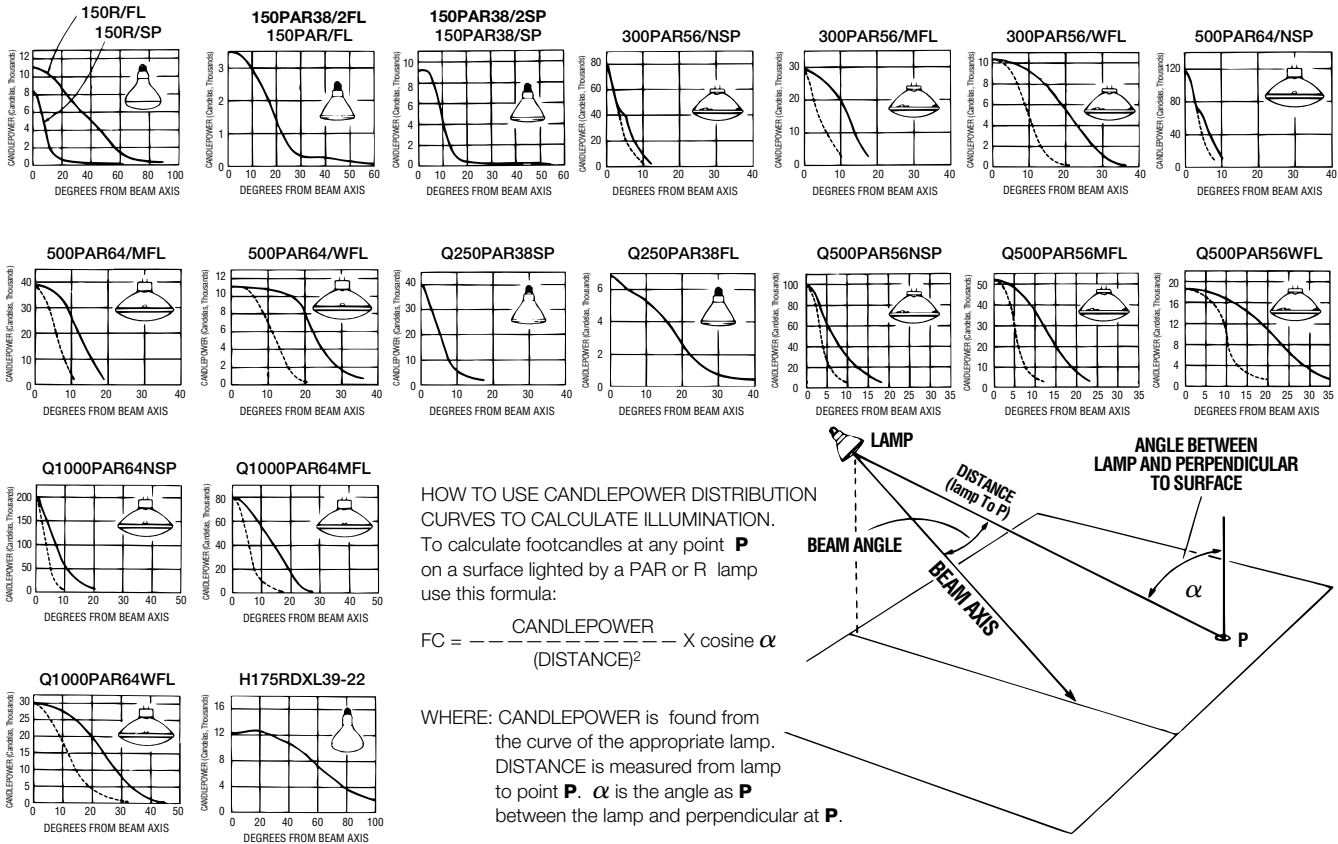


LAMP DATA

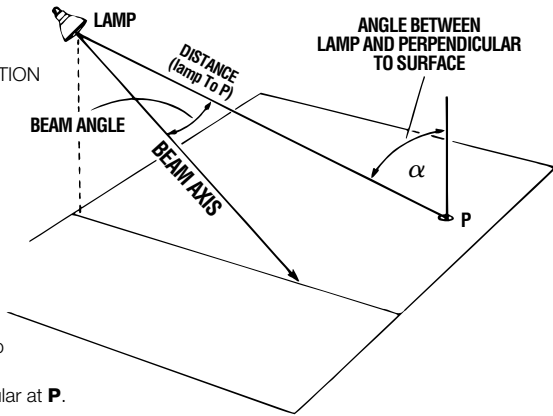
Approximate Candlepower Distribution Curves for PAR and R Lamps



