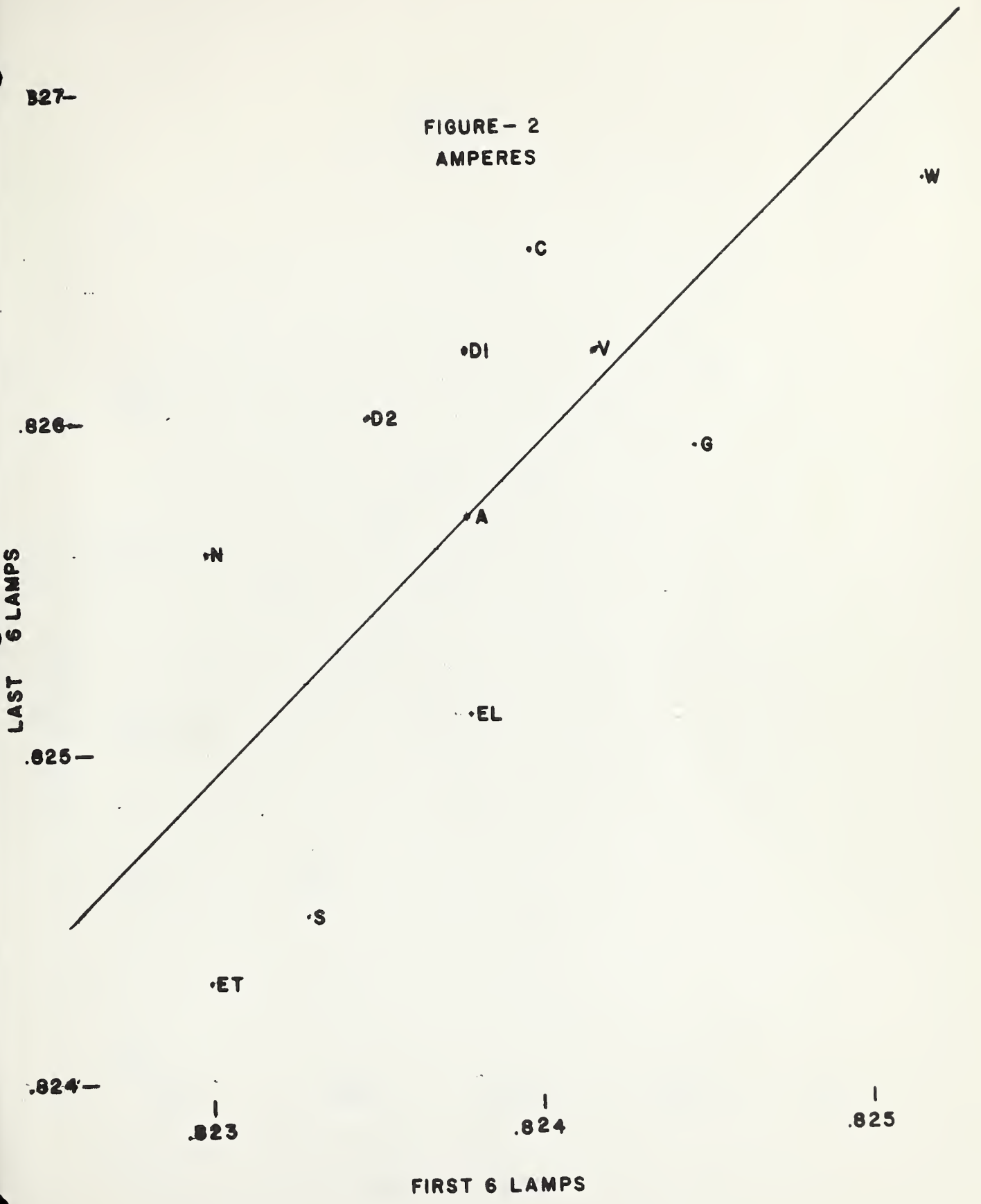
