2015

Lighting: The Same Game, Only Dramatically Different♪

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“Actions by DOE, voluntary energy-efficiency programs, and standards organizations have helped the U.S. market to avoid some problems with early SSL products.

Standardized testing, minimum performance and reporting requirements, and publication of testing and demonstration results have made it more difficult for poor-performing products to remain on the market, and rewarded manufacturers whose products perform well.”

Pacific Northwest National Laboratory
Richland, Washington 99352

Right results, the ***Right*** way.

power of one ... it begins with you

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There is an exception to every RULE!


"i" before
"e" except
after "c"
WEIRD!

The LED Revolution….. Really?

Just because the lamp fits…….

……doesn't make it the RIGHT solution!

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LM-80 LM-79 TM-21

Manufacturer

Consumer

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Incandescent 

Fluorescent

Compact Fluorescent 

Linear Fluorescent 

(T-8, T-5HO)

Induction 

High Intensity Discharge 

(Metal Halide, High Pressure Sodium)

Solid State Lighting 

(LED, OLED, etc.)

2012 100-watt
2013 75-watt
2014 60-watt and 40-watt

EXPENDITURES EXAMPLE	STANDARD 60-WATT INCANDESCENT	15-WATT SPIRAL® BULB
Illustration initial purchase price, per bulb	$0.27	**$3.77**
Illustration replacement cost (need to purchase 7 more)	$1.89	**$0.00**
Energy cost (based on $0.10 per kWh over the life of the 8,000-hour bulb)	$48.00	**$12.00**
Total cost	**$50.16**	**$15.77**


25,000 HOUR RATED LIFETIME
9.5
WATTS
10-YEAR LIMITED WARRANTY
1,000 HOUR TYPICAL LIFETIME
60
WATTS
NO EXPRESS WARRANTY[4]

