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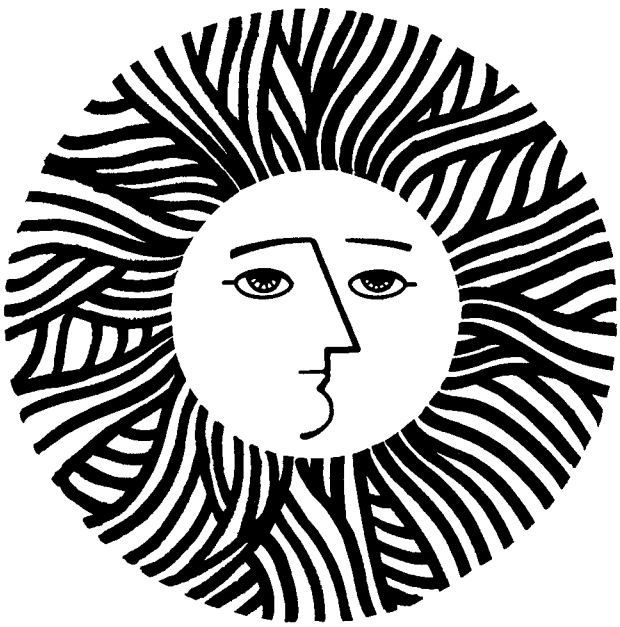

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LAWRENCE BERKELEY LABORATORY
Room: 157A Bldg.: 46 Ext.: 5571

MEMORANDUM

LBID-600

DATE: August 11, 1982

TO: Lighting Systems Research Group

FROM: Greg Ward

RE: Life Testing on Westinghouse EELB

Introduction

This memorandum describes the electrical, photometric and chromatic performance of the Westinghouse compact fluorescent lamps after 945 hours of burning time. Initial performance of these lamps was described in a previous memorandum dated April 27, 1982.

Test Procedure

Before taking any measurements, each lamp was placed in the integrating sphere base down and burned for 30 minutes. Lamps were operated and tested at 120 volts. Care was taken at all times to keep the lamps in an upright position to avoid spillage of excess mercury collected in the nipple at the base of each bulb. The sphere was closed, and electrical and photometric data were taken.

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

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

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Test Results

Major test results of the lamp performance after 945 hours are given in Table 1. Results of earlier tests are given graphically in graphs 1-7. In graphs 1-3, the average of the y-parameter is taken at each data point, and the bars on the graphs indicate the standard deviation of that average, not the experimental uncertainty. Instrumental uncertainties are given below.

Parameter	Estimated Instrumental Uncertainty
Input Voltage	±0.8 volts
Current	±20 milliamps
Power	±1 watt
Relative Luminous Flux	±45 lumens
Absolute Luminous Flux	±100 lumens
Color Temperature	±50 degrees Kelvin
Color-Rendering Index	±1.0%

Lamp #7 was not included in any of the data after 468 hours due to a faulty starting device.

Discussion

The average luminous flux of the Westinghouse lamps has depreciated by 23% from the initial value of 1695 lumens (after 105 hour burn-in, from previous memo.) to 1300 lumens 840 hours later. In graph 1, this drop is shown dramatically as the change between measurements taken at 468 hours and those taken at 945 hours. This rate of depreciation is unusual for fluorescent lights. At maximum loading, 10% lumen loss would be the most one would expect after 1000 hours. However, since it is still early in the life of these lamps, it is perhaps too soon to be making conclusions regarding any sudden variation in measurements which may turn out to be anomalous. Another characteristic of the lumen depreciation curve which is unusual is its shape. Rather than being exponentially decreasing, it seems to be falling off. Also because of this, it is best to withhold any observations until more data has been taken.

Power input to the lamps has dropped an average of 10%, counteracting the loss

in light output somewhat thereby keeping the drop in efficacy to 17%. Although this is better than 23%, it is still quite high for a fluorescent with a core ballast.

None of the other measurements changed significantly over 945 hours. Graph 7 shows how the Color Rendering Index has remained very constant above 81%.