HOW TO USE CANDLEPOWER DISTRIBUTION CURVES TO CALCULATE ILLUMINATION. To calculate footcandles at any point **P** on a surface lighted by a PAR or R lamp use this formula:

$$FC = \frac{\text{CANDLEPOWER}}{(\text{DISTANCE})^2} \times \cos \alpha$$

WHERE: CANDLEPOWER is found from the curve of the appropriate lamp. DISTANCE is measured from lamp to point **P**. α is the angle as **P** between the lamp and perpendicular at **P**.



12V PAR & R LAMPS IN SPORTS & FLOODS

Watts	Bulb	Base	Filament	Max. Overall Length (Inches)	Beam Description	Approx. Beam Spread ① to 50% Max. Candlepower	Approx. Beam Spread ① To 10% Max. Candlepower	Initial Candlepower ②
120	PAR56	Screw Terminal	C-6	4-1/2	Very Narrow Spot	6° x 8°	10° x 15°	60,000
			C-6	4-1/2	Medium Flood	9° x 18°	15° x 29°	19,000
			C-6	4-1/2	Wide Flood	18° x 35°	25° x 50°	5,625
240	PAR56	Screw Terminal	C-6	4-1/2	Very Narrow Spot	6° x 9°	10° x 17°	140,000
			C-6	4-1/2	Medium Flood	8° x 19°	15° x 28°	46,000
			C-6	4-1/2	Wide Flood	18° x 35°	27° x 50°	13,000

Lamps listed above have an average rated life of 2000 hours.

① For asymmetric beams, the vertical spread is listed first, then the horizontal.

② Peak candlepower for VNSP, average in central 5° cone for NSP, average in center 10° cone for MFL, WFL, VWFL.

