

# Better Buildings By Design 2010



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# Learning Objectives



## Efficient Lighting Fundamentals

- **At the end of this program, participants will be able to:**
  - Understand key techniques and common terminology of energy efficient lighting.
  - Understand how to apply knowledge of lighting terminology toward the proper selection of light sources.
  - Strengthen your communications with lighting designers, suppliers and manufacturers.
  - Increase your understanding of lighting decisions on your projects.

# LIGHTING TERMINOLOGY

## QUANTITY OF

LIGHT  
LUMENS

FOOTCANDLES

ILLUMINANCE

LUMINANCE

EFFICACY

## APPEARANCE OF

LIGHT  
COLOR

TEMPERATURE

COLOR RENDERING

# LIGHTING TERMINOLOGY

**LUMEN:** A unit of light flow, or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp.

**LUMEN:** The amount of light generated by a light source, at the source.

Glossary definition as defined by Architectural Lighting Magazine 2008.

# LIGHTING TERMINOLOGY

**FOOTCANDLE (FC):** The English unit of measurement of the illuminance (or light level) on a surface. One footcandle is equal to one lumen per square foot.

**FOOTCANDLE (FC):** The amount of illumination measured (with a light meter) on a vertical or horizontal surface.

\*\*\*We do not see footcandles.\*\*\*

Glossary definition as defined by Architectural Lighting Magazine 2008.

# LIGHTING TERMINOLOGY

**ILLUMINANCE:** A photometric term that quantifies light incident on a surface or plane. Illuminance is commonly called light level. It is expressed as lumens per square foot (footcandles), or lumens per square meter (lux).

**ILLUMINANCE:** The term for what a what a light meter measures (in footcandles).

Glossary definition as defined by Architectural Lighting Magazine 2008.

# LIGHTING TERMINOLOGY

**LUMINANCE:** A photometric term that quantifies brightness of a light source or of an illuminated surface that reflects light. It is expressed as footlamberts (English units) or candelas per square meter (Metric units).

**LUMINANCE:** The term for what we actually see, which is reflected illumination off of a surface.

Glossary definition as defined by Architectural Lighting Magazine 2008.



**LUMENS**



**ILLUMINANCE  
(FOOTCANDLES)**



**LUMINANCE  
(REFLECTED  
LIGHT)**



# LIGHTING TERMINOLOGY

**EFFICACY:** A metric used to compare light output to energy consumption. Efficacy is measured in lumens per watt. Efficacy is similar to efficiency, but is expressed in dissimilar units. For example, if a 100-watt source produces 9000 lumens, then the efficacy is 90 lumens per watt.

**EFFICACY:** Lumens per watt.

Glossary definition as defined by Architectural Lighting Magazine 2008.