Acknowledgement

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

TABLE 1

Westinghouse Lamps

Date: 7/23/82

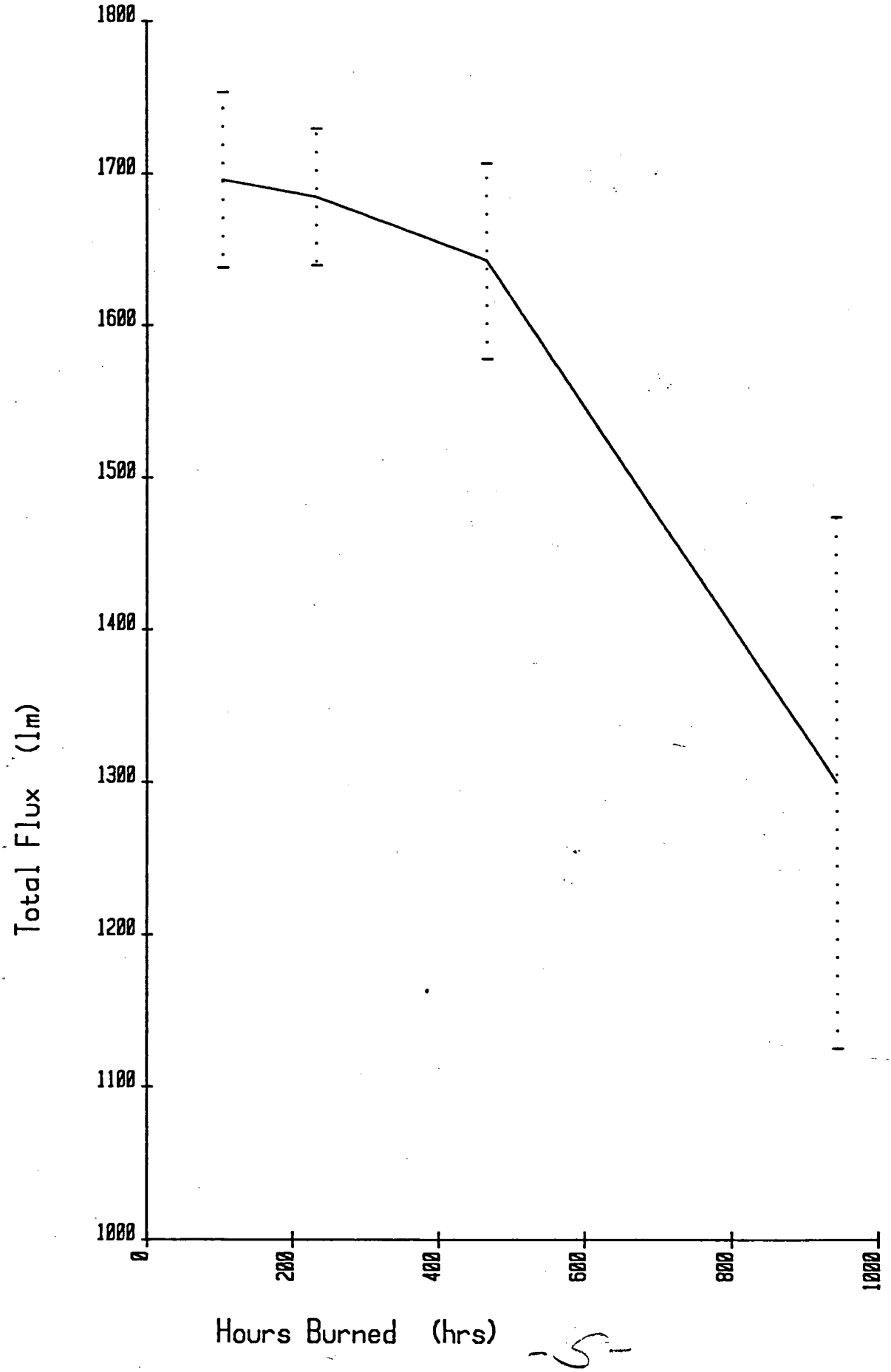
(After 945 Hours of Burning)

Operating Voltage: 120
Calibration Factor: 1.1424

Lamp No	Cur'nt (mA)	Power (w)	Power Factor (%)	Lux (lux)	Total Flux (lm)	Eff'cy (lm/w)	Color Temp (degK)	CRI (%)
1	384	32.5	70.6	1259	1438	44.3	2672	78.5
2	378	29.6	65.2	1135	1297	43.8	2672	80.4
3	359	34.0	79.0	1276	1458	42.9	2496	82.5
4	380	28.2	61.9	985	1125	39.9	2679	80.7
5	366	30.3	69.0	1112	1270	41.9	2463	82.4
6	365	33.4	76.2	1366	1561	46.7	2486	82.3
8	370	27.6	62.2	906	1035	37.5	2687	80.4
9	381	31.1	68.0	1202	1373	44.2	2642	79.5
10	381	28.5	62.4	999	1141	40.0	2665	80.2
AVG:	374	30.6	68.3	1138	1300	42.4	2607	80.8
DEV:	9	2.3	6.2	153	175	2.8	95	1.4