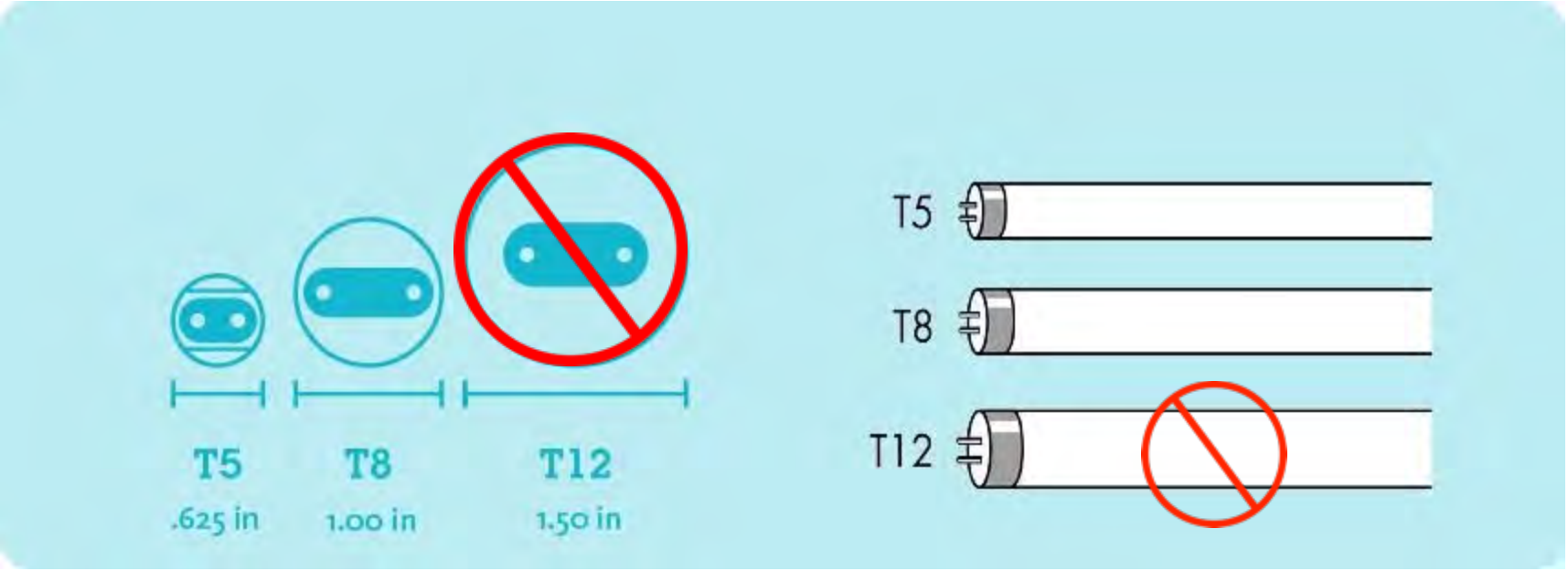
Operating Hours: 3 Hours/Day

Lamp Change: 1X

Lamp Change: 5X

Lamp Change: 10X

Linear Fluorescent



T8 Fluorescent

90,000 Hours x 8,760 (24/7)

T5HO Fluorescent

60,000 Hours x 8,760 (24/7)

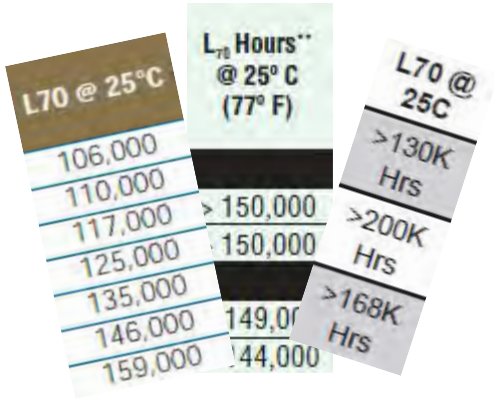
Tubular LED

50,000 Hours x 8,760 (24/7)

SPECIFICATIONS AND FEATURES	
Length	Four Foot External Driver Version
Wattage	9, 14, 18 watts fixed, 2-20 dimmable
Total Lumens (@5000K)	9 watt >> 1300 lumens 14 watt >> 2030 lumens 18 watt >> 2600 lumens 20 watts>> 2900 lumens
Efficacy (@ 5000K, Clear lens)	145 Lms/Watt
CRI	CRI 82
Total Harmonic Distortion	3.58% (120 VAC) 7.64% (277 VAC)
Duv	Duv = 0.00127
Voltage	120 ~ 277VAC 50-60 Hz
Power Supply Options	RB-9W-132-E, RB-14W-132-E, RB-18W-132-E, RB-20W-132-DIM, RB-40W-132-DIM, RB-88W-132-DIM
Power Factor	0.998 (120 VAC) 0.953 (277 VAC)
Power Input to Tube	Double ended, Low voltage, 32-40 VDC, constant current regulation, Polarity not important
Endcaps	G13 Bi-Pin, rotatable option available
LED Elements	288 LEDs, Surface Mount Devices (SMDs)
Color Temperature	3500K, 4100K, 5000K +/- 200°K (3 McAdam Ellipses)
cULus listed	E347929, E363806, E 357319, E362805, E341042 Dry or Damp Locations
Beam Angle	120° (Clear Lens Installed)