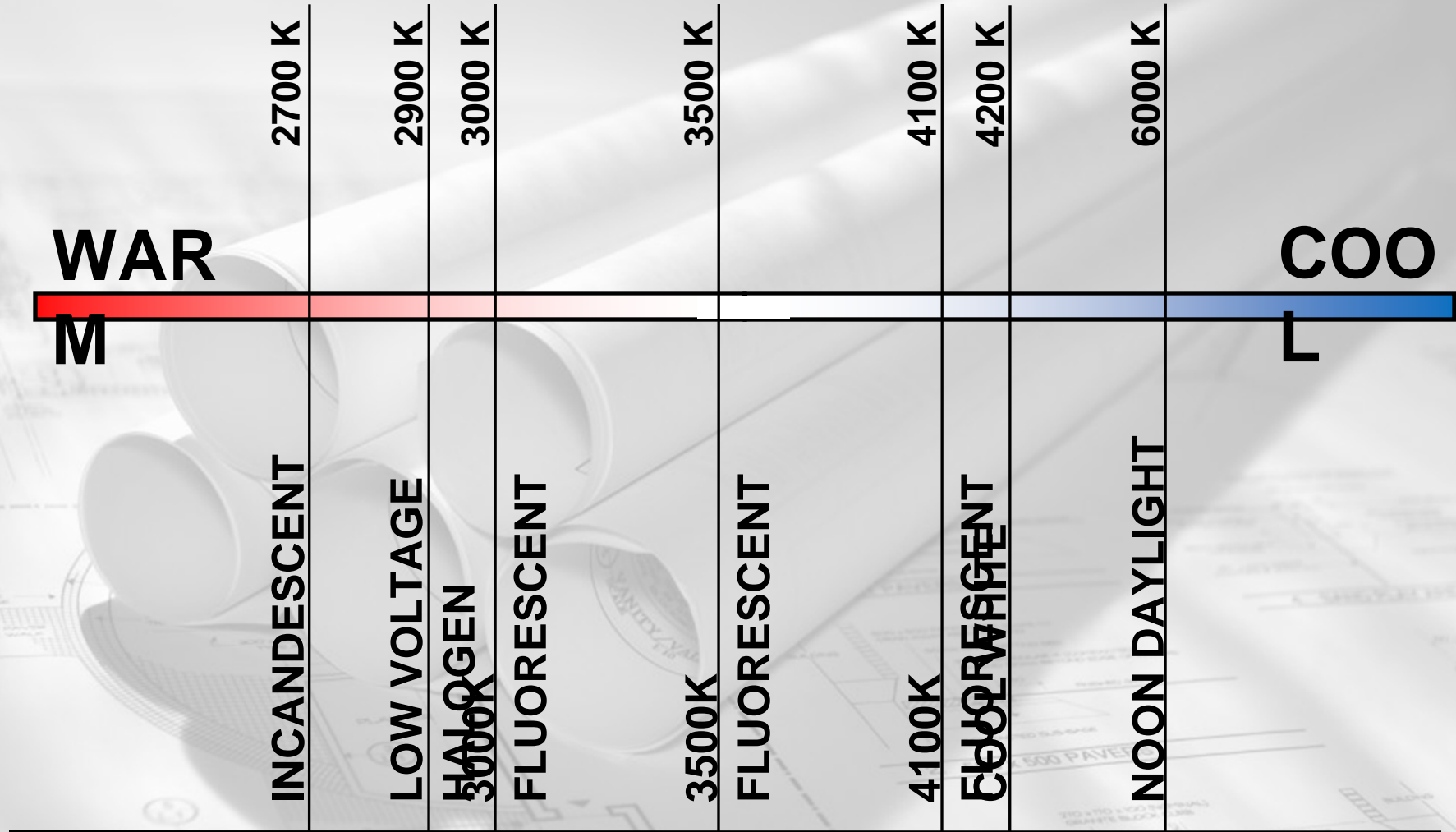
# LIGHTING TERMINOLOGY

**COLOR TEMPERATURE:** The color temperature is a specification of the color appearance of a light source, relating the color to a reference source heated to a particular temperature, measured by the thermal unit Kelvin. The measurement can also be described as the "warmth" or "coolness" of a light source. Generally, sources below 3200K are considered "warm;" while those above 4000K are considered "cool" sources.

**COLOR TEMPERATURE:** The outward appearance of the color of a light source (i.e. warm or cool).

Glossary definition as defined by Architectural Lighting Magazine 2008.

# LIGHTING TERMINOLOGY



# LIGHTING TERMINOLOGY

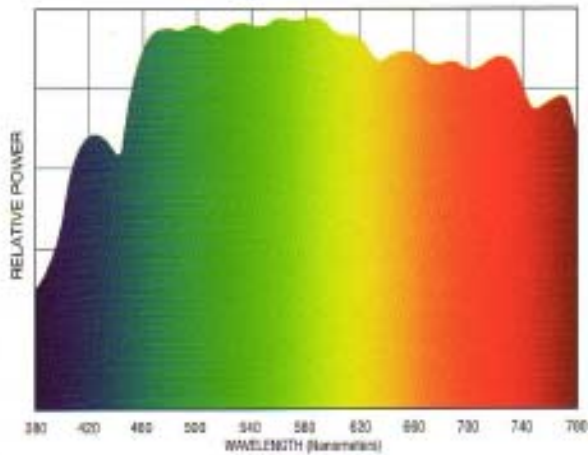
**COLOR RENDERING INDEX (CRI):** A scale of the effect of a light source on the color appearance of an object compared to its color appearance under a reference light source. Expressed on a scale of 1 to 100, where 100 indicates no color shift. A low CRI rating suggests that the colors of objects will appear unnatural under that particular light source.