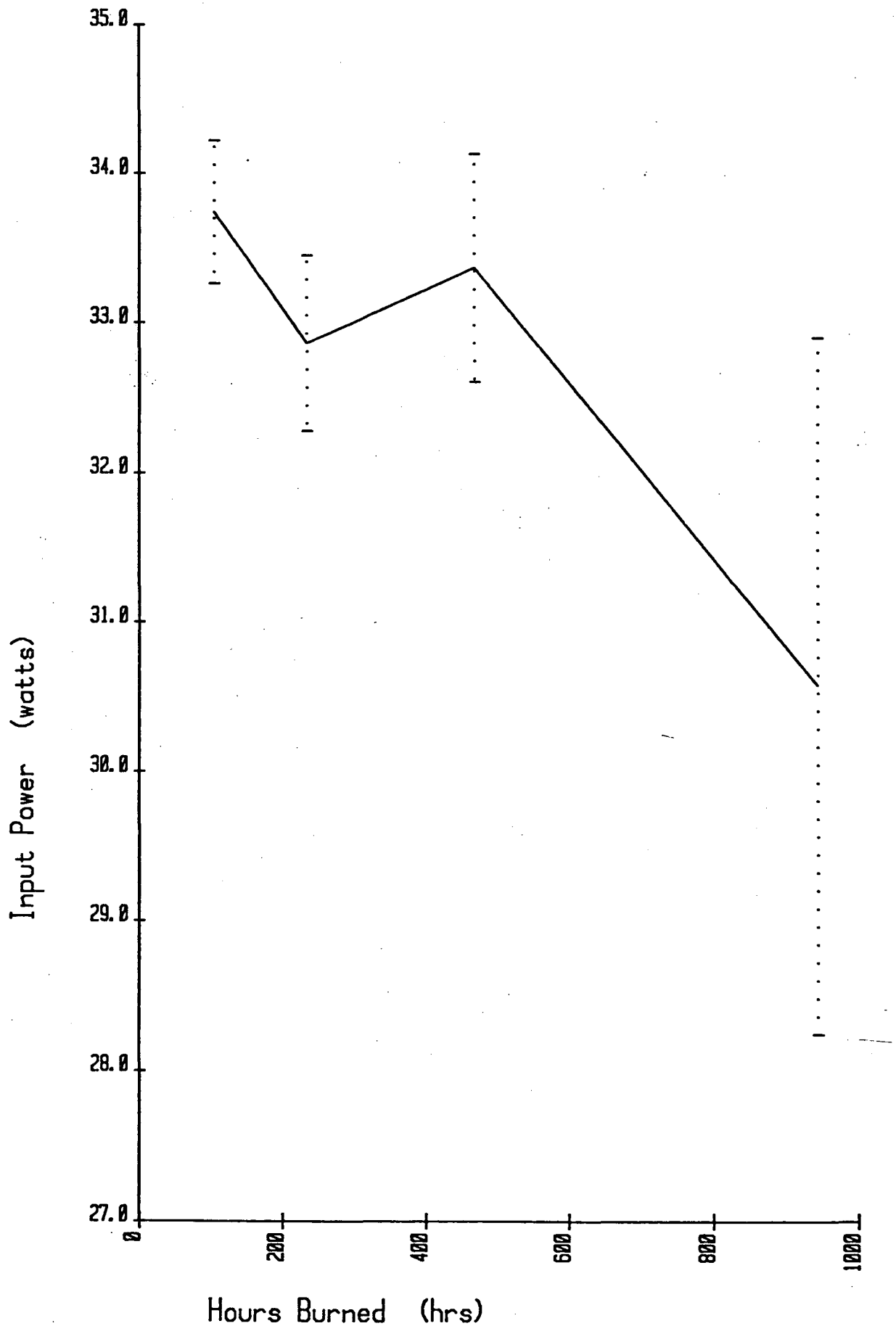
GRAPH 1

WESTINGHOUSE LIFE TEST DATA
TOTAL FLUX vs HOURS BURNED



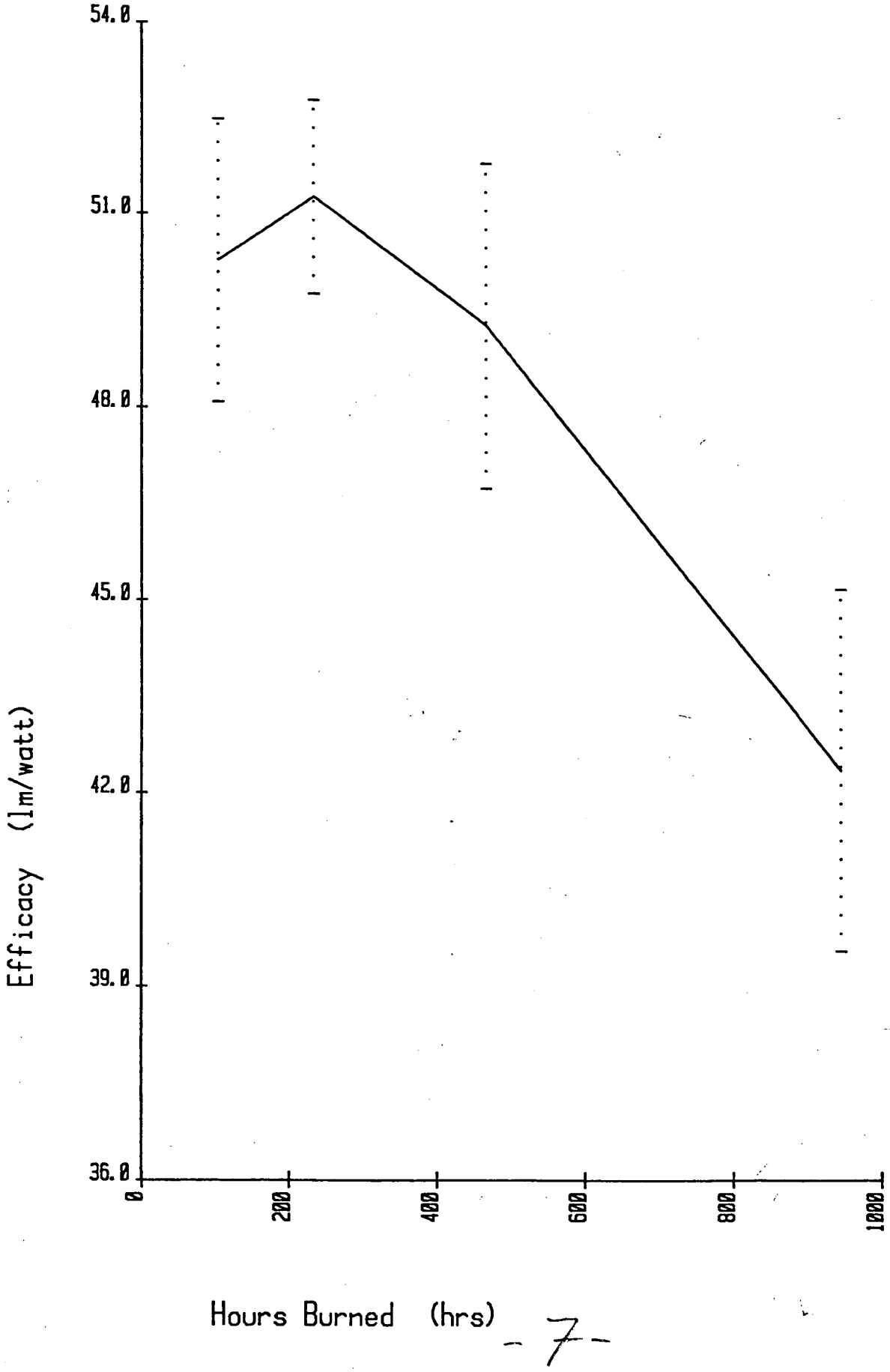