Size	48"
Operating Temperature	-40 °F to 110 °F
Certifications	UL, cUL, RU, 1993, 1598, 1598(B), 1598(C) 8750, FCC, CE, RoHS
DesignLights Consortium	32 RedBird models on the DLC List Highest efficacy LED tube on the DLC list
Warranty	**10 Years** warranty@redbirdled.com
Lifetime	**100,000 Hours** (LM-80 available)


CAUTION
BUYER
BEWARE!
Proceed At Own Risk

Realistic Lifetimes



- Remember L70 50,000 hours?
- Is 150,000 hours a realistic or reasonable lifetime?
- At 12 hrs/day that's over 34 years
- Who will still want today's technology in 30 years ?
- Of course not everything gets better over 30 years

Courtesy of Mark Hand
Acuity Brands Lighting

Where are excessive lifetimes coming from?

- LED lifetime projections from LM80 and TM21
- Note the difference between Calculated and Reported L70
- Reported being 6 x LM80 duration

1.284E-06

1.016E+00

L70(10k) = 290,000 hours

L70(10k) > 60,500 hours

TM-21 Projection

Time	0 h	500 h	1016 h	2002 h	2980 h	
ln(Avg.)	0.0000	-0.0087	-0.0105	-0.0211	-0.0222	-

Test duration used	4984 h to 10029 h
B	0.9827
α	1.1458E-06
R^2	0.8385
Calculated L_{70} (10K)	296048 hours
Reported L_{70} (10K)	> 60000 hours

Courtesy of Mark Hand
Acuity Brands Lighting

Why are the Calculated Lifetimes unrealistic?