**COLOR RENDERING INDEX (CRI):** The ability of a light source to render colors in comparison to other light sources of a similar color temperature.

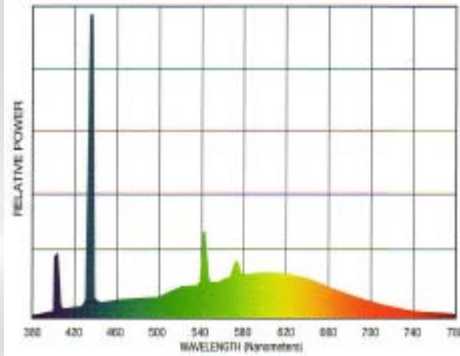
Glossary definition as defined by Architectural Lighting Magazine 2008.

# Spectral Power Distribution Graphs

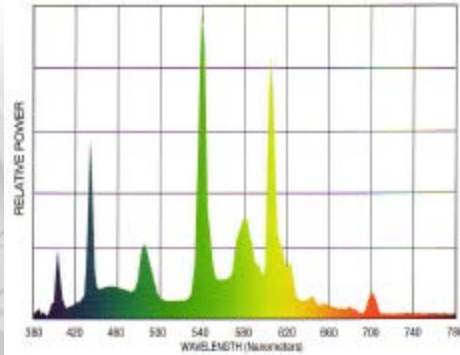
Noontime Sunlight



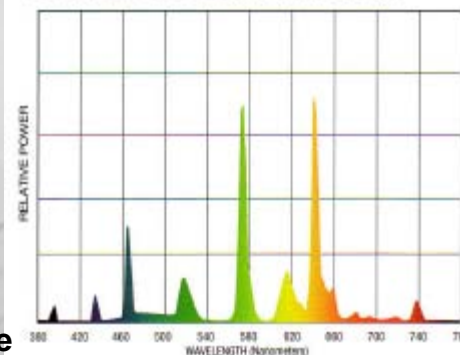
Cool White Fluorescent



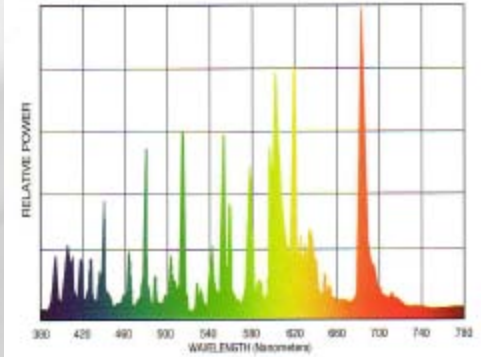
OCTRON® 4100K Fluorescent



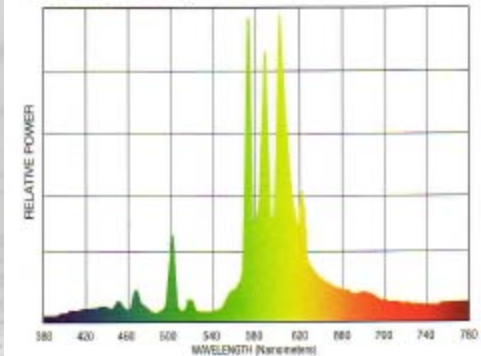
OCTRON® XP 3500K Fluorescent



METALARC® Metal Halide



LUMALUX® High Pressure Sodium



# DETERMINING FACTORS

**Color Temperature**

**Initial Cost**

**Heat Production**

**Color Rendering**

**Operating Cost**

**Fixture Compatibility**

**Color Changing**

**Replacement Cost**

**UV Transmittance**

**Light Output (actual)**

**Ease of Maintenance**

**Code Compliance**

**Lumen Output**

**Availability**

**Energy Efficiency**

**Efficacy**

**Lamp Life**

**Accessorization**

**Distribution**

**Physical Size**

**Soft / Hard Edge**

**Dimmability**

**Physical Appearance**

**Effect on People**

# Lamp Data Comparison

## GENERAL PURPOSE LAMPS

Watts	Bulb	Base	Product Number	Symbols & Footnotes	Ordering Abbreviation	Volts	Pkg Qty	Description	Class & Filament	Avg Rated Life (hrs)	Lumens Beam Angle C/BCP	LCL (in)	MOL (in)
75	A19	Med	10970	●●●	75A/W/4/RP	120	48	Soft White	C, CC-8	750	1170	3.13	4.44
			10967	●●●	75A/W/RP	120	24	Soft White	C, CC-8	750	1170	3.13	4.44
			12500	●●●	75A/CL	120	120	Clear	C, CC-8	750	1200	3.13	4.44
			11225	●●●	75A/CL/RP	120	24	Clear	C, CC-8	750	1200	3.13	4.44
			12502	●●● ①②③④	75A/CL	120	120	Clear	C, CC-8	750	1190	3.13	4.44

@ 120\_volts, approximate 66 watts, 910 lumens, 1875 hours