WESTINGHOUSE LIFE TEST DATA
INPUT POWER vs HOURS BURNED

GRAPH 2



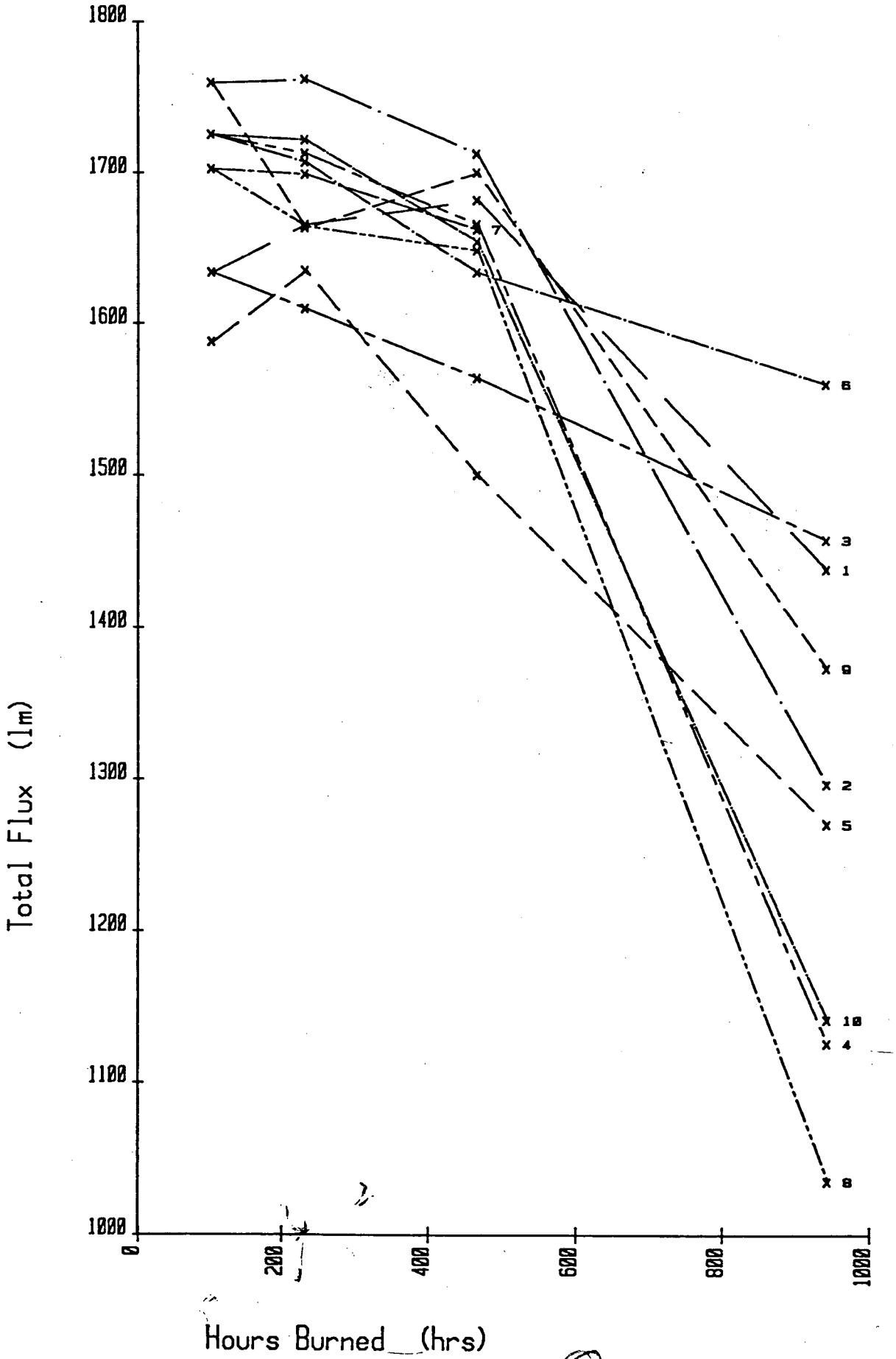
WESTINGHOUSE LIFE TEST DATA
EFFICACY vs HOURS BURNED