First let's consider what happens to LEDs in the REAL world

- LEDs that are assembled in luminaires can experience many adverse conditions
  - Wide range of ambient temperatures
  - Drive current variations – In-Rush, Surge, Dimming etc
  - Turned on and off several times a day
  - Thermal shock
  - Vibrations

Courtesy of Mark Hand
Acuity Brands Lighting

Why are the Calculated Lifetimes unrealistic?

Then let's consider what happens to LEDs in a TM-21 world

- LED lumen depreciation predictions are based on the behavior of LEDs tested per LM80 which
  - Are maintained in a constant ambient
  - Always have a perfectly controlled drive current
  - Only get turned off 12 times
  - Never experience vibrations and are moved gently and carefully
  - Have a life other hard-working LEDs can only dream of

Courtesy of Mark Hand
Acuity Brands Lighting

Is TM-21 flawed?

No it is not flawed

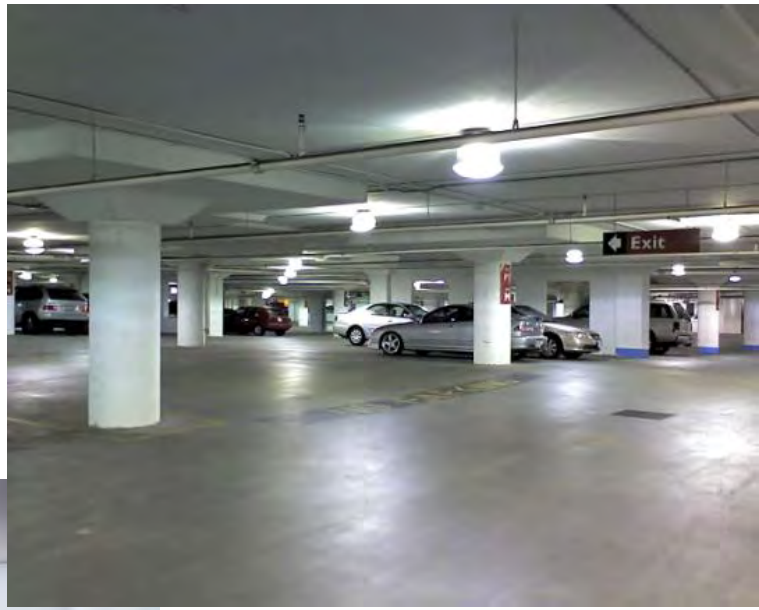
- It's much better than nothing
- It's a lot quicker than testing for 60,000 hours
- It's very good for comparative analyses
- Gives Luminaire Manufacturers confidence in the numbers
- Makes some sense of the LM80 data

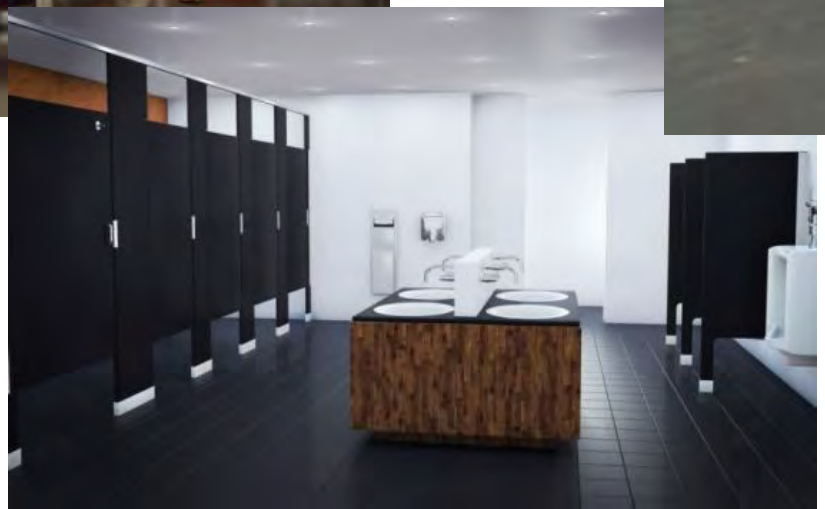
Courtesy of Mark Hand
Acuity Brands Lighting

Realistic Lifetimes

So what are realistic lifetimes?

