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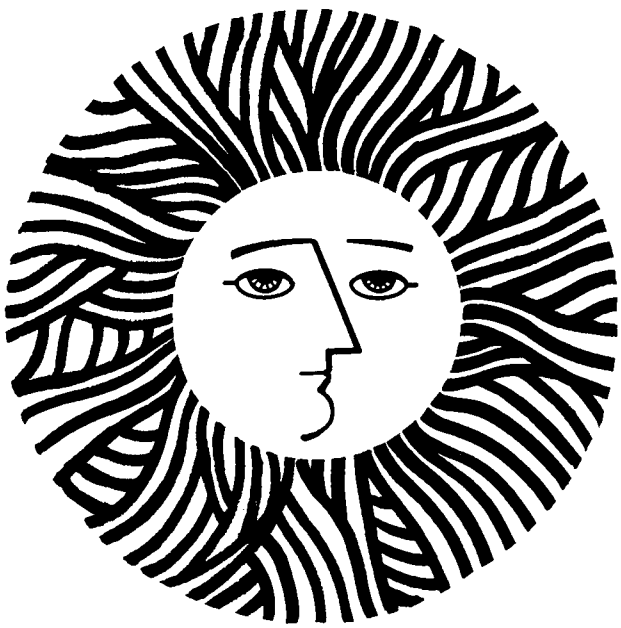

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LAWRENCE BERKELEY LABORATORY
Room: 150 Bldg.: 46 Ext.: 5571

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MEMORANDUM

DATE: July 7, 1982

TO: Lighting Systems Research Group

FROM: Greg Ward

RE: Life Testing on Duro-Test Lamps

Introduction

This memorandum describes the electrical, photometric and chromatic performance of the Duro-Test incandescent lamps after 520 hours of burning time. Initial performance of these lamps was described in a previous memorandum dated May 4, 1982.

Test Procedure

Before taking any measurements, each lamp was placed in the integrating sphere base up and burned at 115 VAC for 20 minutes. The sphere was then closed, and photometric and electrical data were taken. In accordance with the manufacturer's recomendations, lamps were operated and tested at 115 VAC rather than 120 VAC.

Spectral power distributions were measured with the specroradiometer.

Color temperature and color-rendering indices were computed from the spectral power distribution data.

Luminous flux values were calculated using an NBS-calibrated incandescent lamp as the transfer standard.

The equipment used for all measurements is listed below:

Equipment	Parameter Measured
Clarke-Hess 255 watt-meter	Power, input voltage, current
Tektronix J-16 photometer	Luminous flux
EG&G Electro-Optics 555 spectroradiometer	Spectral power distribution

Test Results

Major test results are shown in Table 1. Initial lamp performance data (from previous memorandum) is included in this table to show the relative change in lamp performance over time. Also, the average value for each measured parameter is calculated with the standard deviation of the sample. The percent change in light output and efficacy are given for each lamp in columns 10 and 13, respectively.

It should be noted that lamp #479 burned out after 280 hours of operation and could not be included in the measurements taken at 520 hours. The averages taken to make graphs 1, 2, and 4 did not include lamp #479 but the initial averages given in Table 1 did.

The most significant result in the life test measurements is the unusually rapid decline in light output. The average loss in output after 520 hours (roughly 1/5 of the total rated life) was 24%. Two lamps (#497 & #486) had lost near forty percent of their initial luminous flux. These results were not expected because the average decrease in output at the equivalent point in the life of a standard incandescent is about 8%, and there is no obvious reason why light output would decline so much faster in this design.

Discussion

To a large degree, the depreciation in light output appears to be caused by the deposition of tungsten on the bulb wall, as in most incandescent designs. However, bulbs #497 and #486 showed signs of deterioration in the reflective coating which has assumed a brownish clouded appearance. Also, leakage in the seals of the bulbs could be causing oxidation of the filament and the early burnout of #479 and since then #460 and #476.

Although these measurements are not conclusive, they do suggest that further tests should be made on the envelope seal under operating conditions and the stability of the reflective coating.

Acknowledgement

This work was supported by the Assistant Secretary for Conservation and Renewable Energy, Office of Building Energy Research and Development, Building Equipment Division of the U.S. Department of Energy under Contract No. DE-AC03-76SF00098.

TABLE 1

Lamp #	Input Power (watts)		Current (milliamps)		Power Factor (%)		Luminous Flux (lumens)		Change in Output (%)	Efficacy (lumens/watt)		Change in Efficacy (%)	Color Temperature (°K)		C.R.I. (%)	
	Initial	520 hr	Initial	520 hr	Initial	520 hr	Initial	520 hr		Initial	520 hr		Initial	520 hr	Initial	520 hr
442	55.5	54.2	677.4	679.0	71.2	69.4	1600	1228	-23	28.8	22.7	-21	2965	2949	90.8	90.6
441	53.4	54.9	654.5	672.0	70.9	71.0	1493	1186	-21	28.0	21.6	-23	2938	2805	90.9	93.7
497	54.7	55.4	668.1	695.0	71.2	69.3	1637	987	-40	30.0	17.8	-41	3026	2826	87.4	89.2
486	53.2	55.7	638.0	682.0	72.5	71.0	1543	956	-38	29.0	17.2	-41	2881	2807	90.1	91.0
479*	52.8	----	672.0	-----	68.3	----	1668	----	---	31.6	----	---	2941	----	86.9	----
460	53.4	54.3	654.0	670.0	71.0	70.5	1498	1245	-17	28.1	22.9	-19	2911	2822	89.5	91.8
438	54.0	54.4	662.0	667.0	70.9	70.9	1522	1233	-19	28.2	22.7	-20	2976	2973	88.7	87.6
450	53.1	54.9	643.0	676.0	71.8	70.6	1471	1212	-18	27.7	22.1	-20	2908	2829	90.2	92.3
476	53.9	54.0	660.0	666.0	71.0	70.5	1529	1220	-20	28.4	22.6	-20	2893	2951	87.7	86.0
Average	53.8	54.7	658.8	676.0	71.0	70.4	1551	1158	-24	28.9	21.2	-26	2938	2870	89.1	90.3
Standard Deviation	0.9	0.6	12.95	9.6	1.13	0.7	68.4	117	9.1	1.23	2.3	9.6	45.9	73.0	1.51	2.6