## DULUX® EL SELF-BALLASTED COMPACT FLUORESCENT LAMPS

### Mini Twist Compact Fluorescent Lamps

Nominal Wattage	Bulb	MOL (in)	Base	Product Number	Ordering Abbreviation	Voltage	Pkg Qty	Avg Rated Life (hrs)	CCT (K)	CRI	Approx Initial Lumens @25°C/77°F	Approx Mean Lumens @25°C/77°F	Symbols & Footnotes
13	MINITWIST	4.6	Medium	29727	CF13EL/MICRO/830/RP2	120	12	12000	3000	82	825	660	☑ ☐ Ⓢ 1,3,4 9,12,14,20
		4.5	Medium	29376	CF13EL/MINI/830	120	6	8000	3000	82	800	640	☑ ☐ Ⓢ 1,3,4 9,12,14,20
		4.2	Medium	29069	CF13EL/SUPER/827/BL	120	6	10000	2700	82	880	704	☑ ☐ Ⓢ 1,3,4 9,12,14,20
				29449	CF13EL/SUPER/830/BL	120	6	10000	3000	82	880	704	☑ ☐ Ⓢ 1,3,4 9,12,14,20
				29713	CF13EL/SUPER/835/BL	120	6	10000	3500	82	800	640	☑ ☐ Ⓢ 1,3,4 9,12,14,20
		4.6	Medium	29567	CF13EL/MINI/841	120	6	10000	4100	82	800	640	☑ ☐ Ⓢ 1,3,4 9,12,14,20

# NAMING A LIGHT SOURCE

**WATTS / SHAPE / SIZE /  
ATTRIBUTES**

**75 / A / 19 / CL**

**50 / PAR / 20 / NFL25**

**75 / PAR / 20 / NSP15**

**F32 / T / 8 / 830**

**F26 / TBX / 830**

# Lamp Data Comparison

Watts	Bulb	Base	Product Number	Symbols & Footnotes	Ordering Abbreviation	Volts	Pkg Qty	Beam Type	Class & Filament	Avg Rated Life(hrs)	Lumens CCT	CBCP	Beam Angle	MOL (in)
50	PAR30LN	E26 Med	14482	★ 40, 2, 118, 124, 127, 132 @ 120 volts, approximate 44 watts, 500 lumens, 5000 hours	50PAR30LNHALNSP9	130	15	NSP	C,CC-8	2500	660 2850	7000	10	4.63
			14520	★ 40, 2, 118, 124	50PAR30LNHALNFL25	120	15	NFL	C,CC-8	2500	660 2850	2100	25	4.63
			14822	★ 40, 2, 118, 124	50PAR30LNHALNFL	120	6	NFL	C,CC-8	2500	660 2850	2100	25	4.63
			14478	★ 40, 2, 118, 124, 127, 132 @ 120 volts, approximate 44 watts, 500 lumens, 5000 hours	50PAR30LNHALNFL25	130	15	NFL	C,CC-8	2500	660 2850	2100	25	4.63
			14537	★ 40, 2, 118, 124	50PAR30LNHALWFL50	120	15	WFL	C,CC-8	2500	660 2850	660	50	4.63