- That's Application Dependent
  - 24/7 applications? 50-60k hours makes sense.
  - 4/5 applications? 10-20k hours makes sense.





Courtesy of Mark Hand
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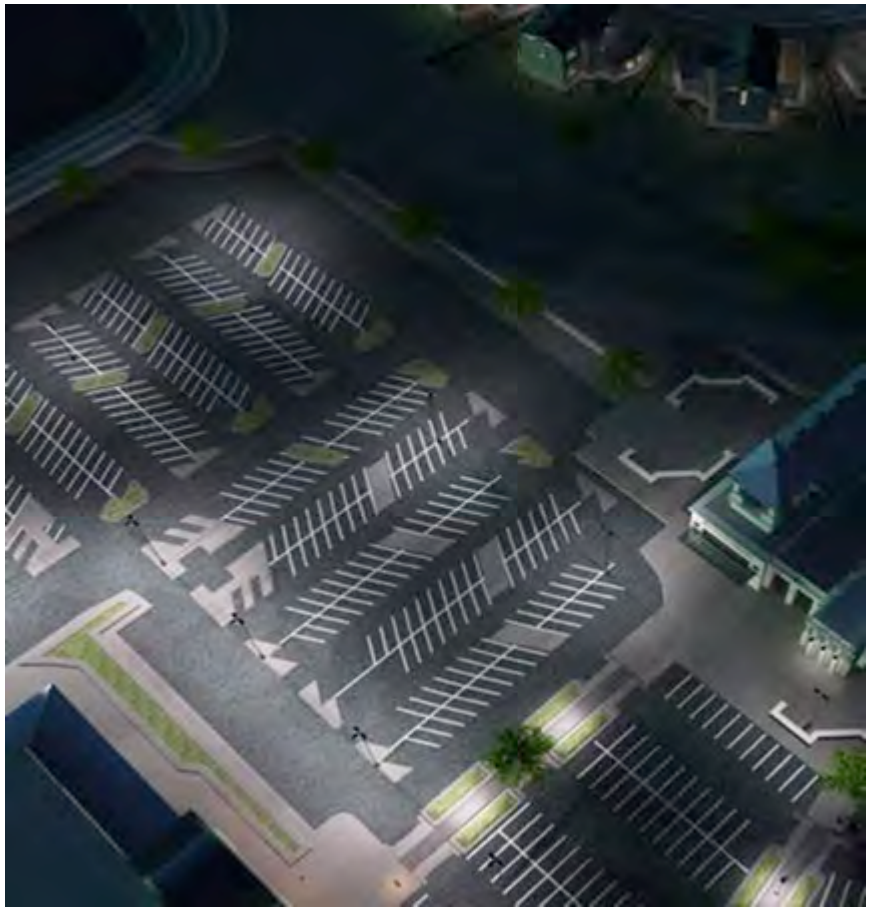
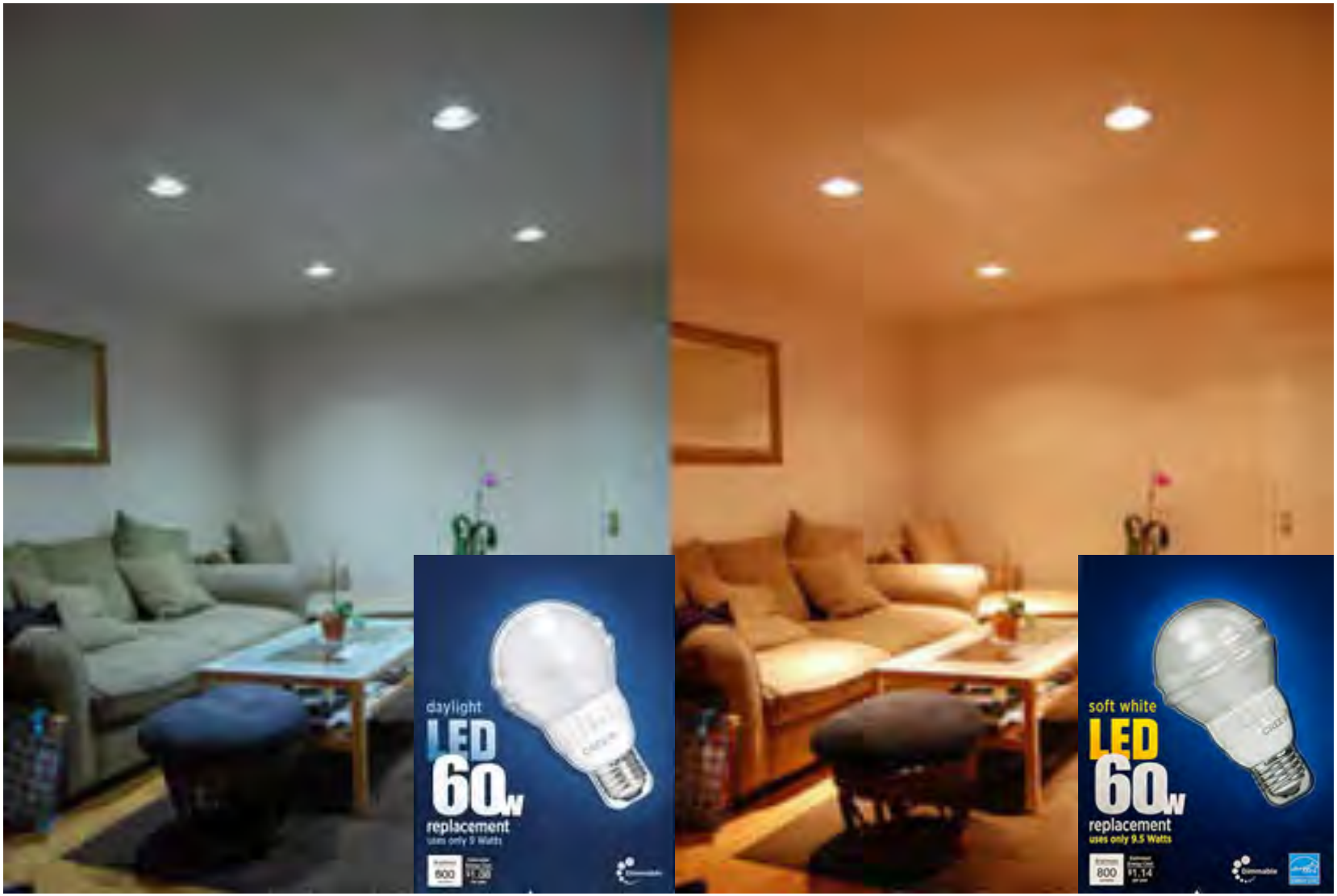
Be careful what you ask for……..