*Burned out @280 hrs.

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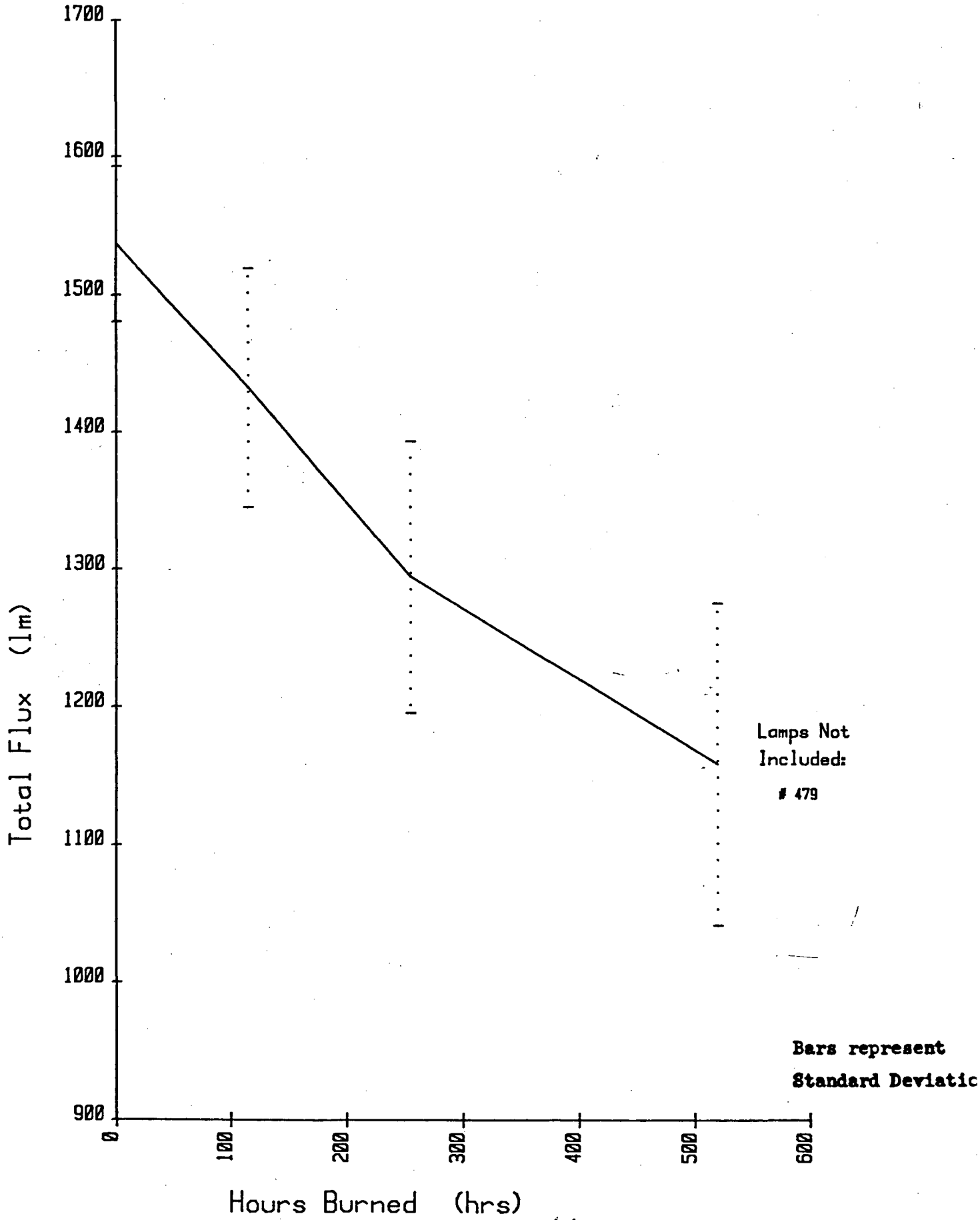
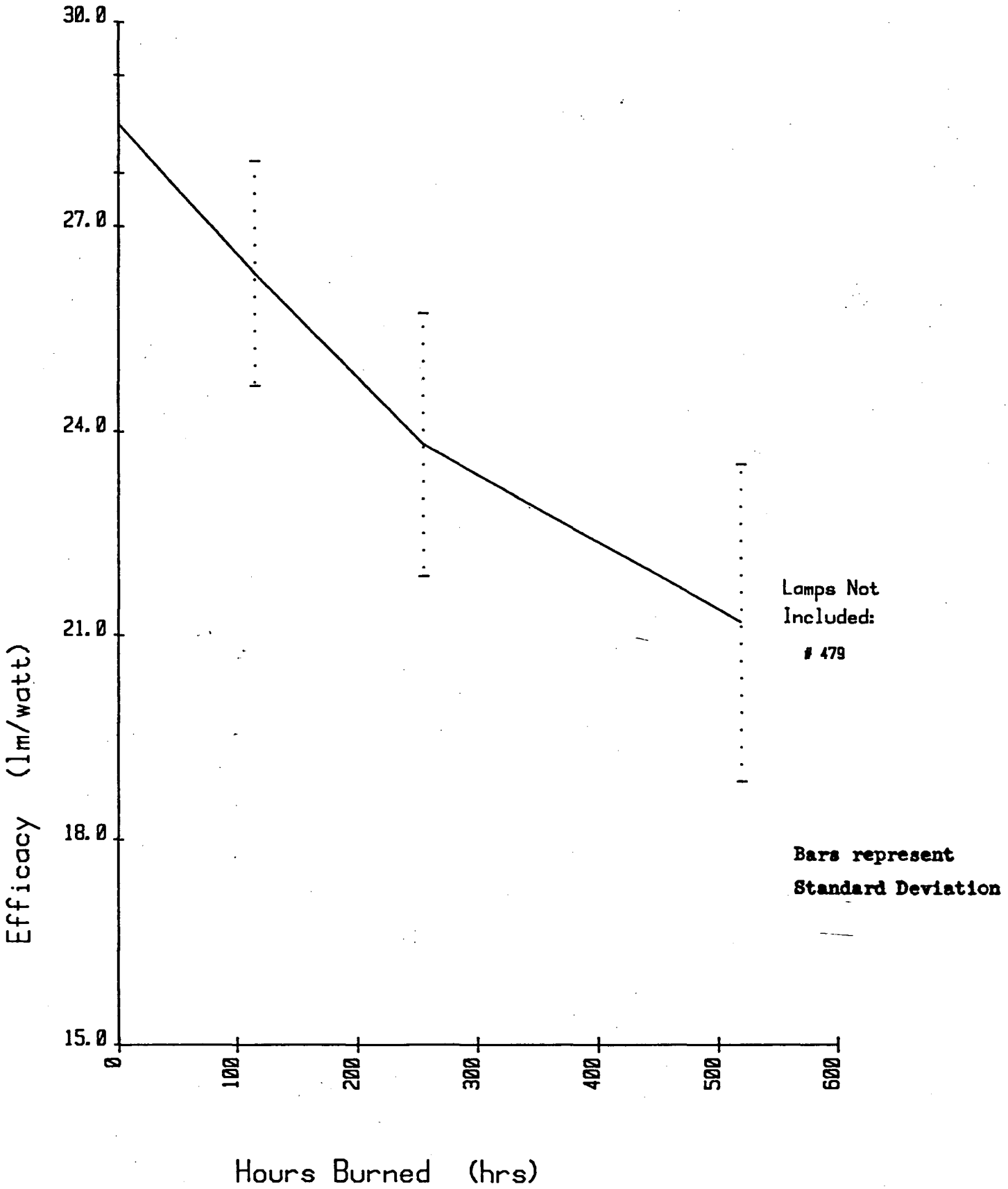
DURO-TEST LIFE TEST DATA
TOTAL FLUX vs HOURS BURNED