## Reflector Compact Fluorescent Lamps

Nominal Wattage	Bulb	MOL (in)	Base	Product Number	Ordering Abbreviation	Voltage	Pkg Qty	Avg Rated Life (hrs)	CCT (K)	CRI	Approx Lumens Initial	Mean @25°C/77°F	Symbols & Footnotes
9	R20	3.94	Medium	29638	CF9EL/R20/827	120	6	8000	2700	82	300	240	1,1A, 9, 12, 14, 20
				29640	CF9EL/R20/830/BL	120	6	8000	3000	82	300	240	1,1A, 9, 12, 14, 20
14	R20	4.25	Medium	29624	CF14EL/R20/827	120	6	8000	2700	82	495	396	1,1A, 9, 12, 14, 20
				29587	CF14EL/R20/830/BL	120	6	8000	3000	82	495	396	1,1A, 9, 12, 14, 20
15	BR30	5.5	Medium	29465	CF15EL/BR30/DIM/827	120	6	6000	2700	82	600	480	1,1A, 9, 12, 14, 20
				29667	CF15EL/BR30/DIM/830/BL	120	6	8000	3000	82	600	480	1,1A, 9, 12, 14, 20

# Lamp Data Comparison

Watts	Bulb	Base	Product Number	Symbols & Footnotes	Ordering Abbreviation	Volts	Pkg Qty	Beam Type	Class & Filament	Avg Rated Life(hrs)	Lumens CCT	CBCP	Beam Angle	MOL (in)
50	PAR30LN	E26 Med	14482	★ 40,2,118,124,127,132 @ 120 volts, approximate 44 watts, 500 lumens, 5000 hours	50PAR30LNHALNSP9	130	15	NSP	C,CC-8	2500	660 2850	7000	10	4.63
			14520	★ 40,2,118,124	50PAR30LNHALNFL25	120	15	NFL	C,CC-8	2500	660 2850	2100	25	4.63
			14822	★ 40,2,118,124	50PAR30LNHALNFL	120	6	NFL	C,CC-8	2500	660 2850	2100	25	4.63
			14478	★ 40,2,118,124,127,132 @ 120 volts, approximate 44 watts, 500 lumens, 5000 hours	50PAR30LNHALNFL25	130	15	NFL	C,CC-8	2500	660 2850	2100	25	4.63
			14537	★ 40,2,118,124	50PAR30LNHALWFL50	120	15	WFL	C,CC-8	2500	660 2850	660	50	4.63

## Reflector Compact Fluorescent Lamps

Nominal Wattage	Bulb	MOL (in)	Base	Product Number	Ordering Abbreviation	Voltage	Pkg Qty	Avg Rated Life (hrs)	CCT (K)	CRI	Approx Lumens Initial @25°C/77°F	Mean	Symbols & Footnotes
9	R20	3.94	Medium	29638	CF9EL/R20/827	120	6	8000	2700	82	300	240	1,1A 9,12,14,20
				29640	CF9EL/R20/830/BL	120	6	8000	3000	82	300	240	1,1A 9,12,14,20
14	R20	4.25	Medium	29624	CF14EL/R20/827	120	6	8000	2700	82	495	396	1,1A 9,12,14,20
				29587	CF14EL/R20/830/BL	120	6	8000	3000	82	495	396	1,1A 9,12,14,20
15	BR30	5.5	Medium	29465	CF15EL/BR30/DIM/827	120	6	6000	2700	82	600	480	1,1A 9,12,14,20
				29667	CF15EL/BR30/DIM/830/BL	120	6	8000	3000	82	600	480	1,1A 9,12,14,20