400W Metal Halide

280W LED


daylight
LED
60W
replacement
uses only 9 Watts
soft white
LED
60W
replacement
uses only 9.5 Watts

LED

830W

Metal Halide

3,070W

STOP!

LOOK!

LISTEN!

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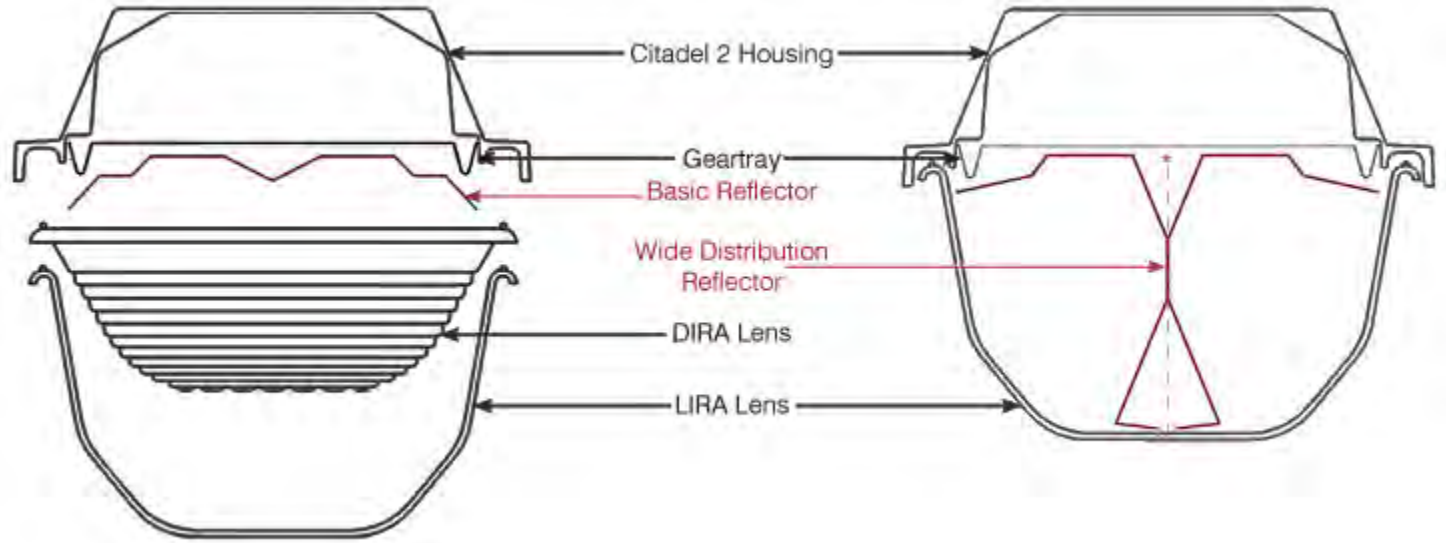
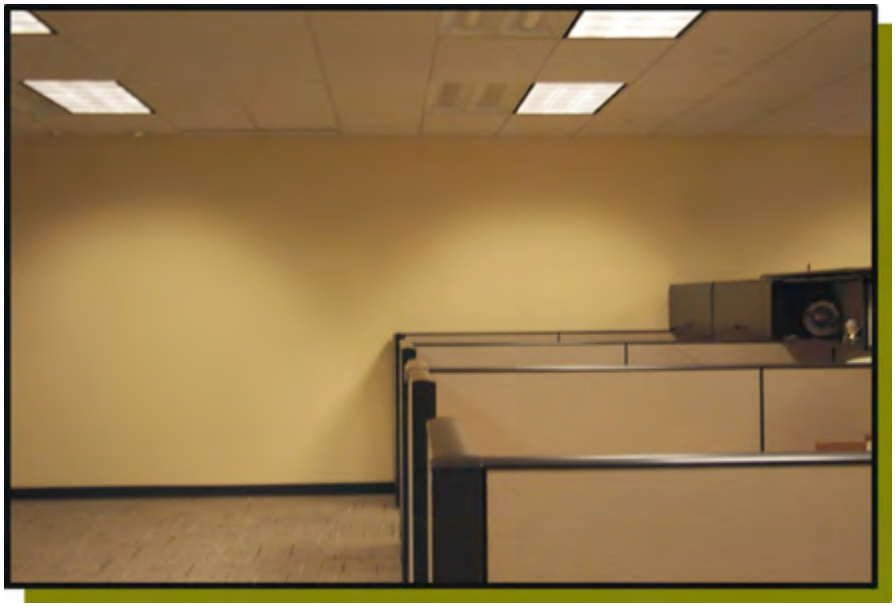

Citadel 2 Housing
Geartray
Basic Reflector
Wide Distribution
Reflector
DIRA Lens
LIRA Lens