GRAPH 1



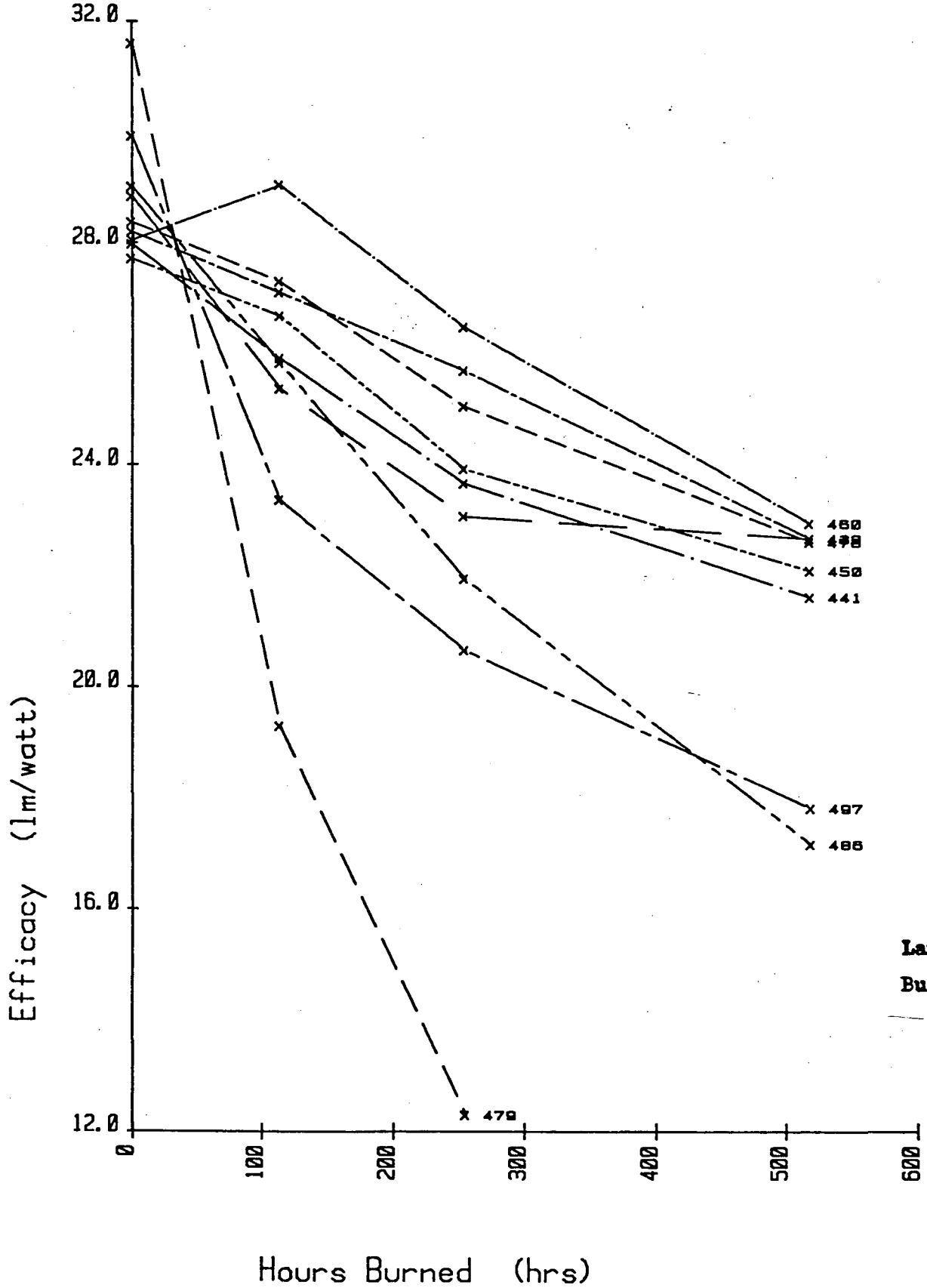
DURO-TEST LIFE TEST DATA
EFFICACY vs HOURS BURNED