GRAPH 3



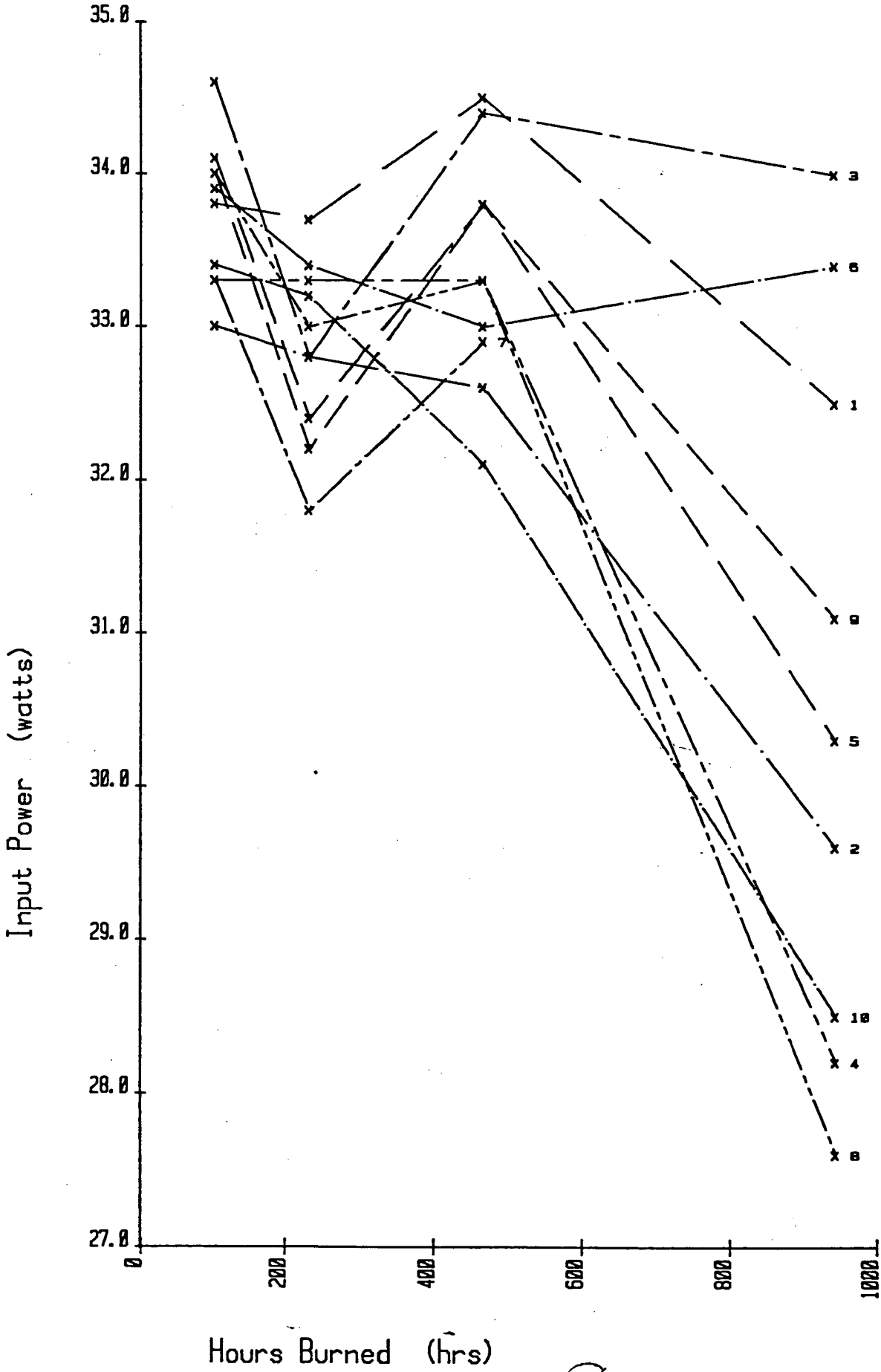
GRAPH 4

WESTINGHOUSE LIFE TEST DATA
TOTAL FLUX vs HOURS BURNED