Manufacturer A

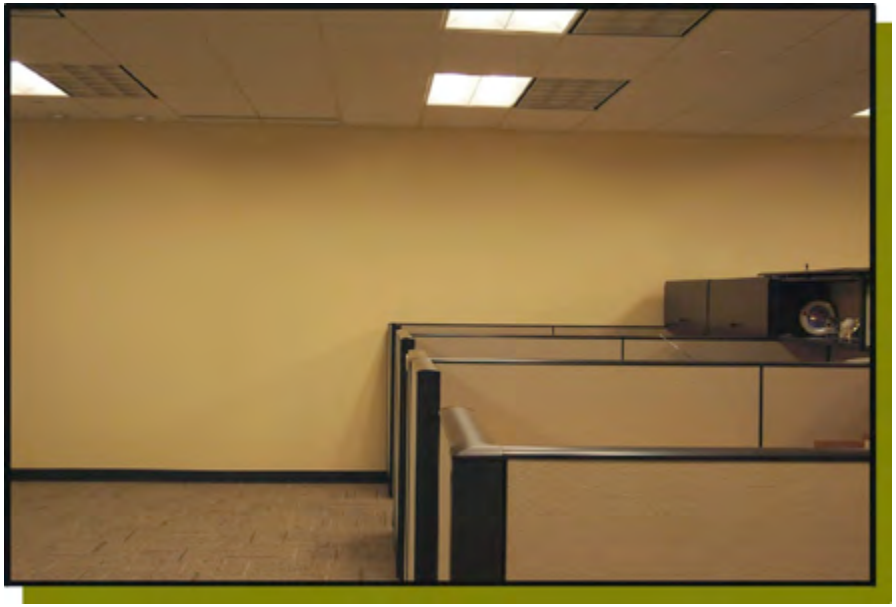
Fixture	System watts	Actual lumens	mA	Max. ambient temp. (°C)		Width	IMAFL depth	IMACD or IMAFD depth	Length	Comparable fluorescent/HID
				Suspended**	Surface mounted					
EMS4 3L	39	3418	350	40	25	7 (17.8)	4 3/4 (12.1)	6 1/8 (15.5)	52 (132.1)	1-lamp 32W T8, 1-lamp 54W T5HO, 70W MH
EMS4 4L	61	4728	525	35	25	7 (17.8)	4 3/4 (12.1)	6 1/8 (15.5)	52 (132.1)	2-lamp 32W T8, 70W HPS
EMS8 6L	78	6836	350	40	25	7 (17.8)	4 3/4 (12.1)	6 1/8 (15.5)	100 1/4 (254.6)	3-lamp 32W T8, 2-lamp 54W T5HO, 100W HPS, 100W MH
EMS8 9L	122	9456	525	25	25	7 (17.8)	4 3/4 (12.1)	6 1/8 (15.5)	100 1/4 (254.6)	4-lamp 32W T8, 150W MH