GRAPH 2



DURO-TEST LIFE TEST DATA
EFFICACY vs HOURS BURNED

GRAPH 3

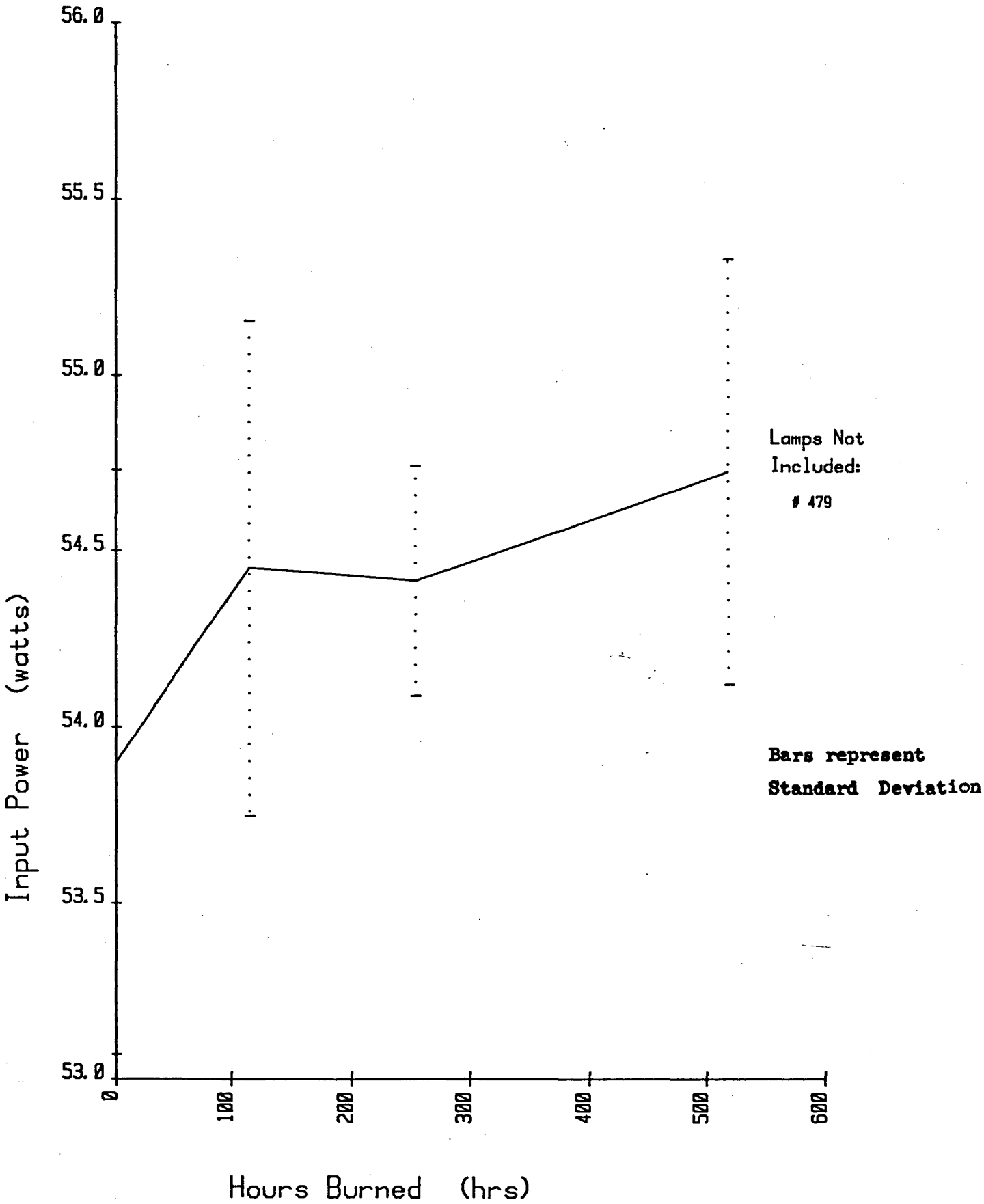


Lamp #479
Burned out @ 280

6