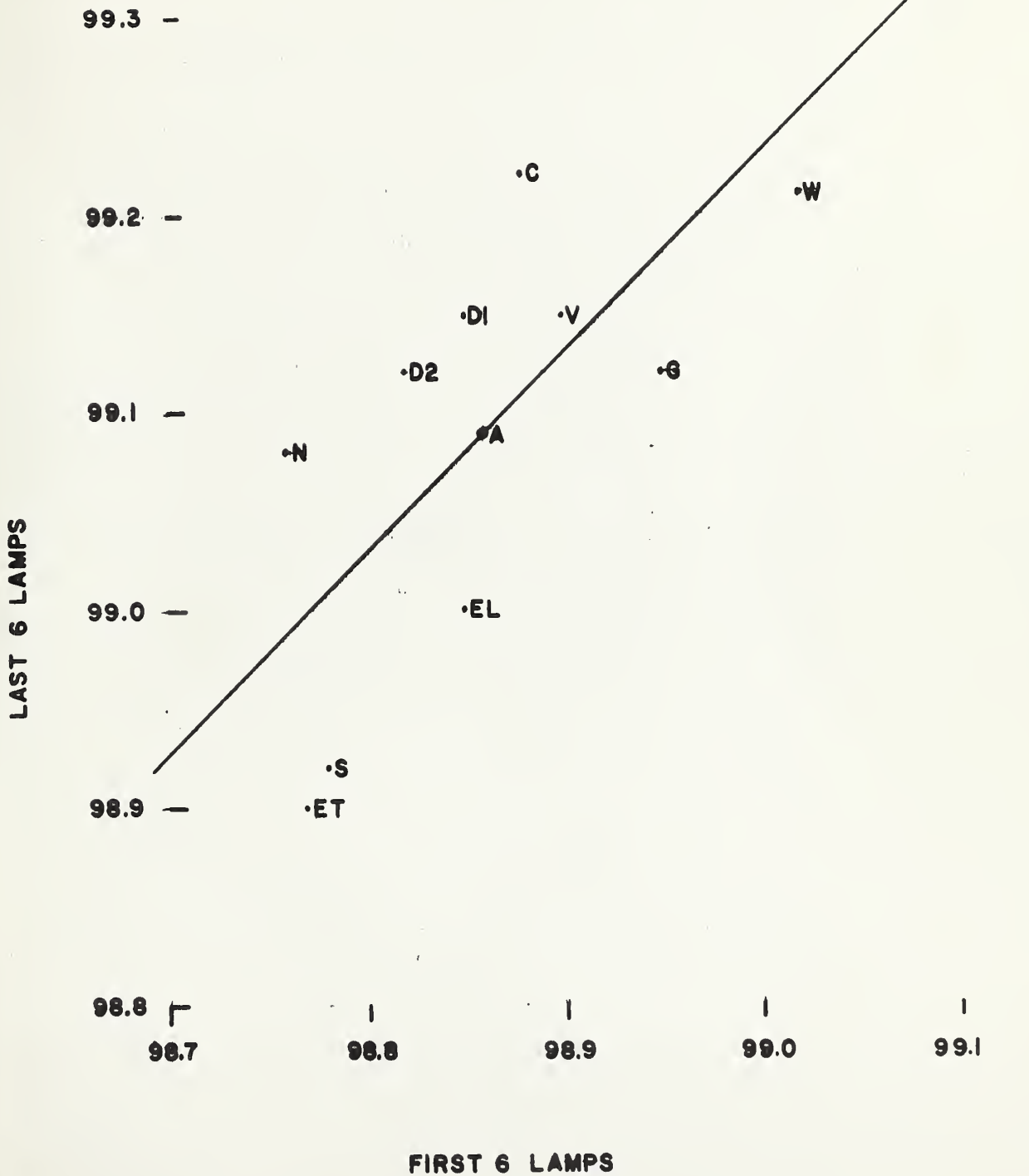




FIGURE-3  
WATTS