Manufacturer B

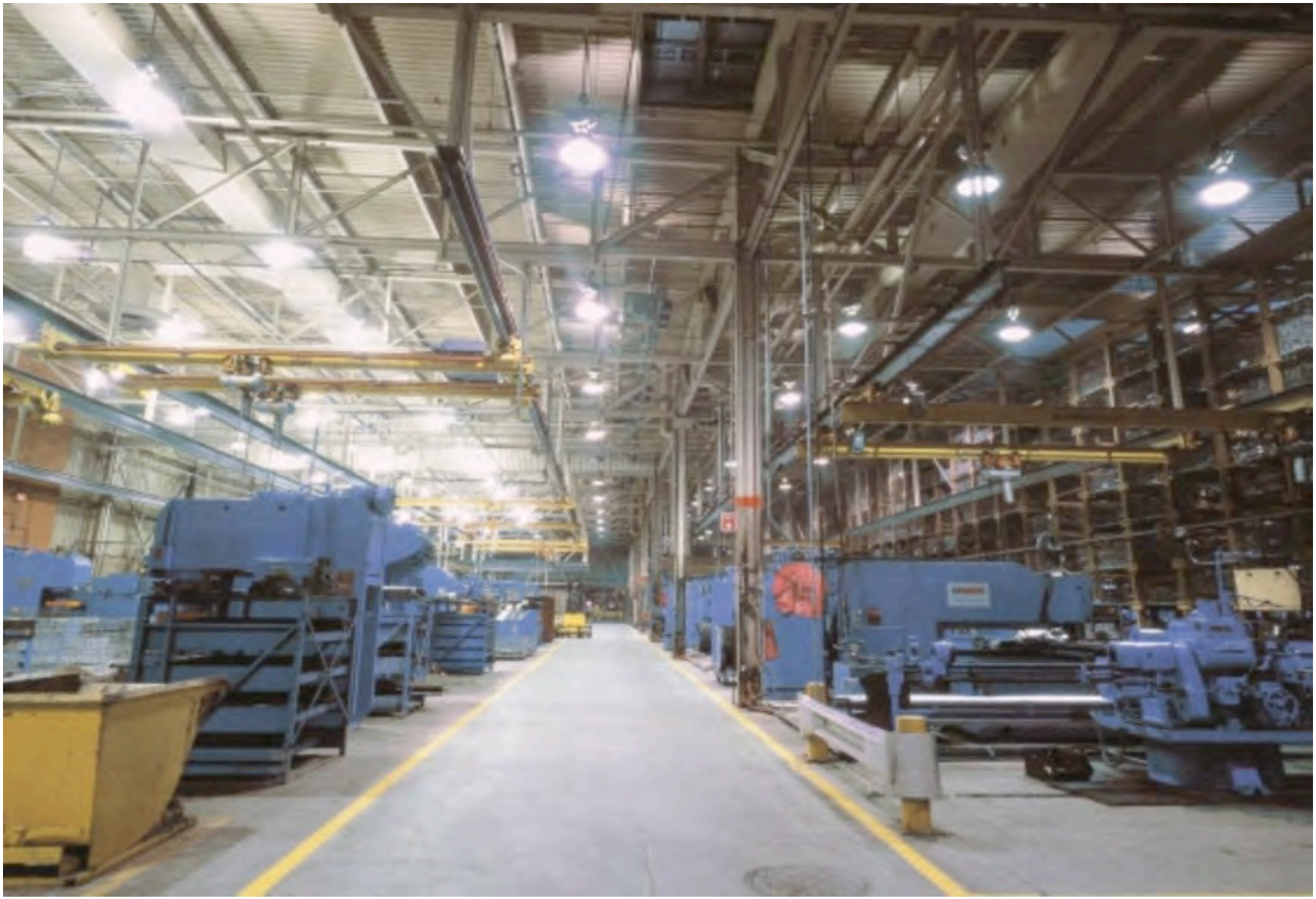
Proposed System	Lumen Output	CRI	4000K DETAILS*				5000K DETAILS**			
			CCT	Lumens Per Fixture	Input Watts	Lumens Per Watt	CCT	Lumens Per Fixture	Input Watts	Lumens Per Watt
VTL-1X2-XL	XL	>80	4000K	2507	28	89	5000K	2557	29	89
VTL-1X2-LW	LW	>80	4000K	3187	31	103	5000K	3251	32	103
VTL-1X2-ML	ML	>80	4000K	3720	36	102	5000K	3794	37	102
VTL-1X2-HL	HL	>80	4000K	4265	45	94	5000K	4351	46	94
VTL-1X4-XL	XL	>80	4000K	3238	32	101	5000K	3303	33	101
VTL-1X4-LW	LW	>80	4000K	5275	51	103	5000K	5380	52	103
VTL-1X4-ML	ML	>80	4000K	7474	74	101	5000K	7624	75	101
VTL-1X4-HL	HL	>80	4000K	9351	97	96	5000K	9538	99	96
VTL-1X8-XL	XL	>80	4000K	6477	64	101	5000K	6606	65	101
VTL-1X8-LW	LW	>80	4000K	10550	102	103	5000K	10761	105	103
VTL-1X8-ML	ML	>80	4000K	14948	148	101	5000K	15247	151	101
VTL-1X8-HL	HL	>80	4000K	18702	194	96	5000K	19076	198	96



Parabolic



Volumetric



Only YOU can control YOUR future.

-Dr. Seuss

Controls

- *Dimmers*
- *Occupancy Sensors*
- *Daylighting Sensors*


EDISON AWARDS
NGL
Best in Class


Bi-Level Controls

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Reinventing the wheel.


got goals?

Lighting Services

T1 Prescriptive Approach

1. ***Customer Interaction Phase*** explore overall objectives and assess expectations.
2. ***Customer Education Phase*** introduce available options for general lighting applications.

T2 Comprehensive Approach

1. ***Customer Interaction Phase*** explore overall objectives and assess expectations.
2. ***Concept Design Phase*** measure and achieve desired outcome.
3. ***Lighting Specification Phase*** meet both the design intent and budgetary requirements.
4. ***Presentation Phase*** review the recommendation lighting system(s)
    A. Electronic documentation of the lighting design, benefit/cost analysis, lighting specifications, applicable Minnesota Power rebates, and schedules for material procurement and installation.
5. ***Sample Installation Phase*** for the purposes of design validation.


Q&A