DURO-TEST LIFE TEST DATA
INPUT POWER vs HOURS BURNED

GRAPH 4



Duro-Test Lamps

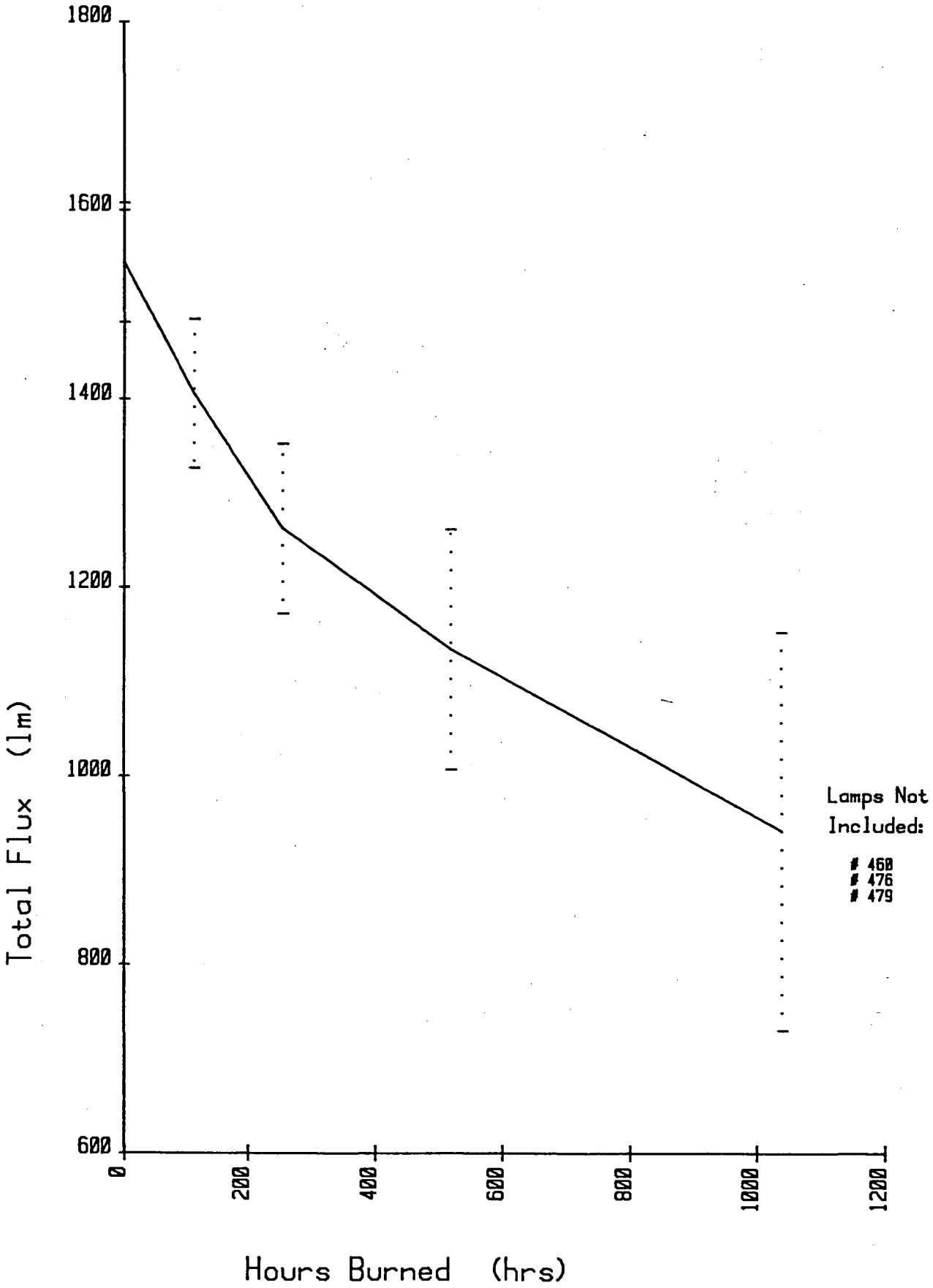
Date: 7/22/82

(After 1040 Hours of Burning)