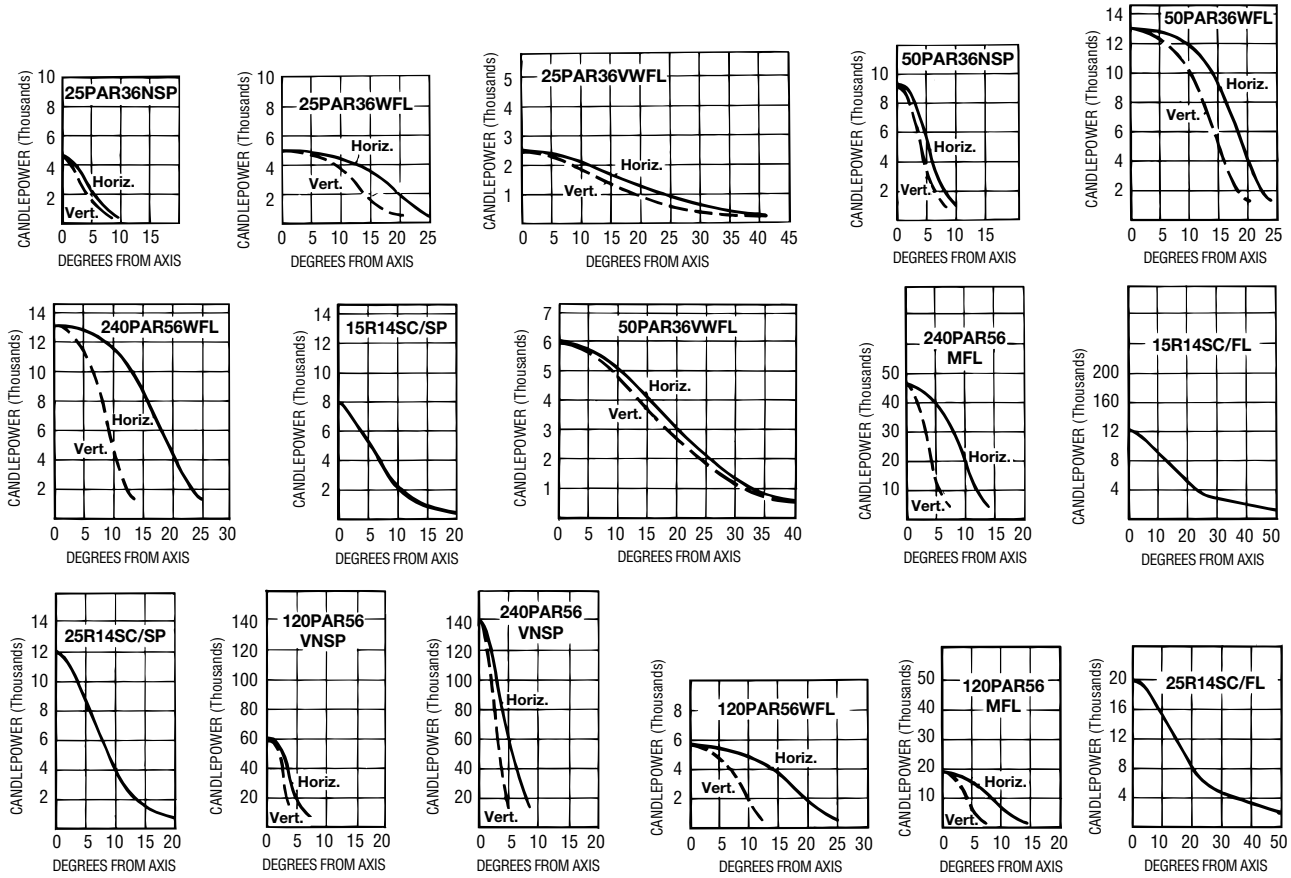
6.0 VOLT "BULLET BEAM" SPOTS

Watts	Volts	Bulb	Base	Filament	Maximum Overall Length	Beam Spread 10% of Max.	Maximum Initial Beam CP	Average Rated Life (Hrs.)
120	6.0	PAR64	Screw Terminal	C-6	4"	5° 9°	180,000	3000
120	6.0	PAR64	Screw Terminal	C-6	4"	5° 9°	180,000	2000

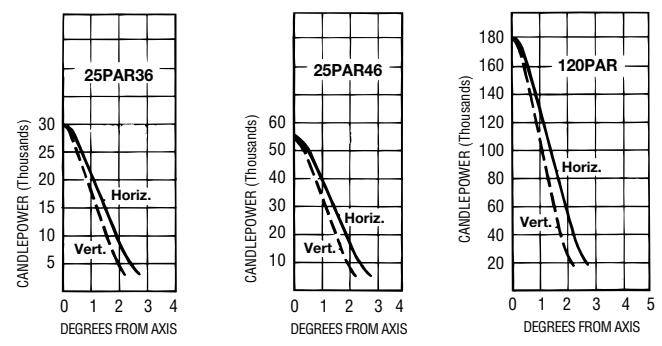
"HID BULLET" SPOT & FLOOD

Watts	Volts	Bulb	Base	Filament	Beam Spread 10% of Max.	Maximum Initial Beam CP	Average Rated Life (Hrs.)
100	4000K	R40	Medium	Flood	70°	3300	10,000
100	4000K	R40	Medium	Spot	15°	80,000	10,000
175	4000K	R40	Medium	Flood	70°	6,500	10,000
175	4000K	R40	Medium	Spot	15°	95,000	10,000

Approximate Initial Candlepower Distribution In 12V PAR Lamps



Approximate Initial Candlepower Distribution In 5.5 and 6.0 Volt Lamps



LIGHTING SOURCE COMPARISON

	INCANDESCENT Standard	INCANDESCENT Quartz	COMPACT FLUORESCENT	Mercury	HIGH INTENSITY DISCHARGE (HID)			
					Metal Halide	HP Sodium	LP Sodium	
Initial System Cost	Low	Low	Moderate	Moderate	High	High	High	
Operating Energy Cost	High	High	Moderate	Moderate	Moderate	Low	Very Low	
Efficiency Lumens Per Watt	5-22	12-36	27-80	50-60	80-115	90-140	133-183	
Average Rated Lamp Life (Hrs.)	1,000	2,000	10,000	24,000	10-15,000	24,000	20,000	
Color Definition	Very Good		Very Good	Good	Moderate/Good		Fair	
Monochromatic								
Colors Strengthened	Red, Orange Yellow	Red, Orange Yellow	Red, Orange Yellow	Yellow, Green Blue	Yellow, Green Blue	Yellow, Orange Green	Yellow	
Effect on Neutral Surface	Warm White	Warm White	Warm White	Cool White	White	Warm Yellow	Sunny Yellow	
Beam Control	Very Good		Very Good	Poor	Fair	Good	Good	Fair
Cold Weather Operation	Very Good		Very Good	Good	Fair	Fair	Good	Very Good