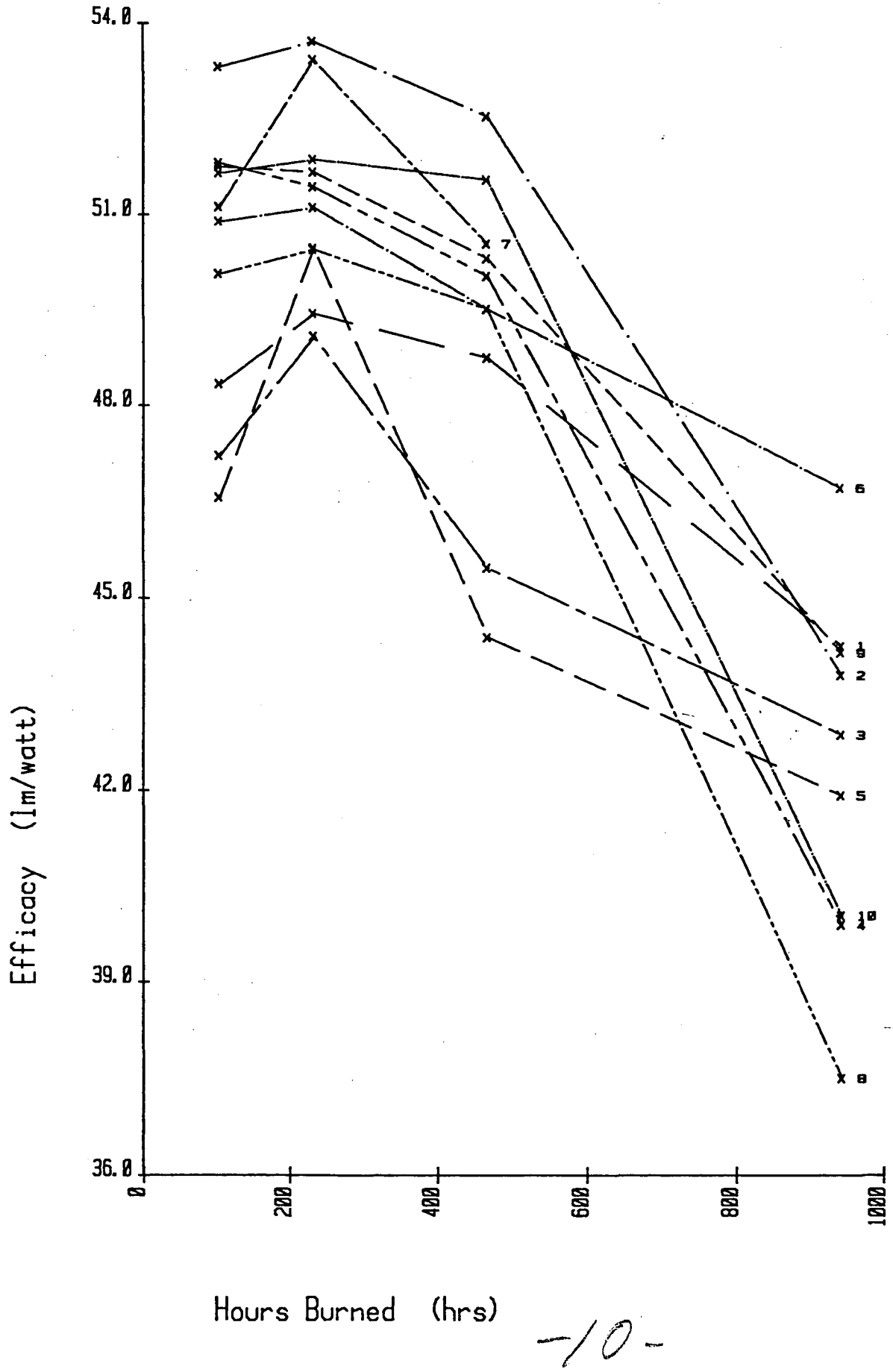
GRAPH 5

WESTINGHOUSE LIFE TEST DATA
INPUT POWER vs HOURS BURNED