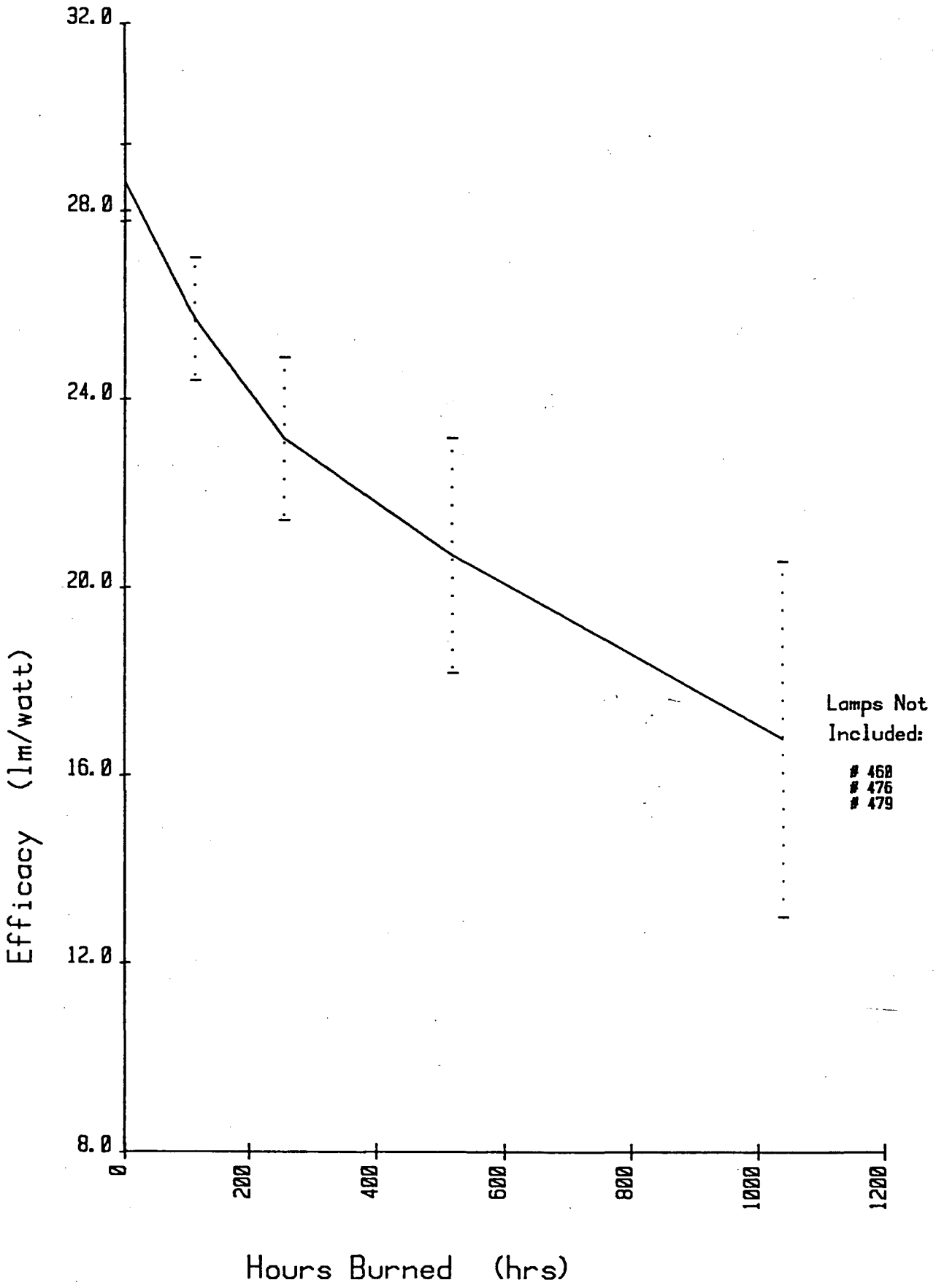
Operating Voltage: 115
Calibration Factor: 1.1352

Lamp No	Cur'nt (mA)	Power (w)	Power Factor (%)	Lux (lux)	Total Flux (lm)	Eff'cy (lm/w)	Color Temp (degK)	CRI (%)
497	693	56.1	70.4	588	667	11.9	2646	91.5
442	698	56.3	70.1	866	983	17.5	2791	94.0
438	716	57.4	69.7	1005	1141	19.9	2852	90.8
486	707	56.6	69.6	605	687	12.1	2657	94.6
441	700	56.3	69.9	968	1099	19.5	2761	94.1
450	676	54.3	69.8	944	1072	19.7	2749	93.5
AVG:	698	56.2	69.9	829	941	16.8	2743	93.1
DEV:	14	1.0	0.3	186	211	3.8	79	1.6