LAMP DATA

Watts	Lamp Type	Lamp Base	ANSI Code	Desc.	Life (Hrs.)	Initial Lumens
HIGH PRESSURE SODIUM						
35	E17	Medium	S76HA	Clear	16,000	2,250
35	E17	Medium	S76HB	Diffuse	16,000	2,150
50	E17	Medium	S68LP	Clear	24,000+	4,000
50	E17	Medium	S68LR	Diffuse	24,000+	3,800
70	E23 1/2	Mogul	S62ME	Clear	24,000+	6,300
70	E23 1/2	Mogul	S62MF	Diffuse	24,000+	5,860
70	E17	Medium	S621G	Clear	24,000+	6,300
70	E17	Medium	S62LH	Diffuse	24,000+	5,860
100	E23 1/2	Mogul	S54SB	Clear	24,000+	9,500
100	E23 1/2	Mogul	S54ML	Diffuse	24,000+	8,800
100	E17	Medium	S54SG	Clear	24,000+	9,500
100	E17	Medium	S54SH	Diffuse	24,000+	8,800
150	E23 1/2	Mogul	S55SC	Clear	24,000+	16,000
150	E23 1/2	Mogul	S55MD	Diffuse	24,000+	15,000
150	E17	Medium	M110	Clear	24,000+	16,000
150	E17	Medium	M98	Diffuse	24,000+	15,000
250	E18	Mogul	S50VA	Clear	24,000+	28,500
250	E28	Mogul	S50VC	Diffuse	24,000+	26,000
400	E18	Mogul	S51WA	Clear	24,000+	50,000
400	E37	Mogul	S51WB	Diffuse	24,000+	47,500
750	BT37	Mogul	S111NH	Clear	24,000+	99,000
1000	E25	Mogul	S52XB	Clear	24,000+	140,000
METAL HALIDE						
50	ED17	Medium	M110TM	Clear	10,000	2,250
*50	ED17	Medium	M110	Clear	10,000	3,400
**50	ED17	#Medium	M110	Clear	10,000	3,200
70	ED17	Medium	M98SJ	Clear	15,000	5,600
*70	ED17	Medium	M98	Clear	15,000	5,600
**70	ED17	#Medium	M98	Clear	15,000	5,600
100	ED17	Medium	M107	Clear	7,500	7,200
*100	ED17	Medium	M90	Clear	15,000	9,000
**100	ED17	#Medium	M90	Clear	15,000	8,500
150	ED17	Medium	M57	Clear	10,000	13,500
*150	ED17	Medium	M102	Clear	15,000	15,000
**150	ED17	#Medium	M102	Clear	15,000	14,250
175	ED17	Medium	M57	Clear	10,000	14,000
*175	ED17	Medium	M137	Clear	15,000	17,500
175	ED28	Mogul	M57PE	Clear	10,000	12,000
*175	ED28	Mogul	M137	Clear	15,000	14,000
175	ED28	Mogul	M57PF	Diffuse	10,000	14,000
*175	ED28	Mogul	M137	Diffuse	15,000	16,600
*200	ED17	Medium	M136	Clear	12,000	21,000
*200	ED17	Medium	M136	Diffuse	12,000	20,000
*200	ED28	Mogul	M136	Clear	15,000	21,000
*200	ED28	Mogul	M136	Diffuse	15,000	20,000
**200	ED28	#Mogul	M136	Clear	15,000	20,000
**200	ED28	#Mogul	M136	Diffuse	15,000	19,000
250	ED28	Mogul	M58PG	Clear	10,000	20,500
*250	ED28	Mogul	M138	Clear	15,000	26,300
**250	ED28	#Mogul	M138	Clear	15,000	25,000
250	ED28	Mogul	M58PH	Diffuse	10,000	19,475
*250	ED28	Mogul	M138	Diffuse	15,000	25,000
**250	ED28	#Mogul	M138	Diffuse	15,000	23,800
*320	ED37	Mogul	M132	Clear	20,000	33,000
*320	ED37	Mogul	M132	Diffuse	20,000	31,000
**320	ED37	#Mogul	M132	Clear	20,000	32,300
**320	ED37	#Mogul	M132	Diffuse	20,000	30,600
*350	ED37	Mogul	M131	Clear	20,000	38,000
*350	ED37	Mogul	M131	Diffuse	20,000	36,000
**350	ED37	#Mogul	M131	Clear	20,000	36,000
**350	ED37	#Mogul	M131	Diffuse	20,000	34,200
400	ED37	Mogul	M59PJ	Clear	20,000	36,000
*400	ED37	Mogul	M135	Clear	20,000	44,000
**400	ED37	#Mogul	M135	Clear	20,000	42,000
400	ED37	Mogul	M59PK	Diffuse	20,000	36,000
*400	ED37	Mogul	M135	Diffuse	20,000	42,000
**400	ED37	#Mogul	M135	Diffuse	20,000	40,000
400	ED28	Mogul	M59	Clear	20,000	36,000
*400	ED28	Mogul	M135	Clear	20,000	44,000
**400	ED28	#Mogul	M135	Clear	20,000	42,000
400	BT28	Mogul	M59	Clear	20,000	36,000
*450	ED37	Mogul	M144	Clear	20,000	50,000
**450	ED37	#Mogul	M144	Clear	20,000	47,500
1000	BT56	Mogul	M47PA	Clear	12,000	110,000
1000	BT56	Mogul	M47PB	Diffuse	12,000	110,000
1000	BT37	Mogul	M47	Clear	12,000	110,000