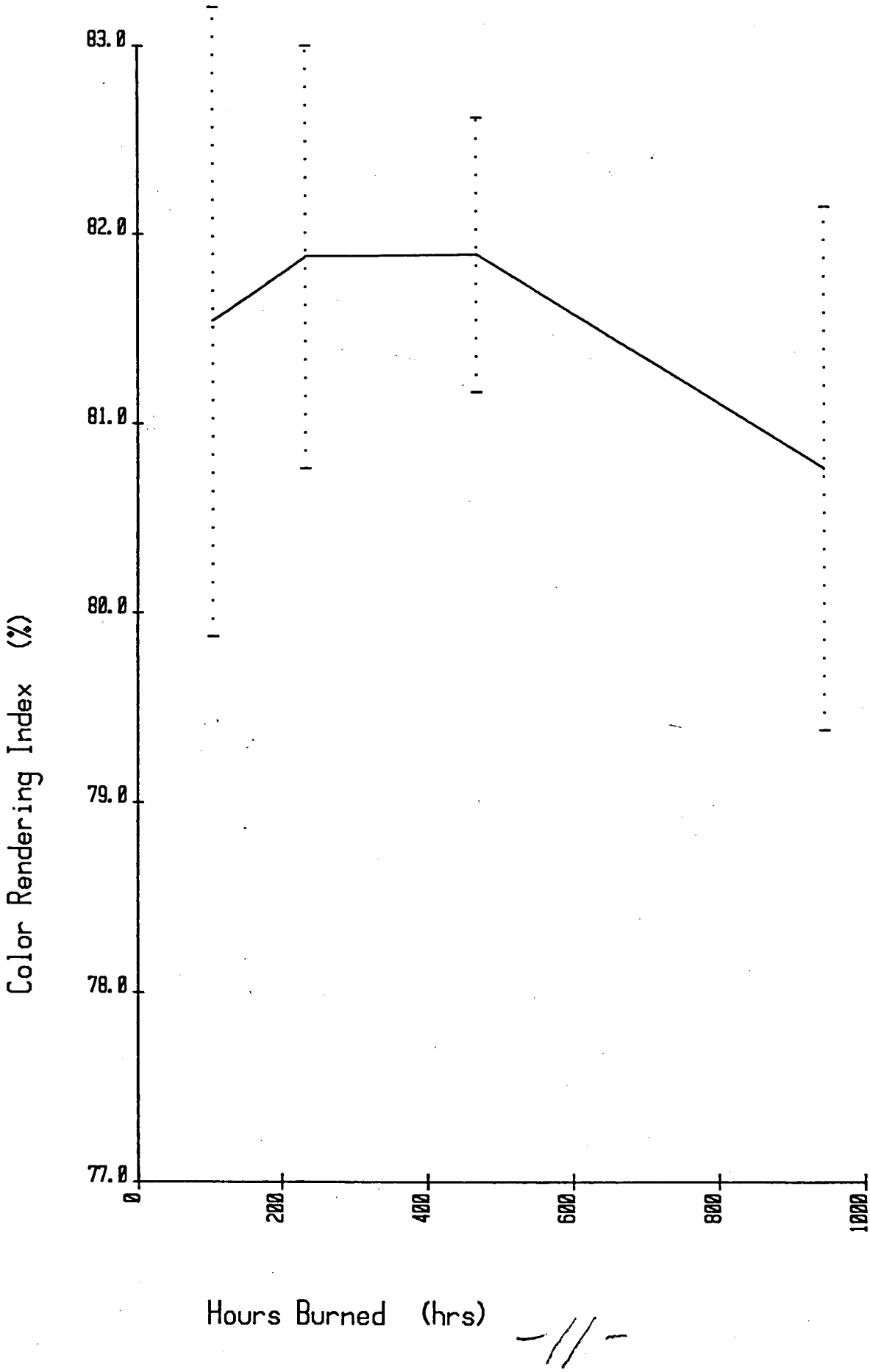
WESTINGHOUSE LIFE TEST DATA
EFFICACY vs HOURS BURNED