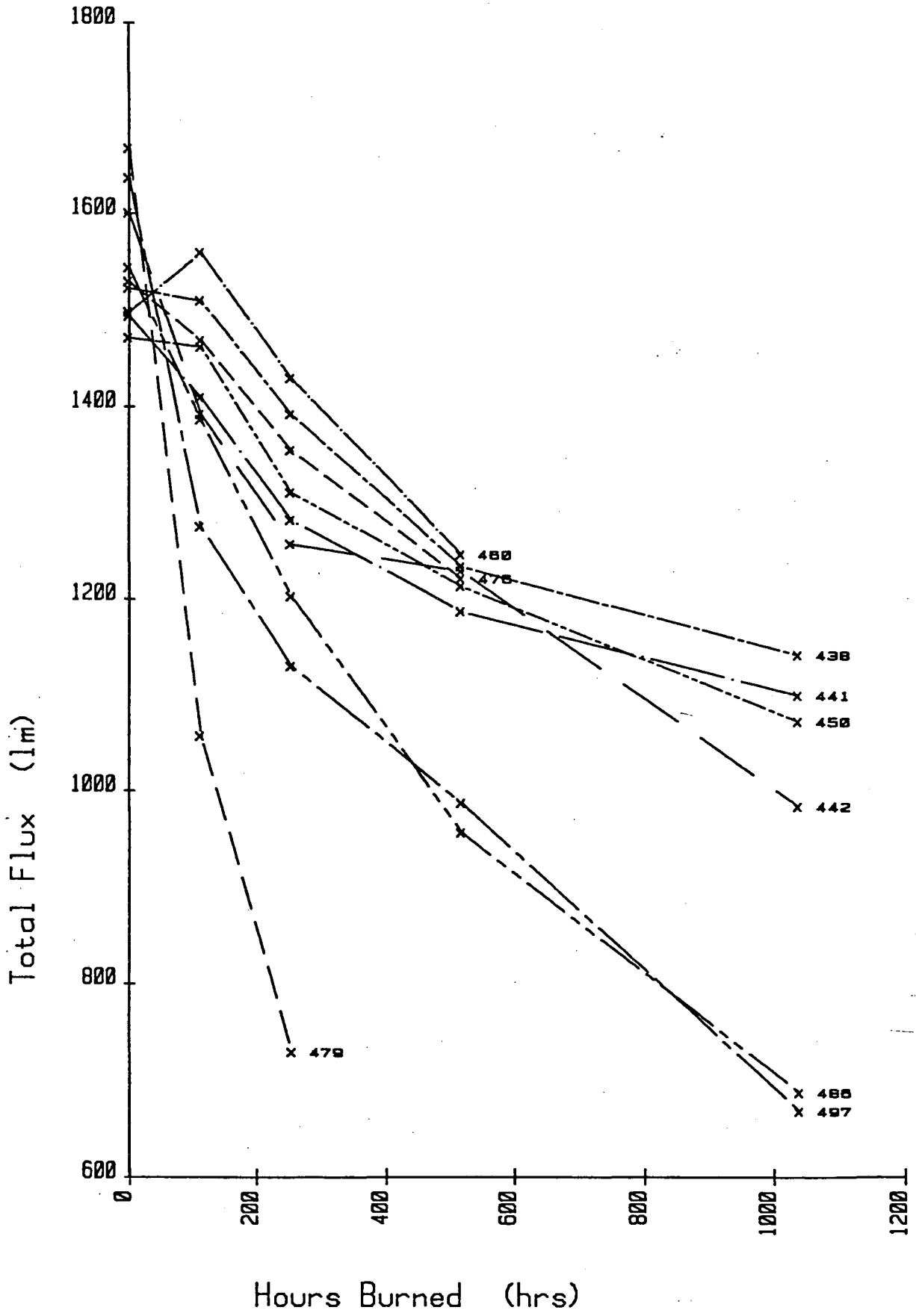
DURO-TEST LIFE TEST DATA
TOTAL FLUX vs HOURS BURNED



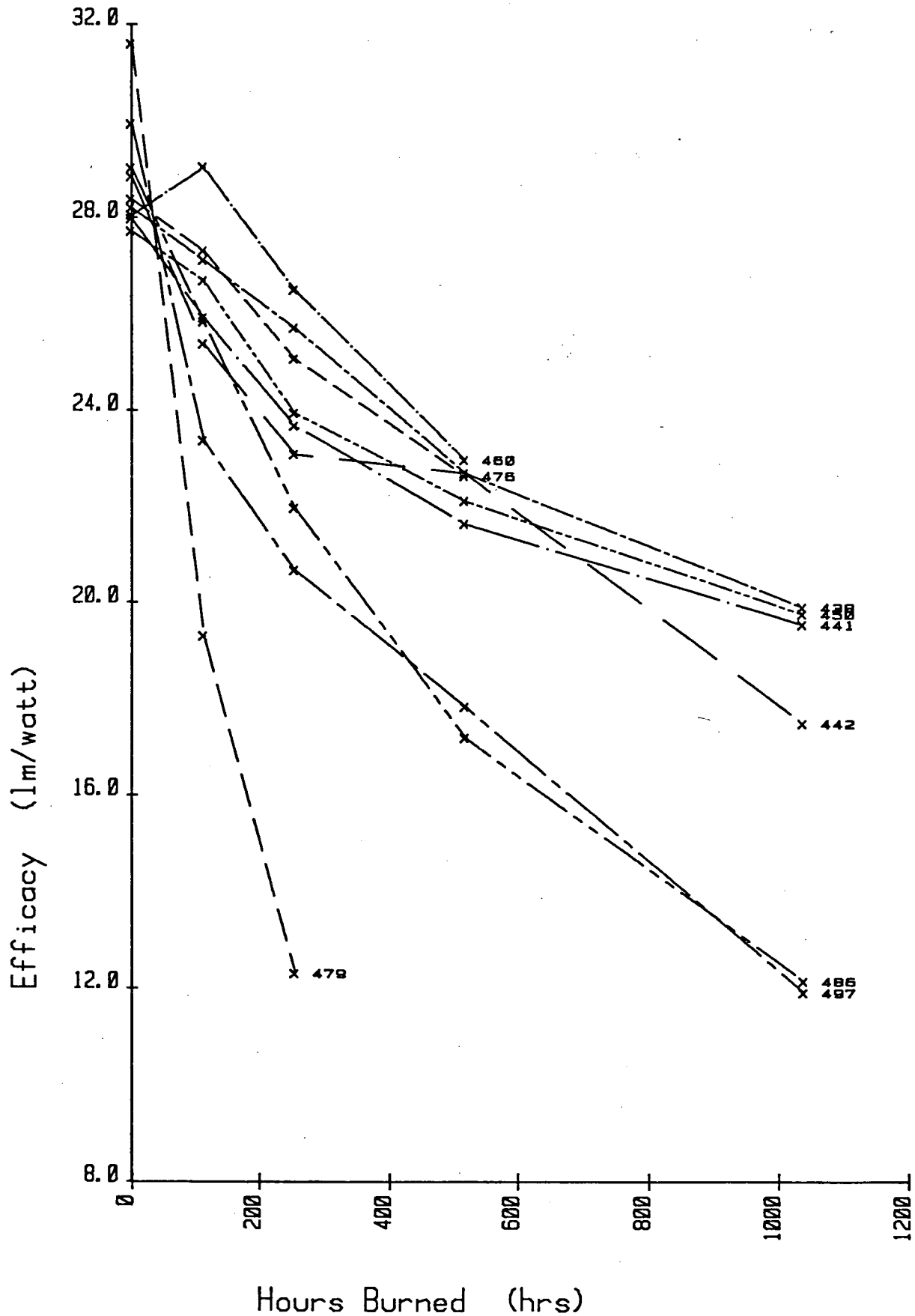
DURO-TEST LIFE TEST DATA
EFFICACY vs HOURS BURNED