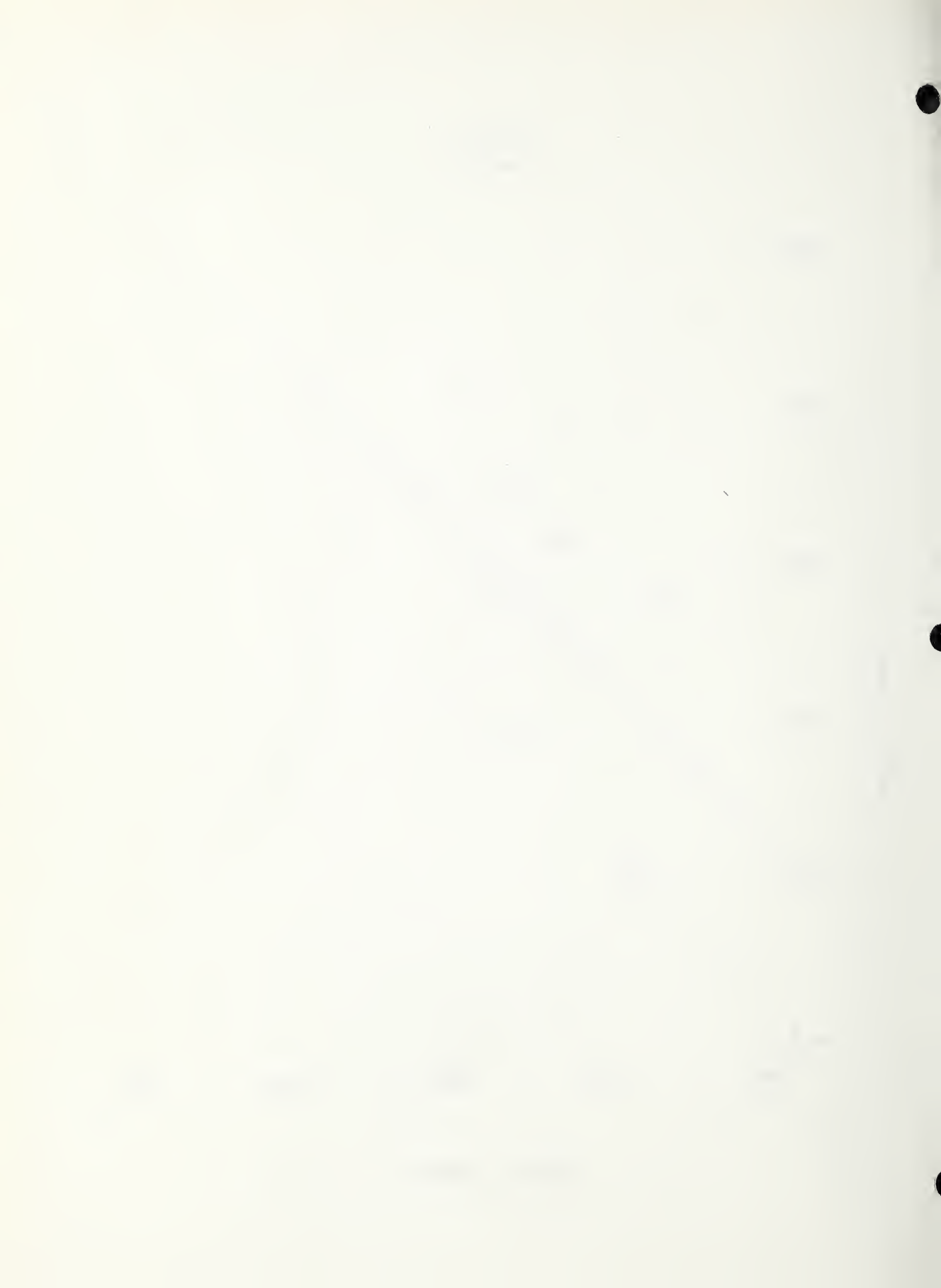


FIGURE - 4  
LUMENS PER WATT