MERCURY VAPOR

50	E17	Medium	H45AY	Deluxe White	16,000	1,140
100	A23	Medium	H38LL	Clear	18,000	3,700
100	R40	Medium	H38MP	Deluxe White	18,000	4,000
100	E23 1/2	Mogul	H38JA	Deluxe White	24,000	4,200
175	E28	Mogul	H39KC	Deluxe White	24,000	8,600
175	E28	Mogul	H39KB	Clear	24,000	7,950
175	R40	Medium	H39BP	Deluxe White	24,000	5,700
250	E28	Mogul	H37KC	Deluxe White	24,000	12,100
250	E28	Mogul	H37KB	Clear	24,000	11,200
400	E37	Mogul	H33GL	Deluxe White	24,000	22,500
400	E37	Mogul	H33CP	Clear	24,000	21,000
1000	BT56	Mogul	H36GV	Deluxe White	24,000	63,000
1000	BT56	Mogul	H36GV	Clear	24,000	57,000

*Pulse Start Lamps for enclosed fixtures.
 **Pulse Start Lamps for open fixtures.
 # OPEN MED(EX26) or OPEN MOG(EX29) Sockets Required.
 Life (hrs) is shown for vertical burn, all other burning positions are 75% of rated life.

Lamp Watts	Type	Lamp Base	Life (Hours)	Initial Lumens
QUARTZ				
150	T4	D.C. Bayonet	2,000	2,800
250	T4	D.C. Bayonet	2,000	5,000
300	T3	RSC	2,000	5,950
500	T3	RSC	2,000	11,100
500	PAR56	Mogul End Prong	4,000	8,000
1000	T3	RSC	2,000	21,500
1000	PAR64	Extended Mogul End Prong	4,000	19,400
1500	T3	RSC	2,000	35,800

INCANDESCENT

60	A19	Medium	1,000	870
100	A19	Medium	750	1,750
150	PAR38	Medium	2,000	1,740
150	R40	Medium	2,000	1,900
150	PAR46	Medium Side Prong	2,000	1,740
200	A21	Medium	750	4,010
200	PAR46	Medium Side Prong	2,000	2,300
200	PAR56	Mogul End Prong	2,000	—
300	PAR56	Mogul End Prong	2,000	3,840
500	PAR64	Extended Mogul End Prong	2,000	6,500

COMPACT FLUORESCENT

7	PL	G23	10,000	400
9	PL	G23	10,000	600
13	PL	GX23	10,000	900
18	SL18	Medium, ANSI 30570-6	10,000	1,100
22	PLC	GX32d-2, ANSI 20478-4	10,000	1,200
28	PLC	GX32d-3, ANSI 20479-2	10,000	1,600
32	PLT	GX24q-3, 4 Pin Triple Tube	10,000	2,400
42	PLT	GX24q-4, 4 Pin Triple Tube	10,000	3,200