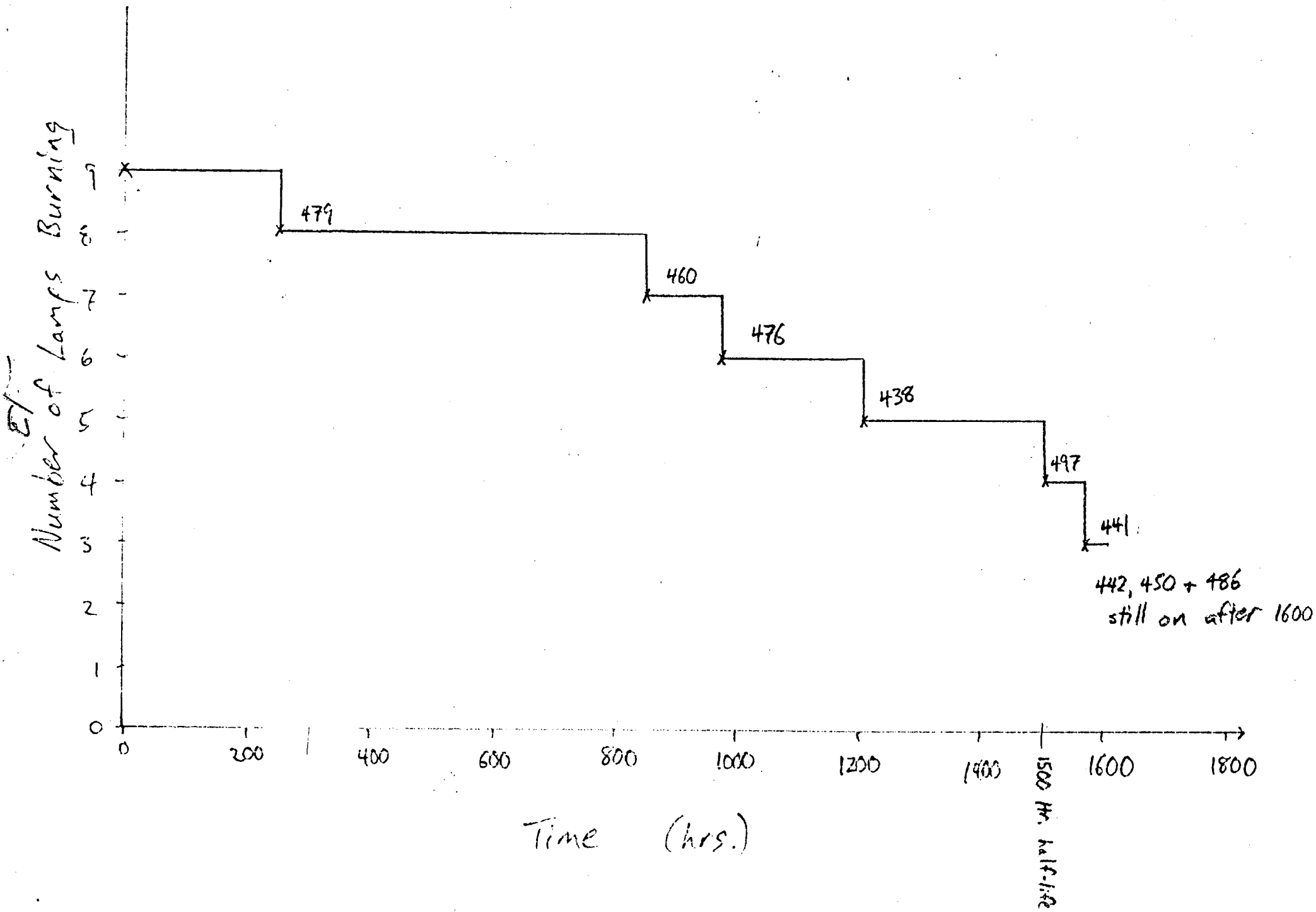
DURO-TEST LIFE TEST DATA
TOTAL FLUX vs HOURS BURNED



DURO-TEST LIFE TEST DATA
EFFICACY vs HOURS BURNED



Duro-Test Life Curve



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