# Lamp Data Comparison

## R LAMP SPECIFICATIONS

Watts	Order Code	Description	Incandescent Equivalent	Lumens	Lamp Life (Hrs)	Pack Type	Case Pack	Dimensions (W" x MOL")	K
11	07011	SKR211FLWW R20 FloodMax	40	400	8,000	Box	25	2.5 x 4.8	2700
★ 15	33015	SKR315FLWW R30 FloodMax	75	750	8,000	Box	12	3.75 x 5.8	2700
★ 15	33031	SKR315FLCW R30 FloodMax Cool White	40	550	10,000	Box	12	3.75 x 5.8	4100
15	33019	SKR315FLDL R30 FloodMax Daylight	75	690	8,000	Box	12	3.75 x 5.8	5000
★ 23	33023	SKR423FLWW R40 FloodMax	125	1300	8,000	Box	12	4.9 x 6.25	2700
23	33030	SKR423FLCW R40 FloodMax Cool White	125	1300	8,000	Box	12	4.9 x 6.25	4100
23	70282	SKR423FLDL R40 FloodMax Daylight	125	1300	8,000	Box	12	4.9 x 6.25	5000


## PAR LAMP SPECIFICATIONS

Watts	Order Code	Description	Incandescent Equivalent	Lumens	Lamp Life (Hrs)	Pack Type	Case Pack	Dimensions (W" x MOL")	K
★ 9	11197	SKR2009FLWW Par20 Indoor/Outdoor	30	300	8,000	Box	12	2.45 x 3.8	2700
9	11199	SKR2009FLDL Par20 Indoor/Outdoor	30	330	8,000	Box	12	2.45 x 3.8	5000
★ 15	33010	SKR3015FLWW Par30 Indoor/Outdoor	75	750	8,000	Box	12	3.75 x 5.1	2700
15	33020	SKR3015FLDL Par30 In-Outdoor Daylight	75	660	8,000	Box	12	3.75 x 5.1	5000
★ 20	33032	SKR3820FLWW Par38 Indoor/Outdoor	75	900	8,000	Box	12	4.8 x 6.5	2700
★ 23	33018	SKR3823FLWW Par38 Indoor/Outdoor	100	1370	8,000	Box	12	5 x 6.2	2700
★ 23	11150	SKR3823FLDL Par38 In-Outdoor Daylight	100	1200	8,000	Box	12	5 x 6.2	5000

All specifications are subject to change without notice


MAY 10 12

# Lamp Data Comparison




SKR211FL


FOR >> RECESSED CANS & HIGH HATS  
>> CEILING MOUNTED STRIP LIGHTING




SKR315FLWW+  
SKR315FLDL  
SKR315FLCW+




SKR423FLWW+  
SKR423FLDL  
SKR423FLCW




SKR2009FLWW+  
SKR2009FLDL



SKR3015FLWW  
SKR3015FLDL




SKR3820FLWW+



SKR3823FLWW+  
SKR3823FLDL+

ENERGY STAFF qualified



- Fits flush with standard recessed can fixtures
- Same size and shape as incandescent lamps
- Long life, 8,000 hours; saves up to 75% in energy costs
- Par lamps suitable for indoor/outdoor use
- Frosted glass on R20, R30, and R40 for softer lighting

# LIGHTING TERMINOLOGY

# CONTRAST

# CONTRAST

# LIGHTING TERMINOLOGY

# SIZE

SIZE

# LIGHTING TERMINOLOGY

CONTRAST

# LIGHTING TERMINOLOGY

CONTRAST

# **LIGHTING TERMINOLOGY**

## **Layers of Light**

**General (ambient)**

**Task**

**Accent**

**Sparkle**

# LIGHTING TERMINOLOGY

## Distribution



**Direct**



**Indirect**



**Indirect  
/ Direct**



**Diffuse  
(general  
)**