APPROXIMATE INITIAL OUTPUT OF TYPICAL R and PAR LAMPS

FLOOD LAMPS

Watts	Average Max.				
	Lamp	Candelas C.P.①	Beam Spread②	Beam Lumens	Total Lumens
75	R30	400	136°	730	900
150	R40	1040	124°	1650	1900
300	R40	1950	123°	3200	3650
500	R40	3800	124°	6000	6500
150	PAR38	4000	60°	1690	1740
200	PAR48	11500④	23° x 38°	1300	2300
300	PAR56	24000④	19° x 34°	2100	3840
300	PAR56	11000⑤	27° x 52°	2200	3840
500	PAR64	37000⑤	19° x 35°	3300	6500
500	PAR64	13000⑤	32° x 55°	3400	6500

SPOT LAMPS

75	R30	1540③	78°	760	900
150	R40	5400③	49°	1550	1900
300	R40	8900③	60°	3100	3650
500	R40	21000③	42°	4700	6500
150	PAR38	11500③	28°	1200	1740
200	PAR46	31000③⑥	19° x 23°	1100	2300
300	PAR56	68000③⑥	14° x 20°	1800	3840
300	PAR56	—	—	—	—
500	PAR64	11,000③⑥	14° x 19°	3000	6500
500	PAR64	—	—	—	—

① Average in 10° Cone. ② To 10% (approx.) of maximum candlepower.
 ③ Average in 5° Cone. ④ Medium flood. ⑤ Wide flood. ⑥ Narrow flood.

LAMP DATA FLUORESCENT						
WATTS	TYPE	DESCRIPTION	NOMINAL LENGTH	AVG LIFE	INITIAL	CRI LUMENS
8	T5	WARM WHITE, 3000K	12	7500	400	53
8	T5	COOL WHITE, 4100K	12	7500	400	62
13	T5	COOL WHITE, 4100K	21	7500	820	62
14	T5	3000K	22	20,000	1350	85
14	T5	3500K	22	20,000	1350	85
14	T5	4100K	22	20,000	1350	85
17	T8	3500K	24	20000	1400	85
17	T8	4100K	24	20000	1400	85
20	T12	4100K	24	7500	1090	62
21	T5	3000K	34	20,000	2100	85
21	T5	3500K	34	20,000	2100	85
21	T5	4100K	34	20,000	2100	85
24	T5HO	3000K	22	20,000	2000	85
24	T5HO	3500K	22	20,000	2000	85
24	T5HO	4100K	22	20,000	2000	85
25	T8	3500K	36	20,000	2225	85
25	T8	4100K	36	20,000	2225	85
25	T12	4100K	36	18,000	1950	62
28	T5	3000K	46	20,000	2900	85
28	T5	3500K	46	20,000	2900	85
28	T5	4100K	46	20,000	2900	85
30	T12	4100K	36	7500	1850	62
32	T8	3500K	48	20,000	2950	85
32	T8	4100K	48	20,000	2950	85
32	T8 U-BENT	3500k	22 7/16	20,000	2800	85
32	T8 U-BENT	4100K	22 7/16	20,000	2800	85
34	T12	WARM WHITE, 3000K	48	20,000	2700	62
34	T12	COOL WHITE, 4100K	48	20,000	2650	62
34	T12 U-BENT	WARM WHITE, 3000K	22 7/16	18,000	2425	51
34	T12 U-BENT	COOL WHITE, 4100K	22 7/16	18,000	2350	62
39	T5HO	3000K	34	20,000	3500	85
39	T5HO	3500K	34	20,000	3500	85
39	T5HO	4100K	34	20,000	3500	85
44	T8	3500K	48	18,000	4000	85
44	T8	4100K	48	18,000	4000	85
54	T5HO	3000K	46	20,000	5000	85
54	T5HO	3500K	46	20,000	5000	85
54	T5HO	4100K	46	20,000	5000	85
59	T8	3500K	96	15,000	5490	85
59	T8	4100K	96	15,000	5490	85
60	T12 HO	COOL WHITE, 4100K	48	12,000	4050	62
65	T8	3500K	72	18,000	6100	85
65	T8	4100K	72	18,000	6100	85
86	T8	3500K	96	18,000	8200	85
86	T8	4100K	96	18,000	8200	85
95	T12 HO	COOL WHITE, 4100K	96	12000	8000	62
110	T12 VHO	COOL WHITE, 4100K	48	12,000	7800	62
160	T12 VHO	COOL WHITE, 4100K	72	12,000	11,250	62
215	T12 VHO	COOL WHITE, 4100K	96	12,000	15,200	62