GRAPH 6



GRAPH 7

WESTINGHOUSE LIFE TEST DATA
COLOR RENDERING INDEX vs HOURS BURNED



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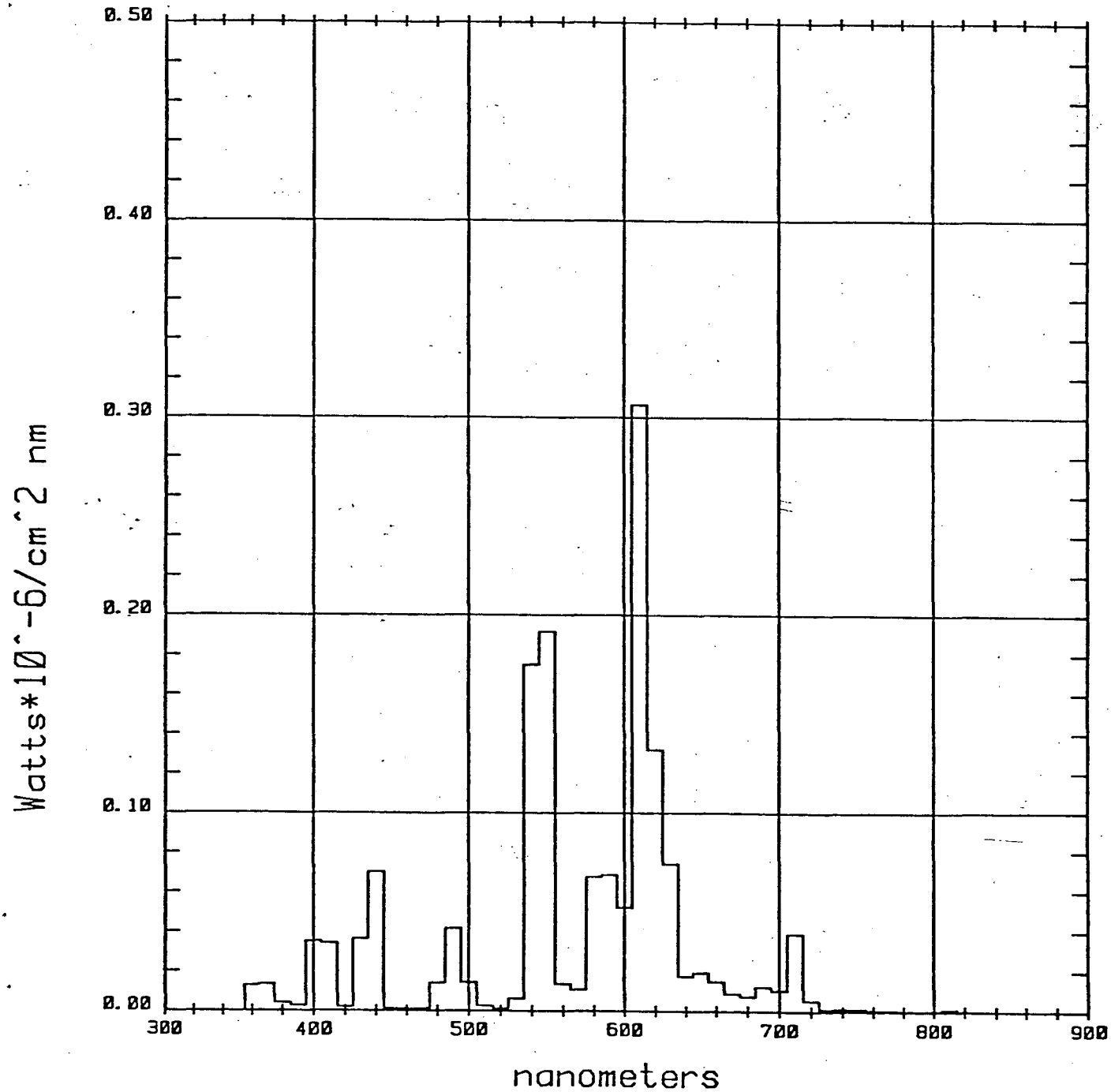
SPECTRAL IRRADIANCE MEASUREMENT

LAMP TYPE:Westinghouse #8 Comment:1/2 Hr. warm up time
OP:L.Leung DATE:7/23/82

10nm MEAS. INC.
Sum from 350 to 800nm= 1.528E-05 Watts/cm^2
Lumens per square foot(Footcandles)= 4.936E 00
x=0.4631 y=0.4146 u=0.2627 v=0.3529 C.C.T.(Kelvin)= 2687 mired= 372.2
General color rendering index (Ra)= 80.4
R(9)=$$$$$ R(10)= 50.2 R(11)= 78.6 R(12)= 42.4 R(13)= 93.0 R(14)= 67.5



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